

## **R. Alton Gilbert**

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# **A Case Study in Monetary Control: 1980-82**

**F**OR SEVERAL YEARS PRIOR to October 1979, the Federal Reserve implemented monetary policy decisions of the Federal Open Market Committee (FOMC) by targeting the federal funds rate. Staff of the Open Market Desk bought or sold government securities with the objective of keeping the federal funds rate within a range specified by the FOMC at its latest meeting.

The effects of monetary policy on the economy under a procedure of targeting the federal funds rate depend on the willingness of policymakers to move the funds rate target fast enough and far enough when the pace of economic activity changes. In the 1970s, the tendency of the Fed to limit changes in the federal funds rate as the growth of total spending accelerated produced rapid money growth, resulting in accelerating inflation in the late 1970s.

In response to the accelerating inflation, the Fed in October 1979 adopted a procedure of targeting nonborrowed reserves (NBR). The FOMC stated that it adopted the NBR operating

procedure to promote better short-run control of the monetary aggregates, to better control inflation.<sup>1</sup> Under the NBR operating procedure, the objective of the staff of the Open Market Desk was to keep the average level of NBR between FOMC meetings at levels consistent with the short-run objectives of the FOMC for growth of the monetary aggregates.

The Fed stopped targeting NBR in the fall of 1982; the operating procedure used since then is similar to targeting the federal funds rate.<sup>2</sup>

The NBR operating procedure generated a great deal of interest and controversy among economists. There is a large literature on the conduct of monetary policy under that procedure and, in recent years, economists have continued to analyze the conduct of monetary policy during the three years ending in the fall of 1982.<sup>3</sup> Critics of the NBR procedure contend that it caused a high degree of interest rate volatility, as illustrated in Figure 1. Some critics argue that the Fed actually did not change its operating procedure

<sup>1</sup> For a description of the decisions by the FOMC at its meeting in October 1979, see Board of Governors (1979, p. 974).

<sup>2</sup> For a general description of the mechanics of various operating procedures, see Gilbert (1985). Thornton (1988) provides evidence that targeting borrowed reserves has been essentially the same as targeting the federal funds rate.

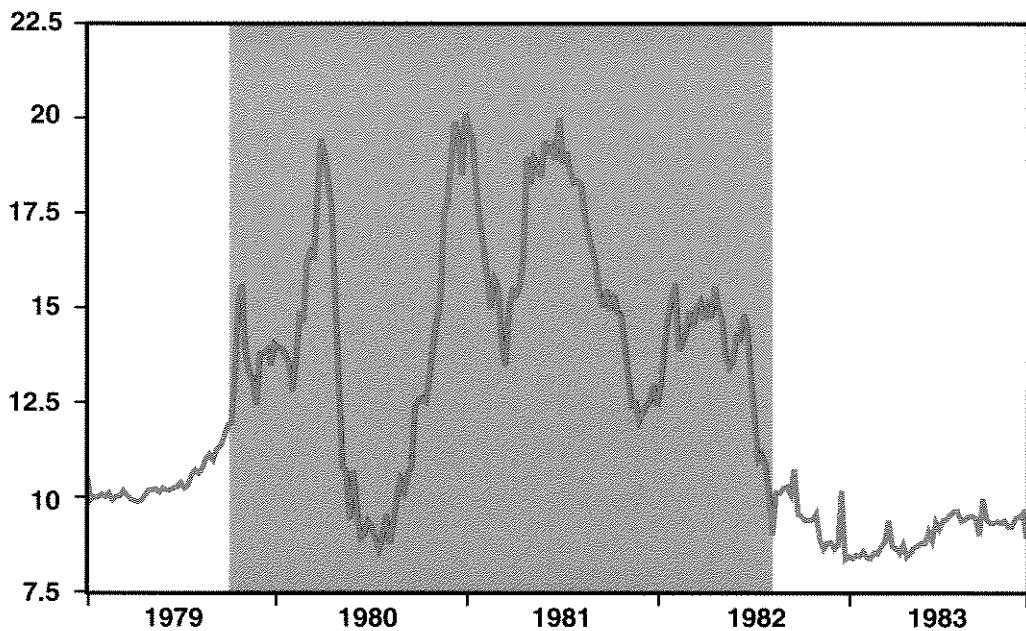
<sup>3</sup> The following are selected references to the literature on the NBR operating procedure: Goodfriend (1983); Hetzel (1982,

1986); Hoehn (1983); Lindsey (1982, 1983); Lindsey and others (1984); McCallum (1985); Poole (1982); and Spindt and Tarhan (1987). For recent additions, see Avery and Kwast (1993), Goodfriend and Small (1993) and Pearce (1993).

Figure 1

**Weekly Federal Funds Rate: January 3, 1979, to December 28, 1983**

Percent



**Note: Shaded area encompasses the period of nonborrowed reserves targeting (10/3/79 through 9/29/82).**

in any fundamental way in October 1979.<sup>4</sup> Others blame large errors in hitting money targets on improper design of the operating procedure, especially in combination with lagged reserve accounting in effect at the time.<sup>5</sup>

Whatever the flaws in the NBR targeting procedure as a method of monetary control, the Federal Reserve did achieve its objective of sharply reducing the rate of inflation during the period in which it used that procedure (Figure 2). That success in reducing the rate of inflation, however, came at the price of a very sharp recession (Figure 3).

This article extends the literature on NBR targeting in two ways. First, it presents information relevant for interpreting policy actions that was confidential until several years after the end

of the period of NBR targeting: Federal Reserve staff projections of total reserves (TR) over periods between FOMC meetings, and staff estimates of the levels of TR over the same periods that would have been consistent with FOMC objectives for growth of the monetary aggregates (the TR paths).<sup>6</sup> In addition, this article extends the literature by answering a question not answered by the other studies: Did the pattern of policy actions under the NBR operating procedure reflect a consistent use of the procedure for hitting short-run targets for growth of the monetary aggregates, given the information available to policymakers on staff projections of TR and estimates of the TR paths?

This article may have implications for the choice of operating procedure in the future. If the Federal Reserve chose once again to target a

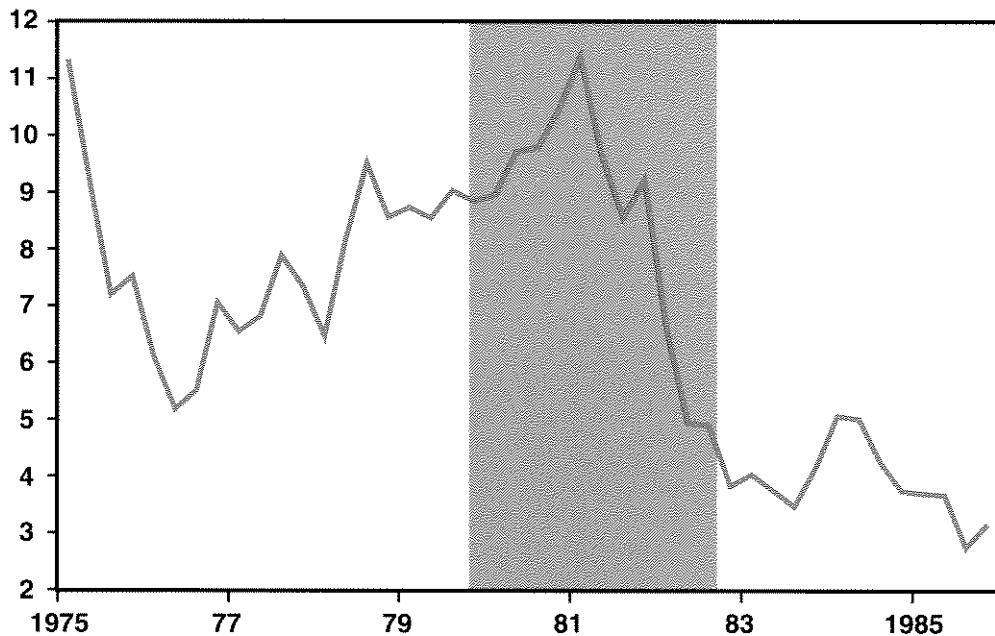
<sup>4</sup> See Poole (1982).

<sup>5</sup> See McCallum (1985). Gilbert and Trebing (1982) provide a description of lagged and contemporaneous reserve accounting.

<sup>6</sup> The weekly reports of the Manager of the Open Market Account, which included the projections and estimates of TR, became public information five years after the dates of the reports. Cook (1989a, 1989b) presents some, but not

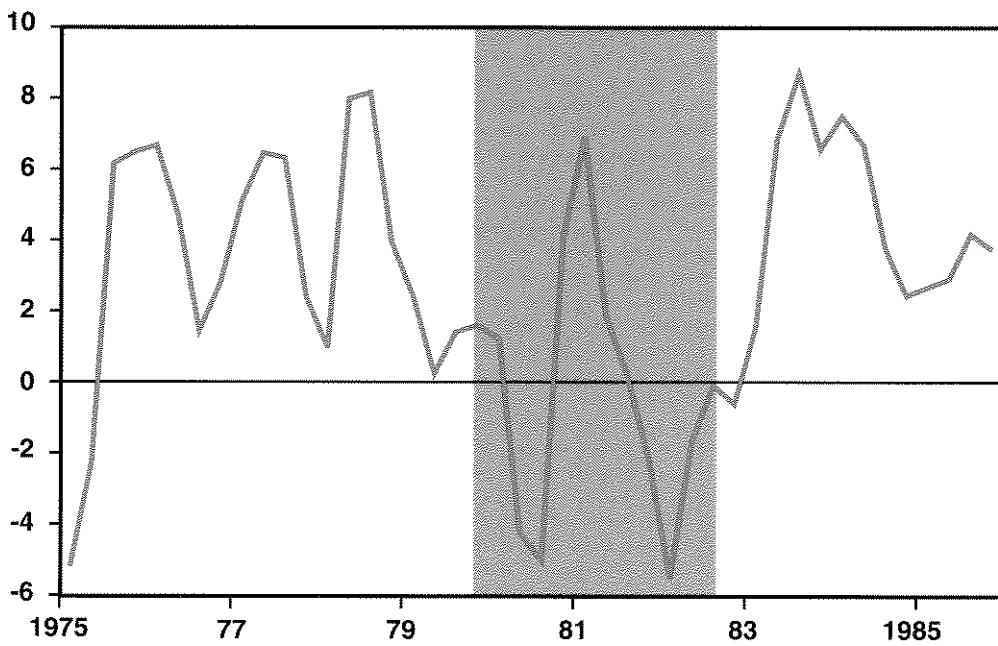
all, of the information on the NBR operating procedure presented in this article. In particular, Cook presents information on the *gap* between projections of TR and the TR path, but he does not present the levels of those projections and estimates. Feinman (1988) made extensive use of the data from the weekly reports of the Manager of the Open Market Account in an unpublished dissertation.

**Figure 2**  
**Rate of Growth in the GDP Deflator**



Note: Rates of growth in the GDP deflator are two-quarter growth rates; the shaded area encompasses the period of nonborrowed reserves targeting (1979:Q4 through 1982:Q3).

**Figure 3**  
**Rate of Real GDP Growth**



Note: Rates of real GDP growth are two-quarter growth rates; the shaded area encompasses the period of nonborrowed reserves targeting (1979:Q4 through 1982:Q3).

narrow monetary aggregate, the Federal Reserve might consider a change in operating procedure, perhaps to an NBR operating procedure. Several prominent monetary economists have expressed dissatisfaction with the lack of success of the FOMC in hitting its targets for money growth under NBR targeting.<sup>7</sup> It is not possible to evaluate NBR targeting as a method of monetary control from the experience of 1979-82, however, without knowing whether policy actions were consistent with use of the procedure for monetary targeting.

## TARGETING NONBORROWED RESERVES

This section describes the nature of the NBR operating procedure. Most members of the FOMC at the special meeting on October 6, 1979, agreed that the degree of monetary control under the procedure of targeting the federal funds rate had become unsatisfactory. They decided to adopt instead a procedure that linked the supply of NBR to their objectives for money growth, while permitting larger fluctuations in the federal funds rate than under the previous procedure of federal funds rate targeting.<sup>8</sup>

### *Changes in the Nature of FOMC Decisions*

Under the federal funds rate targeting procedure, the FOMC stated its objectives for growth of each monetary aggregate between meetings as a range of growth rates from a month before the meeting to a month after the meeting. Beginning with its meeting on October 6, 1979, the FOMC began specifying its objectives for growth of the monetary aggregates as specific growth rates over periods between meetings. Under the federal funds rate targeting procedure, in contrast, the FOMC stated its objectives for money growth as ranges of growth rates of the monetary aggregates.

Although the FOMC continued to specify ranges for the federal funds rate under the NBR operating procedure, the ranges were widened substantially. For most periods, the range was 400 basis points, compared with ranges of 50 to 100 basis points under the federal funds rate operating procedure. The role that the wider ranges for the funds rate played in the operating

procedure is unclear. On several occasions, the FOMC widened the range on the federal funds rate when the rate threatened to move outside the range. On other occasions, the federal funds rate was allowed to move outside its range for short periods of time.<sup>9</sup>

At each meeting, the FOMC also made an assumption about the average level of borrowed reserves over the period until the next meeting. The staff used this "borrowings assumption" in deriving the target level for NBR.

### *Staff Projections of TR and Estimates of the TR Path*

After each FOMC meeting, the staff would estimate the average level of TR that would be consistent with the FOMC's objectives for growth of monetary aggregates until the next meeting. This was called the "TR path." The target for the average level of NBR between FOMC meetings, called the "NBR path," was simply the TR path minus the borrowings assumption of the FOMC. The objective of the Open Market Desk was to keep the average level of NBR between FOMC meetings equal to the NBR path.<sup>10</sup>

Staff estimates of the TR path were based on FOMC objectives for M1 and M2 and estimates of the following: (1) currency in the hands of the public; (2) average reserve requirements on deposit liabilities in M1 and M2; (3) required reserves on bank liabilities not included in M1 or M2; and (4) excess reserves. The staff generally revised their estimate of the TR path each week, based on new information about the factors that affected the relationship between reserves and the monetary aggregates.

Each time the staff estimated the TR path, they also projected the average level of TR over the same period. Projections of TR were based on estimates of the actual levels of the monetary aggregates between FOMC meetings and the four estimates specified above that were made in estimating the TR path. Each change in the gap between the staff projection of TR and their estimate of the TR path during an intermeeting period, therefore, reflected a change in the staff projections of the monetary aggregates. Appendix 1 illustrates the process of projecting TR and esti-

<sup>7</sup> See Friedman (1984), McCallum (1985), Pierce (1984) and Poole (1982).

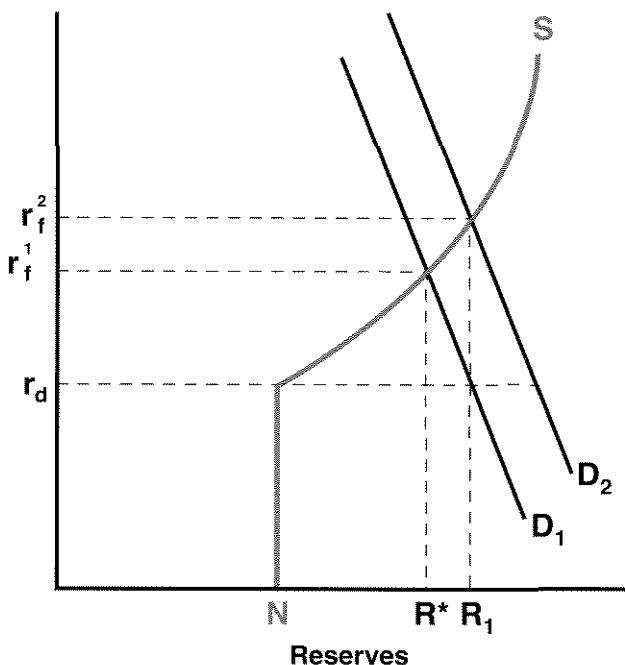
<sup>8</sup> See Board of Governors (1979, p. 974).

<sup>9</sup> See Gilbert and Trebing (1981) and Thornton (1982, 1983).

<sup>10</sup> The staff of the Open Market Desk converted the NBR path for each intermeeting period into weekly and daily objectives for NBR. See Levin and Meek (1981), Meek (1982) and Stevens (1981).

**Figure 4**  
**Supply and Demand for Reserves**

Interest rates



mating the TR path for the first intermeeting period in Table 1.<sup>11</sup>

Since projections of TR and estimates of the TR path reflected information about the same four variables specified above, projections of TR often were revised in the same direction as the estimates of the TR path. In the three weeks ending February 27, 1980, for instance, the projections of TR and the TR path were both reduced, but by different amounts (Table 1). Changes in projections of TR and TR paths over the 37 periods in Table 1 had the same signs in all but eight of the periods. These comparisons indicate that changes in projections of TR over intermeeting periods tended to reflect the same factors that caused the staff to revise its estimates of the TR path: changes in factors that affect the relationship between reserves and the monetary aggregates.

<sup>11</sup> Although the Federal Reserve began using the NBR operating procedure in October 1979, the reports of the Manager of the Open Market Account did not include projections of TR and TR paths on a consistent basis until February 1980. Cook (1989b) discusses some of the difficulties in deriving consistent information from the weekly Reports of Open Market Operations on the conduct of monetary policy in the first few weeks under the NBR operating procedure.

#### *Graphical Representation of NBR Targeting*

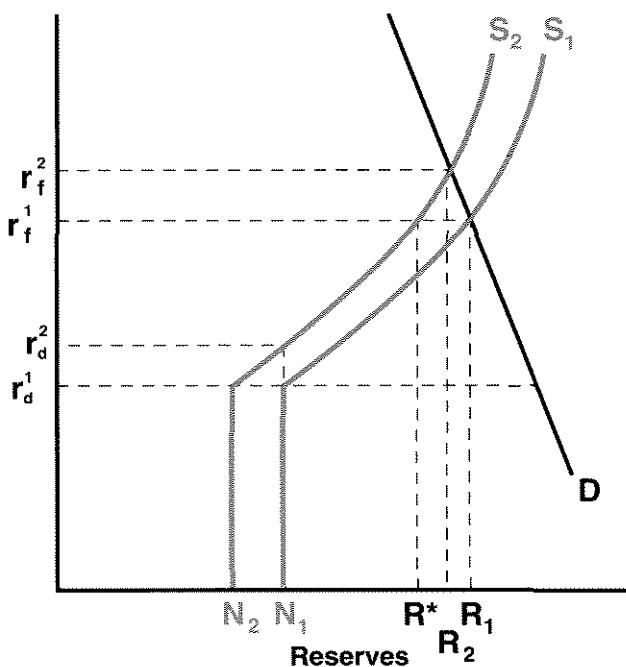
Implementation of monetary policy under this operating procedure is illustrated in Figure 4, using the concepts of supply and demand for reserves and equilibrium in the market for reserves described in Appendix 2.<sup>12</sup> Levels of TR and NBR on the horizontal axis refer to average levels for the weeks between FOMC meetings. On the vertical axis,  $r_d$  is the level of the discount rate and  $r_f$  is the level of the federal funds rate. The TR path is illustrated as  $R^*$ . The NBR path is  $N$ , based on a borrowings assumption of  $R^*$  minus  $N$ . The objective of the Open Market Desk was to keep the average level of NBR over intermeeting periods close to the NBR path.

TR would be at the path level  $R^*$  if the demand

<sup>12</sup> Lindsey (1982, 1983) describes how the procedure of targeting NBR worked in practice by examining the timing of money growth relative to FOMC objectives, borrowed reserves, the federal funds rate and the discount rate. Meek (1982) describes in detail the operations of the Open Market Desk under NBR targeting.

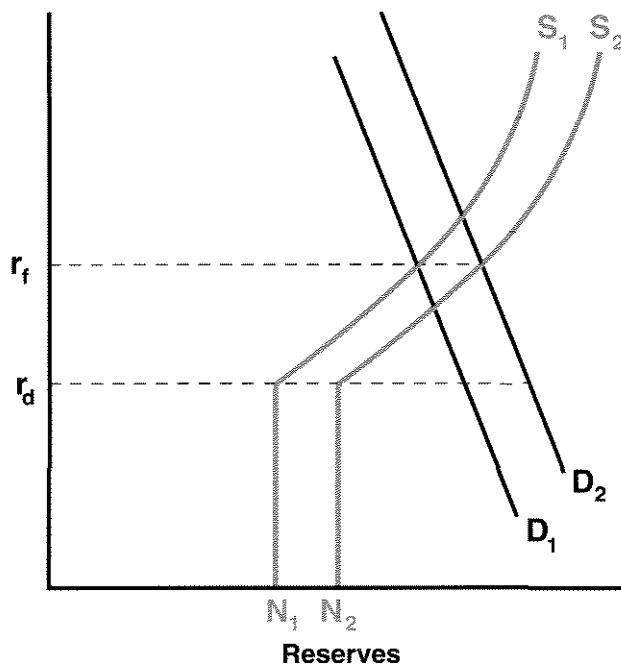
**Figure 5**  
**Tightening of Monetary Policy**

Interest rates



**Figure 6**  
**Federal Funds Rate Targeting**

Interest rates



curve for reserves was  $D_1$ . From that initial position, consider the effects of an increase in the demand for reserves, illustrated by a shift in the demand curve to  $D_2$ , which reflected an increase in the demand for money.<sup>13</sup> TR would rise to  $R_1$ , which is above the TR path. Since the staff of the Open Market Desk would keep NBR at the level  $N$ , the rise in TR to  $R_1$  would involve an increase in borrowed reserves. The federal funds rate would rise from  $r_f^1$  to  $r_f^2$ , inducing the higher level of borrowings. Without any additional policy actions, the money stock would tend to exceed the FOMC's objectives because TR would be above the path level.

During some intermeeting periods, the Federal Reserve took no policy actions in response to changes in the demand for reserves. In the case illustrated in Figure 4, FOMC members considered the rise in the federal funds rate from  $r_f^1$  to  $r_f^2$  an adequate response to the shift in demand for reserves, even if growth of the monetary aggregates exceeded objectives established at the last FOMC meeting.

Experience eventually convinced some Federal Reserve officials that rapid policy responses were necessary to close the gap between actual money growth and FOMC objectives once money growth started to deviate substantially from FOMC objectives.<sup>14</sup> During some periods between FOMC meetings, the Federal Reserve adjusted the level of the NBR path or the discount rate to reduce the deviations of the money stock from desired levels. The Federal Reserve took such policy actions when the deviations appeared to reflect more than transitory movements in the money demand schedule, perhaps due to changes in aggregate spending.<sup>15</sup>

In the situation illustrated in Figure 5, the staff projects TR to be  $R_1$ , which is above the TR path ( $R^*$ ). The policy action illustrated in Figure 5 is a reduction in the NBR path from  $N_1$  to  $N_2$ , which involves an increase in the borrowings assumption from  $R^*$  minus  $N_1$  to  $R^*$  minus  $N_2$ . Due to the inelastic demand for reserves over intermeeting periods, the average level of TR would decline to  $R_2$ , still above the TR path, but

the reduction in NBR would produce a sharp increase in the federal funds rate. The Fed could have the same effect on the funds rate and TR by keeping NBR at  $N_1$  and raising the discount rate to  $r_d^2$ . In taking policy actions that reduced but did not eliminate the gap between projections of TR and path levels, Fed officials emphasized the assumption that sharp increases in interest rates would, over time, reduce the quantity of money demanded. This article does not model the assumed feedback mechanism based on money demand as a function of lagged interest rates.<sup>16</sup>

One of the issues policymakers confronted in determining whether to adjust the NBR path or the discount rate when TR was projected to deviate from path levels involved their confidence in the projections of TR and estimates of the TR path. Studies conducted during the period of NBR targeting indicated large errors in these projections and estimates.<sup>17</sup> These errors would tend to be smaller later in intermeeting periods, when actual observations were available for part of the periods. Observations in Table 1 are consistent with the view that the projections and estimates of TR were subject to large errors, and that the errors affected the timing of policy actions. Table 1 indicates that often there were large revisions to the projections of TR and to TR paths over intermeeting periods. Also, on those occasions when policymakers took actions between FOMC meetings, they generally acted at least two weeks after an FOMC meeting, when they might assume that the projections and estimates were more accurate.

### *Graphical Representation of Targeting the Federal Funds Rate*

One way to highlight the nature of NBR targeting is to contrast the open market operations for a given situation under NBR targeting and under the procedure of targeting the federal funds rate. Suppose the demand for reserves increases, reflecting an increase in the demand for money. Under the NBR targeting procedure, the staff of the Open Market Desk would continue to target the same average level of NBR over the intermediate period (as in Figure 4). If the policymakers

<sup>13</sup> If the shift in demand for reserves resulted from an increase in average reserve requirements on deposit liabilities or excess reserves, the TR path would shift to the right. The rise in the demand for reserves would not affect the federal funds rate.

<sup>14</sup> See Axilrod (1981, pp. A23 - A24).

<sup>15</sup> See Lindsey (1983, p. 5).

<sup>16</sup> For references to this feedback mechanism from changes in interest rates to changes in the quantity of money demanded, see Axilrod (1981, p. A23) and Lindsey (1983).

<sup>17</sup> See Levin and Meek (1981) and Pierce (1981).

wished to limit the deviation of money growth from FOMC objectives, they would reduce the target level of NBR (as in Figure 5). Under the federal funds rate targeting procedure, in contrast, the Fed would respond to an increase in the demand for reserves by increasing the level of NBR enough to keep the federal funds rate unchanged, as illustrated in Figure 6. This contrast provides a standard for judging whether Fed actions in the three years ending in the fall of 1982 were consistent with use of the NBR operating procedure for targeting the monetary aggregates.

## INTERPRETING FEDERAL RESERVE ACTIONS

The framework of supply and demand for reserves is used to interpret monetary policy actions under the NBR operating procedure, as recorded in Table 1.<sup>18</sup>

### *Policy Actions in Selected Intermeeting Periods*

This section illustrates use of the NBR operating procedure for implementing monetary policy during the first two intermeeting periods covered in Table 1. These periods illustrate very different patterns in use of the procedure. During the first period, after the FOMC meeting on February 4-5, 1980, the Fed reduced the NBR path and raised the discount rate when projections of TR began to rise relative to the TR path. This period illustrates aggressive use of the procedure for monetary targeting. During the second period, after the FOMC meeting on March 18, estimates of TR declined sharply relative to the TR path, but the Fed made no adjustments in the NBR path or discount rate in response.

The period from the FOMC meeting on February 4-5, 1980, until the next FOMC meeting was divided into two periods of three weeks each for purposes of projecting the average level of TR and estimating the TR path.<sup>19</sup> As of February 7, the staff projected an average level of TR for the

three weeks ending February 27 that was only \$38 million below the initial estimate of the TR path. By February 15, however, the projections and estimates of TR had changed substantially, with TR projected to be \$313 million above the path level. As of February 15, the Fed reduced the target for NBR by \$67 million relative to the new estimate of the TR path. The reduction in the NBR path was a restrictive policy action. The staff of the Open Market Desk responded to a reduction in the NBR path by adjusting its plans for open market operations to hit a lower average of NBR over the intermeeting period. The Fed also raised the discount rate from 12 percent to 13 percent, effective February 16, another restrictive policy action.

Even though the Fed took these restrictive policy actions over the three weeks ending February 27, the average level of TR was \$272 million above the final estimate of the TR path. These observations raise an issue about how to interpret monetary policy actions under the NBR operating procedure. One view of the conduct of monetary policy during the three weeks ending February 27 would be that policy actions were inconsistent with hitting FOMC targets for monetary aggregates because TR was above the TR path. Interpretation of these actions, however, must account for the way that the Fed operated under lagged reserve requirements, which were in effect during the period of NBR targeting. Required reserves for each week were determined by deposit liabilities two weeks earlier. The Fed operated under the constraint of supplying each week enough reserves to meet required reserves, either through open market operations or through the discount window. For the three weeks ending February 27, required reserves were based on deposits over the three weeks ending February 13. By the time the Fed took policy actions on February 15, therefore, required reserves for the three weeks ending February 27 were predetermined.

This article evaluates whether policy actions

<sup>18</sup> Information on the conduct of monetary policy in Cook (1989a, 1989b) is similar to that in columns six through nine of Table 1. One difference involves the dating of the difference between projections of TR and the TR path (column six) and policy actions (columns seven and eight). The dates in Table 1 are those in the weekly Report of Open Market Operations from the Federal Reserve Bank of New York. Cook dates the gap between the projections of TR and the TR path and dates policy actions as of weeks ending on Wednesdays, thus reflecting the changes that occurred during each seven-day period. For this reason, the dates in Table 1 and in Cook (1989a, 1989b) do not match.

<sup>19</sup> When periods between FOMC meetings were longer than five weeks, the staff divided the intermeeting periods into two subperiods for purposes of setting TR paths and projecting the average levels of TR. The staff divided these intermeeting periods into subperiods to avoid setting weekly objectives for NBR just after an FOMC meeting based on estimates of variables for six or seven weeks into the future. The staff considered their estimates that far into the future to be so unreliable that revisions in their estimates over intermeeting periods could generate unnecessary noise in weekly objectives for NBR.

Table 1

**Policy Actions Under the Nonborrowed Reserves Operating Procedure (amounts in millions of dollars)**

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points		
								1980	1980	1980
<b>1980</b>										
February 4-5	3 weeks ending February 27	February 7 15 22 27	\$ 43,182 43,083 43,311 43,042 -140	\$ 43,220 42,770 42,770 42,770 -450	\$ -38 313 541 272	As of 2/15: \$ -67	Through 2/15: 12% As of 2/16: 13%	February 13 20 27	84 123 -25	
	Change									
	3 weeks ending March 19	February 29 March 7 14 19	42,915 42,933 43,013 43,005 90	42,289 42,289 42,289 42,289 0	626 644 724 716	As of 2/29: \$ -300 <sup>1</sup>	As of 3/14: imposed 3% surcharge	March 5 12 19	155 28 -21	
	Change									
March 18	5 weeks ending April 23	March 21 28 April 4 14 18 23	44,597 44,633 44,458 44,476 44,339 44,336 -261	44,571 44,571 44,771 44,771 44,771 44,771 200	26 62 -313 -295 -432 -435		No change	March 26 April 2 9 16 23	154 161 -35 -69 -79	
	Change									
April 22	4 weeks ending May 21	April 25 May 2 9 16 21	44,543 44,379 44,410 44,377 44,352 -191	45,131 45,181 45,231 45,231 45,231 100	-588 -802 -821 -854 -879	As of 5/2: \$ 100	As of 5/7: eliminated 3% surcharge	April 30 May 7 14 21	244 -216 -211 -14	
	Change									
May 20	4 weeks ending June 18	May 23 30 June 6 13 18	43,821 43,714 43,548 43,592 43,535 -286	43,821 43,714 43,554 43,592 43,592 -229	0 0 -6 0 -57		As of 5/28: 12% As of 6/13: 11%	May 28 June 4 11 18	-125 128 -106 -69	
	Change									
	3 weeks ending July 9	June 20 July 7 9	43,299 43,354 43,377 43,509 210	43,299 43,354 43,377 43,377 78	0 0 0 132		No change	June 25 July 2 9	9 33 -15	
	Change									
July 9	5 weeks ending August 13	July 11 23 28 August 1 8 13	41,602 41,558 41,538 41,512 41,639 41,645 43	41,602 41,558 41,505 41,455 41,480 41,480 -122	0 0 33 57 159 165		As of 7/28: 10%	July 16 23 30 August 6 13	-28 -30 30 62 -75	
	Change									

Table 1(continued)

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points		
								1980	1980	1980
<b>1980</b>										
August 12	5 weeks ending September 17	August 15 19 22 29 September 5 12 17	\$ 39,944 40,239 40,393 40,623 40,596 40,691 40,686 742	\$ 39,816 40,111 40,111 40,261 40,311 40,311 40,311 495	\$ 128 128 282 362 285 380 375	As of 9/5: \$ -150	No change	August 20 27 Sept. 3 10 17	20 68 3 44 -25 42	50 68 44 -25 42
Sept. 16	5 weeks ending October 22	September 19 26 October 3 10 17 22	41,581 41,694 41,522 41,741 41,737 41,697 116	41,199 41,199 41,199 41,299 41,299 41,299 100	382 495 323 442 438 398	As of 10/3: \$ -200	As of 9/26: 11%	Sept. 24 1 8 15 22	24 1 8 15 9	21 153 21 5 9
Oct. 21	4 weeks ending November 19	October 24 31 November 7 14 19	42,004 41,996 41,639 41,745 41,753 -251	41,795 41,795 41,420 41,445 41,445 -350	209 201 219 300 300 308	As of 11/7: \$ -100 As of 11/14: \$ -50	As of 11/17: basic rate 12%, 2% surcharge	October 29 Nov. 5 12 19	29 82 66 57	62 82 66 57
Nov. 18	5 weeks ending December 24	November 21 25 December 1 5 12 23 24	39,988 40,224 40,382 40,392 40,381 40,395 40,514 526	39,691 39,821 40,041 40,131 40,171 40,171 40,171 480	297 403 341 261 210 224 343	As of 12/1: \$ -170	As of 12/5: basic rate 13%; 3% surcharge	Nov. 26 Dec. 3 10 17 24	26 29 110 101 -39	221 29 110 101 -39
December 18-19	4 weeks ending January 14	December 23 29 January 5 9 14	40,948 40,991 40,971 41,168 41,199 251	40,948 41,048 41,148 41,338 41,338 390	0 -57 -177 -170 -139		No change	Dec. 31 January 7 14	31 161 -42	-99 161 -42
	3 weeks ending February 4	January 16 23 February 2 4	41,740 41,509 41,427 41,520 41,371 -369	42,041 41,841 41,841 41,934 41,934 -107	-301 -332 -414 -414 -563		No change	January 21 28 February 4	21 28 -123 -93	-29 -123 -93

Table 1(continued)

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points		
								February	March	April
<b>1981</b>										
February 2-3	4 weeks ending March 4	February 6 17 25 27	\$ 39,627 39,671 39,622 39,489	\$ 39,796 39,998 39,973 39,973	\$ -169 -327 -351 -484 -390	As of 2/25: \$ -166	No change	February 11 18 25 4	-68 -70 -85 77	
	Change	March 4	39,583 -44	39,973 177			No change	March 11 18 25 1	-20 -140 -65 145	
	4 weeks ending April 1	March 6 13 20 27	39,819 39,663 39,661 39,608	40,300 40,135 40,010 40,010	\$ -481 -472 -349 -402 -296					
	Change	April 1	39,714 -105	40,010 -290						
March 31	4 weeks ending April 29	April 3 10 20 24 29	40,006 40,132 40,229 40,122 40,027	40,006 40,165 40,132 40,132 40,132	0 -33 97 -10 -105		No change	April 8 15 22 29	50 -10 22 73	
	Change		21	126						
	3 weeks ending May 20	May 1 8 15 20	40,959 40,736 40,683 40,679	40,407 40,362 40,294 40,294	552 374 389 385	As of 5/1: \$ -250 <sup>a</sup> As of 5/8: \$ -234	As of 5/5: basic rate 14%, 4% surcharge	May 6 13 20	263 -70 68	
	Change		-280	-113						
May 18	4 weeks ending June 17	May 22 29 June 5 12 17	40,011 40,104 40,141 40,078 40,069	40,011 40,098 40,204 40,138 40,138	0 6 -63 -60 -69		No change	May 27 June 3 10 17	-18 -31 93 -23	
	Change		58	127						
	3 weeks ending July 8	June 19 30 July 6 8	40,464 40,674 40,743 40,879	40,643 40,808 40,907 40,907	-179 -134 -164 -28		No change	June 24 July 1 8	10 -36 109	
	Change		415	264						

Table 1(continued)

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points			
								1981	1981	1981	
July 6-7	3 weeks ending July 29	July 10 17 24	\$ 41,359	\$ 41,359	\$ 0		No change	July 15 22 29	-117 29 -51		
		29	41,136 41,126 41,273 -86	41,104 41,134 41,134 -225	32 -8 139						
		Change									
	3 weeks ending August 19	July 31 Aug. 6 14	40,627	40,782	-155		No change	Aug. 5 12 19	-29 4 -10		
		19	40,815 40,824 40,830 203	40,954 40,982 40,982 200	-139 -158 -152						
		Change									
August 18	4 weeks ending September 16	Aug. 21 28	40,510	40,668	-158		No change	Aug. 26 Sept. 2 9	-78 -52 -39		
		4	40,483	40,683	-200						
		15	40,515 40,535	40,833 40,833 165	-318 -298 -244						
	Change	16	40,589 79	40,833 165							
		3 weeks ending October 7	Sept. 18 25	40,715	-447	As of 9/22: 3% surcharge	Sept. 23 Oct. 30 7	-76 -33 46			
			Oct. 2	40,721	-419						
		7	40,847 106	41,226 41,226 64	-379 -405						
October 5-6	3 weeks ending October 28	Oct. 9 20	40,997	40,997	0		As of 10/12: 2% surcharge	Oct. 14 21 28	-53 39 -45		
		23	40,812	40,883	-71						
		28	40,799 40,751 -246	40,868 40,868 -129	-69 -117						
	Change	3 weeks ending November 18	Oct. 30 Nov. 6	40,751		As of 11/6: \$56	As of 11/2: basic rate 13% As of 11/17: surcharge eliminated	Nov. 4 11 18	-8 -78 -84		
			13	40,673	-144						
			17	40,661 40,600 40,617	-194 -154 -154						
		18	40,662 -11	40,771 40,771 -46	-109						
November 17	5 weeks ending December 23	Nov. 20 30	41,209	41,209	0		As of 12/4: 12%	Nov. 25 Dec. 2 9	-75 6 -44		
			41,277	41,252	25						
			41,305	41,252	53						
		Change	Dec. 4 14 18 23	41,620	41,525			16 23	22 17		
				41,488	41,389						
				41,488	41,389						
46			41,533	41,389 324 180	99 99 144						

Table 1(continued)

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points	
<b>1982</b>								<b>1982</b>	
December 21-22, 1981	6 weeks ending February 3	Dec. Jan. 28 4 8 15 22 29	\$ 42,684 42,779 42,860 43,020 42,976 42,965 43,013	\$ 42,684 42,573 42,536 42,534 42,459 42,351 42,351	\$ 0 206 324 486 517 614 662	As of 1/15: \$ -187	No change	Dec. Jan. 30 6 13 20 27 Feb. 3	11 44 -56 54 102 79
	Change	Feb. 3	329	-333					
February 1-2	4 weeks ending March 3	Feb. 5 16 19 26	41,270 41,214 41,077 41,065	41,270 41,309 41,158 41,181	0 -95 -81 -116		No change	Feb. 10 17 24 March 3	42 42 -175 21
	Change	March 3	-129	-89	-40				
	4 weeks ending March 31	March 5 12 19 26 31	39,102 39,094 38,988 39,002 39,035	39,376 39,239 39,159 39,159 39,159	-274 -145 -171 -157 -124			March 10 17 24 31	28 54 -41 51
	Change		-67	-217					
March 29-30	4 weeks ending April 28	April 2 9 16 23 28	39,536 39,537 39,582 39,498 39,474	39,536 39,449 39,414 39,334 39,334	0 88 168 164 140		No change	April 7 14 21 28	16 -47 33 -29
	Change		-62	-202					
	3 weeks ending May 19	April 30 May 7 14 19	39,679 39,658 39,786 39,810	39,702 39,702 39,821 39,821	-23 -44 -35 -11			May 5 12 19	81 -56 -30
	Change		131	119					
May 18	6 weeks ending June 30	May 21 28 June 4 11 18 28 30	39,401 39,409 39,368 39,478 39,487 39,472 39,507	39,401 39,385 39,355 39,428 39,373 39,373 39,373	0 24 13 50 114 99 134		No change	May 26 June 2 9 16 23 30	-97 -27 17 64 -7 64
	Change		106	-28					

Table 1(continued)

FOMC meeting	Period for setting total reserves path	Dates of projections and estimates	Projected total reserves	Total reserves path	Difference	Changes in the NBR path between FOMC meetings to limit the size of deviations of TR from path	Discount rate	Change in the federal funds rate, in basis points		
								1982	July	Aug.
<b>1982</b>										
June 30–July 1	4 weeks ending July 28	July 2 9 16 23 28	\$ 39,978 39,994 40,017 40,002 39,976 -2	\$ 39,978 40,078 40,114 40,085 40,085 107	\$ 0 -84 -97 -83 -109 -107	As of 7/16: \$ 85	As of 7/20: 11.50%	July 7 14 21 28	34 -129 -104 -112	
	Change									
	4 weeks ending Aug. 25	July 30 Aug. 6 13 20 25	40,203 40,156 40,139 40,112 40,111 -92	40,411 40,411 40,391 40,343 40,343 -68	-208 -255 -252 -231 -232 -68	As of 7/30: \$ 100	As of 8/2: 11% As of 8/16: 10.50%	Aug. 4 11 18 25	13 -25 -79 -107	
	Change									
Aug. 24	3 weeks ending Sept. 15	Aug. Sept. 27 3 10 15	39,510 39,609 39,767 39,812 302	39,510 39,573 39,663 39,663 153	0 36 104 149		As of 8/27: 10%	Sept. 1 8 15	111 -1 13	
	Change									
	3 weeks ending Oct. 6	Sept. 17 Oct. 24 1 6	40,227 40,279 40,348 40,386 159	39,933 39,784 39,784 39,784 -149	294 495 564 602	As of 9/24: \$ 248		Sept. 22 Oct. 29 6	4 -19 65	
	Change									
Oct. 5	3 weeks ending Oct. 27	Oct. 8 15 22 27	40,454 40,579 40,583 40,578 124	40,454 40,598 40,587 40,587 133	0 -19 -4 -9		As of 10/12: 9.50%	Oct. 13 20 27	-117 -7 -9	
	Change									

<sup>1</sup> The three weeks ending March 19, 1980, is the second subperiod between FOMC meetings on February 4-5 and March 18. The NBR path was reduced by \$300 million relative to the TR path at the beginning of this subperiod to limit the size of the deviation of TR from path.

<sup>2</sup> The three weeks ending May 20 is the second subperiod between FOMC meetings on March 31 and May 18. The NBR path was reduced by \$250 million relative to the TR path at the beginning of this second subperiod to limit the size of the deviation of TR from path.

were consistent with use of the NBR procedure for monetary control by examining the direction and magnitude of policy actions in relation to the gaps between the projections of TR and estimates of the TR path at the time of the policy actions. From this perspective, policy actions during the three weeks ending February 27, 1980, were consistent with use of the NBR operating procedure for monetary control.<sup>20</sup>

As of February 29, the staff projected that TR would be \$626 million above path level in the second intermeeting period (the three weeks ending March 19). That day, the Fed reduced its target for NBR by \$300 million relative to the TR path to limit the size of this deviation of TR from the path. As a result of that reduction in the NBR path, banks were forced to obtain more of the reserves from the discount window to meet their required reserves. The federal funds rate rose by 155 basis points in the week of this policy action.

Projections later in the period indicated that the gap between TR and the path level was continuing to grow. On March 14, the Fed imposed a surcharge of 3 percent on discount window borrowings by banks with deposits of \$500 million or more that borrowed frequently, as part of President Carter's program of credit controls and monetary restraint.<sup>21</sup> During this first intermeeting period examined in Table 1, the Fed took four policy actions that were appropriate for monetary control with TR projected to exceed the path level: two reductions in the NBR path and two increases in the discount rate.

The FOMC met again on March 18, four days after President Carter announced a program of credit controls and monetary restraint. In support of the President's program, the FOMC tightened

monetary policy by increasing the borrowings assumption substantially (Table 4). With given objectives for growth of the monetary aggregates, a larger borrowings assumption implies a lower NBR path and, therefore, a more restrictive monetary policy.

As of the beginning of the period after the March FOMC meeting (that is, the five weeks ending April 23, 1980), TR was projected to be approximately equal to the TR path. Later in that period, the projection of TR was reduced and the TR path increased, producing a widening gap between projected TR and the path level. The Fed, however, took no policy actions to limit the size of that gap. The actual level of TR ended up \$435 million below the final estimate of the TR path.

### *General Patterns in Policy Actions*

Examination of policy actions in Table 1 for the entire period from February 1980 through October 1982 indicates several patterns:<sup>22</sup>

**Variable Pattern in the Use of Policy Tools —** For given staff projections and estimates of TR, policy actions were highly variable. As noted for periods examined above, widening gaps between projections of TR and path levels induced prompt and substantial adjustments of policy tools in some periods but not in other periods. To identify relevant periods when the Fed did not take policy actions, it is necessary to specify a criterion for identifying relatively large deviations of TR from the TR path. This paper uses \$200 million or more as the size of a large deviation, based on the following reasoning. Over the period of NBR targeting, TR was approximately \$40 billion. A gap of \$200 million is one-half of 1 percent of

<sup>20</sup> The last observation for TR over each intermeeting period reflects the information available to Fed staff as of the end of the period. For instance, the last estimate of TR for the three weeks ending February 27, 1980, was the staff estimate as of February 27. The data for TR over intermeeting periods reflect the information available to policymakers at the time, not subsequent revisions to TR.

<sup>21</sup> For more details on the discount rate surcharge, see Board of Governors (1980, pp. 315-18). For a description of the credit control program, see Gilbert and Trebing (1981).

<sup>22</sup> This article does not include among the policy actions some adjustments to the supply of NBR which might properly be classified as policy actions. Levin and Meek (1981) mention that on some occasions the staff of the Open Market Desk based open market operations on movements in the federal funds rate, rather than their numbers on factors affecting NBR. As they describe those actions, the objective was to use the federal funds rate as an indicator of errors in their numbers on factors affecting NBR. They do not indicate that these open market operations based on movements in the

federal funds rate interfered with hitting targets for NBR over intermeeting periods.

Other adjustments to the supply of NBR raise more questions about adjustments to the supply of NBR that should be labeled as policy actions. At times, the staff adjusted the supply of NBR to prevent large movements in borrowings and in the federal funds rate just prior to FOMC meetings. Weekly Reports on Open Market Operations mention that at times the staff did not make the full adjustments to the TR path that were indicated by their information on factors affecting the relationship between reserves and the monetary aggregates, and the reports refer to occasions when the staff deliberately allowed NBR to deviate from its path level, to avoid forcing large changes in borrowed reserves just before FOMC meetings. Table 1 limits its list of policy actions to those identified clearly as policy actions in the Report on Open Market Operations.

\$40 billion. An error of approximately one-half of 1 percent in hitting a target for an aggregate over a month, compounded over a year, would be an error of 6 percent, which could be interpreted as a substantial error. TR deviated from the TR path by at least \$200 million, and the Fed took no policy actions in response, in each of the periods after the FOMC meetings on March 18, 1980, and December 18-19, 1980.

**Directions of Policy Actions Were Appropriate for Monetary Control** — Prior to the fall of 1982, the *direction* of each policy action between FOMC meetings was appropriate for monetary control. When TR was projected to be above the path level, policy actions included reductions in the target for NBR relative to the TR path or increases in the discount rate. The Fed took the opposite types of policy actions when TR was projected to be below the path level.<sup>23</sup>

The only exception to this pattern occurred on February 25, 1981. The Fed reduced the NBR path by \$166 million when the staff projected TR to be \$351 million below the TR path. At that time, the growth of M2 and M3 exceeded FOMC objectives, whereas M1 was growing more slowly than the target set by the FOMC at its meeting on February 2-3, 1981. TR was below the TR path because required reserves predominately reflected the required reserves on deposits in M1. In February 1981, the FOMC decided to put more weight on its objectives for M2 and M3 than on M1. Therefore, the FOMC decided to reduce the supply of NBR to limit the growth of M2 and M3. This reduction in the NBR path on February 25, 1981, was consistent with use of the NBR procedure for monetary targeting, even though TR was projected to be below the path at the time of the policy action.

The change in the NBR target on September 24, 1982, in contrast, illustrates a policy action that was inconsistent with use of the NBR operating procedure for monetary control. It is generally

recognized that by the fall of 1982, the Fed had abandoned use of the NBR operating procedure in favor of smoothing short-term interest rates.<sup>24</sup> For operational purposes, however, the staff continued to calculate the numbers that had been important for conducting policy under the NBR procedure. After the FOMC meeting on August 24, 1982, projections of TR were increased gradually relative to estimates of the TR path, and by September 24, the gap had reached \$495 million. A policy action appropriate for monetary targeting would have been a reduction in NBR. Instead, the Fed *increased* the target for NBR, to limit the rise in short-term interest rates in response to the rise in demand for reserves. This action, the kind of policy action illustrated in Figure 6, provides one way to date the end of the NBR operating procedure.

**Size of the Policy Actions** — Table 2 lists the changes in the NBR path between FOMC meetings that the Fed classified as policy actions. These changes in the NBR path generally were about half or less of the gap between TR projected by the staff and the TR path at the time of the policy actions. These observations indicate that even at those times when the Fed adjusted the NBR path as a policy action, the Fed was willing to tolerate large deviations of TR from the path over intermeeting periods. The emphasis in the policy was bringing the levels of the monetary aggregates closer to FOMC objectives over time. The policy did not call for actions to force immediate shifts of the levels of the aggregates back to the levels specified in FOMC directives.

**Policy Actions Did Not Cause All of the Sharp Fluctuations in Interest Rates** — The federal funds rate was more variable during the period of NBR targeting than in surrounding periods (Figure 1). These large fluctuations generated a lot of complaints from market participants and from economists critical of the procedure. In evaluating NBR targeting as a method of implementing monetary policy, it would be useful to

<sup>23</sup> Some changes in the gap between the NBR path and the TR path were labeled "technical adjustments" to the supply of NBR, not policy actions. The purpose of these technical adjustments was to offset the effects on interest rates of changes in the relationship between borrowings and the spread between the federal funds rate and the discount rate for TR. At times, the staff concluded that there were persistent changes in the quantity of reserves borrowed by banks for given spreads between the federal funds rate and the discount rate. In terms of Figures 1 and 4, there appeared to be shifts in the slope of the supply curve of reserves. At those times, the staff adjusted the supply of NBR to offset possible effects on interest rates of such changes in the

behavior of banks. Table 1 does not include these adjustments to the supply of NBR because the purpose of this article is to examine patterns of policy actions under the NBR operating procedure. Reports by the Manager of the Open Market Account distinguish between technical adjustments and changes in the supply of NBR labeled policy actions.

<sup>24</sup> See Thornton (1983, 1988).

**Table 2**  
**Size of Changes in the Nonborrowed Reserves Path**

Date	Change in the NBR path (millions of dollars)	Change in the NBR path as a percentage of the most current staff projection of the gap between TR and the TR path
<b>1980</b>		
2/15	\$ -67	21.4%
2/29	-300	47.9
5/2	+100	12.5
9/5	-150	52.6
10/3	-200	61.9
11/7	-100	45.7
11/14	-50	16.7
12/1	-170	49.9
<b>1981</b>		
2/25	\$ -166	N/A <sup>1</sup>
5/1	-250	45.3%
5/8	-234	62.6
11/6	+56	28.9
<b>1982</b>		
1/15	\$ -187	38.5%
7/16	+85	87.6
7/30	+100	48.1

<sup>1</sup> The NBR path reduced at a time when TR were projected to be below the TR path.

know whether the relatively large fluctuations in interest rates under NBR targeting reflected frequent, aggressive policy actions to hit short-run money targets. Perhaps fluctuations in the federal funds rate under a NBR targeting procedure would be substantially smaller than the experience of 1980-82 if the Fed used the procedure less aggressively in attempting to hit short-run money targets. In contrast, many of the relatively large weekly changes in the federal funds rate may have

<sup>25</sup> Cook (1989a, 1989b) conducted a similar analysis of the timing of policy actions and changes in the federal funds rate during the period of NBR targeting. Cook investigated the degree to which changes in the federal funds rate over periods between FOMC meetings could be explained in terms of policy actions. Cook concluded that roughly two-thirds of

occurred simply because the Fed placed less weight on limiting interest rate fluctuations under the NBR operating procedure than other operating procedures.

It is possible to determine whether the relatively large weekly fluctuations in the federal funds rate reflected the effects of policy actions by examining their timing and the timing of policy actions.<sup>25</sup> Table 3 examines the pattern of policy actions during the weeks in which the federal funds rate changed by 100 basis points or more. Changes in weekly average levels of the federal funds rate of 100 basis points or more were relatively common during the three years ending in September 1982. For example, Table 3 lists 29 weekly occurrences. During the three years ending in September 1979, in contrast, there were no weeks when the federal funds rate changed by as much as 100 basis points. During the three years ending in September 1985, the three years following the period of NBR targeting, the federal funds rate changed by 100 basis points or more in only five weeks.

Seven of the relatively large changes in the federal funds rate in Table 3 occurred in the weeks just after FOMC meetings. For instance, the federal funds rate rose 154 basis points in the week ending March 26, 1980, the first week after the FOMC meeting on March 18. The decisions of the FOMC at its meeting on March 18, 1980, can be characterized as a tightening of monetary policy. Table 4 illustrates the shift in monetary policy at the FOMC meeting on March 18 in terms of an increase in the borrowings assumption relative to the level set at the prior meeting: from a level of \$1.25 billion set at the meeting on February 4-5 to a level of \$2.75 billion set on March 18. The rise in the federal funds rate in the week ending March 26 is consistent with a tightening of monetary policy at the FOMC meeting on March 18.

The federal funds rate fell by 244 basis points in the week ending April 30, 1980, which was the first week after the FOMC meeting on April 22. At its meeting on April 22, the FOMC decided to reverse the tightening of monetary policy at its prior meeting. Table 4 illustrates the easing of monetary policy at the meeting of April 22 with

the changes in the federal funds rate were due to judgmental actions of the Federal Reserve. This article, in contrast, examines the timing of relatively large weekly changes in the federal funds rate and policy actions.

Table 3

**Association Between Weekly Changes in the Federal Funds Rate  
of 100 Basis Points or More and Policy Actions**

Week ending	Change in the federal funds rate from the prior week, in basis points	Change in the NBR target	Change in the discount rate or surcharge	First week after an FOMC meeting
X indicates occurrence in the week				
<b>1980</b>				
2/20	+123	X	X	
3/5	+155	X		
3/26	+154			X
4/2	+161			
4/30	-244			X
5/7	-216	X	X	
5/14	-211			
5/28	-125		X	
6/4	+128			
6/11	-106			
10/1	+153		X	
11/26	+221			
12/10	+110		X	
12/17	+101			
<b>1981</b>				
1/7	+161			
1/28	-123			
3/18	-140			
4/1	+145			
5/6	+263	X	X	
7/8	+109			
7/15	-117			X
<b>1982</b>				
1/27	+102			
2/24	-175			
7/14	-129			
7/21	-104	X	X	
7/28	-112			
8/25	-107			
9/1	+111		X	X
10/13	-117		X	

**Table 4  
Initial Assumptions for Borrowed  
Reserves Set by the FOMC, 1980-82**

Date of FOMC meeting	Initial assumption for borrowed reserves (millions of dollars)
<b>1980</b>	
January 8-9	\$ 1,000
February 4-5	1,250
March 18	2,750
April 22	1,375
May 20	100
July 9	75
August 12	75
September 16	750
October 21	1,300
November 18	1,500
December 18-19	1,500
<b>1981</b>	
February 2-3	\$ 1,300
March 31	1,150
May 18	2,100
July 6-7	1,500
August 18	1,400
October 5-6	850
November 17	400
December 21-22	300
<b>1982</b>	
February 1-2	\$ 1,500
March 29-30	1,150
May 18	800
June 30-July 1	800
August 24	350
October 5	300
November 16	250
December 20-21	200

the decline in the initial borrowings assumption to \$1.375 billion.

Comparison of Tables 3 and 4 illustrates this consistent pattern: On those occasions when the federal funds rate changed by over 100 basis points in the first week after an FOMC meeting, increases in the federal funds rate coincided with increases in the initial borrowings assump-

tions at the FOMC meetings, and relatively large decreases in the federal funds rates were associated with reductions in the initial borrowings assumptions. This pattern prevailed until the fall of 1982, when the Fed had largely abandoned use of NBR targeting. Thus, some of the relatively large changes in the federal funds rate reflected policy actions initiated at the time of FOMC meetings.

Of the 29 weeks in Table 3 in which the federal funds rate changed by 100 basis points or more, 15 were *not* the first week after an FOMC meeting or weeks of changes in the NBR path or the discount rate. Many of the relatively large weekly changes in the federal funds rate, therefore, reflected the relatively low weight the Fed attached to limiting fluctuations in the federal funds rate under the NBR operating procedure. Also, the economy was very volatile during the period of NBR targeting. Influences other than the conduct of monetary policy may have contributed substantially to the variability of interest rates over this period.

## CONCLUSIONS

The conduct of monetary policy in the United States from October 1979 through the fall of 1982 has important implications for the design of procedures for targeting monetary aggregates today. This is the only period in which daily open market operations were tied directly to objectives of the FOMC for growth of the monetary aggregates. It is our closest approximation to short-run monetary control in the United States. Some critics of the conduct of monetary policy in this period have concluded that errors in hitting the money targets of the FOMC reflected problems inherent in the design of the procedure.

This article presents information on the conduct of monetary policy in this period of nonborrowed reserves (NBR) targeting not available in other published studies. This information includes Fed staff projections of the actual levels of total reserves (TR) over periods between FOMC meetings and staff estimates of the average levels of TR between meetings that would have been consistent with FOMC objectives for money growth (the TR paths). Using this information, we can examine the timing and size of policy actions in relation to the information available to Fed policymakers at the time.

Examination of policy actions during the period of NBR targeting yields the following

observations. First, the pattern of policy actions does not reflect consistent use of the procedure over time for monetary targeting. During some intermeeting periods in which the staff projected that TR would deviate substantially from the TR path, the Fed took no policy actions, whereas in other periods the Fed took aggressive actions consistent with monetary targeting. Second, when the Fed did take policy actions, they were in the *directions* appropriate for monetary control, given the staff projections and estimates available at the time. This observation contradicts assertions that there was no change in the operating procedure in October 1979. Third, the *magnitude* of policy actions often was small in relation to the gap between the projection of TR and the path. These three observations have implications for interpreting the three years ending in the fall of 1982 as an experiment in monetary targeting. The commitment of policymakers to hitting short-run money targets varied over those three years. Any conclusions derived from data for those three years concerning NBR targeting as a method of monetary control should account for variation over time in the commitment of policymakers to take actions appropriate for monetary control.

The fourth observation concerns the degree of interest rate variability under a procedure of NBR targeting. While several of the relatively large weekly changes in the federal funds rate coincided with the timing of policy actions, the Fed took no policy actions at the time of some relatively large fluctuations in the federal funds rate. Interest rate fluctuations during the period of NBR targeting reflect use of an operating procedure which left the federal funds rate largely unconstrained within wide bands. It is difficult to extrapolate from this experience to the degree of weekly interest rate variability that would exist under use of an NBR procedure now. This experience, however, is consistent with the view that targeting NBR for purposes of short-run monetary control would tend to increase weekly interest rate variability.

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## Appendix 1

### Illustration of Staff Projections and Estimates of Total Reserves

This appendix describes the steps involved in staff estimates of the TR path and projections of TR for the intermeeting period after the FOMC meeting on February 4-5, 1980. The staff divided the intermeeting period into two subperiods of three weeks each, ending on February 27 and March 18. They made such divisions when the periods between meetings were longer than five weeks to avoid using projections of variables several weeks into the future in determining the supply of NBR early in an intermeeting period.

To aid in clarifying the timing of relationships between deposits and reserves, Table A1 presents a calendar of January and February 1980. At its meeting on February 4-5, the FOMC specified its short-run objectives as growth of M1-B at a 5 percent rate and M2 at a 6.5 percent rate over the first quarter of 1980. To estimate the TR path for the three weeks ending February 27, the staff would do the following calculations:

1. Project the weekly levels of M1 and M2 growing at the desired rates from mid-December through the three weeks ending February 13. Deposits over the three weeks ending February 13 determine required reserves over the three weeks ending February 27. These weekly levels are projected from the seasonally adjusted data for December and then converted into nonseasonally adjusted levels using the seasonal factors for those weeks.
2. Estimate currency in the hands of the public, not seasonally adjusted, for the three weeks ending February 13.
3. Subtract the estimate of currency in the hands of the public from the projection of M1 to derive the level of checkable deposits, not seasonally adjusted, if M1 grew at the rate desired by the FOMC.
4. Multiply the average level of checkable deposits as derived in step 3 by an estimate of the average reserve requirement on checkable deposits.
5. Subtract the estimate of average currency holdings as described in step 2 and checkable deposits as described in step 3 from the projection of M2, as described in step 1.

Table A1

#### Calendar of January and February 1980

January						
S	M	T	W	Th	F	S
			1	2	3	4
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February						
S	M	T	W	Th	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

Multiply by an estimate of the average reserve requirement on deposits in M2 but not in M1.

6. Sum estimates of required reserves as described in steps 4 and 5 and an estimate of required reserves on deposits not in M2 to derive an estimate of what required reserves would be in the three weeks ending February 27 if M1 and M2 grew at the rates specified by the FOMC at its meeting on February 4-5. Add an estimate of the average level of excess reserves for the three weeks ending February 27 to get an estimate of the TR path over the three weeks ending February 27.

The steps involved in projecting TR are similar to the steps in estimating the TR path:

1. Estimate liabilities subject to reserve requirements for the three weeks ending February 13, not seasonally adjusted. The Federal Reserve

staff generally had data on reservable liabilities eight days after the end of a reserve maintenance week. By February 7, the date of the first projection, the staff would have had information on reservable liabilities for the week ending January 30. They would have to estimate liabilities for the weeks ending February 6 and 13.

2. Estimate average reserve requirements on various categories of liabilities.
3. Sum the projections for required reserves for the three weeks ending February 27, based on calculations described in steps 1 and 2, and add an estimate of average excess reserves.

## Appendix 2

### A Tool for Describing the Conduct of Monetary Policy: Supply and Demand for Reserves

This paper describes the conduct of monetary policy under the NBR operating procedure using diagrams of the supply and demand for bank reserves.<sup>1</sup> This appendix describes the determinants of the supply and demand curves, and the following section uses this analytical tool to describe the mechanics of the NBR operating procedure.

Reserves available to meet reserve requirements include currency that banks hold in their vaults and their reserve balances at Federal Reserve Banks. The Federal Reserve supplies reserves. Banks demand reserves to facilitate their customers' transactions and to meet reserve requirements imposed by the Federal Reserve, which are based on the amount and composition of their liabilities.

Banks earn no interest on reserves. This article identifies the opportunity cost to banks of holding reserves as the federal funds rate, which is the interest rate that banks charge each other for lending reserves.<sup>2</sup> A bank changes its reserves by borrowing or lending at the federal funds rate.

Demand for reserves by banks is drawn as a function of the federal funds rate in Figures 4-6. Reserve requirements on deposits included in the money stock create a close relationship

between the demand for money by the public and the demand for reserves by banks. Demand for reserves, therefore, depends on reserve requirements and the demand for money.

Demand for money is assumed to be a function of total spending in the economy and interest rates. Various influences can cause shifts in the demand curve for reserves. A change in total spending in the economy, which influences the demand for money, would cause the demand curve for reserves to shift. Shifts in the demand for reserves could reflect other influences: changes in the random component of money demand; the average reserve requirement on deposit liabilities included in the money stock; reserve requirements on other liabilities; or the demand for excess reserves.

Elasticity of the demand for reserves depends on the relevant time period over which average reserves are measured. The demand curves for reserves in Figures 4-6 are steeply sloped because it is for a period between FOMC meetings. Over these periods, there is little time for a change in interest rates to change the quantity of money demanded, feeding back to a change in the quantity of reserves demanded.

Factors that influence the supply of reserves can be analyzed by considering separately the

<sup>1</sup> For convenience of exposition, the term "bank" refers to all depository institutions.

<sup>2</sup> Federal funds brokers facilitate the operation of the federal funds market. These brokers receive orders from depository institutions located throughout the nation to lend or borrow reserves, and the brokers match lenders and borrowers at mutually agreeable interest rates. Most of the transactions through the federal funds market involve borrowing and

lending reserves for one day. The transfers of reserves to borrowers are made the same day through wire transfer systems, including the Fed Wire of the Federal Reserve System.

determinants of borrowed reserves and NBR. The Federal Reserve determines the amount of NBR directly through the open market operations. Banks decide the amount of reserves they borrow from the Federal Reserve, but their decisions are shaped by lending terms set by the Federal Reserve, including the discount rate and limits on the size and frequency of borrowings by individual banks. Banks try to avoid exceeding these borrowing limits to ensure that they maintain access to credit from the Fed to cover their short-term liquidity requirements. If a bank borrows now, it will be subjected to greater administrative pressure to limit its borrowings in the future, when the attractiveness of borrowing from the discount window might be greater.

The supply curve for reserves in Figure 4 is drawn as a vertical line from the level of NBR (labeled N) up to the level on the vertical axis at which the federal funds rate equals the discount rate ( $r_d$ ). If the discount rate is above the federal funds rate, the amount of reserves borrowed from Federal Reserve Banks tends to be relatively low and insensitive to small changes in the federal funds rate. The supply curve of reserves is upward sloping in the range with the federal funds rate above the discount rate. Given the terms for lending set by the Federal Reserve, it takes an increase in the spread between the federal funds rate and the discount rate to induce banks to increase their borrowings from the discount window.<sup>3</sup>

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<sup>3</sup> Goodfriend (1983) derives the relationship between borrowings and the rate spread from a theoretical framework that is based on profit-maximizing bank behavior.