
Highlights of Domestic Open Market Operations during 1998

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The Trading Desk at the Federal Reserve Bank of New York uses open market operations to implement the policy directives of the Federal Open Market Committee (FOMC). The FOMC expresses its short-term objective for open market operations as a target level for the federal funds rate—the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions. To keep the federal funds rate near the level specified by the FOMC, the Desk uses open market operations to bring the supply of balances at the Federal Reserve into line with the demand for them.

In 1998 the level of balances that depository institutions were required to hold at the Federal Reserve continued to slip, to historic lows. The primary reason for this decline was the ongoing proliferation of retail “sweep” programs, which transfer depositors’ funds from transaction accounts that are subject to reserve requirements into other deposit accounts that are not.¹ The decline in required balances encouraged depository institutions to hold more excess reserves during the year.²

In past years, declines in required balances had been associated with greater volatility in the federal funds rate because depository institutions have less

flexibility in managing their daily balance positions. With lower requirements, a depository institution is less able to substitute balances across days of the maintenance period to meet its balance requirement, which must be met by the average of its holdings over the period, because the risk of overdrawing its account at the end of the day is greater.³ However, through the first three quarters of 1998, the funds rate behaved much as it had in 1997, even though required balances were lower. In the final quarter of 1998, funds rate volatility and levels of excess reserves rose when funds market participants evinced greater concerns about the credit quality of their counterparties at a time of increased uncertainty in financial markets. These heightened credit concerns upset normal trading relationships among institutions in the federal funds market, and market participants were more wary of approaching the Federal Reserve’s discount window to borrow for fear of being perceived as being in unsound financial condition, even though the identity of any institution that borrows is strictly confidential. In this environment, many depository institutions bid aggressively for balances at the Federal Reserve, thus lifting the funds rate, especially early in the day, but often with the result that the rate fell off in later trading after borrowers became confident that their demand for balances would be satisfied. The Desk responded to the upward rate pressure it saw on many mornings by elevating the levels of excess reserves it provided.

The Desk’s selection of open market operations in 1998 was influenced by changing market circumstances, such as the ongoing decline in required balances. With the backdrop of falling required balances, the Desk in managing reserve supply increased its reliance on very short-term operations. It also adopted a somewhat different approach to addressing deep seasonal reserve shortages around the end of the

1. Past annual reports on open market operations have discussed the growth of sweep accounts and other developments surrounding the Desk’s operations, and these remained themes in 1998. The annual report for 1998 and those from other recent years are available on the web site of the Federal Reserve Bank of New York (<http://www.ny.frb.org>).

2. Depository institutions hold balances at the Federal Reserve to satisfy reserve and other balance requirements. Some institutions also hold additional balances—called excess reserves—to guard against unanticipated debits to their accounts at the Federal Reserve that could leave the account overdrawn at the end of the day or short of the level needed to satisfy their requirements.

3. For further detail on the operating practices and techniques used by the Trading Desk, see Cheryl L. Edwards, “Open Market Operations in the 1990s,” *Federal Reserve Bulletin*, vol. 83 (November 1997) pp. 859–74; Ann-Marie Meulendyke, *U.S. Monetary Policy and Financial Markets* (Federal Reserve Bank of New York, 1998); and M. A. Akhtar, *Understanding Open Market Operations* (Federal Reserve Bank of New York, 1997).

year—an approach designed to take advantage of its new authority granted by the FOMC to arrange temporary transactions with maturities of up to sixty days. Largely as a consequence, fewer reserves were added on a permanent basis in 1998 than in 1997.

IMPLEMENTATION OF MONETARY POLICY IN 1998

Directives of the Federal Open Market Committee

In 1998 the Federal Open Market Committee (FOMC) continued to express its operating objective for monetary policy as a specific level of the overnight federal funds rate—the interest rate on interbank loans of balances held on deposit at the Federal Reserve. After each of its policy meetings, the FOMC issued a written directive to the Trading Desk, instructing it to foster conditions in reserve markets consistent with maintaining the federal funds rate at an average around the target rate.⁴ Beginning in September 1998, the FOMC lowered its target level for the federal funds rate on three occasions before the end of the year, each time by 25 basis points. On two of these occasions the Board of Governors also approved an equal reduction in the discount rate, the interest rate that the Federal Reserve charges depository institutions for borrowing at its discount window facility (table 1). The reduction in the funds rate in September was the first time that the FOMC had changed its target rate since March 1997.

4. The directive is released along with the minutes of each FOMC meeting shortly after the conclusion of the next regularly scheduled FOMC meeting. The minutes, which contain the directives, are reprinted in the *Federal Reserve Bulletin* and are available on the Board's web site (<http://www.federalreserve.gov>).

1. Changes in the federal funds rate specified in directives of the Federal Open Market Committee, March 25, 1997–November 17, 1998

Percent

Date of change	Expected federal funds rate	Associated discount rate
March 25, 1997	5.50	5.00
September 29, 1998	5.25	5.00
October 15, 1998	5.00 ¹	4.75
November 17, 1998	4.75	4.50

1. First change made between regular Federal Open Market Committee (FOMC) meetings since April 18, 1994.

Maintenance Periods and the Desk's Nonborrowed Reserve Objective

Each depository institution is required to hold reserves, either in the form of vault cash or balances at the Federal Reserve, in a fixed proportion to certain of its deposit liabilities. Two-week computation periods establish the time frame over which institutions' deposit levels are averaged for the purpose of calculating their reserve requirements. Two-week maintenance periods define the time frame over which institutions can accumulate daily balances at the Federal Reserve to meet the portion of their period-average reserve requirements that is not met with vault cash.

The nonborrowed reserve objective, or "path," that the Desk estimates for each maintenance period is a measure of the level of nonborrowed reserves—vault cash and reserve balances created through sources other than borrowing at the Federal Reserve's discount window—that is associated with maintaining the federal funds rate around the target. This path captures the average demand for reserves for that period arising from reserve requirements plus the estimated demand for excess reserves, less an allowance for expected discount window borrowing associated with the funds rate remaining at its objective.

Reserve requirements are known at the start of each maintenance period based on deposit information that banks provide to the Federal Reserve, but demand for excess reserves and borrowing from the discount window are estimated or anticipated on the basis of experience. The difference between the path and estimates of average reserve supply for the period provides a general indication of the overall need for open market operations to bring reserve supply in line with demand over the maintenance period. The specific operations chosen by the Desk are driven largely by the estimated daily patterns of both demand and supply and the observed behavior of the funds rate. As a maintenance period progresses, the allowances for excess reserves and borrowing are revised when incoming information suggests that they are inconsistent with maintaining the funds rate around the FOMC's target.

Overview of Operating Procedures and Practices

In attempting to achieve the FOMC's target for the federal funds rate, the New York Trading Desk tries to align the supply of reserve balances with the level of demand believed consistent with maintaining the funds rate around its target level (see box "Maintenance Periods and the Desk's Nonborrowed Reserve Objective"). The Desk is able to alter reserve balances by engaging in open market operations with primary dealers of government securities. If the open

market operation is intended to add reserve balances, the Desk agrees to buy securities from one or more dealers. When the dealers deliver the agreed-upon securities to the Desk, it credits the dealers' accounts at their clearing banks, a process that creates reserve balances. If the operation is intended to drain reserves, the Desk sells securities, and reserve balances are extinguished.

Each morning the Desk considers whether an open market operation is needed on the basis of estimates of the demand for and supply of reserves. Any operation designed to alter reserve balances that same day is typically arranged shortly thereafter. Reserve needs in upcoming days and weeks are also considered and sometimes influence the choice of operations, as does an assessment of possible errors in the forecasts of demand for and supply of reserves. Current trading conditions in the funds market, which can shed light on reserve imbalances, also play a role in determining the structure of open market operations. When selecting open market operations, the Desk views its objective as keeping the funds rate on current and future days as close to the target as possible, but it does not target an average rate over any preset time frame and thereby try to create high rates to offset low rates on past days, or vice versa.

New Developments in 1998

Two important changes in 1998 affected the Desk's conduct of open market operations. The Board of Governors approved a return to lagged reserve requirements (LRR) beginning with the maintenance period ended August 12, 1998. LRR replaced contemporaneous reserve requirements (CRR), which had been in place since 1984. LRR are designed to improve the Desk's ability to estimate the demand for reserves to meet requirements and thus help it calibrate open market operations. Under LRR, a depository institution's reserve requirement depends on its average reservable deposit liabilities in a two-week computation period that ends seventeen days before the start of the corresponding reserve maintenance period. At the same time, the computation period for applied vault cash, which was lagged one period even under CRR, was shifted back further to coincide with the computation period for reservable deposit liabilities. Thus, under LRR, the Desk knows with virtual certainty the aggregate level of reserve requirements at the outset of each maintenance period, and each depository institution knows the average level of required reserve balances it must hold over the period.

The second change involved the maximum length of repurchase agreements (RPs) permitted by the FOMC in its authorization for domestic open market operations. At its November meeting, the FOMC extended the maximum maturity of RPs that the Desk may arrange to sixty calendar days from the previous fifteen-day limit.⁵ RPs are agreements that the Desk makes with government securities dealers to purchase securities and then to sell the same securities back to the dealers on a specified date at a predetermined price. These operations are useful for increasing reserves on a temporary basis. The lengthening of the maturity limit provides the Desk with additional means for addressing reserve shortages that are temporary but that are certain to exceed in length the fifteen-day maturity previously set for RPs. The use of long-term RPs in 1998 is discussed later in this article.

Sweep Programs and Total Required Balances

Since 1994 depository institutions have used retail sweep programs to reduce the amount of balances they must hold at the Federal Reserve to meet reserve requirements. Under these programs, depository institutions shift their customers' funds from checking accounts that are reservable into special-purpose money market deposit accounts that are not reservable. Thus, depository institutions can decrease the level of their deposits subject to reserve requirements and, with no change in their vault cash holdings, their total required balances, on which they earn no interest. Sweep programs are profitable because depository institutions can invest the balances that they are no longer required to hold in interest-bearing assets.⁶ The adoption of sweep programs over the past few years has led to a significant decrease in required reserves and required balances.⁷

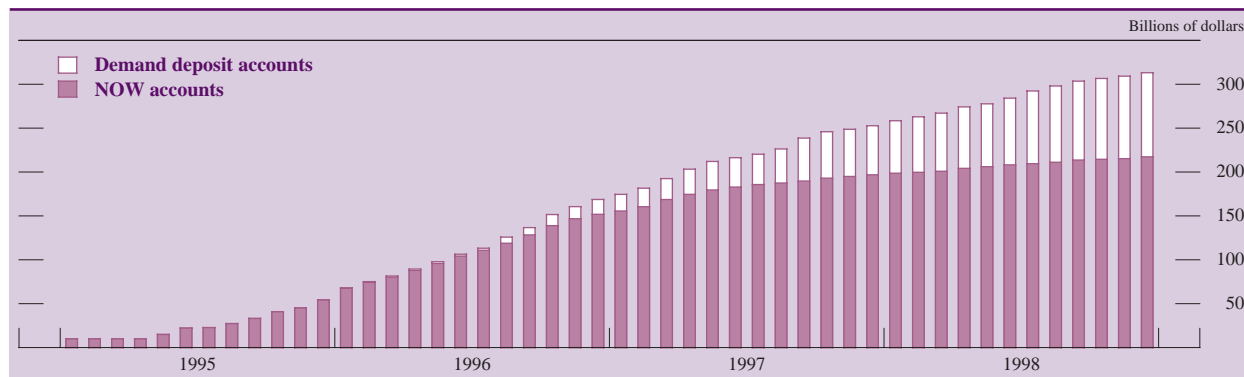
In 1998, the spread of sweep programs slowed as the proportion of deposit accounts not already cov-

5. The authorization is reprinted in the *Federal Reserve Bulletin* with the minutes from the first FOMC meeting each year. For the text of the authorization in place at the end of 1998, see "Minutes of the Federal Open Market Committee Meeting Held on November 17, 1998," *Federal Reserve Bulletin*, vol. 85 (February 1999), pp. 122–23.

6. For further information on sweep programs, see Edwards, "Open Market Operations in the 1990s," p. 870.

7. Total required balances consist of required reserve balances and required clearing balances. Required reserve balances are the portion of a depository institution's reserve requirement that is not satisfied with vault cash. Required clearing balances are balances depository institutions agree in advance to hold at the Federal Reserve, usually to facilitate payments.

1. Deposits affected by new or expanded sweep programs, 1995–98



NOTE. Data are monthly averages.

ered by these programs diminished and as the expansion of sweep programs became less profitable for institutions that began to meet their entire reserve requirement with vault cash. The level of deposits affected by new or expanded sweep programs in 1998 rose \$60 billion, an increase that was nearly \$25 billion less than that of 1997 and about half that of 1996 (chart 1).⁸ Demand deposits and other checkable deposits fell moderately, by \$34 billion, as the depressing effect of sweeps was partly countered by higher demand for liquid balances arising from the more rapid growth of income and declining opportunity costs of holding money.⁹ As a result, required reserves fell \$3½ billion on balance between the final maintenance period of 1997 and that of 1998 (chart 2). Also during this period, applied vault cash fell \$1 billion and required clearing balances were little changed, so that total required balances dropped \$2½ billion.

The decline in total required balances in 1998 was similar in size to the \$2¾ billion drop of 1997, but much less than the \$6 billion fall in 1996. However, comparing changes in these reserve measures in 1998 with changes in earlier years is complicated by the switch to LRR, which altered the lags between movements in required reserves and applied vault cash and the underlying seasonal swings in demand deposits and currency around the year-end.¹⁰ Absent this

8. These figures apply to deposits initially swept by banks at the start of a program or when the coverage was expanded. The data are not updated to include any later changes in the underlying deposit balances included in an existing program.

9. The change in deposits is measured using not seasonally adjusted data from December 1997 to November 1998. The decline over this period best correlates with the change in reserve requirements over the year because the switch to LRR created a lag of about one month between deposit levels and reserve requirements.

10. The shift to LRR left the level of reserve requirements in the final maintenance period of 1998 about \$2 billion below the level it would have been under CRR because the seasonal rise in requirements

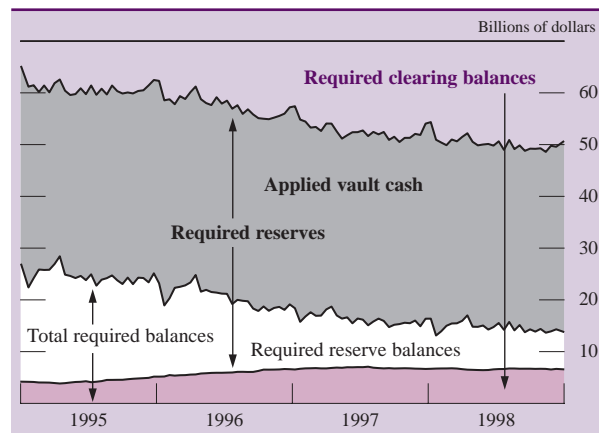
effect, total required balances would have shown a much smaller decline in 1998.

The slowing pace of decline in total required balances reflects both the ebbing in the spread of sweep programs and the fact that an increasing number of new sweep programs were byproducts of efforts to reduce vault cash holdings and were not intended to reduce required reserve balances.¹¹

that typically occurred in the final maintenance period of the year under CRR occurs about two maintenance periods later under LRR. For related reasons, the move to LRR left the level of applied vault cash in the final maintenance period of the year about \$¾ billion higher than it otherwise would have been.

11. A bank can profit by reducing its vault cash holdings because it earns no interest on these assets. If the eliminated vault cash had been used to meet reserve requirements, the bank can use a sweep program to reduce its reserve requirements simultaneously; without the sweep program the bank would have to hold more non-interest-bearing balances at the Federal Reserve in place of vault cash to meet its reserve requirements.

2. Reserve measures, 1995–98



NOTE. All figures are maintenance-period averages calculated at two-week intervals. Required reserves are the sum of required reserve balances and applied vault cash. Total required balances are the sum of required reserve balances and required clearing balances.

OUTRIGHT TRANSACTIONS FOR THE SYSTEM OPEN MARKET ACCOUNT

In 1998 the portfolio of domestic securities held in the System Open Market Account (SOMA) grew \$25 billion, to \$473 billion at year-end (chart 3).¹² Most of the expansion was achieved through outright (permanent) purchases of securities made by the Desk in the market, with a small portion obtained through purchases from foreign accounts.

Changes in the Size of the System Open Market Account

The Desk increased the SOMA portfolio to offset the effect of movements in operating factors on nonborrowed reserve supply. Operating factors (listed in table 2), which are sometimes called technical factors, are items on the Federal Reserve’s balance sheet other than loans and holdings of domestic securities that can affect the supply of reserves available to depository institutions. Movements in these factors typically prompt the Desk to arrange open market operations to negate their effect on reserve supply. The growth in the SOMA this past year was well below the record \$41 billion expansion of 1997, largely because of differences in the mix of temporary and permanent operations used to address reserve shortages at year-end.¹³

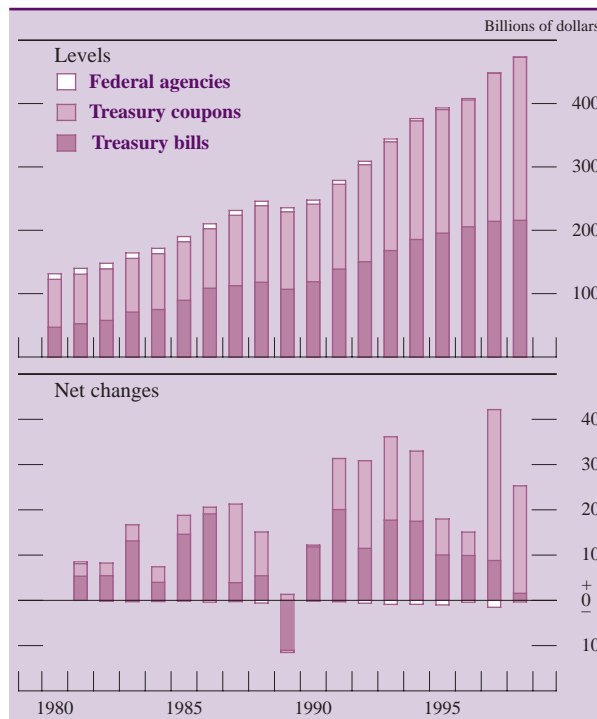
12. All figures on SOMA holdings in this article are par values unless otherwise stated and exclude any securities held under outstanding RPs. Reported Treasury bill holdings include the portion sold to foreign accounts under matched sale-purchase agreements. Reported changes and levels of Treasury coupon securities do not include the accrual of compensation for the effects of inflation on the principal of inflation-indexed issues. At the end of 1998, these accruals totaled \$79 million, \$56 million higher than one year earlier.

13. The attribution of changes in the portfolio from year-end to year-end either to factor movements over the year or to year-end reserve management strategies is based on the accounting identity:

$$\begin{aligned}
 PORT_{end98} - PORT_{end97} &= RP_{end97} - RP_{end98} - DFACTORS_{98} \\
 &+ RR_{end98} - RR_{end97} + ER_{end98} \\
 &- ER_{end97} + BR_{end97} - BR_{end98},
 \end{aligned}$$

where *PORT* is the size of the portfolio, *RP* is the value of RP agreements outstanding, *ER* is the level of excess reserves, *BR* is discount window credit, and *RR* is the level of reserve requirements, each for the end of the indicated year. *DFACTORS* reflects the net effect of changes over 1998 in all operating factors on reserve supply. Changes in discount window borrowing, which affect reserve supply, and excess reserve demand were not substantial relative to other factors during the year and are not considered explicitly in the text. In the tables and charts in this article, values for the portfolio are taken from year-end dates while values for RPs outstanding and changes in factors are based on averages taken from maintenance periods at the year-end.

3. System portfolio of Treasury and federal agency securities, 1980-98



NOTE. Values for the portfolio are taken from year-end dates.

2. Required reserves and factors affecting nonborrowed reserves, 1997-98

Billions of dollars

Item	Levels in maintenance period ending			Effect of change on reserve supply	
	Jan. 1, 1997	Dec. 31, 1997	Dec. 30, 1998	1997	1998
Required reserves	50.6	47.4	44.0	3.2	3.4
<i>Factors affecting nonborrowed reserves¹</i>					
Currency in circulation	448.1	479.3	514.0	-31.3	-34.7
Foreign currency	16.2	16.6	17.4	.4	.8
Foreign RP pool	14.0	17.0	19.4	-3.0	-2.4
Gold and foreign deposits	20.6	20.1	20.1	-5	0
Float	2.0	.8	2.6	-1.2	1.8
Treasury balance	6.0	4.9	6.3	1.1	-1.4
Applied vault cash	38.1	37.7	36.7	-4	-9
Required clearing balances	6.6	6.7	6.6	-1	0
All other items ²	24.3	23.3	25.4	-1.0	2.1
Net changes in nonborrowed factors . . . . .	. . . . .	. . . . .	. . . . .	-36.0	-34.7
<i>Outstanding RPs¹</i>					
Par value	16.3	10.1	15.2	-6.2	5.1
Premium	1.4	.5	1.1	-8	.6

NOTE. A decline in required reserves is counted as a rise in reserve supply.

1. Values for changes in factors and repurchase agreements (RPs) outstanding are based on averages taken from maintenance periods at the year-end.

2. The category “All other items” equals all other assets minus all other liabilities not listed in the table and excludes the premium on RPs.

Factors Affecting the Need for a Change in the SOMA Portfolio

Changes in the Supply of and Demand for Nonborrowed Reserves

The expansion of the portfolio in 1998 was driven primarily by the need to offset the reserve drain caused by continued strong growth of currency in circulation, which increased nearly \$35 billion during the year and reduced reserve supply by an equivalent amount (table 2). On balance, the other factors affecting supply were little changed over the year. The \$3½ billion decline in required reserves reduced the demand for reserves and lessened the need to offset all of the decline in supply with open market operations. Altogether, these movements in operating factors and required reserves deepened reserve shortages a little more than \$30 billion in 1998, slightly less than their net effect in 1997.

The Effect of Year-End Reserve Management Strategies

Despite the similarity in net movements in operating factors in 1997 and 1998, the increase in the SOMA portfolio in 1998 was much smaller than in 1997 because of shifts in year-end reserve management strategies. Over the year-end period in each of the past three years, the Desk has used very different combinations of outright purchases and RPs to address seasonal reserve shortages, which typically deepen leading up to the year-end and then recede after the year-end.

Over the 1998 year-end, about \$6 billion more of RPs were used to address reserve shortages than were used over year-end 1997 (table 2). Total outstanding RPs over the year-end 1998 period included \$8 billion of long-term operations with maturities longer than fifteen days. These long-term RPs addressed some of the deep year-end shortages that were expected to recede early in 1999. In the absence of these long-term RPs, more outright purchases would likely have been undertaken to cover a greater portion of the year-end deficiency.

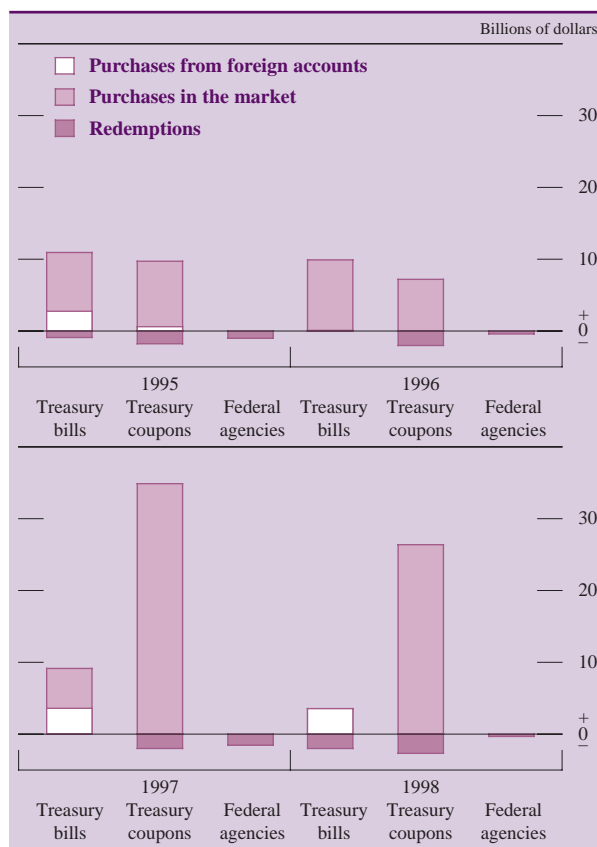
In 1996 the Desk had also made relatively few outright purchases to address year-end reserve shortages, preferring to use more short-term RPs. As a result of this strategy, outright purchases that otherwise would have been made late in 1996 were deferred until early 1997, after the RPs matured. This postponement of purchases also elevated the total quantity of outright purchases made in 1997 relative to the amounts in other recent years.

Outright Market Activity Affecting the SOMA Portfolio

Virtually all of the expansion of the portfolio in 1998 was achieved through \$26.4 billion of outright purchases—entirely of Treasury coupon securities—made in the market (chart 4). Because of the relatively low level of Treasury bill issuance over the past two years, the Desk refrained from making purchases of bills in the market out of concern that any reduction in the supply of bills held by the public might further diminish bill market liquidity. At the same time, existing bill holdings in the portfolio were viewed as sufficient for addressing any contingency.

In purchasing Treasury coupon securities in the market, the Desk continued to segment its purchases into separate tranches covering different portions of the yield curve. Beginning in October, the Desk took steps to reduce further the price effect of its operations by narrowing the maturity range of issues considered for any one operation. This step was intended to limit the number of issues and thereby the total number of offerings or propositions by the Desk's

4. System portfolio of Treasury and federal agency securities, year-end holdings, 1995–98



NOTE. Purchases are positive values; redemptions are negative values.

counterparties—the primary dealers—that would have to be evaluated in the selection process. The total value of purchases made in each operation was reduced accordingly. This modification permitted faster turnaround times, which is a factor in the competitiveness of the propositions the Desk receives, and also helped to reduce further any effect of the Desk's operations on market prices. At the same time, in the messages announcing operations that are sent to the primary dealers, the Desk began to specify those issues within the maturity range that it would not purchase because of portfolio considerations. Specifying these issues in the announcements simplified the submission and selection process further for the Desk's counterparties.

In November, the Desk limited one of the tranches, to Treasury inflation-indexed securities (TIISs) for the first time. The Desk judged that the different asset characteristics and market trading dynamics of TIISs warranted their separation from the operations in nominal coupon issues. Previously, the Desk had considered propositions on TIISs and nominal coupon issues together so long as they were in the specified maturity range of a tranche, and it had purchased \$100 million of inflation-indexed securities in one operation in 1997. But the Desk had found it difficult to make relative value judgements between inflation-indexed and nominal coupon issues during the process of selecting propositions.

Other Activity Affecting the Size of the SOMA Portfolio

Besides its market purchases, the Desk acquired securities through transactions with foreign accounts, and it shrank some of its securities holdings through redemptions. Many foreign central banks and international organizations have custodial accounts at the Federal Reserve Bank of New York, and the FOMC authorizes the Desk to transact with these foreign account holders. When the foreign account holders have securities to sell, the Desk may purchase these securities if doing so is consistent with reserve needs. The Desk acquired \$3.6 billion of Treasury bills through such purchases in 1998.

The SOMA portfolio contains publicly offered U.S. Treasury securities. When these securities mature, the Desk is permitted to exchange them for new securities that settle on the same day. In 1998, when more than one auction for new securities settled on one of these dates, the distribution of issues newly acquired by the Desk was proportional to the amounts the Treasury was issuing to the public. The Desk can also tender for fewer securities than mature on an

auction settlement date, but it cannot tender for more. Early in 1998, the Desk redeemed \$2 billion in Treasury bills by letting them mature without replacement to address seasonal reserve surpluses. It also redeemed a portion of its holdings of original-issue seven-year notes (which are no longer issued). The Desk held \$4.3 billion of such notes that matured during the year, all on dates when new Treasury inflation-indexed securities settled. Altogether, the Desk exchanged \$1.6 billion of the maturing seven-year notes for TIISs, equal in value to 5 percent of the amount issued to the public, while the remaining \$2.7 billion of the maturing notes was redeemed.

About \$300 million of federal agency securities was redeemed in 1998 as part of the SOMA's ongoing reduction of its holdings of agency securities. The Desk also sold \$25 million of agency debt back to the original issuer as part of that agency's program to retire or replace a portion of its outstanding debt. At the end of the year, SOMA agency holdings had fallen to a little more than \$300 million.

SOMA Portfolio Management

As in 1997, the overall expansion of the domestic portfolio in 1998 was in holdings of Treasury coupon securities. The declining share of short-term Treasury bills held in the portfolio increased the average maturity of all Treasury issues in the SOMA at year-end to forty-seven months, compared with forty-three months at year-end 1997 (table 3). At the end of 1998, 14 percent of the volume of all outstanding marketable Treasury debt was held in the SOMA portfolio, up a bit from 13 percent one year earlier.

3. Weighted-average maturity of marketable Treasury debt, selected years, 1960–98

Months

Year-end	Holdings in the System Open Market Account	Total outstanding debt
1960	19	55
1965	16	60
1970	24	40
1975	31	33
1980	55	48
1985	49	59
1990	41	68
1991	31	68
1992	36	67
1993	38	65
1994	38	66
1995	39	63
1996	41	63
1997	43	65
1998	47	68

NOTE. The effects of all outstanding temporary transactions on System Open Market Account (SOMA) holdings are excluded from the calculation. The maturity of total outstanding Treasury debt for 1998 is as of the end of the fiscal year.

The percentage of all outstanding Treasury bills that was held in the portfolio increased to 31 percent at the end of 1998 from about 30 percent in 1997, reflecting the decline in the volume of bills outstanding. A little more than 9 percent of the total outstanding volume of coupon issues, including TISs, was held in the portfolio at the end of 1998, about 1 percentage point more than a year earlier.

TEMPORARY TRANSACTIONS FOR THE SYSTEM OPEN MARKET ACCOUNT

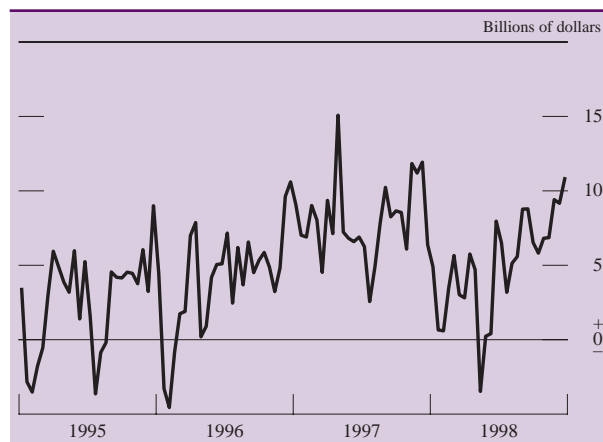
Period-Average Reserve Needs and Revisions

The difference between the path and the estimated supply of nonborrowed reserves at the outset of each two-week maintenance period, after incorporating the effects of any outright operations arranged previously, indicates the need for open market operations during that period. In 1998 the estimates of the period-average reserve needs made at the start of each maintenance period—in absolute value to allow for temporary reserve surpluses—averaged \$5.3 billion, down from \$8.0 billion in 1997 (chart 5).¹⁴ The decline in the average was partly the byproduct of the higher volume of outright purchases made in 1997, which left smaller reserve imbalances early in 1998 than had existed early in 1997.

Revisions to estimates of operating factors affecting the supply of or demand for reserves during a

14. Some of these initial estimated reserve needs were reduced by temporary term RPs that were arranged in an earlier maintenance period and extended into later periods.

5. Open market operations needed to hit the nonborrowed reserve path, 1995–98



NOTE. Estimates are from the first day of each maintenance period. Positive numbers indicate a need to add reserves.

period affect the actual size of temporary operations needed during that maintenance period. Therefore, the Desk must allow for the possibility of such revisions in structuring its operations as it goes through a period. Net revisions to operating factors affecting the supply of reserve balances over an entire period tended to be less in 1998 than in other recent years, largely reflecting smaller Treasury balance revisions (table 4). At the same time, revisions to key determinants of the demand for balances at the Federal Reserve—required reserves and applied vault cash—were virtually eliminated with the advent of LRR in August. Before the introduction of LRR, sizable revisions to required reserves and applied vault cash sometimes were made relatively late in a period, which was a major source of uncertainty. Thus the Desk had to take the uncertainty in these estimates into account when structuring its operations late in a period.

Daily Volatility of and Projection Errors for the Supply of and Demand for Reserves

The decline in total required balances resulting from the implementation of sweep programs over the past several years has increased depository institutions' exposure to overdrafts arising from unanticipated shifts in their daily reserve positions. As a result, both the day-to-day swings in factors affecting the supply

4. Revisions to estimates of open market operations needed to hit the nonborrowed reserve path, 1997–98

Millions of dollars, maintenance-period averages

Item	1997	1998
<i>Factors affecting the supply of reserve balances at the Federal Reserve</i>		
Treasury balance	1,002	506
Currency in circulation	361	500
Foreign RP pool	500	381
Float	227	312
Net factor revision	1,413	1,034
<i>Factors affecting the demand for reserve balances at the Federal Reserve¹</i>		
Required reserves		
Before LRR	443	353
After LRR .....	...	22
Applied vault cash		
Before LRR	231	316
After LRR .....	...	12
Required reserves–applied vault cash		
Before LRR	352	182
After LRR .....	...	25

NOTE. Data are average absolute revisions to initial estimates of maintenance-period-average values. Projection errors are based on estimates by the staff of the Federal Reserve Bank of New York.

1. All revisions in 1997 were before the introduction of lagged reserve requirements (LRR); revisions in 1998 through the period ending July 29 were before LRR.

5. Daily changes and forecast errors in key determinants of reserve balance supply, 1995–98

Millions of dollars, average and maximum of absolute values

Item	1995		1996		1997		1998	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
<i>Daily changes</i>								
Treasury balance	1,233	12,639	1,002	9,780	1,484	17,393	1,413	22,571
Currency in circulation	655	1,582	646	2,016	679	2,474	709	2,788
Foreign RP pool	486	3,955	369	3,017	542	6,989	500	6,193
Float	515	3,748	790	8,154	548	4,605	791	5,449
Net value	1,491	11,470	1,413	11,787	1,896	18,366	1,751	23,727
<i>Daily forecast error</i>								
Treasury balance	642	4,188	732	4,921	726	5,969	620	3,407
Currency in circulation	206	932	213	932	200	980	217	999
Foreign RP pool	124	617	113	617	203	1,433	150	935
Float	284	1,903	371	3,768	312	3,433	383	2,386
Net value	743	4,139	898	5,042	848	5,991	744	3,664

NOTE. Projection errors are based on estimates by the staff of the Federal Reserve Bank of New York.

of reserve balances and the potential for error in the projections of these factors have taken on a greater role in the Desk's daily reserve management deliberations.¹⁵ For the same reason, the day-to-day volatility in the demand for excess reserves and the potential for error in the judgment of daily excess demand have also become more important considerations in the Desk's management of reserves.

Recent experience with daily changes and forecast errors of key operating factors that determine the supply of balances at the Federal Reserve—the Treasury balance at the Federal Reserve, Federal Reserve float, currency in circulation, and the foreign RP pool—is summarized in table 5. The average of the absolute daily net changes in reserve balances arising from movements in the four key operating factors approached \$2 billion in both 1997 and 1998, highlighting the importance of the Desk's temporary operations for smoothing out daily reserve patterns. To some degree, the average was driven by outliers, which topped out at about \$20 billion in each of the past two years, thus illustrating the potential for huge swings. The biggest swings tended to be associated with movements in the Treasury balance around key tax dates.

Average absolute daily forecast errors underscore the risks in managing reserve supply. The average of the absolute daily net forecast error for the sum of these same four operating factors in 1998 was about \$750 million, somewhat less than the errors in the preceding two years but still of the same general

order of magnitude. The largest daily miss in 1998 was more than \$3½ billion. The Treasury balance is usually the single most difficult factor to estimate, and it, along with float, were the sources of the biggest daily errors.

Comparable measures of changes in the daily demand for excess reserves consistent with the funds rate target and of errors in the daily estimation of excess demand are not available. Important determinants of the intraday pattern of the demand for excess reserves are discussed later.

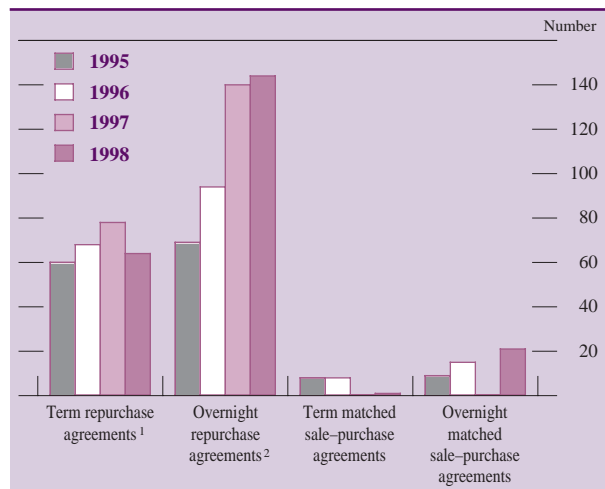
Temporary Open Market Operations Arranged in 1998

The Desk typically relies on a mix of term and overnight RPs to meet reserve shortages (chart 6).¹⁶ With total required balances remaining low in 1998, the Desk continued to use overnight RPs extensively to address reserve shortages to take into account the daily volatility of operating factors and of excess reserve demand and also potential projection errors. For the same reasons, a term RP was rarely intended to address entirely the reserve shortages estimated beyond the initial date, and frequently an overnight operation was arranged on the same day as a term operation. Term RPs were usually designed to leave reserve shortages of at least moderate size in subsequent days to be addressed with additional RPs. This approach allowed the Desk to tailor the total amount of all RPs outstanding on any day to fit the most up-to-date estimates of the daily reserve pattern.

15. The reserve supply projections presented in this section are those of the Federal Reserve Bank of New York staff. In making reserve management decisions, the Desk also uses estimates made by the Board for all factors and by the Treasury for the Treasury balance. Differences among the staff estimates underscore the risks inherent in these daily estimates.

16. The expression *overnight* is used to denote any operation that matures on the next business day.

6. System temporary operations, by type, 1995–98



1. Includes fixed and withdrawable repurchase agreements.
2. Includes system and customer repurchase agreements.

The frequency with which term RPs were arranged was down a bit from 1997, partly reflecting the smaller reserve shortages that occurred in 1998. Three fixed-term operations with maturities ranging from thirty days to forty-five days were arranged in December, using the Desk's new authority for long-term RPs, to address that portion of the year-end reserve shortages that was expected to recede significantly in January 1999. These term RPs were among the few such RPs that were set to mature in a maintenance period beyond the one in which they were arranged.

The Desk used matched sale-purchase agreements (MSPs) in 1998 for the first time since May 1996. These agreements, under which the Desk first sells securities and then purchases them at a predetermined price from dealers at a later date, are used to address temporary reserve surpluses. The first two of these operations took place in the January 14 period, when huge upward revisions were made to weather-related float after term RPs had been put in place to address what were expected to be reserve shortages. Most of the MSPs were arranged in May, after earlier projections of potentially huge reserve shortages during the April-May tax season proved inaccurate (see box "The Management of Reserves around the April 15 Tax Season").

Technique of Intervention

The Desk retained its practice of normally arranging temporary open market operations no more than once a day, shortly after 10:30 a.m. when a complete set of

reserve estimates first becomes available. For the new long-term RPs that were used in 1998, operations were arranged earlier in the day, around 8:30 a.m., because the Desk wanted to take advantage of the more liquid financing market that an earlier entry time would offer. Moreover, these RPs were not necessarily intended to meet all of the reserve shortage estimated for the day on which they were arranged, so there was no need to wait for a complete set of reserve estimates. For the three long-term operations arranged in 1998, propositions were strong—measured in total volume and in rates offered relative to current market quotes.

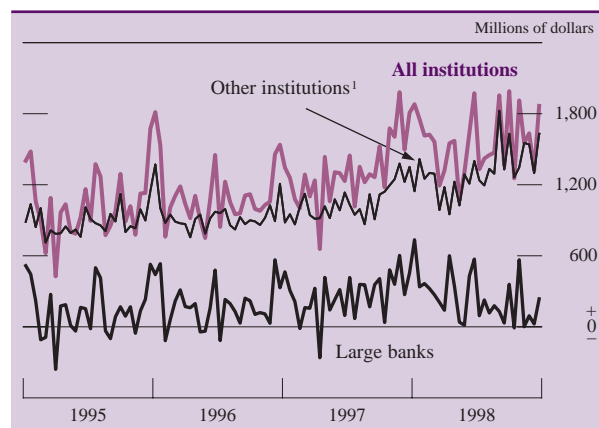
The Desk was always prepared to depart from its usual practices as circumstances warranted. It entered the market ahead of the usual intervention time on numerous occasions apart from the three long-term RPs. These early entries were motivated either by a view that the expected reserve shortage on the day required taking advantage of the greater market liquidity that exists earlier in the morning or by a belief that the firm financing pressures that existed at the time needed to be addressed promptly. On one occasion, an early entry was followed up with another operation at the usual market intervention time.

EXCESS RESERVES

Period-Average Excess Reserves

The uptrend in period-average levels of excess reserves that became evident in 1997 and that has been associated with the decline in total required

7. Excess reserve holdings, by bank category, 1995–98



NOTE. Data are maintenance-period averages. Total excess reserves averaged \$1,012 million in 1995, \$1,120 million in 1996, \$1,322 million in 1997, and \$1,548 million in 1998.

1. "Other institutions" include small banks and thrift institutions, foreign-related institutions, and nonreporters.

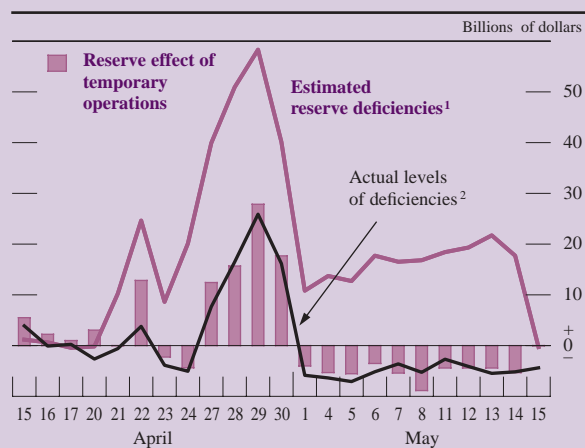
The Management of Reserves around the April 15 Tax Season

The Desk's initial reserve management strategy around the April 15 tax date reflected its experience in April–May 1997. Tax receipts in April–May 1997 far exceeded projected inflows, and the resulting reserve shortages that the Desk had to address with temporary operations were unprecedented. Tax receipts in April–May 1998 were expected to exceed their level of the previous year by a substantial amount, and the Treasury's balance at the Federal Reserve was expected to surge again, even though the Treasury had arranged to have \$64 billion in cash management bills mature in mid-April (\$14 billion more than in 1997) in order to control the buildup in its general cash position.

To prepare for the expected surge in Treasury receipts, the Desk purchased \$13.2 billion of securities outright in March and April, much more than it had acquired during that time in 1997, to limit the reserve shortages that would have to be addressed with RPs. Even so, sizable RPs were still expected to be needed through mid-May to meet reserve shortages that, according to the highest estimates, were expected to peak at nearly \$60 billion in late April. Only after the planned outright operations were completed did it become evident that reserve deficiencies would be significantly less than initially anticipated. To a large degree, this projection error reflected the success that the Treasury had in promoting participation in its Treasury Tax & Loan (TT&L) program after it broadened the types of collateral it accepted for this purpose. TT&L capacity was more than \$15 billion higher than anticipated, and this higher capacity reduced the cash balance that had to be held in the Federal Reserve account by a similar amount once the Treasury's total cash position exceeded the holding capacity at private banks. At the same time, total corporate and individual taxes fell about \$20 billion short of the high end of the set of estimates.

After making its outright purchases in April, the Desk unexpectedly found itself having to drain reserves as a result of the higher TT&L capacity and Treasury's lower total cash position. Large RPs were still needed to add reserves in late April when the Treasury balance at the Federal Reserve was at its peak. But for a few days before a brief surge in cash holdings and again starting at the very end of the month when large government outlays and paydowns brought Treasury's cash position down, matched sale–purchase agreements were used to drain reserve surpluses.

Reserve deficiencies (reserve requirements less reserve supply) and temporary open market operations in April and May



NOTE. Actual and projected reserve deficiencies include all outright operations arranged through mid-May. A positive value denotes a level of reserve supply below reserve requirements and a need to add reserves; a negative value indicates a level of supply above requirements.

1. Reserve deficiencies are estimated as of April 14 by the staff of the Federal Reserve Bank of New York.

2. Levels before temporary open market operations.

balances intensified in 1998.¹⁷ However, the increase in 1997 was observed broadly across different classes of depository institutions, whereas in 1998 the increase in the underlying demand for excess reserves occurred away from large institutions and was concentrated among other institutions, nota-

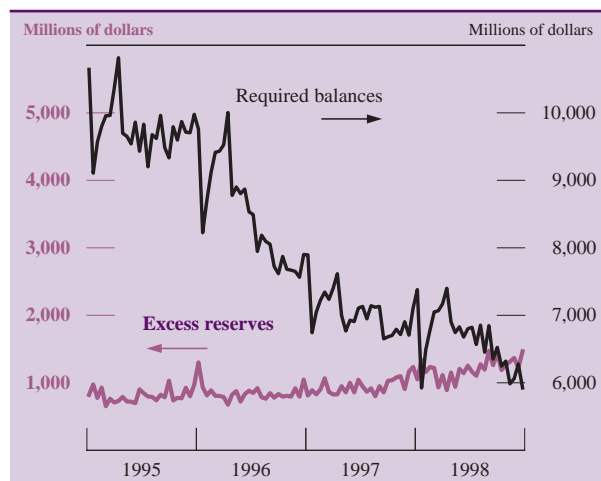
bly small commercial banks and thrift institutions (chart 7).¹⁸

The link between excess reserve levels and total required balances of small commercial banks and thrifts can be seen in chart 8. From 1995 to the middle of 1997, the period of greatest decline in total required balances for small commercial banks and thrifts, only a small fraction of this decline was reflected in higher excess levels for these institutions.

17. The Desk attempts to meet depository institutions' demand for excess reserves both for every maintenance period and for each day in a period. For this reason, absent a true measure of excess demand, actual levels of excess reserves can be taken as an approximation of demand, notwithstanding the surprises to reserve supply and misjudgments the Desk may make about demand that can cause actual excess levels to diverge from true demands on any given day. For a discussion of the uptrend in excess reserves in 1997, see Virginia Cheng, Spence Hilton, and Ted Tulpan, "Open Market Operations during 1997," *Federal Reserve Bulletin*, vol. 84 (July 1998), pp. 523–25.

18. The "large" bank category for which the Federal Reserve collects reserve information includes about 130 of the largest depository institutions. The Federal Reserve also collects reserve information separately for small commercial banks, thrift institutions, foreign-related institutions, and nonreporting banks. In this article, these four categories are sometimes aggregated into a grouping labeled "other institutions."

8. Total required balances and excess reserves at small banks, thrift institutions, and nonreporters, 1995–98



NOTE. Data are maintenance-period averages. Total required balances are reserve requirements plus required clearing balances less applied vault cash. Excess reserves at these institutions averaged \$810 million in 1995, \$847 million in 1996, \$951 million in 1997, and \$1,207 million in 1998. The measures of excess reserves and total required balances in this and the charts that follow are drawn from internal data sources that reflect only revisions to the data made within the first five weeks after a maintenance period has ended.

From the middle of 1997 through 1998, even though the pace of decline in required balances slowed, at the margin the further decline had a greater effect on excess reserve levels.

The link between excess reserves and total required balances among large depository institutions as a group was less clear in 1998. The pace of decline in total required balances at these institutions also slowed around the middle of 1997. Although required balances have fallen a bit since then, the average level of excess reserves at these institutions was unchanged on balance in 1998, after having risen in 1997 (chart 9).

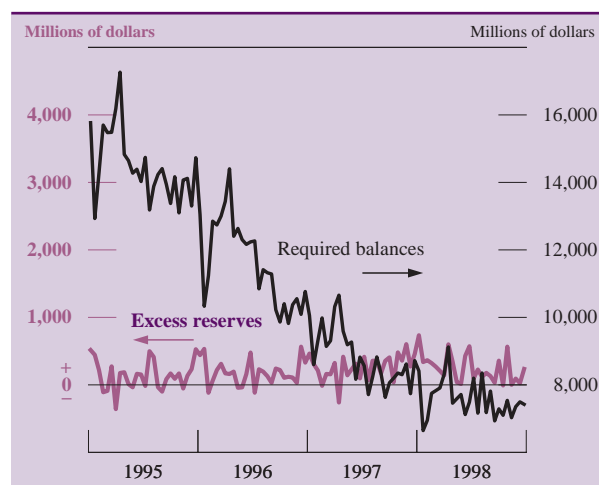
Lower levels of total required balances have led to higher excess reserve levels in two ways. Some depository institutions working with lower required balances have consistently chosen to hold a higher level of excess reserves at the end of each day as a precaution against contingencies that could reduce their balances and send them into overdraft. This behavior—an increase in precautionary demands for excess reserves—is more characteristic of some institutions, especially smaller entities, that have limited access to funding markets. However, among larger banks and even some smaller institutions that have the ability to adjust their balances throughout the day by trading in the federal funds market, higher excess reserve levels have been the byproduct mostly of unanticipated late-day payment inflows. Unintended high excess levels that individual institutions occa-

sionally have been left with on some days have been harder to offset fully with negative excess positions on remaining days within the same maintenance period because required balances have been so low. That is, depository institutions in general have been more prone to becoming “locked in” inadvertently to holding an undesirably high level of excess reserves under low required balances.

In making its allowance for excess reserve demand in a maintenance period, the Desk allows for elevated precautionary demands, and it takes stock of any lock-ins that arise as a maintenance period progresses. But the Desk does not provide higher excess reserve levels as it goes through a period in anticipation of undesired lock-ins that have not yet arisen, even if these are now seen as more likely to develop at some point. Doing so would risk leaving depository institutions holding undesired reserve surpluses at the end of the period if they succeed in avoiding lock-ins

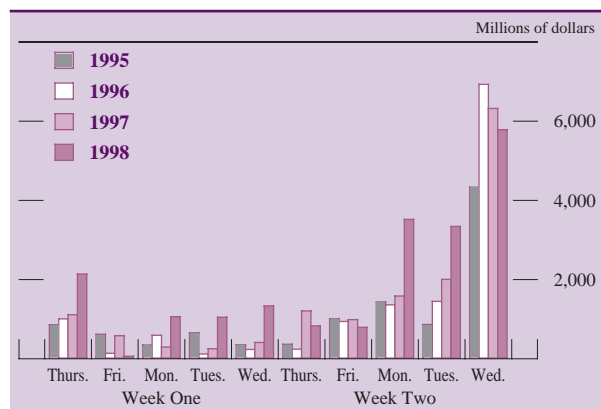
In 1998 in recognition of recent trends, the allowances in the nonborrowed reserve objective that the Desk made at the start of each maintenance period for period-average excess demand rose from about \$1 billion, a level that had prevailed for many years, to levels that were often close to \$1½ billion. However, the Desk treated any initial allowance very flexibly, making more frequent informal modifications as a period unfolded in response to actual patterns of excess holdings and to the observed behavior of the funds rate. To aid in its judgment, the Desk used daily reports of excess holdings at small

9. Total required balances and excess reserves at large banks, 1995–98



NOTE. Data are maintenance-period averages. Total required balances are reserve requirements plus required clearing balances less applied vault cash. Excess reserves at these institutions averaged \$126 million in 1995, \$190 million in 1996, \$267 million in 1997, and \$247 million in 1998.

10. Average levels of daily excess reserve holdings, by day in a maintenance period, 1995–98

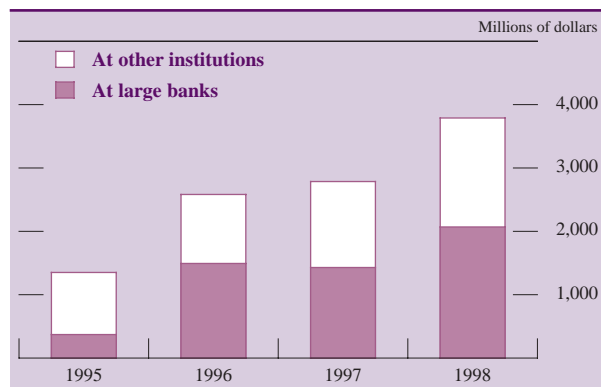


and large institutions to evaluate their levels of demand. It also used daily reports containing reserve information for about twenty-five individual large banks to determine whether any of these banks were locked into holding excess reserves in a maintenance period.

Daily Patterns of Excess Reserves

The preference that depository institutions have shown for years for concentrating reserve balance holdings late in a maintenance period was again evident in 1998 (chart 10). This skewed pattern was most pronounced at large banks, where cumulative average excess positions were usually negative throughout the period until the final day.

11. Excess reserves on high payment flow days, 1995–98



NOTE. Data are annual averages. High payment flow days include the first and last business day of each month (excluding quarter-end dates), major tax dates, and midquarter settlement dates for Treasury refundings. The quarter-ends are dropped even though payment flows are extremely heavy on these days because the levels of excess reserves some banks held on these days for balance-sheet-statement purposes was very volatile.

In 1998, the Desk provided even higher levels of excess reserves than it had in previous years on days when payment flows were heaviest and most unpredictable (chart 11). These days include the first and last business day of each month, tax dates, and major Treasury auction settlement dates. Most, but not all, of the increase in excess reserves provided by the Desk wound up at larger banks. In providing even higher levels of excess reserves on high payment flow days, the Desk looked for other occasions within the same maintenance period to leave fewer excess reserves, consistent with depository institutions' period-average demands, with the attendant risk that unexpected reserve shortfalls on those days could leave the actual level of balances for the banking system precariously low.

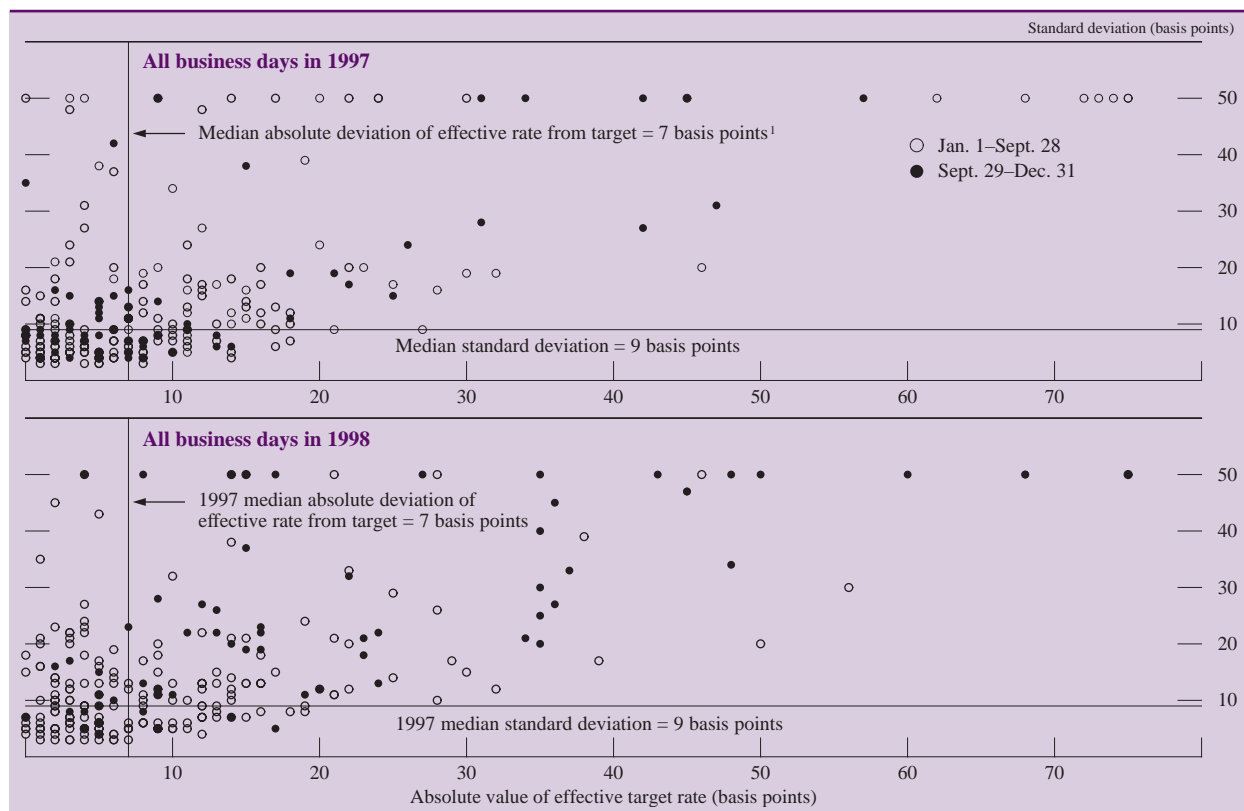
Excess Reserve Developments in October–December

The trends noted in the previous discussion, both for higher period-average excess levels and for elevated levels on high payment flow days, were reinforced late in the year by the Desk's reaction to recurring bouts of rate firmness that emerged in overnight funding markets. The background for these pressures is discussed more fully in the following section, which reviews the behavior of the federal funds rate late in 1998. The Desk often responded to any upward rate pressure in the morning by providing a higher level of excess reserves for that day. These funds market pressures were typically most intense around high payment flow days, so that the Desk was particularly careful to leave total balances high on those days. Sometimes suitable opportunities to work off the resulting high excess levels did not arise because the funds rate often remained firm even in the presence of the accumulation of excess reserves. As a result, average excess levels for some periods in October and November were particularly elevated. But the trend toward higher excess levels previously described was evident even before the final quarter of the year.

THE BEHAVIOR OF THE FEDERAL FUNDS RATE

Daily behavior of the federal funds rate is measured by the absolute deviation of the effective (trade-weighted average) rate from the target rate specified in FOMC directives and by the standard deviation of the rates on each day's transactions around the effective rate. Through the first three quarters of 1998, the

12. Absolute values of deviations of the daily effective federal funds rate from target and the standard deviations of the daily effective funds rate, all business days, 1997–98



NOTE. Daily observations form a discrete rather than a continuous distribution. For this reason, when calculating the percentage of days that fell either above or below a median value, observations having values equal to the median are apportioned equally above and below the median. All values have been restricted to fit on a reduced scale to provide more detail at the lower values where most observations are concentrated.

In 1997 the percentage of days on which the deviation of the effective funds rate from the target and the standard deviation were both either above or below the median values are the following:

	Jan. 1–Sept. 28 (percent)	Sept. 29–Dec. 31 (percent)
Both below median	35	31
Both above median	35	32

In 1998 the percentage of days on which the deviation of the effective funds rate from the target and the standard deviation were both either above or below the median values are the following:

	Jan. 1–Sept. 28 (percent)	Sept. 29–Dec. 31 (percent)
Both below 1997 median	29	10
Both above 1997 median	32	73

1. Average absolute deviation of effective rate from target is 12 basis points.

daily behavior of the federal funds rate was similar to that of 1997 (chart 12). But both the deviations from target and the intraday standard deviations increased perceptibly during the final quarter of the year when pressures associated with volatility in other financial markets began to affect financing flows and the trading behavior of participants in the federal funds market.¹⁹

Daily Deviations and Volatility of the Federal Funds Rate in 1998

Data needed to calculate the absolute deviations of the effective funds rate from target and the standard deviation of each day’s rates are compiled every morning by the Desk from a broad sample of brokers who arrange transactions between participants in the federal funds market. Each of these statistics captures somewhat different aspects of the behavior of the funds market. For example, the deviation of the daily effective rate from target is often strongly influenced by participants’ expectations about whether reserve

19. In this article, the persistence of higher daily volatility in the funds market is dated as having begun on September 29, although its actual emergence was somewhat more gradual.

6. Deviations of the daily effective federal funds rate from target and the daily standard deviation of the funds rate, 1997–98

Basis points

Item	1997	1998	1998	
			Jan. 1– Sept. 28	Sept. 29– Dec. 31
Median of standard deviations	9	12	10	22
Median of absolute deviations of the effective rate from target	7	8	6	16
Average of absolute deviations of the effective rate from target	12	13	10	22

supply will prove to be either scarce or plentiful on any day. Such expectations, which may be formed largely on the basis of past experience, often establish the rate at which transactions will be arranged through most of the day. The daily standard deviation will capture shifts in these expectations during the day, and it is influenced, as is the effective rate, by actual reserve conditions as they become apparent in late-day trading. Changes in underlying reserve conditions and the behavior of market participants are often reflected in changes in the behavior of these two daily statistics.

From January through late September 1998, the median values for both the standard deviations and deviations of the effective rate from target were within 1 basis point of their median values for 1997 (table 6).²⁰ This similarity in behavior of the funds rate held despite the further modest decline in the level of total required balances in 1998. Still, volatility in these measures remained above the levels that prevailed before 1996, when the rapid decline in total required balances first began to have a notable effect on the daily behavior of the funds rate.

By late September, heightened aversion to credit risk and accompanying dislocations in other financial markets began to affect the funding needs and behavior of key participants in the federal funds market. Some depository institutions encountered reduced access to term funding, and their demand for overnight funding rose as a result. Lenders in the overnight federal funds and Eurodollar markets in some cases cut credit lines to certain borrowers. At the

same time, banks' aversion to borrowing at the discount window appears to have intensified out of concern that borrowing might be seen as a sign of poor financial health.

The intraday trading strategies many market participants adopted often lent a very firm bias to rates in the morning as highly risk-averse borrowers bid aggressively for funds early in the day. Their actions sometimes lifted the entire rate structure paid by all borrowers for much of the day, especially as lenders in the market came to recognize this caution. This pattern was most prevalent on days characterized by high payment flows, when uncertainties about daily reserve positions are typically greatest.

The Desk responded to these conditions by providing higher excess reserves on days when these financing pressures were most evident. This response reinforced the tendency of the funds rate to fall off late in the day when the level of balances left in place proved higher than final demands. Furthermore, the high period-average levels of excess reserves that resulted also encouraged very soft conditions in the funds rate on several maintenance period settlement days in October and November. The funds market went through several cycles of firmness sustained over several days, often triggered by high payment flow dates, followed by periods of softness.²¹ By late November, the Desk's provisions of added reserves and the adjustments made by some regular borrowers in the funds market to reduce their reliance on overnight financing helped ease these upward rate pressures, but they remained a feature of the funds market through the year-end.

The volatile rate environment created by market participants' defensive trading strategies and the Desk's response to them was reflected in both larger deviations of the effective daily funds rate from target and higher daily standard deviations. The median value of the daily standard deviations was 22 basis points from late September through December, and the median absolute deviation of the funds rate was 16 basis points, both well above the corresponding levels for all of 1997 and through the first three

20. In making comparisons between different time periods, median values are used instead of means because of the possible influence of a small number of very large outliers on the calculation of the mean. All calculations are based on business day observations, with no adjustment for the effect of holidays or weekends on the calculation of effective rates averaged over longer time periods.

21. Softer rates sometimes emerged after participants began to incorporate expectations, which were often incorrect, that the Desk was going out of its way to make generous reserve provisions. On many days when these expectations were not accurate, the funds rate nonetheless remained soft as participants at first traded on the expectation or perception of Desk generosity and then as actual levels of excess reserves, even if quite low, still proved sufficient to cover end-of-day needs. Conversely, market expectations or perceptions of low levels of liquidity kept the funds rate firm on some days when excess levels were high.

quarters of 1998 (table 6).²² While the degree of volatility observed in the daily behavior of the funds rate during the final quarter was likely aggravated by required balance levels, which hovered near historic lows, the immediate cause was the changed market climate.

Average Levels of the Federal Funds Rate

Because of these pressures on the funds rate late in 1998, the Desk was less successful in maintaining the average daily effective rate around the target (chart 13). For the maintenance periods that covered the fourth quarter, the absolute deviations of the period-average effective rates from target averaged 10 basis points.²³ The average absolute deviation from target of the period-average effective funds rate was 5 basis points for earlier periods in 1998, and it was 4 basis points in 1997.

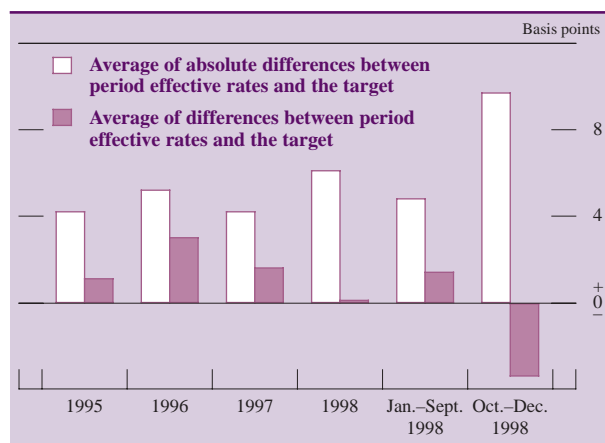
Intraperiod Patterns of the Federal Funds Rate

Intraperiod patterns of the effective funds rate, measured by the deviation of the effective rate from target averaged separately for each day in a maintenance period, were similar to those in preceding years (chart 14). For example, soft conditions continued to

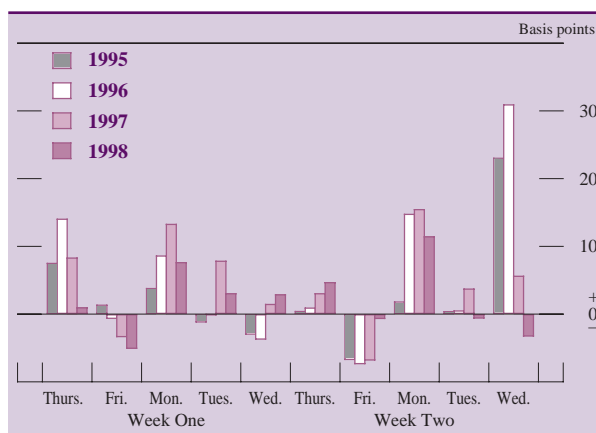
22. Historically, the funds rate has tended to be a bit more volatile in the fourth quarter of a year compared with the preceding three quarters. However, median values of the standard deviations and of the absolute deviations of the effective rate from target in the final quarter were never more than a couple of basis points higher than in the first three quarters in any year from 1995 through 1997.

23. This calculation is based on the seven maintenance periods running from the period ended October 7 through the period ended December 30.

13. Maintenance period averages of the effective federal funds rate versus the target rate, 1995–98



14. Average levels of the daily effective federal funds rate less the target rate, by day in a maintenance period, 1995–98



prevail on many Fridays. The sharpest departure from past patterns appeared on settlement Wednesdays, the last day of a maintenance period. The effective rate on those days in 1998 was, on average, below target. However, the low average for settlement days in 1998 to a large degree reflected developments that occurred late in the year. During the final three months of 1998, the funds rate on settlement Wednesdays averaged 27 basis points below the target level. This development reinforces the judgment that the period-average levels of excess reserves in these maintenance periods exceeded demands. Over the first three quarters of 1998, the effective rates from these settlement days averaged 6 basis points above target, similar to their average deviation in 1997.

SUMMARY

The conduct of open market operations throughout 1998 was influenced by the continued growth of sweep programs, which reduced further the level of total required balances, and late in the year by heightened aversion to credit risk in financial markets, which affected the activity of some participants in the federal funds market. Both developments contributed to higher levels of excess reserves in the banking system and reinforced the Desk's growing reliance on very short-term operations to balance daily swings in reserve supply and demand. Through the first three quarters of 1998, intraday volatility in the federal funds rate and deviations in the daily effective rate from target were similar to those of the previous year. But late in the year, funds rate volatility rose with the growing aversion to credit risk among financial market participants. □

APPENDIX

A.1. U.S. Treasury bills in the System Open Market Account, December 31, 1998

Thousands of dollars except as noted

Maturity date of issue outstanding	Holdings, 12/31/98	Percentage of total issue outstanding
1/07/99 ¹	109,320	.3
1/14/99 ¹	156,860	.7
1/21/99 ¹	6,533,390	13.8
1/28/99	7,342,815	31.8
2/04/99	14,018,010	26.0
2/11/99	7,534,485	32.2
2/18/99	7,621,564	32.5
2/25/99	7,688,180	33.5
3/04/99	13,214,955	32.5
3/11/99	7,591,780	32.6
3/18/99	7,304,310	32.0
3/25/99	6,954,235	30.9
4/01/99	12,662,430	32.1
4/08/99	3,645,000	31.3
4/15/99	4,105,000	33.7
4/22/99	3,695,000	31.6
4/29/99	8,440,000	31.7
5/06/99	3,935,000	32.1
5/13/99	3,800,000	32.2
5/20/99	3,855,000	32.5
5/27/99	9,090,000	33.5
6/03/99	3,840,000	32.4
6/10/99	3,900,000	30.9
6/17/99	3,775,000	31.2
6/24/99	7,925,000	30.9
7/01/99	3,540,000	32.0
7/22/99	5,305,000	33.7
8/19/99	5,565,000	35.3
9/16/99	5,390,000	34.9
10/14/99	5,650,000	33.9
11/12/99	5,225,000	32.2
12/09/99	5,360,000	32.8
Total Treasury bills	194,772,334¹	...
Net change since 12/31/97	-2,350,364	...

NOTE. Data are on a statement-date basis.

1. Holdings of Treasury bills were reduced by the following amounts of matched sale-purchase agreements, which are returned the next day: \$12,700,000 of Jan. 7 Treasury bills, \$7,700,000 of Jan. 14 Treasury bills, and \$527,110 of Jan. 21 Treasury bills.

A.2. U.S. Treasury bonds in the System Open Market Account, December 31, 1998

Thousands of dollars except as noted

Issue outstanding		Holdings, 12/31/98	Percentage of total issue outstanding	Net change since 12/31/97
Coupon	Maturity date			
11.750	2/15/01	165,803	11.0	5,000
13.125	5/15/01	166,926	9.5	1,200
13.375	8/15/01	256,092	14.6	...
15.750	11/15/01	172,904	9.9	...
14.250	2/15/02	184,800	10.5	25,000
11.625	11/15/02	347,850	12.6	...
10.750	2/15/03	739,250	24.6	...
10.750	5/15/03	380,800	11.7	49,800
11.125	8/15/03	514,300	14.7	...
11.875	11/15/03	870,340	12.0	119,000
12.375	5/15/04	769,786	20.5	...
13.750	8/15/04	528,000	13.2	...
11.625	11/15/04	994,600	12.0	47,400
8.250	5/15/05	1,513,660	35.8	...
12.000	5/15/05	728,476	17.1	...
10.750	8/15/05	1,187,000	12.8	...
9.375	2/15/06	133,000	2.8	113,000
7.625	2/15/07	1,396,164	33.0	...
7.875	11/15/07	378,500	25.3	...
8.375	8/15/08	788,500	37.5	...
8.750	11/15/08	1,588,500	30.4	...
9.125	5/15/09	921,205	20.0	...
10.375	11/15/09	1,075,939	25.6	...
11.750	2/15/10	717,400	28.8	...
10.000	5/15/10	1,176,556	39.4	...
12.750	11/15/10	1,260,865	26.6	...
13.875	5/15/11	1,073,542	23.3	...
14.000	11/15/11	975,091	19.9	...
10.375	11/15/12	1,611,741	14.6	...
12.000	8/15/13	3,040,772	20.6	...
13.250	5/15/14	869,450	17.4	...
12.500	8/15/14	905,720	17.7	...
11.750	11/15/14	1,195,000	19.9	...
11.250	2/15/15	1,335,733	10.5	...
10.625	8/15/15	1,167,400	16.3	...
9.875	11/15/15	941,500	13.6	...
9.250	2/15/16	880,000	12.1	...
7.250	5/15/16	1,098,000	5.8	103,000
7.500	11/15/16	1,378,000	7.3	115,000
8.750	5/15/17	1,855,000	10.2	405,000
8.875	8/15/17	1,494,000	10.7	585,000
9.125	5/15/18	728,900	8.4	232,000
9.000	11/15/18	304,000	3.4	48,000
8.875	2/15/19	1,224,000	6.4	291,000
8.125	8/15/19	1,735,900	8.6	45,000
8.500	2/15/20	1,095,879	10.7	135,000
8.750	5/15/20	1,211,600	11.9	145,000
8.750	8/15/20	1,366,600	12.5	...
7.875	2/15/21	830,500	7.5	55,000
8.125	5/15/21	1,103,000	9.2	165,000
8.125	8/15/21	940,000	7.7	260,000
8.000	11/15/21	1,695,000	5.2	545,000
7.250	8/15/22	605,000	5.8	145,000
7.625	11/15/22	810,000	7.6	150,000
7.125	2/15/23	1,981,000	10.8	568,000
6.250	8/15/23	1,447,000	6.3	412,000
7.500	11/15/24	565,000	4.9	60,000
7.625	2/15/25	875,000	7.5	60,000
6.875	8/15/25	1,345,000	10.7	140,000
6.000	2/15/26	999,000	7.7	65,000
6.750	8/15/26	1,050,000	9.6	85,000
6.500	11/15/26	1,470,000	12.8	...
6.625	2/15/27	530,000	5.1	50,000
6.375	8/15/27	730,000	6.8	...
6.125	11/15/27	2,505,000	11.1	1,325,000
5.500	8/15/28	1,771,808	15.0	1,771,808
5.250	11/15/28	945,000	8.6	945,000
Matured in 1998	...	...	...	-30,750
Total Treasury bonds	...	68,642,352	...	9,235,458

NOTE. Data are on a statement-date basis.

A.3. U.S. Treasury notes in the System Open Market Account, December 31, 1998

Thousands of dollars except as noted

Issue outstanding		Holdings, 12/31/98	Percentage of total issue outstanding	Net change since 12/31/97
Coupon	Maturity date			
6.375	1/15/99	892,045	8.5	...
5.000	1/31/99	848,000	6.6	91,000
5.875	1/31/99	1,917,000	9.9	1,172,000
5.000	2/15/99	3,644,140	16.6	...
8.875	2/15/99	1,048,600	10.8	97,000
5.500	2/28/99	915,000	7.7	200,000
5.875	2/28/99	1,656,000	8.3	457,000
5.875	3/31/99	1,875,000	14.7	...
6.250	3/31/99	1,420,000	7.2	...
7.000	4/15/99	1,073,700	10.6	...
6.375	4/30/99	1,545,000	8.0	320,000
6.500	4/30/99	1,324,620	10.8	105,000
6.375	5/15/99	2,869,124	12.3	...
9.125	5/15/99	1,637,500	16.3	...
6.250	5/31/99	1,020,900	5.5	282,900
6.750	5/31/99	871,990	7.1	185,000
6.000	6/30/99	839,435	4.7	195,000
6.750	6/30/99	1,644,820	12.6	...
6.375	7/15/99	409,000	4.1	60,000
5.875	7/31/99	1,421,970	8.5	325,000
6.875	7/31/99	1,531,400	12.4	...
6.000	8/15/99	2,676,110	11.8	444,000
8.000	8/15/99	943,600	9.3	85,000
5.875	8/31/99	1,439,630	8.4	135,000
6.875	8/31/99	1,101,480	8.9	150,000
5.750	9/30/99	667,380	3.8	25,000
7.125	9/30/99	1,349,752	10.6	271,000
6.000	10/15/99	406,115	3.9	...
5.625	10/31/99	732,000	4.4	230,000
7.500	10/31/99	1,107,315	9.2	549,000
5.875	11/15/99	2,790,968	12.2	...
7.875	11/15/99	814,000	7.6	...
5.625	11/30/99	1,131,175	6.7	583,000
7.750	11/30/99	1,408,145	11.9	232,000
5.625	12/31/99	795,780	4.8	...
7.750	12/31/99	1,379,665	11.1	...
6.375	1/15/00	689,545	6.8	...
5.375	1/31/00	1,140,730	6.5	1,140,730
7.750	1/31/00	1,125,440	9.3	261,000
5.875	2/15/00	1,232,796	6.0	386,000
8.500	2/15/00	1,204,000	11.3	218,000
5.500	2/29/00	1,497,320	8.4	1,497,320
7.125	2/29/00	1,477,290	11.9	155,000
5.500	3/31/00	1,998,220	11.6	1,998,220
6.875	3/31/00	1,401,510	10.7	60,000
5.500	4/15/00	368,000	3.5	8,000
5.625	4/30/00	1,321,000	8.5	1,321,000
6.750	4/30/00	1,524,250	12.3	500,000
6.375	5/15/00	2,807,000	13.5	...
8.875	5/15/00	480,000	4.6	...
5.500	5/31/00	1,321,000	8.0	1,321,000
6.250	5/31/00	911,460	7.2	68,000
5.375	6/30/00	1,383,000	9.3	1,383,000
5.875	6/30/00	740,100	5.9	...
5.375	7/31/00	1,976,750	10.6	1,976,750
6.125	7/31/00	698,000	5.7	243,000
6.000	8/15/00	2,147,845	11.9	837,900
8.750	8/15/00	1,212,400	10.9	54,000
5.125	8/31/00	2,994,300	15.0	2,994,300
6.250	8/31/00	721,000	6.1	71,000
4.500	9/30/00	2,241,500	11.6	2,241,500
6.125	9/30/00	1,009,000	8.4	...
4.000	10/31/00	2,462,900	12.0	2,462,900
5.750	10/31/00	729,430	6.0	192,000
5.750	11/15/00	1,888,200	11.8	237,000
8.500	11/15/00	882,300	7.7	1,300
4.625	11/30/00	2,032,200	10.1	2,032,200
5.625	11/30/00	878,200	7.1	232,000

A.3.—Continued

Issue outstanding		Holdings, 12/31/98	Percentage of total issue outstanding	Net change since 12/31/97
Coupon	Maturity date			
4.625	12/31/00	2,554,662	13.1	2,554,662
5.500	12/31/00	891,000	7.0	...
5.250	1/31/01	800,000	6.2	...
5.375	2/15/01	1,532,560	10.0	1,532,560
7.750	2/15/01	993,500	8.8	64,000
5.625	2/28/01	1,061,000	8.3	160,000
6.375	3/31/01	1,630,000	11.5	30,000
6.250	4/30/01	1,257,500	9.1	319,000
5.625	5/15/01	2,270,117	17.7	2,270,117
8.000	5/15/01	1,473,000	11.9	316,000
6.500	5/31/01	1,074,900	7.8	163,000
6.625	6/30/01	1,175,000	8.2	...
6.625	7/31/01	957,000	6.8	84,000
7.875	8/15/01	1,469,400	11.9	94,400
6.500	8/31/01	1,041,300	7.5	181,000
6.375	9/30/01	1,144,100	7.9	107,100
6.250	10/31/01	949,000	6.5	66,000
7.500	11/15/01	2,824,000	11.7	383,000
5.875	11/30/01	729,000	5.2	253,000
6.125	12/31/01	900,000	6.4	275,000
6.250	1/31/02	1,105,000	8.2	328,000
6.250	2/28/02	944,400	6.9	141,400
6.625	3/31/02	1,400,900	9.8	420,000
6.625	4/30/02	1,292,500	9.0	257,500
7.500	5/15/02	1,341,009	11.5	325,000
6.500	5/31/02	1,132,000	8.4	183,000
6.250	6/30/02	867,000	6.6	81,000
6.000	7/31/02	442,000	3.6	147,000
6.375	8/15/02	2,612,000	11.0	365,000
6.250	8/31/02	942,000	7.4	241,000
5.875	9/30/02	635,000	5.0	175,000
5.750	10/31/02	710,000	6.1	320,000
5.750	11/30/02	644,000	5.3	244,000
5.625	12/31/02	700,000	5.8	115,000
5.500	1/31/03	802,000	6.1	802,000
6.250	2/15/03	2,160,000	9.2	15,000
5.500	2/28/03	1,199,000	8.8	1,199,000
5.500	3/31/03	1,385,000	9.8	1,385,000
5.750	4/30/03	1,010,000	8.0	1,010,000
5.500	5/31/03	1,115,000	8.5	1,115,000
5.375	6/30/03	1,309,000	10.0	1,309,000
5.250	8/15/03	2,834,000	14.3	2,834,000
5.750	8/15/03	3,685,000	13.2	...
4.250	11/15/03	1,518,385	8.2	1,518,385
5.875	2/15/04	650,000	5.0	...
7.250	5/15/04	1,940,550	13.5	35,000
7.250	8/15/04	835,000	6.3	25,000
7.875	11/15/04	1,753,040	12.3	...
7.500	2/15/05	1,291,600	9.4	141,600
6.500	5/15/05	2,000,000	13.6	...
6.500	8/15/05	1,800,000	12.0	...
5.875	11/15/05	1,700,000	11.2	...
5.625	2/15/06	1,708,000	11.0	208,000
6.875	5/15/06	2,075,000	13.0	...
7.000	7/15/06	2,724,752	12.0	459,000
6.500	10/15/06	2,577,800	11.5	145,000
6.250	2/15/07	840,000	6.4	300,000
6.625	5/15/07	1,750,000	12.5	...
6.125	8/15/07	2,518,000	9.8	343,000
5.500	2/15/08	1,420,000	10.5	1,420,000
5.625	5/15/08	4,084,000	15.0	4,084,000
4.750	11/15/08	1,135,000	8.4	1,135,000
Matured in 1998	...	...	...	-52,079,735
Total Treasury notes	...	184,960,020	...	12,427,009

NOTE. Data are on a statement-date basis.

A.4. U.S. Treasury inflation index bonds and inflation index notes in the System Open Market Account, December 31, 1998

Thousands of dollars except as noted

Issue outstanding		Holdings, 12/31/98	Percentage of total issue outstanding	Net change since 12/31/97
Coupon	Maturity date			
<i>Treasury inflation index bonds (IIB)</i>				
3.625	4/15/28	820,000	4.9	820,000
Matured in 1998 .....	...	...	...	...
Total Treasury IIB .....	...	820,000	...	820,000
<i>Treasury inflation index notes (IIN)</i>				
3.625	7/15/02	900,000	5.4	...
3.375	1/15/07	832,000	5.3	82,000
3.625	1/15/08	1,135,000	6.8	1,135,000
Matured in 1998 .....	...	...	...	...
Total Treasury IIN .....	...	2,867,000	...	1,217,000
Total Treasury bonds, notes, IIN, and IIB¹ .....	...	257,289,372	...	...

NOTE. Data are on a statement-date basis.

1. Total amounts of Treasury bonds and notes are from tables A.2 and A.3 respectively.

A.5. U.S. federal agency holdings in the System Open Market Account, December 31, 1998

Thousands of dollars except as noted

Agency and issue outstanding		Holdings, 12/31/98	Percentage of total issue outstanding	Net change since 12/31/97
Coupon	Maturity date			
<i>Federal National Mortgage Association (FNMA)</i>				
9.550	3/10/99	25,000	3.6	...
8.700	6/10/99	23,000	2.8	...
8.450	7/12/99	5,000	1.0	...
8.350	11/10/99	7,000	.4	...
6.100	2/10/00	25,000	5.0	...
9.050	4/10/00	10,000	1.3	...
9.200	9/11/00	10,000	2.5	...
6.625	4/10/03	...	0	-30,000 ¹
6.450	6/10/03	...	0	-25,000 ¹
5.800	12/10/03	10,000	1.3	...
7.550	6/10/04	24,650	3.1	...
8.250	10/12/04	30,000	7.5	...
6.850	9/12/05	20,000	5.0	...
6.700	11/10/05	100,000	25.0	...
10.350	12/10/15	...	0	-10,000
8.200	3/10/16	...	0	-15,000
Matured in 1998 .....	...	...	...	-328,000
Total, FNMA .....	...	289,650	...	-328,000
<i>Federal Home Loan Banks (FHLBanks)</i>				
9.300	1/25/99	2,000	.6	...
8.600	6/25/99	3,900	1.2	...
8.450	7/26/99	5,000	2.0	...
8.600	8/25/99	11,000	4.5	...
8.375	10/25/99	10,000	3.7	...
8.600	1/25/00	6,000	2.0	...
Matured in 1998 .....	...	...	...	-19,000
Total, FHLBanks .....	...	37,900	...	-19,000
<i>Farm Credit Administration (FCA)</i>				
8.650	10/01/99	10,000	2.9	...
Matured in 1998 .....	...	...	...	...
Total, FCA .....	...	10,000	...	...
Total agency issues .....	...	337,550	...	-347,000
Total Treasury and agency issues² .....	...	452,399,256	...	...

NOTE. Data are on a statement-date basis.

1. Called issue.

2. Totals for Treasury issues are from tables A.1, A.2, A.3, and A.4.