

# Approaches to Bank Liquidity Management

By Dudley G. Luckett

The concept of bank "liquidity"—the short-run ability of commercial banks to service deposit withdrawals and loan requests—has undergone fundamental changes in the past 20 years. Prior to that time, banks in the United States measured their liquidity positions by the amounts of certain short-term, readily marketable assets they held. These assets, commonly called "secondary reserves," consisted of such earning assets as short-term U.S. Treasury bills, broker and dealer loans, and bankers' acceptances. Additionally, many small banks used cash assets, such as correspondent balances and excess reserves, for liquidity purposes.

The only liability item used widely by banks to service deposit flows was member bank borrowings from the Federal Reserve. Most member banks, however, borrowed only reluctantly and sporadically from the Federal Reserve. Bank liquidity management was mainly confined to managing the bank's assets.

Beginning in the early 1960s, commercial banks in the United States developed a number of liability instruments that gave them the

ability to acquire liquidity from the liability side of the balance sheet. The development of these instruments—Federal funds, large certificates of deposit, Eurodollar borrowings, and repurchase agreements—has given rise to bank liquidity management practices that are quite different from those previously used by U.S. commercial banks. Yet the practice of *liability management*, as it has come to be called, while widely remarked upon, is but little understood by those not directly engaged in banking. Accordingly, the purpose of this article is to describe contemporary liquidity management practices of commercial banks. This will be done by reference to data on a sample of banks in the Tenth Federal Reserve District. Before presenting these data, however, it is first useful to develop an overall conceptual framework within which to examine the data.

## THE SHORT-RUN ADJUSTMENT PROBLEM

Over a period of several weeks, a commercial bank must simultaneously seek to achieve a number of overlapping goals. There is, first, the goal of efficiently managing its reserve position. As is well known, a member bank of the Federal Reserve is legally required to hold cash reserves equal to a stipulated percentage of its deposits. It is not necessary for a bank to meet its reserve requirements on a daily basis;

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rather, it is only required that the average reserve balance held by the bank during a given week be of the required amount. The week over which reserves are averaged begins on Thursday and is known as the "reserve settlement period."<sup>1</sup>

If a bank ends its reserve settlement period with its average reserves being either larger or smaller than required, it suffers a loss in profits. A bank with excess reserves will have lost the return that these funds would have earned had they been invested; a bank with too few reserves incurs a penalty rate of interest on the deficiency.<sup>2</sup> One very immediate, and very important, short-run goal for the bank is to manage its "money position," that is, its average reserve balance, so that it ends the week with the amount of reserves it is legally required to hold, neither more nor less.

Superimposed on the bank's goal of managing its money position is a second set of goals which, while usually not so pressing as reserve adjustments, are as important. These goals deal with the servicing of the general and particular needs of the bank's customers. A bank must be constantly aware, for example, of where it stands today relative to the seasonal deposit and loan patterns expected to emerge in coming weeks. Similarly, bankers try to anticipate the special financial needs of their large

customers—needs that can be very complex in terms of the financial arrangements involved.

Finally, overlying the other goals, the bank will be pursuing an overall investment strategy. The bank's investment strategy consists of determining the types and amounts of various open market debt instruments—mainly government bonds—the bank wants to hold as earning assets. This set of decisions is quite complex, depending on such factors as risk, tax status, maturity, and the comparative yields of the various instruments available. A bank does not pursue an investment strategy on a weekly or even a monthly basis. Rather, a bank will typically attempt to change the composition of its investment portfolio over a period of several months, with only marginal adjustments being made during shorter periods.

Achieving the bank's various short-run goals is not a simple matter. Each day, large sums of money flow through the bank in a subtle interweaving of patterns: deposits are withdrawn and added to, loans are made, repaid, and renewed, old investments mature and new ones are acquired, scheduled liabilities come due and may or may not be replaced. The problem faced by the bank is to organize this complex of events so that it meets its weekly need for legal reserves while simultaneously achieving or making progress toward its other short-run goals.

To help understand how the bank meets its goals, a distinction may be made between *non-discretionary* and *discretionary* changes in the bank's balance sheet items. While this distinction is not precise and to some extent depends on the period under consideration, within the present context of a few weeks or months it can serve as a useful organizing principle. By *non-discretionary* balance sheet changes is meant those changes over which the bank has little or no short-run control. Perhaps the most obvious example of a *nondiscretionary* balance sheet

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<sup>1</sup> The actual reserve requirement calculation is quite complex and is not immediately germane to this article. For definitions and percentages, see any recent *Federal Reserve Bulletin*. Under the lagged reserve accounting system now in operation, average weekly reserves are held against average deposits two weeks prior to the reserve settlement period. Thus, the bank has a known and definite reserve goal in the settlement period.

<sup>2</sup> The penalty rate is 2 per cent above the current discount rate. However, a bank may be as much as 2 per cent deficient in its required reserves without incurring a penalty, providing that such a deficiency is offset by an equivalent excess in the following reserve settlement period. Similarly, a bank may carry over as much as a 2 per cent excess of reserves to the following reserve week.

item is a bank's deposits (except large CD's). Since the bank is a profitmaking institution, it will accept any deposits it is offered; and the bank is, of course, legally or conventionally obliged to repay deposits on customer demand. Thus, short-run deposit fluctuations "just happen" for the individual bank.

Another major example of a nondiscretionary balance sheet item, only slightly less obvious than deposits, is loans. A bank is not, of course, under legal obligation to make loans. But the logic of the bank's own long-run self-interest is almost equally as compelling. A bank that is temporarily unable or unwilling to make loans to an established customer of proven creditworthiness is likely to lose that customer—and hence a profitable customer relationship—permanently. Other examples of nondiscretionary balance sheet items are short-run changes in the bank's capital accounts, cash items in the process of collection, and required reserves.

In contrast, discretionary balance sheet items are those items over which, under ordinary circumstances, the bank has considerable short-run control. Discretionary items would include such liabilities as Federal funds purchased, negotiable certificates of deposit, Eurodollar borrowings, and repurchase agreements. Here also should probably be listed limited and occasional borrowings from the Federal Reserve. On the asset side, the bank would usually regard any unencumbered<sup>3</sup> short-term open market assets as being subject to short-run control.

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<sup>3</sup> Deposits of governmental units usually carry with them the stipulation that certain of the bank's assets be pledged against their repayment. The most common bank assets used for this purpose are U.S. government securities. Such pledged assets are not, of course, available to the bank for liquidation. For a discussion of pledging requirements, see Ronald A. Ratti, "Pledging Requirements and Bank Assets Portfolios," Federal Reserve Bank of Kansas City *Economic Review*, September-October 1979, pp. 13-23.

The process of short-run bank management can be understood in terms of this distinction between discretionary and nondiscretionary balance sheet items. Each day the bank experiences substantial nondiscretionary flows of funds moving through it. Some of these flows, such as deposit increases, loan repayments, and maturing investments, supply the bank with funds. Others, such as deposit withdrawals and new loans, absorb bank funds. Short-run bank liquidity management consists of making changes in the bank's discretionary items to offset or reinforce the net effect of the nondiscretionary flows in order to achieve the short-run goals of the bank.

## INSTRUMENTS OF SHORT-RUN BANK ADJUSTMENTS

The instruments available for short-run bank liquidity management encompass the entire money market. This section discusses the general features of those instruments commonly used by banks in the Tenth Federal Reserve District.<sup>4</sup>

### Federal Funds

Federal funds are short-term funds that banks lend to one another. While other institutions also participate in this market, and while longer term trades are sometimes made, the bulk of the market consists of one-day (or weekend) loans between banks. Market usage describes the borrowing of Federal funds as a purchase and the lending of Federal funds as a sale. Federal funds purchased are nondeposit liabilities, and prior to October 11, 1979, banks were not required to hold reserves against

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<sup>4</sup> The most important money market instrument omitted from the following discussion is Eurodollars, dollar-denominated deposits in offshore foreign banks, which are used very little by Tenth District banks.

them.<sup>5</sup> Moreover, purchased Federal funds do not affect the premiums banks pay for deposit insurance.

### **Large Certificates of Deposit (CD's)**

Large (over \$100,000) certificates of deposit are evidences of money that customers have left on deposit in a bank for a stipulated number of days. They are either negotiable, in which case they may be sold and resold in the CD market, or non-negotiable, in which case they may not. Maturities generally run from 30 to 90 days, although sometimes they are longer. CD's are subject to both reserve requirements and FDIC insurance assessments.

### **Repurchase Agreements and Reverses**

A repurchase agreement (also called a repo or RP) is an arrangement between a commercial bank and a corporate or governmental customer first to sell and then to repurchase a security. Since the price and date at which the security will be repurchased are stipulated in the original sale contract, a repurchase agreement is, in effect, a secured loan with a fixed return and maturity. By far the most common type of security used in repurchase agreements is the U.S. Treasury bill. Maturities on repurchase agreements are usually very short, frequently one day, although term repos are not uncommon.<sup>6</sup> A reverse repurchase agreement is

the opposite of a repo: The bank agrees first to buy the security and then resell it to the customer. A repurchase agreement is a source of funds to the bank, and a reverse, a use of the bank's funds.

### **Borrowing from the Federal Reserve**

A member bank of the Federal Reserve System may adjust its reserve position by borrowing reserves directly from the Federal Reserve. These borrowings are typically for very short periods, with the rate of interest paid being the well-publicized "discount rate." As a matter of management policy, and in line with Federal Reserve regulations, most member banks make only limited use of this privilege.

### **Treasury Bills and Other Government Obligations**

Treasury bills are short-term debt obligations of the U.S. government. They do not carry an explicit rate of interest; rather, they are traded on a discount basis, with the difference between their purchase price and their maturity value being the investors' return.<sup>7</sup> Although some T-bills, as they are called, are issued with original maturities of one year, the bulk of them are issued each week with three- and six-month maturities. Because of their absence of credit risk, their easy marketability, and the narrow range over which their market price fluctuates, Treasury bills are, with the exception of Federal funds sold, generally considered the most highly liquid of bank assets. For this reason, they were the secondary reserve asset *par excellence* prior to the advent of bank liability management practices. Today,

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<sup>5</sup> Effective in the statement week beginning October 11, 1979, a marginal reserve requirement was placed on the "managed liabilities" of member banks. Managed liabilities include, but are not limited to, repurchase agreements against U.S. government and Federal agency securities and Federal funds borrowings from nonmember institutions.

<sup>6</sup> For a more detailed discussion of the repurchase agreement market, see Norman N. Bowsher, "Repurchase Agreements," Federal Reserve Bank of St. Louis *Review*, September 1979, pp. 17-22.

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<sup>7</sup> See Margaret E. Bedford, "The Federal Reserve and the Government Securities Market," Federal Reserve Bank of Kansas City *Economic Review*, April 1978, pp. 15-31.

many banks hold T-bills primarily to be used in repurchase agreements and as pledged securities against government deposits.

Besides Treasury bills, the U.S. government also issues and guarantees a wide variety of debt obligations. Any of these obligations nearing maturity possesses most of the desirable characteristics of Treasury bills and may be purchased or sold by banks for short-run adjustment purposes.

### **Other Money Market Instruments**

In addition to the instruments previously described, banks may use various other money market instruments for short-run liquidity. The most common of these instruments are: *prime commercial paper*, which is short-term debt issued by large, well-known corporations; *bankers' acceptances*, which is short-term corporate debt that has been guaranteed by a bank; and *loans to brokers and dealers*, which are secured loans made to securities dealers. Like Treasury bills, these instruments are earning assets of the bank that may be purchased for a short-term bank investment or sold as a ready source of bank funds.

## **PRINCIPLES OF BANK LIQUIDITY MANAGEMENT**

As seen from the preceding discussion, the individual bank is presented with a large number of means to effect a given adjustment. Since the bank is not confined to a single discretionary instrument, there are in principle an infinite number of responses it may make to any given net change in its nondiscretionary items. In this sense, each bank is unique. Nevertheless, there are two underlying principles involved in the bank's decision process which, while not explaining bank behavior, may serve as an aid in understanding it. The first of these principles is the philosophy of the

bank's management. The second is that the bank will strive to minimize the cost of managing its liquidity position.

### **Management Philosophy**

Operationally, a management philosophy consists of a set of explicit or implicit guidelines laid down by top management that specify certain constraints on the behavior of different departments of the bank. Because these constraints are frequently the result of a group decisionmaking process, and because department heads may also play a role in formulating the rules relevant to their own department, a management philosophy does not necessarily represent a single, consistent viewpoint. For example, a bank may be quite aggressive in seeking out new loan customers and at the same time quite conservative in the way it handles the activities of its trust department. Considerable care thus needs to be exercised in categorizing and judging actual banks with respect to their approach to management practices; the spectrum of "good" management philosophies in banking is virtually as broad as the banking system itself. Granted this qualification, however, it is possible to describe, in very general terms, banks at either end of the conservative-aggressive spectrum.

Probably the main focal point of different management approaches to short-run bank adjustment is the concept of bank liquidity. While the basic idea behind this concept remains the same today as it was 100 years ago, its operational content has evolved with the banking system. What any measure of liquidity tries to quantify is the ability of the bank to service its deposit and loan customers, even under difficult circumstances. Prior to the 1960s, the most commonly used measure of bank liquidity was the loan-deposit ratio, which compared the bank's least liquid assets with its most liquid liabilities. With the advent of liabil-

ity management, however, the loan-deposit ratio has become increasingly irrelevant. A single example will illustrate why this is so: A bank that makes regular use of purchased Federal funds to service its loan customers will raise the numerator without affecting the denominator of its loan-deposit ratio. Yet, such a bank is not necessarily less liquid because it purchased Federal funds.

While there is no commonly agreed upon contemporary measure of bank liquidity, the various measures now in use have as their central concept the notion of confidence-sensitive money. Confidence-sensitive money is any source of bank funds that is sensitive to a loss of confidence either in a particular bank or in the banking system generally. While a strict interpretation of this concept would include the uninsured portion of any bank deposit, empirical definitions are usually confined to Federal funds purchased, large certificates of deposit, and other bank liabilities for borrowed money.<sup>8</sup>

The linking of the ideas of confidence-sensitive money and bank liquidity is meant to give some indication of the extent to which a bank relies on sources of funds that could disappear in difficult times. Thus a bank that makes little or no use of confidence-sensitive money—one that relies exclusively on its own resources—reflects a conservative management philosophy.

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<sup>8</sup> A related but somewhat narrower concept is that of "brokered funds." Brokered funds are those funds that a bank acquires through a broker. This concept is narrower than confidence-sensitive money because it does not include all Federal funds purchased, large CD's, etc., but only those acquired through a broker. For example, a city correspondent bank may buy Federal funds directly from one of its country respondent banks without going through a broker. Or a bank may sell a negotiable certificate of deposit directly to a corporate customer with the understanding that the corporation will sell it only in an emergency (however defined). In neither of these examples would the bank have increased its use of brokered funds, although the bank's reliance on confidence-sensitive money would have gone up in both cases.

Presumably, such a bank would encounter little difficulty in meeting the needs of its customers even in troubled economic times. At the other end of the spectrum is the bank that seeks out funds from any source, so long as the total cost of such funds is less than the net rate of return the bank is earning by investing them. Such a bank is relying heavily on outside sources of funds and reflects an aggressive management philosophy. Most banks in the United States fall somewhere between the conservative-aggressive dichotomy, with neither extreme describing an actual bank. Nevertheless, management philosophy has a profound effect on the paths individual banks use to make short-run balance sheet adjustments.

### **Cost Minimization**

Given the general viewpoint of the bank's management, there remains a wide variety of decisions to be made in bank liquidity management. A bank needing additional loan funds, for example, may acquire them in many different ways: purchasing Federal funds, issuing large certificates of deposit, entering into repurchase agreements, or selling Treasury bills, to name only a few. In very general terms, the particular instrument, or combination of instruments, chosen by the bank to achieve a given goal will conform to the least-cost principle. That is, the bank will attempt to minimize the cost of managing portfolio changes subject to the overall constraints imposed by its management philosophy. The "cost" of bank funds is to be understood in its broadest sense. It includes not only the market rate of interest on the instrument used, but such additional considerations as maturity, quality (risk), brokerage fees, paperwork costs, FDIC insurance premiums, and reserve requirements. Moreover, the bank must make judgments about a number of factors whose consequences cannot be definitely known at the time a

decision is made. These factors may generally be classified under two headings: (1) the particular circumstances of the bank, including the manner in which these circumstances are likely to evolve in the immediate future, and (2) forecasts of open market interest rates.

*Particular Bank Circumstances.* Each individual bank has certain unique circumstances surrounding its own situation that affect the choice of instruments used in making a short-run adjustment. One such factor is *the time for which the funds are needed or available*. For example, a bank facing a seasonal peak in its loan demand may finance these loans with either large CD's or repurchase agreements. One fundamental difference between the two instruments is that repurchase agreements are commonly renewed on a daily basis with different customers. Moreover, because they involve the literal sale and repurchase of securities, repos require a great deal of paperwork. Thus the total costs of repurchase agreements are largely variable, rising steadily as a function of the length of time for which the funds are needed. Issuing CD's, in contrast, involves the bank in high fixed costs (including insurance premiums and nonearning reserves), but no variable costs; once the CD's are issued, no further expenses are incurred. Thus, other considerations aside, the bank would tend to finance a loan expansion of a few days' duration with repurchase agreements and a loan expansion of several weeks' duration with CD's.

This point can be made more precisely with the aid of Chart 1, in which total net costs are shown on the vertical axis and time (days or weeks) is shown on the horizontal axis. The net costs of financing a given amount of borrowing by repurchase agreements<sup>9</sup> are shown as the upward-sloping solid line, and the net costs of financing the same amount by issuing CD's are shown as the horizontal solid line. If the bank needs the funds for a period of time less than

0a, it will minimize costs by using repurchase agreements; if the bank expects to need the money for a period longer than 0a, it will be better off issuing large CD's.

As is usual with such graphic analysis, Chart 1 assumes that a great many other factors are held constant—factors such as interest rate expectations, bank liquidity, and uncertainty about the period for which the funds are needed. Thus, Chart 1 should be thought of as describing a tendency only. With this qualification, however, it is possible to extend the analysis to illustrate an ancillary tendency. Suppose that the net cost to the bank of issuing large CD's rises. Such a rise might occur for many reasons—for example, a widening spread in market interest rates, a change in brokerage fees, or an increase in the legal reserve requirement applicable to large CD's. In terms of Chart 1, the consequences of such a rise is to shift the solid horizontal line upward to the dashed line shown in the chart. This upward shift in turn lengthens from 0a to 0b the period over which it is economical to finance the funds by using repos.

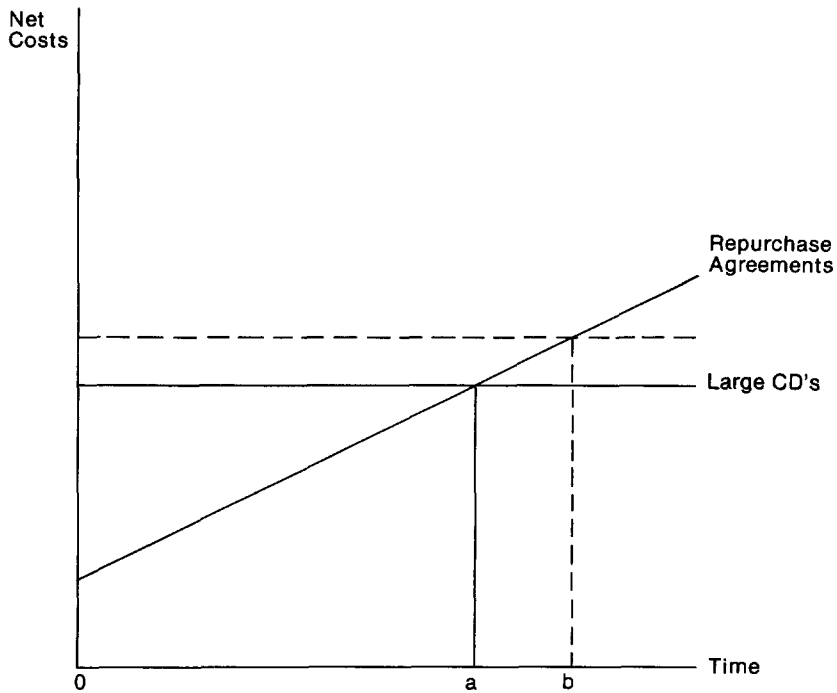
The preceding analysis thus suggests that, to the extent they are not self-financed by deposit inflows, banks will tend to finance seasonal and cyclical loan expansions by using their longer term instruments. Random or unexpected fluctuations in deposits and loans, alternatively, will tend to be associated with changes in instruments of short duration, such as Federal funds and repurchase agreements.

A second important factor having to do with particular bank circumstances is that of

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<sup>9</sup> The purpose of Chart 1 is to contrast sources of bank funds of very short maturity with sources that mature in several weeks. Thus, in terms of the chart, long-term repurchase agreements, or purchases of term Federal funds, would take on many of the analytical characteristics of CD's. Of course, RP's are a potential source of funds only if the bank has available securities that are being held for pledging or for longer run investments.

**Chart 1**  
**THE NET COSTS OF LARGE CD'S COMPARED WITH REPURCHASE AGREEMENTS**



*customer needs.* In a great many cases the choice of which adjustment instruments to use is forced onto the bank by circumstances beyond its immediate control. A large city bank that does an extensive correspondent business, for example, may engage in some Federal funds purchases and sales solely to accommodate its country respondent banks. Similarly, repurchase agreements may be used by a bank's corporate and governmental customers as a substitute for interest-bearing demand deposits and hence may be undertaken at the initiative of the customer. And, of course, banks must respond to customers who request CD's as a temporary repository for idle funds. Thus, for large banks particularly, there may be no single balance sheet category that is wholly discretionary.

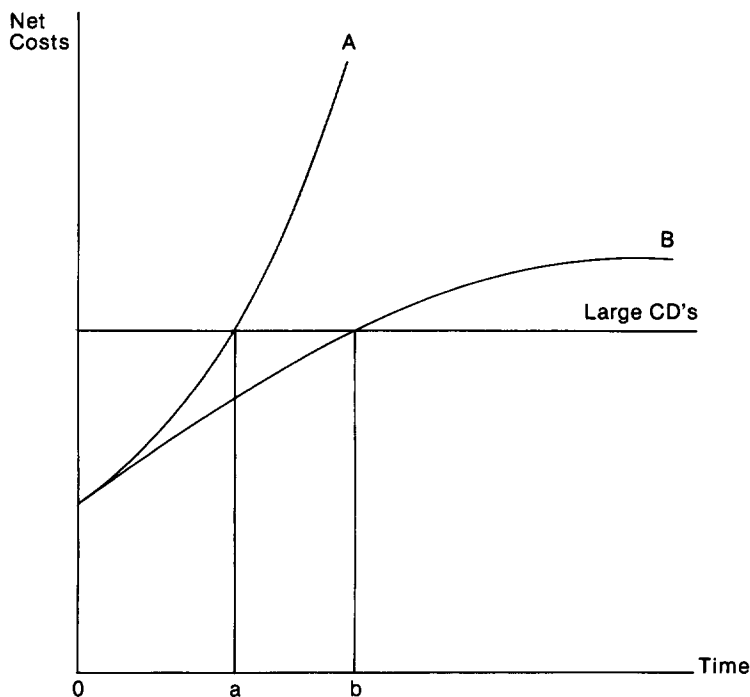
The bank's perception of its current *liquidity* relative to where it wants to be is another factor that undoubtedly influences the way a particular bank manages its money position.<sup>10</sup> As previously discussed, banks operate within the framework of a management philosophy that sets limits on the use they make of the various adjustment instruments. The nature of this constraint is misconceived, however, if it is thought of as a boundary line that the bank either does or does not exceed. A more

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<sup>10</sup> For empirical evidence on this point, see in particular Donald Michael DePamphillis, *A Microeconomic Analysis of the Short-Term Commercial Bank Adjustment Process*, Federal Reserve Bank of Boston, Research Report 55, April 1974, chapters 4 and 5.



**Chart 2**  
**THE NET COST OF REPURCHASE AGREEMENTS**

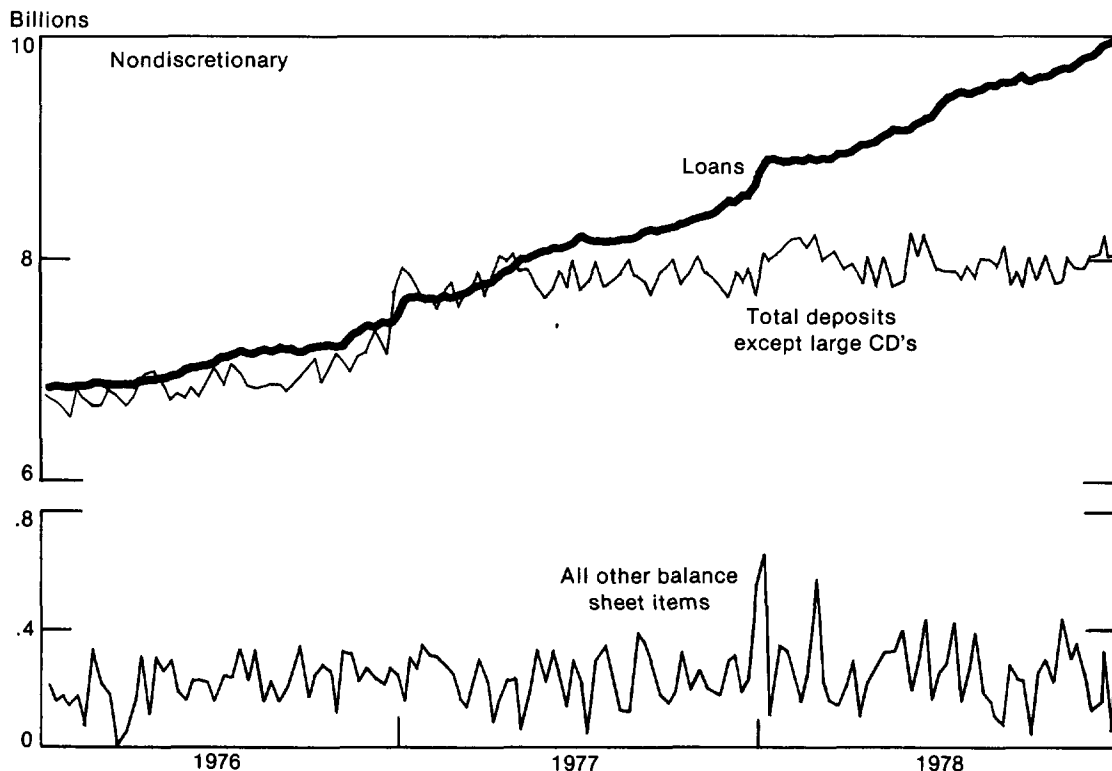


appropriate analogy would be to think of it as an elastic band that becomes more resistant the farther it is stretched. The individual bank, that is, does not adjust its liquidity position on a weekly basis. Rather, the adjustment is likely to take place over a period of several months and to take into account such factors as the phase of the credit cycle.

*Interest Rate Expectations.* A very important factor in determining bank portfolio behavior is expectations about future interest rates. This can be illustrated with the aid of Chart 2, which is a variant of Chart 1. In Chart 2 the net costs of financing a given amount of bank funds with repurchase agreements are shown as curves A and B. The higher curve, A, depicts the way these costs would behave if interest

rates were to rise in the future. Because the repos would have to be rolled over at higher and higher rates, total costs would rise at an increasing rate. Under such circumstances, the bank would prefer to "lock in" the current low CD rate for all but its most temporary needs. That is, only if the bank needed the funds for only a very short time period,  $0a$ , would it prefer to use repurchase agreements. Alternatively, if interest rates are expected to fall in the future the total costs of bank borrowing through repurchase agreements would rise at a decreasing rate of increase (curve B). In this case, the bank would prefer to avoid a comparatively long-term commitment at the currently high CD rate and instead would prefer to stay in repos to take advantage

**Chart 3  
TENTH DISTRICT WEEKLY REPORTING BANKS**



of the expected lower rates in the future. Thus, in periods when the bank expects interest rates to rise, the tendency is to raise funds through longer term adjustment instruments. In periods when rates are expected to fall, the tendency is to utilize very short-term sources of funds, such as Federal funds and repurchase agreements.

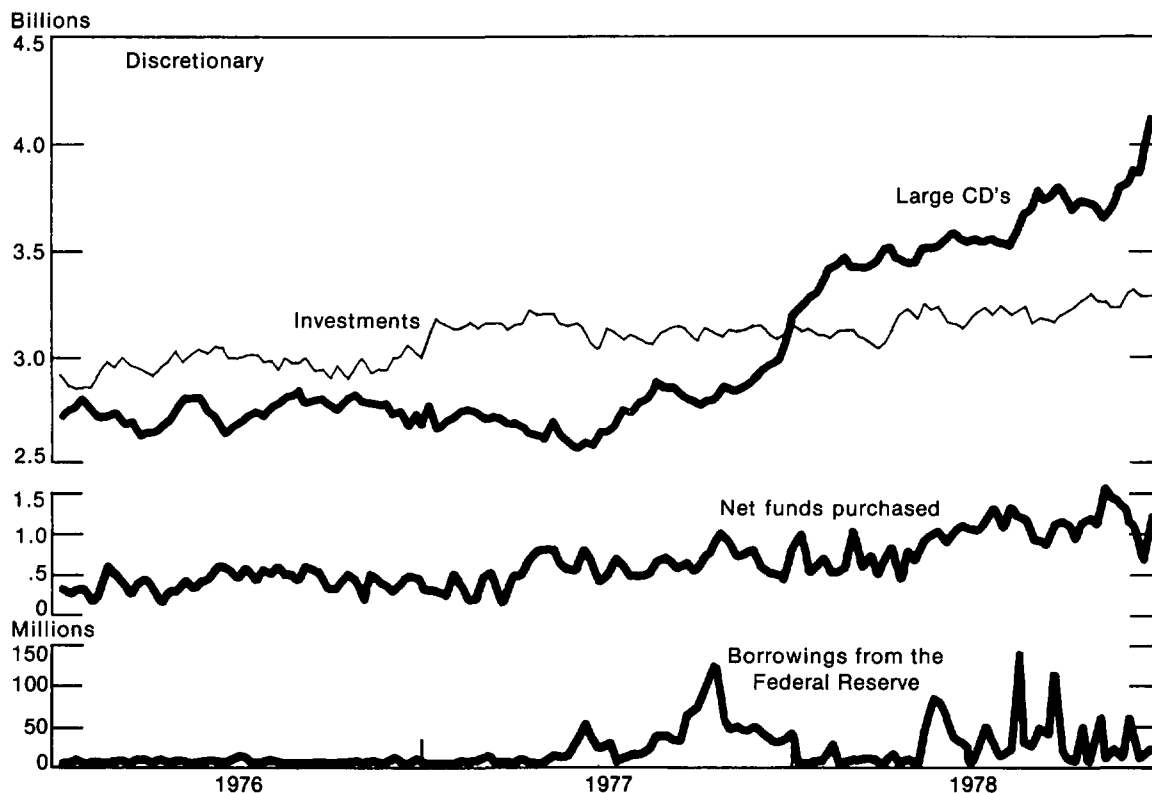
### CASES OF BANK BEHAVIOR

Each week the Federal Reserve Bank of Kansas City collects balance sheet data from a sample of 35 member banks in the Tenth Federal Reserve District. These data are used in this section to illustrate some of the principles of short-run bank liquidity management

discussed in the preceding section.<sup>11</sup> Both aggregate and individual bank data are presented—aggregate data to show general tendencies and individual data to illustrate some of the varieties of approaches to contemporary liquidity management.

<sup>11</sup> The banks in this particular sample range in size from about \$70 million to about \$1.3 billion in total assets, so that there are no truly small banks represented. Additionally, the data are collected as of the close of business on Wednesday, the final day of the reserve settlement period and hence a particularly active day in terms of bank adjustments. Thus, Federal funds and repurchase agreement activities may not be representative of bank behavior throughout the rest of the week. Also, information on Federal funds and repos is consolidated, so that it is not possible to distinguish bank activities in these markets separately.

**Chart 4  
TENTH DISTRICT WEEKLY REPORTING BANKS**



**Aggregate Data for 35 Weekly Reporting Banks**

Charts 3 and 4 show the data for all 35 weekly reporting banks for the three-year period, 1976-78. Chart 3 shows the data that may roughly be classified as nondiscretionary—total bank loans, total bank deposits except large CD's, and "all other balance sheet items." By all other balance sheet items is meant the net sum of all other balance sheet items that are not shown separately in both Charts 3 and 4. It is a residual item and includes such things as the banks' capital accounts, legal reserves, and correspondent

balances. Liability and capital items are entered into this sum negatively and assets are entered in as a positive figure. Thus, the series, "all other balance sheet items," is analogous to loans: an increase represents a net use of funds, and a decrease represents a net source of funds.

Chart 4 shows those items over which the banks are assumed to exercise discretionary control—net Federal funds purchased plus repurchase agreements, large certificates of deposit, borrowings from the Federal Reserve, and total bank investments. The first three of these items are sources of bank funds, while the last, bank investments, is a use of bank funds. Because Charts 3 and 4 taken together exhaust

the banks' balance sheets, the algebraic sum of the nondiscretionary items shown in Chart 3 must be of equal value but opposite sign to the sum of the discretionary items shown in Chart 4. For example, a net increase in the nondiscretionary uses of bank funds in Chart 3 must be exactly offset by a net increase in the discretionary sources of bank funds in Chart 4.

During the 1976-78 period, the aggregate behavior of the 35 Tenth District banks was dominated by a large expansion in their loan portfolios (Chart 3). From the beginning of 1976 to the end of 1978, the total of the banks' loans rose from about \$7 billion to about \$10 billion—a loan expansion of \$3 billion, or almost 43 per cent, during the three-year period. The resulting need for additional funds was reinforced by the behavior of all other balance sheet items, which rose from about \$200 million to about \$400 million. Taking loans and all other balance sheet items together, the sample banks thus needed to acquire some \$3.2 billion throughout the period. To some extent, this need was met through the expansion of the remaining nondiscretionary item, total bank deposits except large CD's. From 1976 through 1978, the banks' deposits rose by about \$1.2 billion, from \$6.8 billion to \$8 billion. Thus, the net change in the banks' nondiscretionary items was a \$2-billion increase. Clearly, this increase had to be financed from an equal net increase in the banks' discretionary items.

As seen from Chart 4, the needed \$2 billion did not come from either a liquidation of bank investments or borrowings at the Federal Reserve. In fact, bank investments actually rose irregularly throughout the period, by about \$400 million, thus adding slightly to the banks' need for funds. And, while borrowings from the Federal Reserve did expand during the period, the expansion was quantitatively negligible. Thus, almost all of the nondiscretionary need

for funds was financed through an expansion of large certificates of deposits, purchased Federal funds, and repurchase agreements. Of these, CD's accounted for about \$1.4 billion, and net Federal funds plus repos accounted for about \$1 billion.

The discussion surrounding Charts 1 and 2 suggests that banks will tend to use large certificates of deposit to finance their longer term needs for loans, while using Federal funds and repos for short-term reserve adjustments. This conclusion is borne out by casual inspection of the data. The behavior of the Federal funds and repurchase agreement series is highly irregular and is probably related to the irregularity of movements in deposits and "all other balance sheet items." It is not possible to demonstrate this point statistically, however. The behavioral hypothesis that banks use changes in Federal funds and repos to offset net weekly fluctuations in all their other balance sheet items is statistically indistinguishable from the fact that solving a balance sheet identity for any one item necessarily results in equal values on both sides of the equation. Evidence from other studies, however, supports the view that the magnitude of weekly changes in a bank's Federal funds position is related to fluctuations in its deposits.<sup>12</sup>

While it is not possible to demonstrate the tendency of banks to use Federal funds and repos for temporary needs, it is possible to develop evidence in support of the other half of the hypothesis—that banks tend to use large CD's to finance more permanent needs for funds. Specifically, the following hypothesis can be tested: Those bank loans that are not financed by a permanent deposit flow will be financed through the issuance of certificates of

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<sup>12</sup> See Carl M. Gambs and Donald V. Kimball, "Small Banks and the Federal Funds Market," Federal Reserve Bank of Kansas City *Economic Review*, November 1979, pp. 3-12.

deposit. To test this hypothesis, permanent deposits were defined as the trend line of the deposit series shown in Chart 3.<sup>13</sup> This trend in deposits was then subtracted from the loan series to form an adjusted loan series, which represents that part of the loan expansion shown in Chart 3 that could not be financed through the rise in permanent deposits. The adjusted loan series was then used in a regression analysis to explain the behavior of the large CD series (Chart 4). The resulting regression equation, which was statistically significant, indicated that adjusted loans explained about 52 per cent of large CD's.<sup>14</sup> This result lends empirical support to the hypothesis that banks use large CD's to finance loans not financed by permanent deposit flows.

One final point may be made about the data shown in Chart 4. The behavior of the series on bank investments may appear surprising because it indicates that the banks were adding to their investment portfolios during a period when they were under heavy pressure to make additional loans. The explanation for this behavior lies partly in the banks' increased need for securities for pledging requirements and for repurchase agreements. Also, that this sample of banks increased their investments during a period of rapid loan expansion is explained by the U.S. banking system's movement away from the asset management practices of 25 years ago and by its adoption of the liability management practices of today.

### Cases of Individual Banks

Economic theory and aggregate data are useful for analyzing and describing general tendencies, but they necessarily fail to capture the wide range of behavioral patterns to be found within the banking system. To round out the discussion of contemporary bank management practices three cases of individual bank behavior are examined. The three cases

are taken from the sample of 35 weekly reporting banks previously described and cover the same period of time. The data shown in Charts 5, 6, and 7 are classified indentially with the data in Charts 3 and 4, with two

<sup>13</sup> Various nonlinear forms for the trend were computed. While the differences among them were small, the most satisfactory form was the quadratic. The estimated trend for the deposit series shown in Chart 3 is  $D = 6,549 + 24T - 0.1T^2$ , where D is total deposits (except large CD's), in million of dollars, and T is time in weeks. All coefficients are significant at the 1 per cent level.  $R^2 = .88$ .

<sup>14</sup> The regression equation was  $LCD = 2,718 + .58L^*$ , where LCD is large certificates of deposit and  $L^*$  is the adjusted loan series. (See text above.) Figures are in millions of dollars. Both coefficients are significant at the 1 per cent level, and  $R^2 = .52$  after adjustment was made to eliminate autocorrelation. Alternative forms of the equation were run with loans lagged from one to four weeks. In most cases, the results improved very slightly in terms of  $R^2$ .

The analysis represented by Charts 1 and 2 contains three hypotheses: (1) banks will use CD's to finance longer term needs for funds, (2) the behavior of hypothesis (1) will be modified by the relative costs of CD's and purchased Federal funds, and (3) the behavior of hypothesis (1) will be modified by expected interest rate movements. Attempts to incorporate all three hypotheses into a single regression equation were unsuccessful but promising. One such regression, for example, was:

$$LCD = 2,671 + .58L^* - 38,111(R_{CD} - R_{FF}) + 8,784 R_{6,6}^e$$

(29.88) (11.44) (-1.16) (0.53)

where LCD and  $L^*$  are as defined above,  $R_{CD} - R_{FF}$  is the spread between in the interest rate on 90-day negotiable CD's and the interest rate on overnight Federal funds, and  $R_{6,6}^e$  is the 6-week Treasury bill rate expected at t to prevail at t + 6 weeks.  $R_{6,6}^e$  was proxied by the "forward" rate implied by the Treasury bill yield curve. Dollar amounts are in millions of dollars, and interest rates are expressed as a per cent. T-statistics are shown in parentheses, and  $R^2 = .57$  after adjustment was made for autocorrelation in the residuals.

Although the coefficients on the final two variables in the above regression are not significant, each has the theoretically correct algebraic sign. It should be noted, however, that there is a strong possibility of simultaneous equation bias. The regression analysis treats only the supply side of the large CD market and ignores the demand for CD's by the sample banks' customers. As previously discussed, however, the needs of a bank's customers are very important in determining the mix of adjustment instruments it uses. The regression analysis thus may contain simultaneous equation bias of unknown influence.

exceptions. First, the series on "all other balance sheet items" and "borrowings from the Federal Reserve" are not shown. Second, each series shown is expressed relative to the mean of the bank's assets over the three-year period.

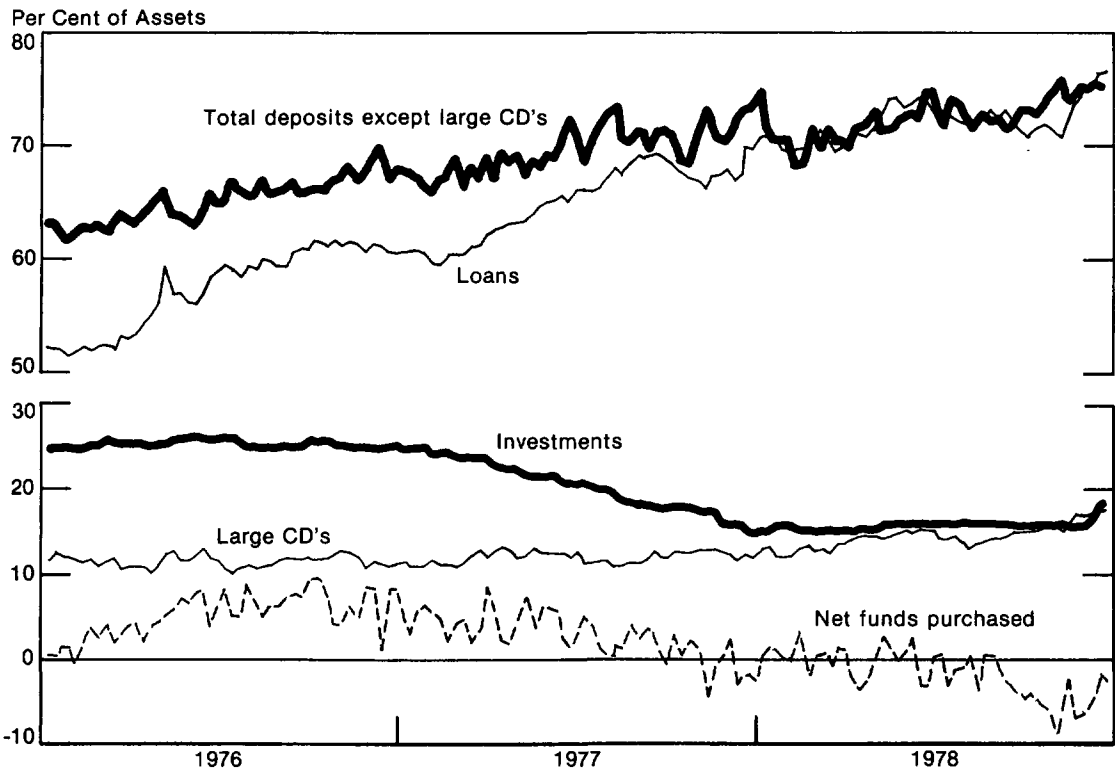
The first case, that of Bank A, is shown in Chart 5. Bank A is one of the smaller banks in the sample, with assets of less than \$100 million. It is also one of the larger affiliates of a multibank holding company. The holding company practices only loose control over its affiliate banks, permitting a good deal of autonomy at the local level.

Bank A experienced a very rapid rise in its loans throughout 1976. This increase was, for the most part, financed by an equally rapid rise

in its deposits. However, during this same period the sum of all other balance sheet items (not shown in Chart 5) fell substantially, thus using bank funds and necessitating the expansion of an offsetting discretionary source. In 1976, Bank A met this need by expanding its Federal funds position; by yearend, purchased Federal funds was about 10 per cent of its mean assets.

What is of particular interest about Bank A is its subsequent response to its heavy involvement in purchased Federal funds. In 1977, the bank's management evidently decided that its dependence on confidence-sensitive sources of funds was too great—i.e., that the bank's liquidity was below the

**Chart 5  
BANK A**



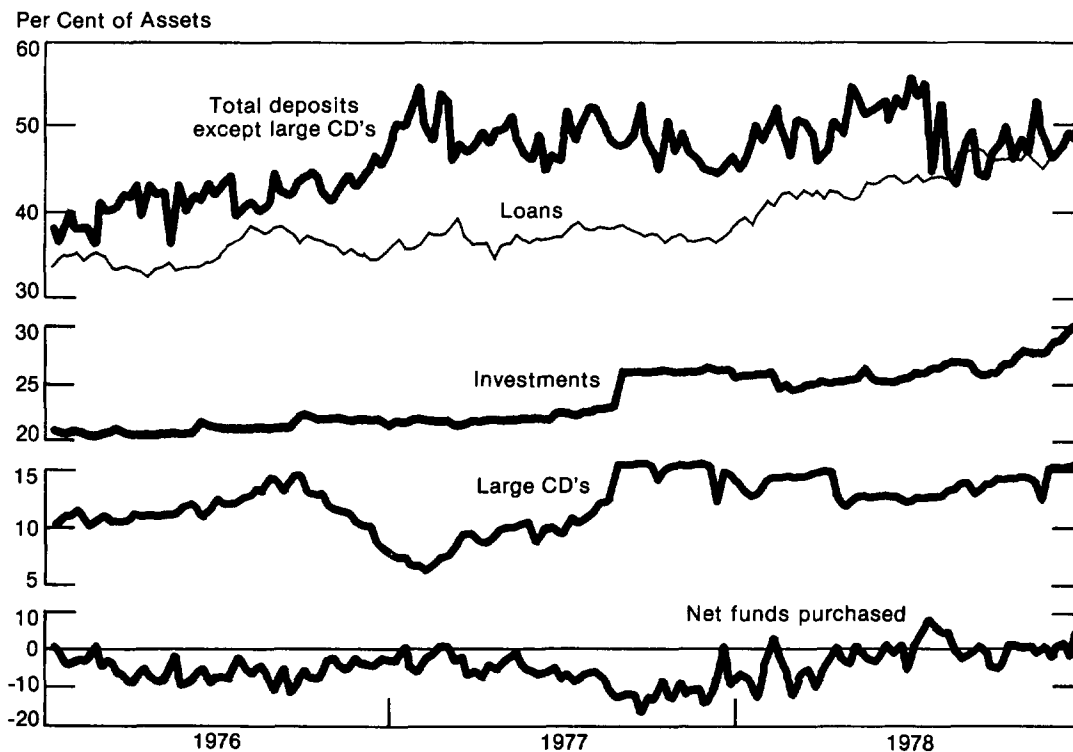
desirable level. In any case, Bank A began a systematic reduction of its investments, using the money acquired to move from a net-purchased to a net-sold position in the Federal funds market. Despite the fundamental change in its Federal funds position throughout 1977 and 1978, Bank A continued to use weekly changes in Federal funds for reserve settlement purposes. Thus, the case of Bank A illustrates how a bank may alter its approach to liquidity management through time.

The case of Bank B (Chart 6) illustrates the way banks may coordinate the use of Federal funds and large CD's. Bank B is one of the medium-sized banks of the weekly reporting sample, having assets in the \$250- to \$500-million range. It has a strong board of direc-

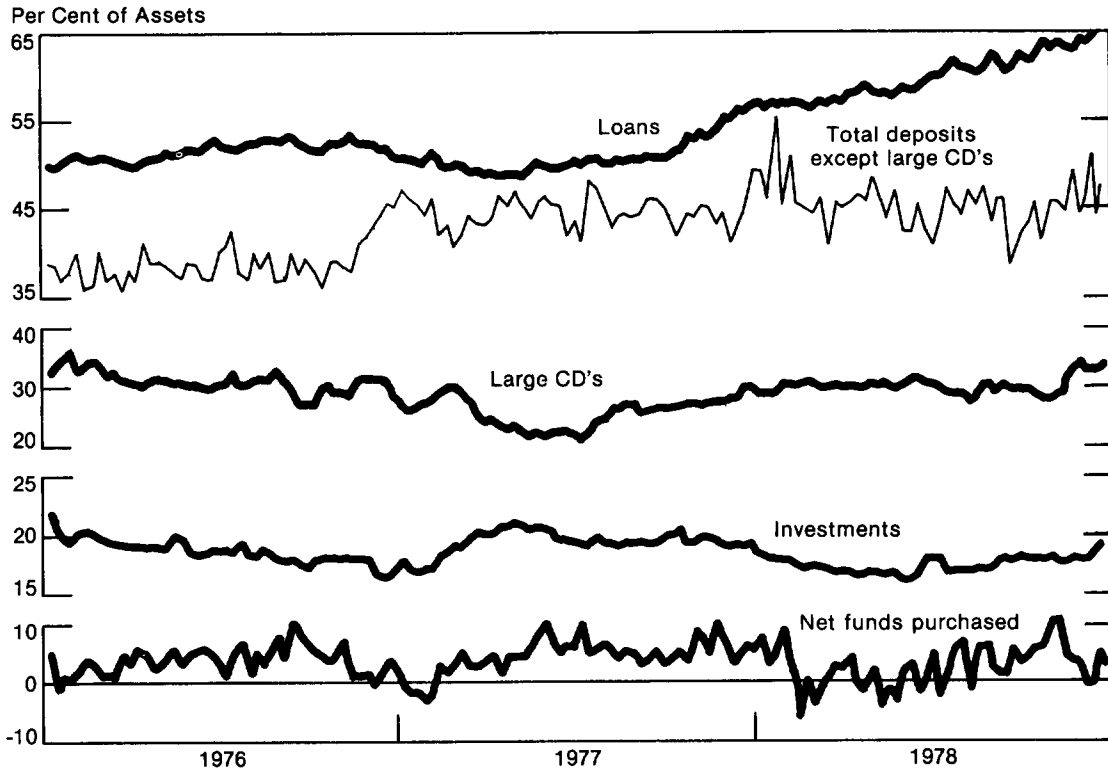
tors, structured management, and procedural guides for all of the bank's various departments. Within the framework of these management guidelines, authority and responsibility are readily delegated.

The flow of nondiscretionary funds through Bank B has two features of particular interest. One feature is the considerable variability of its deposits. In fact, a large variance in many of its nondiscretionary balance sheet items is a characteristic of Bank B, which in turn requires considerable skill in portfolio management. The second feature of Bank B's nondiscretionary items is the relative movement in deposits and loans. In 1976, deposits grew very rapidly, while loans (except for seasonal factors) rose only slightly. In the latter part of 1977 and all

**Chart 6  
BANK B**



**Chart 7  
BANK C**



of 1978, the reverse was true: deposits had an essentially "flat" trajectory, while loans expanded sharply. Thus, Bank B was faced alternately with first using and then acquiring additional funds, while simultaneously dealing with a high degree of balance sheet volatility.

The series showing discretionary funds in Chart 6 indicate how Bank B resolved these problems. First, like Bank A, the variability in the Federal funds series strongly suggests that Bank B used its Federal funds position to manage weekly fluctuations in its deposits. In the case of Bank B, however, the Federal funds market was also used for longer run purposes. During most of 1976, the bulk of the excess of deposits over loans went into the Federal funds

market; at one point, Bank B's sales of Federal funds was more than 10 per cent of its mean assets. In the final quarter of 1976, however, as deposits rose sharply, the management of Bank B dramatically reduced its large CD's outstanding and simultaneously liquidated most of its Federal funds position.

In 1977, the relative use made of federal funds and large CD's was reversed once again. From January to October of that year, as total deposits trended downward, Bank B's certificates of deposit more than tripled, while its sales of Federal funds expanded, at one point to over 15 per cent of its mean assets. In 1978, a reduction of these Federal funds sales was then used to finance the heavy loan



expansion of that year, while CD's remained approximately constant.

Bank C (Chart 7) is one of the largest banks in the sample, having assets approaching \$1 billion. It is of interest primarily because of the aggressive use it makes of the instruments of liability management and the way that it coordinated its use of these instruments with its investment portfolio. Unlike the two banks previously examined, Bank C is typically a net purchaser of Federal funds, at times financing more than 10 per cent of its assets in this market. It also makes heavy and varied use of large certificates of deposit. Its use of its investment portfolio as an adjustment instrument, while quantitatively less than Federal funds and large CD's, is also substantial.

Of particular interest among Bank C's non-discretionary items is the very large and prolonged increase in loan demand that this bank experienced over approximately the last two-thirds of the period. Beginning early in the second quarter of 1977, total loans rose in an almost uninterrupted movement from less than 50 per cent to more than 65 per cent of its mean assets. This loan increase was offset only slightly by an upward trend in deposits. Indeed, considering the variability of the deposit series, it is doubtful that Bank C's management considered that it had received any offsetting increase in its permanent deposits. Thus, Bank C was obliged to finance all, or very nearly all, of its 1977-78 loan expansion through discretionary sources of funds.

The discretionary funds series given in Chart 7 show how Bank C utilized these sources of funds. Its first reaction, chronologically, was to expand its net purchases position in the Federal funds market. This reaction is consistent with uncertainty, on management's part, about the permanence of the increased demand for loans. Evidently, however, as it became clearer in

mid-1977 that the higher demand for loans was likely to persist, Bank C began selling some of its open market investments and expanding its large CD's. By yearend 1978, Bank C had considerably expanded its Federal funds and repo position, its outstanding CD's, and decreased its investment portfolio. Throughout the entire period, the Federal funds market and occasional borrowing from the Federal Reserve (not shown in Chart 7) were used for weekly reserve settlement purposes.

## SUMMARY AND CONCLUSIONS

Commercial bank management practices in the United States have changed markedly in the past 20 years under the impact of rising interest rates and development of so-called liability management practices. This article has attempted to analyze and describe some of the principles involved in these new management practices. These principles were illustrated by reference to the aggregate data from a sample of 35 weekly reporting banks in the Tenth Federal Reserve District. Also, the principles were illustrated through the use of case studies, since some of the diversity of individual bank behavior can be obscured by aggregate data.

A very basic influence on bank behavior is management philosophy, particularly with respect to bank liquidity. Within this context, banks adjust to changes in balance sheet items over which they have no short-run control by making extensive use of the various instruments of bank liability management that have been developed in the past 20 years. The combination of these instruments that a particular bank chooses to use for this purpose will be heavily influenced by the circumstances that are unique to that bank and by what that bank perceives to be its least-cost method of adjustment.