

# BUSINESS REVIEW

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Federal Reserve Bank of Philadelphia  
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## THE DISCOUNT WINDOW AND MONEY CONTROL

*Herb Taylor*

The role of the discount window in the Fed's money control strategy is a topic of continuous debate. Recommendations for interest rates at the window run the gamut from a penalty rate to a subsidy rate. Now that the Fed is using open market operations to target reserves, and is instituting new reserve accounting procedures, how should the discount rate be set to improve the Fed's control over the money stock? The answer depends on how well the Fed is able to predict the public's demand for money and the financial system's willingness and ability to supply it.

## WHEN IS THE PRIME RATE SECOND CHOICE?

*Brian C. Gendreau*

Large banks are making many loans at below-prime rates. At the same time, banks are changing the prime faster in response to market interest rate movements. Both these changes can be traced to shifts in the sources of banks' lendable funds. As interest rates became more volatile in recent years, banks were forced to rely increasingly on liabilities paying market rates of interest, and to charge rates on loans that were closer to rates on money market instruments.

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# The Discount Window and Money Control

*by Herb Taylor\**

Concerned about the inflationary pressures that rapid money growth can create, the Federal Reserve has been moving to improve its control over the nation's money stock in recent years. In October 1979, the Fed began using its open market operations to control more closely the supply of bank reserves—the raw material banks need to create money. Recently, the Fed's Board of Governors voted to adopt a system of contemporaneous reserve requirements that will strengthen the link between reserves and money. The new system of reserve requirement accounting is scheduled for implementation early in 1984, and once in place, two of the Fed's major policy tools—open market operations and reserve requirements—will have been reworked to produce better money control. Is an overhaul of the Fed's third policy tool—the

discount window—the next logical step? Perhaps so.

In addition to supplying reserves to the financial system through open market operations, the Fed also lends reserves to banks at its discount window. The Fed generally has set the discount rate, the interest rate on borrowed reserves, somewhat below short-term market interest rates, and has relied on an established set of lending practices to limit the amount banks borrow at the discount window.

Before the Fed's October 1979 switch to a reserve-oriented procedure for open market operations, its handling of the discount window had little impact on the Fed's ability to control the money stock. Now, with the Fed following the reserve operating procedure, but contemporaneous reserve requirements not yet implemented, the Fed's current approach to discount window administration actually enhances short-run money control. Many argue that, once contemporaneous

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reserve requirements are instituted next year, this approach should be abandoned because it will compromise the Fed's control over the stock of money. They recommend the Fed reduce banks' incentives to borrow reserves at the discount window by setting the discount rate well above short-term market interest rates. But the case for going to a so-called penalty discount rate is not clear-cut. To assess whether a change in the discount window procedure would be appropriate, we must take a closer look at how the discount window fits into the Fed's evolving money control strategy.

#### CONTROLLING THE STOCK OF MONEY BY CONTROLLING THE SUPPLY OF RESERVES

The Fed's narrowest definition of money, M1, includes both currency in circulation and the balances the public holds in transactions accounts at depository financial institutions (commercial banks, mutual savings banks, savings and loans, and credit unions). These institutions are required by law to hold reserves in proportion to the balances in the transactions accounts they issue.<sup>1</sup> They also provide currency when people decide to withdraw funds from their accounts; to make such transfers, institutions "buy" currency from the Fed with their reserves. So, when the Fed changes the amount of reserves it supplies to the financial system, it changes the amount of money—currency and transactions balances—that the financial system is *able* to supply to the public.

This does not mean that the Fed can tell exactly how much the quantity of money *will* change when it changes the supply of reserves. The outcome will depend on exactly how financial institutions and the public react to the change in reserves—in other words, on supply and demand factors. Based on previous experience and an assessment of current economic and financial conditions, the Fed can *predict* how much the quantity of money is likely to change when it adds reserves to, or

<sup>1</sup>Transactions accounts in M1 include checking accounts at commercial banks and mutual savings banks, NOW and ATS accounts at these institutions and at savings and loans, and share draft accounts at credit unions. The definition of M1 is given in Table 1.21 of the Financial and Business Statistics Section of each issue of the *Federal Reserve Bulletin*.

Depository institutions may hold reserves either as deposits at the Federal Reserve Bank or as cash in their vaults.

withdraws reserves from, the financial system. But in the short run, at least, the actual outcome is likely to differ somewhat from the Fed's expectation.

**Controlling the Supply of Reserves Through Open Market Operations.** The Fed affects the supply of reserves primarily through its open market operations, that is, its purchases and sales of U.S. Government securities. On average only about 3 percent of the total reserves held by depository institutions are borrowed from the Fed at the discount window. The other 97 percent are nonborrowed reserves which the Fed has provided through open market purchases of government securities.<sup>2</sup> The Fed's open market operations can substantially influence short-term market interest rates as well, especially the federal funds rate—the rate at which banks lend reserves to one another overnight.

Each February, the Federal Open Market Committee (FOMC)—the principal group within the Fed charged with setting monetary policy—announces target ranges for growth in M1 and several broader measures of the money supply over the course of the year. At regular intervals, the FOMC meets to assess the performance of the monetary aggregates relative to these ranges. If money growth has deviated substantially from the long-term targets, the FOMC typically determines a short-run strategy for returning money to those targets. Under the pre-1979 federal funds rate operating procedure, the FOMC used open market operations to adjust the federal funds rate to a level thought to be consistent with returning to its money growth targets. Under the reserve operating procedure, the FOMC now uses open market operations to adjust the amount of reserves to a level which the Fed staff estimates to be consistent with the desired behavior of money growth.<sup>3</sup>

<sup>2</sup>When the Fed buys U.S. Government securities, the supply of reserves available to the banking system rises. The Fed pays brokers for the securities it purchases with checks drawn on the Fed; the brokers deposit the checks with their banks; the banks present the checks to the Fed for payment; and the Fed makes payment by crediting the banks' reserve accounts in the amount of the check. When the Fed sells securities, bank reserves fall.

<sup>3</sup>For a more detailed discussion of the Fed's switch to a reserves operating procedure and the impact of this change on money growth and interest rate behavior, see "The FOMC in

If the staff's estimates of banks' willingness to supply money and of the public's willingness to hold money (rather than other forms of assets) were correct, the changes in reserves would work their way through the financial system, expanding or contracting the money stock by just enough to achieve the FOMC's money growth target. But the staff's estimates are always subject to some error. So the supply of nonborrowed reserves that the Fed makes available may not keep money growth exactly on target. How far off target the money stock ends up depends not only on how large an unexpected shift occurred in the behavior of financial institutions or the general public, but also on how the Fed has deployed its other monetary policy tools—reserve requirements and the discount window.

**Contemporaneous Reserve Requirements Will Strengthen the Link Between Reserves and Money.**

In September 1982, the Board of Governors approved a switch to contemporaneous reserve accounting in order to strengthen the relationship between the amount of reserves the Fed supplies and the amount of money the financial system creates.

The textbook version of the money supply process suggests that a bank's reserve requirements are based on the balances *currently* outstanding in its customers' transactions accounts. But since 1968, the Fed has been using a system of lagged reserve requirements (LRR). Under this system, banks meet their reserve requirements by maintaining a specified average reserve balance with the Fed each week computed on the basis of the average level of transactions balances held at the bank two weeks previous. Therefore, the level of transactions deposits outstanding in the current week does not affect banks' required reserves until two weeks in the future. Under LRR, if the public's demand for transactions balances is exceptionally

strong in the current week, depository institutions can meet the higher demand without any immediate increase in their current week's required reserves. (See THE DISCOUNT WINDOW AND MONEY CONTROL UNDER LRR, p. 6.)

Under the contemporaneous reserve requirements (CRR) system scheduled for implementation in February 1984, depository institutions will face two-week settlement periods ending with the close of business every other Wednesday. But their reserve requirements for each settlement period will depend on the amount currently outstanding in their customers' transactions accounts.<sup>4</sup> So the average volume of transactions accounts that the depository institutions can support during any settlement period will depend directly on the amount of reserves the Fed is willing to supply over that period.<sup>5</sup>

CRR will strengthen the link between required reserves and the volume of transactions balances, but it will not forge an ironclad bond between the

<sup>4</sup>In particular, an institution's reserve requirements are computed on the basis of its average level of deposits for the two-week period beginning with the opening of business the Monday before the settlement period begins, and ending with the close of business on the Monday before the settlement period closes. Except for a two-day lag, then, an institution's current reserve requirements will depend upon its current deposit level. For a detailed discussion of the new CRR system see "The New System of Contemporaneous Reserve Requirements," by R. Alton Gilbert and Michael E. Trebing in the *Federal Reserve Bank of St. Louis Review*, (December 1982), pp. 3-7.

<sup>5</sup>From the perspective of money control, a weakness of the current reserve requirement structure is that not all depository institutions are required to hold reserves in the same proportion to their outstanding transactions deposits. In addition, certain types of time and savings deposits, which are not part of the narrowly defined money supply, are subject to reserve requirements. Consequently, the public's choices of which particular depository institutions they will use and of how much to hold in various non-transactions type accounts affect the amount of reserves the financial system will require to support a particular volume of transactions balances.

After an eight-year phase-in period, the Depository Institution Deregulation and Monetary Control Act of 1980 (MCA) will bring the Fed closer to a uniform set of reserve requirements on all transactions balances included in M1, although some differences among depository institutions and types of deposits will remain. For a detailed presentation of these requirements and of the reserve requirements prior to MCA see Table 1.15 in the Financial and Business Statistics section of any recent issue of the *Federal Reserve Bulletin*.

1979: "Introducing Reserve Targeting," by Richard W. Lang in the *Federal Reserve Bank of St. Louis Review*, (March 1980), pp. 2-25, and "The FOMC in 1980: A Year of Reserve Targeting," by R. Alton Gilbert and Michael E. Trebing in the *Federal Reserve Bank of St. Louis Review*, (August/September 1981), pp. 2-22. Also see "Federal Reserve System Implementation of Monetary Policy: Analytical Foundations of the New Approach," by Stephen Axilrod and David E. Lindsey in the *American Economic Review*, Papers and Proceedings vol. 17 (May 1981), pp. 246-252.

### THE DISCOUNT WINDOW AND MONEY CONTROL UNDER LRR

Lagged reserve requirements (LRR) weaken the short-run relationship between money and reserves. As long as LRR remains in place, the only immediate impact open market operations have on the money stock is through their impact on the federal funds rate. Under these circumstances, combining a penalty discount rate with a reserve targeting procedure for open market operations could produce substantial swings in both the federal funds rate and the money stock.

Under LRR, when the Fed must decide on how many reserves to buy or sell in the open market, banks' reserve requirements for the week have already been determined by the level of transactions deposits two weeks previous. No matter how much deposits expand or contract in the current week, they cannot affect banks' current reserve requirements. To the fixed amount of required reserves, the Fed can add its estimate of the amount of excess reserves banks will want to hold and the amount of reserves they will need to meet the public's currency demand in the current week. This will give the Fed an estimate of the financial system's total demand for reserves in the current week. Then the question is, how much of this relatively fixed demand for reserves the Fed should meet through open market operations. One thing to avoid is supplying too many nonborrowed reserves. Suppose the amount of reserves supplied through the open market were to exceed the demand for reserves initially. Some banks with extra reserves to lend in the federal funds market would find few, if any, banks willing to borrow, even at low interest rates. So the federal funds rate would begin to fall. Individual banks could rid themselves of their unwanted excess reserves by writing more loans. Customers spending the proceeds of the loans would move the reserves to other banks. But the extra reserves would still be available to the banking system as a whole. And even though the loans create more transactions deposits, the additional deposits do not raise the current week's reserve requirements. So the funds rate would keep falling and the money stock would keep growing until, ultimately, banks elected to hold enough excess reserves or the public elected to hold enough of the additional money as currency to use up the extra reserves.

To avoid the potential difficulties associated with supplying more reserves than banks demand, the Fed usually attempts to supply fewer reserves through open market operations than banks demand, thereby forcing banks to borrow the rest at the discount window. But the Fed cannot use this strategy and sustain a penalty discount rate. As long as the amount of reserves the Fed supplies

supply of reserves and the quantity of money. Even after CRR is implemented, the amount by which money expands when the Fed increases reserves will still depend on the reaction of depository institutions and the public to the added reserves. And the success of shifting to CRR also will depend on the extent to which, and the conditions under which, depository institutions supplement their nonborrowed reserve holdings by borrowing reserves at the Fed's discount window.

#### THE WAY THE DISCOUNT WINDOW WORKS NOW

The Fed decides on the size of its open market operations unilaterally, but the volume of discount window borrowing represents the interaction of the Fed with the depository institutions eligible to borrow. The Fed establishes the rules and pro-

cedures under which depository institutions may borrow. The depository institutions seek to use the borrowing privilege to their best advantage without violating the rules.

The Fed usually sets the basic discount rate, the rate at which banks can borrow short-term funds at the discount window, below prevailing short-term market interest rates, such as the federal funds rate. But the Fed does not intend for banks to use the discount window simply as an inexpensive source of funds. Rather the Fed wants banks to view the discount window as a "last resort"—a source of funds when they face unexpected needs for funds and have already exhausted all other reasonable sources. This intention is stated both in the Fed's Regulation A, which sets out the guidelines for discount window borrowing, and in an explanatory pamphlet on the discount window

in the open market is less than the amount banks need to meet reserve requirements, competition among banks for those reserves will keep the federal funds rate at least as high as the discount rate. Even if the Fed were to start out with a relatively high discount rate, so that it initially imposed an interest penalty on borrowing, the relative shortage of nonborrowed reserves would force the funds rate higher and higher until it finally broke through the "penalty" rate, and borrowing filled the gap between the demand for reserves and supply of nonborrowed reserves.

So with LRR still in place the Fed generally maintains a discount rate below the federal funds rate. In fact, the Fed uses the sensitivity of borrowing to the federal funds rate, which a relatively low discount rate provides, to help control the money stock in the short run. The fewer reserves the Fed supplies in the open market, the more banks are forced to borrow at the window. Based on previous experience, the Fed can estimate how high the funds rate will have to go to generate the expected or desired level of borrowing. It can then estimate how much money the financial system will be willing to create, and the public will be willing to hold, at that funds rate. So the link between banks' discount window borrowing and the spread of the funds rate over the discount rate allows the Fed to use its reserve operating procedure to influence the money supply in the short run, even with LRR.

Keeping a relatively low discount rate has an advantage for short-run money control when the unexpected happens as well under LRR. If banks unexpectedly change their willingness to borrow at the window or their desire to hold excess reserves, or if the public decides on an unexpectedly large proportion of currency in its money holdings, the interest-sensitive discount window helps minimize the impact of these changes on the prevailing funds rate and hence, as under CRR, helps minimize their impact on the outstanding money stock. And if the public's demand for money unexpectedly shifts under LRR, banks' decisions to accommodate the shifts will not affect their current demand for reserves, as it does under CRR.<sup>a</sup>

<sup>a</sup>A recent study of discount rate policy under reserve targeting is "The Impact of Discount Policy Procedures on the Effectiveness of Reserve Targeting" by Peter Keir in *New Monetary Control Procedures*. Federal Reserve Board Staff Study, Volume I, (February 1981).

that the Fed provides to eligible depository institutions.<sup>6</sup>

While the Fed frowns on the notion of borrowing for profit, the guidelines themselves are extremely broad, and the discount officer at each Federal

Reserve Bank has the discretionary authority to decide on the appropriateness of each borrowing request. This discretionary procedure imposes costs on banks that borrow—the costs of providing information to, and negotiating with, the Federal Reserve Bank. These costs have proven sufficient to keep most banks away from the window, even when market rates are substantially higher than the discount rate.

When banks do decide to come to the discount window, the Fed's administrative procedures typically serve to limit their borrowing. If a particular institution exhibits a well-defined pattern of borrowing, borrows frequently, or borrows in relatively large amounts, the Fed becomes concerned that some of the institution's borrowing may be inappropriate, and subjects each additional request for borrowing to closer scrutiny. Ultimately, such a

<sup>6</sup>"The Federal Reserve Discount Window", Federal Reserve Publication, (October 1980).

The Fed lends reserves to banks primarily through its adjustment credit program, and it is with adjustment borrowing that the present discussion is concerned. In September 1980, the Fed amended Regulation A to establish an extended credit program under which depository institutions could borrow for longer periods than under the adjustment credit program. The amounts borrowed and numbers of institutions involved thus far have been relatively small. For a discussion of the extended credit program, see Janice M. Moulton, "Implementing the Monetary Control Act in a Troubled Environment For Thrifts," this *Business Review*, (July/August 1982) pp. 13-21.

borrower may be turned down and told to avoid the window for "an extended period." In short, the more a bank borrows at the discount window, the more costly each additional dollar of borrowing becomes. The explicit interest rate the bank pays on each dollar—the discount rate—stays the same, but the implicit costs it must bear—including the potential costs of impaired future borrowing privileges—rise with each additional dollar borrowed. These rising costs of borrowing limit the amount that banks choose to borrow at the discount window. The profit-seeking bank will borrow only up to the point where the costs of borrowing another dollar would more than offset the gain, as measured by the spread between market interest rates and the discount rate.

Of course, the wider the spread between market rates and the discount rate the greater the benefit from each dollar borrowed, and the more worthwhile borrowing at the discount window becomes. Economists find that borrowings rise significantly as the federal funds rate rises above the basic discount rate. When the federal funds rate falls below the discount rate, adjustment borrowing typically drops to minimal levels (see Figure 1).<sup>7</sup> Thus, as long as the discount rate is below the federal funds rate, borrowing is "interest-sensitive." But, when the discount rate is above the federal funds rate, as would be the case under a penalty discount rate, borrowing is not "interest-sensitive."

It might be argued that the Fed's current administrative procedures are not particularly efficient for achieving the stated purpose of the window. If the Fed were simply to keep the discount rate above the prevailing funds rate, the incentive for inappropriate borrowing would be eliminated and the Fed

could dispense with its complicated administration of the discount window. With the discount rate set at a penalty level, a bank naturally would seek adjustment credit only when it unexpectedly needed funds and could not raise them from its usual market sources, just as the Fed intends.

The important question is whether the sensitivity of borrowing to movements in the federal funds rate, produced by setting a relatively low discount rate, improves or weakens the Fed's control over the money stock. Under the reserve operating procedure, once the FOMC has decided on a money growth target, the Fed staff must estimate how many nonborrowed reserves must be supplied in order to achieve that target. First, the Fed staff must estimate how much of the targeted money stock the public will choose to hold as currency and how much as transactions balances at depository institutions. They can then determine how many reserves banks will need in order to provide the currency demanded and to meet the reserve requirements against the transactions balances. (Under CRR, required reserves will change as soon as transactions balances change.) To that amount the staff must then add its estimate of the amount of reserves banks will need to meet reserve requirements on certain nontransactions balances and its estimate of the amount of excess reserves banks will want to hold. This gives an estimate of the *total* amount of reserves the Fed must supply to meet its money stock goal. The staff then subtracts the amount of reserves that the FOMC judges banks will borrow at the discount window, yielding a target for the nonborrowed reserves to be supplied through open market operations.

As long as all of the Fed's estimates are accurate, the reserves it supplies through the open market will keep the money stock on target, regardless of the particular discount window policy in effect. It is when the Fed's estimates are off that discount window administration matters. Would a discount rate below the federal funds rate, which keeps borrowings sensitive to federal funds rate changes, help minimize the impact of such errors on the money stock, or would a penalty discount rate do a better job? That is not an easy question to answer; it depends on the source of the error. The amount of money in the hands of the public is, as economists are fond of saying, a matter of supply and demand. The argument for going to a penalty

<sup>7</sup>A study by Stephen M. Goldfeld and Edward J. Kane, "The Determinants of Member Bank Borrowing: An Econometric Study," *Journal of Finance* vol. 21 (1966), pp. 499-514, is often cited as the classic analysis of banks' discount window behavior. For empirical estimates of the borrowing relationship based on more recent data see, for example, the equations estimated in "Policy Robustness: Specification and Simulation of a Monthly Money Market Model," by Peter A. Tinsley, and others, in the *Journal of Money, Credit and Banking*, vol. 14 part 2, (November 1982) pp. 830-856, and in "Detecting and Estimating Changing Economic Relationships: The Case of Discount Window Borrowings," by D.H. Resler, J.R. Barth and P.A.V.B. Swamy, Federal Reserve Board Special Studies Paper No. 165 (August 1982).



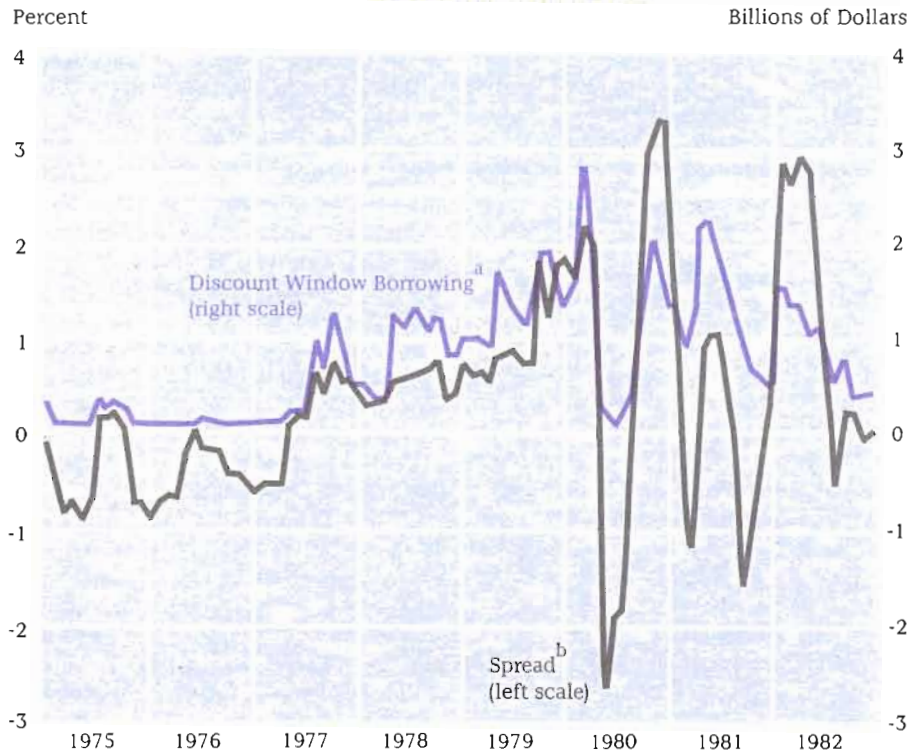
discount rate hinges on the Fed's finding it easier to predict how much money the financial system will be willing and able to *supply* than it is to predict how much money the public will *demand*.

**SOMETIMES THE CURRENT DISCOUNT WINDOW POLICY WOULD IMPROVE MONEY CONTROL**

If the Fed makes an error in assessing the

willingness or ability of the financial system to supply money, then an interest-sensitive discount window would help minimize the impact of the error on the actual money stock. Such an error could occur for several reasons. The public may choose to hold an unexpectedly large ratio of currency relative to transactions accounts, or choose to hold more in reservable nontransactions accounts than the Fed had expected. Banks may

**FIGURE 1**  
**DISCOUNT WINDOW BORROWING FLUCTUATES WITH THE SPREAD BETWEEN THE FEDERAL FUNDS RATE AND THE DISCOUNT RATE**



<sup>a</sup>The monthly average of total discount window borrowing less borrowing under the extended credit program.

<sup>b</sup>The monthly average of the federal funds rate less the sum of the basic discount rate plus the surcharge. During two separate periods in 1980 and 1981, the Fed imposed a surcharge on adjustment borrowing by institutions with \$500 million or more in deposits that borrowed in successive weeks or more than four weeks in a calendar quarter. For a good discussion of the surcharge's impact, see "The Discount Rate: Experience Under Reserve Targeting," by Gordon H. Sellon, Jr. and Diane Seibert in the Federal Reserve Bank of Kansas City *Economic Review* (September-October 1982), pp. 3-18.

want to hold more excess reserves than the Fed had anticipated, or they may start out less willing to borrow reserves at the discount window than the Fed thought they would be. Any of these circumstances would leave the financial system with fewer reserves available to meet reserve requirements on transactions balances than the Fed had expected. With CRR, that means more reserves would have to be added in the current settlement period in order to keep transactions accounts, and hence the quantity of money, from falling below target. An interest-sensitive discount window would keep money closer to target by inducing banks to borrow more reserves to make up the shortfall.

Suppose, for example, individual banks unexpectedly decide to hold more excess reserves. As a result, the demand for reserves is greater than the Fed expected, and competition for the available reserves puts unexpected upward pressure on the federal funds rate. The higher funds rate widens the positive spread on discount window borrowing when the discount rate is below the federal funds rate. This, in turn, induces banks to step up their borrowing from the Fed, thereby increasing the quantity of reserves supplied and bringing the money supply back up towards target.

Similarly, the impact of any unexpected increase in the ability of the financial system to supply money—such as a smaller than expected ratio of currency to transactions accounts ratio, or a sudden decrease in excess reserve holdings—would be at least partly offset if the Fed were to maintain a discount rate below the federal funds rate. The interest-sensitive discount window that this policy produces would tend to reduce the quantity of reserves supplied and help keep the money stock from overshooting its target.

Under a penalty discount rate, any errors the Fed makes in estimating the strength of the financial system's willingness and ability to supply money also would produce unexpected movements in the federal funds rate. But as long as the discount rate is kept above the funds rate as it changes, these funds rate movements would not generate a positive spread on discount window borrowing, and would not affect the level of borrowing and the total supply of reserves. The money stock would proceed unexpectedly off course. Thus, the more uncertain the Fed is concerning the behavior of

the financial system in supplying money, the less desirable a penalty discount rate is. However, if the Fed's uncertainty is instead about the public's demand to hold money balances, then a penalty rate may be advantageous.

#### **BUT SOMETIMES A PENALTY DISCOUNT RATE WOULD PROVIDE BETTER MONEY CONTROL**

When choosing the appropriate level of open market operations, the Fed must consider the public's demand for money as well as the factors affecting the financial system's ability to supply money. In estimating the demand for money, the Fed can take advantage of certain stable economic relationships: the public's demand for money depends fundamentally on the level of economic activity and the level of interest rates. But the Fed's estimates of money demand are still subject to error.

In our economy, few transactions involve the direct exchange of goods and services; almost all involve the exchange of goods or services for money. So the greater the volume of transactions households and businesses intend to carry out, the more money they will want to have on hand. Since the overall volume of transactions rises and falls with the volume of goods and services bought and sold, economists find a strong direct relationship between the quantity of money the public demands and measures of economic activity such as gross national product: as GNP rises, so does the quantity of money demanded.

On the other hand, economists find an inverse relationship between interest rates and the quantity of money people want to hold: as interest rates rise, the quantity of money demanded declines. Money offers its holder the convenience of making market transactions right away, but it pays either no interest or low interest compared to the rates being paid on alternative short-term financial instruments. So as the rates on short-term instruments rise, people have an incentive to economize on their money holdings and buy more of these instruments. Consequently economists find that the quantity of money the public demands moves inversely with the general level of interest rates.

The relationship of money demand to levels of economic activity and interest rates helps the Fed assess the likely strength of that money demand.

But the relationships are not known with precision. Even if they were, the Fed's assessments still would be subject to error simply because data on the economy's performance are not immediately available. Furthermore, other factors affect the public's demand for money. Some factors, such as seasonal influences, the Fed finds relatively easy to predict. But other factors, such as the impact of technological or financial innovations, are more difficult to predict. So for a variety of reasons, the Fed's money demand forecasts are far from precisely correct.

When the Fed errs in assessing the strength of the public's demand for money, a relatively low discount rate, which keeps borrowing sensitive to funds rate changes, magnifies its impact on the quantity of money. On the other hand, a penalty discount rate, which keeps bank borrowing from responding to funds rate changes, virtually eliminates the impact of such a forecasting error on the stock of money.

Suppose, for example, that a sudden increase in the level of economic activity causes an increase in the public's demand for money which the Fed did not expect when it decided how many non-borrowed reserves to supply. As banks accommodate their customers' demands, outstanding transactions balances at the banks grow. Under CRR, the banks must now hold additional reserves. They go to the federal funds market to procure the reserves and the increased demand for reserves begins to bid up the federal funds rate. What happens next depends on the Fed's discount rate policy.

If the Fed has set the discount rate below the funds rate, the rising funds rate opens up a larger spread and automatically induces some banks to borrow more at the window. If borrowing is extremely sensitive to the spread, then, with just a very small increase in the federal funds rate, the discount window will provide nearly all the reserves needed to meet the reserve requirements on the additional transactions balances the public demands. In that case the Fed would overshoot its targeted money supply by an amount almost equal to the unexpected increase in money demand. If borrowing is less sensitive to the spread (but the discount rate is still not a penalty rate), then the unexpected increase in the funds rate will be larger, and the unexpected increase in total reserves

will be smaller, but the surge in money demand still will cause some overshooting of the FOMC's money target.

Suppose, on the other hand, that the Fed had set the discount rate at a level well above the federal funds rate. As before, in response to the surge in money demand, banks come to the funds market to obtain more reserves and the funds rate begins to rise. But as long as the discount rate is kept above the funds rate, the spread remains negative and banks have little incentive to increase their borrowing from the Fed, so total reserves do not grow. Meanwhile, the rising funds rate is making it more expensive for banks to meet reserve requirements on transactions balances. Consequently, banks begin to raise the rates they charge on loans. In addition, they try to induce the public to hold more of the instruments on which there are no reserve requirements by offering higher interest rates on those instruments. Thus, higher market interest rates work to reduce the amount of money that the public wants to hold, restoring it to the amount that the Fed had initially expected. By setting a penalty discount rate then, the Fed allows rising interest rates—a rising funds rate, rising loan rates, rising rates on other instruments—to choke off the impact of an unexpected increase in the public's demand for money and thereby keeps the money supply on target.

In the face of an unexpected decline in the public's demand for money, setting a penalty discount rate enjoys a similar advantage over a discount policy that keeps the discount rate relatively low. With CRR, the initial decline in money demand immediately reduces the demand for reserves and hence, the funds rate. If the discount rate is kept below the funds rate, discount window borrowings fall, total reserves fall and the actual money stock falls below target. But if the discount rate had been set at a penalty level, the declining funds rate would not reduce borrowing any further, so the supply of reserves would remain unchanged, and generally falling interest rates would work to maintain the amount of money the public is willing to hold at the targeted level.

In short, when the Fed makes errors in forecasting the public's demand for money, maintaining a penalty discount rate forces market interest rates, rather than the money stock, to make the adjustment. So when these errors occur, interest

rates will rise or fall by more than the Fed had expected, but the money stock will remain closer to the target the Fed had set.<sup>8</sup>

## CONCLUSION

Over the past several years, the Fed has been in the process of reworking its major policy tools so that its control over the supply of reserves will produce better control over the nation's stock of money. First, the FOMC restructured its procedures for controlling money growth by focusing the conduct of open market operations on the supply of nonborrowed reserves rather than on the level of the federal funds rate. More recently, the Board of Governors adopted a system of contemporaneous reserve requirements that will tighten the short-run relationship between reserves and the amount of money the financial system creates. Nonetheless, elements of unpredictability will remain in the monetary control process.

Would maintaining a penalty discount rate eliminate these elements of unpredictability? Unhappily, it would not eliminate them entirely. In the face of unexpected shifts in the public's demand for money, keeping a penalty discount rate would reduce the magnitude of unexpected movements in the actual money stock. But when unexpected shifts occur in the willingness and ability of the financial system to supply money, a penalty discount rate would amplify their impact on the money stock. So a penalty rate would provide better money control only to the extent that the Fed finds it more difficult to predict the

public's demand for money than to predict the financial system's willingness and ability to supply money.

Other proposals for discount window reform have been made with the aim of achieving a balance between the current administrative procedures and setting a penalty discount rate. Their aim is to reduce, rather than virtually eliminate, the interest-sensitivity of discount window borrowing.<sup>9</sup> One suggestion is to maintain a relatively low discount rate, but to increase the additional costs imposed on large or frequent borrowers, either by tightening District Banks' administrative procedures for handling banks' borrowing requests or by imposing a system of graduated surcharges on heavy borrowers. Another approach is to prevent federal funds rate movements from creating too big a spread between the funds rate and the discount rate by adopting a formula for adjusting the discount rate automatically as market rates fluctuate.

In short, once CRR is in place, reworking discount window procedures might very well improve the Fed's short-run control over the money stock. But determining whether a penalty rate would improve money control, or how much of an improvement the various compromise alternatives would make, must await an assessment of the predictability of the public's demand for money and the predictability of the financial system's willingness and ability to supply it.

<sup>8</sup>The problem of how the discount window fits into the money control process is given a graphical treatment in, "The Role of the Discount Rate in Monetary Policy: A Theoretical Analysis," by Gordon H. Sellon in the Federal Reserve Bank of Kansas City *Economic Review* (June 1980) pp. 3-15 and "Should the Discount Rate Be A Penalty Rate?" by J.A. Cacy, Bryon Higgins and Gordon H. Sellon, Jr. in the Federal Reserve Bank of Kansas City *Economic Review* (January 1981) pp. 3-10. For a mathematical approach, see "Simple Analytics of the Money Supply Process and Monetary Control," by Daniel Thornton in the Federal Reserve Bank of St. Louis *Review* (October 1982) pp. 22-39.

<sup>9</sup>Some of these proposals also are intended to make the degree of interest-sensitivity to borrowing more certain. It is important to note that in choosing among alternative proposals for discount window reform, improved money control may not be policymakers' only criterion. A penalty discount rate, for example, may make short-run money growth more predictable while making short-term interest rate movements larger or more volatile. So if policymakers are concerned about the magnitude or variability of interest rate movements, then this complicates the choice of discount window policy. On the other hand, by maintaining a discount rate below short-term market interest rates, the Fed subsidizes the banks that do borrow at the window. So if policymakers are concerned about the extent to which borrowing banks are receiving a subsidy, then this also may influence their choice among discount window policies.