The Role of the Discount Rate in Monetary Policy: A Theoretical Analysis

By Gordon H. Sellon, Jr.

Following the Federal Reserve System's recent shift from an interest rate to a reserves targeting approach to monetary control, a number of questions have been raised concerning the role of the discount rate. The discount rate is the interest rate at which commercial banks and other depository institutions can borrow reserves from regional Federal Reserve Banks to facilitate short-term adjustments to temporary changes in the structure of their assets and liabilities. The directors of the Federal Reserve Banks make recommendations concerning discount rate changes every two weeks. Proposed changes are subject to approval by the Board of Governors.[1]

This paper examines two of the issues surrounding the discount rate.[2] The first concerns the scope for discount rate policy under the two operating procedures. Will a change in the discount rate have a similar impact on financial markets and the economy under an interest rate versus a reserves approach to monetary control, and will the timing of discount rate changes be similar under the two operating procedures?

The second issue concerns the circumstances under which a change in the discount rate mechanism could improve monetary control under a reserves targeting procedure. Some critics of the present system believe that excessive borrowing is encouraged by a

Gordon H. Sellon, Jr., is a financial economist with the Federal Reserve Bank of Kansas City.

[1] Under the Depository Institutions Deregulation and Monetary Control Act of 1980, access to the discount window has been extended to nonmember banks and other depository institutions with transaction accounts or nonpersonal time accounts.

[2] This article focuses on the role that the discount rate plays in monetary policy. For a comprehensive discussion of the discount mechanism, including issues relating to the administration of the discount window, see *Reappraisal of the Federal Reserve Discount Mechanism*, Board of Governors of the Federal Reserve System, 1971. Some recent studies of the discount mechanism and commercial bank behavior are R. A. Gilbert, "Access to the Discount Window for All Commercial Banks: Is It Important for Monetary Policy?" *Review*, Federal Reserve Bank of St. Louis, February 1980, pp. 15-24; R. A. Gilbert, "Benefits of Borrowing from the Federal Reserve When the Discount Rate is Below Market Interest Rates," *Review*, Federal Reserve Bank of St. Louis, March 1979, pp. 25-32; and S. L. Graham, "Is the Fed's Seasonal Borrowing Privilege Justified?" *Quarterly Review*, Federal Reserve Bank of Minneapolis, Fall 1974, pp. 9-14.

discount rate that remains below market rates for extended periods of time. This borrowing is seen as weakening Federal Reserve attempts to control monetary growth. Those holding this viewpoint propose changing to a system in which the discount rate is automatically adjusted to changing market rates or, alternatively, is set as a penalty rate above market rates. Other observers believe that the current system does not weaken monetary control. Rather, they emphasize that the discount window may act as a "safety valve" which permits banks to adjust to unexpected deposit flows with minimum disruption to financial markets. In this view, tying the discount rate to market rates or setting the discount rate as a penalty rate might impair the stabilizing function performed by the discount mechanism.

A FRAMEWORK FOR THE ANALYSIS

This section develops a simple money market model which provides a framework for the discussion of discount rate policy. The model contains three elements: a money demand function which describes the behavior of the nonbank public, a money supply function which incorporates important aspects of Federal Reserve and commercial bank behavior, and a condition for money market equilibrium. The model is specified in the three following equations wherein the signs over the variables indicate the direction of their effects on money demand and money supply.

$$(1)\quad M^d = f(\overset{-}{r}, \overset{+}{y}, L)$$

$$(2)\quad M^s = g(\overset{+}{r}, \overset{-}{rD}, \overset{+}{NBR}, F)$$

$$(3)\quad M^d \stackrel{e}{=} M^s$$

In equation (1), the demand for money by the nonbank public depends upon the market interest rate (r), personal income (y), and other factors (L). As the market interest rate rises, the public economizes on its transactions balances and reduces its demand for money. In contrast, a higher level of personal income is expected to lead to a greater transactions demand for money. Other factors which might influence money demand, such as wealth or inflationary expectations, are represented by the variable (L).

In equation (2), the quantity of money supplied depends upon the market interest rate (r), the Federal Reserve discount rate (rD), the quantity of nonborrowed reserves supplied to the banking system by the Federal Reserve (NBR), and other factors (F). The amount of money supplied is assumed to vary positively with the market interest rate. The interest-sensitivity of the money supply arises from two sources. First, as the market interest rate rises, banks reduce their holdings of excess reserves by using these reserves to support the acquisition of earning assets and the associated growth in deposit liabilities. Second, as the market rate rises relative to an unchanged discount rate, banks increase their borrowing from the Federal Reserve. The increase in borrowing expands the total reserves in the banking system and serves as a basis for deposit expansion. Taking these two factors together, a rise in the market interest rate results in an increase in the quantity of money supplied by the banking system.

Also in equation (2), the money supply is assumed to vary negatively with the discount rate. An increase in the discount rate makes it less profitable for banks to borrow from the Federal Reserve. As banks reduce their borrowing, the total reserves of the banking system are reduced and the quantity of money supplied by the banking system declines. In addition, the supply of money varies positively with the quantity of nonborrowed reserves supplied by the Federal Reserve through open market operations. The final variable, F,

represents factors other than the interest rate that affect banks' demand for excess and borrowed reserves. An increase in banks' desired holdings of excess reserves effectively reduces the total quantity of deposits that the banking system can provide and therefore leads to a reduction in the quantity of money supplied. An increase in borrowings from the Federal Reserve expands the total reserves of the banking system and can result in a greater quantity of money supplied by banks.

A graphic illustration of the model is shown in Figure 1. Interaction of demand and supply in the money market determines an equilibrium interest rate (r_e) and an equilibrium quantity of money (M_e). Changes in the market equilibrium can arise from shifts in the money demand curve or the money supply curve reflecting the influence on money of factors other than the market interest rate. A change in y or L causes the money demand curve to shift. In contrast, a change in banks' desired holdings of excess or borrowed reserves or a change in the Federal Reserve's policy instruments, rD and NBR, results in a shift in the money supply curve.

For example, suppose that higher personal income growth causes an increase in money demand. In Figure 2a, an upward shift in the money demand curve to $M^{d'}$ causes the interest rate to rise to r_e'. As the interest rate increases, banks decrease their holdings of excess reserves and increase their borrowings. The result is an increase in the equilibrium quantity of money to M_e'. A shift in banks' desired holdings of excess or borrowed reserves may also cause the equilibrium to change. As shown in Figure 2b, if banks decide to hold more excess reserves or to reduce their borrowings, they effectively reduce the total quantity of deposits that the banking system can support. In Figure 2b, these changes cause an upward shift in the money supply curve to $M^{s'}$. The interest rate increases to r_e' and the quantity of money falls to M_e'.

The third source of a change in money and

Figure 1

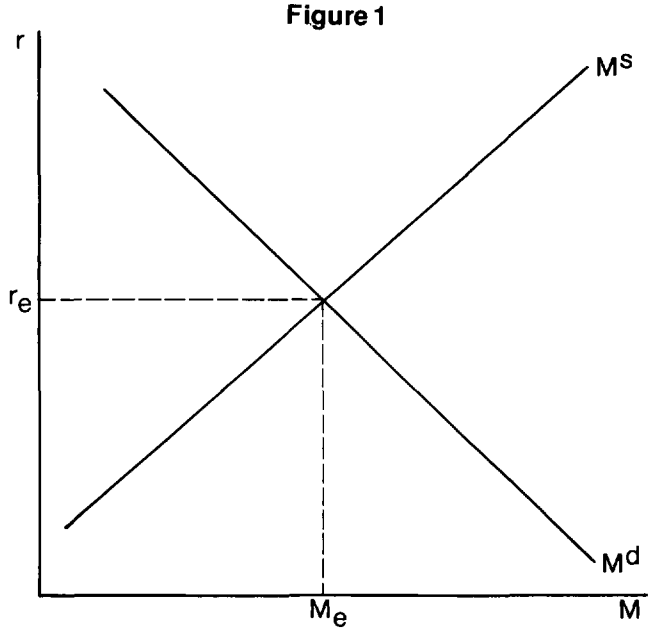


Figure 2

Figure 2a

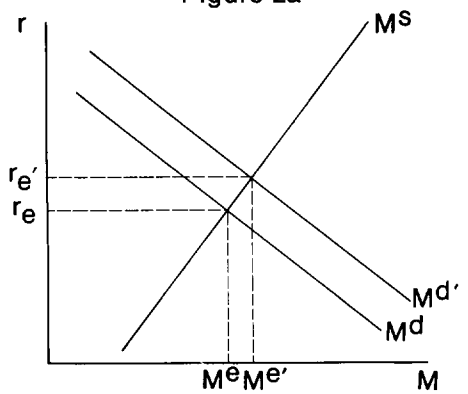
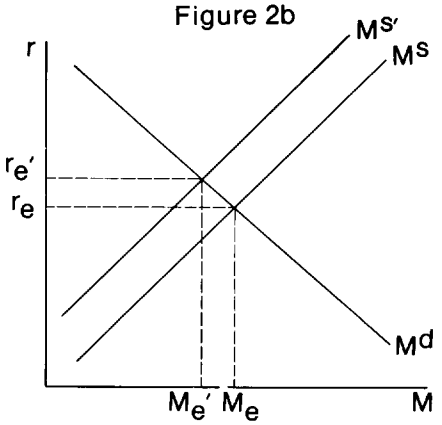


Figure 2b



interest rates is a shift in Federal Reserve policy. For example, the Federal Reserve might desire to reduce monetary growth through open market operations. Sale of securities reduces the quantity of nonborrowed reserves in the banking system. Such an action is shown in Figure 2b by the upward shift in the money supply function to $M^{s'}$ which results in a higher interest rate and a lower quantity of money. Alternatively, the Federal Reserve might reduce monetary growth by raising the discount rate. An increase in the discount rate reduces bank borrowing and forces banks to dispose of earning assets or reduce excess reserves to adjust their reserve positions. These actions put upward pressure on the market interest rate and lower monetary growth. In Figure 2b, an increase in the discount rate shifts the money supply function up to $M^{s'}$, resulting in a higher equilibrium interest rate and a lower equilibrium quantity of money.[3]

THE ROLE OF THE DISCOUNT RATE

The discount rate can play two distinct roles in monetary policy. First, as a measure of the cost of reserves to banks, a discount rate change can have a direct impact on interest rates and the money supply. Second, a change in the discount rate can have announcement effects which alter expectations in financial markets as to the direction of monetary policy.[4] The role that the discount rate actually plays depends on the choice of an operating procedure and on the role assigned to open market operations. Generally speaking, there are two types of operating procedures that must

---

[3] This analysis assumes that the discount rate is below the market rate so that banks have an incentive to borrow from the Federal Reserve System. In contrast, if the discount rate is above the market rate, banks' incentives to borrow are eliminated and a change in the discount rate will not cause a shift in the money supply function. A discount rate that is above the market rate is referred to as a penalty rate. The discount rate may become a penalty rate either as a result of Federal Reserve actions to set the discount rate above the market rate, or as a result of a decline in market rates with an unchanged discount rate.

[4] Discount rate changes aimed at curbing speculation in financial markets or dampening inflationary expectations typically rely on announcement effects to be successful. Two recent studies of such effects are R. E. Lombra and R. G. Torto, "Discount Rate Changes and Announcement Effects," *Quarterly Journal of Economics*, February 1977, pp. 171-76, and D. R. Mudd, "Did Discount Rate Changes Affect the Foreign Exchange Value of the Dollar During 1978?" *Review*, Federal Reserve Bank of St. Louis, April 1979, pp. 20-26.

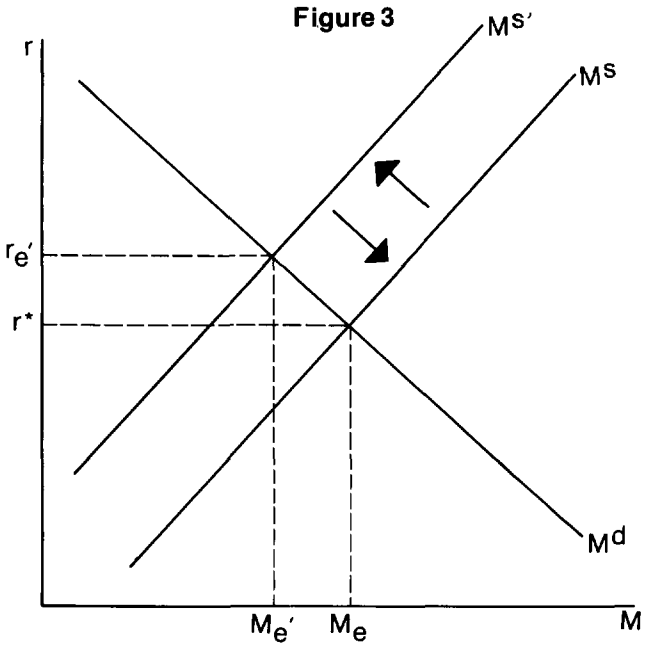
be analyzed, an interest rate targeting approach and a reserves targeting approach.

Interest Rate Targeting

Under an interest rate targeting procedure, the Federal Open Market Committee provides the Open Market Account Manager with a desired range of monetary growth and instructions as to how the Federal funds rate should be adjusted to control monetary growth. Generally speaking, as long as monetary growth is within the desired ranges, changes in nonborrowed reserves are used to offset any changes in money demand or money supply that might cause the funds rate to vary from a specified level. If actual monetary growth differs from desired growth, however, nonborrowed reserves are adjusted so as to move the funds rate within a stipulated range.

The impact of a discount rate change under an interest rate targeting procedure is illustrated in Figure 3. The analysis can be simplified by focusing on a pure interest rate strategy where nonborrowed reserves are used to achieve a fixed interest rate target, r*. As explained earlier, an increase in the discount rate with nonborrowed reserves unchanged would shift the money supply function leftward from M^S to $M^{S'}$. As long as nonborrowed reserves are held constant, the discount rate increase would raise the market interest rate to r_e' and lower monetary growth to M_e'. Under interest rate targeting, however, these effects do not occur because the impact of the discount rate increase is offset by a compensating increase in nonborrowed reserves. Thus, in Figure 3, an increase in nonborrowed reserves will shift the $M^{S'}$ curve back to M^S so as to restore the original money stock, M_e, and the target interest rate, r*. With an unchanged interest rate target, an increase in the discount rate will have no direct impact on market interest rates or on the money supply. Bank borrowing from the discount window is reduced, but an equal amount of reserves is provided by open market operations, leaving

Figure 3



total reserves unchanged.

Because the direct effect of a discount rate change is removed under a pure interest rate targeting procedure, the role of the discount rate is confined to announcement effects. Only in those circumstances in which the interest rate target is changed at the same time as the discount rate are there direct effects as well as announcement effects. Given the relative importance of announcement effects, the timing of discount rate changes mainly reflects the type of signal that the Federal Reserve wishes to convey to financial markets. In some circumstances, the Federal Reserve may merely want to reaffirm the current stance of monetary policy. That can be accomplished by changing the discount rate while maintaining the existing interest rate target. In other circumstances, the discount rate and the interest rate objective may be changed simultaneously to signal a new policy initiative.

These two types of signals can be illustrated with examples of two recent discount rate actions. In a period of rapid expansion of bank credit and monetary aggregates, the Federal Reserve raised the discount rate from 10 1/2 to 11 per cent on September 19, 1979. That increase had little visible impact on money market interest rates, indicating the absence of either direct cost effects or announcement effects. The discount rate increase had no direct impact on market rates because the Federal funds rate target was not changed at the same time. Moreover, since the discount rate lagged behind previous changes in market rates, the possibility of announcement effects was greatly reduced as market participants had anticipated the discount rate action. In that situation, the Federal Reserve's objective was to indicate its continuing concern about inflation and the value of the dollar in foreign exchange markets.

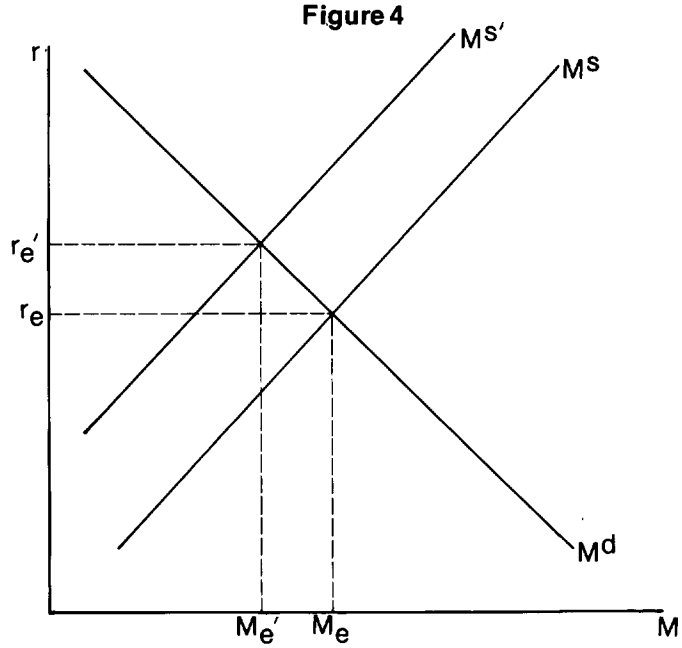
In contrast, the discount rate increase from 11 to 12 per cent announced as part of the October 6, 1979, policy initiative signaled a movement to a significantly more restrictive monetary policy. That discount rate change was associated with substantial increases in money market interest rates. Part of the rise in market rates could be attributed to a direct effect of the discount rate increase, because the narrow constraint on the Federal funds rate was removed as part of the switch to a reserves operating procedure. In addition, unlike the earlier discount rate increase, the October 6 action was not generally anticipated by financial markets. Thus, part of the response of market rates may have reflected announcement effects as well.

Reserves Targeting

Under a reserves operating procedure, the objective is to use open market operations to maintain a target path for reserves that is thought to be consistent with desired monetary growth. The reserve paths are constructed within the framework of a simple money market model or a money multiplier process. The starting point is a desired rate of monetary growth that is thought to be consistent with long-run objectives such as price stability and full employment. The desired rate of monetary growth is then translated into a path for total bank reserves and a path for nonborrowed reserves.

The impact of a discount rate change under reserves targeting is illustrated in Figure 4. For simplicity, the Federal Reserve is assumed to employ a pure reserves approach where open market operations are used to maintain a target level of nonborrowed reserves. An increase in the discount rate will cause banks to reduce their borrowing at the discount window. If nonborrowed reserves are held constant, the reduction in borrowing leads to a decline in total reserves, putting upward pressure on

Figure 4



market interest rates and lowering monetary growth.[5] In Figure 4, the increase in the discount rate shifts the money supply function leftward to $M^{S'}$, resulting in a higher interest rate r_e' and a lower money stock M_e'. With nonborrowed reserves held constant, a discount rate increase has a direct impact on market interest rates and monetary growth. This impact is in clear contrast to the pure interest rate approach where the impact of a discount rate change is offset by open market operations.[6]

Because discount rate changes have both direct cost effects and announcement effects under reserves targeting, the timing of discount rate changes is more complicated than under interest rate targeting. Under the interest rate

[5] The lagged reserve accounting system now in use has implications for the impact of discount rate changes under a reserves targeting procedure. Under this system, required reserves during any statement week are based on the level of deposits two weeks earlier. Since required reserves in the statement week are predetermined, banks must adjust to reserve pressure by varying their holdings of excess and borrowed reserves. A change in the discount rate will have a larger immediate impact on interest rates and the money supply under a lagged system than under a contemporaneous reserve accounting system. With contemporaneous reserve requirements, an increase in the discount rate will put upward pressure on market interest rates but will also lead banks to undertake portfolio adjustments which reduce their required reserves and moderate the upward pressure on interest rates. In contrast, under lagged accounting, banks cannot reduce their required reserves in the current statement week so that a discount rate change has a larger impact on market rates and money demand. For a general discussion of lagged reserve accounting, see S. F. LeRoy, "Monetary Control Under Lagged Reserve Accounting," *Southern Economic Journal*, October 1979, pp. 460-70, and D. E. Laufenberg, "Contemporaneous Versus Lagged Reserve Accounting," *Journal of Money, Credit, and Banking*, May 1976, pp. 239-45.

[6] This analysis assumes that the discount rate is below the market rate. If the discount rate is a penalty rate so that banks do not have an incentive to use the discount window, a change in the discount rate will not cause a shift in the money supply curve. In this case, a discount rate change will not have a direct effect on the market rate under reserves targeting but may continue to have announcement effects.

approach, discount rate changes are frequently made to align the discount rate with market rates. While discount rate changes may also be made for alignment purposes under a reserves approach, the differential between the funds rate and the discount rate is not a reliable guide to possible discount rate actions. Under the reserves approach, the Federal funds rate is not directly controlled. As a result, shifts in money demand and money supply may cause the funds rate-discount rate differential to change. If the Federal Reserve believes that these disturbances are temporary and if monetary growth is on target, no discount rate change may be necessary regardless of the size of the interest rate differential.

Even when monetary growth is off track, an increasing interest rate differential may not foreshadow a change in the discount rate. For example, if the money supply function shifts to the left because banks increase their holdings of excess reserves or reduce their borrowings, market rates will tend to rise relative to the discount rate. In this situation, however, actual monetary growth will be less than desired, so that a discount rate increase for alignment purposes will lead to a further reduction in monetary growth. In contrast, if there is an unexpected rightward shift in the money demand curve, an increasing interest rate differential may be associated with excessive monetary growth. In this situation, the Federal Reserve may choose to align the discount rate with market rates to curtail monetary growth.

While experience under reserves targeting is still somewhat limited, some examples may illustrate these points. Following the October 6, 1979, increase in the discount rate, no further discount rate action was taken until February 15, 1980. In that four-month interval, the differential between the Federal funds rate and the discount rate fluctuated over a wide range and was at times, quite large. Market observers who focused their attention on the interest rate differential repeatedly forecasted discount rate increases that did not occur. It is important to note, however, that monetary growth was either on path or below path during this period. The Federal Reserve reacted to unexpected changes in excess and borrowed reserves during this period by using open market operations rather than discount rate changes. In contrast, in raising the discount rate from 12 to 13 per cent on February 15, the Federal Reserve was responding to an unexpected surge in money demand and bank credit. The alignment of the discount rate with market rates in this instance was aimed at curbing monetary expansion.

In summary, the role of the discount rate in monetary policy depends on the Federal Reserve's choice of a short-run operating target and on the type of open market operation that accompanies the discount rate change. Under a pure interest rate procedure, the impact of a discount rate change is restricted to announcement effects. Any direct cost effect of a discount rate change on market interest rates is offset by a compensating change in nonborrowed reserves. In contrast, under a pure reserves targeting approach, where open market operations are directed toward maintaining a given level of nonborrowed reserves, a change in the discount rate can have a direct impact on market interest rates, total reserves, and monetary growth as well as announcement effects.

The timing of discount rate changes may be more predictable under an interest rate procedure than under a reserves approach. Under the interest rate system, the Federal Reserve controls both the Federal funds rate and the discount rate. When monetary growth is greater than desired, the funds rate target is raised and the differential with the discount rate widens. Subsequently, when a sizable rate differential develops, the discount rate may be

aligned with the funds rate to signal that policy remains restrictive. In contrast, the rate differential is not a reliable guide to the possibility of a discount rate change under reserves targeting. The Federal Reserve may not take action for temporary changes in the rate differential as long as monetary growth is on track. Even when monetary growth is off track, the Federal Reserve will need to take into account the source of the disturbance before deciding whether to change the discount rate.

FIXED VERSUS VARIABLE DISCOUNT RATE SYSTEMS

Critics of Federal Reserve discount policy have argued that a large differential between the discount rate and market rates encourages borrowing and weakens the Federal Reserve's ability to control the money supply. Remedies that have been suggested for this problem range from tying the discount rate to a market rate to setting the discount rate as a penalty rate above the market rate. An alternative viewpoint held by some within the Federal Reserve System sees the discount mechanism as performing a stabilizing function. Banks are able to adjust to unexpected changes in their reserve position through the discount window with minimum disruption to financial markets. There has also been opposition to giving up discretionary control of the discount rate since this would eliminate the possibility of using the discount rate to signal policy through announcement effects.

These issues concerning the mechanism for discount rate changes can be analyzed in the framework of the money market model presented earlier. In the model, bank borrowing from the discount window is an increasing function of the differential between the market interest rate and the administered discount rate. An increase in the market rate relative to the fixed discount rate results in increased borrowing which raises total reserves and supports an expansion in the money supply. A fall in the market rate leads to decreased borrowing, lower total reserves, and a reduction in the money supply. Such a discount rate mechanism can be termed a "fixed discount rate" (FDR) system.

As an alternative discount mechanism, suppose that the discount rate is tied to the market rate. As the market rate rises or falls, the discount rate is automatically adjusted to maintain a constant differential. Under such a "variable discount rate" (VDR) system, wherein the differential between the market rate and the discount rate is constant, banks have no incentive to adjust their borrowings in response to changes in market interest rates.[7] As a result, the supply of total reserves and the money supply are less responsive to changes in market rates as compared to the FDR system. The difference in the two discount mechanisms can be seen in Figure 5. The money supply function for the fixed discount rate system is labeled M^S, while the steeper curve, M^{S*}, represents the money supply function under the variable discount rate system.[8]

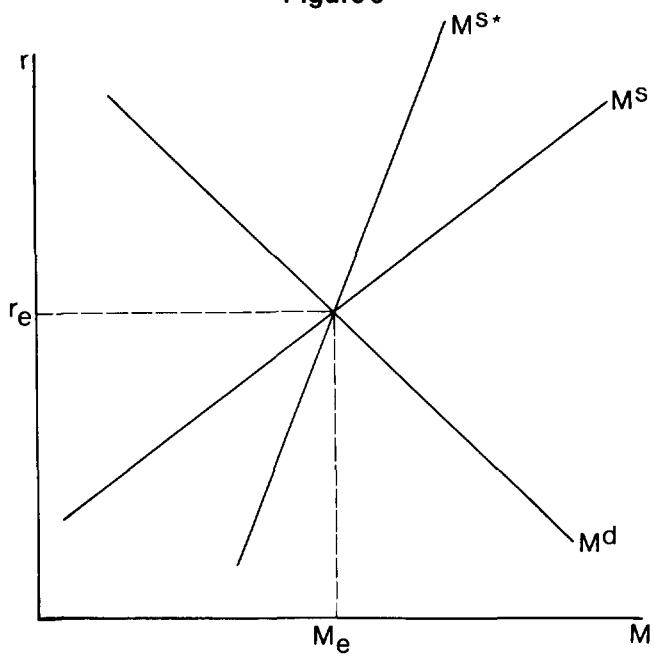
---

7 If the discount rate is above the market rate under the fixed rate system, banks do not have an incentive to use the discount window. In this situation, the fixed rate system has properties similar to the variable rate system.

8 The form of the variable discount rate mechanism used in this paper is intended to highlight the basic issues concerning monetary control. There are numerous practical difficulties involved in designing a workable system such as the choice of a market rate to which the discount rate is tied and the appropriate rate differential, issues which are beyond the scope of this paper.

Under a lagged reserve accounting system, changes in deposits in the current week have no effect on banks' required reserves. This reduces the responsiveness of the demand for total reserves to market interest rates, since interest rate effects on money demand are not transmitted to required reserves in the current statement week. Under a lagged system, both the M^S and the M^{S*} curves in Figure 5 rotate to the right and become flatter as compared to a

Figure 5



In developing the implications for monetary policy of these two discount mechanisms, it is important to distinguish between two types of monetary control. It was shown earlier that a change in the equilibrium quantity of money can arise from a change in the public's demand for money, a change in banks' desired holdings of excess and borrowed reserves, or a change in Federal Reserve policy. The term "automatic control" refers to changes in the quantity of money which arise from shifts in the demand for money or in bank behavior, assuming that the Federal Reserve does not take any policy action to alter nonborrowed reserves. The term "discretionary control" refers to changes in the equilibrium quantity of money that result from policy actions which change nonborrowed reserves, assuming no shifts in money demand or bank behavior.

Whether the variable rate or the fixed rate system provides better automatic control depends on the source of the disturbance causing the quantity of money to vary. Suppose first that there is an increase in the public's demand for money which puts upward pressure on market interest rates. With a fixed discount rate, banks have an incentive to increase their borrowings at the discount window. The addition to total reserves from this borrowing supports further deposit expansion. In contrast, if the discount rate is adjusted so as to eliminate this incentive to borrow, there is a smaller increase in the money supply. Thus, for shifts in money demand, the VDR system results in smaller induced changes in the money supply and better monetary control.[9]

The conclusion in the above examples is

contemporaneous accounting system. If banks' demand for excess and required reserves depend only on interest rates and not on the current level of deposits, the money supply functions become horizontal. See LeRoy and Laufenberg.

Figure 6

Figure 6a

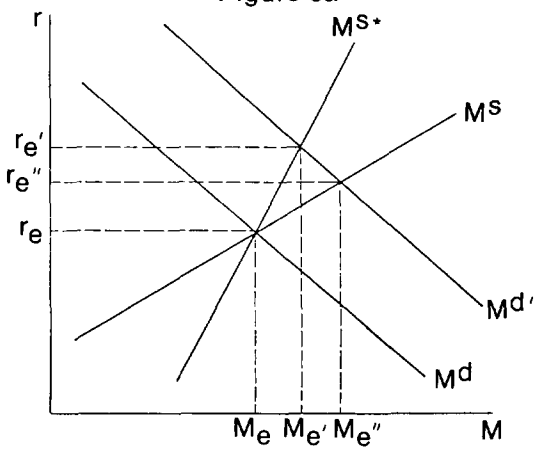
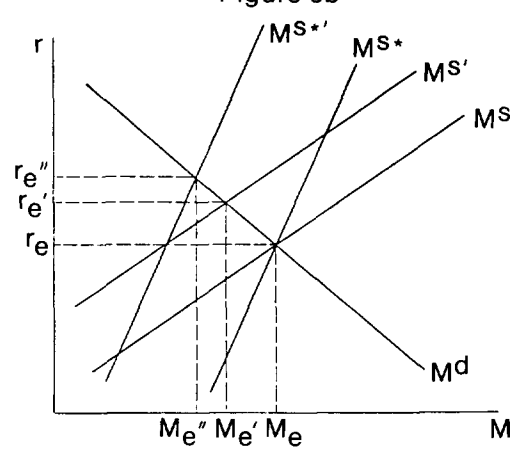


Figure 6b



illustrated in Figure 6a. Starting from an initial equilibrium position, (r_e, M_e), an outward shift in the money demand curve to $M^{d'}$ results in greater monetary growth under FDR ($M_{e''}$) than under VDR ($M_{e'}$). Notice, however, that interest rate movements differ under the two systems. Indeed, the increased control over money under VDR is purchased at the cost of greater volatility of interest rates.[10]

The analysis reaches different conclusions about the relative merits of VDR and FDR if the source of the change in the quantity of money is a shift in bank behavior. Suppose that banks decide to hold more excess reserves. This action effectively reduces the total amount of deposits that the banking system can support and places upward pressure on market interest rates. An increase in the market rate relative to the fixed discount rate encourages banks to borrow more at the discount window. Once again, the addition to total reserves can support further deposit expansion. In this situation, borrowing actually performs a stabilizing function by partly offsetting the initial fall in the money supply. In contrast, with a variable discount rate system, banks have no incentive to expand their borrowing as market rates increase, so there is no offset to the original reduction in the money supply. Thus, for changes in bank behavior, the FDR system provides better monetary control.[11]

---

9 Under lagged reserve accounting there are circumstances in which VDR may not improve monetary control. Specifically, if the money supply curves in Figure 5 are horizontal, changes in money demand have no impact on interest rates in the current statement week. In this situation there is no change in the interest rate differential under either the VDR or the FDR system. Thus, the change in the quantity of money is the same under the two systems.

10 The degree of interest rate variability may be of concern to policymakers in itself or because of the implications of interest rate changes for spending and production in the economy as a whole. In this broader context, it is important to consider whether the shift in money demand is due to changes in personal income or to a change in the desired composition of investors' portfolios. These issues are beyond the scope of this paper, which focuses on the money market.

11 The analysis in this section assumes that the Federal Reserve uses open market operations to offset changes in technical factors such as float and the Treasury balance, which might cause nonborrowed reserves to deviate from target rates. If these factors are not offset, their influence will be similar to changes in bank behavior and an FDR system will provide better monetary control.

Under a lagged reserve accounting system, shifts in bank behavior result in greater money supply variability

The result in the above examples is shown in Figure 6b. An increase in banks' desired holdings of excess reserves shifts both the M^S and the M^{S*} curves to the left by an equal horizontal distance. The decrease in the equilibrium money supply to M_e' under the fixed discount rate system is smaller than the decrease to M_e'' that results under the variable rate system. Moreover, the rise in the interest rate to r_e' under the fixed rate system is less than the increase to r_e'', under the variable rate system. Thus, for this type of disturbance, a variable discount rate system worsens monetary control and leads to greater interest rate volatility.

The second type of monetary control suggested earlier is discretionary control, which refers to the impact of Federal Reserve open market operations on the money supply. Assume that the Federal Reserve wishes to curtail monetary growth by reducing nonborrowed reserves. That action places upward pressure on market interest rates. With a fixed discount rate, the growing interest rate differential encourages banks to increase their discount borrowing. The increased borrowing expands total reserves and provides a basis for deposit expansion. Thus, Federal Reserve actions to restrict monetary growth are partly offset by the effects of expanded discount borrowing. In contrast, if the discount rate is kept in alignment with market rates under the VDR system, there is no incentive toward increasing borrowing and so there is no offset to the open market operation. Open market operations, therefore, are more powerful under a variable discount rate system, in the sense that a given change in nonborrowed reserves has a greater impact on the money supply. Equivalently, under a VDR system, it takes a smaller change in nonborrowed reserves to hit a given money supply target.[12]

Whether a fixed or variable discount rate mechanism produces better monetary control, then, depends critically on the type of disturbance causing changes in the money supply. A basic characteristic of the fixed discount rate system is the induced change in borrowing and total reserves that results from changes in the market rate of interest. In the case of a shift in the money demand function, the induced changes in borrowing and total reserves act to increase the total variation in the money supply. These induced changes do not occur under a variable rate system. Thus, for money demand disturbances, the variable rate system leads to improved monetary control by removing the effects of the induced changes. If there is a shift in bank behavior, however, the fixed discount rate system is superior to the variable rate system. In this situation, the interest-induced changes in borrowing and total reserves that occur with a fixed rate system actually reduce the total variation in the money supply, resulting in better monetary control.

The two discount rate systems also have implications for the degree of interest rate variability in financial markets. Generally speaking, banks can adjust to a reserve deficiency by reducing their required reserves through adjustments in their assets or liabilities, by reducing their holdings of excess reserves, or by borrowing from the Federal

---

and greater interest rate variability as compared to a contemporaneous reserve accounting system. With lagged accounting in effect, a VDR system would result in still greater variability in both money and interest rates as compared to an FDR system for shifts in bank behavior.

[12] Under a lagged accounting system, a given change in nonborrowed reserves has a greater impact on market interest rates and money than under a contemporaneous accounting system. With lagged accounting in effect, a VDR system would result in nonborrowed reserves having a larger impact on both money and interest rates as compared to an FDR system.

Reserve. By removing the interest inducement to borrow, the variable rate system forces more of the burden of adjustment of bank reserve positions onto required and excess reserves resulting in greater interest rate volatility. Alternatively, borrowings can be viewed as having a cushioning effect on market rates. When market rates rise relative to the discount rate, banks increase their borrowing and the addition to total reserves moderates the increase in market rates. In contrast, when market rates fall relative to the discount rate, banks repay their borrowings and the reduced supply of total reserves cushions the fall in market rates. Thus, by removing the incentive to borrow, the variable rate system leads to increased interest rate variability regardless of the source of the money market disturbance.[13]

13 The analysis suggests that the combination of a variable discount rate system or a penalty rate system with lagged reserve accounting may result in extreme interest rate volatility. As noted above, the variable rate system removes banks' incentive to use the discount window, one of the three ways that banks use to adjust their reserve positions. Under lagged reserve accounting a second adjustment mechanism is eliminated. Since required reserves are determined by deposits two weeks earlier under lagged accounting, banks cannot alter their required reserves in the current statement week through portfolio adjustments of their assets and liabilities. Thus, with the combination of lagged reserve accounting and a variable discount rate system or a penalty rate system, the entire burden of reserve adjustment falls on banks' holding of excess reserves. Since banks' demand for excess reserves tends to be quite insensitive to interest rate changes, large fluctuations in market rates may be necessary for banks to complete their reserve adjustments.

SUMMARY

In view of the Federal Reserve's recent emphasis on a reserves operating procedure, this paper has examined the role that the discount rate plays in monetary policy. The analysis shows that discount rate changes tend to have direct effects on market interest rates as well as announcement effects under a reserves operating approach. In contrast, under an interest rate operating procedure, the announcement effects of a discount rate tend to predominate. As a result of the expanded role for discount rate changes under a reserves operating procedure, discount rate policy is more complicated and the timing of discount rate changes is less predictable than under an interest rate approach.

This paper has also examined whether monetary control could be improved by changing from a fixed or administered discount rate system to a variable rate system where the discount rate is automatically adjusted to market interest rates. The analysis shows that the type of disturbance affecting the quantity of money determines which discount rate system provides better monetary control. For money demand disturbances, a variable rate system provides better monetary control, while a fixed discount rate system is preferred if the source of the disturbance is a shift in bank behavior. Moreover, a variable rate system leads to increased variability of interest rates regardless of the type of disturbance affecting the quantity of money.