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# Monetary Policy Without Reserve Requirements: Analytical Issues

*By Gordon H. Sellon, Jr. and Stuart E. Weiner*

Reserve requirements have traditionally been viewed as a key instrument of monetary policy. Indeed, textbook discussions of monetary policy typically center on the role of reserve requirements in determining the size of the money multiplier and the magnitude of bank credit expansion. In recent years, however, there has been a significant decline in the use of reserve requirements in the United States and in other industrialized countries. Many countries have made substantial cuts in the level of reserve requirements, and some countries have eliminated reserve requirements altogether.

The diminished role of reserve requirements stems from several developments. One factor is a change in the way that central banks implement monetary policy. Over the past decade, many central banks have shifted their emphasis from short-run control of reserves to control over short-term interest rates. While reserve requirements are essential to a reserves strategy, they play a less important role in an interest-rate

strategy. A second reason for reduced reliance on reserve requirements is the view that such requirements serve as a tax on depository institutions that puts them at a competitive disadvantage relative to other financial institutions. And third, even where reserve requirements have not been reduced formally, their effectiveness has been reduced by financial innovations. For example, the spread of deposit “sweep accounts” in the United States over the past two years has reduced the level of required reserve balances to its lowest level in 30 years.

The declining use of reserve requirements has important implications for monetary policy. First, in the absence of a binding level of reserve requirements, the demand for central bank balances is no longer determined by the public’s demand for transactions deposits and term deposits but, instead, depends on depository institutions’ need to hold balances for clearing and settlement purposes. This means that there is a direct connection between the payments system and monetary policy and implies that institutional changes in the payments system, such as new clearing and settlement methods, may require corresponding changes in monetary policy operating procedures. Second, the absence of binding reserve requirements may lead to increased volatility of short-term interest rates and impair the ability of central banks to implement monetary policy. If so, central banks may

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have to adapt operating procedures to contain this volatility.

This article, the first of two, examines the implications for monetary policy of the declining use of reserve requirements. The first section discusses the historical role of reserve requirements and documents their recent decline in the United States and other industrialized countries. The second section shows how a reduction in reserve requirements can lead to an environment in which monetary policy issues and payments system issues are directly linked. The third section discusses how a reduction in reserve requirements potentially increases the volatility of short-term interest rates. The companion article, to be published in a future issue of the *Review*, looks at three countries that have eliminated reserve requirements—Canada, the United Kingdom, and New Zealand—and asks whether adaptations to monetary policy procedures in those countries could be extended to the United States.

## I. THE DECLINING USE OF RESERVE REQUIREMENTS

While reserve requirements have been a part of banking systems for many years, their role has evolved due to changes in the financial system and monetary policy operating procedures. Once viewed as essential in controlling the creation of money and credit and providing financial stability, reserve requirements have come to be seen as a useful supplement to other instruments. As the rationale for reserve requirements has weakened, their use has diminished. In recent years, many central banks have reduced reserve requirements, and, in some countries, reserve requirements have been eliminated.

### *What are reserve requirements?*

In the United States and many other countries, banks and other depository institutions are

required to maintain a fraction of their deposit liabilities in the form of reserves—required reserve balances held at the central bank or vault cash held at the institution. While reserve requirements typically apply to demand or transactions accounts, savings accounts and other short-term bank liabilities may also be subject to reserve requirements.<sup>1</sup>

Generally, depository institutions do not have to meet reserve requirements on a daily basis but only, on average, over a period of one or more weeks. For example, in the United States, reserves are maintained over a two-week period based on the level of transactions deposits also averaged over a two-week period.<sup>2</sup> Additionally, in the United States, depository institutions are allowed to carry over part of a reserve deficiency or surplus into the next maintenance period.<sup>3</sup>

The Federal Reserve, like many central banks, does not pay interest on reserve balances. Thus, to the extent that reserve requirements force depository institutions to hold higher balances than necessary for normal business purposes, reserve requirements constitute a tax on depository institutions. These institutions cannot avoid this tax by holding fewer balances than required because there are monetary penalties for reserve deficiencies. In the United States, for example, depository institutions can be penalized if reserve balances are negative on a daily basis or if reserves are deficient over a two-week maintenance period.<sup>4</sup>

### *The changing rationale for reserve requirements*

While reserve requirements have existed in one form or another for many years, their rationale has changed over time (Feinman). Initially, reserve requirements were supposed to provide stability to the financial system by decreasing the likelihood that individual banks

would experience liquidity problems from depositor withdrawals. In the United States, this role became less important with the development of bank clearinghouse facilities in the latter part of the 19th century and the Federal Reserve's discount window in 1913.

Subsequently, reserve requirements came to be viewed as an essential means of controlling bank credit-creation. During the 1930s, for example, the Federal Reserve used changes in reserve requirements in an attempt to alter bank credit expansion. More recently, during the credit control program in 1980, the Federal Reserve imposed marginal reserve requirements on certain bank liabilities in an attempt to curtail the growth of bank credit. And reserve requirements were lowered in 1990, in part, to stimulate bank lending (Feinman).

The use of reserve requirements to control bank credit has become less important over time, however. One reason is that reserve requirement changes are a relatively blunt instrument for changing reserve availability as compared to the use of open-market operations. That is, changes in reserve supply can be accomplished more easily and more quickly through open market operations. A more important factor has been the evolution of the financial system and the smaller role played by banks in credit markets. In this new environment, controlling bank credit may no longer be sufficient to affect overall credit extension, given the growing availability of substitutes for bank credit. Moreover, controlling only bank credit may place banks at a serious competitive disadvantage relative to other lenders.

A third important rationale for reserve requirements has been control over the supply of money. The level of reserve requirements is an important component of the multiplier relationship connecting the quantity of reserves provided by the central bank to the quantity of broader mone-

tary aggregates believed to influence spending in the economy. During the late 1970s and early 1980s when the Federal Reserve and other central banks emphasized close control over reserves as a means of reducing inflationary pressures, reserve requirements played an important part in monetary policy discussions. More recently, however, as central banks have moved away from reserves targeting, issues concerning reserve requirements have become less prominent in monetary policy discussions.

Currently, in many countries reserve requirements are seen as a useful, but no longer essential, part of monetary policy.<sup>5</sup> Many central banks now implement monetary policy chiefly by influencing the level of short-term interest rates, pushing rates up to reduce inflationary pressures and moving rates down to offset weak economic activity. In this framework, reserve requirements play a secondary role to open-market operations in the implementation of monetary policy. Indeed, the main function of reserve requirements in this environment is to provide a stable demand for reserves which makes it easier for the central bank to influence the level of short-term interest rates (Weiner).<sup>6</sup>

#### *The diminished use of reserve requirements*

Reserve requirements have been reduced in many major industrialized countries in recent years. Several countries now operate monetary policy in an environment in which reserve requirements are zero or so low that they are no longer binding on the behavior of depository institutions.

The trend toward lower reserve requirements is widespread (Table 1). Since 1990, for example, the Federal Reserve has reduced reserve requirements twice. In December 1990, elimination of the 3 percent reserve requirement on

Table 1

## LEGAL RESERVE REQUIREMENTS

Selected years (percent)

	<u>1989</u>	<u>1992</u>	<u>1996</u>
Transactions deposits			
United States	12.0	10.0 <sup>b</sup>	10.0
Germany	12.1	12.1	2.0
France	5.5 <sup>a</sup>	1.0 <sup>c</sup>	1.0
Japan	1.75	1.2	1.2
Canada	10.0	.0 <sup>d</sup>	.0
United Kingdom	.45	.35	.35
New Zealand	.0	.0	.0
Term deposits			
United States	3.0	.0	.0
Germany	4.95	4.95	2.0
France	3.0 <sup>a</sup>	.0	.0
Japan	2.5	1.3	1.3
Canada	3.0	.0 <sup>d</sup>	.0
United Kingdom	.45	.35	.35
New Zealand	.0	.0	.0

<sup>a</sup> Effective October 16, 1989.<sup>b</sup> Effective April 2, 1992.<sup>c</sup> Effective May 16, 1992.<sup>d</sup> The marginal reserve requirement was set at zero in June 1992. Overall reserve requirements were phased out over the next two years, culminating in a zero overall reserve ratio in July 1994.

Note: Figures shown are highest marginal ratios. In some cases, applicable marginal ratios may vary according to specific type of deposit or level of deposit liabilities.

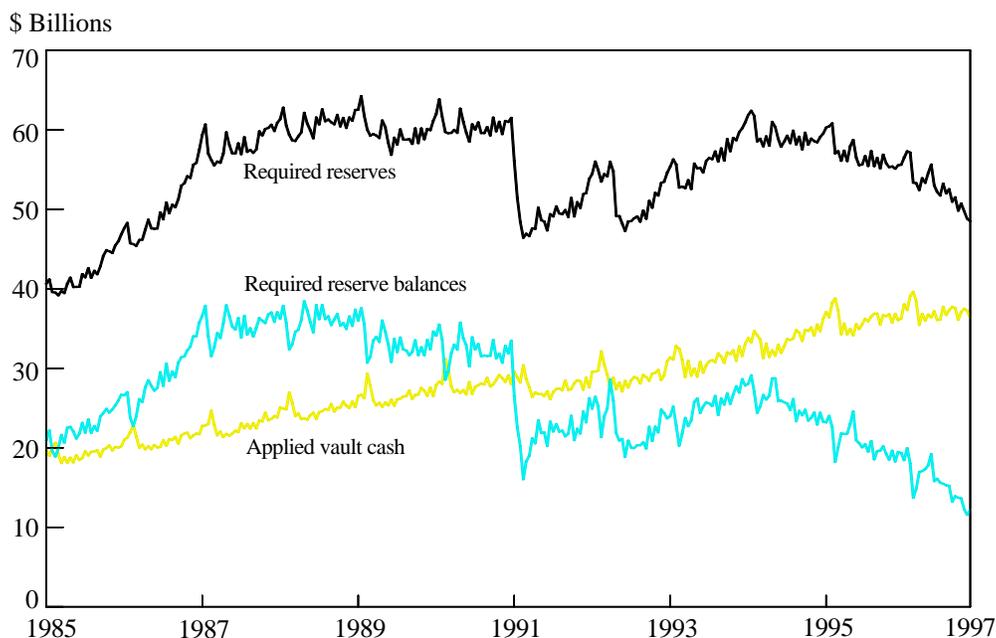
Sources: Bank of Japan (1995); Federal Reserve System; Deutsche Bundesbank; Banque de France; Bank of Japan; Bank of Canada; Bank of England; Reserve Bank of New Zealand.

nontransaction accounts reduced the level of required reserves by \$11.5 billion, a cut of almost one-third (Feinman). Then, in April 1992, the Federal Reserve cut reserve requirements on transactions deposits from 12 percent to 10 percent, reducing required reserves by an additional \$8.5 billion. Germany, France, and Japan have also lowered reserve requirements in recent years. And some countries have gone even fur-

ther. In 1994, Canada eliminated reserve requirements, joining the United Kingdom and New Zealand, which had previously moved to abolish reserve requirements.<sup>7</sup>

This trend toward lower reserve requirements stems from three developments. The first, noted above, is growing acceptance of the view that reserve requirements are less essential to the

Chart 1  
RECENT BEHAVIOR OF RESERVES



Source: Board of Governors of the Federal Reserve System.

implementation of monetary policy. Canada, the United Kingdom, and New Zealand, for example, have demonstrated it is possible to pursue sound monetary policies without relying on reserve requirements as a policy instrument.

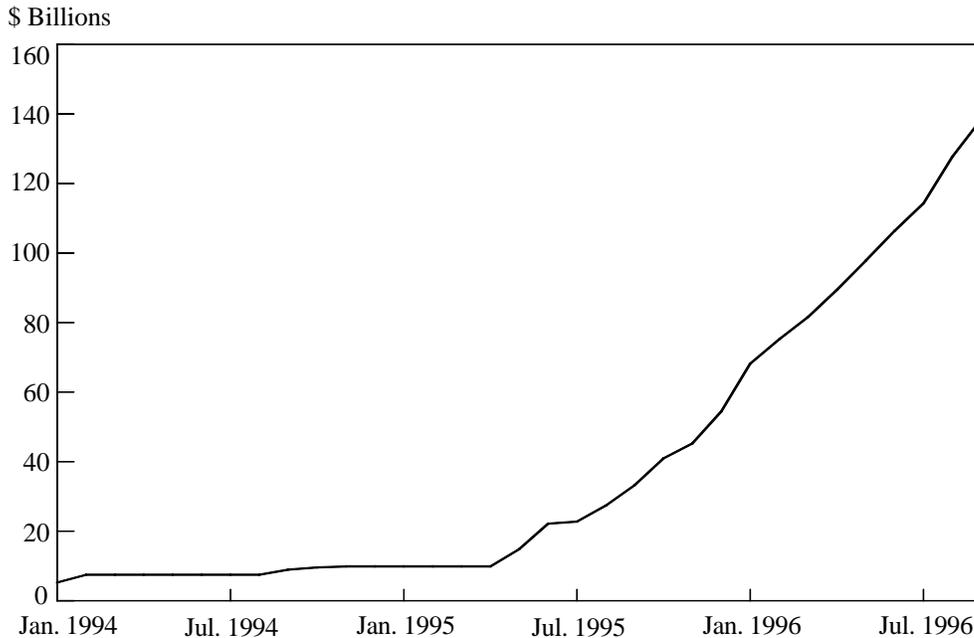
The second factor leading to diminished use of reserve requirements is the view that such requirements are a serious distortion in an increasingly competitive financial world. Reserve requirements are generally applied to a narrow range of liabilities of depository institutions, and reserve balances typically pay no interest. Thus, reserve requirements constitute a tax which differentially affects depository institutions relative to other financial institutions. A common theme

across countries that have lowered reserve requirements is that such reductions remove an inequitable tax on the banking system, improving bank profitability and allowing banks to compete on more even terms with other financial institutions.

The third factor underlying the reduced role of reserve requirements is financial market innovation. Even where reserve requirements have not been formally cut, their effectiveness has been eroded by financial innovation. This is particularly evident in the United States. For many years, depository institutions in the United States have attempted to evade reserve requirements by creating new types of deposit-like

Chart 2

### CUMULATIVE SWEEPS OF TRANSACTION DEPOSITS INTO MONEY MARKET DEPOSIT ACCOUNTS



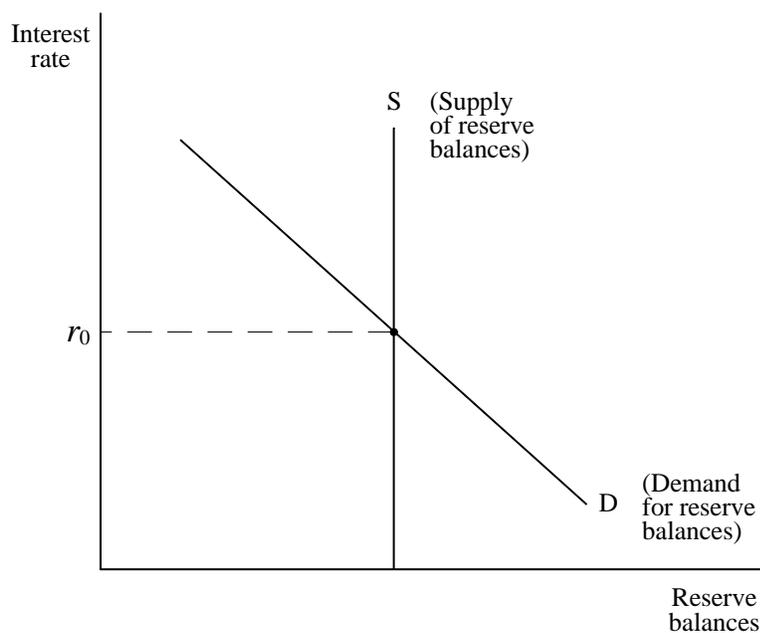
Note: Based on monthly averages of initial amounts.  
Source: Board of Governors of the Federal Reserve System.

liabilities that are not subject to reserve requirements. By shifting the composition of liabilities from reservable deposits to nonreservable liabilities, these institutions have lowered their required reserves even without a formal cut in reserve requirements. Examples include the development of certificates of deposit (CDs), Eurodollar borrowing, repurchase agreements, and, most recently, "sweep accounts."<sup>8</sup>

The combined effects of legal reserve requirement changes and financial innovations have had a significant impact on U.S. depository institutions (Chart 1). The top line in this chart shows total required reserves of depository institutions.

The bottom two lines show how institutions meet reserve requirements, by holding vault cash and by holding required reserve balances at the Federal Reserve. Especially striking in the chart are the two formal cuts in reserve requirements in 1990 and 1992 and the further decline in required reserves over the past two years. The most recent decline is largely attributable to the widespread use by depository institutions of so-called "sweep accounts," in which funds are automatically transferred from reservable deposit accounts, such as demand deposits and other checkable deposits, to nonreservable accounts, such as money market deposit accounts. Such a transfer lowers the deposit base for the calcula-

Figure 1



tion of reserve requirements. The use of sweep accounts by banks began modestly in 1994 but has increased considerably since the spring of 1995 (Chart 2).<sup>9</sup>

Particularly dramatic is the reduction in the size of required reserve balances held at the Federal Reserve (Chart 1). These balances, which represent that part of required reserves satisfied by holding funds in reserve accounts at the Federal Reserve, are now at their lowest level in over 30 years. Increasingly, depository institutions are able to meet reserve requirements entirely through their holding of vault cash rather than by holding reserve accounts at the Federal Reserve. Indeed, while approximately 26,000 depository institutions in the United States

currently have reservable liabilities, only about 2,000 hold required reserve balances at the Federal Reserve.

## II. THE PAYMENTS SYSTEM AND MONETARY POLICY

The declining use of reserve requirements has important implications for the relationship between monetary policy and the payments system. In a traditional banking system where reserve requirements are binding on depository institutions, short-term interest rates are determined by the demand for and supply of central bank reserves. In this framework, the structure of the payments system has only a minor influence on reserve demand and supply and so has

little bearing on the conduct of monetary policy. However, in a world in which reserve requirements are no longer binding, the demand for central bank balances is no longer based on the demand for reserves but depends on the need of depository institutions to make payments. These payments include clearing and settlement transactions with other depository institutions and transactions with the government. In this environment, monetary policy operating procedures and the payments system are directly linked, and ongoing changes in the payments system may require corresponding changes in monetary policy procedures.

### *Monetary policy when reserve requirements are binding*

Today, a majority of central banks still operate in a world in which reserve requirements are high enough to influence the behavior of many depository institutions. In this framework, the short-term or overnight interest rate is determined by the demand for and supply of reserves (Figure 1). The demand for reserves  $D$  comes primarily from the need of depository institutions to hold reserves to meet reserve requirements. This demand depends on the public's choice of the amount of transactions deposits to hold at depository institutions.<sup>10</sup> In addition, institutions may hold a small amount of excess reserves for precautionary purposes to prevent deficiencies in their reserve account.

The demand for reserves shown in Figure 1 is inversely related to the short-term interest rate for two reasons. First, higher interest rates cause depositors to shift funds out of transactions accounts into higher yielding, nonreservable assets, reducing the demand for required reserves. Second, the demand for excess reserves is also somewhat sensitive to market interest rates. Since reserve balances generally pay no interest, institutions must trade off the cost of holding

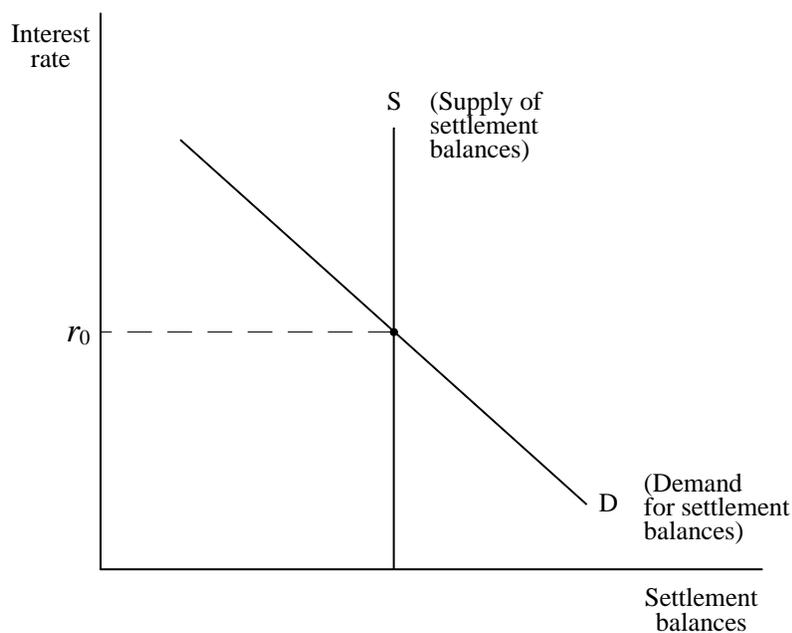
idle balances against the cost of penalties imposed by the central bank for reserve deficiencies. As market rates rise, the cost of holding idle funds increases, inducing institutions to hold fewer excess reserves.

While the demand for reserves depends on the behavior of depository institutions, the supply of reserves  $S$  is largely determined by the central bank through its open market operations and discount or lending facility.<sup>11</sup> In addition, reserve supply is also influenced by nonpolicy factors, such as flows of funds into and out of government accounts at the central bank. For example, when the government collects more tax revenue and transfers these funds to the central bank, its balances at the central bank rise while depository institutions' reserves fall. Similarly, increased government expenditures reduce the government's central bank account and increase the supply of reserves.

In this framework, monetary policy is implemented by using central bank control over the supply of reserves to affect short-term interest rates. The central bank can change the stance of monetary policy by using open-market operations to shift the supply curve  $S$  in Figure 1. By reducing or increasing the supply of reserves available to the banking system, the central bank can push interest rates higher or lower.

In the traditional reserves framework, monetary policy is largely independent of the structure of the payments system. When reserve requirements are high enough to be binding on depository institutions, these institutions are forced to hold more central bank balances than are actually needed for payments purposes. That is, the demand for reserves depends primarily on the legal reserve requirement and not the need of institutions to make payments. Indeed, of the total demand for reserves, only the demand for excess reserves is likely to be affected by payments

Figure 2



system changes.<sup>12</sup> Consequently, institutional changes in the payments system, such as new clearing and settlement procedures that reduce the need for central bank balances, are likely to have little effect on the reserves market. Thus, in a reserves framework, changes in the payments system do not affect the central bank's ability to influence short-term interest rates by controlling the supply of reserves.

#### *Monetary policy when reserve requirements are not binding*

A world where reserve requirements are not binding requires changes in this policy framework. For simplicity, consider a situation in which reserve requirements are zero. Without

reserve requirements, strictly speaking, there is no demand for reserves. In this case it is no longer possible to think in terms of a model in which the short-term interest rate is determined by the demand for and supply of reserves.

Even in the absence of reserve requirements, however, there is likely to be a continuing demand for central bank balances. This demand arises from the need of financial institutions to make payments. That is, even without formal reserve requirements, the banking system will generally hold balances at the central bank to clear and settle transactions and to transact business with the government.<sup>13</sup> This demand for settlement balances will depend on institutional aspects of the payments system as well as the

penalties that the central bank charges for overdrafts in these settlement accounts. Generally speaking, the higher the overdraft penalties and the greater the degree of uncertainty about payments flows, the higher the level of settlement balances institutions are likely to hold.

The existence of settlement balances held at the central bank provides a conceptual basis for monetary policy in a world without reserve requirements.<sup>14</sup> As long as there is a demand for settlement balances, central banks can influence short-term interest rates by altering the supply of these balances (Figure 2).<sup>15</sup> That is, monetary policy can operate through short-term interest rates even in the absence of reserve requirements. For example, to push interest rates up, a central bank can reduce the supply of settlement balances by selling securities in an open market operation. This action would force banks to bid for additional settlement balances in the interbank market or sell assets to obtain more balances, causing short-term rates to rise. Similarly, to push rates down, the central bank can use open market purchases of securities to increase the supply of settlement balances. To the extent that it is costly to hold excess balances, institutions will tend to dispose of excess balances, forcing short-term rates down.

At the same time, there are some important practical difficulties in using settlement balances instead of reserve balances as the fulcrum for monetary policy. The chief problem is in modeling financial institutions' demand for these balances. When reserve requirements are binding, the demand for reserves is largely derived from the public's desire to hold transactions accounts at depository institutions. In this case, changes in the public's demand for money are the principal factor causing a change in the demand for reserves. In contrast, when reserve requirements are not binding, an institution's decision to hold settlement balances is likely to

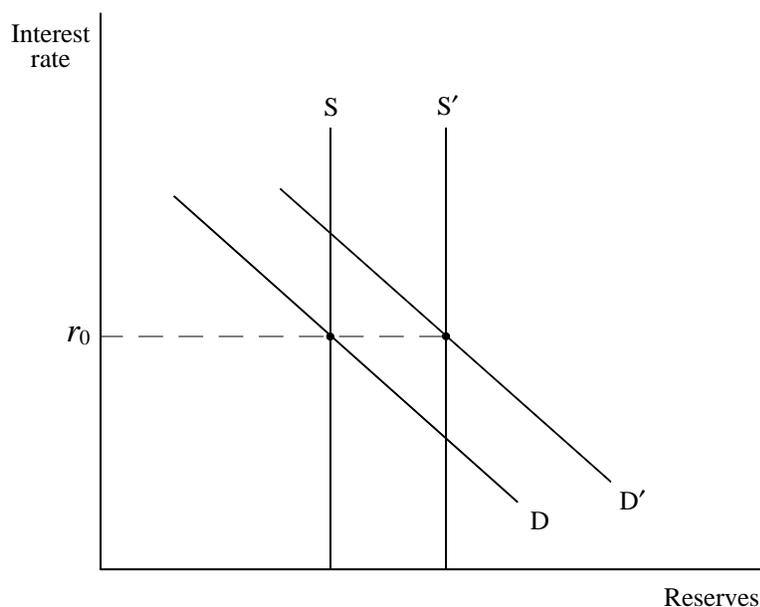
bear little relation to the public's demand for money. Rather, the demand for these balances will depend on institutional features of the payments system affecting the timing of payments flows into and out of settlement accounts.

Changes in payments practices or the structure of the payments system are likely to alter the amounts of settlement balances that institutions maintain. These changes have implications for monetary policy to the extent that they cause shifts in the demand for central bank balances. For example, the development of improved balance monitoring capabilities by depository institutions may reduce the degree of uncertainty about inflows and outflows from settlement accounts. If so, institutions may reduce the size of their desired balances. This would cause the demand curve for settlement balances *D* in Figure 2 to shift to the left over time. Similarly, mergers in the banking industry could reduce the desired amounts of these balances to the extent that more transactions are settled internally within the banking organization rather than being settled at the central bank.

The analysis to this point has assumed that reserve requirements are zero. But, in fact, the analysis will hold in any situation in which reserve requirements are so low as to be non-binding. Central banks need not eliminate reserve requirements, but only lower them to nonbinding levels, to find themselves operating in this new environment.

Without a good idea of the factors affecting the demand for settlement balances, a central bank may have difficulty in implementing monetary policy. That is, it may become more difficult to achieve control over short-term interest rates when the demand for central bank balances is derived from payments needs rather than from the demand for transactions balances. More fundamentally, in a world where reserve

Figure 3



requirements are no longer effective, there is an important linkage between the payments system and monetary policy that does not exist when reserve requirements are binding on depository institutions. The existence of this linkage implies that ongoing changes in the payments system that alter the demand for clearing and settlement balances may require continuing changes in monetary policy operating procedures to maintain the effectiveness of monetary policy.

### III. RESERVE REQUIREMENTS AND INTEREST RATE VOLATILITY

A second implication of reduced reserve requirements is the potential for greater volatility of short-term interest rates. To the extent that increased volatility impairs the implementation

of monetary policy, central banks may have to take measures to limit volatility. In the United States, institutional changes by the Federal Reserve and adjustments by depository institutions have helped limit interest rate volatility as reserve balances have declined. Moreover, reserve requirements remain binding for a number of institutions. However, continuing financial innovation could push the United States closer to a world where reserve requirements are no longer effective and interest rate volatility is a more pressing concern for monetary policy.

#### *Causes and consequences of greater volatility*

Currently, many central banks conduct day-to-day monetary policy by attempting to stabilize

a short-term interest rate around a target value or by maintaining the rate within a narrow range.<sup>16</sup> In a reserves framework, the key to the central bank's ability to influence interest rates is its ability to forecast the demand for reserves and nonpolicy factors tending to shift the supply of reserves (Figure 3). That is, the central bank needs to be able to offset shifts in the demand for reserves or nonpolicy shifts in the supply of reserves that might cause interest rates to deviate from desired levels. For example, an increased demand for reserves caused by faster deposit growth would cause the demand curve in Figure 3 to shift out to the right to  $D'$  putting upward pressure on the interest rate. To maintain the current interest rate,  $r_0$ , the central bank would have to provide additional reserves, shifting the supply curve to the right to  $S'$ . In this framework, mistakes in forecasting reserve demand or supply translate into volatility of interest rates around desired levels.

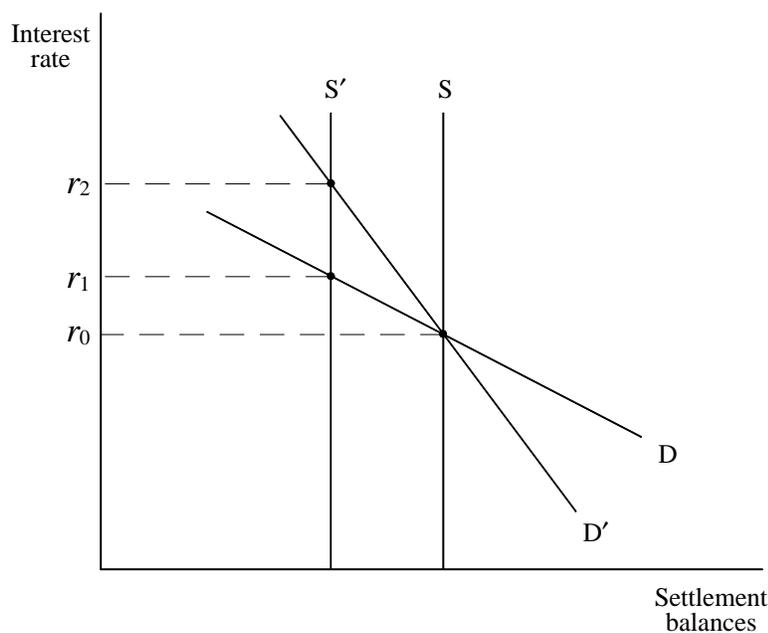
In a world where reserve requirements are no longer binding, financial markets could experience even greater interest rate volatility than in a reserves environment due to the different nature of the demand for settlement balances. As noted in the previous section, this demand is fundamentally different from the demand for reserves. The demand for settlement balances depends largely on expected payments flows and institutional features of the payments system which affect the timing of payments. In contrast, the demand for reserves is primarily derived from the level of transactions balances on an institution's balance sheet which, in turn, reflects both the public's need to make transactions and its choice of financial assets. Because of these differences, it is possible the demand for settlement balances could be less stable and less predictable than the demand for reserves.<sup>17</sup> If so, the central bank may have greater difficulty in judging the size of the open market operation needed to achieve a given level of interest rates, resulting in greater rate volatility.

In addition, the demand for settlement balances may be less sensitive to interest rates than is the demand for reserves. This could happen if institutions maintain only a small cushion of precautionary balances above their clearing and settlement needs, a cushion which is smaller than institutions would hold under a system of binding reserve requirements. With only a small amount of precautionary balances, institutions have less ability to absorb unexpected changes in the size of their settlement balance at the central bank. Faced with an unexpected shortfall in settlement balances, for example, institutions would be forced to obtain additional balances in the overnight market, putting upward pressure on interest rates.

If the demand for settlement balances is relatively insensitive to interest rates, errors in predicting either the demand for or supply of these balances are likely to result in heightened interest rate volatility. For example, in Figure 4, suppose the central bank is targeting an interest rate  $r_0$  and that there is an error in predicting the amount of settlement balances supplied by nonpolicy factors. That is, the supply of settlement balances turns out to be  $S'$  rather than  $S$ . Market rates will be pushed up as institutions scramble for additional settlement balances, but the amount of the increase will be larger the steeper or less interest-sensitive is the demand curve for settlement balances  $D'$ . Similar results are obtained for errors in forecasting the demand for settlement balances. Thus, if the demand for settlement balances is very insensitive to interest rates, central banks may experience greater volatility of short-term interest rates.

Greater interest rate volatility could be a concern for a central bank for several reasons. Most basically, volatility may make it difficult for a central bank to implement policy through control over short-term interest rates. That is, it may become more difficult for the central bank to

Figure 4



achieve a given interest rate target or operating range. This, in turn, may make it harder for financial markets to judge the stance of monetary policy. Volatility is of greatest concern if it is transmitted up the yield curve to longer-term interest rates and prices of other financial assets. In this situation, increased volatility could have real economic effects if it influences spending or investment planning decisions.<sup>18</sup>

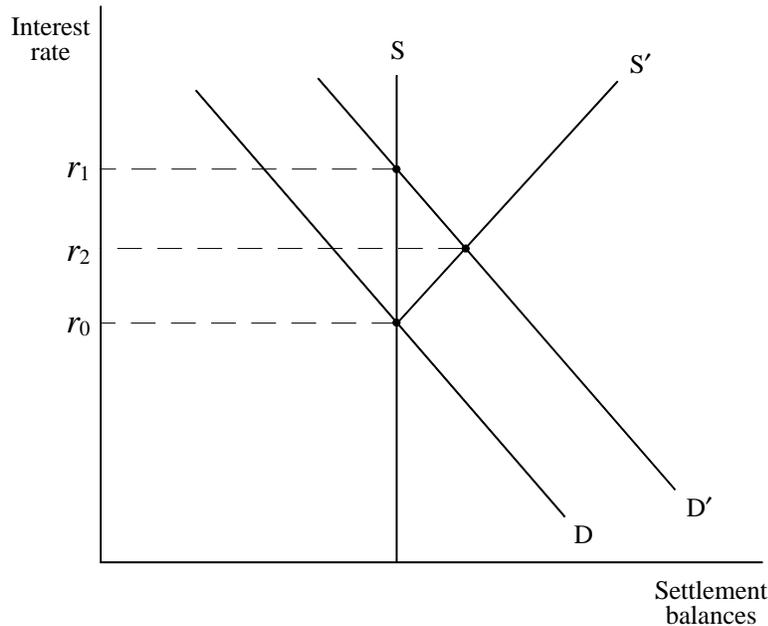
#### *Managing greater interest rate volatility*

If a move to lower reserve requirements results in greater interest rate volatility, central banks have a number of options to limit volatility. One approach is to attempt to alter the interest sensitiv-

ity of the supply of settlement balances by changing the operation of its discount or lending facility.<sup>19</sup>

If institutions can obtain additional settlement balances from the central bank as market rates rise, the availability of these funds will dampen the increase in market rates (Figure 5). When the central bank lends additional settlement balances as interest rates rise, the supply curve for settlement balances would be flatter  $S'$  rather than vertical  $S$ . For an unexpected shift in the demand for settlement balances  $D'$ , interest rates would rise less with the flatter supply curve  $S'$  as settlement balances provided through the discount window would cushion the rise in rates.<sup>20</sup> Simi-

Figure 5



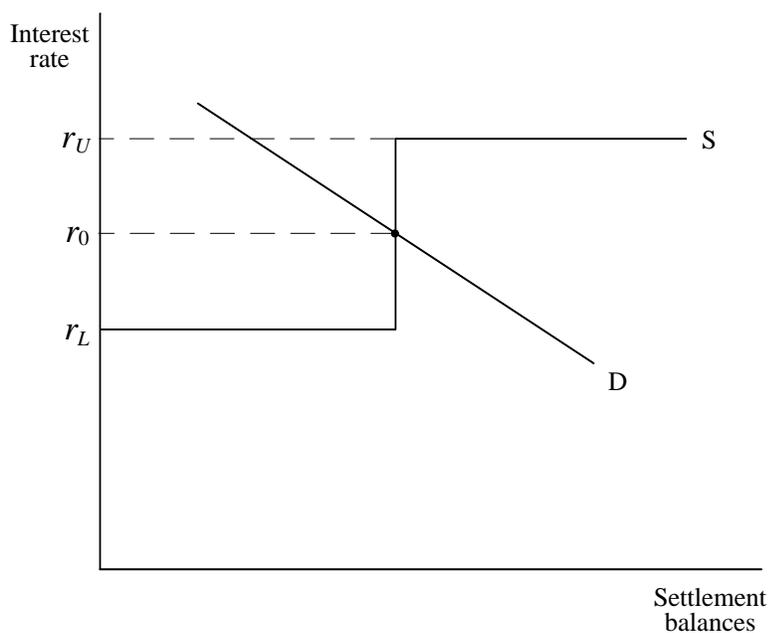
larly, a flatter supply curve would reduce rate volatility for unexpected shifts in nonpolicy factors shifting the supply curve for settlement balances.<sup>21</sup>

In the limit, the central bank could make the supply curve horizontal by altering the central bank lending facility to provide unlimited balances at a penalty rate above the market rate. This penalty discount or lending rate would establish a ceiling on overnight interest rates because institutions would never be willing to pay more for settlement balances than this rate. As shown in Figure 6, this type of lending facility would establish an upper bound  $r_U$  to the market rate, making the supply curve horizontal. Similarly, the central bank could put a floor on

market rates by offering to purchase excess settlement balances at below market rates. As shown in Figure 6, if the central bank purchased excess settlement balances at the rate  $r_L$ , the supply of settlement balances would become horizontal at this rate, establishing a lower bound to market rates. This procedure is equivalent to paying interest on excess settlement balances.

Instead of changing the discount facility, an alternative approach to limit interest rate volatility is for the central bank to intervene in financial markets using open-market operations. By using open-market operations as frequently as necessary during the day, the central bank can maintain short-term interest rates within a narrow range. Thus, as shown in Figure 6, when a short-

Figure 6



fall in settlement balances pushes interest rates to the upper limit of the desired trading range, the central bank would purchase securities to provide additional settlement balances. Similarly, when excess settlement balances push rates downward, the central bank would sell securities to absorb settlement balances and prevent interest rates from falling below the lower limit of the target range.

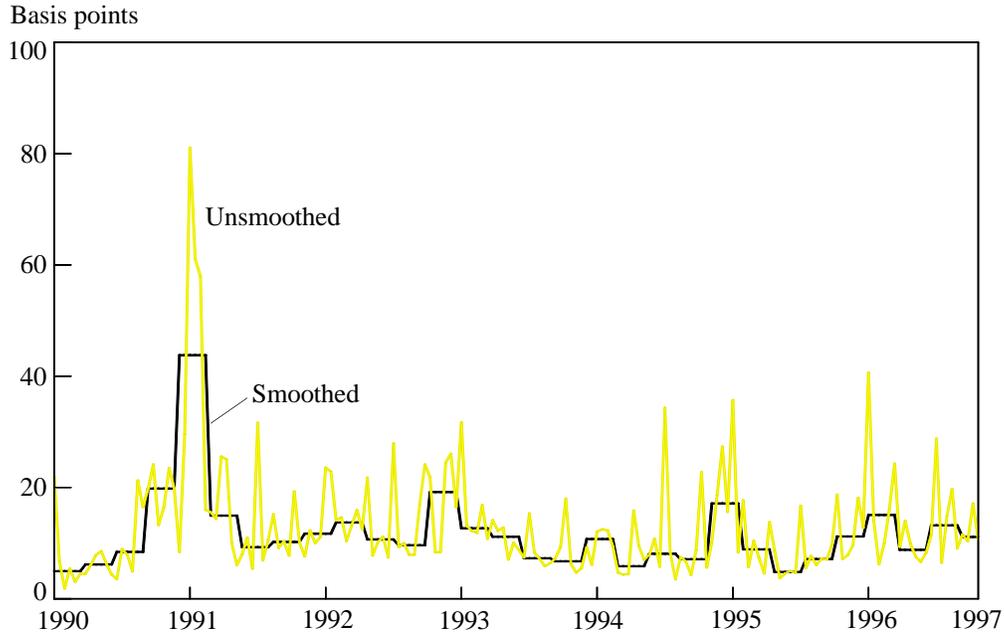
While the central bank has several options to limit interest rate volatility, market participants may take steps on their own to reduce volatility. For example, faced with greater volatility, institutions may decide to hold additional settlement balances as a precaution against having to turn to the market to adjust surpluses or deficiencies

in their settlement account. Such a response by institutions could result in a greater degree of interest sensitivity in the demand for settlement balances which would tend to limit rate volatility.

#### *Volatility: The U.S. experience*

The declining level of required reserve balances in the United States in recent years has raised concerns about the possibility of increased volatility in short-term interest rates (Board of Governors). To date, however, the United States has not experienced a sustained rise in interest rate volatility (Chart 3).<sup>22</sup> As illustrated by this chart, volatility of the federal funds rate rose sharply at the end of 1990 around the time of the Federal Reserve's cut in reserve requirements.

Chart 3  
VOLATILITY OF THE FEDERAL FUNDS RATE



Note: Mean absolute deviation of daily federal funds rate from intended rate by maintenance period. For details, see endnote 22.  
Source: Board of Governors of the Federal Reserve System and Federal Reserve Bank of New York.

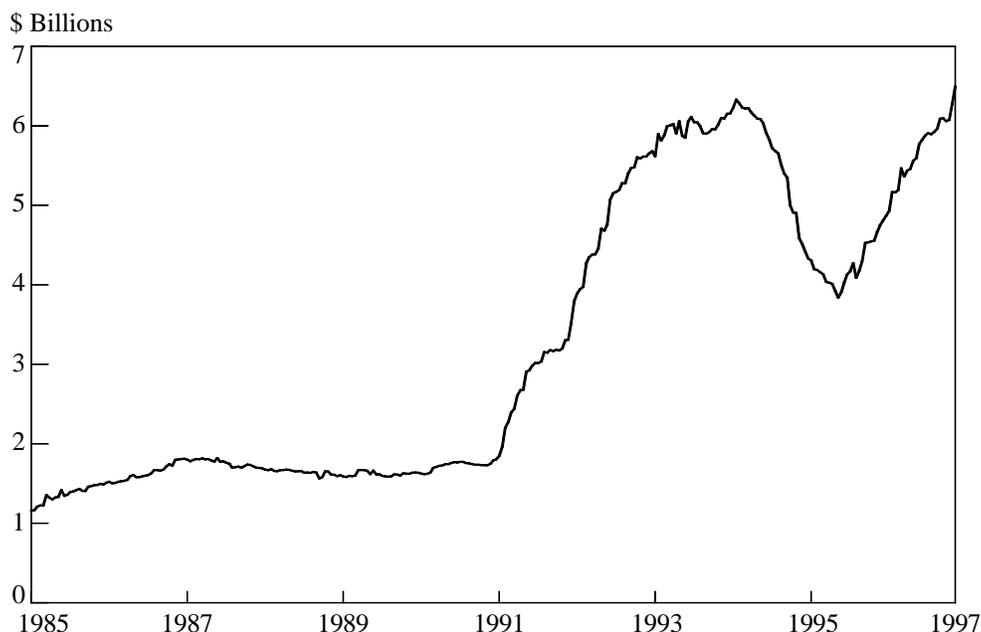
This increase was short-lived, however, as volatility returned to more normal levels later in the year. In contrast to 1990, there is little indication of increased volatility at the time of the April 1992 cut in reserve requirements or, more recently, with the spread of sweep accounts in 1995-96.

The failure of volatility to rise in 1992 and in 1995-96 may be partly attributable to institutional changes made by the Federal Reserve. In 1992, the Federal Reserve doubled the reserve carryover provision, allowing institutions to carry forward larger reserve excesses and deficiencies into the next maintenance period. This action was taken in an attempt to forestall an increase in volatility similar to that which occurred in 1990

(Feinman). In addition, accounting rules for the treatment of vault cash were modified in 1992 in an attempt to smooth the reserve adjustment process (Feinman).

Another important factor that may have prevented an increase in interest rate volatility in recent years is a change in the behavior of depository institutions. Specifically, as required reserve balances at the Federal Reserve have fallen in recent years, many depository institutions have established "clearing balances" at the Federal Reserve or have increased the size of existing clearing balances to serve as a cushion against account overdrafts and to offset service charges from the use of the Fed's clear-

Chart 4  
REQUIRED CLEARING BALANCES



Source: Board of Governors of the Federal Reserve System.

ing, settlement, and other payments services. Authorized under the Monetary Control Act of 1980, clearing balances allow institutions without reserve balances or with reserve balances too small for payments needs to use Federal Reserve payments services. The decision to establish these accounts and their size is largely voluntary. Once the accounts are established, however, they operate much like required reserve balances in the sense that institutions are penalized for significant deficiencies to their clearing accounts. That is, once a clearing balance account is set up by an institution, the institution must meet a clearing balance requirement.

Required clearing balances differ from required reserve balances in two important ways. First,

required clearing balances are not tied to the level of an institution's transactions accounts but, rather, to expected payments needs. Second, clearing balances earn implicit interest in the form of offsets to the cost of Federal Reserve payments services.<sup>23</sup>

Required clearing balances have grown considerably in recent years (Chart 4). Indeed, growth was especially rapid after the reductions in reserve requirements in 1990 and 1992 and during the growth of sweep accounts in 1995-96. The growth in the use of clearing balances suggests that depository institutions are offsetting reductions in required reserve balances, at least partially, by establishing clearing balances at the Federal Reserve.<sup>24</sup> Thus, increased reliance on clearing

balances may have helped to prevent a rise in interest rate volatility as required reserve balances have declined.

While these factors likely help explain the recent behavior of short-term interest rate volatility in the United States, a third, more fundamental reason should not be overlooked. Despite the decline in required reserve balances, reserve requirements may still be binding on enough depository institutions to limit volatility. As noted earlier, approximately 2,000 institutions still maintain required reserve balances at the Federal Reserve. If current trends continue, however, this situation may not last. Since depository institutions began to use sweep accounts at the beginning of 1994, the number of institutions holding reserve balances has fallen by more than 500. If this trend continues, it may not be long before the United States is in a world where reserve requirements are no longer effective and interest rate volatility becomes a more important concern.

## SUMMARY AND CONCLUSIONS

Over the past decade, reserve requirements have been reduced or eliminated in a number of industrialized countries. Even where reserve

requirements have not been lowered, their effectiveness has been reduced by financial innovation. Thus, central banks increasingly find themselves operating in an environment in which the traditional framework for implementing monetary policy no longer applies.

The declining use of reserve requirements has two important implications for monetary policy. First, in a world without binding reserve requirements, there is a crucial link between the structure of the payments system and monetary policy operating procedures. Second, a system of low or zero reserve requirements may generate greater volatility of short-term interest rates. Both implications present central banks with challenges in implementing monetary policy.

This article, the first of two, has examined some of the analytical issues that arise in moving to a world where reserve requirements are no longer binding. The companion article, to be published in a future issue of the *Review*, discusses how three countries—Canada, the United Kingdom, and New Zealand—conduct monetary policy without reserve requirements and examines whether similar procedures could be implemented in the United States.

## ENDNOTES

<sup>1</sup> In the United States, the basic structure of reserve requirements is set out in the Monetary Control Act of 1980, and the Federal Reserve's authority to adjust reserve requirements is limited by this legislation. Depository institutions in the United States currently face a 10 percent reserve requirement on transactions account balances in excess of \$52 million and a 3 percent requirement on transactions balances of \$0 to \$52 million. There is an exemption for smaller institutions set out in the Garn-St. Germain Depository Institutions Act of 1982 that limits the amount of transactions balances subject to the 3 percent requirement. Currently, there are no reserve requirements on nonpersonal time deposits or eurocurrency liabilities.

<sup>2</sup> For larger institutions, these two periods are overlapping but not coincident. Reserve requirements are calculated on the basis of the average daily level of transactions deposits held during a period beginning on a Tuesday and ending 14 days later on a Monday. The corresponding reserve maintenance period begins on the Thursday following the beginning of the calculation period and ends 14 days later on a Wednesday. Smaller institutions are subject to a separate reserve maintenance and computation scheme.

<sup>3</sup> In the United States, depository institutions are allowed to carry over an excess or deficiency of up to 4 percent of required reserves into the next maintenance period.

<sup>4</sup> In the United States, the monetary charge for an overnight overdraft is 4 percentage points above the effective federal funds rate on the day of the overdraft. Reserve deficiencies for an entire maintenance period (beyond allowable carryover) are charged at the rate of the discount rate on adjustment credit plus 2 percentage points.

<sup>5</sup> While this view is increasingly widespread, it is not universal. For example, some countries, such as Germany continue to view reserve requirements as an essential part of monetary policy. Also, in small open economies, reserve requirements are sometimes seen as a way to counteract adverse capital flows (Bisignano).

<sup>6</sup> The shift in emphasis from a reserves operating procedure to an interest rate operating procedure does not preclude retaining a monetary aggregate as an intermediate target.

<sup>7</sup> The small (.35%) reserve requirement in the United Kingdom, officially termed the cash ratio, is viewed as serving no monetary policy purpose; its sole function is to provide income for the Bank of England (King). Other countries currently operating without reserve requirements include Belgium, Denmark, and Sweden.

<sup>8</sup> All of these innovations can be viewed as ways of avoiding reserve requirements and other regulatory restrictions on bank behavior such as Regulation Q interest rate ceilings.

<sup>9</sup> More detailed discussion of sweep accounts and their implications can be found in Federal Reserve Bank of New York (1995) and Board of Governors of the Federal Reserve System.

<sup>10</sup> The demand for reserves will also depend on the public's holdings of term deposits in those countries in which term deposits are subject to reserve requirements.

<sup>11</sup> For simplicity, the supply curve ( $S$ ) in Figure 1 is drawn as a vertical line under the assumption that the only source of reserves from the central bank is through open market operations. If reserves are also available through a discount window or central bank lending facility, the supply curve would be positively-sloped or horizontal depending on the administration of the discount window and the level of the discount rate. In the United States, for example, where access to the discount window is restricted and the discount rate is generally below market rates, the supply of reserves would be upward sloping. That is, as the market rate rises above the discount rate, depository institutions have a greater incentive to borrow reserves at the discount window. In contrast, in a Lombard system such as that found in Germany, the ready availability of reserves at a

penalty rate would result in a horizontal supply curve at the Lombard rate. These points are discussed in more detail in the final section of this article.

<sup>12</sup> Changes in payments practices could alter the demand for excess reserves by changing the degree of uncertainty of flows through an institution's reserve account.

<sup>13</sup> For example, because governments generally hold their main accounts at central banks, depository institutions will also need to hold accounts at the central bank to transact business with the government. In addition to a voluntary demand for settlement balances driven by business needs, institutions may be required to hold some settlement balances at the central bank.

<sup>14</sup> This point has been made by Freedman, Feinman, and Bisignano, among others.

<sup>15</sup> The supply curve for central bank balances is unchanged by moving to a world without reserve requirements. That is, the supply of central bank balances and its determinants are unchanged whether these balances are labeled reserves or settlement balances.

<sup>16</sup> The greater emphasis on interest rates in monetary policy operating procedures in many countries is discussed in Kneeshaw and Van den Bergh.

<sup>17</sup> Whether the demand for settlement balances is fundamentally more or less stable than the demand for reserves is a difficult issue that must ultimately be decided by empirical work. Certainly, financial innovations affecting money demand have made it difficult to estimate the demand for reserves in recent years. In the short run, during the transition from a world of binding reserve requirements to a world of settlement balances, however, volatility is likely to be an especially serious issue because it may take time to develop reliable models of the demand for settlement balances.

<sup>18</sup> For evidence on the transmission of volatility to longer-term rates, see Kasman; for further discussion, see King.

<sup>19</sup> There are also possibilities for the central bank to alter the interest sensitivity of the demand for settlement balances, for example, by changing the penalty structure for overdrafts to induce institutions to hold additional settlement balances.

<sup>20</sup> The operation of the central bank lending facility shown in the supply curve ( $S'$ ) is similar to the current operation of the Federal Reserve's discount window. Specifically, for

the supply curve to be upward-sloping, access to the lending facility would have to be limited or institutions would have to view balances obtained in the market to be an imperfect substitute for balances obtained through the central bank, perhaps because of a reluctance to borrow funds from the central bank. Without these conditions, the supply curve would be horizontal and the lending rate would establish a ceiling to market rates.

<sup>21</sup> Note, however, that the cushioning effect of this type of lending facility can operate asymmetrically. Indeed, if the demand curve  $D$  were to shift to the left rather than to the right, the discount window would not cushion the fall in the interest rate below  $r0$ . Thus, for this type of lending facility to work symmetrically, the central bank would have to consistently under-provide settlement balances through open market operations, forcing institutions to use the lending facility. In Figure 5, the central bank would want to insure that the demand curve for settlement balances always intersected the upward-sloping part of the supply curve  $S'$ .

<sup>22</sup> This chart shows one measure of the volatility of the federal funds rate—the mean absolute deviation of the daily effective funds rate from the intended rate over two-week maintenance periods. To highlight trend behavior, a smoothed series is shown along with the actual data. The smoothed series was calculated by dividing the data into bands of approximately quarterly frequency (six maintenance periods) and calculating the median value for each band. Data and further details are available from the authors.

<sup>23</sup> For a more complete discussion of clearing balances, see Stevens (1993a) and Stevens (1993b).

<sup>24</sup> The rise in clearing balances has not offset the decline in required reserve balances. As a result, required operating balances, the sum of required clearing balances and required reserve balances, has declined as well.

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