

A Comparison of Monetary Policy Operating Procedures in Six Industrial Countries

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The institutional environments in which the central banks of the industrial world operate have changed substantially since the mid-1970s. Financial market liberalization, along with regulatory and technological change, has altered the relationships between central bank policy tools and objectives. Authorities have responded to these changes by revising the techniques and procedures they use to implement monetary policy. In Japan and France, where far-reaching reforms of the financial system have taken place, central bank operating procedures have been substantially transformed. In countries where well-developed capital markets existed earlier, the revisions in monetary policy operating procedures have been considerably less dramatic.

As financial liberalization and innovation proceed, the institutional settings of the central banks are becoming more uniform. Although arrangements still vary across countries, this convergence suggests that a comparison of central bank operating procedures is now likely to be of greater relevance to policy makers than at any time in the past.

An assessment of foreign practices may provide a particularly useful perspective on the changing conditions affecting the operations of the Federal Reserve's Open Market Desk. A noticeable increase in banks' reluctance to borrow at the Federal Reserve's discount window in recent years has at times contributed to large daily fluctuations in the federal funds rate. Moreover, reductions in reserve requirements in 1990 and April of this year have led to occasional conflicts between the Desk's reserve management strategy and more volatile day-to-day conditions in the funds market. With other central banks offering a wide variety of alternative tech-

niques for implementing policy and a number currently operating in an environment of low, nonbinding reserve requirements, an examination of operating procedures followed by foreign central banks seems timely.¹

This article describes monetary policy operating procedures in six industrial countries—the United States, Japan, Germany, the United Kingdom, Canada, and Switzerland. The object is to shed light on central bank strategies elsewhere in the industrial world and to compare them with the practices of the Federal Reserve. As part of this review, particular attention is given to the institutional environments in which central banks operate. The intermediate and ultimate objectives of a central bank, while important in an overall survey of monetary policy transmission, are not discussed in any detail.

Our review suggests that basic central bank intervention strategies are currently quite similar across the industrial world. Nearly all the central banks analyzed use interest rate operating objectives to guide their daily activities. In addition, although the central banks employ different instruments, they all implement policy principally through daily operations supplying or absorbing reserves at market-determined prices.

The Federal Reserve and several foreign central banks are also alike in having chosen to lower their reserve requirements in recent years. In most cases, the foreign monetary authorities have adjusted their operating procedures to accommodate this change.

¹A good discussion of Federal Reserve operating procedures following the reduction in reserve requirements can be found in "Monetary Policy and Open Market Operations during 1991," this *Quarterly Review*, Spring 1992, pp. 72-95.

Specifically, they have provided a more elastic intraday supply of central bank reserves, largely through their credit facilities. In this way, they have limited any tendency for reduced reserve margins to lead to higher day-to-day interest rate volatility.

Our analysis suggests that some of the practices observed abroad might be helpful in limiting the short-run volatility of the federal funds rate in the United States. However, our analysis also indicates that the volatility of the federal funds rate, although higher since the 1990 cut in reserve requirements, remains low relative to that of comparable rates in most other countries. Moreover, we find no evidence that federal funds rate variability, within its current range, is transmitted to other money markets. Thus, the rise in interest variability that has accompanied the reduction in reserve requirements in the United States has probably not materially affected the monetary policy transmission mechanism.

Comparing operating procedures in six industrial countries²

Key features of central bank operating procedures

A central bank must choose implementation procedures that enable it to achieve its macroeconomic goals. Although the six central banks considered in this article have different objectives and operate under varied institutional environments, the key features of their implementation strategies are currently quite similar.

All six central banks implement policy by controlling the aggregate level of reserves available to the banking system. Although they are not in a position to control movements in all components of their balance sheets, particularly those related to their function as banker to the government and their holdings of foreign currency reserves, these banks currently have sufficient information and operational leeway to neutralize the effects of other activities and regulate the aggregate supply of reserves with a high degree of control.

In managing the reserve position of the banking system, central banks generally pursue short-run operating objectives. Operating objectives link reserve management activities to the intermediate and ultimate goals of policy and, in most countries, are also used to signal central bank policy intentions to market participants. Ideally, the authorities exert close control over operating objectives.

Bank reserves have served as an operating objective, but the relationship between reserves and economic activity generally has been viewed as too volatile for reserves to function as an effective short-run guide to

policy. Most of these central banks have instead geared their reserve management activities toward short-term interest rate objectives.³ A wide variety of money market interest rates are employed as operating objectives. Nonetheless, influence over overnight interest rates is a goal common to the daily activities of all six of these central banks. Each of these countries has a well-functioning interbank money market where individual banks trade reserves on deposit at the central bank.⁴ If the aggregate supply of banking system reserves does not correspond to demand, the cost of overnight funds in this market is immediately affected.

Although central banks' reserve management activities give them considerable control over short-term interbank rates, their influence on interest rates must extend to maturities well beyond overnight rates to affect economic activity. Central bank influence over longer term rates is indirect and principally determined by market forces. Through arbitrage, longer term rates reflect market expectations of future short-term rates. A central bank's leverage over longer term rates is obtained largely through its influence on these expectations. By taking steps to communicate credible intentions about the range in which overnight and other short-term interest rates should trade in the future, central banks can transmit their interest rate policies throughout the money market term structure and beyond.

To this end, most of these central banks limit themselves to infrequent adjustments in their operating objectives. Targeted interest rates are generally changed in small steps and only after a sufficient amount of new information has accumulated to warrant a change in policy. By encouraging expectations of interest rate stability over a medium-term horizon, policy makers gain influence over rates throughout the term structure.

Although interest rate operating objectives have been prevalent among these central banks over the past two decades, the type of implementation strategy employed

³The notable exception is the Swiss National Bank, which has maintained bank reserve operating targets. In addition, the Federal Reserve experimented briefly with nonborrowed reserve objectives from 1979 to 1982. The choice of monetary policy operating targets has been the subject of considerable debate. William Poole provides the seminal discussion of these issues in "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, vol. 84 (1970), pp. 197-216. For a recent discussion of interest rate operating objectives in the United States, see Marvin Goodfriend, "Interest Rates and the Conduct of Monetary Policy," and the accompanying comments by William Poole in *Carnegie-Rochester Conference Series on Public Policy*, no. 34 (1991), pp. 7-39.

⁴In Japan and the United Kingdom, nonbank financial intermediaries participate in the interbank market. In Canada, an important overnight market in call loans, used by both banks and investment dealers, exists alongside the interbank market.

²The discussion in this section benefited from exchanges with staff members of each of the five foreign central banks. Any errors of fact or interpretation are, of course, the responsibility of the author.

has, in many countries, evolved considerably.⁵ During the 1970s, the central bank of Japan and several European central banks relied heavily on a system of administered interest rates to implement policy. Banks' marginal reserve demand in these countries was largely met through central bank credit facilities, often at below-market rates.⁶ "Official" or tightly controlled money market rates served as anchors for regulated deposit and lending rates. Together with other controls over financial activity, official rate changes were transmitted largely through their direct effect on bank credit availability.

This approach came under pressure in the late 1970s. The delays by some central banks in adjusting interest rates to counter a buildup of inflation in the late 1970s raised concerns about the inflexibility of interest rate determination. Many observers believed that the use of highly visible official rates constrained banks from adjusting policy in a timely fashion. More important, however, rising inflation helped spur the liberalization of financial markets, which in turn substantially increased the importance of competitive forces in determining interest rates. Domestic financial markets also became more closely integrated with foreign markets. As a consequence, market-determined interest rates and exchange rates played an increasingly central role in private agents' expenditure decisions.⁷

Although procedural changes have been greatest in those countries where financial change has been most significant, the central banks under review have in general moved towards market-oriented methods for implementing monetary policy. As noted earlier, authorities increasingly rely on market-determined interest rates both as operating objectives and as key elements in the transmission mechanism. At the same time, market operations, in which central banks intervene in financial markets at freely determined prices, have gradually replaced lending and regulatory controls as the principal instrument for altering reserve supplies in most countries.

The shift toward market-oriented interest rate objectives has helped the central banks to reduce the repercussions arising from changes in their policy stance. In

addition, open market operations permit central banks to exercise considerable discretion in the day-to-day management of reserves. While relying on market forces to determine interest rates, central banks can intervene at select times to influence the range within which rates move. Furthermore, the wide variety of available domestic money market instruments (whose development was greatly encouraged by monetary authorities in most countries) allows the banks to construct intervention strategies that span the money market term structure.

In practice, central banks continue to severely limit the range in which short-term interest rates fluctuate. By fine-tuning their market operations, usually on a daily basis, these central banks alter reserves to accommodate variations in reserve demand.

This active effort to moderate even transitory interest rate fluctuations underscores central banks' desire to communicate their policy intentions clearly to market participants. In nearly all the countries under review, the stance of monetary policy is signaled through interest rates. Market interest rates respond to developments other than policy changes, however, and movements unrelated to policy must be filtered out before policy inferences can be drawn. By sharply limiting interest rate variations daily, central banks ensure that market participants can clearly identify interest rate targets and quickly ascertain changes in the monetary policy stance.

To implement an interest-rate-based operating policy through periodic open market operations, central banks must be able to predict the demand for bank reserves over some relevant horizon. Banks need reserves to meet reserve requirements and to make interbank payments. Central banks have considerable influence over reserve demand through their role in setting reserve requirements and interbank clearing rules. Specific rules (lagged reserve accounting, reserve averaging, and carryover provisions) and payment systems practices (timing of payments, overdraft provisions) have been designed, in part, to strengthen and stabilize the short-term demand for bank reserves. In general, the stability of reserve demand over a maintenance period has been a key element underlying central bank implementation procedures.

In the past, many central banks actively managed reserve demand by changing reserve requirements and applying other administrative controls to bank behavior. These practices have greatly diminished in recent years, a change that in part reflects the general trend towards market-based policy strategies. At the same time, all six central banks have reduced reserve requirement ratios over the past decade in an attempt to lighten the burden they place on banks. In some coun-

⁵An excellent discussion of how monetary policy procedures have evolved can be found in J.T. Kneeshaw and P. Van den Bergh, "Changes in Central Bank Money Market Operating Procedures in the 1980s," *BIS Economic Papers*, no. 23, January 1989.

⁶Reliance on subsidized central bank credit sources for bank reserve needs characterized German, Japanese, and Swiss monetary policy.

⁷A detailed analysis of financial innovation and its effect on the monetary policy transmission mechanism can be found in *Financial Innovation and Monetary Policy*, Bank for International Settlements (Basle, 1984).

tries, the relaxation of restrictions on banks' reserve holdings has led to greater variability in reserve demand, compelling authorities to adjust their reserve management procedures.

Although this overview of the key features of central bank implementation strategies suggests broad similarities across countries, the specific techniques employed by individual central banks to implement monetary policy vary greatly. Central bank market operations span a wide spectrum of assets and maturities; the timing of operations and the frequency with which they are conducted also differ. Significant differences can be seen as well in the conditions determining access to central bank credit, the regulations setting required reserve levels, and the length of time granted depository institutions to meet their obligations.

In many cases, these differences are institutional in nature, reflecting the particular environments in which central banks operate. For example, in conducting open market operations, central banks must depend on the markets available to them. Where active secondary security markets have not developed, central banks may need to make special arrangements for implementing their reserve management policies.

The remainder of this section compares monetary policy implementation techniques across the six countries. By examining the particular institutional environment in which each central bank operates and by observing the interaction of the specific instruments central banks employ—open market operations, central bank lending policy, and reserve requirements—one can identify meaningful differences between Federal Reserve and foreign central bank operating procedures.

Operating objectives and procedures

All six central banks gear their short-term reserve management activities toward influencing interest rates, but specific interest rate strategies differ from bank to bank. The Federal Reserve in the United States limits its activities to influencing overnight interbank rates (the federal funds rate), allowing market forces to determine the transmission of policy to other financial markets. The Swiss National Bank also acts to smooth daily fluctuations in overnight interbank rates, but it is unique among these central banks in setting no explicit interest rate operating objective. Although the four other central banks also actively intervene to smooth fluctuations in overnight rates, they generally seek to influence money market rates of longer maturities as well. In Japan, overnight interbank rates remain the primary operating objective of the central bank, while in Canada, Germany, and the United Kingdom, interest rates of longer maturity, up to three months in some cases, are employed as the primary operating objective. A sum-

mary of the interest rates important to the banks' policy implementation is presented in Table 1. The primary interest rate operating objective for each country is highlighted.

Of the central banks considered, the Bank of England (BOE) is probably most active in its daily reserve management activities. Operating in an environment in which reserve requirements are low and banks try to maintain a specific daily level of operational balances at the BOE, the Bank has developed a strategy of frequent intraday interventions in money markets to achieve its interest rate objectives.⁸

Each morning at 9:45 a.m. the BOE announces its estimate of the net reserve position of the banking system for the day. Based largely on expected government transactions and the BOE's maturing stock of short-term bills, these estimates signal the amount of reserves that the BOE anticipates must be supplied to bring actual balances of clearing banks to the levels the banks are expected to maintain.⁹

Because the bulk of the BOE's assets are in short-term bills (commercial or Treasury) that mature in less than three months and that do not roll over automatically, the banking system will usually be projected to have a "cash shortage" at current interest rates. To meet this shortage, discount houses, which serve as intermediaries between the BOE and private banks, are invited to offer bills to the Bank for purchase, indicating the price at which they are willing to sell.¹⁰ The BOE buys bills to meet the estimated shortage in four maturity bands: zero to fourteen days, fifteen to thirty-three days, thirty-four to sixty-three days and sixty-four to ninety-one days. It chooses the best prices offered but holds unchanged the minimum dealing rate (stop rate) on Band 1 bills maturing in up to fourteen days. As many as three rounds of these operations may take place in a day, enabling the BOE to respond to changing intraday market conditions. If late-day imbalances arise, they are met through credit facilities available to discount houses.

By purchasing bills across bands (maturities), the BOE attempts to extend its influence over interest rates

⁸To assist the BOE in its daily forecast of the reserve position of the banking system, each clearing bank is obliged to specify the size of reserve balances that it will try to maintain daily.

⁹The government holds most of its balances with the BOE. Because its daily transactions with the rest of the economy are large and fluctuate widely, the BOE's forecast of net government flows is both the key component of this estimate and the greatest source of uncertainty.

¹⁰For more detailed information on the role of discount houses in the U.K. financial system and the BOE's money market operations more generally, see "Bank of England Operations in the Sterling Money Market," *Bank of England Quarterly*, October 1988.

throughout the money market. Variations in the amount of bills purchased in Band 4 (sixty-four to ninety-one days), for example, tend to have a strong influence on three-month Treasury bill rates. The BOE also has the option of offering repurchase agreements to discount houses on its own terms if it does not wish to validate the rates being offered. Mindful of this option, the discount houses will generally offer prices embodying their expectation of the BOE's desired rate objectives.

The stop rate changes infrequently. Movements in this rate signal a shift in BOE policy and are usually reflected immediately throughout the interbank market and in commercial bank base lending rates (Chart 1). On occasion, the BOE will send a strong signal of its intention to shift policy by choosing not to accommodate a shortage in reserve needs during the day, thereby obliging discount houses to borrow from the BOE at terms announced by the Bank. Since the BOE has the flexibility to set this lending rate either above or below current stop rates, it can use this procedure to signal a tightening or an easing in policy.

Japanese monetary authorities followed a similar strategy of tight control over the key intervention rate until the early 1980s. Combining reserve management operations with administrative control over interbank market participants, the Bank of Japan (BOJ) was able

to stabilize the call-money overnight interbank interest rate at the level desired for long periods. As part of a broader reform of financial markets over the past decade, the BOJ has actively promoted integration of the interbank with other financial markets and encouraged greater flexibility of interbank interest rates, particularly on an intraday basis.¹¹

The overnight call rate remains the BOJ's key operating objective, and although it is subject to greater influence from market forces than in the past, the BOJ still actively strives to limit its fluctuations around the targeted level (Chart 2). The BOJ implements this policy through a variety of market operations, primarily transactions in commercial bills, and through its daily management of discount window credit. Control over the "reserve progress ratio," which measures reserves accumulated by banks relative to those required within a maintenance period, is a key element of this policy. Upward pressure on interest rates is effected by supplying fewer reserves than are necessary for the reserve progress ratio to rise at an average pace.

¹¹For a detailed analysis of the evolution of Bank of Japan policy and references to the literature on financial market liberalization in Japan, see Bruce Kasman and Anthony P. Rodrigues, "Financial Liberalization and Monetary Control in Japan," this *Quarterly Review*, Autumn 1991, pp. 28-46.

Table 1

Structure of Short-Term Interest Rates

Country	Official Rates	Overnight Interest Rates	Other Key Interest Rates
United States	Discount rate	Federal funds rate	Treasury bill rate
Germany	Discount rate Lombard rate Treasury bill selling rate	Day-to-day money rate	Repurchase agreement rate (one- to two-month) Three-month interbank loan rate
Japan	Discount rate	Interbank call money rate	Certificate of deposit rate (three-month) Bill discount rate
United Kingdom	No posted rate	Overnight interbank rate	Bank of England minimum dealing rate (Band 1 bills) Commercial bank base lending rate Three-month interbank loan rate
Canada	Bank Rate	Money market financing rate	Three-month Treasury bill tender rate Ninety-day prime corporate paper rate
Switzerland†	Discount rate Lombard rate	Call money rate	Three-month Euro-franc deposit rate

Note: Each central bank's primary interest rate objective appears in boldface type.

†The Swiss National Bank does not employ interest rate operating objectives.

Banks have considerable leeway in managing their reserve positions because the reserve maintenance period is a full month in Japan. Nevertheless, changes in the reserve progress ratio clearly convey the BOJ intentions concerning future interest rates and, as a result, usually lead to a quick response in overnight interest rates.

The evolution of BOJ policy over the past decade reflects a movement towards procedures long followed by the Federal Reserve System. Indeed, the two central bank implementation strategies appear quite similar in their basic characteristics—an overnight interbank rate operating objective, the use of market operations and discretionary central bank lending facilities as policy instruments, and a focus on reserve management over a maintenance period.

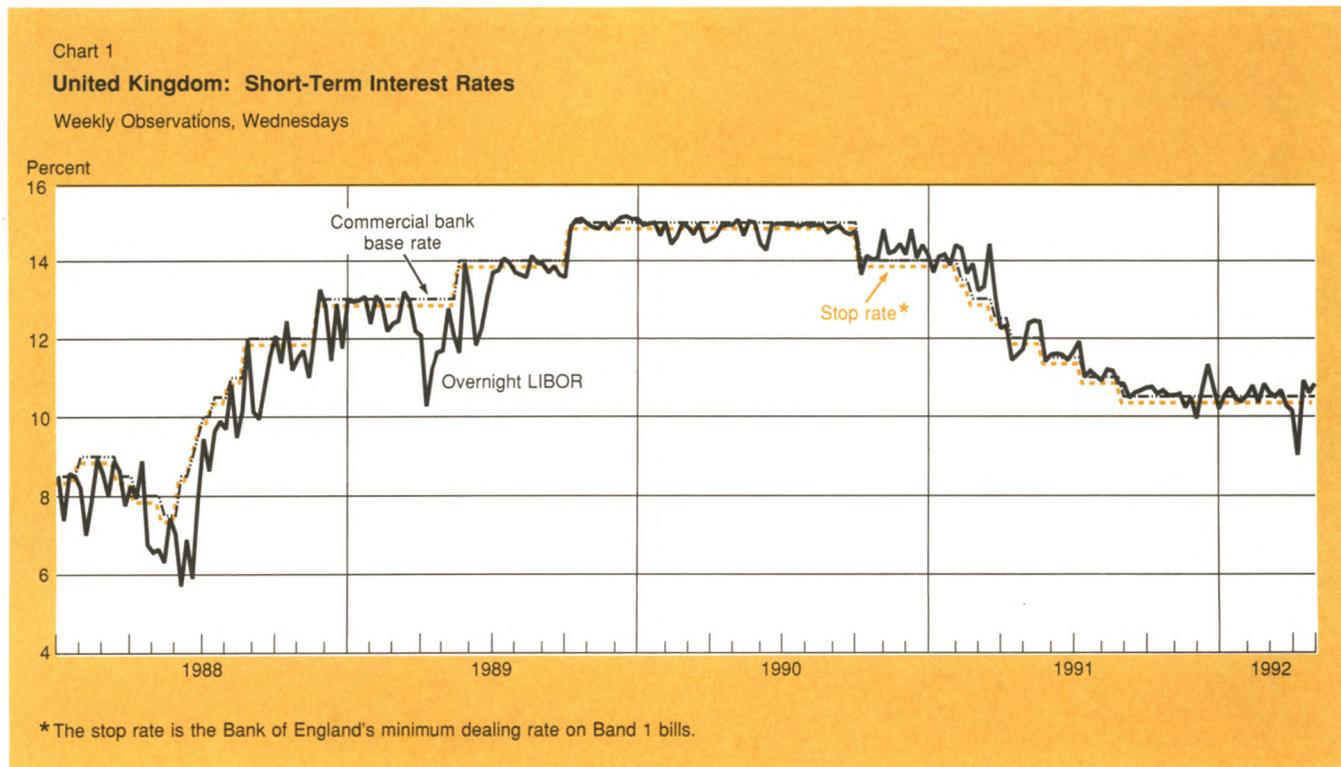
Still, important differences remain between the operating strategies of the Bank of Japan and the Federal Reserve. While the Federal Reserve conducts most of its daily operations in the repurchase market for government securities, the BOJ relies on a variety of private market instruments, including commercial bills, commercial paper, and certificates of deposit. In part, the BOJ's reserve management activities reflect the limited development of a single short-term government securi-

ties market in Japan. However, the BOJ has also employed operations in different instruments to exert direct influence on money market interest rates. Up until 1988 interbank and other open markets were not fully integrated, and the BOJ intervened actively in longer term money markets, primarily to influence the three-month certificate of deposit rate.

Following a period in 1987 and 1988 in which open market rates moved well above comparable rates in the interbank market, the BOJ implemented a series of reforms to facilitate arbitrage across short-term money markets.¹² Since that time, the BOJ has generally limited its efforts to influence interest rates in the interbank market to instruments of seven days' maturity or less. Market operations in longer term money market instruments are now primarily designed to offset seasonal fluctuations in reserve demand.

The administration of discount window lending also differs considerably in the two countries. In the United States, banks initiate the decision to borrow at the Federal Reserve's discount window, and borrowing is

¹²For a detailed discussion of money market reforms implemented since 1988, see *Japan's Short-Term Money Market and Issues*, Ministry of Finance and Bank of Japan, Money Market Study Group, August 1991.



rations through a set of administrative guidelines. In Japan, the BOJ decides on the level of bank borrowing and the length of loans (a factor that determines the effective cost of a loan). In administering discount window lending, the BOJ actively manages loan provision on a daily basis to respond to intraday fluctuations in reserve positions. The BOJ is unique among the central banks surveyed in employing lending as a discretionary instrument of daily reserve management.

The institutional environment in which the Swiss National Bank (SNB) operates has undergone considerable change in recent years. From 1980 through 1988 the SNB guided its policy largely with short-term bank reserve targets. Although interbank interest rates fluctuated widely on a daily basis, the SNB was reasonably successful in achieving its primary policy objective of maintaining low rates of inflation.¹³

In 1988, the combined effects of implementing an electronic payment system for the settlement of interbank cash balances (1987) and introducing new liqui-

dity rules (January 1988) led to a sharp decline in bank reserve demand (Chart 3).¹⁴ The difficulties faced by the SNB in predicting the size of this decline led to an unwanted expansionary monetary policy in early 1988. In response, the SNB shifted its operating objectives away from reserves toward short-term interest rates and exchange rates.¹⁵ Although the SNB has gradually moved back towards an implementation strategy based on operational targets for bank reserves, it has continued to emphasize interest rates in its daily operating procedures.

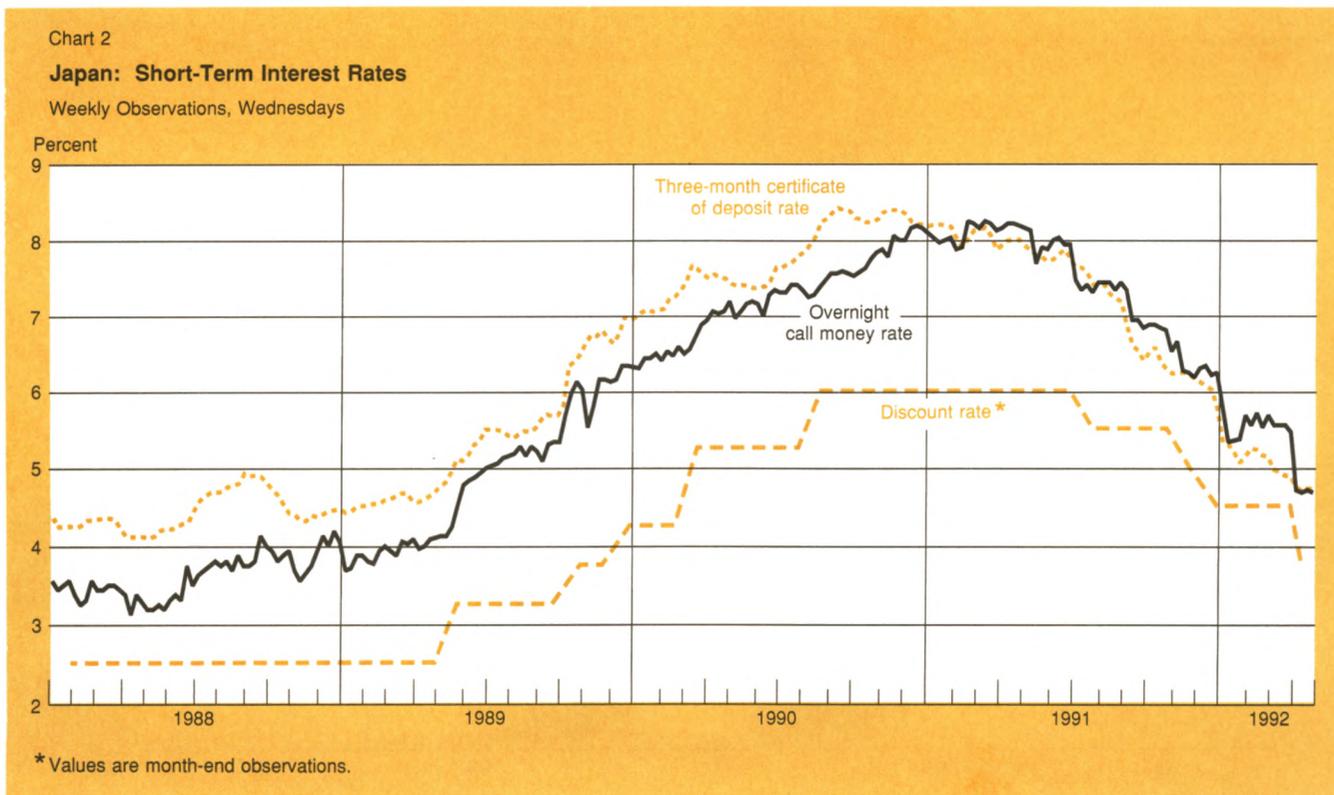
Each quarter the SNB signals its short-term policy intentions by announcing a forecast of the level of the monetary base in the subsequent quarter.¹⁶ Incorporo-

¹³See Ben Bernanke and Frederic Mishkin, "Central Bank Behavior and the Strategy of Monetary Policy: Observations from Six Industrial Countries," National Bureau of Economic Research, Working Paper no. 4082, May 1992, for a recent assessment of Swiss monetary policy over the past two decades.

¹⁴The new liquidity rules lowered required reserves and shifted the maintenance period from the end of the month to a month average.

¹⁵See Organization for Economic Cooperation and Development, *OECD Economic Survey-Switzerland* (Paris, 1989), for a discussion of Swiss monetary policy following these institutional changes.

¹⁶The forecasts are designed to be consistent with medium-run growth targets for the monetary base. Since 1990, these medium-run targets have been defined as annual growth rates to be achieved over a period of three to five years. The targets thus give the SNB considerable flexibility in determining its quarterly forecasts.



rated in this forecast is an unannounced operational target for the level of bank reserves held at the SNB. Although this target serves as a guide to policy operations over each month and each quarter, authorities have considerable discretion in deciding on their day-to-day activities. In implementing daily policy, the Bank largely seeks to smooth fluctuations in overnight inter-bank rates. Nonetheless, the interest rate policy of the SNB differs significantly from the policies of the other central banks under review. No operational targets are set for the level of interest rates, and the SNB does not employ interest rates to signal its stance to market participants.

The institutional changes that took place in Switzerland in the late 1980s have not led to substantial changes in the implementation procedures employed by the SNB. As before, market operations are generally conducted once each morning through foreign currency operations. These transactions, in the form of U.S. dollar-Swiss franc swaps, are conducted at rates close to those prevailing in Euromarkets and extend up to one year in maturity.

Earlier SNB restrictions, which placed limits on end-of-month Lombard lending and required banks to give advance notification of their credit needs, were removed when reserve requirements were reduced in 1988.¹⁷

Nevertheless, in 1989 the Bank floated the Lombard rate 200 basis points above market rates, a move that has substantially limited recourse to this facility.

In Germany, interest rates on security repurchase agreements of one- to two-month maturities are the primary operating objective of the Bundesbank.¹⁸ These rates are determined at periodic tenders typically conducted once a week. The Bundesbank normally determines the aggregate value of repurchase agreements offered at a tender by assessing market demand for reserves, and it chooses the best prices available. On occasion, it will fix the price (interest rate) at a tender to send a clear signal of its policy intentions to markets.¹⁹

Of the central banks considered, the Bundesbank is probably the least active in its daily reserve management activities. Repurchase agreement tenders generally provide the liquidity needed each day. Occasional

Footnote 17 continued
consequently soared at this time. With access to Lombard lending limited by these restrictions, short-term interest rates often rose very steeply at month's end.

¹⁸For a recent discussion of Bundesbank operating procedures, see Andre Bartholomae, "Some Operational and Instrumental Aspects of Monetary Targeting in Germany," Deutsche Bundesbank, unpublished paper, 1991.

¹⁹For example, the Bundesbank employed "volume tenders" in which it set interest rates for several months following the October 1987 stock market crash.

¹⁷Before January 1988, banks' reserve requirements were monitored only on the last day of a month. Banks' demand for reserves



“supportive” operations are undertaken to influence the day-to-day money rate through a number of reversible fine-tuning measures. Short-term interest rate smoothing, however, is largely obtained through means other than market operations, a system that reflects the limited development of domestic money markets in Germany. Specifically, official rate facilities on Lombard loans and the Bundesbank’s Treasury bill selling rate bound the range within which money market rates can fluctuate (Chart 4). In addition, high reserve requirement ratios and long (one-month) maintenance periods provide banks with considerable flexibility to arbitrage away transitory shocks to their reserve positions.

For the Bank of Canada (BOC), the three-month Treasury bill tender rate is the primary operating objective. The BOC participates in the weekly auction and buys and sells bills in the market from time to time, both on an outright and on a buy-back basis. But the BOC implements policy mainly through daily transfers of government demand deposits between the BOC and private banks.²⁰ These transfers are decided late in the day, by which time the BOC has information on government transactions and other payment items that might affect bank reserves. Thus, the BOC is able to deter-

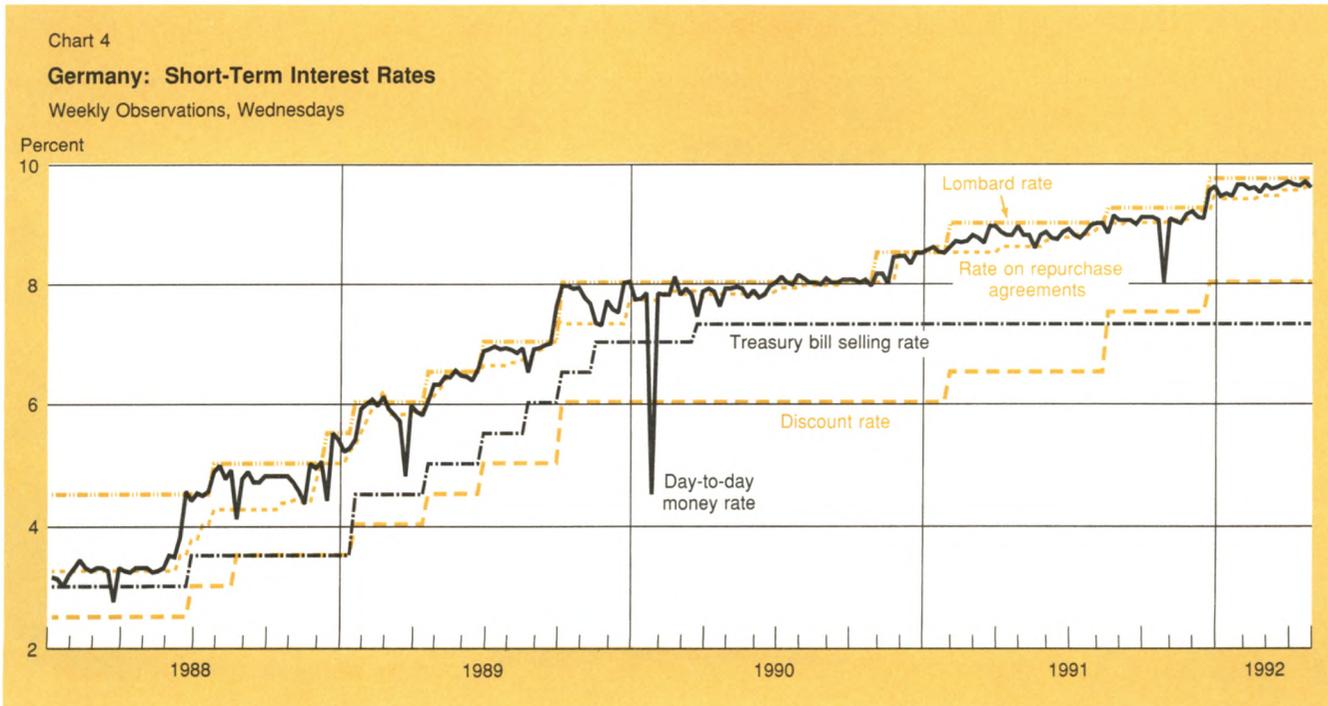
mine end-of-day reserve positions with unusual precision, particularly because these “drawdowns” or “redeposits” of government balances occur too late for banks to make further adjustments to their balance sheets. These transfers have a direct effect on overnight rates in the call and interbank markets. Daily reserve management activities are geared, however, toward maintaining market conditions consistent with the BOC’s weekly Treasury bill rate objective (Chart 5).

Key instruments of reserve management

Intervention tools vary widely across the central banks surveyed. In part, these instruments reflect the differing financial environments facing authorities in the six countries. The choice of instruments is, however, also related to specific objectives of reserve management and the means chosen by the authorities to signal their policy intentions to financial market participants. A summary of the market operations employed by the six central banks is presented in Table 2.

The U.S. Federal Reserve operates mostly in the secondary market for government securities. The prototypical open market operation, the outright purchase or sale of government securities in the secondary market, has long been the major instrument for providing permanent bank reserves in the United States. The breadth and depth of this market allow the Federal Reserve to add or drain large amounts of reserves

²⁰A detailed description of these operations is found in Kevin Clinton, “Bank of Canada Cash Management: The Main Technique for Implementing Monetary Policy,” *Bank of Canada Review*, January 1991, pp. 3-25.



without significantly distorting yield structures.

Although outright purchases of securities provide the primary source of secular reserve creation, the Federal Reserve typically conducts less than ten outright purchases and sales in the market each year.²¹ On a daily

basis, policy is implemented primarily through repurchase agreements (which add reserves) or matched sale-purchase agreements (which drain reserves). These

Footnote 21 continued
orders of foreign official accounts when these are consistent with reserve objectives.

²¹The Federal Reserve does take advantage of purchase or sale

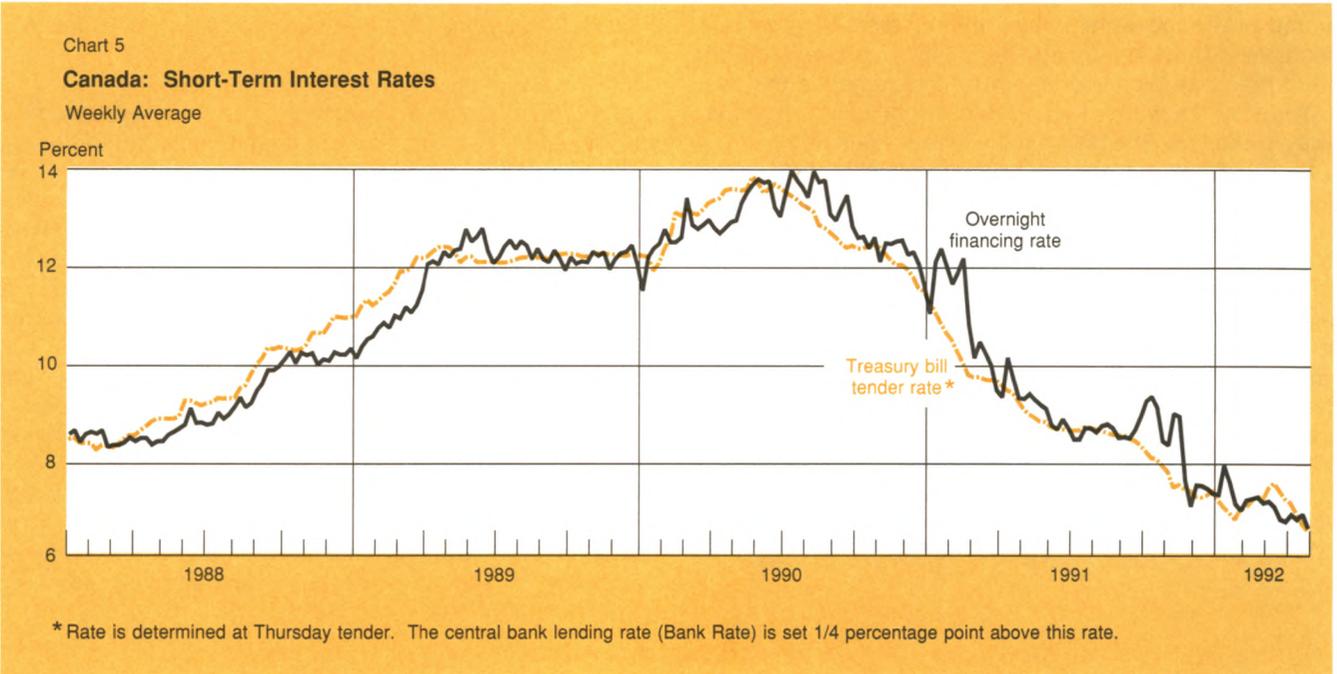


Table 2

Instruments for Reserve Management

Country	Primary Short-Term Reserve Management Tool		Other Operations	
	Activity	Instrument	Activity	Instrument
United States	Repurchase agreement Matched purchase and sale	Government security Government security	Purchase or sale	Government security
Germany	Repurchase agreement	Government security	Purchase or sale Foreign exchange	Government security Swap
Japan	Repurchase agreement Discount window lending	Commercial bills, government security —	Purchase or sale Repurchase agreement	Government security Commercial paper
United Kingdom	Purchase or sale	Commercial bills, government security	Repurchase agreement	Government security
Canada	Drawdown/redeposit	Government deposits	Purchase or sale or repurchase agreement	Government security
Switzerland	Foreign exchange	Swaps	Purchase or sale Drawdown/redeposit	Cantonal and bank bonds Government deposits

reversed security transactions involve lower transactions costs than outright transactions and provide a much more flexible instrument for the temporary adjustment of reserve positions. They are conducted through a large existing private market and may range up to fifteen days in maturity, although they usually mature in one or a few days. Although most of these transactions are designed to smooth temporary fluctuations in reserve markets, they are also employed by the Federal Reserve to implement a change in its policy stance.

In Japan, Canada, and the United Kingdom, as in the United States, outright purchases of securities are the main asset counterpart to the expansion in the monetary base over time. In Japan, the purchase of ten-year government bonds meets the secular demand for reserves but is not important in short-term reserve management. The BOJ conducts a variety of other operations to affect reserve positions on a temporary basis. Outright and reversed transactions in commercial bills and other money market instruments are designed to offset seasonal and other short-term fluctuations in reserve demand. Discount window lending activities remain the primary tool to smooth unanticipated day-to-day fluctuations in reserve positions.

Canadian monetary authorities also employ a variety of instruments to achieve policy objectives. The BOC's weekly participation in the three-month Treasury bill tender and its purchases of long-term government bonds at issue are the principal asset counterparts of money base increases in Canada. On a day-to-day basis, the BOC's drawdown/redeposit mechanism, described earlier, is its primary instrument of reserve management. The distribution of drawdowns and redeposits among clearing banks is determined at twice-monthly auctions where banks bid competitively for allocation ratios of government demand deposits. Supplementing this mechanism are other market operations, including outright purchases of short-term government securities and repurchase agreements. All open market operations are, however, routinely neutralized by the BOC as part of its drawdown/redeposit activities. As a result, open market operations are geared toward directly influencing particular money market interest rates.

In the United Kingdom, BOE assets are held primarily in the form of short-term eligible bills. The BOE routinely purchases bills to roll over its maturing portfolio and to achieve its short-term reserve management objectives.²²

²²Eligible bills include Treasury bills and commercial bills carrying two established names, usually those of a British bank and a discount house. The BOE will buy or sell bills of up to three months' maturity and does conduct some reversed security transactions.

As noted earlier, BOE operations are designed to relieve daily money market shortages through the outright purchase of bills from discount houses. Although it typically maintains a fixed stop rate on Band 1 bills, the BOE generally does not relieve the entire shortage through Band 1 bill purchases. It conducts bill operations in maturities as long as three months, designing these operations to exert influence on rates throughout the money market term structure. In addition, the BOE can refuse to relieve shortages through bill purchases if it is unhappy with the rates being offered. In these circumstances, the BOE can offer repurchase agreements on its own terms or invite discount houses to use their borrowing facilities at 2:30 p.m. at a rate set at the BOE's discretion.²³

Neither the Bundesbank nor the SNB holds significant portfolios of securities because well-developed short-term money markets do not exist outside the interbank market in Germany and Switzerland. In this environment, the Bundesbank uses central bank lending (mainly bills rediscounted) and bond repurchase operations as the major vehicles to augment the monetary base. The Bundesbank has established special provisions for reversed security transactions with banks; these transactions serve as the Bank's primary instrument of short-term reserve management. The Bundesbank conducts periodic tenders (usually weekly) for one- to two-month repurchase agreements. These repurchase agreements consist of a secular component and a component that makes temporary adjustments to reserve positions. Repurchase agreements have steadily increased as a share of Bundesbank assets since the mid-1980s, gradually supplanting discount window lending as the principal asset counterpart of the money base. Other instruments, such as foreign exchange swaps and the transfer of government deposits from the Bundesbank to banks, are employed when daily adjustments in reserve positions are deemed necessary.²⁴

In Switzerland, the domestic securities market is extremely narrow. An active interbank swap market for major foreign currencies does exist, however, and the SNB employs currency swaps as the primary instrument of both permanent and temporary reserve operations. Conducted daily in the form of U.S. dollar-Swiss franc swaps with a small number of banks, these operations currently provide over 90 percent of the reserve creation

²³The 2:30 borrowing differs from normal day-to-day late assistance in that the interest rates on loans are published and the amounts borrowed do not count against discount houses' borrowing facilities.

²⁴Foreign exchange swaps are usually employed to neutralize an expansion in reserves resulting from international capital inflows. Transfers of government deposits between the Bundesbank and private banks are generally used to offset temporary reserve shortages associated with tax payments.

Table 3

Central Bank Lending Facilities

	United States	Germany	Japan	United Kingdom	Canada	Switzerland
1) Credit available at below market rates	Yes	Yes	Yes	No	No	Yes
Access restricted by: Q = quotas, D = administrative discretion	Q,D	Q	Q,D	—	—	Q
Interest rate setting: P = posted rate D = set at discretion of central bank	P	P	P,D [†]			P
2) Other credit sources available	No	Yes	No	Yes	Yes	Yes
Access restricted by: Q = quotas, D = administrative discretion O = other	—	Q [‡]		D	O [§]	Q [‡]
Interest rate setting: F = Floats in relation to market rate P = Posted rate D = set at discretion of central bank	—	P		D	F	F

[†]The Bank of Japan provides credit at the official discount rate. The Bank can add or call loans at will, however, and interest charged is calculated on the period of the loan plus one day. The effective cost of borrowing thus rises as the maturity of a loan is reduced.

[‡]Generally nonbinding.

[§]Bank of Canada advances are provided only for an end-of-averaging-period reserve deficiency or for overdrafts to meet a deficiency of clearing balances.

for Swiss banks. Since the dollars purchased by the SNB are covered forward, these transactions are equivalent to temporary operations in domestic securities. Because swaps are settled with a two-day lag, the SNB supplements these activities with same-day shifts of government deposits between its books and those of private banks.

Central bank credit facilities

The monetary authorities in all six countries considered offer banks a facility for obtaining credit. The market operations described above, however, have largely replaced central bank credit as the major tool for short-term reserve management in these countries. At present, most central bank lending facilities are designed to meet unforeseen and temporary end-of-day liquidity shortages or to provide assistance for institutions in times of stress. Nonetheless, the role of lending in the six central banks' implementation strategies varies. A summary of key characteristics of central bank lending facilities is presented in Table 3.

In four of the countries considered (Germany, Japan, the United States, and Switzerland), a collateralized

Table 4

Central Bank Lending as a Share of Central Bank Assets

(Annual Average of End-of-Month Observations)

	1985	1988	1991
United States	0.7	0.9	0.1
Japan	8.4	13.6	12.1
Germany	29.4	22.5	25.0
United Kingdom	1.8	1.8	3.0
Canada	7.4	2.2	2.0
Switzerland	9.9	0.9	1.2

credit facility is made available to banks at below-market interest rates. In Germany, Japan, and Switzerland, discount window lending, determined by quotas, provides an ongoing source of subsidized funds to meet a portion of secular reserve demand. The Bundesbank's facility is particularly large, currently accounting for about one-quarter of total central bank assets (Table 4). The large volume of subsidized discount window lend-

ing in Germany is designed, in part, to offset the costs to banks of high levels of required reserves.

Because German and Swiss banks fully use their quotas most of the time, discount window lending does not accommodate banks' unanticipated reserve needs in these countries. Both the Bundesbank and the SNB provide an additional line of credit at a penal rate to meet unexpected short-term liquidity needs. These facilities, called Lombard loans, effectively cap interest rate increases for short periods.²⁵ Swiss Lombard rates float daily at two percentage points above the average of the previous two days' interbank call money rates. German Lombard rates, in contrast, are fixed by the Bundesbank and in recent years have generally remained no more than 100 basis points above the repurchase agreement rate.

Lombard lending by the Bundesbank has soared for brief periods on several occasions in recent years. These surges in lending reflect, in addition to market-related liquidity developments, a strategy for tightening policy: money market rates are increased first; once market pressures build, these increases are validated in official rates.²⁶

In the other countries reviewed, the central bank has greater freedom to decide the terms on which lending is made available. In the United States, the Federal Reserve generally sets the discount rate below short-term market rates and rations access through administrative guidelines. Lending is designed to provide for unexpected liquidity needs, particularly at the end of reserve maintenance periods. For institutions that use the window frequently, however, future access is reduced, raising the implicit cost of borrowing. Furthermore, worries about potential adverse market reactions to discount window borrowing have developed in recent years as bank failures and earnings stress have risen. The use of the discount window has, consequently, been relatively limited.

Of the countries under review, only Japan makes lending an important instrument in short-term reserve management. Discount window lending makes up a substantial share of BOJ assets (currently over 10 percent), and the Bank actively manages its lending policies on a daily basis. The BOJ can either increase or call discount window loans at its discretion, and typ-

ically uses this instrument to smooth daily fluctuations in bank reserve positions. In addition, with its "plus-one-day" pricing of loans, the BOJ's effective lending rate exceeds the discount rate and can become penal for very short-term loans.²⁷ Discount window lending thus gives the BOJ a highly flexible instrument for influencing daily conditions in interbank markets.

England's central bank also has discretion in providing credit. In its transactions with discount houses the BOE can decide whether to provide credit and what the price of that credit will be. Funds are made available for "late assistance" to meet interbank clearing needs, but the terms of this borrowing are determined by the BOE and are not disclosed publicly. Generally funds are lent at or above market rates, in a way that permits the discount house to predict the cost accurately. As noted earlier, the BOE occasionally uses its lending policies to signal changes in its policy stance, allowing discount houses to borrow at a publicly announced rate after it has refrained from accommodating reserve demand earlier in the day.

The central bank lending rate of the BOC (the Bank Rate) is adjusted weekly and set ¼ percentage point above the previous Thursday's three-month Treasury bill tender. Until recently, banks were guaranteed recourse to this facility only once during a reserve maintenance period. The cost and availability of further borrowing were subject to the discretion of the BOC. Funds were provided, but at a rising cost for repeated use.

These restrictions on access to BOC credit were removed in November 1991. Banks can now borrow freely at the Bank Rate to cover overnight overdrafts or reserve deficiencies, a change seen as a necessary prelude to the phased elimination of reserve requirements that began in June 1992.²⁸

In addition to providing credit to meet short-term liquidity needs, most countries also offer a facility to absorb excess reserves so that short-term downward pressures on interest rates will be limited. In Japan, the BOJ has the option of withdrawing outstanding loans at will during banking hours. The Bundesbank's Treasury bill selling rate functions as an effective floor on call money rates in Germany, and in Canada, matched or outright sales of Treasury bills serve a similar purpose. In the United Kingdom, discount houses can offer to

²⁵Both central banks impose quotas on access to Lombard facilities, but the quotas rarely impose an effective constraint on borrowing.

²⁶The maturity of Lombard loans is determined by the remaining maturity of securities rediscounted. Generally the Bundesbank grants such loans with the expectation that borrowing should be repaid the following day. Nonetheless, there exists some incentive to borrow heavily through Lombard loans when repurchase interest rates are expected to increase above Lombard rates at the subsequent weekly repurchase agreement tender.

²⁷The interest charged on discount window loans is calculated on the period of the loan (using the official discount rate) plus one day. Thus, the effective rate of interest rises as the BOJ reduces the length of time for which it is willing to lend.

²⁸Under the regulations in place since June 1992, a bank with a cumulative deficiency at the end of a reserve maintenance period may pay a fee, charged at the Bank Rate, in lieu of taking an end-of-period advance. In practice, banks have adopted the fee option, so that end-of-period advances no longer appear on the BOC balance sheet.

purchase securities from the BOE in the afternoon if surpluses emerge.

Reserve requirements

Like central bank lending, required reserve ratios have diminished sharply in recent years. Required reserve ratios in all these countries stand well below their levels of the early 1980s; in some countries, requirements no longer effectively constrain bank behavior. In addition, the once common practice of altering reserve requirements to adjust the monetary policy stance has largely been discontinued.

Nonetheless, most central banks still view reserve requirements as an important part of their implementation procedures. Requirements are seen as strengthening and stabilizing the short-run demand for reserves, thus enhancing central bank control over interest rates. A summary of important characteristics of reserve requirement regulations is presented in Table 5.

Required reserves in all six countries examined are determined by ratios linked to categories of bank liabilities.²⁹ In the United States and, until recently, in Canada, requirements have primarily been imposed on transactions deposits, a practice that reflects earlier attempts to use reserve requirements to facilitate the

targeting of M1 through operating objectives for bank reserves. Elsewhere, requirements are more broadly based. In the United Kingdom, Japan, and Switzerland, requirements are roughly similar across types of eligible liabilities.

In all these countries, the period in which liabilities are incurred (the accounting period) ends before the period in which required reserves are held (the maintenance period). These lagged or semilagged accounting mechanisms are operationally convenient and, where reserve requirements are binding, provide central banks with a relatively good estimate of reserve demand within a maintenance period. For all six central banks except the BOE, reserve projections at maintenance period horizons are a key element in determining policy operations.³⁰

Although lagged reserve requirements predetermine the demand for reserves, they can also severely limit the interest sensitivity of reserve demand, particularly at the end of maintenance periods. Unforeseen shifts in either the demand for or the supply of reserves have often led to large fluctuations in overnight rates at the end of a maintenance period. To provide greater flexibility in reserve management, particularly in the early

²⁹In June 1992, Canada removed required reserve ratios as part of its phased elimination of reserve requirements.

³⁰As noted earlier, clearing banks in the United Kingdom provide the BOE with an estimate of the operational balances they wish to hold each day. The BOE uses these estimates as a guide in determining daily security operations.

Table 5

Reserve Requirement Regulations

	United States	Japan	Germany	United Kingdom	Canada [†]	Switzerland
Length of reserve accounting period	14 days	1 month	1 month	6 months	1 month	3 months
Length of maintenance period	14 days	1 month	1 month	6 months	15 days	1 month
Interval from end of accounting period to end of maintenance period	2 days	15 days	15 days	180 days	30/45 days	50 days
Highest reserve ratio for demand deposits	10	1.3	12.1	0.5	10	2.5 [‡]
Highest reserve ratio for other deposits	0	1.2	4.95	0.5	3	0.5
Averaging provisions	Yes	Yes	Yes	No	Yes	Yes
Carryover provisions	Yes	No	No	No	No	No
Vault cash satisfies requirement	Yes	No	Up to 50 percent	No	Yes	Yes
Penalty for reserve deficiency (percentage above central bank lending rate)	2	3-5	3	0	0	0
Interest paid on reserves	No	No	No	No	No	No

[†]As of June 1992, reserve ratios were eliminated in Canada as part of a planned phaseout of required reserves. Currently, required reserves are set at a fixed level for each bank; these levels will decline to zero in 1994. The maintenance period has been extended to one month. Banks incurring a reserve deficiency pay a penalty calculated at the Bank Rate.

[‡]Includes time deposits with a term to maturity of up to three months.

stages of a maintenance period, nearly all of these central banks allow required reserves to be met by average reserve holdings over a maintenance period.³¹ Reserve averaging gives value to banks' excess reserve positions by enabling the banks to maintain offsetting deficiencies during other days within the period. As a result, banks have an incentive to arbitrage away the interest rate effects of temporary reserve shocks. Through this mechanism, required deposits at the central bank can function as an important aid to central banks in promoting interest rate stability.³²

The extent to which bank reserves actually serve as a buffer stock is related to the level of reserve balances held at the central bank. Because overnight overdrafts are restricted in Switzerland, Japan, and Germany, and penalized in the United States, Canada, and the United Kingdom, the cost of running reserve deficiencies rises substantially when average reserve balances are low. In the United States and Canada particularly, concerns have arisen about the banking system's reduced ability to absorb reserve imbalances at low reserve levels. Reserve deposits held at the central banks of both countries have fallen sharply in recent years as a result of a secular increase in demand for vault cash to satisfy reserve requirements and, in the United States, a reduction in reserve requirements (Table 6).³³

³¹Reserve averaging extends over one month in Germany, Japan, and Switzerland, and over two weeks in the United States. In Canada, reserve averaging extended over two half-month periods until June 1992, when it was extended to one month.

³²A provision for the carryover of a portion of reserve surpluses (or shortages) allows for some additional flexibility in managing reserves across maintenance periods in the United States.

³³In both countries, holdings of vault cash over previous maintenance periods satisfy current reserve requirements. Increased demand for vault cash thus lowers required deposits even when reserve requirements are unchanged.

Reserve management strategy in the United States traditionally focused on the two-week average reserve levels held by banks over a maintenance period. Since the cut in reserve requirements in December 1990, however, the open market desk has experienced increasing conflict between this strategy and daily federal funds market conditions. Many banks have become less tolerant of excess reserve positions early in the maintenance period, a reaction that has often led to significant late-day downward pressure in federal funds rates. At the same time, the funds rate in the morning can be a misleading guide to reserve market conditions because banks sometimes hold on to reserves early in the day to guard against inadvertent overdrafts. When faced with these conflicts in conducting its operations, the Desk has chosen to pay greater attention to daily trading conditions in the federal funds markets to prevent misleading signals from being sent to markets.³⁴

In two countries, the United Kingdom and Switzerland, reserve requirements place no effective constraint on bank behavior. In the United Kingdom, banks must place small nonliquid deposits at the Bank of England for six months at a time. This requirement provides the BOE with operating income but is not intended to play a role in the BOE's monetary policy operating strategy.

Since effective requirements are lacking, demand for reserves (operational deposits) is determined entirely by daily clearing needs. In this environment, the BOE has developed an operating strategy involving a number of daily market operations to respond to interest fluctuations and other intraday developments. In addition, banks' uncertainty over their end-of-day clearing needs is eased by the availability of BOE late-day lending facilities to discount houses. BOE policies stabilize reserve demand and encourage banks to economize on reserve holdings (Table 6).

Since the decline in reserve requirements in Switzerland in 1988, the SNB has placed greater emphasis on smoothing daily fluctuations in interest rates through its daily activities. In addition, central bank lending facilities in the form of Lombard loans are available to banks without restriction to meet unexpected liquidity shortfalls. Nonetheless, the SNB is much less accommodative than other central banks in its approach to offsetting temporary reserve disturbances, prohibiting overnight overdrafts and setting a large spread (200 basis points) between market and Lombard lending rates. In this environment, Swiss banks have chosen to hold substantial reserve deposits in excess of those required by regulations.

Table 6
Reserve Deposits Held at Central Banks as a Share of Total Bank Liabilities
 (Year Average of End-Month Observations, in Percent)

	1980	1985	1988	1991
United States	1.6	0.8	1.0	0.6
Japan	1.6	1.1	1.0	1.0
Germany	7.2	5.6	5.5	5.5
Switzerland	4.0	3.1	1.7	0.7
United Kingdom	0.3 [†]	0.1	0.1	0.1
Canada	3.9	1.4	0.8	0.4

[†]Figure is for year-end 1981.

³⁴See "Monetary Policy and Open Market Operations during 1991" for further details.

Relevance for U.S. monetary policy operations

The varied institutional and political environments facing these central banks make it difficult to assess whether practices followed in any one country would be useful to another. Nonetheless, the comparison of operating procedures presented above does provide interesting insights, some of which may be relevant to U.S. policy makers.

The similarities in operating strategy among these central banks dominate any existing differences. All six banks currently gear their daily policies toward influencing money market interest rates; all except the SNB use short-term interest rates as operating objectives to guide their reserve management activities.

Furthermore, none of the banks employing interest rate objectives aims to control interest rates rigidly. Although the tolerance for interest rate divergences from objectives differs across banks, authorities generally allow market forces to determine interest rates and intervene only to limit short-term fluctuations or to alter rates when changing economic conditions warrant.

Since interest rate operating objectives are transmitted to economic activity largely through their linkage to longer term interest rates and other financial prices, central bank intervention strategies are designed to communicate information about current and future policy that strengthens this transmission. In most cases, interest rate objectives are changed in small steps to stabilize expectations across the term structure. In some countries, central banks intervene in assets of varying maturities to influence the money market term structure directly.

In addition, these central banks actively seek to limit the daily volatility of targeted interest rates in order to reduce uncertainty about the stance of policy. In some countries (Germany, the United Kingdom) intervention rates under the tight control of the central bank send a precise signal of central bank intentions. Elsewhere, although some interpretation of money market interest rate movements is necessary, the central banks stabilize their targeted rates sufficiently so that the basic thrust of their policies is clear.

Over the past decade, foreign central banks have increased the role of open market operations as a reserve management instrument, moving toward an approach long followed by the Federal Reserve in the United States. At present, each of the central banks reviewed employs some form of open market operation as an instrument for controlling reserves. Some foreign central banks conduct their operations through special arrangements with banks or other counterparties. But where these arrangements exist, they generally reflect the limited development of secondary security markets.

More meaningful differences among the six central

banks emerge in the functioning of their credit facilities. To be sure, the monetary authorities in all six countries extend credit to banks with temporary clearing imbalances and to banks in financial stress. But the foreign central banks differ from the Federal Reserve in their tendency to eliminate administrative controls on credit allocation.

In three countries—Germany, Switzerland, and Canada—banks are able to access an open-ended line of credit for temporary liquidity needs at their discretion. Borrowing rates are set above the prevailing market rates and, in Switzerland and Canada, rates adjust automatically to market rates. In Japan and the United Kingdom, access to the discount window remains at the discretion of the central bank. In practice, however, discount houses in the United Kingdom can count on the central bank to meet temporary liquidity needs at rates close to the Bank of England's prevailing intervention rates.

These facilities provide foreign central banks with a flexible instrument to contain interest rate pressures, particularly late in a trading day when other intervention instruments are unavailable. In addition, each of these foreign central banks offers a facility to absorb late-day reserve excesses and thereby moderate downward interest rate pressures.

The Federal Reserve's discount mechanism has considerably less value as a device for smoothing interest rates. U.S. discount window lending is provided at subsidized rates and in accordance with administrative discretion. Partly because of this subsidy, the Fed discourages frequent use of the window. In recent years, banks have shied away from approaching the window, fearing that the markets will perceive them to be dependent on discount window support. The unwillingness of banks to borrow at the discount window also reduces the ability of banks to shed excess reserves through their repayment of outstanding credit.

In an environment of high, binding reserve requirements, the methods employed by central banks to allocate credit might not significantly affect their ability to limit interest rate variability. With sufficient averaging provisions in place, banks can be expected to arbitrage away the interest rate effects of transitory shocks to their reserve positions within a maintenance period. Indeed, recourse to Lombard loans in Germany, the country that has the highest reserve requirements and longest maintenance period of the six countries considered, is quite small under normal market conditions.³⁵

³⁵The Bundesbank estimates normal Lombard lending at DM 0.5 billion, a level representing less than 0.2 percent of total central bank assets. As noted earlier, Lombard lending has risen sharply during short periods in which the Bundesbank allows repurchase agreement rates to push up against Lombard rates before it tightens policy.

Box: Overnight Interest Rate Variability

The review of central bank operating procedures presented in the text suggests that foreign central banks, in contrast to the Federal Reserve, employ their reserve management instruments, particularly lending facilities, in a way that places strict limits on overnight interest rate variability. In assessing the relevance of such facilities for the Federal Reserve, it is useful to compare the variability of interest rates in the United States and the five other countries considered.

Table A1 presents two measures of overnight interest rate variability for the 1988-91 period. The first computes the average absolute deviation of overnight rates around a thirty-day centered moving average. The second measures the average absolute deviation of overnight rates around a mean adjusted for changes in policy stance. This second measure is constructed by identifying dates on which each central bank's interest rate operating objectives changed.[†] The mean level of overnight rates under a particular policy objective is used to represent a central bank's policy stance, and variability is computed around this changing mean.

[†]For the United States, dates on which the expected trading range for the federal funds rate changed were obtained from the Open Market Desk of the New York Federal Reserve Bank. Figures for 1990 and 1991 appear in "Monetary Policy Operations during 1991," this *Quarterly Review*, Spring 1992; and "Monetary Policy Operations during 1990," this *Quarterly Review*, Spring 1991. For countries with well-defined intervention rates that signal the monetary policy stance—Canada, the United Kingdom, and Germany—movements in these rates were used to identify policy changes.

In principle, this measure should provide a more accurate indication of how interest rates diverge from a central bank's objective. However, changes in policy stance cannot be identified precisely. Moreover, although most central banks try to smooth overnight rates, significant differences in the degree of their tolerance for overnight rate volatility are not accounted for in this analysis.

The two measures of interest rate variability present a very similar picture. Despite the limited instruments available to the Federal Reserve to offset late-day reserve market imbalances, a comparison with other countries indicates that U.S. overnight interest rate variability is relatively low. The federal funds rate has diverged, on average, about 14 basis points daily from mean levels over 1988-91, a deviation less than that in any other country except Japan. Note, however, that these measures do not indicate the degree of intraday interest rate variability, an issue of some concern to U.S. policy makers.

The evidence also points to a relationship between required reserves and overnight interest rate variability. In the United Kingdom and Switzerland, the two countries operating with low, nonbinding reserve requirements, overnight rates are much more volatile than the

[†] continued

For Japan, discrete changes in the overnight call rate were inferred from the actual movements in rates. Since the SNB does not employ interest rate operating objectives, this measure of rate variability was not computed for Switzerland.

Table A1

Overnight Interest Rate Variability

(Mean Absolute Deviation of Daily Observations, in Basis Points)

	Deviations from Thirty-Day Centered Moving Average					Deviations from Mean Adjusted for Changes in Policy Stance [†]				
	1988	1989	1990	1991	Average 1988-91	1988	1989	1990	1991	Average 1988-91
United States	12.3	11.9	12.3	21.1	14.4	13.0	11.8	12.8	18.5	14.0
Japan	8.7	8.5	7.1	8.4	8.2	12.5	8.5	7.4	5.8	8.6
Germany	15.7	18.2	13.6	13.4	15.2	15.8	17.4	14.5	14.8	15.6
United Kingdom	50.4	32.9	14.8	25.3	30.9	52.5	39.7	14.2	25.0	32.9
Canada	9.7	13.4	21.3	28.7	18.3	11.0	15.7	21.3	28.8	19.2
Switzerland	—	33.8	34.8	37.8	35.5	—	—	—	—	—

Note: Overnight interest rates are the effective overnight federal funds rate (the United States), overnight call rate (Japan), day-to-day money rate (Germany), London interbank offer rate (the United Kingdom), overnight money market financing rate (Canada), and overnight call rate (Switzerland).

[†]Values are average absolute deviations of overnight rates from a mean that changes with estimated shifts in central bank interest rate operating objectives.

Box: Overnight Interest Rate Variability (Continued)

Table A2

The Transmission of Overnight Rate Variability to the Variability of Three-Month Money Market Rates

(Based on Monthly Observations, 1988-91)

$$MAD^M_t = C + B MAD^O_t + \mu_t$$

	C	B	\bar{R}^2	DW
United States	0.12 (4.79)	-0.16 (-0.95)	-0.01	2.23
Japan	0.04 (0.90)	0.22 (0.41)	-0.01	2.34
Germany	0.05 (1.46)	0.25 (1.28)	-0.02	1.92
United Kingdom	0.14 (7.14)	-0.01 (-.14)	-0.01	1.67
Canada	0.05 (3.71)	0.04 (0.58)	0.10	1.90
Switzerland†	-0.13 (-0.79)	0.70* (2.07)	0.23	2.32

Note: Equation is estimated using instrumental variables. Instruments include lagged MAD^O and lagged levels of interbank interest rates. Overnight interest rates are those described in Table A1. Three-month money market rates are the three-month Treasury bill rate (the United States and Canada), Gensaki rate (Japan), three-month interbank loan rate (Germany, Switzerland) and the three-month Sterling interbank deposit rate (the United Kingdom).

†Sample covers June 1989-December 1991.

*Significant at 5 percent level.

rates elsewhere. In addition, in the United States and Canada, where reserve deposits held at the central bank have fallen in recent years, the decline in reserves has been accompanied by rising interest rate variability.

These findings support the view that central banks face greater difficulty in stabilizing interest rates around desired levels when reserve requirements are eased. Nevertheless, increased overnight interest rate volatility, per se, need not erode the effectiveness of monetary policy, particularly if fluctuations in overnight rates are transitory and do not reduce the ability of market participants to identify the authorities' policy intentions.

To assess whether overnight interest rate variability has influenced the monetary transmission mechanism, one must determine whether the overnight rate variability affects longer term market interest rates. Table A2 presents regression results estimating the effect of overnight rate variability (MAD^O) on the measured volatility of three-month money market rates (MAD^M).[‡] As the table shows, overnight rate variability is not systematically related to three-month money market rate divergences in the United States. Indeed, of the countries surveyed, only Switzerland has large and statistically significant coefficient estimates for transmission.

‡In Table A2 the volatility of interbank (MAD^O) and three-month money market rates (MAD^M) is measured as the absolute deviation of rates adjusted for changes in the monetary policy stance. For Switzerland, however, deviations around a thirty-day centered moving average are used. Note that the results are qualitatively unchanged by the choice of variability measure.

Table A3

Interest Rate Variability and the Transmission of Changes in Federal Funds Rate Objectives: 1988-91

$$\Delta R_t = C + (B_1 + B_2 MAD^O_{t-1})\Delta ff_t + \mu_t$$

	C	B ₁	B ₂	\bar{R}^2	DW
Response of three-month bill rates (ΔR_t)					
Day of federal funds objective change	-0.02 (-1.51)	0.22** (4.03)	0.06 (0.22)	.51	1.86
Five days following federal funds objective change	-0.38 (-1.39)	0.26* (2.42)	0.58 (1.31)	.40	2.25

*Significant at the 5 percent level

**Significant at the 1 percent level

Box: Overnight Interest Rate Variability (Continued)

Perhaps a more important issue is whether overnight rate variability influences the transmission of changes in central bank operating objectives to money market rates. To resolve this issue in the case of the United States, one can test whether the federal funds rate variability measure affects the response of three-month Treasury bill rates immediately after a change in the Open Market Desk's federal funds rate objective. In the regression

$$\Delta R_t = c + (b_1 + b_2 \text{MAD}_{t-1}^o) \Delta \text{ff}_t + \mu_t$$

ΔR_t is the change in the three-month Treasury bill rate; MAD_{t-1}^o is the average absolute deviation of the federal funds rate from the Desk's objective, measured over the preceding objective period; and Δff_t is the change in the Desk's federal funds objective.⁵ The coefficient estimate

⁵This analysis closely follows earlier work by Timothy Cook and Thomas Khan, "The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s," *Journal Of Monetary Economics*, vol. 24 (1989), pp. 331-51.

But in the United States, recent declines in reserve requirements, coupled with increased demand for vault cash, have sharply reduced reserve deposits at the Federal Reserve. In an environment where overnight overdrafts are costly, the ability of banks to take advantage of reserve averaging has become more limited as reserve deposits decline. These developments, coinciding with the deterioration in the functioning of the discount window, may have increased the sensitivity of the federal funds rate to reserve shocks.

The foreign central banks that have faced similar concerns about the effects of lower reserve requirements have tended to revise their procedures to allow for a more elastic late-day reserve supply. The BOE, operating for over a decade in an environment where banks are effectively free from reserve requirements, has developed a strategy combining the elastic provision of central bank credit for late-day reserve imbalances with frequent open market operations during the trading day. The SNB has placed greater emphasis on interest rate smoothing in daily operations since a reduction in reserve requirements in 1988. In addition, while maintaining a large spread between rates on its Lombard lending and overnight rates, the SNB has increased access to central bank lending facilities since the decline in required reserves. In Canada, restrictions on bank access to BOC credit have also recently been removed as part of the phased elimination of reserve requirements.

The example of other central banks, then, raises a question: Should the Federal Reserve consider revising

its operating procedures to adapt to lower reserve requirements? A procedural change that enabled the Federal Reserve to supply reserves more elastically outside of the time it conducts open market operations could conceivably help limit the variability of interest rates from objectives.

To resolve this issue, an assessment of federal funds rate variability and its effect on monetary policy transmission is essential. The accompanying box sheds some light on the issue by presenting evidence on actual interest rate variability. The interday fluctuations of the federal funds rate does appear to have risen following the decline in reserve requirements in 1990. However, U.S. federal funds variability remains low in comparison with the volatility observed in overnight rates in other countries. More important perhaps, the evidence indicates that increased federal funds rate variability, within the range observed, has not diminished the response of three-month money market rates to changes in interest rate objectives. Thus, these results suggest that the reduction in reserve requirements has not weakened the effectiveness of the Federal Reserve's policy transmission mechanism.

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Conclusion

Our analysis, while far from conclusive, provides insights that may be useful in assessing monetary policy operating procedures in the United States. Like the Federal Reserve in the United States, several foreign central banks have lowered their reserve requirements in recent years. Their experience indicates that interest-

rate-oriented monetary policies can be carried out in an environment of low, nonbinding reserve requirements. Central banks operating in such an environment have been able to achieve their interest rate objectives using reserve management techniques quite similar to those employed by the Federal Reserve System in the United States.

Foreign central banks have, however, seen the need to develop mechanisms that provide a highly elastic supply of reserves to restrict the intraday fluctuation of overnight interest rates. In most countries, the authorities have designed their central bank lending facilities, with rates set at or above current market interest rates,

to achieve this goal.

The empirical evidence presented in this article indicates that the recent decline in reserve requirements in the United States, combined with the increased reluctance of banks to approach the discount window, has been associated with greater variability in the federal funds rate. Nevertheless, the evidence also suggests that this rise in variability has not diminished the effectiveness of U.S. monetary policy operating procedures. Within its current range, the variability of the federal funds rate remains low and does not appear to have affected the linkage between federal funds and other money market rates.