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Chapter Title: A Comparative Perspective on Japanese Monetary Policy: Short-Ru Monetary Control and the Transmission Mechanism

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1 A Comparative Perspective on Japanese Monetary Policy: Short-Run Monetary Control and the Transmission Mechanism

Kazuo Ueda

Three major building blocks of the analysis of a country's monetary policy are the reaction function of the central bank, or the ultimate targets of policy; short-run monetary control; and the transmission mechanism. Japanese monetary policy has been unique in all three aspects. This paper analyzes the special features of the second and third of these building blocks of Japanese monetary policy, but not the first. That is, it discusses the daily monetary control of interest rates and the mechanism by which interest rate changes affect the real economy, but does not address the question of what causes a change in policy instruments.

In my analysis of short-run monetary control and the transmission mechanism, I try to relate the discussion, to a maximum extent, to current research on the same topics in the United States. A perspective relevant for both aspects is that Japanese monetary policy has been moving very rapidly over the past few years from old-fashioned direct control through moral suasion of interest rates and quantities of transactions to one with heavier reliance on the price mechanism in money and capital markets. In this sense, the present study is in line with previous studies on Japanese money and financial markets, such as Suzuki (1980), Feldman (1986), and Cargill and Royama (1988), but it adds to the literature by providing a more rigorous statistical analysis of the Japanese interest rate and money-supply data and by discussing more carefully institutional aspects of the Bank of Japan's short-run monetary control process.

The Federal Reserve (henceforth the Fed) has alternated between controlling the federal funds rate and bank reserves. The funds rate volatility was

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much higher during 1979–82—the period of bank reserve control. In either case, the Fed uses open-market operations to hit its target. Operations are "defensive" ones in which the Fed accommodates short-run temporary fluctuations in the demand for high-powered money, and "dynamic" ones directed toward changing the level of the target.[1]

Has the Bank of Japan (BOJ) controlled bank reserves? How stable is the call rate relative to the funds rate? How important are "defensive" and "dynamic" operations? What are the instruments available to the BOJ for controlling the call rate or bank reserves? These are the major questions I address in my comparative analysis of Japanese monetary control.

I argue that the BOJ, in its daily operations, has long targeted the call rate and other interbank rates. It has never targeted bank reserves in the sense of setting target growth ranges for reserves and reaching them within a short period of time such as a few months. I show this first by presenting evidence of the stability of interbank rates in Japan relative to the United States and then by pointing out the importance of "defensive" operations by the BOJ in stabilizing interbank rates.

An important consequence of interbank rate targeting in Japan is that the stock of high-powered money has been an endogenous variable. That is, the BOJ has been accommodating fluctuations in the demand for high-powered money at target levels of interbank rates.

Another feature of Japanese monetary policy is that for both "defensive" and "dynamic" operations the BOJ uses changes in lending at the discount window very extensively. That is, discount window lending is an important daily instrument for the BOJ. This differs from the role of borrowing from the Fed, which moves more or less passively in response to the requests of commercial banks. The difference results from the absence of large-scale open markets in Japan.

An important question discussed in the literature is whether the call rate has been at the correct level to clear the market for high-powered money. I do not offer a definitive answer. But I supply casual evidence pointing to the importance of more direct control, possibly through moral suasion, of interbank rates by the BOJ, at least for certain subperiods of the postwar period. I discuss in a related context the new operating procedure introduced in 1988, which has allowed less restricted movement of interest rates and funds.

In section 1.2 of the paper, I look at the transmission mechanism of Japanese monetary policy. The analysis is again related to current research on the topic in the United States. The controversy between the credit and money views of the transmission mechanism is receiving renewed interest in the recent literature, although conclusive evidence has yet to be offered. The topic is even more interesting in Japan because of the availability of a unique policy instrument, window guidance, by which bank loans are directly controlled by

1. See, for example, Roosa (1956) for "defensive" and "dynamic" operations.

the BOJ. Hence, loans may be important not only as a channel of policy transmission but also as an instrument of policy.

I apply techniques used in the recent U.S. literature to analyze Japanese data. I find two important conclusions. First, the results of time series analysis of Japanese data involving monetary aggregates are extremely sensitive to the choice of prefiltering technique. Hence, robust results are rather hard to obtain. Second, despite the sensitivity to the methods used, I find support for the importance of loans in the transmission mechanism of Japanese monetary policy.

I also find that both the call rate and bank loans cause other monetary indicators in the Granger sense. Hence, we might characterize the behavior of the BOJ as using both the call rate and window guidance to move bank loans and other interest rates, which in turn change other monetary aggregates and real variables of the economy.

The BOJ announced in June 1991 that it would discontinue its use of window guidance. Perhaps this was part of the new strategy of the BOJ to rely more heavily on the price mechanism in money and capital markets for carrying out monetary policy. Whether such moves will be permanent and whether they will be successful has yet to be determined.

Section 1.1 starts with a brief summary of the Fed's operating procedure. I then compare it with the BOJ's operations. Detailed analysis of the behavior of interest rates and bank reserves is presented. I turn to the analysis of the transmission mechanism of Japanese monetary policy in section 1.2. I carry out time series analysis of monetary indicators, paying particular attention to the comparison of the predictive power of money and lending. Section 1.3 summarizes the major conclusions of the paper.

1.1 The Short-Run Monetary Control Technique of the BOJ

In this section I try to relate the daily operating procedures of the BOJ and associated issues as much as possible to the procedures of U.S. monetary control. I briefly summarize what appears to be the consensus view of the Fed's operating procedure and then explain the operating procedure of the BOJ, highlighting the similarities and dissimilarities between the operating procedures of the two central banks.

It is important to keep in mind the time unit of analysis. Some of the discussion below refers to daily operations of the central banks, some abstracts from daily movements and looks at averages over reserve accounting periods, and some is not affected by the time unit.

1.1.1 The Operating Procedures of the Federal Reserve

It will be useful for later purposes to discuss the operating procedures of the Fed. The following discussion owes much to Federal Reserve Bank of New

York (1981, 1988), Kanzaki (1988), and Partlan, Hamdani, and Camilli (1986).

A convenient starting point is the balance sheet of the Fed, shown in table 1.1. From the equality of total assets and liabilities, we have

$$S = R + VC + CU + DG - (BL + FL + NA), \tag{1}$$

where S is security holdings, R is member-bank deposits, VC is vault cash, CU is currency held by the public, DG is treasury deposits, BL is discount window lending, FL is float, and NA is other net assets. This can be rewritten as

$$S = (TR - BL) + RF = NBR + RF, \tag{2}$$

where TR is total reserves defined as $R + VC$; RF is reserve factors, which is the sum of all the other items on the righthand side of (1); and NBR is nonborrowed reserves. By taking the first difference of (2), we obtain an identity involving open-market operations, OMO:

$$OMO = d(TR - BL) + d(RF) = d(NBR) + d(RF), \tag{3}$$

where $d(x)$ indicates the first difference of x.

The Fed derives its objective for NBR or $d(NBR)$ by estimating the demand for required and excess reserves consistent with medium-term targets for monetary aggregates, and then subtracting the estimate of the level of discount window borrowing. This sets the "dynamic" objectives of the Federal Open Market Committee—the first part of the righthand side of (3), with $d(NBR)$ equal to its targets. The second term, $d(RF)$, in addition to being volatile and uncertain, is believed by many central bankers to be beyond their control in the very short run, for example, at the daily level. Therefore, it would be best to estimate as precisely as possible the fluctuations in RF and offset them using open-market operations in order to avoid unnecessary volatility in short-term interest rates.[2] This is the so-called defensive part of open-market operations.

Most observers of the Fed's operating procedures suggest that borrowing at the discount window is not rationed even if the discount rate is below the federal funds rate. Member banks pay surveillance costs, which are increasing in the amount of discount window borrowing. Hence, rational behavior on the part of member banks suggests that BL is determined at a finite level and is increasing in the difference between the federal funds rate and the discount rate.

Assuming that total reserves are a decreasing function of the federal funds rate, equation (3) gives the equilibrium condition of the federal funds market.

2. The reason for central bankers' aversion to interest-rate volatility is a question yet to be answered in the literature. But it has played a major role in the daily operations of many central banks. In the U.S.-Japan context, there is more aversion on the part of the BOJ, as the following analyses reveal.

Table 1.1 **The Fed's Balance Sheet**

Assets	Liabilities
BL (discount window lending)	*R* (member-bank deposits)
S (security holdings)	*VC* (vault cash)
FL (float)	*CU* (currency held by the public)
NA (other net assets)	*DG* (treasury deposits)

To the extent that "defensive" operations fail to fully offset changes in reserve factors, the Fed will observe unexpected changes in discount window borrowing.[3] The Fed tightens its stance by decreasing the "dynamic" part of open-market operations. This creates a rise in the federal funds rate and increased borrowing at the discount window.

It is widely recognized that the Fed targeted nonborrowed reserves during the 1979–82 period and the federal funds rate in other periods.[4] However, the difference lies more in emphasis than in substance. Obviously, the Fed cannot set targets for reserves on a day-to-day or even month-to-month basis and hit them exactly. If this policy were tried, it would create enormous movements in interest rates and confusion in short-term money markets. Targeting reserves merely means more frequent adjustments of the "dynamic" part of open-market operations in response to the deviations of actual reserves from their targets and, consequently, more fluctuations in the federal funds rate than in the case of targeting the federal funds rate.

1.1.2 The BOJ's Operating Procedures

Let us turn to the description of the BOJ's operating procedures, using the argument in the previous section as a benchmark.

Some institutional features of the Japanese money markets and bank regulations should be noted at the outset. Japanese banks are required to hold reserves as deposits at the BOJ; therefore, vault cash is not included in the calculation of legal reserves. The treasury bill (TB) market is not comparable in size to that of the United States. In addition, the current accounting system implies that an operation in the TB market on a certain day is settled three days later. Because of these problems, TB operations are not very useful for daily adjustments of bank reserves.[5]

3. Spindt and Tarhan (1987) show that discount window borrowing responds in this sense to fluctuations in other items. They show for the 1979–82 period that changes in money, which create changes in *TR*, cause discount window borrowing in the Granger sense.

4. See Meulendyke (1988) for a more careful, historical review of the Fed's operating procedure.

5. See Okina's paper in this volume for a more careful description of the Japanese short-term money markets. The report of the Committee on Short-Term Money Markets (1990) discusses other institutional problems, including the effects of taxation on money markets.

Let us reproduce equation (1) for the BOJ, ignoring the float and net assets:

$$BL + S = R + VC + CU + DG. \tag{4}$$

A favored rearrangement of this equation by the BOJ is

$$d(R) = d(BL) + OMO - d(VC + CU + DG). \tag{5}$$

Some of the differences between the BOJ's and the Fed's operating procedures are already apparent. The Japanese counterpart to $d(RF)$—technical reserve factors—is the third term on the righthand side of (5), and unlike (3) it includes vault cash. This is because vault cash cannot be used to meet legal reserve requirements. It also implies that the BOJ regards vault cash as exogenous in the short run. Just as the Fed regards $d(RF)$ in equation (3) as exogenous, the BOJ treats the $d(VC + CU + DG)$ term as exogenous in its daily operations.

Another difference between equations (3) and (5) is that BL is not subtracted from R to arrive at nonborrowed reserves. In fact, the concept of nonborrowed reserves has never been used in Japan.[6] This reflects the use of discount window borrowing as a control variable by the BOJ. The discount rate has always been lower than the call rate. Therefore, discount window lending has been rationed in Japan. And the level of lending has been changed at the initiative of the BOJ, not of private banks.[7] In fact, this has been the major policy instrument of the BOJ, as shown below.

The BOJ calls the $d(VC + CU + DG)$ term of equation (5) the shortage (or surplus if negative) of funds in the money market. The "defensive" operations of the BOJ are directed toward offsetting the effects of changes in this term. The BOJ devotes considerable effort to estimating the shortage of funds. Funds are supplied either through the BOJ's discount window, BL, or by open-market operations, OMO. For "defensive" operations, both instruments are usually used.

The difference between the total supply of funds from the BOJ and the amount of "defensive" operations is accounted for, of course, by the "dynamic" operations of the BOJ, and this difference determines the change in bank reserves. Assuming that the demand for reserves by banks responds to the call market rate, we see that equation (5) determines the equilibrium call rate.

1.1.3 Interbank Rate Targeting in Japan

What has been the target of the BOJ's operations? As far as I know, the BOJ has never targeted bank reserves or high-powered money.[8] In a sense, short-

6. Interestingly, more than all reserves are borrowed; that is, nonborrowed reserves are negative in Japan. In 1990 reserves were about 4.9 trillion yen, while BOJ lending stood at 6.3 trillion yen.

7. Royama (1971) was one of the first to point this out. Although the situation in which the interbank rate is higher than the discount rate is the same in the United States, private banks may borrow at their initiative from the Fed in the United States, while this is not the case in Japan.

8. Many, including Dotsey (1986), Cargill and Royama (1988), and Bryant (1990), have made a similar observation. In particular, Dotsey's work compares the variability of interest rates be-

term (month-to-month) control of bank reserves is almost impossible in Japan because of the lagged reserve accounting system and the near absence of excess reserves.[9] Since the mid-1970s, the BOJ has paid attention to the behavior of broader monetary aggregates as intermediate targets of monetary policy. However, it seems that it has never used information on monetary aggregates to calculate target levels for bank reserves or interbank rates in a mechanical way.

The short-term operating target of the BOJ has long been interbank interest rates. During normal times, when tightening or loosening of monetary policy is unnecessary, the BOJ stabilizes interbank rates. A change in the stance of monetary policy creates new target levels for interbank rates. New targets are almost immediately achieved by "dynamic" operations as explained in section 1.1.4. The precise manner in which the BOJ calculates the target levels of interbank rates has never been disclosed. I doubt that it uses any quick formula to do this. As stated above, it has never targeted bank reserves. But it does pay close attention to the level of the reserve supply relative to required reserves on a daily basis in order to achieve interest rate targets. This will be explained below.

I now show more formally that the BOJ has targeted interbank rates. First I show that, as a statistical matter, the call rate has been much more stable than the federal funds rate. Second I argue that the stability of the call rate is a result of the "defensive" operations of the BOJ rather than a result of the stability or high interest rate elasticity of the demand for high-powered money.

The relative stability of Japanese interbank rates is shown in table 1.2, where the standard deviations of daily interest rates for the periods since the late 1970s are presented for the United States and Japan. Clearly, interest rate volatility is higher in the United States. The differences in the standard deviations between the two countries are significant for all three interest rates on the basis of the usual F-test on two variances.

The difference in the degree of volatility is largest for the interbank rates. The volatility of the federal funds rate for the entire period is affected by the increased volatility in the 1979–82 period, when the Fed paid more attention to the control of reserves. However, the volatility of the call rate is lower than that of the federal funds rate even in periods that exclude 1979–82. The numbers in parentheses are standard deviations calculated from the sample, excluding Wednesday observations. They are presented because the volatility of the federal funds rate is much affected by its behavior on the last day of the reserve accounting period—Wednesday. However, the volatility of the federal funds rate is still much higher than that of the call rate. Though significant,

tween Japan and the United States, as I do in table 1.2, and concludes that in both countries interbank rates are targeted. Because he uses quarterly data, however, he does not find as large a difference in interbank rate variability as I do.

9. For the period 1967–87, excess reserves were, on average, 1.225% of required reserves in the United States and 0.142% in Japan. It is possible, though, that this near absence of excess reserves is the result of passive accommodation of reserve demand by the BOJ.

Table 1.2 **The Volatility of Daily Interest Rates**

Period	Interbank Rate[a]	3-Month Rate	Long-Term Rate
	United States		
1977:1:1–1991:2:11	.523 (.466)	.221	.143
1977:1:1–1979:10:7	.211 (.159)	.180	.0581
1979:10:8–1982:10:22	.841 (.738)	.402	.239
1982:10:24–1991:2:11	.437 (.400)	.111	.112
	Japan		
1978:1:1–1991:2:14	.139	.0725	.121
1978:1:1–1979:4:30	.125	.047	
1979:5:1–1988:10:31	.147	.0801	.136
1988:11:1–1991:2:14	.102	.0254	.0877

Notes: Entries are the variance of deviations of each rate from its centered moving average with ten observations on each side. The interest rates are: the federal funds rate, TB rate, and the seven-year-bonds rate for the United States and the call rate, the CD rate, and the 10-year-bond rate for Japan.

[a]Entries in parentheses are calculated by excluding Wednesday observations.

Table 1.3 **The Volatility of Currency in Circulation**

	Japan 1963–90	United States 1967–90
Seasonally adjusted data	$3.0 * 10^{-4}$	$7.5 * 10^{-6}$
Unadjusted data	$5.6 * 10^{-3}$	$8.0 * 10^{-5}$

Note: Entries show the variance of the monthly rate of change in currency in circulation.

the difference in the volatility of long-term rates between the two countries is not very large.

Consequently, the stability of Japanese interbank rates evidenced in table 1.2 must come from one of three possibilities: the shortage or surplus of funds in Japan is more stable than U.S. reserve factors; the interest rate elasticity of the demand for high-powered money is higher in Japan; or the BOJ carries out more accurate "defensive" operations.

Table 1.3 shows the variability of currency in circulation, the largest component of high-powered money in both countries. Unambiguously, the demand for currency by the nonbank public fluctuates more in Japan than in the United States. Okina's paper in this volume presents evidence, though less formally, of the larger volatility of other components of high-powered money in Japan as well.

Estimates of the interest elasticities of the components of high-powered money—currency held by the public and bank reserves—are presented in table 1.4. The specification of the demand functions is the conventional one of partial adjustment, in which the righthand side of the demand function

Table 1.4 **Interest Rate Elasticities of the Components of High-Powered Money**

	Japan 1963–90	United States 1967–90	Activity Variable
CU (currency in circulation)	−.0014	−.00097	IP
	−.0022	−.000516	C
TR (total reserves including vault cash)	.0032	−.0013	IP
	$-.62 * 10^{-4}$	$-.62 * 10^{-3}$	RR

Notes: The equations estimated are, for example, the log of *CU* regressed on a constant, the call (or funds) rate, the log of an activity variable, and the lagged dependent variable. Both *CU* and *TR* are deflated by the CPI. Entries are short-term (semi-) elasticities. IP = index of production; C = sales of department stores deflated by the CPI; RR = required reserves deflated by the CPI.

includes the lagged dependent variable. The table shows only short-run elasticities, that is, the response of *CU* or *TR* within a month of a change in the interest rate. The magnitude of the elasticity of *CU* is about the same across the two countries, but that of reserves is smaller in Japan.

We have seen no evidence of greater stability or higher interest elasticity in the demand for high-powered money in Japan. Consequently, accurate "defensive" operations by the BOJ must have been the key to achieving stable interbank interest rates in Japan. A back-of-the-envelope calculation will help us to understand the magnitude of interest-rate fluctuations in the absence of "defensive" operations. Monthly variations in the *RF* term can easily come close to a few trillion yen. Suppose that the Bank of Japan did not accommodate these and that the elasticity of *CU* + *TR* was at most .002 based on table 1.4. High-powered money stands at about 40 trillion yen. One would need to change the call rate by close to 100 percentage points to bring about a few trillion yen change in the demand for high-powered money.

Fortunately, the daily data on the shortage or surplus of funds and its previous day's expectation, both published by the BOJ, enable us to check the accuracy of "defensive" operations. If they are successful, they would purge interest rates of any systematic response to the shortage or surplus of funds. Therefore, I regressed daily changes in the unconditional/collateral call rate on the shortage or surplus of funds for the same day, using its forecast of the previous day as an instrument. The results are

$$d(i_c) = \underset{(.071)}{.00713} + \underset{(.080)}{.00690} * d(VC + CU + DG), \text{ D.W.} = 1.99,$$

where i_c is the overnight call rate, the sample is 1990:8:9–1991:1:10, and t-statistics are in parentheses. The equation rejects the existence of any systematic effect of the shortage or surplus of funds on the call rate. The operations of the BOJ must have been accommodating these fluctuations in the demand for high-powered money.[10]

10. Bernanke and Blinder (1990) offer similar evidence for the United States, using weekly data for the period of funds rate control.

To summarize, the BOJ has deliberately aimed at stabilizing the call rate around its target level. To achieve this, the BOJ has used "defensive" operations extensively. An important consequence of this policy, of course, has been that the stock of high-powered money has been an endogenous variable responding to changes in the demand for high-powered money.

1.1.4 Changing the Target Level of the Call Rate

Adjustment of the Reserve Progress Ratio

"Dynamic" operations are the mechanism by which the BOJ changes the target level of the call rate. Toward the end of the 1980s, many new types of operations became available to the BOJ, such as operations in TB, financial bills, (FB) and commercial paper (CP) markets. However, these markets are too small for the BOJ to carry out large-scale operations. Consequently, the BOJ has depended on changes in lending at the discount window and operations in the bill market when it carries out "dynamic" operations.[11]

Table 1.5 presents some regression results highlighting the use of *BL* as the most important instrument of "dynamic" operations. Equation (2) in the table explains the (daily average of the) call rate in any month, using the discount rate and the share of *BL* in high-powered money, both measured at the end of the previous month. The regressors are lagged by one month in order to avoid biases stemming from the correlation between the regressors and the error term. The estimation result shows that, as more funds are supplied through the discount window, the call rate will be lower. Equation (3) shows a similar result in first difference form. These results are at least consistent with the hypothesis that a lowering of interest rates is initiated by an increase in discount window lending.

On the other hand, the correlation between the federal funds rate and discount window borrowing is positive in the United States, as shown in equation (1) of the table. Such a pattern of correlation will result if open-market operations are used as the vehicle of monetary policy and borrowing responds passively to the resulting movements in the funds rate.

During periods of monetary tightening or loosening, the BOJ changes the time path of reserve supplies within one reserve accounting period.[12] Both the BOJ and the market pay attention to the reserve progress ratio, the cumulative sum of actual daily reserves since the beginning of the current reserve accounting period relative to the required reserves of the period. During normal times, this ratio is assumed to start at zero and to increase by about 1/30 every day to reach 1 at the end of the period. A "dynamic" initiative by the BOJ to tighten (loosen) its stance is reflected in a slowing (quickening) of the pace of

11. Operations in the bill market are not "open"; that is, the BOJ picks a bank with which it trades bills. In this sense, operations in the bill market are closed to discount window lending.

12. See, for example, Kanzaki (1988) or Suzuki, Kuroda, and Shirakawa (1988) for a more detailed description of this process.

Table 1.5 **Discount Window Lending and Interbank Interest Rates**

SMPL	Left-hand-side Variable	Right-hand-side Variables	
(1)[a] 1967:1–1987:12	$\log(BL/p)$	$.257 * i_f - .171 * i_d$ (2.19) (−1.00)	$k = .867$ (28.4)
(2)[b] 1966:11–1989:10	i_c	$.792 * i_d(-1) - 1.50 * (BL/H)(-1)$ (11.2) (−2.56)	$k = .949$ (55.1)
(3)[b] 1966:11–1989:10	$d(i_c)$	$.667 * d(i_d)(-1) - .216 * d(\log(BL(-1))$ (9.13) (−3.56)	$k = .0884$ (1.46)

Notes: Constant terms are also included in the equations. Numbers in parentheses are t-statistics. BL = borrowings at the central bank; H = stock of high powered money; i_c = call rate; i_d = discount rate; i_f = federal funds rate; k = estimated coefficient of the first-order serial correlation of the error term; p = index of CPI.

[a]Equation (1) is estimated by Fair's method using the log of real nonborrowed reserves as an instrument.

[b]Equations (2) and (3) use the maximum likelihood method to correct for serial correlation.

the increase in this ratio relative to the normal pattern of increase. This is accomplished by, for example, a decrease (increase) in BOJ lending.

When the BOJ slows the pace of increase in the reserve progress ratio, it sends a signal of monetary tightening to the market, forcing private banks to borrow more funds in the call market and thus achieving the policy objective of raising the call rate.

I make one final remark on the endogeneity of high-powered money. I pointed out in section 1.1.3 that high-powered money is endogenous during normal times because of interest rate targeting. The above interpretation of "dynamic" operations suggests that a process of tightening is begun by a decrease in the stock of high-powered money. By the end of the reserve accounting period, however, the BOJ will be obliged to supply (because of lagged reserve accounting) a predetermined amount of reserves, albeit at a higher interest rate.[13] The total stock of high-powered money will decrease to the

13. Many have discussed what would happen if the interest elasticity of high-powered money were zero. In that case, one could argue that the BOJ may not be able to change the call rate because it cannot change the stock of high-powered money. Private banks may just as well wait until the BOJ supplies enough reserves, making changes in the reserve progress ratio an ineffective tool of monetary control. Suzuki (1980) and Okina (1987 and in this volume) have pointed out the high cost of discount window borrowing close to the end of a reserve accounting period as an important vehicle for the control of the call rate. For example, the BOJ may charge two days of interest (at the discount rate) for a twenty-four-hour loan from the discount window on the last day of the accounting period. In such a case, the daily interest rate is double the usual discount rate and easily exceeds the call rate. Market participants point out another form of penalty for private banks that do not take enough funds in interbank markets. (See Ueda and Uekusa 1988.) The penalty is the calling off of discount window lending. Since BOJ lending is done at a subsidized rate (that is, a rate lower than the call rate), such banks would lose part of the subsidies they receive from the BOJ. The BOJ does not have to impose these penalties all the time. It suffices to create the expectation of such a possibility by using the penalty once in a while. These are inter-

extent that a higher interest rate will decrease some other components of the demand for high-powered money—for example, the demand for currency by the nonbank public. But the amount of the response is usually very small. Hence, most of the movements in the stock of high-powered money are driven by demand-side factors, even in periods when a strong "dynamic" initiative is exercised by the BOJ.

An Alternative View of Interest Rate Control

An alternative explanation of interest rate control by the BOJ is that the BOJ determines the call rate at whatever rate it desires and sometimes forces market participants to take undesired positions. This view has been fairly strong among market participants (for example, Asami 1963) and academics (for example, Horiuchi and Kato 1989). Of course, direct pegging of the call rate by the BOJ would not be much different from the control mechanism explained in the previous section, if the BOJ accommodated all changes in the demand for high-powered money at the quoted call market rate. However, there are reasons to believe that the call market was not in equilibrium at least until 1988.

Direct pegging of the call rate by the BOJ has been achieved by the following mechanism, although the BOJ is not a player in the call market. The BOJ has exerted strong influence on the behavior of the call loan dealers (Tanshi Gaisha) who act as brokers and dealers in the call market. Under the *tatene* system, that is, until 1979, every day after the close of the market the BOJ and a representative call loan dealer met and discussed the next day's call rate; in effect, the BOJ told the dealer the call rate. The rate would be announced the morning of the next day. Under the *kehaichi* system, between 1979 and 1988, the role of the BOJ in the determination of the call rate was officially weakened but actually remained the same.

The next question is whether the call rate that had been quoted was clearing the market. Anecdotal evidence abounds that it did not. Large city banks have been chronic borrowers of funds in the call market. Interviews with these bankers reveal that their daily demand for reserves is interest inelastic. They claim that they only take funds supplied by call loan dealers. This would occur if the call rate were set by the BOJ at artificially low levels so that the market was in a state of excess demand. On the other hand, suppliers of funds in the interbank markets have an incentive to move funds into more flexible markets such as Euromarkets. They speak of informal guidance by the BOJ asking them not to move large quantities of funds away from the interbank markets.

Direct transactions among banks in the call market have been strictly pro-

esting arguments, but they rely on special features of the current reserve accounting system, such as the absence of a carry-over procedure, or on lagged reserve accounting and/or the discount rate being lower than the call rate. Moreover, the issue itself disappears if the interest rate elasticity of high-powered money is nonzero, as shown in table 1.4.

hibited. Such a regulation would be necessary if the call rate quoted by the BOJ was not at the equilibrium level.

Table 1.6 shows the chronology of regulations on interbank rates. During the years before 1988, the only period in which the BOJ did not quote the call rate either directly or indirectly was between August 1955 and June 1957. I have calculated the variance of monthly changes in the call rate for each period. Clearly, the variance is much higher for this period than for the others. This fact and the anecdotal evidence discussed above raise doubts about the explanation that the stability of Japanese interbank rates is the result of accurate defensive operations by the BOJ. The call rate may well have been stable because it was set by the BOJ and because movements of funds between markets were limited by nonmarket forces such as moral suasion. Horiuchi and Kato (1989) also present evidence consistent with a similar interpretation of the stability of interbank rates.

The Liberalization of Short-Term Money Markets

In a sense, the BOJ admitted to such heavy use of moral suasion when it introduced a new operating procedure in November 1988. (See BOJ 1990 for the details of the new procedure.) In the summer of 1988, short-term rates in open markets, such as the CD rate and Euroyen rates, increased as a result of an expectation of a future tightening of monetary policy. But the BOJ wanted to keep interbank rates at relatively low levels. The difference between inter-

Table 1.6 **Chronology of Regulations on Interbank Rates**

Period[a]	Regulations[a]	Variance[b]
1948:1–1955:7	The BOJ sets guidance rates for the call rate at levels not higher than the maximum indicated in the Temporary Law for Interest Rate Adjustment.	
1955:8–1957:6	Guidance rates are abolished.	4.18
1957:7–1967:8	Private banks (under the strict guidance of the BOJ) set the *jishuku* rate.	0.31
1967:9–1979:4	Call loan dealers, in consultation with the BOJ, set tatene for the call rate daily and announce it to market participants.	0.17
1979:5–1988:10	Interbank rates are set daily by the BOJ, and dealers announce it as kehaichi.	0.20
1988:11–	The new monetary control regime is introduced. But the kehaichi system for the call transactions with collateral remains until 1990:10.	0.04

[a]From Horiuchi and Kato (1989), my translation.

[b]The variance of monthly changes in the unconditional call rate with collateral.

bank and open-market rates widened, as illustrated in figure 1.1, and transactions shifted to open markets. However, the large gap between the two types of rates and the existence of transactions in both markets implies that implicit regulations existed that prohibited at least part of the arbitrage between the markets.

In November 1988 the BOJ announced that it would liberalize transactions in the interbank markets and arbitrage between open and interbank markets. The alleged purpose of such a policy change was to increase the degree of arbitrage between interest rates and to encourage more free determination of interbank rates.

Since then, the difference between interbank and open-market rates has never been as large as it was in the summer of 1988. In that sense, the new procedure has increased arbitrage between markets.[14] However, the variability of the call rate has not increased, as is shown in table 1.6. Calculations using daily data also show that the volatility of the call rate has decreased since 1988. This is partly attributable to the decline in the volatility of long-term rates, which is shown in table 1.2. That is, it has been a relatively calm period.[15] But more research needs to be carried out on this point.

To summarize the discussion so far, the call rate has been the target of BOJ policy for most of the postwar period. It has been much more stable than the federal funds rate. The major reason for the stability has been the extensive and accurate use of "defensive" operations by the BOJ. However, the heavily used practice of the BOJ's directly quoting the call rate, together with moral suasions discouraging arbitrage between markets, might also have played a role.

1.2 The Transmission Mechanism

Let us now turn to the analysis of the transmission mechanism of Japanese monetary policy, again comparing it with the U.S. transmission mechanism.

Recent research in the field has centered on the question of the credit-versus-money view of the transmission mechanism of monetary policy. Thus, on the one hand Bernanke and Blinder (1990) present evidence for the importance of bank loans, while King (1986) and Romer and Romer (1990) argue for the importance of bank liabilities. In addition, Bernanke and Blinder report the interesting finding that the federal funds rate is a good indicator of monetary policy. That is, the funds rate is markedly superior to various mon-

14. Even as of early 1991, however, market participants admit that there is guidance given by the BOJ and the Ministry of Finance regarding the proportion of funds participants in the noncollateral call market relative to the collateral market.

15. The practice of the BOJ's setting the call rate indirectly—the kehaichi-sei—remained for the collateral rate until November 1990. But the difference in the volatility of this rate before and after November 1990 is very small.

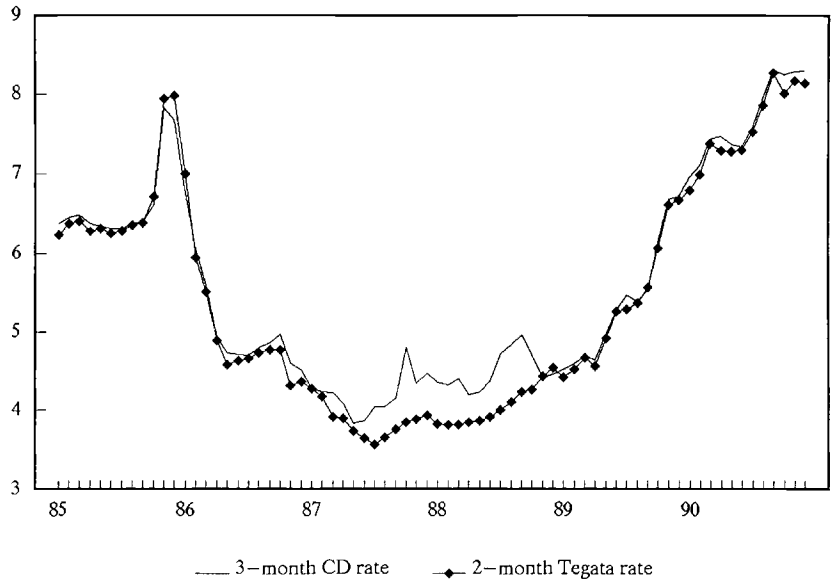

Fig. 1.1 Tegata (bills discount) rate and CD rate

etary aggregates and other interest rates as a forecaster of major macroeconomic variables.

The analysis of the Japanese monetary transmission mechanism is especially interesting in the context of such recent developments. A unique policy instrument available to the BOJ is so-called window guidance, whereby the BOJ controls the amount of bank loans directly. This may increase the importance of bank loans in Japan relative to countries in which such an instrument is not used.

The stability of the call rate relative to the federal funds rate, analyzed in section 1.1.4, may imply that the call rate is a very good indicator of Japanese monetary policy and at the same time a good predictor of macrovariables. The predictive power of the call rate in Japan may be higher than that of the federal funds rate in the United States.

Unfortunately, the statistical relationships between the call rate and other monetary variables or macrovariables are very unstable. Time series analyses involving monetary aggregates and other macroeconomic variables are extremely sensitive to the choice of end-of-period versus average-of-period data as well as to the way the series are detrended and seasonally adjusted. It almost seems as if one can come up with any conclusion by choosing different ways of prefiltering the data.

Tables 1.7 and 1.8 show the results of money-versus-loan causality tests and a comparison of the predictive powers of various monetary variables. In

Table 1.7 **Predictive Power of Monetary Indicators in Bivariate Regressions with Index of Production**

Data	Seasonal Adjustment	Dependent Variable	H	M_1	M_2	L	i_c	SMPL[a]
Average	y	level	y	y	y	y	y	1
			y	—	y	—	—	2
Average	y	FD	—	—	—	—	y	1
			y	—	—	—	—	2
Average	dummy[b]	level	y	y	—	y	—	1
			—	—	—	—	—	2
Average	—	annual change	y	y	—	—	—	1
			—	—	—	—	—	2
End of period	y	level	—	—	y	—	y	1
			—	y	y	—	y	2
End of period	y	FD	—	—	—	—	y	1
			—	y	y	—	y	2
End of period	dummy	level	—	—	—	—	—	1
			—	—	—	—	—	2
End of period	—	annual change	—	—	—	—	—	1
			—	y	y	y	—	2

Notes: The dependent variable is the log of the index of production plus the log of the CPI. The money-supply data are also differenced in the same way. Twelve lags were used for all dependent and independent variables. *Annual change* indicates the log annual change; *FD* means the log difference; *level* is the regression including a linear time trend; *y* indicates significance at the 5% level. H = high-powered money; L = bank loans; i_c = call rate.

[a]1 = estimation for 1969:1–1979:4; 2 = estimation for 1979:5–1989:10.

[b]Monthly dummies are included as independent variables.

table 1.7 the predictive power, in the Granger sense, of monetary indicators is shown in bivariate regressions involving the pace of economic activity (the log of the index of production plus that of the CPI) and one of the indicators. The data are monthly, and twelve lags of each variable were included in the regression.

As warned above, the results are amazingly sensitive to small changes in the data or the specification. Thus, it would be better to use seasonally adjusted data in order to find strong effects of monetary indicators, and better to use nonadjusted, end-of-month data in level form with a time trend in order to support perhaps the real business cycle theory. The use of monthly averages of daily data implies strong effects for indicators in the 1970s; end-of-period data imply strong effects in the 1980s. Money supply measures (M_1 and M_2) appear to exert strong effects on the economy, in terms of the number of times they are significant in the table, as does the call rate.

In table 1.8 I carry out an exercise similar to the one performed by Bernanke and Blinder (1990). When more than one indicator was significant in table 1.7, I included all the indicators in the regression to compare the predic-

Table 1.8 **Marginal Significance Levels of Monetary Indicators for Forecasting the Index of Production**

Data	Seasonal Adjustment	Dependent Variable	H	M_1	M_2	L	i_c	Period[a]
Average	y	level	.012	.093	.212	.120 **	.165	1
			.008	.103	.009	.012 **	.030	2
Average		annual change	.147 *	.045	.242	.646 *	.564	1
End of period	y	level	.010	.010 *	.011 *	.795	.002	1
			.467	.115	.009	.030	.021	2
End of period		annual change	.501	.097	.011 *	.277 *	.116	2

Notes: Regressions in this table include twelve lags of all the monetary indicators. Results are shown only for those cases in which more than one indicator was significant in table 1.7 and at least one indicator was significant when all indicators were included. * means the indicator had the highest explanatory power in terms of variance decomposition either in the order appearing in the table or in the reverse order; ** means the indicator had the highest explanatory power in both decompositions. *Annual change* indicates the log annual change; *FD* means the log difference; *level* is the regression including a linear time trend; *y* indicates significance at the 5% level. H = high-powered money; L = bank loans; i_c = call rate.

[a]1 = estimation for 1969:1–1979:4; 2 = estimation for 1979:5–1989:10.

tive power of each more accurately. In contrast to the finding of Bernanke and Blinder that the federal funds rate is unambiguously the best indicator. I find mixed results. None seems to be markedly superior to the others.

The results of the variance decomposition shown in the table, however, are less ambiguous. Even with reordering of equations, bank loans possess the highest explanatory power in 80% of the cases. This result is, at least, suggestive of the importance of bank loans in the Japanese monetary transmission mechanism. In other words, bank loans affect the real economy through their effects on other indicators such as monetary aggregates, and this accounts for their predictive power in the Granger sense.

Such an interpretation is broadly consistent with the perception of the staff of the BOJ and of market participants about the transmission mechanism. Their perception is conveniently summarized in a flowchart (fig. 1.2) used occasionally by the BOJ. In the middle of the chart we see that the call rate is the most important direct target (or instrument) of policy, and it is controlled mainly by BOJ lending, open-market operations, and the discount rate. This was discussed in section 1.1. Changes in the call rate cause changes in other interest rates, including the loan rate. These changes, together with the effect of window guidance, will affect bank loans and real variables. This has long been the established view of Japanese monetary policy, and it highlights the importance of bank loans. The chart also includes the direct effects of the

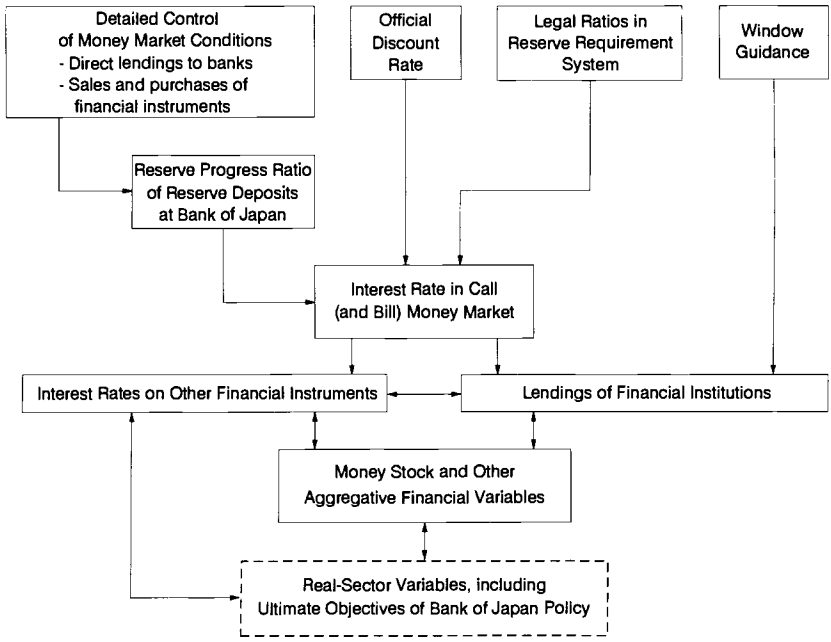

Fig. 1.2 Schematic diagram of the conduct of Japanese monetary policy

money supply and other interest rates on the real sector, but these have not been regarded as the centerpiece of the transmission mechanism.

Slightly more robust time series evidence than that presented in table 1.7 is shown in table 1.9. Here we check for Granger causality among monetary indicators only, and we find exactly the pattern of causation expected from the above discussion. That is, loans and the call rate are not caused by the other variables except for minor cases, while these two indicators help predict other variables.[16]

One additional piece of evidence on the importance of loans is offered, using the technique employed by Romer and Romer (1990). In their study of the money-lending-output correlation they focus on periods when the Fed deliberately shifted to tighter monetary policy. This focus allows them to avoid confusion between the effects of monetary indicators on output and the effects working in the reverse direction.

The dates of deliberate shift to tighter monetary policy are easy to identify in Japan. Most people assume that a change in the discount rate provides such information. (Such dates are March 1957, December 1959, July 1961, March

16. Hutchison (1986) finds causality running from the call rate to M2 in a three-variable system of M_2, the call rate, and nominal retail sales. But he does not check for the importance of bank loans.

Table 1.9 **Granger Causality among Monetary Indicators**

	M_1	M_2	H	L	i_c
M_1	—	n,n	n,y	y,y	n,y
M_2	n,y	—	n,y	y,n	n,y
H	y,y	y,n	—	n,n	y,y
L	n,n	n,n	n,n	—	n,n
IC	y,n	n,n	n,n	n,n	—
M_1	—	n,y	n,y	n,y	n,y
M_2	n,n	—	n,y	n,y	n,y
H	n,n	n,n	—	n,n	y,n
L	n,n	n,n	n,y	—	n,n
IC	n,n	n,n	n,n	n,n	—

Notes: Entries indicate significance in the Granger sense in the regression of a row variable on the column variables. The upper half uses the average of daily data, while the lower half uses end-of-month data. The sample is 1969:1–1979:4 for the first half of the paired entry and 1979:5–1989:10 for the second half. All regressions included twelve lags of each variable and a time trend. Monetary aggregates were seasonally adjusted. H = high-powered money; L = bank loans; i_c = call rate. y = significance at the 5% level; n = insignificance.

1964, September 1967, September 1969, April 1973, April 1979 and May 1989.) In certain cases window guidance preceded an increase in the discount rate. But I do not make adjustments here, in order to preserve the clarity of the criterion.

Essentially, Romer and Romer first calculate the forecast errors of money and bank lending from a regression of each on its own lags immediately after the shifts to tighter monetary policy. The forecast errors (actual minus predicted) are, of course, negative because of the sudden shifts to tightening. However, the errors contain two parts: the independent decrease in money or lending and the response of money or lending to output. The latter may be large in magnitude because tighter policy decreases output over time. In the second part of their analysis they recalculate the forecast errors from a regression of money or lending on its own lags and output. The larger the forecast errors from the second exercise and the smaller the difference between the two exercises, the more important that a monetary indicator is in the transmission mechanism of monetary policy. Based on such an analysis, they conclude that money is more important than lending.

Figures 1.3 and 1.4 present the results of the same analysis using the Japanese data. For money I used M2, and bank loans are the total loans of the banking accounts of all banks—that is, bank loans do not include loans that are backed by money and other trusts of trust banks. The data are monthly, end-of-month, and not seasonally adjusted. The regressions run are money (lending) on a constant, monthly dummies, twelve lags of money (lending), and in some cases the index of production. Variables are in log difference form. I show the forecast errors from regressions that do not include output in

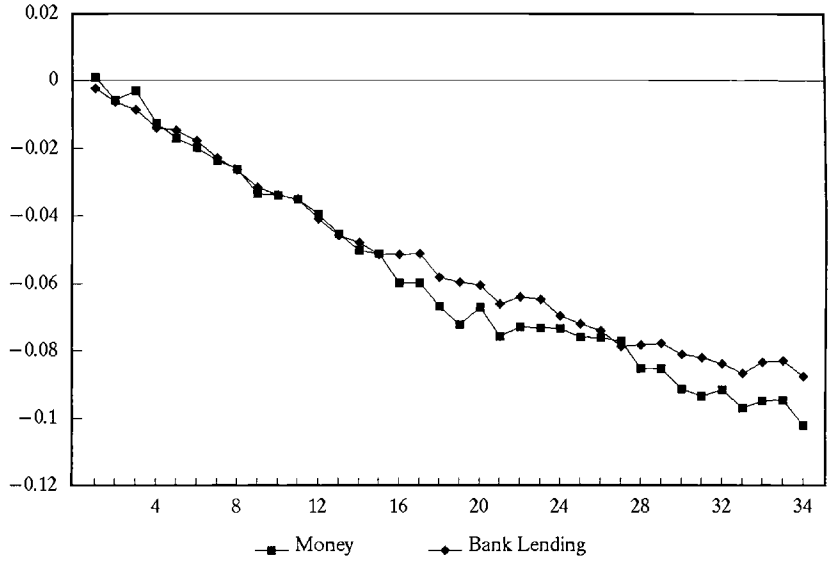

Fig. 1.3 Average forecast errors for money and lending after tightening

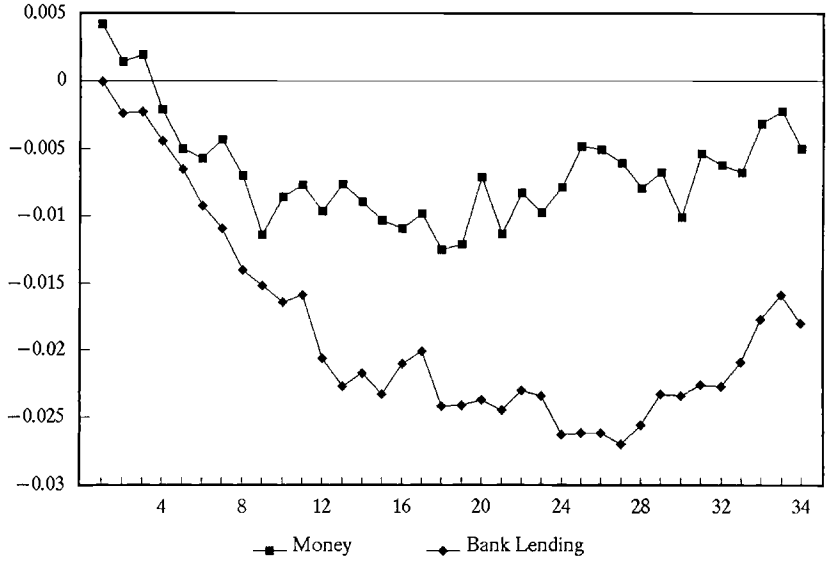

Fig. 1.4 Average forecast errors, given actual path of production

figure 1.3. The errors move in almost the same way for money as for lending, although during the first few months the errors in lending move ahead. (This is already somewhat different from the Romer and Romer finding in which the errors for lending are much larger than, but initially lag behind, those for money.)

The forecast errors from the regressions involving output, presented in figure 1.4, are significantly different between money and lending. Both are much smaller in absolute value than in figure 1.3, but more so for money. Moreover, the peak in the forecast error occurs after eighteen months for money, but after twenty-three months for lending. The errors from the lending regression to monetary tightening respond more quickly than do those from the money regression, which is more evident in figure 1.4 than in figure 1.3. This is also in sharp contrast to Romer and Romer. They find that the error from the lending regression does not become significantly negative until after fifteen months of tightening.

The results in figures 1.3 and 1.4 are supportive of a more important role for bank lending than for money in the transmission mechanism. Also, they are consistent with the interpretation that bank lending itself is an instrument of monetary policy. The results are not sensitive to whether the data are seasonally adjusted or to the choice of monetary aggregate, M1 or M2.

One needs to appreciate fully the important implication of the exogeneity of bank loans together with their high explanatory power for real variables. Bank loans are important not only because monetary policy affects real variables through loans. They also have been under the more direct influence of the BOJ—hence the exogeneity. The BOJ uses both instruments—the call rate and window guidance—to affect real variables.

1.3 Conclusions

In its daily operations, the BOJ's policy target has been the call rate. It has never targeted bank reserves. The call rate has been much more stable than the federal funds rate even for periods during which the Fed targeted the funds rate. Because of this, the stock of high-powered money is an endogenous variable.

The BOJ stabilizes the call rate by using "defensive" operations extensively, which accommodate movements in the shortage or surplus of funds. Although the BOJ also fully accommodates changes in the demand for bank reserves at the monthly level, it carries out "dynamic" operations at the daily level to change the target level of the call rate. Changes in BOJ lending at the discount window are an important instrument for this purpose.

The possibility of more direct control of the call rate by the BOJ has also been pointed out. In some periods the BOJ quoted the call rate either directly or indirectly, at the same time preventing arbitrage between markets through moral suasion. The importance of such non-market-oriented control of the call

rate and the change in its importance over time need to be more carefully studied.

Bank loans play an important role in the transmission of monetary policy in Japan. I find stronger support for the credit view in Japan than in the United States. The interpretation of this finding, however, involves more than merely pointing out that monetary policy affects the real sector through its effects on bank loans.

The call rate is not the best indicator of monetary policy in the sense of being the best predictor of real-sector activity in the economy. Monetary aggregates and loans also predict real variables fairly well. However, the call rate and bank lending cause other monetary indicators in the Granger sense. This is plausible, because the BOJ uses window guidance to control bank lending directly during times of monetary tightening.

Abstracting from daily operations, we may say that the call rate and bank lending are the instruments of monetary policy in Japan.[17] Changes in these will create changes in other interest rates and monetary aggregates, in turn moving real variables.

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17. At the end of June 1991, the BOJ announced that it will no longer use window guidance. The implication of this decision for the conduct of the BOJ's monetary policy is a topic for future study.

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