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Monetary Control Mechanism in Japan

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This paper is to explain Japan's monetary control techniques and to analyze how they determine short-term money market rates and the money stock. We analyze that interest rates in the short-term call and bill-discount markets, operating variables of the Bank of Japan, are determined mainly through the adjustment of the official discount rate and of the "progress ratio of reserve deposits." We also analyze that the Bank of Japan controls M_2+CDs, an intermediate target, by relying upon the transmission of initial changes in the call and bill rates to other financial markets. Finally, we point out some problems that the Bank of Japan has to consider regarding monetary control during the process of financial globalization.

I. Introduction

The purpose of this paper is to explain Japan's monetary control techniques and to analyze how they determine short-term money market rates, high-powered money, and the money stock.

At least two important conclusions emerge from our analysis. First, interest rates in the short-term call and bill-discount markets, which are operating variables of the Bank of Japan, are determined mainly through the adjustment of the official discount rate and of the special reserve accounting concept called the "progress ratio of reserve deposits." Second, the Bank of Japan controls the stock of broadly defined money (M_2+CD), an intermediate target, by relying upon the transmission of initial changes in the call and bill rates to other financial markets. This type of money supply control mechanism based on interest rate transmission is quite different from the so-called multiplier approach based on the adjustment of the demand for and the supply of high-powered money.

This paper is organized as follows. In section II, we briefly explain the reserve deposit requirements system in Japan and credit control techniques of the Bank of Japan. In section III, we analyze how short-term money market rates are determined: we analy-

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ze, first, the control mechanism of the call and bill rates, and second, the transmission process from the call and bill rates to other short-term rates. In section IV, after presenting how the money stock is controlled by the Bank of Japan, we discuss the transmission mechanism from the money stock to the variables on the real side of the economy. Finally, in section V, we point out some problems that the Bank of Japan has to consider regarding monetary control during the process of financial globalization.

II. Reserve Deposit Requirements System in Japan and Credit Control Techniques of the Bank of Japan

A. Reserve Deposit Requirements System in Japan

Good working knowledge of Japan's reserve deposit requirements system is essential before one can attempt to understand the techniques of monetary control in Japan.

The "Law Concerning the Reserve Deposit Requirements System" of May 1957 defines the current reserve deposit requirements system in Japan. Under this system, financial institutions subject to reserve requirements[1] are required to place with the Bank of Japan legal reserve deposits in the following ways:

1. Financial institutions' required reserves are set equal to the product of the required reserve ratio and the average outstanding balance of deposits during one calender month, while a "maintenance period" of reserve deposits begins on the 16th day of that month and ends on the 15th day of the next. The reserve requirements system in Japan can thus be interpreted as a combination of a "lagged reserve system" and a "contemporaneous reserve system."[2]
2. Financial institutions must place reserve deposits only in the form of deposits with the Bank of Japan; cash in vault is not counted as reserve assets.[3]
3. Financial institutions may not carry any of excess reserves of one "maintenance period" over to the next.[4]

[1]As of March 1988, financial institutions subject to reserve deposits requirements in Japan include ordinary banks (including foreign banks in Japan), long-term credit banks, specialized foreign exchange bank, Sogo and Shinkin banks (provided that outstanding deposits of an individual institution are over 0.16 trillion yen) and the Norinchukin Bank.

[2]Under the U.S. Reserve Requirements System in place since February 1984, reserve deposits related to the settlement accounts have been lodged "contemporaneously" (strictly speaking, with a two-day lag), while reserve deposits related to (a) time deposits possessed by nonindividuals and (b) the Euro-market debts have been lodged with lags. In the German minimum reserve requirements system (Mindestreservepolitik), reserve deposits are lodged both "contemporaneously" and "with lags" just as in the Japanese reserve requirements system.

[3]In the U.S., reserve assets include vault cash possessed by financial institutions as well as deposits with Federal Reserve Banks; the German system has also included vault cash since March 1978, as long as the share of vault cash in the required reserves does not exceed 50% on a monthly basis.

[4]In the U.S., a surplus or shortage of reserve deposits in a "maintenance period" can be carried over to the next period, provided that the surplus or shortage does not exceed 25,000 dollars or 2% of required reserves.

4. Should there be any shortage in reserve deposits in a certain "maintenance period," the amount of the shortfall is subject to a penal rate, which is higher than the official discount rate by 3.75 percent per annum.

We now examine factors causing fluctuations in reserve deposits. From the view point of individual financial institutions, fluctuations in their reserve deposits placed with the Bank of Japan reflect the movements of funds for inter-bank settlement, as typically happen in bills clearing. However, from the view point of the financial system as a whole, the movements of funds for inter-bank settlement are mutually offsetting and, therefore, the outstanding balance of reserve deposits held by financial institutions as a whole can fluctuate only if: (a) there are flows of cash between financial institutions on the one hand and corporate businesses or individuals on the other; (b) there are transfers of funds between the government on the one hand and corporate businesses or individuals on the other; and (c) there are net movements of credit between the Bank of Japan and other financial institutions. These relationships on a flow basis can be expressed as follows:

Increases (Decreases) in reserve deposits=
(a) Reflux (Flux) of bank-notes +
(b) Payments (Receipts) of the government +
(c) Provision (Absorption) of credit by the Bank of Japan (1)

Equation (1) is the fundamental formula that the Bank of Japan uses in its conduct of monetary control; the Bank of Japan routinely publishes the actual values of each item in equation (1) in the statistics on "Demand and Supply of Funds in Money Markets." As will be explained later, equation (1) is nothing but the equilibrium equation relating the supply of, and demand for, high-powered money.

The Bank of Japan refers to the total of (a) and (b) in equation (1) as a "surplus or shortage of funds." An increase in the "shortage of funds" (viz., flux of bank-notes and receipts of the government) is interpreted as a tightening of supply and demand conditions in the money market. On the other hand, an increase in the "surplus of funds" (viz., reflux of bank notes and payments of the government) is interpreted as a loosening of the money market conditions. These interpretations follow from the fact that a shortage (or surplus) of funds tends to decrease (or increase) reserve deposits, as long as the amount of credit provision (or absorption) by the Bank of Japan to financial institutions (i.e., (c) in equation (1)) remains unchanged.

B. Money Market Control by the Bank of Japan

In his famous book, *Federal Reserve Operations in the Money and Government Securities Market* (1956), R. Roosa characterized the responsibilities of the Federal Reserve System for monetary control as consisting of two types, namely the "defensive" responsibilities and the "dynamic" responsibilities; the defensive ones are to neutralize the changes in money market conditions caused by independent market factors and

dynamic ones are to positively cause changes in money market conditions in the conduct of monetary policy. The Bank of Japan also employs defensive and dynamic operations within the framework of the reserve deposits requirements system discussed in A. of this section.

First, the defensive operations of the Bank of Japan are conducted as credit provision or absorption to neutralize fluctuations in the "surplus or shortage of funds" (or, fluctuations in money market factors), on a daily or seasonal basis. On a monthly basis (i.e., for each "maintenance period"), moreover, the Bank of Japan controls its credit to financial institutions so as to eventually secure that the average outstanding balance of actual reserve deposits placed with the Bank match the average amount of legal reserve requirements, except for small statistical errors. Such a defensive operation has allowed Japanese financial institutions to keep the holdings of excess reserves to almost zero and to minimize the opportunity cost of holding such non-interest bearing assets in their portfolio (Table 1).[5]

Second, the dynamic operations of the Bank of Japan are conducted in the form of adjustment of the "reserve progress ratio of reserve deposits." The "reserve progress ratio" is the ratio of reserve deposits accumulated from the first day of a "maintenance period" to total cumulative reserve deposits required for that period. The ratio increases by 3.3% a day in a standard path along which required reserve deposits are equally maintained every day during a given "maintenance period" (30 days).[6] The Bank of Japan reduces the "reserve progress ratio of reserve deposits" relative to the standard path by limiting credit provision (or accelerating credit absorption) in responding to day-to-day "shortage of funds (or surplus of funds)" in the money market, whenever it is following a tight monetary policy stance. On the other hand, the Bank of Japan increases the "reserve progress ratio of reserve deposits," whenever it is following a more relaxed monetary policy stance. It should be noted, however, that the monthly average of deposits with the Bank of Japan in a given "maintenance period" is equal *ex post* to the monthly average of required reserve deposits: the "reserve progress ratio" of the last day of lodging is 100%, even if the Bank of Japan conducts dynamic operations. The dynamic operations by the Bank of Japan to influence money market conditions are thus conducted under this terminal constraint; such is the Bank of Japan's art of monetary

[5]The average ratio of excess reserves to total reserves held by Japan's financial institutions as a whole was only 0.076% during the recent monetary relaxation period from September 1980 to January 1988. Furthermore, the ratio for city banks was a negligible 0.012%, and the absolute value of excess reserves was relatively stable at around 200 million yen throughout the period of 23 years from 1965 to 1988 despite the expansion of total reserves. This reflects the "fine tuning" efforts of the Bank of Japan to maintain the level of reserve deposits mainly through transactions with city banks.

[6]Of course, such a path of the "reserve progress ratio" based on the daily lodging of 3.3% may not be the standard case. Participants in the money market might assume a slower (or faster) path of the "reserve progress ratio" in the months with a "shortage (or surplus) of funds."

Table 1. Reserve Deposits, 1965-1988[a]

(¥100 million, %)

		Jan. 1965~ Aug. 1967 E[b]	Sept. 1967~ July 1968 T[c]	Aug. 1968~ Aug. 1969 E	Sept. 1969~ Oct. 1970 T	Nov. 1970~ Mar. 1973 E	Apr. 1973~ Apr. 1975 T	May 1975~ Apr. 1979 E	May 1979~ Aug. 1980 T	Sept. 1980~ Jan. 1988 E
Total Reserve[d]		1331.8	1667.9	1986.0	3133.4	4963.3	20483.0	19437.3	23265.3	26575.2
Ⓐ	City Banks	747.1	898.2	1069.2	1661.8	2595.5	11974.1	12659.1	15102.5	18988.3
	Others	584.7	769.7	916.8	1471.6	2367.8	8505.9	6778.2	8162.8	7586.9
Required Reserve		1326.5	1662.7	1980.5	3123.8	4951.3	19249.9	19421.3	23244.9	26554.9
	City Banks	744.6	895.5	1066.9	1655.8	2592.5	10754.3	12656.7	15100.0	18986.1
	Others	581.9	767.2	913.6	1468.0	2358.8	8495.6	6764.6	8144.9	7568.8
Excess Reserve		5.3	5.2	5.4	9.6	11.9	15.8	15.9	20.4	20.3
Ⓑ	City Banks	2.5	2.6	2.3	6.0	2.9	2.5	2.4	2.5	2.2
	Others	2.8	2.6	3.2	3.6	9.0	13.3	13.6	17.9	18.1
Ratio of Ⓐ to Ⓑ (%)		0.398	0.312	0.272	0.306	0.240	0.077	0.082	0.088	0.076
Ⓑ/Ⓐ	City Banks (%)	0.335	0.289	0.215	0.361	0.112	0.021	0.019	0.017	0.012
	Others (%)	0.479	0.338	0.349	0.245	0.380	0.156	0.201	0.219	0.239

[a] Outstanding deposits are monthly averages.

[b] E indicates a period of easy monetary policy.

[c] T indicates a period of tight monetary policy.

[d] Sum of reserve deposits of all financial institutions subject to reserve requirements.

Figure 1. Demand and Supply in the Short-Term Money Market and Monetary Control by the Bank of Japan

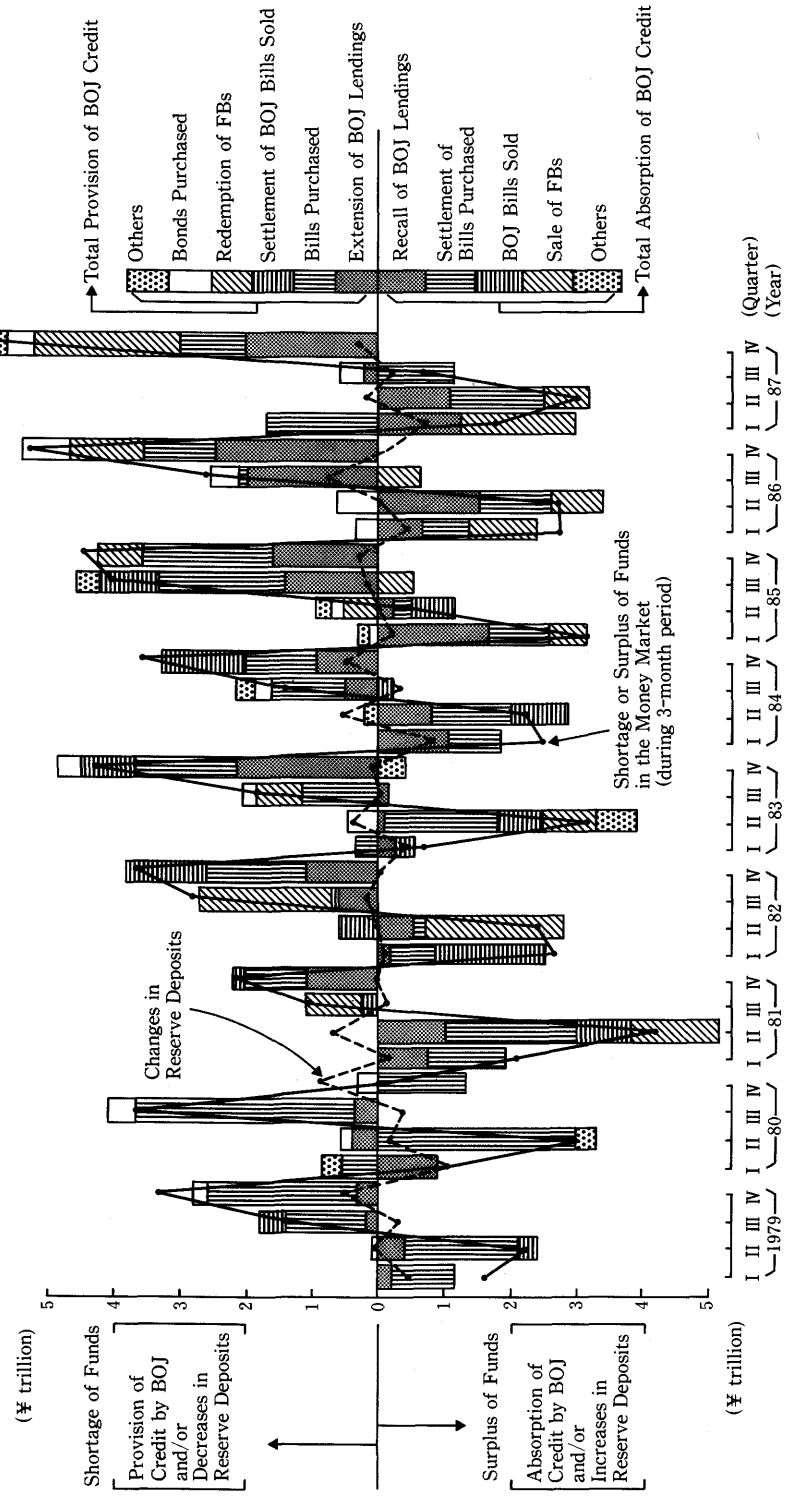
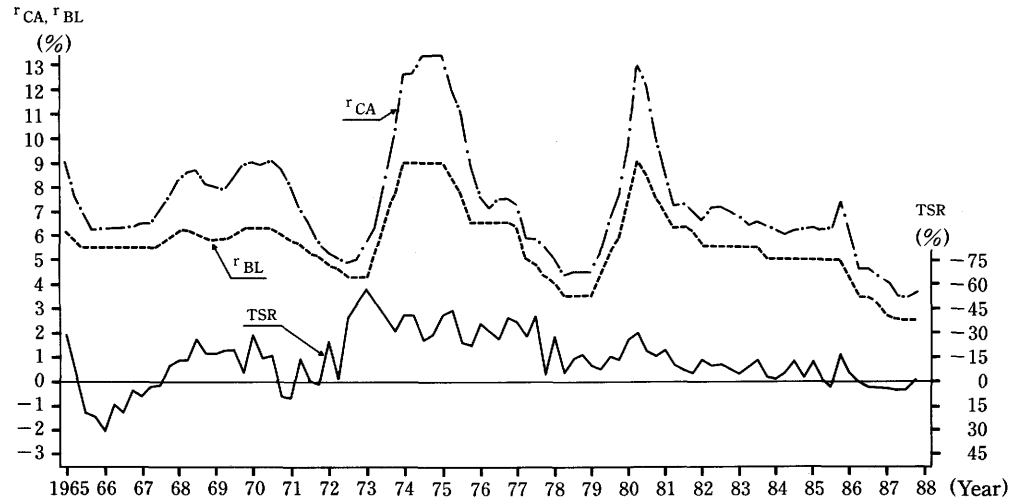


Figure 2. The Weighted Average of Call and Bill Rates (r_{CA}) the Official Discount Rate (r_{BL}) and the Reserve Progress Ratio (TSR)



control.

The Bank of Japan employs various credit control instruments in the inter-bank money market (to which only financial institutions have access), in open money markets (to which non-financial institutions have access), and in the government bonds market (Figure 1).

First, for the control of very short-term fluctuations in the market factors such as daily and monthly variations in the "surplus or shortage of funds," lending by the Bank of Japan is chiefly adopted.[7] The Bank of Japan has traditionally been extending loans at the official discount rate to financial institutions, mainly city banks that are large fund borrowers in the inter-bank market. Because the Bank of Japan has ordinarily set the official discount rate below the call and bill rates (Figure 2), it has been able to either extend or recall such loans at its discretion (i.e., so-called credit rationing); such loans are, therefore, among the most flexible credit control instruments at the Bank's disposal. For instance, on the last day of a "maintenance period," the Bank of Japan adjusts the surplus or shortage of required reserve deposits by extending or recalling loans to the city banks.

The official discount rate is calculated according to what is called the "method of counting both ends" whereby the day when credit is extended is counted as one additional day in calculating the number of days in a lending period. Under this method, as the length of a lending period becomes shorter, the effective interest rate becomes higher.

[7]In addition to lending to commercial banks, the Bank of Japan employs sales of bills (drawn by the Bank of Japan) to the call market as an instrument of controlling daily or monthly changes in money market conditions.

Therefore, the official discount rate could function as a penal rate if the lending period is sufficiently short.

Second, the Bank of Japan conducts market operations in bills (purchases of private bills and sales of bills drawn by the Bank of Japan), short-term government financial bills (FBs), and negotiable certificates of deposits (CDs) in order to adjust seasonal fluctuations in the "surplus or shortage of funds" of a two to three month duration. The bills market has been actively used in credit provision as well as credit absorption by the Bank of Japan since 1972. As an instrument of credit absorption during a period of surplus funds, the Bank of Japan has sold short-term FBs at market rates since May 1981, and the degree of freedom concerning the timing and amount of such sales has increased gradually. Nevertheless, the FBs market has not yet expanded sufficiently to enable the execution of buying operations. Since 1986 the Bank of Japan has executed buying operations in CDs (with money market dealers as its agent) as an instrument to neutralize seasonal fluctuations in the money market conditions.

These operations in bills, FBs, and CDs, as well as government bonds (to be explained later), are conducted at the sole discretion of the Bank of Japan. Of these operations, the Bank of Japan has adopted operations in FBs and CDs for the express purpose of directly controlling short-term interest rates in these open money markets.

Third, the Bank of Japan accommodates secular increases in the "shortage of funds" associated with long-term economic growth with outright purchases of long-term government bonds. Until the 1960s, this type of credit accommodation had mainly taken the form of lending to financial institutions. However, when further economic growth increased the demand for currency in circulation (i.e., "money for growth"), the Bank of Japan faced with cumulative increases in the outstanding amount of loans to financial institutions (so-called "overloan" phenomenon). Consequently, the Bank of Japan changed its procedure in 1963, and has since supplied "money for growth" by purchases of long-term government bonds.

In December 1987, the Bank of Japan began buying operations of long-term government bonds with resale agreements with a view to providing credit flexibly and controlling open market interest rates. Thus, the Bank of Japan employs two types purchases of operations—outright and conditional—in long-term government bonds, each with a quite different purpose in mind.

III. Determination of Short-Term Money Market Rates

In the previous section, we explained Japan's reserve deposit requirements system and the credit control techniques of the Bank of Japan. Our next task is to explain how they in turn determine major monetary variables, such as short-term money market rates, high-powered money and the money stock. In this section, we first analyze the determination mechanism of the call and bill rates, which are the Bank of Japan's most

important operating variables in the short-term money market. We then analyze the process of interest rate transmission from the call and bill-discount markets to the other short-term money markets, such as the market for certificates of deposit (CDs), the "gensaki" market for securities (i.e., the short-term bond repurchase market) and short-term Euro-yen market.

A. Simplified Flow of Funds Model in Japan

In analyzing the monetary control mechanism in Japan, it is useful to think of a simplified flow of funds model composed of several financial markets as follows (Table 2):

1. The model is composed of nine assets, i.e., currency (C), deposits with the Bank of Japan (R), loans by the Bank of Japan (BL), the call and bills discounted (CA), open market assets (OM), deposits with the banking sector (D), loans by the banking sector (L), government bonds (GB), assets denominated in foreign currencies (FA*).
2. The model consists of five sectors, i.e., the Bank of Japan (J), the government (G), the banking sector (B), the non-banking sector (N) and the overseas sector (S).
3. As for interest rates on assets, the official discount rate on BL (r_{BL}) and the deposit rate on D (r_D) are regulated, while rates on CA (r_{CA}), OM (r_{OM}), L (r_L), GB$(r_G)_B$ and FA* (r_{FA}) are not regulated.[8]

Under these assumptions, we can characterize market equilibrium conditions as follows. First, in the market for loans from the Bank of Japan, the banking sector passively accepts the amount of loans as determined solely at the discretion of the Bank of Japan at a given official discount rate (r_{BL}), which is ordinarily set below short-term money market rates, i.e., r_{CA}. and r_{OM}. Second, in the market for deposits with the banking sector whose deposit rates are set below market rates, the banking sector passively supplies the amount of deposits as determined by the non-banking sector's demand. Thus, we are left only with 6 market equilibrium conditions for 6 assets, namely (1) currency and deposits with the Bank of Japan (that is, high-powered money), (2) call and bills discounted, (3) open market assets, (4) loans by the banking sector, (5) government bonds, and (6) assets denominated in foreign currencies. By virtue of Walras' Law, only 5 of these 6 equations are independent. Thus, we will use 5 equations to determine the following five free market rates: r_{CA}, r_{OM}, r_L, r_{GB}, and r^*_{FA};[9] we use five free interest rates to derive the equilibrium values of high-powered money and the money stock that are determined endogenously in the model.

[8]In this model, deposits with market interest rates (such as foreign currency deposits, large-denomination time deposits and MMCs) can be treated as types of open market assets.

[9]Returns on assets denominated in foreign currencies consist of foreign interest rates and the expected rate of change in foreign exchange rates. Therefore, given the foreign interest rates, the conditions of general equilibrium in asset markets will determine the expected rate of change in foreign exchange rates.

Table 2. Simplified Flow of Funds Model in Japan

		The Bank of Japan (J)		Government (G)		Banking Sector (B)		Non-banking Sector (N)		Overseas Sector (S)		Interest Rates
Currency	(C)		C_J			C_B		C_N				0
Deposits with the Bank of Japan	(R)		R_J	R_G		R_B						0
Loans by the Bank of Japan	(BL)	BL_J					BL_B					$\overline{r}_{BL}$
The Call and Bills Discounted	(CA)	CA_J					CA_B					r_{CA}
Open Market Assets	(OM)	OM_J			OM_G		OM_B	OM_N				r_{OM}
Deposits with Banking Sector	(D)						D_B	D_N				$\overline{r}_D$
Loans by Banking Sector	(L)					L_B			L_N			r_L
Government Bonds	(GB)	GB_J			GB_G	GB_B		GB_N				r_{GB}
Assets Denominated in Foreign Currencies	(FA*)	FA_J*		FA_G*			FA_B*	FA_N*			FA_S*	r_{FA}*
Accummulated "Surplus or Shortage of Funds" (Net Outstanding Financial Assets)	(W)	0			W_G[a]	0		W_N[b]			W_{S*}[c]	–

[a] W_G : accumulated financial deficits of the government

[b] W_N : accumulated excess savings of the non-banking sector

[c] W_{S*}: accumulated surplus of the Current account

B. Determination of the Call and Bill Rates

In the theoretical model, all unregulated interest rates and monetary aggregates (e.g., high-powered money and the money stock) are simultaneously determined. In practice, however, there may be lead-lag relationships (or causality of variations) between interest rates or monetary aggregates. Clarification of the possible presence of such lead-lag relationships is crucial to our understanding of the actual monetary control mechanism.

Japan's monetary control begins with the manipulation of call and bill rates through adjustment of high-powered money. The Bank of Japan has traditionally conducted its daily operations in the call and bill discount markets, and continues to regard call and bill rates as important operating variables in its conduct of monetary policy. The changes brought about by recent financial market liberalization and internationalization has not changed the Bank's treatment of the call and bill rates as the most important operating variables.

Table 2 explains the demand for, and supply of, high-powered money (H). The items on the demand side are the banking sector's demand for reserves (R_B), currency possessed by the banking sector (C_B), and currency possessed by the non-banking sector (C_N). Here, R_B and C_B are both expressed as a function of the call and bill rates (r_{CA}) in a partial equilibrium framework.[10]

$$H = R_B(r_{CA}) + C_B(r_{CA}) + C_N \tag{2}$$

On the supply side, high-powered money can be determined by the balance sheets constraints of the Bank of Japan and of the government as follows:

$$\begin{aligned} H &= C_J + R_J - R_G \\ &= (BL_J + CA_J + OM_J + GB_J + FA^*_J) - (OM_G + GB_G - FA^*_G - W_G) \end{aligned} \tag{3}$$

where W_G indicates accumulated financial deficits of the government.

Consequently, the equilibrium condition in the market for high-powered money can be expressed as:

$$\begin{aligned} H &= R_B(r_{CA}) + C_B(r_{CA}) + C_N \\ &= (BL_J + CA_J + OM_J + GB_J + FA^*_J) - (OM_G + GB_G - FA^*_G - W_G). \end{aligned} \tag{4}$$

After shifting C_B and C_N to the other side, equation (4) can be rewritten on a flow basis (indicated by Δ) as follows:

$$\begin{aligned} \Delta R_B(r_{CA}) = &-\Delta(C_B(r_{CA}) + C_N) - \Delta(OM_G + GB_G - FA^*_G - W_G) \\ &+ \Delta(BL_J + CA_J + OM_J + GB_J + FA^*_J) \end{aligned} \tag{5}$$

[10]Demand for vault cash (C_N) by the non-banking sector is expressed as a function not of the inter-bank call and bill rates (r_{CA}), but of open market rates (r_{OM}).

which is equivalent to equation (1), showing "Demand and Supply of Funds" in the money market. Hence, the fundamental formula utilized in money market control by the Bank of Japan is nothing but the equilibrium condition in the market for high-powered money, rearranged in terms of demand and supply adjustment of reserve deposits.

Adjustments of reserve deposits determine the call and bill rates. In this process, the official discount rate plays a crucial role. Changes in the official discount rate can directly influence call and bill rates through the so-called "announcement effect" by revealing changes in the policy stance of the Bank of Japan to the public. In fact, as Figure 2 shows, the weighted average of call rate and bill rate moves almost in parallel with the official discount rate. The "cost effect" of changes in the official discount rate upon call and bill rates, however, is insignificant because, with the official discount rate set below the market interest rates, the Bank of Japan determines the outstanding balance of loans to financial institutions solely at its own discretion.[11]

While changes in the official discount rate express the fundamental changes in the monetary policy stance, the path of the "reserve progress ratio" provides the public with supplementary information about the Bank of Japan's desired degree of tightness or easiness in money market conditions. The "reserve progress ratio" has thus additional influence on the call and bill rates primarily through its own "announcement effect" in a manner similar to the effect of changes in the official discount rate. The "reserve progress ratio" can influence call and bill rates through the "cost effect" as well. For example, if the delayed path of "reserve progress ratio" in comparison with its standard path would raise the implicit cost of lodging required reserves by financial institutions and thereby place upward pressure on call and bill rates.[12]

In order to empirically verify the hypothesis that the official discount rate and "reserve progress ratio" separately influence call and bill rates, we regress the weighted average of call rate and bill rate on (1) the official discount rate, (2) "reserve progress ratio," and, in one specification, (3) the accumulated "shortage or surplus of funds" (adjusted for outright purchases of government bonds by the Bank of Japan) as an autonomous market factor. The results shown in Table 3 seem to support the null hypothesis: the coefficients of (1), (2), and (3) are all significant with expected signs. Hence, the

[11]Because lending to commercial banks is executed at the complete discretion of the Bank of Japan, changes in the official discount rate cannot have any effects on the levels of other interest rates derived from general equilibrium conditions in the asset markets, except through the "announcement effect." In other words, changes in the official discount rate can affect the call and bill rates via the "cost effect," only if the banking sector has some discretion to determine the amount of lending it receives from the Bank of Japan.

[12]Increases in the implicit costs imply: (1) for the financial institutions as a whole, the reinforcement of the Bank of Japan's administration over the lodging process of reserve deposits; and (2) for the individual financial institution whose "reserve progress ratio" is slower than that of the other institutions, increases in the risk of failing to meet the reserve requirement on the final day of the "maintenance period" (that is, the risk of incurring negative publicity from becoming the only one bank that is excessively indebted to the Bank of Japan).

Table 3. Estimation of the Weighted Average of Call and Bill Rates[a]

$$r_{CA} = a_o + b_o r_{BL} + c_o TSR + d_o SKF + \epsilon$$

r_{CA} : Weighted Average of Call and Bill Rates (%)
r_{BL} : Official Discount Rate (%)
TSR : Reserve Progress Ratio (deviation from the standard case, %)
SKF : Accumulated "Surplus or Shortage of Funds" (trillions of yen)

	b_o	c_o	d_o	Const.	$\bar{R}^2$	D.W.
Based on Monthly Data (Feb. 1979 ~ Feb. 1988)	1.154	-0.029		0.636	0.981	1.886
	(16.146**)	(-3.171**)		(1.620)		
	1.176	-0.033	0.031	0.522	0.982	1.854
	(17.759**)	(-3.629**)	(2.470*)	(1.448)		
Based on Quarterly Data (1979 I ~ 1987 IV)	1.447	-0.015		-0.816	0.970	1.720
	(12.538**)	(-1.486)		(-1.372)		
	1.399	-0.014	0.030	-0.599	0.971	1.792
	(13.110**)	(-1.309)	(1.208)	(-1.133)		

Notes: t-values in parentheses.
**(*) indicate that the coefficient is significant at 1% (5%).
[a]First-order serial correlation corrected.

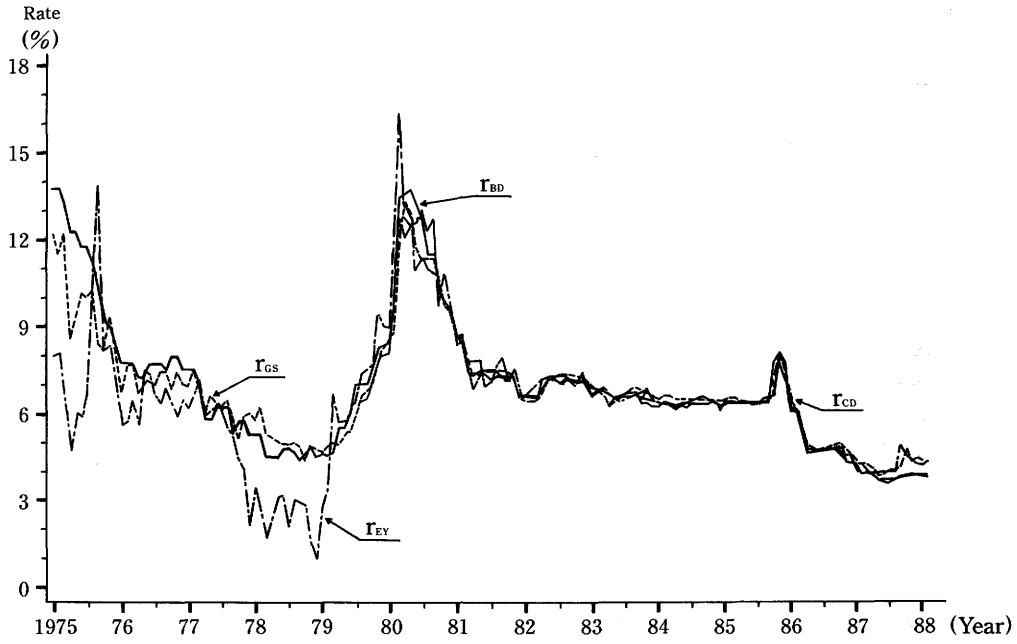
results imply that the call and bill rates have seasonal fluctuations that reflect to some extent variations in such an autonomous market factor as the accumulated "shortage or suplus of funds."[13]

C. Transmission of Interest Rates from the Call and Bill Discount Market to the Other Short-Term Money Markets

Variations in the call and bill rates determined by the mechanism described above are transmitted to the other short-term money market rates via arbitrage transactions. Interest rate arbitrage between the inter-bank and open markets, or domestic and overseas markets, have become more active in recent years, along with the establishment and expansion of several new short-term money markets. As a result, the movements of various money market rates have become increasingly closer (Figure 3).

[13]As shown in Table 3, the parameters of TSR and SKF are not significant in the estimation based on quarterly bata, while they are significant in the estimation based on monthly data, implying that fluctuations in the call and bill rates reflect only monthly variations in TSR and SKF and such monthly fluctuations in TSR and SKF are averaged out in quarterly data.

Figure 3. The Bill Rate (r_{BD}), CD Rate (r_{CD}), Gensaki Rate (r_{GS}) and Euro-yen Rate (r_{EY})



First, liberalization of the short-term money market as reflected in the introduction of CDs market in 1979, gradual relaxation of gensaki transactions by city banks since around the autumn of 1978, and authorization for securities companies to procure funds in the call market, has increased interest arbitrage between the inter-bank and open markets at home. This can be confirmed by calculating correlation coefficients between inter-bank rates and open market rates based on the data of the end-month level of interest rates (Table 4). The value of the correlation coefficient between the bill rate and the gensaki rate rose from 0.958 during 1975–79 to 0.991 during 1980–88. There was also close correlation between the CDs rate and the bill rate because financial institutions view sales of bills and issuing of CDs as close substitutes on the liability side: the correlation coefficient during 1980–88 was 0.990.

Second, arbitrage transactions between domestic and overseas markets, expedited by a series of liberalization measures in 1979 (e.g., authorization for non-residents to participate in the gensaki market), were almost perfectly liberalized with the implementation of the new Foreign Exchange and Foreign Trade Control Law in 1980, and the abrogation of swap limitations on the conversion of foreign currency into yen. As a matter of fact, the correlation coefficient between the bill rate and the Euro-yen rate increased from 0.625 during 1975–79 to 0.979 during 1980–88.

Table 4. Correlation Coefficients of Short-term Money Market Rates[a]

1. Arbitrage between Inter-bank Rates and Open Market Rates

Inter-bank Market	Open Market	Period	Correlation Coefficients
2-month Bills Discounted	3-month Gensaki	Jan. 1975 ~ Dec. 1979	0.958
	3-month Euro-yen	Jan. 1975 ~ Dec. 1979	0.625
3-month Bills Discounted	3-month CDs	Jan. 1980 ~ Jan. 1988	0.990
	3-month Gensaki	Jan. 1980 ~ Feb. 1988	0.991
	3-month Euro-yen	Jan. 1980 ~ Feb. 1988	0.979

2. Arbitrage between Open Market Rates

Open Markets		Period	Correlation Coefficients
3-month Gensaki	3-month Euro-yen	Jan. 1975 ~ Dec. 1979	0.623
3-month CDs	3-month Gensaki	Jan. 1980 ~ Jan. 1988	0.989
3-month CDs	3-month Euro-yen	Jan. 1980 ~ Jan. 1988	0.968
3-month Gensaki	3-month Euro-yen	Jan. 1980 ~ Feb. 1988	0.983

Source: Bank of Japan, *Economic Statistics Monthly*
[a]Rates at the end of the month.

D. The Term Structure of Short-Term Money Market Rates

The analysis of the term structure of short-term money market rates provides us with additional information about their determination mechanism. Here we analyze the relationship of the overnight call rate with the interest rates on financial instruments of the maturity of around three months: namely (1) the bill rate, (2) the CDs rate, (3) the gensaki rate, and (4) the Euro-yen rate.

Under the pure expectations hypothesis of the term structure of interest rates, the interest rate on three-month term instruments (r_T) would be equal to the average of the current and future overnight call rates (r_C^e) during the corresponding three-month period. Therefore, in order to test the pure expectation hypothesis, we regress r_T on r_C^e in the following way.

$$r_T = a_o + b_o r_C^e + \varepsilon \tag{6}$$

where the null hypothesis is expressed as,

Table 5. Term Structure of Short-Term Money Market Rates[a]
(January 1980~December 1987)

$$r_T = a_o + b_o r_c^{\circ} + \epsilon$$

r_T : 3-month Rates of Bills Discounted, CDs, Gensaki and Euro-yen
r_c° : Ex-post Average Call Rate during the Corresponding 3-Month period

r_T	a_o	b_o	R^2	D.W.
Bill Rate	0.279	1.000	0.966	1.742
	(0.626)	(0.003)		
CDs Rate	1.515	0.813	0.957	1.450
	(3.319**)	(2.858**)		
Gensaki Rate	0.924	0.876	0.957	2.017
	(2.998**)	(2.775**)		
Euro-yen Rate	0.338	1.018	0.926	1.939
	(1.148)	(0.423)		

Source: Bank of Japan, *Economic Statistics Monthly*
Notes: t-values in parentheses.
**(*) indicates that the null hypothesis (H_o: $a_o = 0$, $b_o = 1$) is rejected at 1(5)%.
[a]First-order serial correlation corrected.

$$H_o : a_o = 0 \text{ and } b_o = 1. \quad (7)$$

With the assumption of perfect foresight on future call rates, we have estimated the equation (6). The results shown in Table 5 can be summarized as follows:

1. The bill rate can be explained almost entirely by the pure expectations hypothesis: it is remarkable that the coefficient of b_o is exactly 1. This is consistent with the fact that the call rate and the bill rate are treated as close substitutes in Japan's money market.
2. Concerning the Euro-yen rate, which is often characterized as a *de facto* inter-bank market rate, the pure expectations hypothesis can not be rejected at the 5% level of significance, although its significance level is slightly inferior to the one of the bill rate.
3. Concerning the CDs rate and the gensaki rate, which are both open market rates, the pure expectations hypothesis is rejected at the 1% level of significance. Therefore, such results imply that the CDs and gensaki rates are influenced significantly by such market-specific factors as credit risk as well as demand and supply conditions.

IV. Control of the Money Stock and Macroeconomic Performance in Japan

The Bank of Japan's most important intermediate target in its conduct of monetary policy is broadly defined money (M_2 + CDs).

Since the period of high inflation in the mid-1970s following the first oil crisis, the Bank of Japan has given greater preference to price stability relative to business activity as the ultimate objective of monetary policy than had been the case before. As for intermediate targets, the Bank of Japan has given emphasis on the control of the money stock instead of the control of lending by private financial institutions to the non-financial sector. As a reflection of this changed policy stance, in the third quarter of 1978, the Bank of Japan began to announce the quarterly forecasts of the money stock (M_2 at the beginning and M_2 + CD since the second quarter of 1979) for the following quarter in terms of percentage increases in the average outstanding balance over the corresponding quarter of the previous year. In such a manner, the Bank of Japan has been executing monetary policy which pays the closest attention to the money stock.

Let us now discuss (1) the controllability of the money stock and (2) the stability of relationships between the money stock and real economic activity, which are both important assumptions underlying the Bank of Japan's monetary targeting policy.

A. Control Mechanism of the Money Stock

The Bank of Japan controls the money stock through changes in the call and bill rates as operating variables. As we already discussed in section I in the context of the reserve deposits requirements system and the Bank of Japan's credit control techniques, the monetary control of the Bank of Japan takes the form of accommodative provision (or absorption) of credit when the demand for high-powered money fluctuates. The Bank of Japan has never adopted the so-called multiplier approach whereby the money supply is indirectly controlled by the direct control of the supply of high-powered money through a stable multiplier relationships.

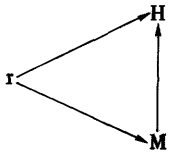
We estimate a Vector Auto Regressive (VAR) model of three variables, namely, the money stock (M), high-powered money (H), and the short-term money market rate (r), during the period between the first quarter of 1968 and the fourth quarter of 1987. Table 6 reports F statistics on the hypothesis that there was a causal relationship in the sense of Granger (1969).

1. There was unidirectional causality from r to M and from r to H, indicating that the control of the short-term money market rates constitutes the first step in the Bank of Japan's conduct of monetary policy.
2. There was unidirectional causality from M to H, indicating the absence of the multiplier approach in Japan's monetary control.

Let us next consider the process by which changes in the call and bill rates ultimately affect the money stock, by taking as an example the case where the Bank of Japan is

Table 6. F-Statistics Based on Three Variable VAR Model (1968 I~1987 IV)

[H: High-Powered Money
r : Weighted Average of Call and Bill Rates
M: Money Stock (M_2 + CDs)]

Independent / Dependent	H	r	M	Causality
H	2.840	6.913*	11.765**	
r	0.418	318.067**	0.728	
M	0.103	6.294**	136.347**	

Source: Bank of Japan, *Economic Statistics Monthly* (seasonally adjusted).
Notes: All variables are percentage increases over the previous quarter.
Lag length of the estimated VAR model is selected by the minimum AIC.
**(*) indicates that the F-value is significant at 1(5)%.

attempting to restrain growth in the money stock. Broadly speaking, there are three channels by which changes in the call and bill rates affect the money stock.

First, the increase in the inter-bank market rates brought about by operations of the Bank of Japan reduces the marginal profitability of additional loans and increases the profitability of portfolio investments on short-term money market assets for financial institutions. Consequently, financial institutions reduce loans and increase net lending in the inter-bank money markets; this follows from the fact that the loan rates of financial institutions are less flexible than the inter-bank rates because they are significantly influenced by prime lending rates which are in turn based on regulated deposits rates and by the consideration of the long-term customers' relationship. Moreover, the effect of an increase in inter-bank rates on the amount of loans of financial institutions through this channel is supplemented by the so-called "window guidance" (a type of moral suasion by the Bank of Japan) which is intended to limit the quarterly increases in the total loan volume of individual financial institutions.

Second, an increase in the inter-bank market rates raises the open money market rates and yields on medium- and long-term government bonds through arbitrage, causing individuals and non-financial firms to make portfolio adjustments away from deposits with regulated interest rates to open market instruments and government bonds whose yields have risen. Financial institutions would thus suffer from outflows of funds in deposits with regulated interest rates (viz., financial dis-intermediation). Along with the

development of open money markets and government bonds markets, non-banking sector behavior has important effects upon the money stock via portfolio selection.

Third, an increase in inter-bank rates reduces the expenditures of the private non-financial sector by raising the cost of obtaining loans or issuing bonds. Business firms thus reduce plant or inventory investment and households reduce expenditures on housing or consumer goods. Such a reduction in business and household expenditures gives rise to a slowdown in the nominal value of transactions in the economy as a whole and, as the result, reduces the transactions-motivated component of the demand for money mainly in the business sector. Moreover, the slowdown of real economic activity influences household savings through a fall in income, thereby reducing the asset-motivated component of the demand for money.

Although these three transmission channels still exist today, the further liberalization of deposit rates since the spring of 1985 has changed the relative importance of each money stock control channel. Important recent liberalization measures have included the introduction of deposits bearing market-related interest rates (MMCs), relaxation of issuing conditions of CDs and liberalization of the interest rates on large denomination time deposits. These measures caused the shift of bank loans from traditional "prime rates banking" based on regulated interest rates to "spread banking" based on market interest rates.

These developments are likely to affect each of the three transmission channels. First, proliferation of "spread banking" will weaken the restraining effect of a reduction in the marginal profitability of loans on the money stock (the first channel). Second, further liberalization of deposit rates will reduce the effect of so-called dis-intermediation

Table 7. Lagged Correlation Coefficients between the Call Rate and the Money Stock

	Period	Maximum Coefficients	Number of Lags
Quarterly[a] Data	1975 I ~ 1979 IV	−0.751	−1
	1980 I ~ 1984 IV	−0.660	−2
	1985 I ~ 1987 IV	−0.480	−4
Monthly[b] Data	Jan. 1975 ~ Dec. 1979	−0.455	−3
	Jan. 1980 ~ Dec. 1984	−0.451	−5
	Jan. 1985 ~ Jan. 1988	−0.350	−18

Source: Bank of Japan, *Economic Statistics Monthly* (seasonally adjusted).
[a]Percentage increases over the previous quarter.
[b]Percentage increases over the previous month.

on the money stock (the second channel) by allowing deposit rates to move in parallel with the short-term money market rates. Third, liberalization of deposit rates and subsequent increases in "spread banking" in the bank loans market will strengthen the effect of a reduction in the business and household demand for money on the money stock (the third channel).

Therefore, it is impossible to make an *a priori* judgement as to whether the recent liberalization of deposit rates has weakened the control mechanism of the money stock. Cross correlation analysis, however, indicates that negative correlation between the call rate and the money stock (M_2 + CD) became somewhat smaller and the length of lag longer during the period after 1985, when a series of measures were taken to liberalize deposit rates (Table 7). Of course, there still exists negative correlation between the short-term interest rate and the money stock, and the Bank of Japan will continue to control the money stock by influencing the call and bill rates. Nevertheless, one needs to watch very carefully how rapidly the recent financial liberalization will change the way money stock control is effected in Japan.

B. The Relationships between the Money Stock and Real Economic Activity

The reason why the Bank of Japan has been paying closest attention to the broadly defined money stock as an intermediate target of monetary policy lies in the existence of a stable relationship between the broad money stock and several real economic variables, as had been demonstrated by many empirical studies.[14] In particular, the stable relationship that exists between the money stock and the price level, which is the ultimate objective of the Bank of Japan, is the important background for the monetary targeting policy.

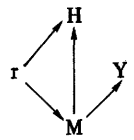
Let us now review the relationship between the money stock and real economic activity by estimating a VAR model. First, we estimate the VAR model of four variables, namely high-powered money (H), the short-term interest rate (r), the money stock (M) and nominal GNP (Y), during the period from the second quarter of 1967 to the fourth quarter of 1987 (Table 8). F statistics indicate unidirectional causality, in the sense of Granger, running from M to Y, but show no evidence of causality running from r to H nor from H to Y. These results reconfirm the importance of the money stock as an intermediate target. Furthermore, the evidence of three sets of unidirectional causality, i.e., from r to M, from r to H, and from M to H, is identical to the causal relationships observed in the earlier three-variable VAR model and seems to show the robustness of our hypothesis about the working mechanism of Japan's money market: the Bank of Japan controls the money stock by influencing short-term interest rates and providing (or absorbing) central bank credit to accommodate fluctuations in the demand for high-

[14]See Suzuki (1985). For a survey of empirical studies based on Granger causality, see Okina (1985).

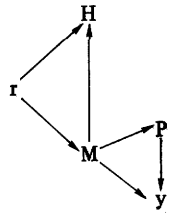
Table 8. F-Statistics Based on Four- and Five-Variable VAR Models (1968 I~1987 IV)

H: High-powered Money
r : Weighted Average of Call and Bill Rates
M: Money Stock (M_2+CDs)
Y: Nominal GNP
y : Real GNP
P: GNP Deflator

1. Four-Variable VAR Model For H, r, M and Y

Independent / Dependent	H	r	M	Y	Causality
H	1.808	7.551**	7.372**	0.719	
r	0.028	248.384**	0.982	2.187	
M	0.143	6.152**	113.770**	0.089	
Y	0.531	1.264	9.232**	3.549*	

2. Five-Variable VAR Model For H, r, M, y and P

Independent / Dependent	H	r	M	y	P	Causality
H	1.063	9.121**	8.095**	0.409	1.957	
r	0.002	191.293**	0.696	0.894	2.331	
M	0.302	5.279**	108.287**	0.247	0.805	
y	0.182	0.163	3.825*	1.028	3.419*	
P	0.173	1.419	7.832**	1.061	21.110**	

Note: See notes for Table 6.

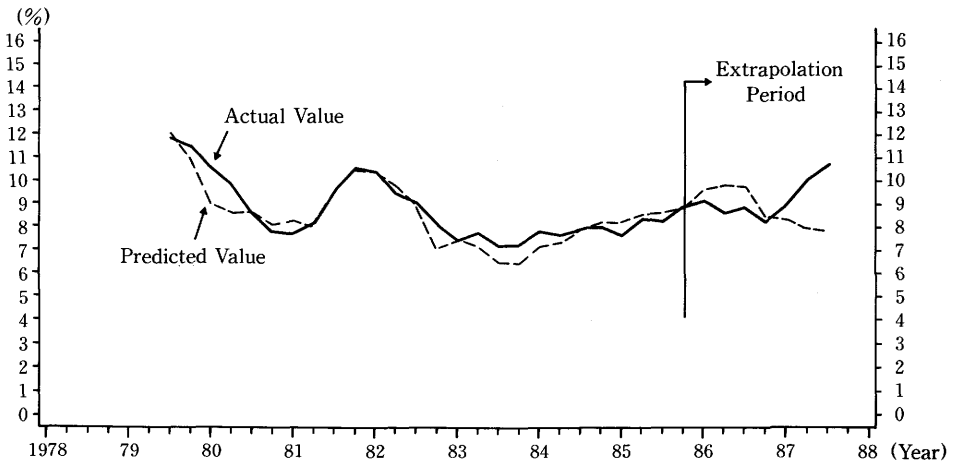
powered money.

Next, we estimate a VAR model of five variables, by adding real GNP (y) (in place of nominal GNP (Y)), and GNP deflator (P), to the four variable VAR model (Table 8). F statistics indicate the presence of three sets of unidirectional causality, running from M to P, from M to y, and from P to y. The causality from P to y suggests the so-called

"deflationary effect of inflation," implying that an increase in M might cause two consequences that are largely offsetting each other, namely an increase in y and the "deflationary effect of inflation." As a result, the effect of an increase in M on y is uncertain in the long run and the long-run Phillips curve is nearly vertical. Furthermore it should be noted here that the causal relationships among three variables, H, r, and M, turn out to be the same as those in the three- or four-variable VAR model.

Having analyzed the mechanism of money stock control and the relationships between the money stock and real economic activity, let us now investigate the recent stability of the demand for money function, which summarizes the functional relationship of the money stock with short-term interest rates and real economic variables.[15] Here, as a standard specification, we assume that the real money stock is determined by short-

Figure 4. Estimation of the Money Demand Function and Simulation Results [I]



Notes: Estimated Function: Period 1978 III-1985 IV

$$\ln(M/P) = -1.3257 + \underset{(2.1)}{0.2260}\ln(Y/P) - \underset{(4.9)}{0.2732}\ln(1 + r) + \underset{(12.6)}{0.8544}\ln(M/P)_{-1} + \varepsilon$$

$R^2 = 0.999$ S.E. = 0.00469

D.W. = 1.946 t-values in parentheses

M: M_2 + CD (average outstanding, seasonally adjusted)

Y: Nominal GNP

P: GNP deflator

r: Gensaki Rate

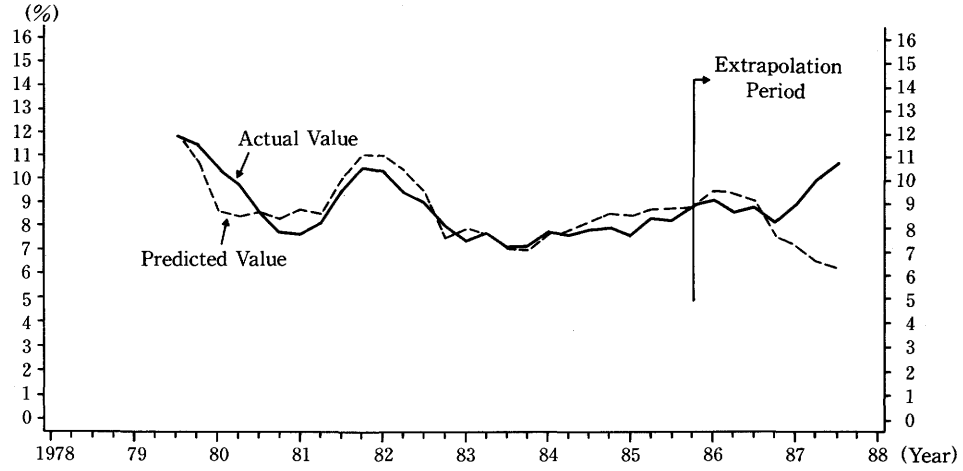
Extrapolation is done as a dynamic simulation beginning in the 4th quarter of 1985.

[15]The estimation and simulation of the demand for money function reported here were performed by Mitsuhiro Fukao and Tetsufumi Yamakawa of the Institute for Monetary and Economic Studies, Bank of Japan.

term interest rate and real GNP. Estimation of a standard money demand function based on the data during the period from the third quarter of 1978 to the fourth quarter of 1985 has yielded a good fit (Figure 4). If we use the estimated function to extrapolate, we can satisfactorily trace the actual path of the money stock from the first quarter of 1986 until the fourth quarter of 1986. However, the estimated function substantially underforecasts the actual path of the money stock after 1987. Therefore, the standard demand for money function does not explain the recent sharp increases in money stock growth.

Next, we estimate an alternatively specified demand for money function by employing the difference between the weighted avarage of interest rates on individual components of M_2 + CDs and the money market interest rate in place of the money-market interest rate itself. This specification takes account of the possibility that the increased weight of free market instruments in M_2 + CD has reduced the opportunity cost for holding M_2 + CDs; for example, the share of free market instruments in M_2 + CDs increased from 8.6% in December 1985 to 19.5% in October 1987. According to

Figure 5. Estimation of the Money Demand Function and Simulation Results [II]



Notes: Estimated Function: Period 1978 III-1985 IV

$$\ln(M/P) = -0.9967 + \underset{(1.5)}{0.1772}\ln(Y/P) - \underset{(4.2)}{0.3741}\ln(1+c) + \underset{(12.1)}{0.8815}\ln(M/P)_{-1} + \varepsilon$$

$R^2 = 0.999$ S.E. = 0.00504

D.W. = 1.895 t-values in parentheses

M: M_2 + CD

Y: Nominal GNP

P: GNP deflator

c: Opportunity Cost for holding M_2+CD
[(Gensaki Rate) − (Average Yield on M_2+CD)]

Extrapolation is done as a dynamic simulation beginning in the 4th quarter of 1985.

estimation results, however, the modified version shows little improvement over the standard demand for money function (Figure 5).

The empirical analysis shown above indicates that the recent sharp increase in the money growth rate in Japan can not be well explained by the demand for money function. At first glance, such a phenomenon seems to suggest the instability of the demand for money function. However, the under-prediction of the money stock might be caused by the shift in the money supply function. For example, short- and long-term interest rates have recently declined to extremely low levels by historical standards and, as a result, the prices of existing assets, such as land and stocks, have increased significantly. Accordingly, the non-financial sector's ability to borrow has risen with the increase in the value of collaterals; the financial sector has increased lending activity. If this interpretation is correct, we have an identification problem. Thus, it is very difficult to know whether the function we are estimating is the "demand for money" function or the "supply of money" function, because both functions could be specified in almost the same way.

Another interpretation for the recent sharp increase in the money growth rate in Japan is to take the stock-motivated demand for money component into consideration. Namely, the recent increase in the stock of wealth, such as the values of stock shares and real estates, might have contributed to the increase in the demand for money. If that is the case, the money demand function which includes the stock of wealth as an additional explanatory variable could solve the problem of the recent under-prediction of the money stock (Ueda 1988).

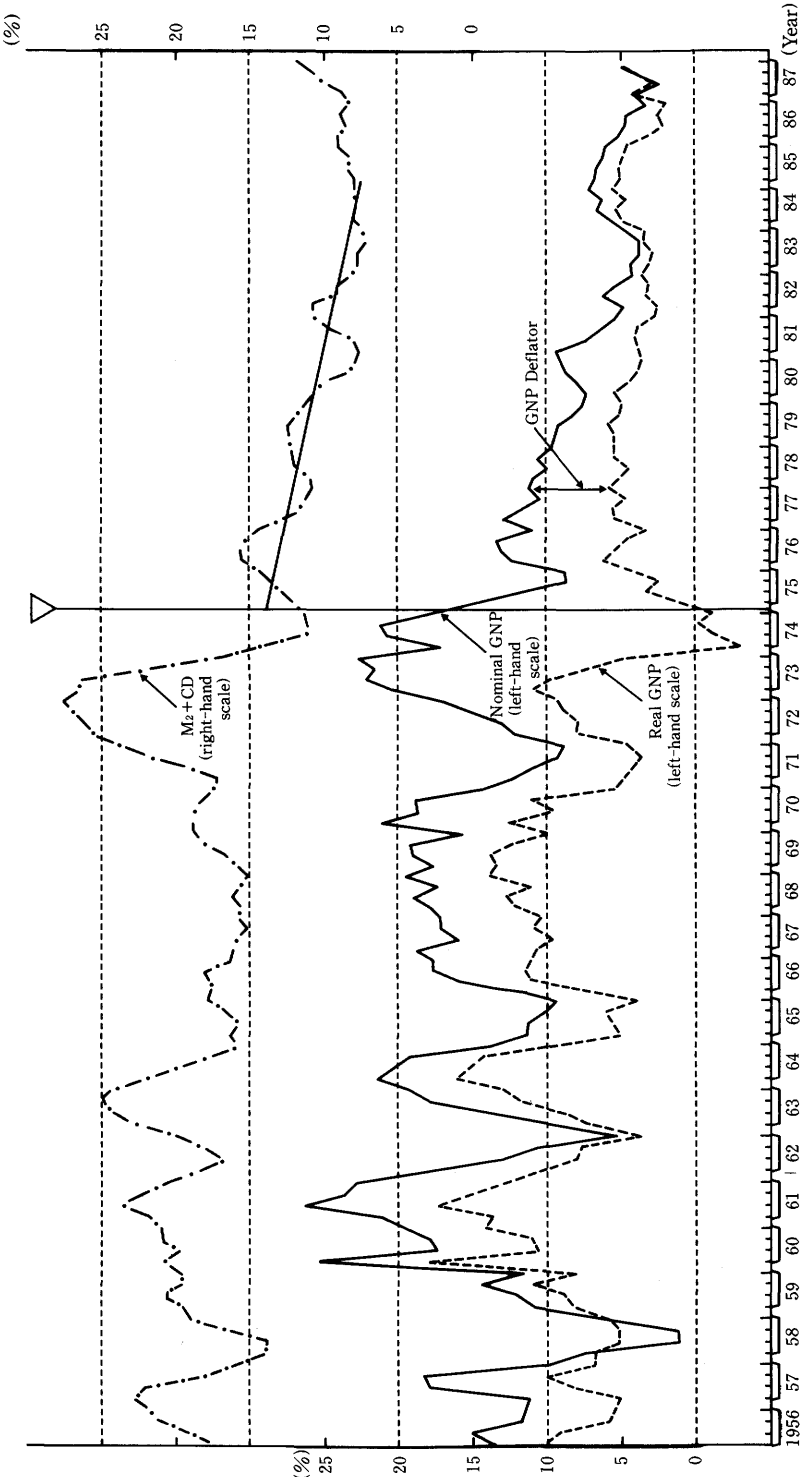
As already described, the mechanism of money stock control has been changing under the recent liberalization of deposit rates; the ability of the standard "demand for money" function to forecast a future money stock has been declining. Therefore, we must pay careful attention to further changes in the money stock control mechanism and in the forecasting ability of the money demand function in the conduct of monetary targeting policy in Japan in the future.

V. Monetary Control under the Globalization of Financial Markets

This paper has analyzed the mechanism of monetary control in Japan, focusing on (1) the determination of short-term money market rates and (2) the control mechanism of the money stock. In this concluding section, we will point out how many tasks that the Bank of Japan must do in order to maintain monetary control under world-wide financial integration (so-called "financial globalization").

The first task is to determine how to maintain the controllability of short-term money market rates as a whole under the expansion of domestic open markets as well as the Euro-yen market. Because short term money market rates are ultimately determined by the conditions in the market for high-powered money, which is under the direct control of the Bank of Japan, the controllability of short-term money market rates cannot

Figure 6. Money Stock and GNP in Japan



Notes: Growth rates of money stock and GNP are calculated not against the previous quarter, but against the same quarter in the previous year. "M_2 + CD" (before 1979 I, "M_2") is an average of end-of-month observations. For example, the value for the first quarter is an average of the values at the end January, February and March.

in principle be weakened through such factors as an increased access to the Euro-yen market. However, the empirical analysis of this paper has suggested that open market rates sometimes deviate from the call and bill rates when there were factors specific to open markets. Therefore, it is important for the Bank of Japan to develop new operation techniques in the newly-established open markets in order to secure the accurate controllability of short-term money market rates as a whole.

The second task is to properly define the intermediate target for monetary targeting policy. Financial globalization would present several problems in this respect: (1) it obscures the range of monetary aggregates to be watched, (2) it changes the mechanism of money stock control, and (3) it increases the instability of the demand for money function. As a result, it will become increasingly difficult to properly define the money stock as the intermediate target. For instance, it would be difficult to decide whether to include Euro-yen deposits which are expanding under financial globalization. Moreover, as we argued earlier, the consecutive liberalization of deposit rates and the resulting increase in "spread banking" in the loans market would significantly affect the mechanism of money stock control in the future. Furthermore, we should take into account the possibility that the demand for money function, which plays an important role in monetary targeting policy, would become unstable.

Since 1975, the monetary targeting policy of the Bank of Japan has been conducted successfully (Figure 6). In order to keep the effectiveness of our monetary policy under rapid environmental changes in Japan's financial markets, we are required to continue to study the mechanisms of money stock control and of transmission from the money stock to real economic variables both in theory and practice.

Here the effect of the recent sharp increase in the money growth rate in Japan upon the rate of inflation and that of the real GNP growth should be carefully watched. At least two points should be considered in this context. Firstly, the increase in the money growth rate might lead to the increase in the rate of the real GNP growth through the so-called "wealth effect." In fact, not only plant and equipment investment but also consumption have already been expanding. Secondly, in order to avoid the rekindling of the inflation, the following conditions on the supply-side of the economy should be satisfactorily achieved: domestically, the industrial production is to increase in parallel with the increase in the demand; internationally, the appreciation of the yen is to continue so as to offset the inflationary pressures from overseas.

Finally, we should recognize that, under the progress of financial globalization, it is a very important task for the Bank of Japan to maintain the stability of financial systems (especially, the payment system) in addition to securing the stability of monetary control regarding short-term market rates and the money stock (Suzuki 1987).

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