Recent developments in the implementation of monetary policy in Japan and its operating procedure[1]

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Introduction

In Japan, there have recently been a number of unprecedented developments in the implementation of monetary policy and its operating procedure. For example, the current level of the official discount rate (ODR hereafter) is not only at a historical low but is in fact lower than experienced in any other major country. Moreover, the overnight call rate, the most representative short-term money market rate, is below the ODR, which is quite divergent from past practice. The traditional role of BOJ (Bank of Japan) lending in the management of money market conditions has also been reviewed and undergone change. Most of these developments reflect BOJ's response to the changing financial and economic environment and its effort to maintain and enhance the effectiveness of monetary policy under new circumstances.

The purpose of this paper is i) to review the recent major developments in the implementation of monetary policy in Japan and its operating procedure in detail, and ii) to try to give a proper explanation or interpretation of these developments against the financial and economic background. In the following, recent changes in monetary policy operating procedure will first be discussed. Then, developments in monetary policy, mainly since the beginning of the current easing phase (from 1991), will be reviewed, with particular reference to the role of monetary aggregates, asset prices, and the foreign exchange rate. Comparison will also be made with the previous easing phase in the late 1980s, which was associated with the so-called asset price bubbles. Finally, Appendix I gives empirical analyses of quantitative indicators used to assess the extent of tightness or ease of monetary policy. Appendix II gives a summary of our recent empirical analyses concerning the relationship between monetary aggregates (mainly M2+CDs) and price/income variables.

1. Recent changes in monetary policy operating procedure

Recent changes in the financial and economic environment have resulted in significant changes in monetary policy operating procedure. In particular, the development or improved efficiency of various financial markets, which has emerged as a result of financial deregulation, has enabled BOJ to mainly rely on the market mechanism in conducting monetary policy. Main features of recent changes and resultant current procedure will be summarised in the following. It should, however, be noted that, in order to maintain the effectiveness and credibility of monetary policy, operating procedure should be constantly reviewed and further modified, if necessary, in accordance with possible changes in the financial environment. Certain factors which are expected to lead to such changes, namely i) the introduction of a repo market, and ii) the possible introduction of RTGS (real-time gross settlement) to the inter-bank settlement practice, will be discussed later in this section.

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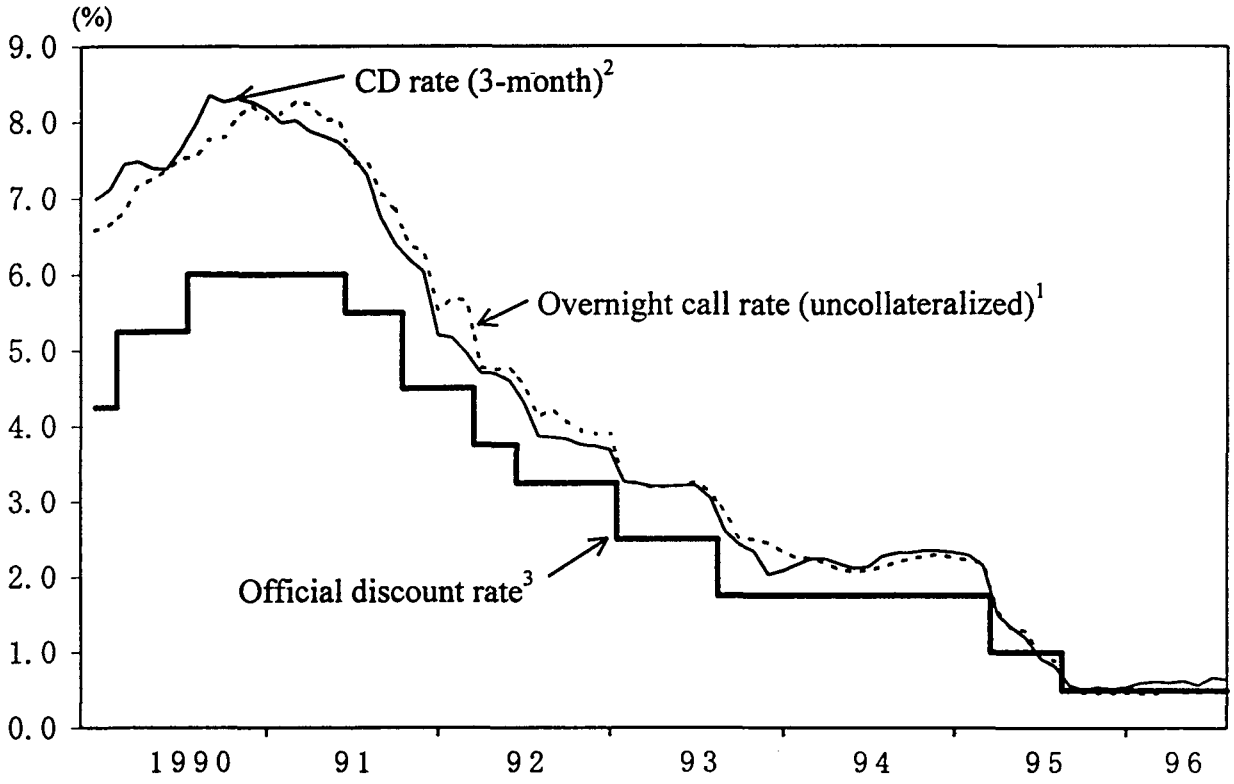
1.1 Changes in the role of the short-term money market rate and the ODR

The most conspicuous feature of recent changes in monetary policy operating procedure is the increased importance attached to the adjustment of market interest rates, in particular, the overnight call rate. BOJ has consistently paid due attention to developments in market rates, and, in fact, implicitly controlled the overnight call rate so that it would move in line with changes in the ODR and normally stay at a level slightly above it. In March 1995, however, BOJ for the first time explicitly announced its intention to lower market interest rates without cutting the ODR. Like changes in the ODR, this measure was based on a decision of BOJ's Policy Board, which is the ultimate decision-making body with respect to monetary policy.

In July 1995, when BOJ decided and announced the further lowering of market interest rates,[2] the level to which it intended to bring the overnight call rate (on average), and which was lower than the ODR, was also made explicit. This announcement, in fact, denotes a distinct change in monetary policy operating procedure in two aspects: i) this was the first time for BOJ to announce such a guidance level for market interest rates, and ii) this was also the first occasion that the overnight call rate was brought to a level lower than the ODR[3] (Figure 1). A new guidance level was again announced when the ODR was further cut by half a percentage point to 0.5% in September 1995.[4]

Figure 1
Short-term money market rates



[1] Figures are monthly average rates. [2] Weekly average rates for the last week of the month, weighted by the volume of CDs issues during the month by city banks, long-term credit banks and trust banks belonging to the Federation of Bankers Associations of Japan. Trust banks which opened in or after October 1993 are excluded. [3] End of month.

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2 Between these two occasions (March 1995 and July 1995), the ODR was cut by ¾ percentage points to 1.0% in April.

3 The actual announcement was: "(BOJ) expects that short-term market rates on average will decline somewhat below the ODR".

4 The announcement was: "(BOJ) expects that short-term money market rates on average will decline slightly below the new ODR".

These measures have given rise to money market conditions that are totally different from those in the past. In the past, the practice whereby the overnight call rate was guided by BOJ, although implicitly, to a level above the ODR was one of the most important features of monetary policy operating procedure. This practice created persistent excess demand for BOJ lending provided at the ODR, and, consequently, BOJ had considerable discretion whether or not to activate lending. BOJ used this discretionary power to affect money market conditions. Under the new procedure, however, since the ODR is, on average, higher than the overnight call rate, commercial banks normally choose to raise funds, when necessary, from money markets at market rates, and hence there is no persistent excess demand for BOJ lending.[5] Thus, the previously substantial role of the ODR has changed, and the primary concern of monetary policy operations is the adjustment of the overnight call rate. A remaining important role of the ODR, for the moment, is that it indicates changes in the basic stance of monetary policy.

There are still certain issues to be further examined or solved concerning this new operating procedure. For example, as mentioned before, only the average level to which BOJ intends to bring the overnight call rate is made explicit. Alternatively, it is also conceivable that BOJ could announce a target range rather than the average, which would make it clearer what degree of variance BOJ was prepared to tolerate.[6] It is also yet to be considered and decided whether or not the current practice of bringing the overnight call rate to a level lower than the ODR should be permanently maintained.

1.2 Increased use of market operations and withdrawal of BOJ lending

Since the ODR is on average higher than the overnight call rate under the new operating procedure and excess demand no longer exists, it has become difficult for BOJ to use ODR lending as the main instrument to influence market interest rates. BOJ has responded to this situation by increasing the use of various market operations. In fact, since July 1995, the frequency of certain operations, such as same-day competitive bidding operations for treasury bills, outright JGB (Japanese government bonds) purchase operations, and bond *gensaki* operations (purchases with resale agreements), has increased. Competitive bidding was also introduced to same-day settlement bill-purchasing operations, which used to be based on "price limit" in which the purchase price had been specified by BOJ. CP operations were also resumed for the first time since 1991, with the method also changed to competitive bidding and participants extended to include banks and securities companies[7] (Figure 2).

This increased use of market operations, along with the above-mentioned new practice of maintaining the overnight call rate below the ODR, has significantly reduced the role of BOJ lending in influencing money market conditions. Taking account of these developments, BOJ reviewed the role of its lending and finally decided to refrain from using it, in principle, as a tool for market adjustment.[8] BOJ lending is now basically reserved for providing liquidity to financial institutions as the lender of last resort (LLR).

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5 Of course, excess demand for BOJ lending could sometimes arise even under the new procedure, for example, when the market rate temporarily goes above the ODR due to exceptionally large fluctuations in factors affecting market liquidity (such as very large receipts of treasury funds).

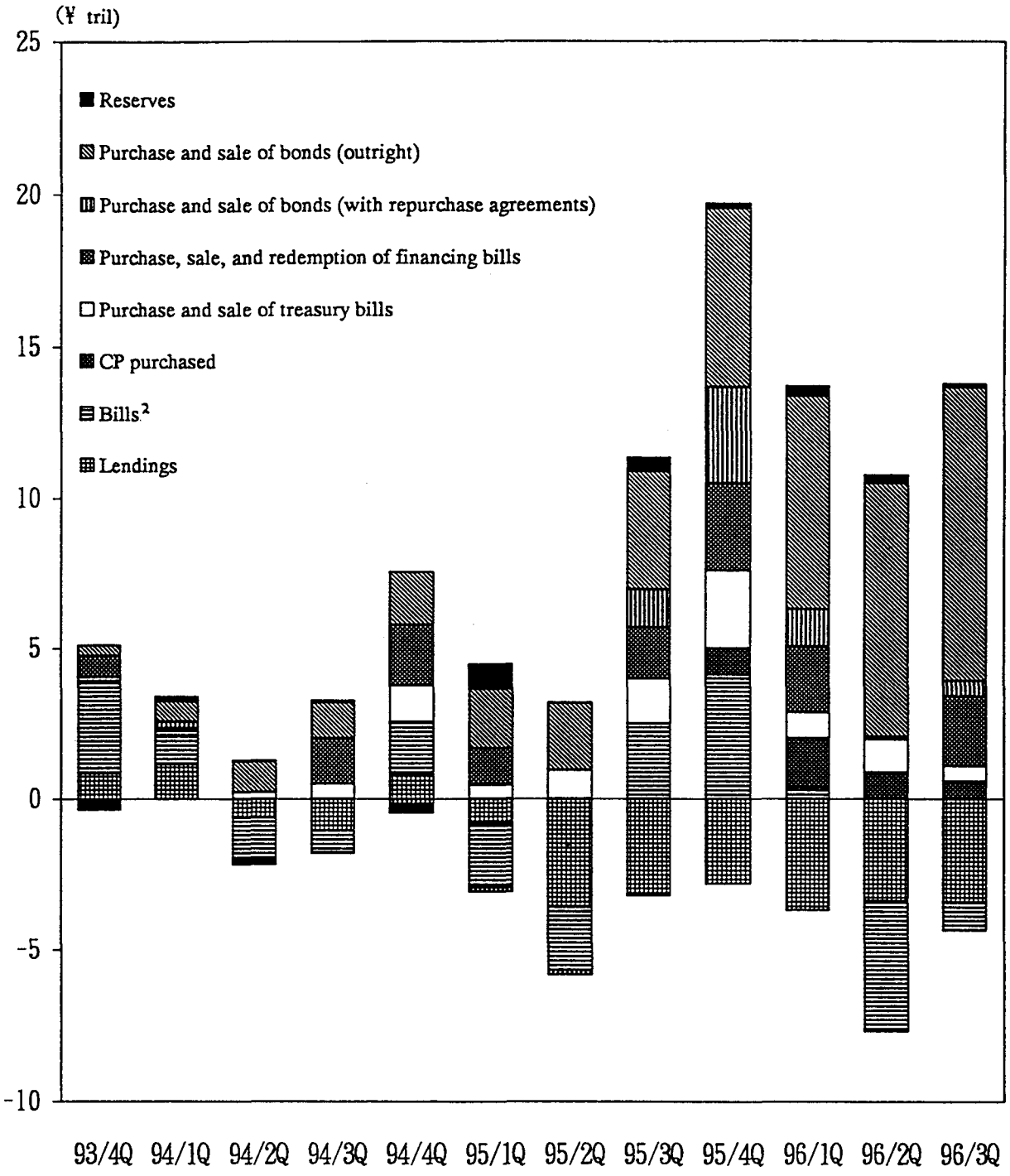
6 Setting a target range for the overnight call rate could, of course, pose certain problems. For example, the range should be wide enough to allow seasonal or daily fluctuations in the rate caused by exogenous factors such as the net receipt of treasury funds, which are in fact quite large. On the other hand, excessively wider ranges could make BOJ's policy intention more ambiguous, possibly resulting in diminished transparency.

7 In the past, CP operations were only available to money market dealers (*tanshi* companies).

8 Heavy reliance on BOJ lending at below market rate in monetary policy operating procedure has also long been criticised as i) giving *de facto* subsidies to banks, and ii) lacking transparency concerning the allocation of lending

Figure 2

Bank of Japan credit operations[1]



[1] Based on cumulative figures from 4th quarter 1993. Positive figures indicate supply of funds. [2] Bills = Bills purchased + bills sold.

One of the consequences of these developments has been an increase in the outstanding balance of the outright purchase of JGBs by BOJ since autumn 1995. Outright JGB-purchasing operations used to be regarded, in principle, as a means of providing the financial system with the additional reserves demanded in line with an increase in money stock, which is indispensable for

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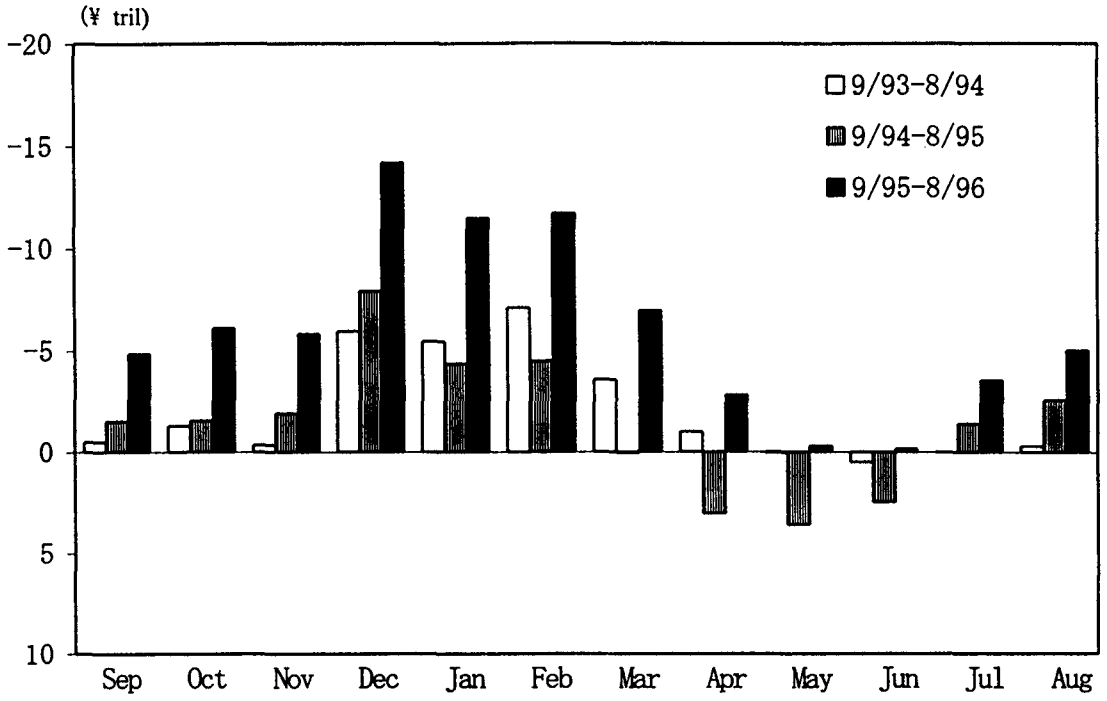
because of its bilateral nature. The recent change in the role of BOJ lending will reduce the significance of these problems.

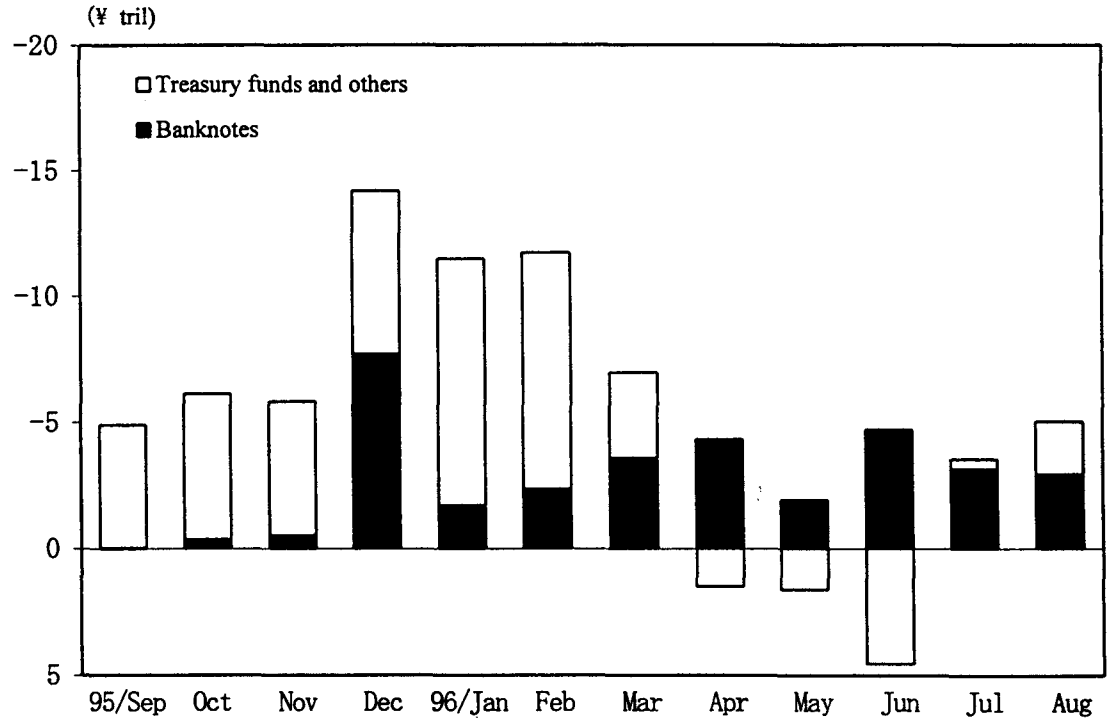
Figure 3

Supply of and demand for funds*

Excess / Shortage of Funds



Breakdown of Fund Excess / Shortage



* Figures are cumulative figures from September. Negative (positive) figures denote shortage (excess) of funds.

economic growth. The increase in purchases since autumn 1995, however, seems to be far larger than needed for this purpose. It is thus often put forward that BOJ has been trying to bring down long-term interest rates by increasing outright purchasing operations. However, this does not seem to be a proper understanding. The operations themselves were conducted mainly to offset a liquidity shortage in the money market caused by the significant increase in the net receipt of treasury funds (Figure 3), and hence were not in any way intended to supply extra liquidity. In addition, the resultant increase in the outstanding balance of outright purchases is to be regarded as just substituting the balance of BOJ lending, which is decreasing gradually.

1.3 Factors likely to cause further change in operating procedure

As stated at the beginning of this section, monetary policy operating procedure should, and is likely to, change further, in accordance with future developments in financial markets. Two particular factors which are likely to cause such changes in the near future: the introduction of a repo market, and the introduction of RTGS (real-time gross settlement) to inter-bank settlement practice in the future.

1.3.1 Introduction of a repo market

A repo market was introduced in April 1996. Formally, it is a market for lending/borrowing bonds (mainly JGBs) with cash offered as collateral. However, since it is now allowed for lenders of bonds to pay any interest on cash offered to them as collateral,[9] the market is expected to function as a *de facto* short-term money market. In Japan, the secondary markets for treasury bills (TBs) and financing bills (FBs), generally regarded as the most suitable markets for central bank operations because no credit risk is involved in the instruments traded, may not be sufficiently developed owing to certain obstacles, such as the withholding tax imposed on interest payments. Given this situation, the repo market is naturally expected to become one of the main markets for BOJ's operations, provided that it becomes sufficiently large.

In terms of size, the market has gradually expanded since its introduction: transaction volume increased from ¥17 trillion in April to ¥55 trillion in August 1996, and the outstanding balance from ¥3 to 6 trillion. However, transactions are mainly made for facilitating the short sale of bonds by securities companies, and hence the market so far does not seem to be functioning as a short-term money market as expected. Certain factors which are preventing the development of the market are pointed out. It is, for example, argued that the separation of decision making between bond and short-term fund dealing sections within financial institutions is an obstacle to growth of repo market. The most important factor, however, is said to have been the inconvenience associated with the settlement practice of JGBs, because, until September, settlements could only be made on certain designated days. This practice is now being changed to the so-called rolling settlement method: from 1st October, settlement is to be made seven days after the contract, and this is planned to be shortened to three days in March next year. This introduction of rolling settlement is expected to contribute to the further development of the repo market and, if the market grows sufficiently, it is possible that BOJ might start utilising it to effect operations.

1.3.2 Introduction of RTGS in the future

In Japan, most inter-bank settlements are effected on a DTNS (designated time net settlement) basis, although RTGS is also institutionally possible and BOJ-NET, the principal inter-bank settlement system run by BOJ, facilitates both. However, BOJ is considering changing this

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9 There used to be a ceiling on interest paid on cash offered as collateral (the ceiling was one percentage point lower than the collateralised overnight call rate), which had prevented the development of a repo market.

practice to make RTGS the principal method for inter-bank settlement, in order to reduce systemic risk involved in DTNS-based settlement.

Under current practice where DTNS is dominant, the average outstanding balance of reserves which banks need to hold for daily settlement operations is quite small, and normally below the level necessary for meeting minimum reserve requirements.[10] In this situation, daily fluctuations in demand for reserve balances needed for settlement purposes are absorbed in changes (leads or lags) in banks' "progress ratios" to meet reserve requirements. Theoretically, this means that banks have a certain degree of discretion in determining their daily holding of reserves, depending on the overnight call rate or its prospects, and hence the demand curve of banks with respect to reserve balances each day is downward sloping against the interest rate (not vertical). Given this, BOJ is able to affect the overnight call rate by controlling the daily supply of reserves through market operations; that is, deciding whether or not to fully offset the liquidity excess/shortage each day, and hence affecting the "progress ratio". In fact, this is the main mechanism by which BOJ controls the overnight call rate under current operating procedure.

If inter-bank settlements come to be mainly on an RTGS basis, the way of controlling the overnight call rate could also change. In fact, the daily volume of inter-bank settlements far exceeds the average reserve balance currently held by banks to meet reserve requirements. Hence, without provision of intra-day liquidity by BOJ, daily demand for reserves could be mainly determined by settlement volume and would not respond to the overnight call rate. If this situation actually prevails, the above-mentioned method for controlling the overnight call rate through affecting the "progress ratio" could not work under RTGS.

Although the most appropriate operating procedure under RTGS is not yet clear and is a subject for further study, one apparent problem to be solved, therefore, is how to provide banks with intra-day credit. As intra-day credit must be provided quite promptly to meet banks' demand and market operations conducted through competitive bidding might not ensure such promptness, the extension of some bilateral credit by BOJ is likely to become necessary. The most suitable way for BOJ to provide banks with intra-day credit, and its desirable conditionality (the applicable interest rate, eligible collateral, etc.) is currently being considered.

2. Implementation of monetary policy in recent years

Against the background of sluggish economic recovery, the easing of monetary policy has been underway in Japan since 1991. Indeed, the level of interest rates has fallen substantially below the low recorded in the previous easing period, which seems to evidence the unprecedented degree of monetary ease. In this section, we first try to assess the extent and effect of this continued easing, and to examine the possible risks involved. Then, the role of certain factors (such as monetary aggregates and policy response to exchange rate developments and asset prices), in the implementation of monetary policy in general, as well as in the current easing of monetary policy in particular, will be discussed.

2.1 Overall assessment of continued easing of monetary policy

Monetary policy in Japan turned to ease in 1991, and has continued easy since. The ODR has been lowered by a total of 5.5 percentage points to the historical low of 0.5%, and market interest rates have fallen accordingly (see Figure 1). The overnight call rate, in particular, has fallen even below the ODR, reflecting the change in monetary policy operating procedure since July 1995 (as

[10] In Japan's reserve requirement system, the reserves held by banks to meet the reserve requirement can also be used for their daily settlement purposes.

discussed in Section 1). This prolonged easing of monetary policy is, of course, mainly associated with the sluggish recovery of economic activity. Although the Japanese economy started to recover towards the end of 1993, the speed remained very slow compared with past recovery phases, and a pause was even feared in the first half of 1995 when the yen began to further appreciate.

Since the current easing period is already longer than the previous one, which was associated with the so-called asset price bubbles in the late 1980s,[11] and the current level of interest rates is far lower (the ODR bottom in the previous easing period was 2.5%), the argument is sometimes heard that there is a risk that the current easing of monetary policy could already be excessive. However, when assessing the appropriateness of current monetary policy, a number of factors influencing recent developments in the Japanese economy, such as changing trade and industrial structures and the damage caused by the bursting of the so-called bubbles, should be taken into account, and comparing the extent of ease just in terms of length or level of nominal interest rates is not necessarily the right way.

In fact, during the current phase of recovery, continuing adjustment pressures stemming from the factors mentioned above are likely to have made the recovery slower than previous ones. For example, there has been continued pressure for Japan's trade and industrial structures to change and adapt in accordance with the appreciation of the yen as well as the rapid industrialisation of Asian economies. Firms have responded to this pressure by investing abroad rather than domestically, and hence shifting some of their production overseas. Accordingly, corporate investments have been more sluggish than is normal during a recovery period. In addition, the rapid and large fall in asset prices, particularly land prices, after the bursting of the bubbles, has seriously impaired balance sheets in both the corporate sector and the financial sector, which has made firms and financial institutions less willing to take risks involved in investment. Many firms have also reduced investment to within the level of cash flow and are avoiding building up further financial liabilities.

These adjustment pressures have also substantially reduced the risk of overheating or the emergence of inflation and asset price bubbles. In fact, even after more than five years of monetary ease, the inflation rate has remained very close to zero, and there is no sign of asset prices regaining momentum. In this situation, it seems quite appropriate for monetary policy to try to mitigate the negative impact of adjustment pressures on the real economy by maintaining low interest rates, thus contributing to the smooth progress of such adjustments.[12]

There could be another argument with respect to the extent of monetary policy ease, which suggests that, taking account of the deceleration of inflation and the fall in the potential growth rate, monetary policy during the current easing phase has not actually been as easy as suggested by developments in nominal interest rates. In order to examine this argument empirically, we tried to develop a measure which enables us to quantitatively assess the real tightness or ease of monetary policy. We tentatively call the measure the "Monetary Thrust Index" (MTI hereafter) and it is defined as the difference between the real interest rate (real cost of funds) and the real rate of return on investment. Thus, monetary conditions can be regarded as stimulative (restrictive) if MTI is negative (positive). In calculating MTI, we actually subtracted the estimated potential growth rate (used as a proxy for the medium-term expected real rate of return on investment) from the real overnight call rate (the nominal call rate, which is the principal policy rate, minus GDP deflator growth). MTI thus calculated, in fact, has been empirically proved to cause (in a Granger sense) real M2+CDs (the representative monetary aggregate in Japan) and real domestic private demand (Figure 4). (For details of MTI calculation and empirical results, see Appendix I.)

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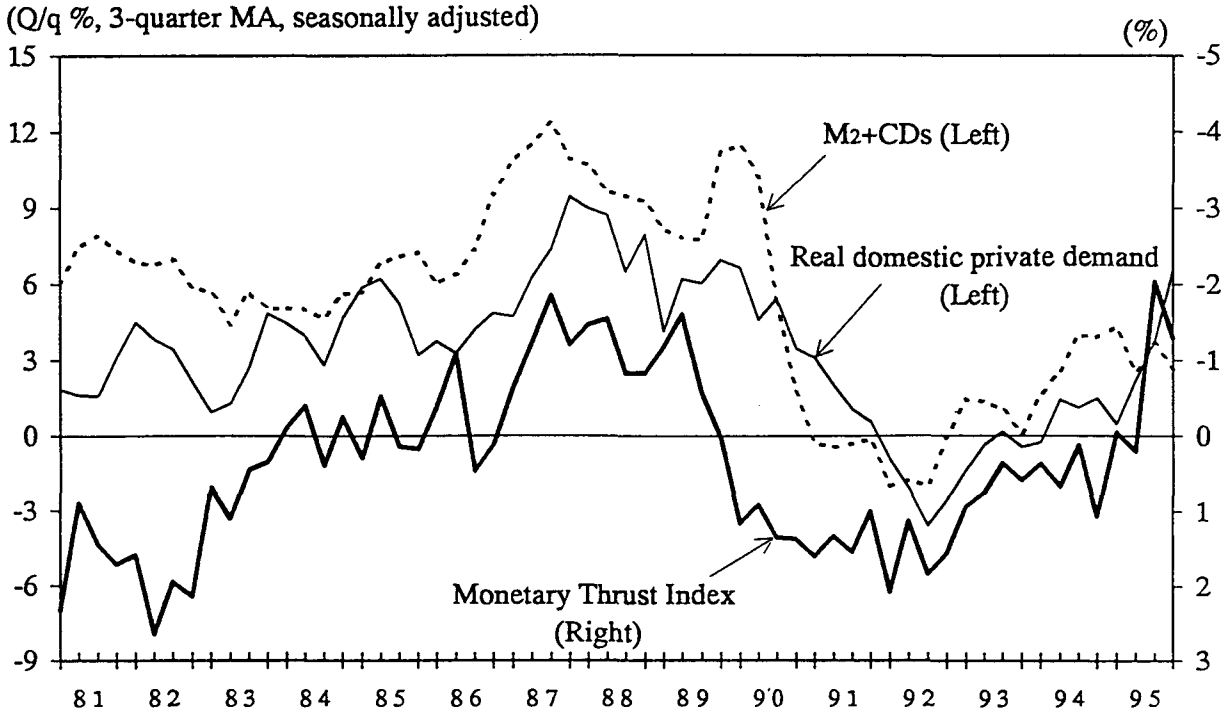
[11] The previous easing period is assumed to have started just after the temporary hike in short-term interest rates towards the end of 1985, which was aimed at bringing down the exchange rate of the US dollar in accordance with the Plaza Agreement.

[12] Low interest rates are believed to have substantially assisted the corporate sector in pursuing adjustment efforts by supporting corporate profit through reduced interest payments on liabilities. For detailed discussion, see Bank of Japan (1996).

Figure 4
Monetary Thrust Index, M2+CDs and real domestic private demand



Note: M2+CDs is deflated by the GDP deflator.

Examining the developments in MTI over time, it can be argued that the quantitative degree of monetary policy ease (in other words, the magnitude of "thrust" stemming from monetary easing) during the current easing phase since 1991 has not been as stimulative as is suggested by the large fall in nominal interest rates. In fact, MTI remained positive until around the end of 1994 (see Figure 4). There are, of course, several problems associated with MTI as calculated here; for example, a) the expected inflation rate used in calculating the real call rate is unobservable and there are various possibilities as to what proxy to use, and b) the estimation of potential growth is not unique and depends on the assumptions made. Thus, certain reservations should be made in interpreting MTI, and it is not necessarily appropriate to simply believe, for example, that a positive MTI means tight monetary policy. Nonetheless, if we compare developments in MTI during the current easing phase with those in the previous one in the late 1980s, it can somewhat safely be argued that the length and extent of easing was far greater in the previous phase.

2.2 Role of monetary aggregates

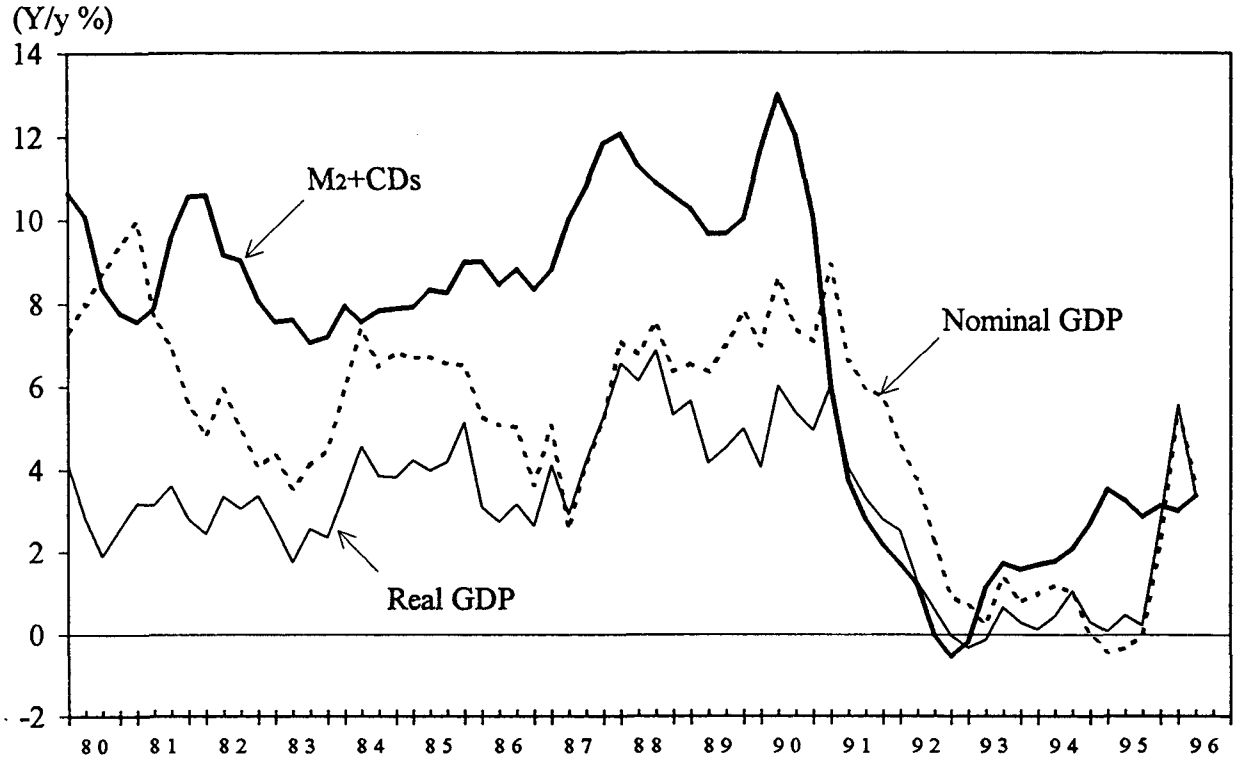
The implementation of monetary policy by BOJ has always been based on an overall judgement, and no targets have been set with respect to any specific economic or financial indicators. Thus, BOJ has never given the role of an intermediate target to monetary aggregates. Nonetheless, BOJ regards them as a most important indicator and information variable for monetary policy, and has continuously published "projections" for the most representative aggregate, that is, M2+CDs, since 3rd quarter 1978.[13]

During the current phase of monetary easing, the growth rate of M2+CDs has remained rather low compared with the past easing period, which has been one important consideration behind

[13] The projections are published in BOJ's "Quarterly Economic Outlook".

BOJ's policy decisions (Figure 5). In fact, in official statements published by BOJ when the easing measures were taken, the slow growth of M2+CDs has often been cited as one of the reasons which induced BOJ's decision.[14]

Figure 5
M2+CDs and GDP



If we look back further, however, it must be admitted that large fluctuations in monetary aggregates, particularly in M2+CDs, were allowed and did not attract sufficient attention in the implementation of monetary policy in the late 1980s and early 1990s. This was mainly because, at that time, the relationship between monetary aggregates and economic variables such as prices and income seemed to have become rather unstable, which was believed to have reduced, at least temporarily, the usefulness of monetary aggregates as an information variable for monetary policy. In fact, many empirical studies conducted during this period failed to confirm the stability of the money demand function or the money-income causality relationship.[15] Needless to say, the large and active shift of funds among financial assets within and outside monetary aggregates caused by the progress of the deregulation of deposit interest rates, as well as the influence of large fluctuations in asset prices on money demand, can be regarded as the main factors underlying the instability.

These factors appear to have subsided substantially in recent years. The influence of asset price fluctuations on money demand seems to have become less significant as asset prices have become more stable, although certain downward pressure is likely to continue stemming from the continuing fall in land prices. Since the deregulation of deposit interest rates has been completed and most rates now tend to move closely with market rates, the large and persistent shift of funds between

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[14] Every time easing measures have been taken since March 1995 (four times: in March, April, July and September 1995, with the April and September cases involving a cut in the ODR), reference to "the slow growth of money supply" was made in BOJ's statements explaining the background against which such measures were taken.

[15] For example, see Bank of Japan (1992).

deposits and other financial assets has become less likely.[16] It can, therefore, be expected that the relationship between monetary aggregates and various economic variables (such as income and prices) has, at least to a certain extent, stabilised. In retrospect, it is also possible that instability in the relationship between monetary aggregates and price/income variables was overly exaggerated in the empirical studies of the late 1980s and early 1990s since large fluctuations existed towards the end of the data series and hence the stable long-term relationship (for example, the tendency to return to the mean) was less likely to be statistically identified.

In fact, our recent empirical studies using the longer data series up to the most recent period suggest that the stable relationship between M2+CDs and price/income variables has continued for a long period, including the late 1980s and early 1990s. For example, the existence of a long-run equilibrium relationship between M2+CDs, the price level (GDP deflator), and real GDP has been confirmed using co-integration analysis. The M2+CDs demand function has also been found to be broadly stable, and money-income causality (in a Granger sense) holds for most cases. (For details of these empirical studies, see Appendix II.)

In the light of these developments, BOJ now fully utilises the information obtained from monetary aggregates in implementing monetary policy, and ensures over the long-term that the stable growth of monetary aggregates is achieved, although no rigid target ranges are yet set. If the growth rate of monetary aggregates is to be kept stable over the long-term, it would also function as a "nominal anchor", and contribute to preventing the excessive use of monetary policy as a tool for fine-tuning economic activity.

2.3 Asset prices and monetary policy

As already mentioned, at the moment there seems to be little risk of a re-emergence of asset price inflation, particularly an upsurge in land prices. In fact, although certain empirical results suggest that land prices have now become quite close to their theoretical level derived from, for example, the "net present value" model, there still is little sign that they have stopped falling.

Theoretically, there is no concrete answer concerning the extent to which monetary policy should attach importance to asset prices. It is, however, rather widely agreed that asset prices could be used as information variables for monetary policy implementation. Asset prices tend to respond to changes in various factors affecting the economy earlier than real economic variables. They could also contain information concerning expectations of future economic developments held by most market participants. In fact, in many empirical studies, it has been found that changes in asset prices precede those in real economic variables, and even those in monetary and other financial aggregates. It might, therefore, be useful for central banks to pay sufficient attention to information contained in asset prices in implementing monetary policy.

One empirical idea to facilitate the use of asset prices as an indicator is to formulate a kind of composite index including both the general price level and asset prices, with proper weights attached to both. Certain trials have already been made (Figure 6),[17] but their usefulness has not yet been sufficiently confirmed empirically, and they seem too primitive to be actually used.

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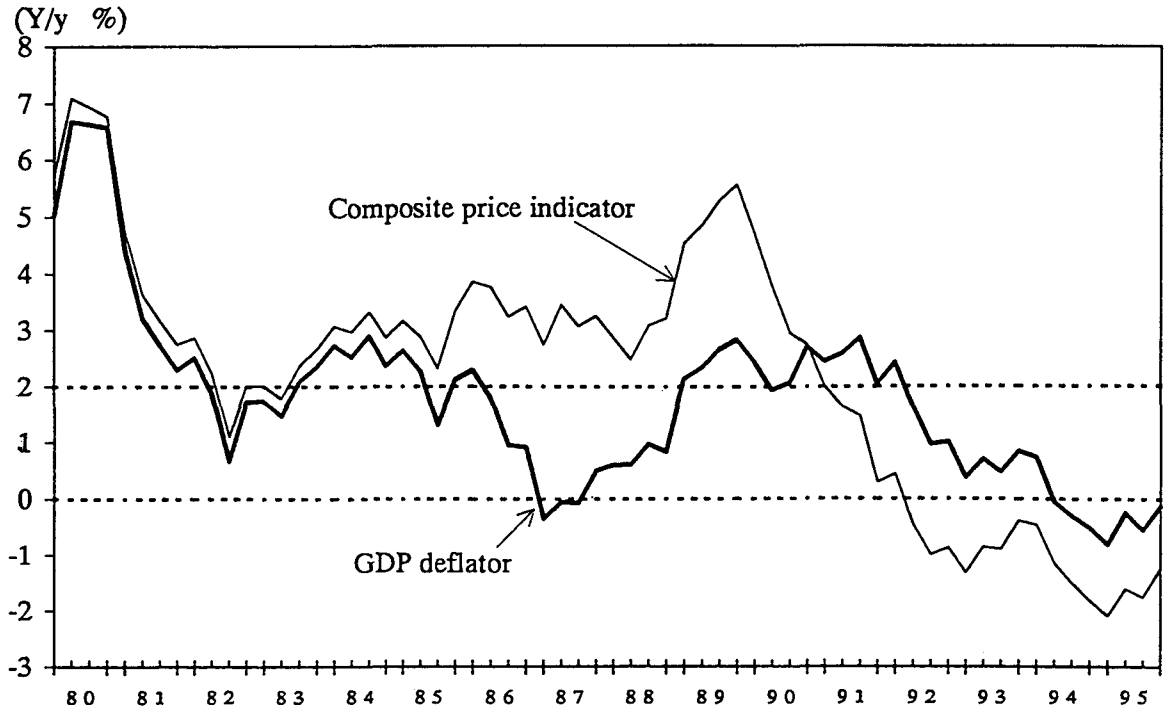
[16] A shift of funds caused by the temporary widening or narrowing of interest rate differentials among various financial assets, stemming from, for example, the difference in the adjustment speed of interest rates, could occur more frequently than before, because financial liberalisation has made such shifts easier. But, this kind of shift is not likely to persist long enough to affect real economic variables. A shift of funds could also be induced by factors other than interest rate differentials. One such factor which commands due attention at the moment is the changing perception of the soundness of various financial institutions. In fact, a shift of funds from small financial institutions and into postal savings is gradually taking place, which might reflect a greater concern for risks associated with private financial institutions, particularly smaller ones.

[17] At a first glance, the composite index shown in the upper panel of Figure 6 seems to be giving a reasonable signal. For example, no deceleration was observed from 1986 to 1988, which could have precluded excessive easing. The index

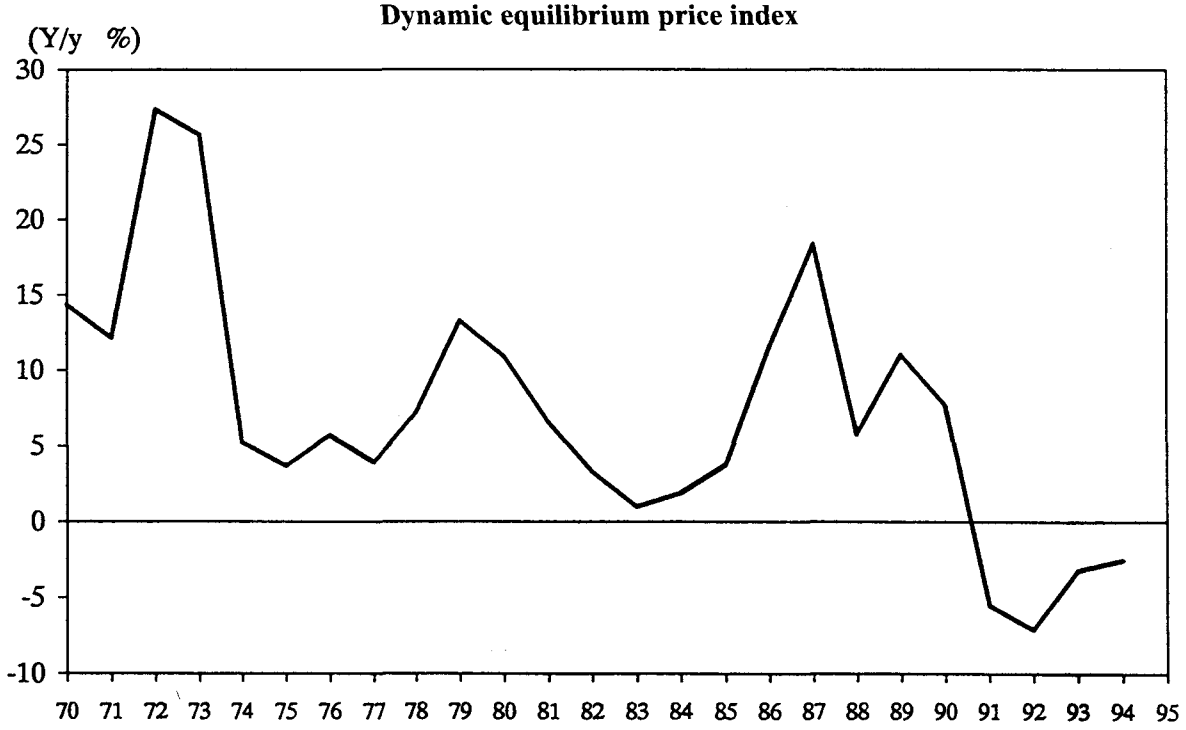
Figure 6

GDP deflator and composite price indicator



Note: Composite price indicator = 0.1* land price + 0.9* GDP deflator.

Dynamic equilibrium price index



Note: Geometric mean of changes in the GDP deflator and net national assets. Weights calculated using a modified version of the "golden rule".

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also shows the need for tightening more clearly than does the GDP deflator around 1989. Although these facts could suggest the usefulness of this kind of index as an indicator of monetary policy, its properties must be examined further, including the appropriateness of the weights.

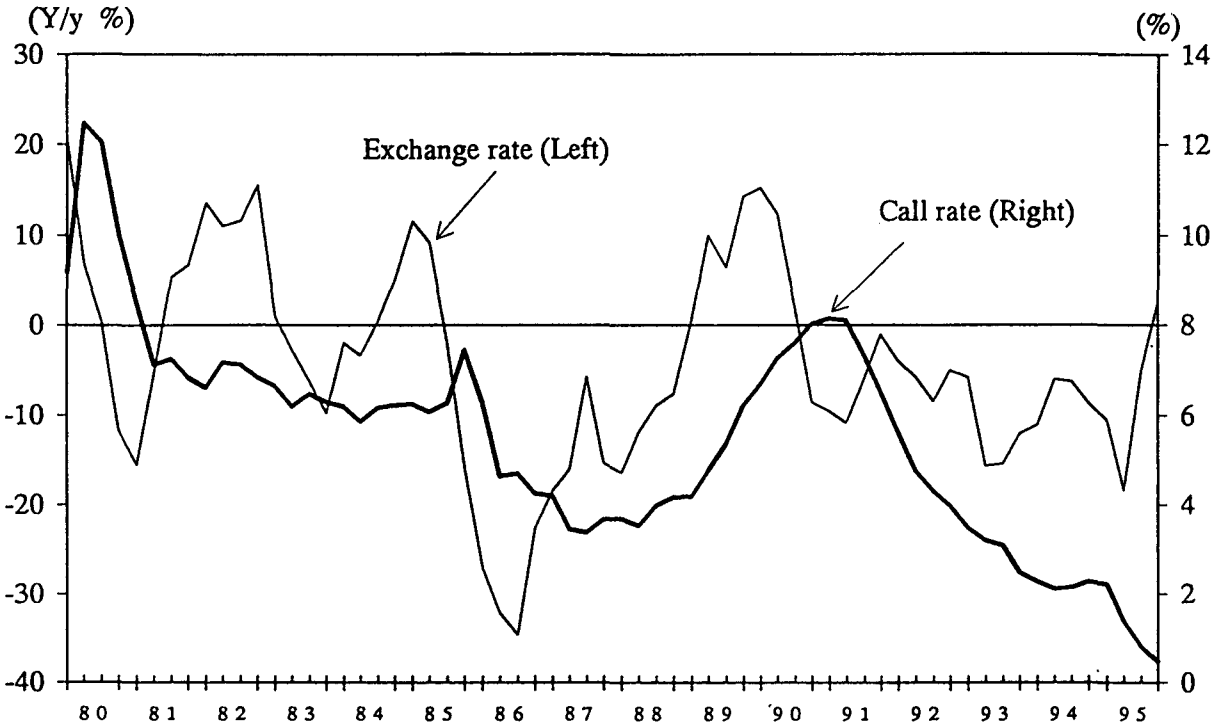
There seems to be far wider divergence of views concerning whether or not the stability of asset prices should be regarded as an objective of monetary policy. It is quite certain that the ultimate objective of monetary policy is to realise and maintain non-inflationary sustainable growth, which does not necessarily include stability of asset prices. Japan's experience since the bubble period, however, clearly shows that large fluctuations in asset prices could influence real economic activity, and hence the long-term objective of non-inflationary sustainable growth. Moreover, in the light of public sentiment, formed against the background of the experience of the bubble economy and the sharp rise in housing prices in particular, it would be impossible to completely ignore the stability of asset prices. The appropriate weight which should be attached to the stability of asset prices in the implementation of monetary policy remains a topic for future studies.

2.4 Exchange rate and monetary policy

Like asset prices, maintaining the stability of the foreign exchange rate itself is not regarded as an ultimate objective of monetary policy. In principle, and in the long-term, the exchange rate can be stabilised by putting the domestic economy in order through the proper management of macroeconomic policies. In fact, although offsetting the deflationary impact stemming from the rapid appreciation of the yen since the beginning of 1995 was one of several considerations leading to the series of easing measures taken since March 1995, halting the yen's appreciation was not regarded as a policy objective in itself.

The exchange rate can sometimes fluctuate considerably, and also diverge from economic fundamentals for a lengthy period. Since these volatile movements in the exchange rate, which may be justified by underlying real economic activity, and thus regarded as "exogenous", would significantly influence the stability of economic growth, it is sometimes necessary and also appropriate for monetary policy to give certain attention to the impact of the exchange rate on economic activity. However, risks involved in monetary policy that fully offsets the impact of the exchange rate have also become clear in light of the experience of the late 1980s.

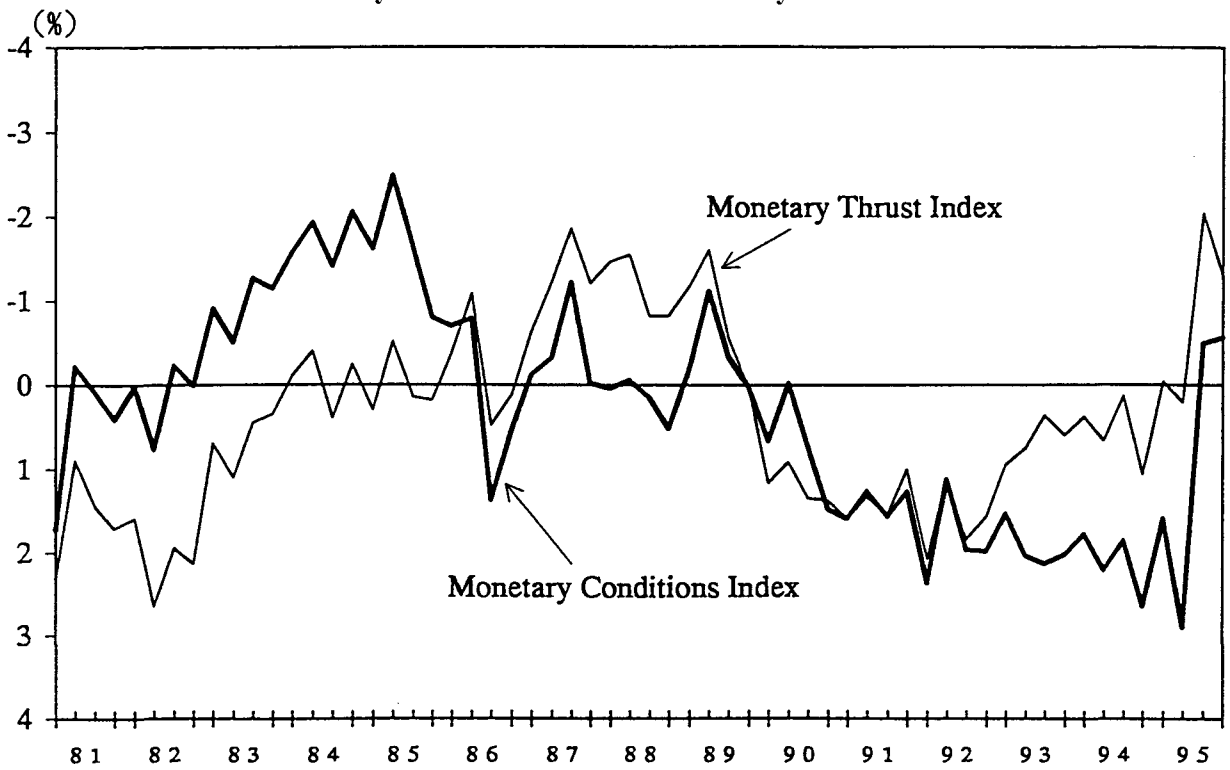
Figure 7
Exchange rate (¥/$) and the call rate



In the late 1980s, when the yen appreciated rather rapidly, the deflationary impact was perceived to be unprecedented, and thus really serious for the Japanese economy. It was therefore thought that offsetting this deflationary impact was a most urgent task for monetary policy. In retrospect, it cannot be denied that, reflecting this perception, the weight attached to exchange rate considerations in the implementation of monetary policy during this period was excessively increased. It can actually be seen that developments in the call rate during this period were rather strongly affected by the exchange rate (Figure 7).

As already explained in 2.1 above, if we evaluate the quantitative thrust of monetary policy during this period using MTI, the easing was quite substantial and prolonged. However, an assessment using the Canadian type MCI (Monetary Conditions Index) indicates that the monetary policy thrust was not that easy, if we take the deflationary impact stemming from the appreciation of the real effective exchange rate into account (Figure 8). (For details of the calculation of MCI in Japan's case and empirical analysis using it, see Appendix I.) In fact, MCI remained, on average, almost neutral from 1986 to 1988, which suggests that the extent of monetary easing during this period was no more than needed to offset the deflationary impact of the appreciation of the yen. Nonetheless, in retrospect, this easing of monetary policy proved to have been one of the main reasons for asset price bubbles,[18] confirming the risk involved in a monetary policy intended to fully offset the impact of exchange rate changes (or other exogenous factor) on total demand and hence GDP.

Figure 8
Monetary Condition Index and Monetary Thrust Index



Note: MCI = real effective exchange rate (% change from base period, 4th quarter 1989) *0.1 + Monetary Thrust Index.

Empirical studies conducted in Appendix I show that monetary policy mainly affects domestic private demand, at least initially, rather than total GDP. Thus, easing monetary policy to offset the deflationary impact of the exchange rate tends to create growth which is heavily dependent

[18] For an analysis of the various factors, including structural ones, which caused asset price inflation in many industrialised countries, see Shigemi (1995).

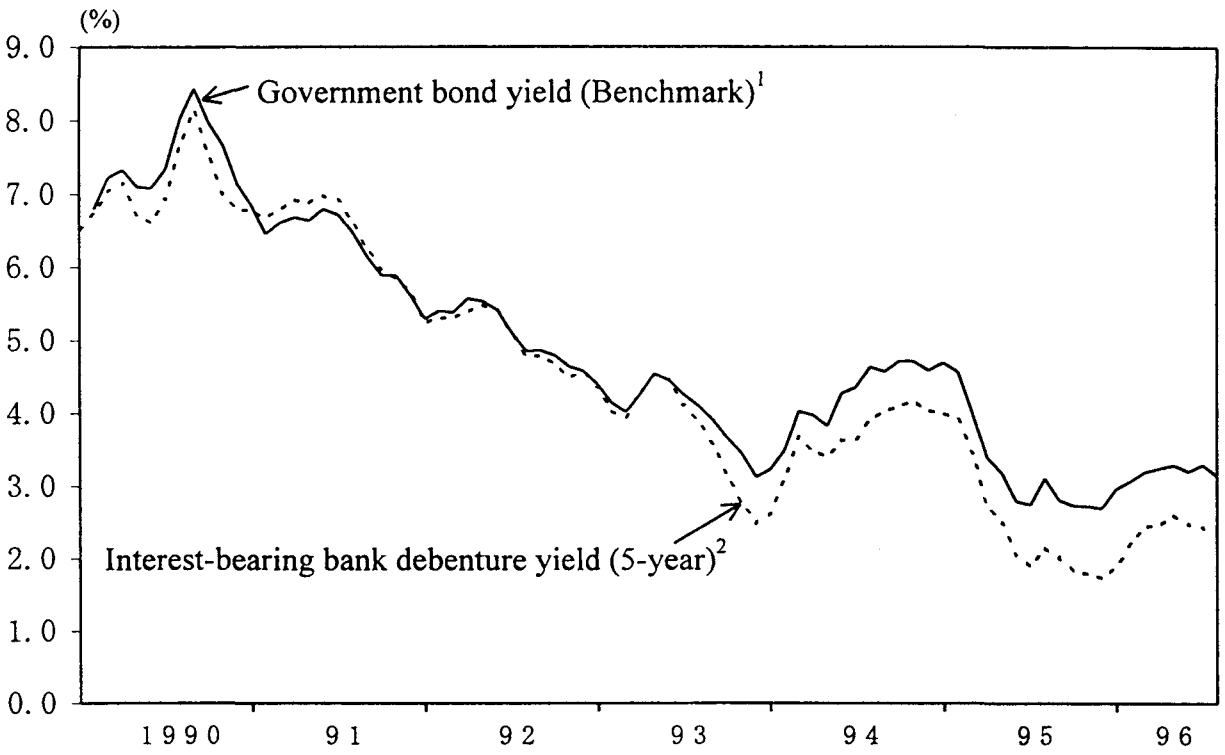
on domestic private demand, as was the case with the expansion of the economy in the late 1980s. It is quite probable that this source of growth triggered the rapid rise in land prices by creating excess demand for land, a most typical "non-tradable" good.

2.5 Monetary policy and long-term interest rates

Long-term interest rates are generally thought to be more important than policy-induced short-term rates as a factor influencing such economic activity as business fixed investment and household residential investment. Thus, developments in long-term interest rates or the shape of the yield curve should be carefully monitored in implementing monetary policy. Since long-term interest rates are strongly influenced by market participants' expectations with respect to the future course of short-term rates or inflation, as well as their actual development, it could sometimes occur that long-term interest rates will not move in the direction consistent with monetary policy.

This actually happened during the current phase of monetary easing in Japan. While the easy stance of monetary policy has been maintained and short-term interest rates have continuously been kept low, there were two instances when long-term interest rates rose significantly: once in late 1994 and the other from the beginning of 1996 until August (Figure 9). These hikes in long-term interest rates are thought to be caused by fluctuations in market participants' expectations concerning the future course of monetary policy.[19]

Figure 9
Long-term market rates

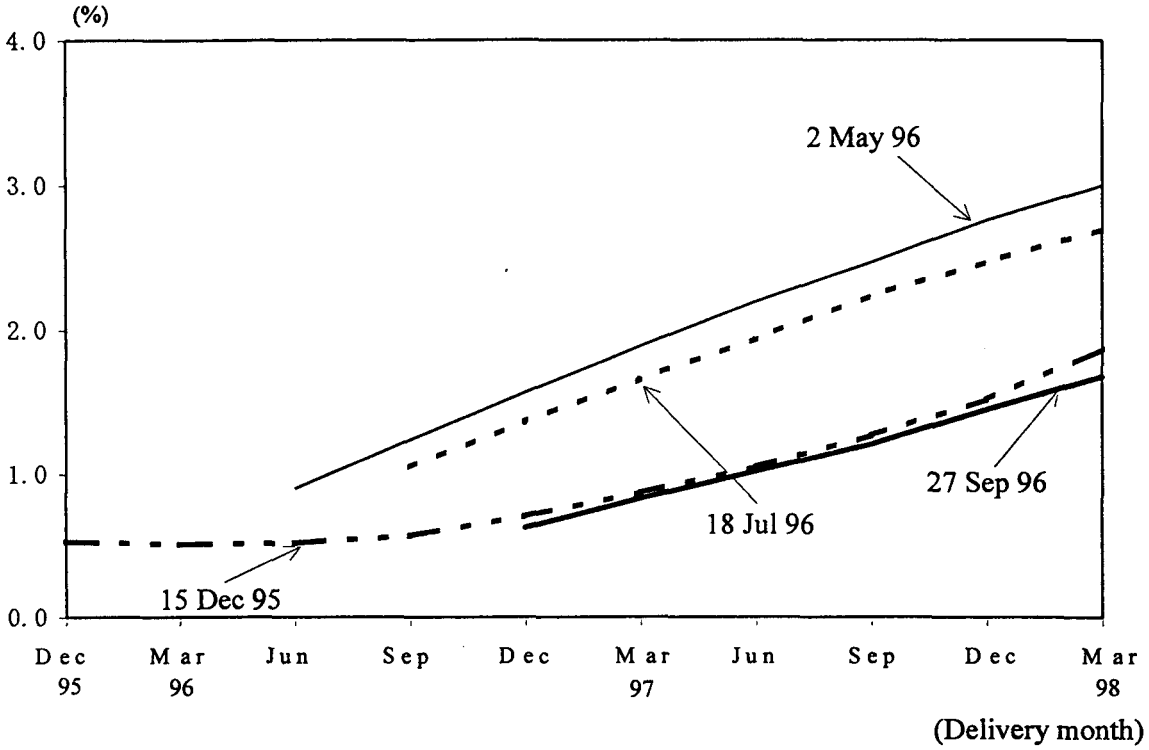


[1] Figures are monthly average rates. [2] Figures for bank debentures by the Industrial Bank of Japan. Based on over-the-counter offer quotations.

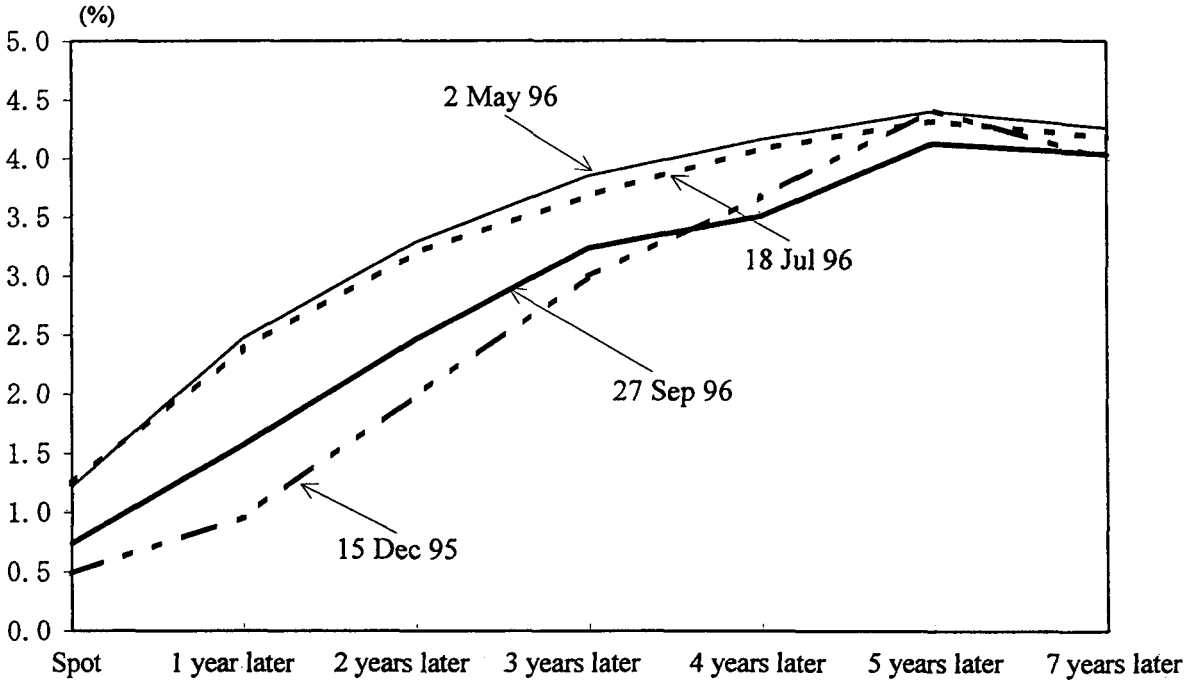
[19] Here, only the analysis of futures and implied forward rates concerning the 1996 case will be made as evidence of this proposition. However, in certain empirical studies, the rise in Japanese long-term interest rates in 1994 has also been found to be mainly attributed to fluctuations in expectations concerning monetary policy rather than to the spill-over from the US long-term rate. See, for example, Borio and McCauley (1995) and Inoue, Ishida and Shirakawa (1995).

Figure 10
Futures and forward rates

Euro-yen Futures (3-month)[1]



Implied Forward Rates[2]



[1] Rates for the corresponding delivery month. [2] One-year forward rates calculated from swap rates.

For example, the development of Euro-yen futures rates (3-month) and implied forward rates (1-year) derived from the yen-yen swaps rate since the beginning of 1996 show that fluctuations in market participants' expectations mainly took place at the relatively short end of the curve, such as rates starting from at most 2 - 3 years later (Figure 10). By contrast, the expected rates (implied forward rates) at the longer end, for example those starting from 5 years later or more, which are thought to be more closely associated with long-term growth or inflation prospects, tended to remain stable. This actually indicates that the rise in long-term interest rates from the beginning of 1996 was mainly caused by fluctuations in market expectations concerning the path of short-term rates, which is most influenced by monetary policy action in the near future.

One reason for this large fluctuation in market participants' expectations concerning future monetary policy is, of course, the increased uncertainty associated with prospects for future economic recovery, which are thought to be the main factor affecting monetary policy. The uncertainty here is not that regarding medium- to long-term growth prospects, but pertains to the timing and speed of recovery in the near future.

It cannot be denied, however, that market participants sometimes reacted wrongly or over-reacted to minor daily changes in the short-term money market rate, causing fluctuations in long-term interest rates. This might have happened because market participants were not yet sufficiently accustomed to the new operating procedure of monetary policy. In addition, since the current level of interest rates is exceptionally low, and hence the possibility that interest rates will go down further is perceived to be very small, market expectations tend to be one-sided (on the upside), which could easily result in excessive expectations of a future rise in short-term interest rates, and hence in an actual excessive rise in long-term rates.

In many industrialised countries, long-term interest rates are also found to be strongly influenced by the fiscal policy stance, which might sometimes reduce the effectiveness of monetary policy: it could occur, for example, that long-term interest rates tend not to fall in line with the easing of monetary policy because of market fears concerning the fiscal deficit. In Japan's case, however, the influence of the fiscal deficit on long-term interest rates has seldom been identified in empirical studies. Thus, at least so far, the fiscal deficit has not been regarded as affecting the effectiveness of monetary policy.

Appendix I

Quantitative measures of monetary policy

In this Appendix, we introduce measures to quantitatively assess the extent of tightness or ease of monetary policy and empirically investigate their usefulness. One measure is called the "Monetary Thrust Index (MTI)", which we are trying to develop, and the other is the Canadian type "Monetary Conditions Index (MCI)". In this paper, however, we have slightly modified the original concept of MCI so as to make it comparable with our MTI. Hence the only difference between two measures here is whether or not to incorporate the impact stemming from changes in the real exchange rate.

1. Monetary Thrust Index (MTI)

1.1 Idea and calculation

The level of nominal interest rates is not necessarily a proper measure of the extent of tightness or ease of monetary policy. For example, an increase in nominal interest rates which falls below the rate of acceleration of inflation would not necessarily have a deflationary impact on real economic activity, since investment decisions, which are naturally thought to be most sensitive to interest rates among various real economic activities, are considered to be based on "real interest rates". If the real expected return on a certain investment is higher than the real interest rate, then that investment is likely to be effected. Thus, whether or not the level of interest rates is thought to be expansionary/deflationary vis-à-vis real activity should be based on a comparison of the real interest rate and the real rate of return on investment.

Based on these considerations, we tried to develop a measure to quantitatively indicate the extent of real tightness or ease of monetary policy, which we call the Monetary Thrust Index (MTI) and define as follows:

MTI = (Nominal policy rate <the overnight call rate>) -

(Expected inflation rate) - (Potential growth rate of GDP)

In the actual calculation of MTI, the *ex post* realised rate of increase in the GDP deflator is used as the expected inflation rate; that is, "perfect foresight" is assumed. For the most recent period where this information is not available, we replace it with our projection of the GDP deflator. The potential growth rate of GDP is used as a proxy for the expected medium-term rate of return on investment. The actual series for the potential growth rate is obtained from our estimation of the production function with certain assumptions. Smoothing of the data series is made for the GDP deflator and potential growth rate by taking the moving average.[20]

1.2 Development of MTI

The actual development of MTI thus calculated is shown in Figure A1, along with the series for each component. From this, we could make certain interpretations of the extent of tightness or ease of monetary policy which are slightly different from those based on nominal interest rates.[21]

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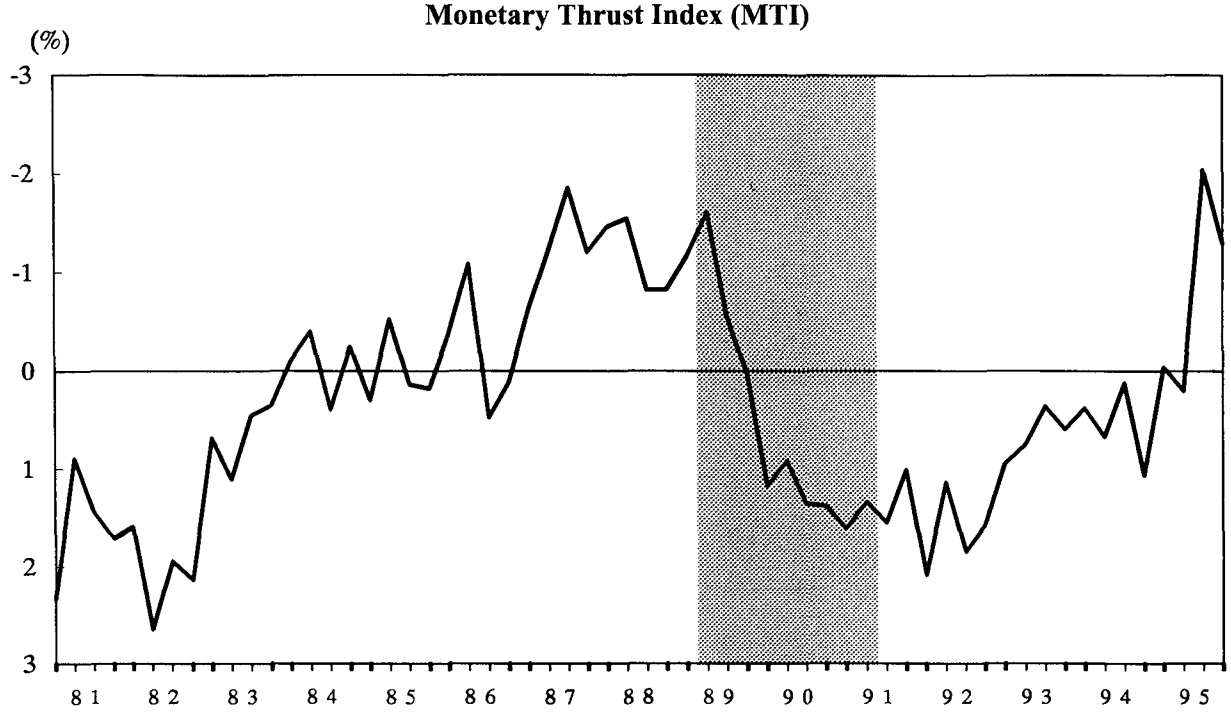
[20] Centred moving averages for three periods (quarters) are actually used.

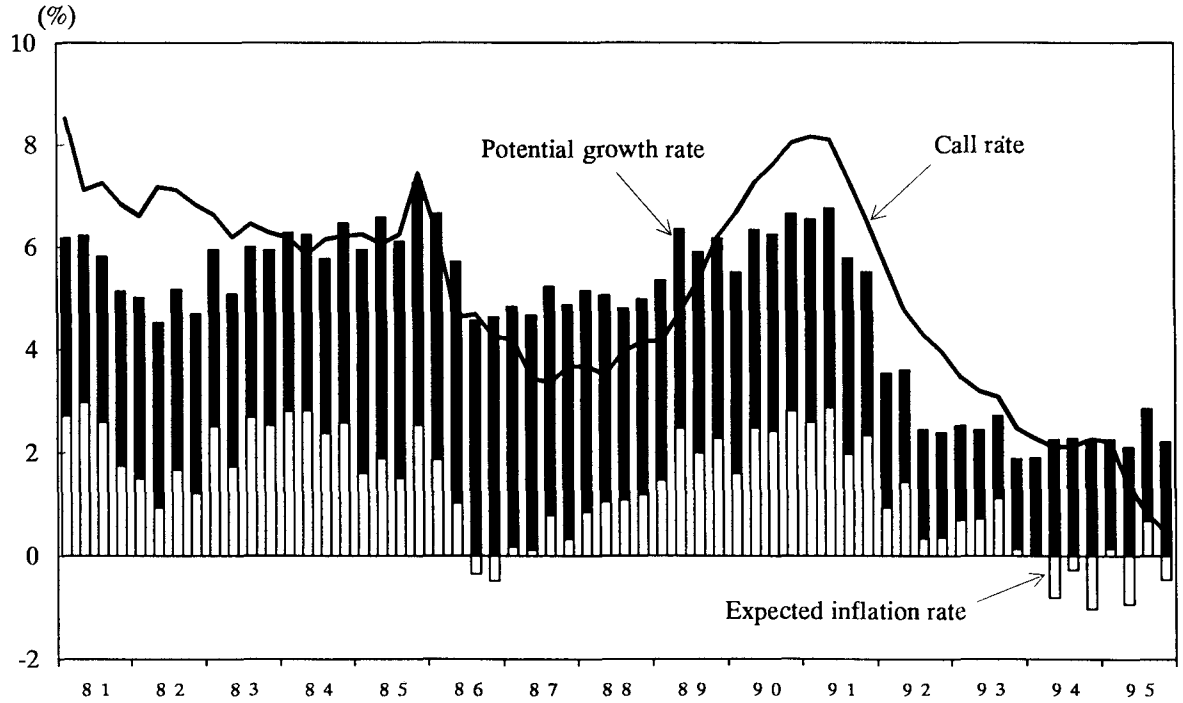
[21] The reservations stated in the text concerning the interpretation of MTI (notably, a wide range of possibilities for proxying the expected inflation rate and the real rate of return) are also applicable here. Hence the following

Figure A1
Monetary Thrust Index (MTI)



Notes: MTI = call rate - $((P_{t+2}/P_{t-1})^{4/3} - 1) \times 100$ - potential growth rate. P = GDP deflator. The shaded area represents monetary tightening period based on official discount rate hike.

Call rate, expected inflation rate and potential growth rate



interpretations, based on the particular calculation used in this paper, should be taken with suitable allowance for the range of variations of MTI.

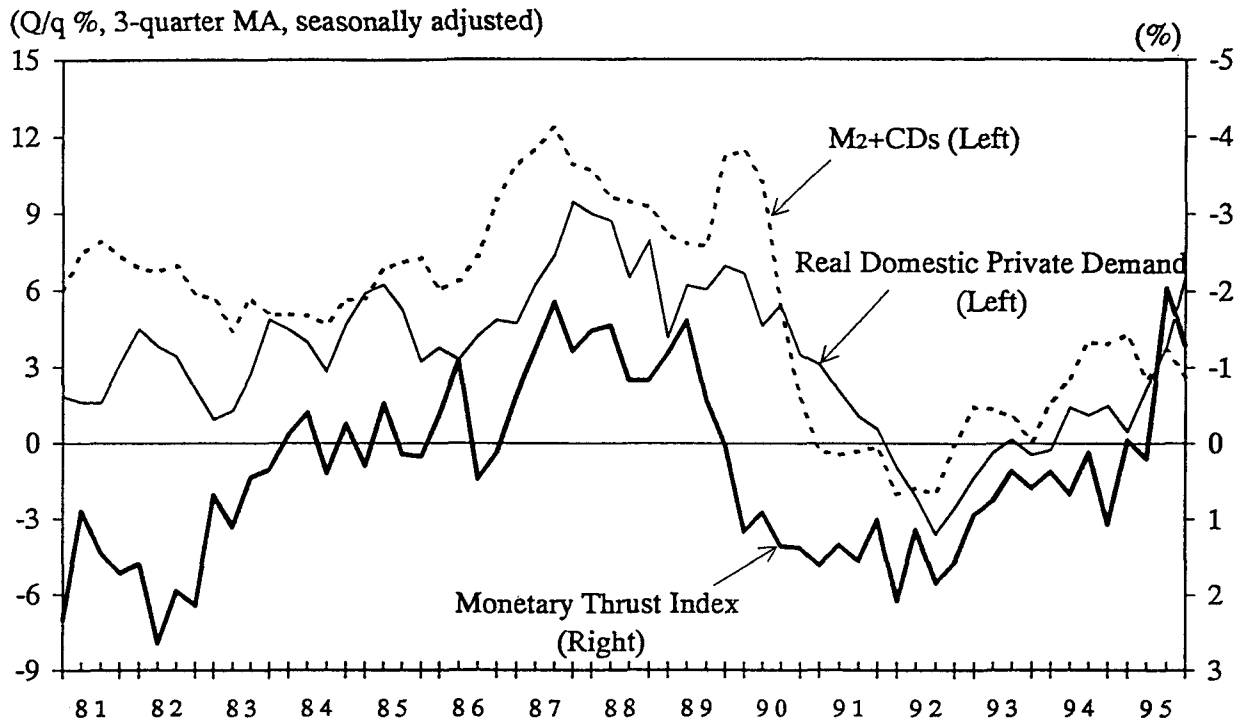
For example:

- since the ODR was gradually lowered, the early 1980s is usually considered a the period of monetary ease. The development of MTI, however, indicates that the actual extent of ease of monetary policy was not as expansionary as suggested by the fall in nominal interest rates alone. In fact, MTI remained positive in the early stage of easing, that is, until around 1983. This was probably because the deceleration of inflation was faster than the fall in nominal interest rates until 1983, since the ODR cuts had been carefully effected so as not to result in further depreciation of the yen;
- although easing of monetary policy started in 1991 and nominal interest rates actually fell quite rapidly, MTI remained positive until around 1994. This suggests that the thrust of monetary policy during this period was not as expansionary as intended, because, in retrospect, the deceleration of inflation and the fall in the potential growth rate were much faster than the reduction of nominal interest rates.

1.3 Usefulness of MTI

To make MTI thus defined and calculated a useful measure of the extent of tightness or ease of monetary policy and the above interpretations plausible, MTI should exhibit a fairly stable relationship with key variables in the policy transmission mechanism. In this light, we empirically checked the relationship between MTI, M2+CDs, and domestic private demand.[22]

Figure A2
Monetary Thrust Index, M2+CDs and real domestic private demand

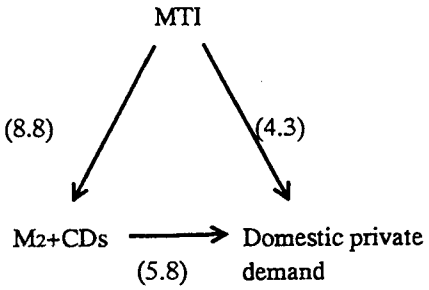


Note: M2+CDs is deflated by the GDP deflator.

[22] M2+CDs is chosen as one of the key variables in the transmission mechanism of monetary policy, because a certain stable relationship with income/price variables has been confirmed in our recent research (see Appendix II). Domestic private demand is chosen as it is the main component of GDP which is directly influenced by monetary policy. External and public demand are thought to be more exogenous and less directly affected by monetary policy.

Figure A3
VAR model estimation results
Sample period: 1st quarter 1981 - 4th quarter 1995

(a) Granger causality

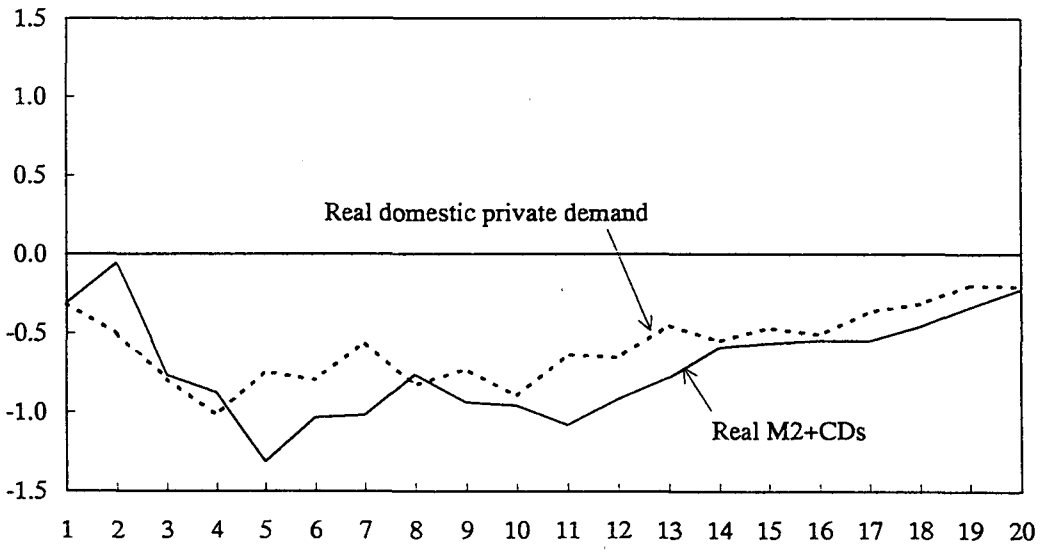


(b) Variance decomposition

LHS variables	RHS variables		
	MTI	M2+CDs	Domestic Private Demand
MTI	93	3	4
M2+CDs	41	44	15
Domestic Private Demand	53	24	23

Notes: 1. M2+CDs and domestic private demand are changes from previous quarter, 3-quarter moving average, seasonally adjusted.
2. Granger causality test at four quarters (directions of arrows represent lead and lag relationships).
⟶ 1% significance level,
⟶ 5% significance level.
3. Figures in parentheses represent F-test values.
4. Variance decomposition at 20-quarter horizon.

Impulse responses (case for 1 standard error MTI shock)



Developments in MTI, real M2+CDs (M2+CDs deflated by the GDP deflator) and real domestic private demand are shown in Figure A2. From this it can be seen that the three variables tend to exhibit similar movements, with MTI maintaining a certain lead over the other two. This can be more formally tested, using a VAR-model of these three variables. The result is shown in Figure A3. The principal findings are as follows:

- MTI causes (in a Granger sense) both M2+CDs and domestic private demand, and M2+CDs also causes domestic private demand;

- variance decomposition result shows that MTI is highly independent, whereas 41% of the variations in M2+CDs is explained by those in MTI. Variations in domestic private demand is substantially explained by both MTI and M2+CDs (53 and 24% respectively).

These empirical results suggest that MTI can actually be regarded as an independent policy variable, affecting the real economic variables through two transmission routes: one by directly influencing private domestic demand, and the other by affecting it via M2+CDs. This can be interpreted as empirically supporting the usefulness of MTI as a quantitative indicator of the extent of tightness or ease of monetary policy.

2. Monetary Conditions Index (MCI)

2.1 Idea of MCI

MCI is a composite index of the short-term interest rate and the foreign exchange rate, and was originally developed by the Bank of Canada. The basic idea can be summarised as follows: There are certain sectors in the economy, such as producers of highly export-oriented goods, which are more directly and sometimes strongly affected by the exchange rate than domestic interest rates. Thus, if the monetary policy stance is assessed only through interest rates, the additional impact of exogenous exchange rate developments directly on these sectors, and also indirectly on the whole economy, could be overlooked and result in the implementation of an inappropriate policy. It is, therefore, more appropriate to look at both interest rates and the exchange rate in order to assess overall "monetary conditions". A composite index, with an appropriate weighting attached to each, would be the most convenient tool for this purpose. MCI is defined as follows:

MCI = (Real short-term interest rate <difference from base period>) + (Fixed weight) * (Real effective exchange rate <percentage divergence from base period>)

The weighting should be determined by the relative size of the impact of changes in the short-term interest rate and the foreign exchange rate on the real economy, which is usually derived from model estimations.

2.2 Application of MCI to Japan

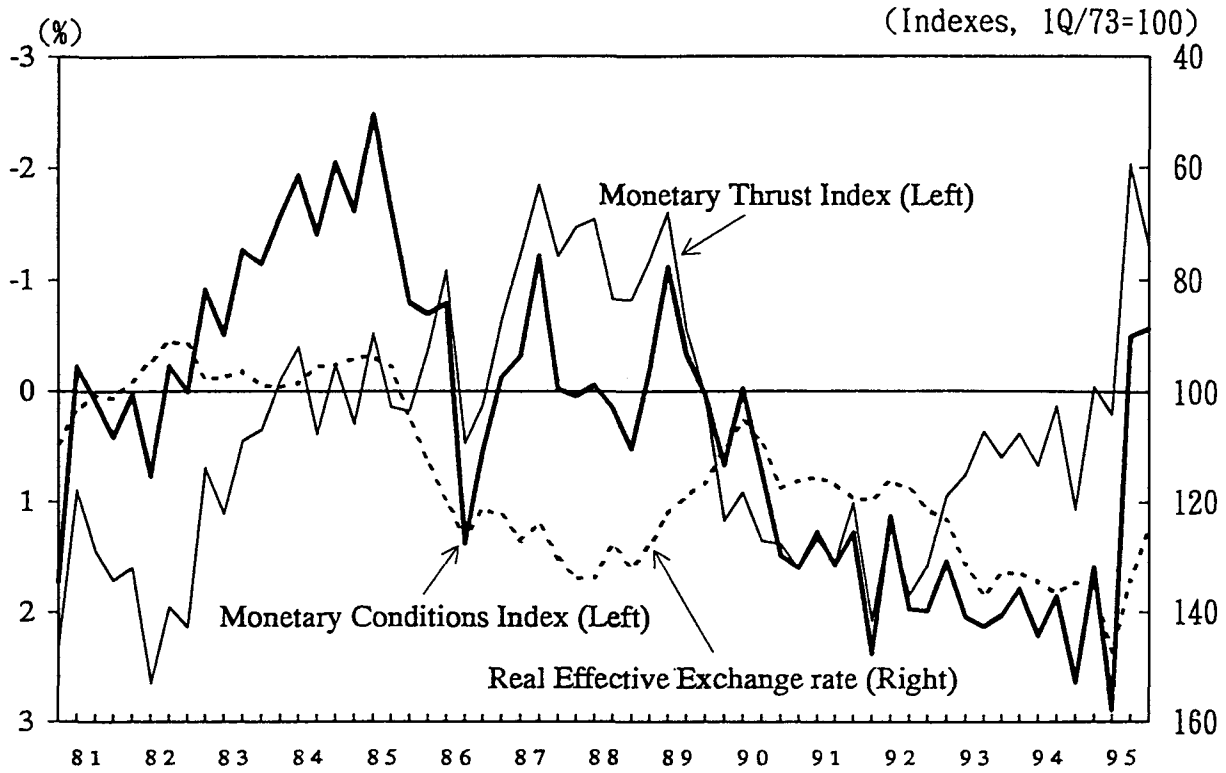
In applying MCI to Japan, we made the following assumptions and modifications:

- the weighting attached to the exchange rate is tentatively assumed to be 1/10, which is much lower than in the Canadian case (1/3), reflecting Japan's lower dependence on the external sector. This weight is based on calculations used by the IMF;
- the divergence of the real short-term interest rate from the base period used in the original MCI formula can theoretically be regarded as a proxy for the divergence of the real interest rate from its equilibrium. This consideration has led us to a slight modification of the formula: that is, in lieu of the divergence from the base period, MTI is used to calculate MCI. This modification has made it possible to directly compare MTI and MCI, the difference between the two being attributed to the exchange rate;
- an export-weighted (rather than trade-weighted) real effective exchange rate is used. This is mainly because, so far in Japan's case, the impact of exchange rate developments on exports through changes in international competitiveness is thought to be far more important.

2.3 Comparison of MTI and MCI, and the usefulness of MCI

MCI thus calculated is compared with MTI in Figure A4. Developments in the real effective exchange rate are also shown for reference. Certain differences between MTI and MCI can be observed: for example, i) monetary conditions from 1983 to 1985 can be regarded as rather expansionary based on MCI (that is, if we take the impact of the depreciation of the yen into account) and ii) monetary conditions in the late 1980s cannot be regarded as expansionary as indicated by MTI, if we take account of the deflationary impact of the appreciation of the yen during this period. These differences between MTI and MCI are, of course, caused by developments in the real effective exchange rate.

Figure A4
Monetary Conditions Index and Monetary Thrust Index



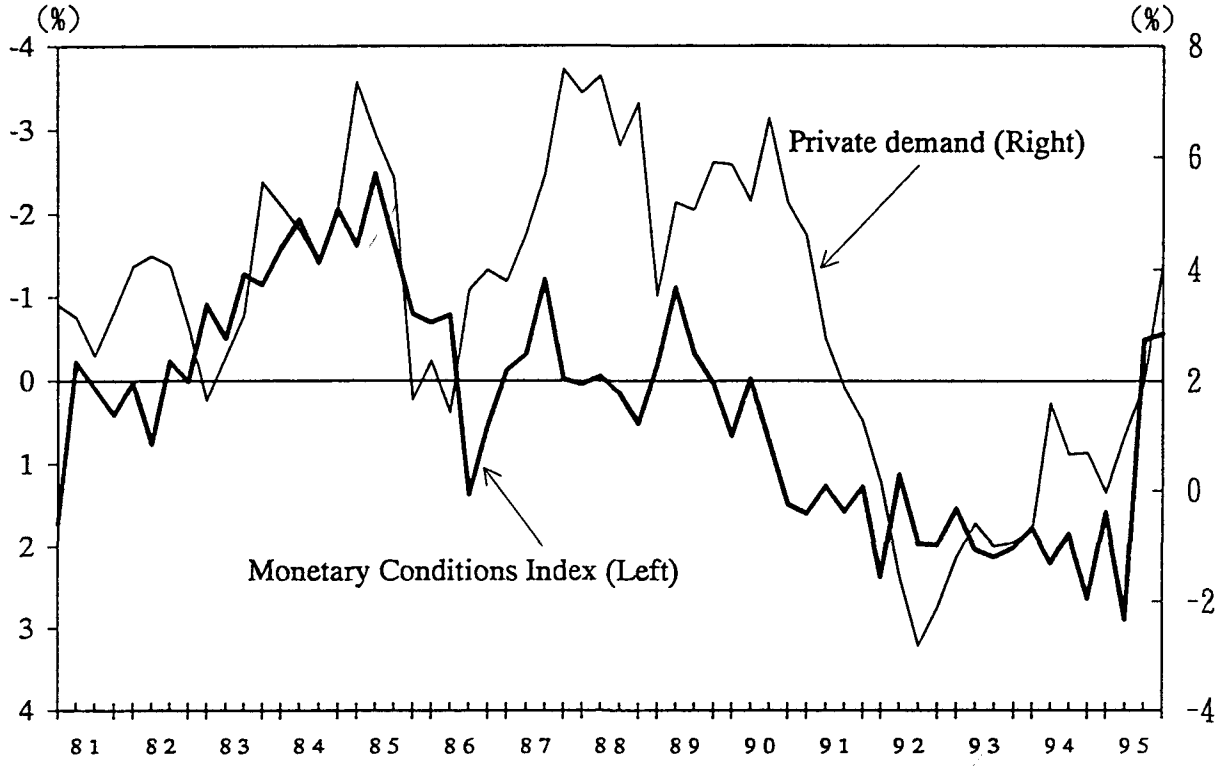
Note: MCI = real effective exchange rate (% change from base period, 4th quarter 1989) *0.1 + Monetary Thrust Index.

Reflecting this difference, MCI is theoretically thought to be more closely correlated with "domestic private demand + net exports" (denoted as "private demand" hereafter), whereas MTI is found to have a close relationship with domestic private demand, as already discussed. However, the close relationship between MCI and private demand has not been confirmed empirically:

- a comparison of both series in Figure A5 fail to prove the existence of a close relationship;
- causality (in a Granger sense) from MCI to private demand seems to be much weaker compared with that from MTI to private domestic demand: i) no direct causality exists from MCI to private demand, and ii) although causality from MCI to private demand through M2+CDs has been found to be significant, the first part of this causality (MCI→ M2+CDs) seems to be weaker (see the F-ratio in Figure A6);

Figure A5

Monetary Conditions Index and private demand



Notes: MCI = real effective exchange rate (% change from base period, 4th quarter 1989) *0.1 + Monetary Thrust Index. Real private demand = real domestic private demand + net exports.

- only 44% of the variations in private demand is explained by those in MCI, compared with 51% in the case of domestic private demand and MTI.

These empirical findings might imply that the usefulness of MCI thus calculated is less significant compared with MTI.[23]

Thus, even if the proposition that monetary policy should be conducted in such a way as to fully offset the impact of the change in the exchange rate is accepted, we should still be very careful in using MCI as an indicator for such policy implementation.

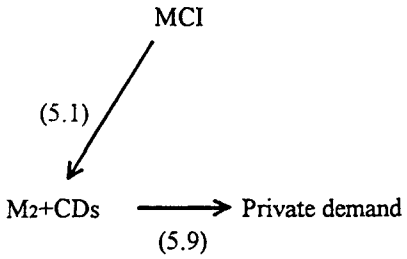
[23] This might be because of the method used in calculating MCI; that is, the appropriateness of the weighting given to the interest rate and the exchange rate. A weighting of 1/10 is tentatively used, but there could be other possibilities. For example, the multiplier derived from the BOJ-model suggests 1/5. We did not use this because it would further widen the difference between MTI and MCI, and, in fact, indicate that monetary conditions were even tight in the late 1980s, which is far from being realistic. A fixed weighting might also be inappropriate, as the impact of the exchange rate on net exports can change over time, owing, for example, to exporters moving production abroad.

Figure A6

VAR model estimation results

Sample period: 1st quarter 1981 - 4th quarter 1995

(a) Granger causality

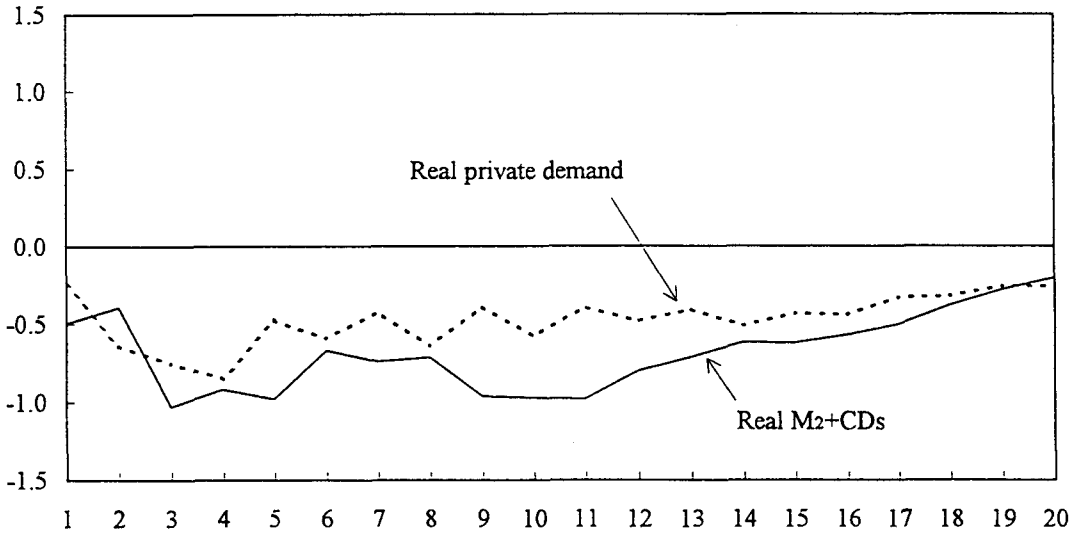


(b) Variance decomposition

LHS variables	RHS variables		
	MCI	M2+CDs	Private demand
MCI	94	3	3
M2+CDs	37	42	21
Private demand	44	25	31

Notes: 1. M2+CDs and domestic private demand are changes from previous quarter, 3-quarter moving average, seasonally adjusted.
2. Granger causality test at four quarters (directions of arrows represent lead and lag relationships).
⟶ 1% significance level,
⟶ 5% significance level.
3. Figures in parentheses represent F-test values.
4. Variance decomposition at 20-quarter horizon.

Impulse responses (case for 1 standard error MCI shock)



Appendix II

Relationship between M2+CDs and price/income variables; main results of empirical analyses

In this Appendix, we summarise the main results obtained from our recent empirical studies concerning the relationship between M2+CDs and price/income variables. The studies are concerned with three aspects: i) the existence of a long-run equilibrium relationship (co-integration) between M2+CDs, price and income; ii) the stability of the money demand function; and iii) the precedence of money to price/income variables.

1. Long-run equilibrium relationship between M2+CDs and price/income

In recent empirical studies, it is quite common to test the long-run relationship by estimating the co-integrating vector. Before applying this method to M2+CDs and price/income variables (respectively the GDP deflator and real GDP), the non-stationarity of each variable has been checked using the ADF test, and each has, in fact, been found to be non-stationary. Then, the co-integrating vector among these three variables was estimated using the Canonical Co-integrating Regression method.[24]

Table A1
Cointegration between M2+CDs and real GDP[1]
Long-term elasticity with real M2+CDs as the dependent variable[2]

Sample period	Independent variables		Results of ADF test on cointegration[3]
	Real GDP	Shift dummy (1986 Q1)	
1967 Q2 - 1985 Q4	1.526 (0.036)	–	Cointegrated
1967 Q2 - 1996 Q1	1.594 (0.020)	–	Cointegrated
1967 Q2 - 1996 Q1	1.526 (0.029)	0.046 (0.023)	Cointegrated

[1] Figures in parentheses represent standard errors. [2] Real M2+CDs represents seasonally adjusted M2+CDs deflated by the GDP deflator. [3] The ADF (Augmented Dickey-Fuller) test, tests the characteristic of a time series. In this test, "cointegrated" indicates rejection of the hypothesis that "a series of residuals is non-stationary" with a significance level of 5%. In other words, the residuals form a stationary process and the dependent and independent variants are cointegrated.

The results are shown in Table A1. The actual estimation of the co-integrating vector was made between real M2+CDs (M2+CDs divided by the GDP deflator) and real GDP, by assuming the long-term neutrality of money; that is, the long-run elasticity of M2+CDs to the price level (GDP deflator) is assumed to be unity. The result shows that, if we make an adjustment for the small structural changes that are supposed to have occurred in the late 1980s (by introducing a level-shift dummy variable),[25] there exists a long-run equilibrium relationship between real M2+CDs and real GDP, and the long-run income elasticity of money is close to 1.5.

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[24] For details, see Park (1992),

[25] This structural change in the late 1980s is thought to have been caused by the diminished opportunity cost of holding M2+CDs following the deregulation of deposit interest rates.

2. Stability of the money demand function

The existence of a co-integrating vector between M2+CDs and GDP just implies that the divergence between them would tend to stay in a certain range in the very long run. Since a considerable divergence could actually emerge in the short-run and last for a period of time, the long-run equilibrium relationship alone might not be sufficient for monetary aggregates to be useful in the implementation of monetary policy. In this light, we estimated a short-run money demand function, and tested its stability.

Table A2
Estimated results of the money demand equation

Explanatory variables	Sub-sample	Full sample
$\Delta(m-p)_{t-1}$	0.428 (3.6)	0.405 (4.7)
ETC_{t-1}	-0.057 (-1.7)	-0.056 (-2.3)
Δy_t	0.391 (3.2)	0.338 (3.6)
$\Delta R_t^{'}$	-0.013 (-1.6)	-0.018 (-3.0)
ΔW	0.172 (3.5)	0.089 (2.5)
$\Delta tika$	0.112 (1.9)	0.125 (4.1)
Constant	-0.455 (-1.9)	-0.441 (-2.3)
$\bar{R}^2$	0.70	0.69
S.E.	0.009	0.008
Durbin's h	-1.46	1.02

Notes:

1. Dependent variable: $\Delta(m-p)_t$

   where m: M2+CDs (nominal); y: real GDP; p: GDP deflator.

   R: opportunity cost of holding money (%) = "rival rate" [average of bonds with repurchase agreements (3-month), medium-term government bond funds, MMFs (money market funds), postal savings certificates (3-year), loan trusts (5-year), money in trust (5-year), and yield to subscribers of interest-bearing bank debentures (5-year)] minus rate of return on holding M2+CDs.

   $R_t^{'} = 6/21 * R_{t-1} + 5/21 * R_{t-2} + 4/21 * R_{t-3} + 3/21 * R_{t-4} + 2/21 * R_{t-5} + 1/21 * R_{t-6}$.

   W: outstanding financial assets of corporate business and personal sector, based on Flow of Funds Accounts.

   tika: land prices, based on Urban Land Price Index (average of residential and commercial land prices in the six major cities: 23 wards of Tokyo, and Yokohama, Nagoya, Kyoto, Osaka and Kobe).

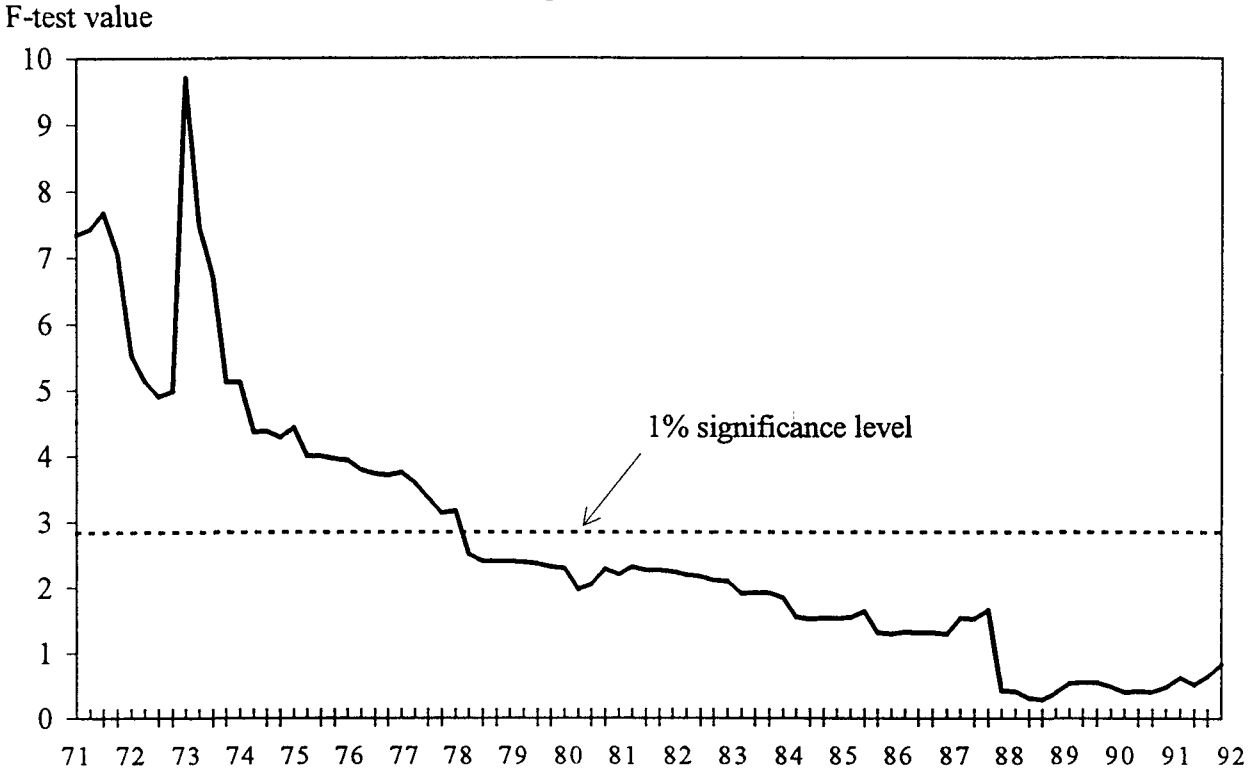
   m, y and p are seasonally adjusted and are represented as logarithms.

   Figures in parentheses are t-values, Δ indicates difference from previous period.

2. *ETC* ("error correction term" based on long-term equilibrium): $m-p-1.5y$; see Table A1.

An ECM (error correction model) money demand function was estimated. This model is able to describe the short-run adjustment process among various (stationary) variables that affect demand for money and fully incorporate the long-run equilibrium relationship between level of money and income. The estimation result is shown in Table A2. By comparing the result for the "full-sample" (1968 1Q - 1996 1Q) and "sub-sample" (1968 1Q - 1985 4Q) periods, it can be seen that,

Figure A7
Stepwise Chow test



although small changes in individual parameters are observed, the same functional structure applies reasonably well to both periods, and the magnitude of change in the parameters is mostly within estimated standard errors. This suggests that the same short-run money demand function exists for the whole period, and that no major structural changes took place in the late 1980s as is usually argued. The Chow test result also seems to confirm the stability of the money demand function during the 1980s (Figure A7).[26]

3. Precedence of money to income/price variables

The money demand function estimated above is in fact a single equation which simply explains the development of M2+CDs when all explanatory variables are given exogenously, and does not incorporate any dynamic interdependence of the variables (for example, GDP could be possibly affected by current and past M2+CDs). Instead of trying to model the whole dynamic system, which might involve various empirical difficulties, we try an approximation using a VAR system which includes only key variables. Before estimating a VAR model, we first checked the lead/lag relationship between money and income/price variables by lagged correlation coefficients.

3.1 Lagged correlation between M2+CDs and income/price variables

3.1.1 Correlation between M2+CDs and GDP, domestic private demand (Table A3-1)

M2+CDs precedes both nominal and real GDP for the last calculation period (1986 1Q - 1996 1Q), with a lead of two to three quarters. The lead of M2+CDs to GDP, however, is not found

[26] The possibility of a structural break in the function is suggested in the early 1970s, which would be attributable to the oil shock. However, no break has been identified after that, including the late 1980s.

during 1977 1Q - 1985 4Q. Although this is probably because the relationship is more difficult to identify statistically due to the very small variations in M2+CDs during this period, there might be some doubt that M2+CDs consistently exhibits precedence to GDP.

In the monetary transmission mechanism, monetary aggregates are expected to affect, in the first place, private domestic demand rather than total GDP, as explained in Appendix I. In fact, the precedence of M2+CDs to private domestic demand seems to be more stable than in the case of GDP.

Table A3
Lagged correlation between M2+CDs and economic indicators[1]

1. GDP, domestic private demand

	1968 1Q - 1976 4Q	1977 1Q - 1985 4Q	1986 1Q - 1996 1Q
Nominal GDP[2]	0.70 (-5)	0.90 (+4)	0.90 (-4)
Real GDP[2]	0.46 (0)	0.77 (+2)	0.89 (-2)
Nominal domestic private demand	0.69 (-4)	0.80 (-1)	0.92 (-2)
Real domestic private demand	0.49 (-1)	0.52 (+1)	0.91 (-1)

2. Inflation indicators

	1968 1Q - 1976 4Q	1977 1Q - 1985 4Q	1986 1Q - 1996 1Q
GDP deflator[2]	0.79 (-6)	0.83 (+5)	0.85 (-8)
WPI[2,3]	0.76 (-6)	0.69 (-5)	0.70 (-7)
CPI[2,4]	0.73 (-7)	0.78 (-6)	0.73 (-8)

3. Asset prices

	1968 1Q - 1976 4Q	1977 1Q - 1985 4Q	1986 1Q - 1996 1Q
Stock prices[2,5]	0.79 (0)	-0.04 (+4)	0.73 (+4)
Land prices[2,6]	0.88 (0)	0.13 (+1)	0.98 (+3)

[1] Figures indicate the largest negative cross-correlation coefficient within the eight periods before and after the period concerned. Figures in parentheses are time lags and negative figures represent the lead of M2+CDs. [2] Based on annual changes in quarterly data. [3] Average of overall domestic wholesale prices. [4] Overall consumer prices. [5] Based on Tokyo Stock Price Index (TOPIX). [6] Based on Urban Land Price Index (average of residential and commercial land prices in the six major cities: 23 wards of Tokyo, and Yokohama, Nagoya, Kyoto, Osaka and Kobe).

Sources: Bank of Japan, *Economic Statistics Monthly*; Management and Coordination Agency, *Consumer Price Index*; Tokyo Stock Exchange, *Monthly Statistics Report*; Japan Real Estate Institute, *Urban Land Price Index*.

3.1.2 Correlation between M2+CDs and price variables (Table A3-2)

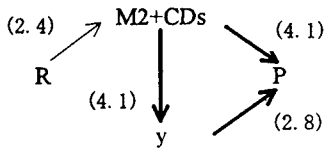
In most case, M2+CDs precede price variables, with a longer lag (five to eight quarters) than in the case of GDP. This observation seems to be consistent with the view that, although short-term changes in monetary aggregates could cause those in real variables such as real GDP, they would only change prices in the long term.

Figure A8
VAR model estimation results

(1) Variables: R (call rate), M_2+CDs, y (real GDP), P (GDP deflator)

① Sample period: 2Q/67-4Q/85

(a) Granger Causality

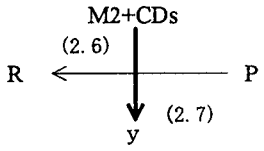


(b) Variance Decomposition

	RHS variables			
LHS variables	R	M2+CDs	y	P
R	71	19	2	7
M2+CDs	10	88	1	1
y	8	28	62	2
P	12	49	7	31

② Sample period: 2Q/86-1Q/96

(a) Granger Causality



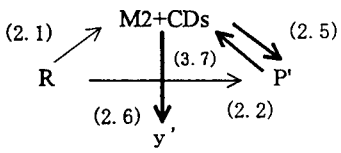
(b) Variance Decomposition

	RHS variables			
LHS variables	R	M2+CDs	y	P
R	46	25	6	13
M2+CDs	30	54	4	12
y	17	29	36	18
P	23	10	10	57

(2) Variables: R (call rate), M2+CDs, y' (real domestic private demand), P' (domestic private demand deflator)

① Sample period: 2Q/67-4Q/85

(a) Granger Causality

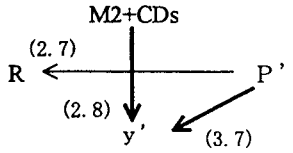


(b) Variance Decomposition

	RHS variables			
LHS variables	R	M2+CDs	y'	P'
R	53	15	9	23
M2+CDs	10	70	2	18
y'	4	18	60	18
P'	10	28	5	57

② Sample period: 2Q/86-1Q/96

(a) Granger Causality



(b) Variance Decomposition

	RHS variables			
LHS variables	R	M2+CDs	y'	P'
R	21	42	1	36
M2+CDs	10	72	1	17
y'	12	31	28	29
P'	12	7	17	64

Notes: 1. y, y', P P' are changes from previous period.
2. Granger causality test at four quarters (directions of arrows represent lead and lag relationships).
⟶ 5% significance level,
⟶ 10% significance level.
3. Figures in parentheses represent F-test values.
4. Variance decomposition at 20-quarter horizon.

3.2 Estimation of the VAR model

Given the observation of the lagged correlation coefficients in (1), two VAR models, both of which consist of four variables, are estimated: i) one including M2+CDs, real GDP, the GDP deflator and the overnight call rate, and ii) a second one with M2+CDs, real domestic private demand, the domestic private demand deflator and the call rate. In each, estimations are made for two different periods, namely, 1967 2Q - 1985 4Q and 1986 2Q - 1996 1Q, to see if any change can be observed after the mid-1980s.

The results are shown in Figure A8. Causality (in a Granger sense) from M2+CDs to income variables is found to be significant in all cases. Contrary to the observations of lagged correlation coefficients, no major difference can be seen between GDP and domestic private demand. As regards price variables, the most embarrassing results would be that, in either case, causality from M2+CDs to the deflator is not significant after the mid-1980s. This might be because the lag of the VAR model (four periods in each model) is too short compared with the rather long lag from M2+CDs to price variables indicated by the lagged correlation coefficients.

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