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Further Monetary Easing Policies under the Non-negativity Constraints of Nominal Interest Rates: Summary of the Discussion Based on Japan's Experience

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Abstract

This paper examined issues surrounding monetary policy under zero interest rates based on one and a half year's experience in Japan. After reviewing the market development in Japan, it summarizes the transmission mechanism of monetary policy under zero nominal interest rates, and considers what would be the likely policy options if a central bank were to conduct further monetary easing. Specifically, a more detailed policy announcement is regarded as feasible, less costly, and the less risky option, although additional effects of monetary easing through this measure are relatively limited. On the other hand, introduction of a temporary fixed exchange rate system and a huge increase in the outright purchase of medium- and long-term government bonds can induce relatively large effects although the uncertainty in the effects as well as the accompanied costs and risks are maybe very large.

In addition, the paper considers the validity of introducing inflation targeting. It summarizes that inflation targeting is not necessarily easy to distinguish from traditional policy management based on an overall consideration. Furthermore, given recent tendencies in Japan, the paper argues that the introduction of inflation targeting in the current situation might impair the conduct of monetary policy in the absence of preconditions for benefiting from its intrinsic merits.

Key words: Monetary policy; Zero interest rate; Long-term interest rate; Market operation of outright purchase of long-term government bonds; Foreign exchange market intervention; Inflation targeting

JEL classification codes: E52, E58

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1 Introduction

At the Monetary Policy Meeting on February 12, 1999, the Bank of Japan (BOJ) decided a directive to guide uncollateralized call rate (overnight) down to virtually zero percent: so called the zero interest rate policy. One and a half years have passed since the launch of the policy, and various suggestions with respect to monetary policy management under zero interest rates have been raised from both domestic and overseas economists. The variety of suggestions partly reflects the different evaluation of the future path of Japan's economy, and partly the different understanding of the transmission mechanism of monetary policy. One typical argument is that the BOJ should "continue the zero interest rate policy until Japan reaches a situation in which deflationary concerns subside" while paying due consideration to economic situation and need not to implement any new additional operations. Another typical view is that the BOJ should effect further monetary easing given the existence of a significant output gap. Those who advocate the latter view suggest several specific policy measures such as; (a) increase excess reserves through normal money market operation, (b) increase the outright purchase of medium- to long-term government bonds, and (c) depreciate the yen by activating foreign exchange intervention. Some recommended policy frameworks such as (d) term interest rates targeting and (e) inflation targeting. In addition, some[1] suggest a combination of tax reduction and underwriting of government bonds, thereby realizing similar effects as helicopter money which in effects spread banknotes from the sky, and raise expected inflation. Other recommend, as one medium- to long-term issue to be discussed in considering monetary policy under low inflation economy, a realization of negative real interest rates by imposing money holding tax[2]. As these last two ideas seem to be less feasible for the time being than other ideas (a)-(e), they are not taken up in this paper.

The purpose of the paper is to evaluate as specifically as possible the monetary operation options that would enable the Bank of Japan to accomplish further monetary easing under zero interest rate policy. This does not indicate that the BOJ's policy interest was in further monetary easing at the time of this paper's writing. Rather, up to the latest minutes of the Monetary Policy Meeting on June 12, 2000, suggest that there have been increasingly more time devoted to discuss about the definition of "a situation in which deflationary concerns are dispelled."

However, we may not deny the possibility that further monetary easing would

[1] Bernanke[1999] suggests this idea.
[2] See Goodfriend[1999], Johnson, Small and Tryon[1999].

become a main issue to be discussed due to some unexpected external shock. In preparation for facing such a shock, it might be useful to examine from theoretical viewpoints the transmission mechanism of the various policy measures, together with their risks and side-effects. It should be noted that evaluation of a certain policy measure depends on the prevailing economic situation: a policy measure that would be recommendable when the economy is on the brink of a serious deflationary spiral may not be appropriate when the state is not that serious. Therefore, it becomes necessary to examine the above five policy options (a)-(e) from the viewpoints such as what types of economic conditions warrants their implementation and what types of costs and benefits are expected in implementing them.

This paper is composed as follows. Section 2 reviews developments in money markets at the time of introducing the zero interest rate policy. Section 3 discusses transmission mechanism of monetary policy under zero interest rates. Section 4 examines specific monetary policy options. Section 5 summarizes main issues of inflation targeting which has been often discussed under zero interest rates. Section 6 provides some concluding remarks.

2 Japan's Money Markets Before and After the Zero Interest Rate Policy

2.1 Money market prior to the introduction of zero interest rate policy

We will begin by briefly reviewing money market developments after 1997.[3] From November 1997, the so-called 'Japan premium' widened in the overseas markets; even in the domestic money markets some Japanese banks found it difficult to raise money smoothly. Facing such a situation, many banks felt increasing uncertainty about the availability of funds and, as a precautionary move, they substantially increased reserves. The reserves of Japanese banks based on precautionary demand used to be small because such demand was thoroughly satisfied as long as they met the legally required level; they rarely held excess reserves (reserves provided in excess of those necessary for meeting the legally required reserves). However, banks suddenly thought that the level of legally required reserves was not enough. In response, the Bank of Japan started to provide a massive amount of excess reserves and, to support the economy, subsequently took the following steps: (1) on September 9, 1998, the uncollateralized

[3] For further details of the money market situation, see Hayakawa and Maeda [2000] and Mori, Shiratsuka and Taguchi [2000].

overnight call rate guideline was lowered from below 0.50% to 0.25% on average, (2) on February 12, 1999 the zero interest rate policy was introduced, and (3) on April 13 at a regular press conference Governor Hayami announced "we (BOJ) will continue the zero interest rate policy until we reach a situation where deflationary concerns are dispelled." Under such monetary policy, the growth rate of base money and money supply has been substantially higher than that of nominal economic growth as shown in Figure 1.

2.2 Daily money market operations at the time of the introduction of the zero interest rate policy

Since the Bank of Japan decided to adopt the zero interest rate policy at its Monetary Policy Meeting on February 12, 1999, its targeted call rate (uncollateralized overnight, same in the remainder of the paper) has been almost stable at 0.02-0.03%[4], and Figure 2 shows how excess reserves finally stabilized at around ¥1 trillion on a daily basis.[5] Let us consider what kind of money market operations realized zero interest rates based on this figure.

When the BOJ provided ¥800 billion excess reserve for two days following adoption and announcement of the zero interest rate policy, the call rate immediately declined from around 0.25% to 0.10%. This was followed by a phase during which the BOJ tried to find a sufficient and appropriate excess reserve level. The BOJ initially

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[4] One reason for a call rate not becoming exactly zero is the existence of various transaction costs. For example, when a fund supplier deposits collateralized overnight funds in a *tanshi* company's dealing account, such supplier requires a minimum 0.01% on the deposit even under an excess reserve situation. In response, fund borrowers will bear an additional 0.01% on the bid-ask spread. With respect to the uncollateralized overnight call rate, the Bank of Japan's targeted rate, there are cases where a spread was further added to make the rate 0.02- 0.03%.

As for a reason why *tanshi* companies keep accepting into their dealing accounts interest-bearing funds which have no place to be invested in, market participants often say that such transactions have so far been executed because the companies put emphasis on long-term trading relationships. Such a background explains the recent phenomenon that, even with the Bank of Japan continuing to provide ample liquidity to the market to realize excess reserves of more than ¥1 trillion, funds provided are not necessarily totally reflected as an increase in the current accounts of financial institutions (which are subject to reserve requirements) held with the Bank of Japan but rather the bulk is kept in the current account deposit of *tanshi* companies which are not subject to the requirement.

[5] When funds supplied through Bank operations (estimated required reserve balance after an operation) are more (less) than legally required reserves for the remaining reserve period (daily average amount necessary to meet the required reserve in the remaining reserve period), the difference is called 'the amount in excess (short) of required reserves' (excess reserves, in short) and used to be announced daily by the Bank. However, such announcement was terminated on March 16, 2000 as a result of reviewing announcements related to money market operations (see Miyanoya [2000] for details).

reduced the level to ¥200-300 billion, which resulted in an increase in the call rate to 0.12%. Then, it gradually widened the excess level to lower the call rate from the end of February to early March 1999. The call rate declined again in the process of excess reserves widening to ¥1.3-1.8 trillion and reached 0.03% on March 4. From then until early April, the call rate remained at 0.03-0.05% and excess reserves at ¥1.2-1.8 trillion, except for around the fiscal year-end (March 31) when the money market became tight. The overall tendency was for the BOJ to supply considerable liquidity when the call rate was likely to exceed 0.03%, and to explore the possibility of reducing excess reserves in the absence of such upward pressure on interest rates. After April 5 the call rate (central rate) remained at around 0.03%, and the excess reserve level moved within a range of ¥1.1-1.3 trillion from April 6 to May 20, and remained at ¥1 trillion after May 21. The exceptions were September 9, 1999 and around January 1, 2000, when concern on Y2K problem mounted, and also around the end of September which corresponded to the end of the interim business term. On these dates fund demand stemming from precautionary demand surged, and the BOJ tentatively supplied a huge amount of excess reserves (a double-digit trillion yen figure) to keep the call rate at the zero range.

In the course of this process, some market observers intended to view the amount in excess of required reserves as a kind of indicator signaling future monetary policy. The BOJ repeatedly denied this view and explained that it had simply increased fund provision when the targeted interest rate exceeded the guideline level and decreased provision when it went below the guideline; there was no particular policy intention in changing the amount of daily operations or amount of excess reserves (see, for example, Miyanoya [2000]). Our interpretation of Figure 2 is consistent with such an explanation by the BOJ.

2.3 Developments in nominal and real interest rates after realization of zero interest rates

This section reviews developments in future expected nominal interest rates and looks at the movement of real interest rates estimated from the expected inflation rate[6] based on the consensus forecast.

Figure 3 shows the implied forward rates of various terms after realization of zero interest rates. Disregarding the effects of risk premiums, implied forward rate

[6] To estimate the expected inflation rate in Japan, in addition to using the consensus forecast, Higo [1999] conducted an empirical analysis by using real potential economic growth per capita estimated from the production function as a proxy.

developments correspond to the expected value of future short-term interest. Namely, implied forward term rates for periods during which the zero interest rate policy will continue are close to zero percent, while term rates for periods when the zero interest rate policy is expected to have been terminated become positive with significance. After the announcement by Governor Hayami on April 13, 2000 that the Bank will pursue zero interest rate until deflationary concerns are disappeared, a mechanism through which implied forward rates increase (decrease) according to the strengthening (weakening) of expectations for economic recovery seems to have functioned.

Looking at Figure 3, implied forward rates equal to or shorter than six months were below 0.1% during most of the period from April 1999 to May 2000, suggesting that the market held a coherent forecast that the zero interest rate policy would continue for at least six months. In contrast, implied forward rates ranging from six months to one year exhibited volatile movement reflecting the economic outlook at the time. For example, such rates declined to about 0.1% in the latter half of May 1999 and also from the latter half of October to the latter half of November 1999, likely caused by the expected duration of the zero interest rate policy being extended to more than one year because of the anticipated worsening of the economy. On the other hand, during periods in which these rates moved at relatively high levels, the prevailing expectation in the market was that the zero interest rate policy would be terminated somewhere between six months to one year ahead. With respect to periods longer than one year, except for quite a short time in late May, it seems that forecasts were consistent in believing that the zero interest rate policy would be terminated by the end of such periods.

Figure 4 shows expected inflation rates as indicated in the monthly consensus forecast conducted by Consensus Economics Inc. While expected CPI for 1999 (growth rate, year-on-year basis) followed a declining trend from the beginning of 1998 and eventually converged at –0.3%, for 2000 it gradually increased from the beginning of 1999 and converged to almost zero percent from September 1999. (As a whole, deflationary expectations have been subsiding since end-1998.) Such changes were, to a certain extent, attributable to the effects of a low interest rate policy including the zero interest rate policy. Turning to the movement of real interest rates, calculated by subtracting the above expected inflation rates from nominal interest rates (one year, government bond yield, intra-month average since January 1999), starting from about 0.7% at the beginning of 1999 they declined with some fluctuations and have been stable within a range of 0.1-0.2% since September 1999. If the zero interest rate policy is forecasted to continue for between six months to one year, as previously mentioned,

the trend of low real interest rates is likely to continue unless deflationary concerns are revived. How such a stabilization mechanism stemming from policy effects actually functions largely depends on market expectations with respect to a central bank's policy management. This highlights the importance of smooth communication between the market and the Bank of Japan.

2.4 Ineffectiveness of quantitative easing through short-term market operations

Under zero interest rates, quantitative easing through short-term money market operations might not have any significant demand stimulating effects since short-term government bonds and base money become highly substitutable. Against such a view, some economists recommended to increase excess reserves, arguing that 'if excess reserves held by individual banks become huge, then banks might naturally try to invest in other assets.' Possibly having this kind of arguments in mind, Makin [1999], for example, stated that "most of ¥1 trillion excess funds remaining in the overnight market flew into idle balance of financial brokers. However, it is impossible even for brokers to absorb if remaining funds in the overnight market exceeds ¥1.5 trillion. If excess funds reach a size of ¥2-3 trillion, such funds consequently flow into banking system and thus growth rate of monetary base is expected to rise." This kind of discussion seems to consist of two separate arguments. This first is the portfolio rebalancing effect, which tacitly assumes a monetary operation with the assets which have relatively low substitutability with base money than short-term government bonds.[7] This

[7] This type of portfolio rebalancing effect can be understood from the viewpoint of Divisia money index as follows.

The index is defined as a 'moneyness'-weighted geometric mean of amounts of various monetary assets (that is, the growth rate of the index is a weighted arithmetic mean), and regarded as an indicator showing the degree of quantitative monetary easing. The 'moneyness' is evaluated by a marginal cost for a money holder: an opportunity cost of holding each monetary asset measured from a baseline interest rate (for example, ten-year interest rate). Figure 5 shows the development of Divisia money index, where base money, short-term government bonds and BOJ bills sold are included, under zero interest rate in Japan. We can see from the figure that the overall growth rate of the index is relatively high under zero interest rate mainly reflecting the increased short term government bonds held in the private sector, and that the growth rate is quite volatile partly reflecting a large fluctuation of changes of BOJ bills sold.

Suppose that the central bank implements monetary operation purchasing short-term government bonds with base money. Moneyness of both assets is the same by definition under zero interest rate. Each of the two assets respectively decreases and increases by the same amount while the absolute rate of change will be different from each other reflecting the difference in original outstanding amounts. In this case the rate of change in the Divisia money index is calculated as a equally weighted arithmetic mean of rates of change in the two assets. Except the technical factor stemming from the difference in original outstanding

mechanism is examined separately in Sections 3.2 and 4.3. The second argument is more straightforward: if excess reserves become huge, mere cost pressure should force banks to invest into riskier assets. However, in reality, under zero interest rates the excess reserves were piled up in the account of *tanshi* brokers and banks with the BOJ, and failed to exert this kind of pressure.

In this regard, a simple quantitative illustration might be useful. Excess reserves provided by the BOJ under zero interest rates are about ¥1 trillion (The BOJ's current account balance, which includes required reserves, is about ¥5 trillion). With an interest rate of 0.02% under the zero interest rate policy, the cost would only be ¥200 million even if a bank held all excess reserves for one year. If the BOJ increased excess reserves to ¥3 trillion, three times the current figure, as Makin [1999] suggested, the yearly cost would be ¥600 million. Even if excess reserves are increased to ¥100 trillion, 100 times more than now, the cost would be ¥20 billion, or only 0.9% of city banks' aggregate annual business profit (which was an average ¥2.3 trillion during fiscal 1990-98). Therefore, the cost of holding excess reserves as a precaution could be considered practically negligible; holding huge excess reserves does not pose a serious cost pressure on banks at all.

In fact, on occasions such as Y2K, the leap year date period, and the end of the fiscal year (see Figure 6 which shows changes in the BOJ's current account deposit balance[8]), excess reserves provided by the BOJ were substantial in order to maintain zero interest rates. This was not because Japanese banks were much more cautious than their overseas counterparts, but because the cost of holding such huge excess reserves was virtually negligible.

Perhaps the only plausible counterargument to the ineffectiveness of

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amounts, the Divisia money index does not change with this operation since their moneyness is equal.

On the other hand, suppose that the central bank implements monetary operation purchasing long-term government bonds with base money. While each of the two assets respectively decreases and increases by the same amount again, their moneyness differs. The rate of change in the Divisia money index is calculated as an arithmetic mean of the rate of decrease in the long-term bonds with relatively small weight and the rate of increase in base money with large weight. In this case, except the above technical factor, the Divisia money index does increase reflecting the difference of the moneyness of the two assets. This illustration shows a mechanism where quantitative monetary easing effect is brought by the operation that exchanges two assets not substitutable in terms of moneyness.

[8] While the BOJ's current account deposit balance was about ¥5 trillion in normal times, it reached about ¥23 trillion during the end-1999 to January 2000 period when possible Y2K problems were of concern. In addition, excess reserves increased to some ¥15 trillion at end-February 2000 reflecting anxiety over the leap year factor, and increased to about ¥18 trillion at end-March 2000 because of fund settlement demand toward the end of the fiscal year.

quantitative easing through short-term money market operations would be that the amount of excess reserves may signal to the market the possibility of future policy changes. However, so far, the Policy Board of the BOJ has not issued any instruction concerning the amount of excess reserves. Moreover, since the Director of Money Market Operations Department of the BOJ cannot disseminate a signal of policy change of his own accord, it would be a misunderstanding on the part of the market if it tried to read any signals from the amount of excess reserves. While we are not sure as to what extent such misunderstanding has prevailed, it is hard to believe that continuation of such a misunderstanding would result in any quantitative easing effects.

3 Transmission Mechanism of Monetary Policy Under Zero Interest Rates

This section examines how, under the zero interest rate policy, monetary policy can affect the real economy. Mishkin [1995] summarized the transmission mechanism of monetary policy according to the interest rate channel, asset price channel, and foreign exchange rate channel, although he did not focus on a zero boundary of nominal interest rates. The conclusion of this section is, in short, that each channel functions by mutually affecting each other even under zero interest rates. However, when nominal long-term interest rates are already extremely low and there is little room for further decline, effects through a decline in long-term interest rates are limited, while those which work through paths such as the foreign exchange rate can remain effective. These conclusions will be a starting point in examining the possibility of further monetary easing in Section 4. In order to make discussions simple this section assumes expected inflation as being constant. Policies affecting the expected inflation rate will be examined in Section 5 where we discuss inflation targeting.

3.1 Interest rate channel

As discussed in studies such as Taylor [1995], on the presumption of rational expectations and nominal rigidity, when nominal short-term interest rates are reduced, real interest rates will decline at least in the short term and reduce costs of capital, thereby encouraging a rise in output. In the following, we consider the formation mechanism of nominal long-term interest rates treating expected inflation rate as given.[9]

[9] While this section considers a reduction in nominal long-term interest rates through monetary policy by treating the expected inflation rate as given, if changes in monetary policy actually

Following Shiller [1979] and Shiller, Campbell, and Schoenholtz [1983], we assume the following as a process where factors such as the moves of a central bank targeting short-term interest rates (the uncollateralized overnight rate in Japan) and announcement with respect to policy stance determine long-term interest rates by affecting the formation of market expectations.[10]

$$R_t = \sum_{i=0}^{n} \alpha_i E_t(r_{t+i}) + \theta_t \qquad \text{……..(1)}$$

R_t: long-term interest rates at time t (yield on risk-free long-term government bonds)
r_t: short-term interest rate at time t (yield on risk-free short-term government bonds)
θ_t: risk premium
α_t: weight (constant regardless of interest rates)

Formula (1) indicates that long-term interest rates are determined by the weighted average of future expected short-term interest rates (first element on the right side) and risk premium (second element on the right side), which implies there is an 'arbitrage' transaction accompanying risk premium reflecting factors such as uncertainty with respect to future expected short-term interest rates. For example, when the Bank of Japan announces that it will 'continue the zero interest rate policy until deflationary concerns are dispelled,' a deterioration in the economic outlook leads to an expectation that $E_t(r_{t+i}) = 0$ will hold longer than previously expected, i.e. i will increase, and thus R_t will decline. In contrast, if expectations for economic recovery become strong, expected timing of the termination of the zero interest rate policy will be brought forward and R_t will increase, and thus exert downward pressure on demand. In this sense, monetary easing effected by the BOJ has worked both by achieving zero interest rates and by affecting the interest rate channel through expectations about the duration of zero interest rates.

Returning to formula (1), the following can be considered as components of risk premium θ_t:

(a) uncertainty with respect to future short-term interest rates stemming from an unexpected economic shock (demand/supply shock);
(b) even treating economic shocks as given, uncertainty with respect to future short-term interest rates stemming from the non-transparency of monetary policy

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lead to an increase in the expected inflation rate to some extent, then the stimulative effects on aggregate demand through a decline in real interest rates will be more effective than from a decline on a nominal basis.

[10] In the context of the zero interest rate policy, Clouse et. al. [1999] also offers some discussions based on formula (1).

management; and

(c) effects stemming from bond prices (long-term interest rates) being affected according to the supply of long-term government bonds because of market segmentation[11].

Of these, (b) and (c) can be influenced through monetary policy management (specific ways are examined in Section 4), and which will generally hold regardless of the zero boundary of nominal interest rates. What is characteristic under the Bank of Japan's current zero interest rate policy is that, since both expected interest rates and risk premium are at already extremely low levels, room for further reducing them through monetary policy is limited.

3.2 Portfolio rebalancing channel

Suppose that a central bank increased the outright purchase of long-term government bonds,[12] thereby reducing government bonds outstanding in the market with a medium- to long-term (from one to ten years) remaining period until maturity as well as increasing the supply of base money. Then, individual economic entities would rebalance their portfolios, resulting in the effects as pointed out in Section 3.1 (decline in long-term interest rates following a fall in risk premium due to supply and demand factors) and others on various asset markets.[13] In the process toward regaining equilibrium, stock prices would rise (Tobin's q would increase) and investment expenditure would be stimulated since there would be a move in the stock market to convert cash into stocks. If we focus on the corporate bond market and loan market, investment would be stimulated through a decline in credit premium and new loans would increase. The real estate market and other markets would witness new demand effects through a similar mechanism. These are all transmission effects of medium- to long-term operations, where tightened supply and demand conditions in the bond

[11] Here, a flow of funds model based on the preferred habitat theory is assumed. While the market segmentation hypothesis is a premise for the model (see Clouse et. al.), many empirical results cast doubt on the validity of the hypothesis (see Shiller [1990] for a survey).

[12] As for channels based on portfolio selection theory and which affect asset prices, not only the case where a central bank trades long-term government bonds but also, cases where other types of assets such as corporate bonds, CP, stocks, and real estate are traded can be considered. In order to evaluate the validity of such policies, it is necessary to discuss to what extent risk can be shouldered by a central bank while ensuring its asset soundness, although a specific evaluation of risks attached to individual assets goes beyond the scope of this paper. Nevertheless, when the public sector and a central bank shoulder private sector credits in an extremely large amount, such behavior might be at quite a substantial social cost that would erode the mechanism of capitalism.

[13] See Meltzer [1995, 1999].

market spill over to other financial markets tightening respective supply and demand conditions, leading to a new equilibrium price and asset balance.

According to general equilibrium analysis, such effects can be expected to be obtained qualitatively. However, in order to consider over what time span and in what manner a new equilibrium might be realized in actual respective markets, several factors are important. First is the amount of outright purchase of medium- to long-term government bonds necessary for changing equilibrium to any significant degree. In order to consider this, we need to compare effects accompanying the operation and the potential costs (which we consider in Section 4). The second factor is the magnitude of portfolio rebalancing activity according to the risk-return profile of fund providers such as financial intermediaries and investors. This point is currently important in Japan where banks, institutional investors, and firms have been cautious in risk taking. Let us briefly analyze this issue.

Suppose that a representative agent holds multiple assets and, under the constraint of containing overall risk amount below a certain limit, rebalances its portfolio so as to maximize its objective function (for example, if we assume a utility function with given absolute risk aversion, the expected return and its variance from the portfolio become explanatory variables of utility). Then, let us think of a case where, as a result of the outright purchase of long-term government bonds by the Bank of Japan, a portion of the long-term government holdings of the representative agent is converted to base money. The reduction in portfolio risk (interest rate volatility risk of government bonds) generates room for new risk taking and thus part of base money should be converted to some type of risk assets. To make our discussion clear, let us assume lending (or corporate bonds) bearing a certain credit risk as the only alternative risk asset. In such a case, only part of the initial reduction in government bond holdings would result in an increase in new lending since, to lending, in addition to interest rate risk which is attached to government bonds (assume maturity is the same as lending) too, credit risk would be attached, and therefore the risk limit of the representative agent would be rapidly exhausted. At equilibrium, utility is kept constant by marginally increasing the amount of holdings of both assets and the marginal increase in expected profits offsets increased risk. Because profits and risk (interest rate volatility risk) are approximately linear to the holding amount in the case of government bonds, the above argument can be extended to a non-marginal limited increase/decrease in positions. While, in the case of lending, risks corresponding to the credit portion can either be progressive (risk of concentrating on existing borrowers)

or diminishing (risk diversification effect[14] in response to an increase in borrowers), for the sake of simplicity let us assume a linear relationship on a net basis. In addition, if we assume there is no correlation between asset prices, the amount of lending (corporate bonds purchased) to replace the reduction in government bonds due to central bank operations would be a ratio of interest risk divided by the sum of interest rate and credit risks (for example, if the obtained ratio is 0.5, the purchased amount would be half the initial government bond holding). While interest risk can be hedged for the very short term (for example one day) with the help of the developed futures and swap markets, credit risk is hard to hedge.[15] In addition, when the economy is in recession such as with a zero interest rate policy in place, credit risk[16] is likely to be much greater than in a boom, i.e. and credit risk per unit value is likely to be substantially larger than interest rate risk. Therefore, the purchased amount of loans (corporate bonds) would remain small compared with the initial reduction in government bonds. At this point, money left over would be accumulated as excess reserves at the central bank under zero interest rates. Whether such an effect is welcomed or not needs to be evaluated, as will be discussed in Section 4, in comparison with costs.

Let us make some simple estimates with respect to portfolio rebalancing effects using this framework. If we take end-February 2000 as a base point, the loans outstanding of domestic banks totaled ¥463 trillion, government bonds outstanding (excluding FBs) ¥331 trillion, and government bonds held by the Bank of Japan (excluding FBs) ¥44 trillion. We chose three scenarios for the ratio of interest rate risk/credit risk per unit value (1.0, 0.5, and 0.1), and calculated by what percentage the total loans outstanding of domestic banks would increase in response to the amount of long-term government bonds additionally purchased by the Bank of Japan. The results are shown in Table 1. For example, let us assume that the Bank newly conducted an outright purchase of ¥60 trillion in long-term government bonds. Since this corresponds to 18% of total government bonds outstanding (or 1.36 times the Bank's government bond holdings), the operation should have some impact on the market. Effects on total loans outstanding greatly depend on the interest rate risk/credit risk ratio

[14] However, in exploring new borrowers and promoting diversified investment, monitoring cost will increase. Here we assume a situation in which the effects of risk diversification materialize when such monitoring costs are negligible.

[15] Since in many countries, including Japan, asset liquidation, securitization, asset swap, and credit derivative markets are relatively underdeveloped, it is difficult to effect flexible hedging, especially by small and medium-sized firms.

[16] In a recession, since a firm's default probability is high on average and the expected loss on lending and variance of default probability large, it is also likely that the unexpected loss would be large.

assumption. According to Table 1, when we assume that the above ratio is 0.1, 90.9% of the additionally supplied base money will remain as excess reserves. This means that growth in total loans outstanding obtained through portfolio rebalancing effects as a result of the outright purchase of ¥60 trillion in long-term government bonds would be only 1.2%.

In fact, when we decompose money supply growth into contributing factors in order to review the current situation in Japan, we can see that while lending to the private sector has recently been a negative factor, credit extended to the fiscal sector, such as government bonds, has been a large positive factor (Figure 7). One reason for this is said to be because financial institutions and investors tend to be risk averse (increased investment in low risk government bonds) in making portfolio selection under given net worth. In such circumstances, a policy which directly affects financial institutions' risk preference (parameter within an objective function) is likely to be much more effective. For example, if banks have continued to take a cautious lending stance structurally due to their non-performing asset problem, it should be possible, by strengthening their capital base through the sufficient injection of public funds,[17] to increase their capacity to take new risks as well as heighten their risk preference.

3.3 Credit channel

There is a difference called the external finance premium between the cost of external financing (equity and debt) and that of internal financing (retained earnings), which arises from the existence of an agency cost due to information asymmetry with respect to corporate management information within and outside a firm. When short-term interest rates decline, the external finance premium declines, thereby facilitating corporate external financing, and demand stimulating effects other than through the interest rate channel will materialize (Bernanke and Gertler [1995]). As for the mechanism behind a decline in the external finance premium, it has been pointed out that an interest rate decline improves a firm's financial position, a central bank's increased provision of reserves enhances banks' lending capacities, and a private sector's increased collateral value stemming from a rise in asset prices reduces premiums at the time of bank lending. With respect to lending capacity, it is a mechanism which functions when the funding ability of banks from the market is

[17] In assessing the validity of policy such as injecting capital using public funds (a fiscal policy measure), it is necessary to examine the subject from various viewpoints such as the normalization of the macro financial intermediary function, which this paper focuses on, and the possibility of moral hazard on the part of bank management.

constrained compared with fund demand, though it does not apply to the case of Japan where supply and demand conditions in the bank lending market have been quite loose. The asset price effect, however, would work as a factor to amplify the policy effects through interest rate, portfolio rebalancing, and foreign exchange channels (explained in the next section). Namely, as long as these channels function, market would expect asset prices to rise in the future, and this change in expectation would cause an actual rise in asset prices. However, the credit channel is not expected to function on its own unless we assume an extreme case[18] where asset prices rise in a self-fulfilling manner.

3.4 Foreign exchange rate channel

If the nominal exchange rate of own currency can be depreciated in a stable manner through foreign exchange intervention, the real exchange rate will also depreciate[19] given that prices will not change in the short term, resulting in increased exports thus stimulating aggregate demand. While there is a constraint in terms of foreign currency reserves when the authorities intend to effect the appreciation of their own currency, as long as they tried to see a depreciation there would be no constraints since, in principle, they can issue money unlimitedly[20] to buy foreign currency.[21] Therefore, unless

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[18] Regardless of whether it is a portfolio rebalancing channel or foreign exchange channel, if a central bank continued to implement additional measures on a massive size, there is a possibility that asset prices would increase in a self-fulfilling manner to a level beyond fundamentals. If such a bubble is generated, effects through the credit channel would be amplified compared with those in normal times. However, it is impossible to control the size and timing of the generation and bursting of a bubble, and thus it is difficult to think of monetary policy management which expects such controlling effects.

[19] Froot and Rogoff [1995] conducted a broad survey of empirical studies on the extremely slow regression speed of the real exchange rate (PPP puzzle), and said the consensus among major industrialized countries was that once real exchange rates diverge from PPP it takes about four years to recover half the divergence. Therefore, it is possible to assume, as we did in this paper, a case in which the real exchange rate is not thoroughly adjusted. With respect to the PPP puzzle, see also Rogoff [1996].

[20] While it is, in principle, possible to issue money unlimitedly, in the context of Japan's current financial system, attention should be paid to the fact decision-making power with respect to foreign exchange intervention rests not with the Bank of Japan but the Ministry of Finance. As to the role of the Bank of Japan in foreign exchange intervention, the new Bank of Japan Law stipulates that "The Bank shall buy and sell foreign exchange as an agent of the government, in accordance with the provisions of Article 36, Paragraph 1, when its purpose is to stabilize the exchange rate of the national currency." (Article 40, Paragraph 2). This is different in substance compared with the US where the FRB functions as a junior partner of the Treasury. Therefore, the above mentioned type of foreign exchange intervention would only be realized if the Bank of Japan supplied money by cooperatively absorbing financing bills (FBs) in response to the Ministry of Finance's foreign exchange intervention policy.

[21] With respect to sustainability of a fixed exchange rate system and target zone system, traditional analysis which focuses on constraints of foreign currency reserves based on the

intervention is countered by intervention in the opposite direction from counterpart countries the home currency would eventually depreciate through portfolio rebalancing effects as argued by Bernanke [1999]. Moreover, noticing such intervention, market participants would forecast the authorities' target exchange rate and duration of intervention policy and base their foreign exchange transactions on such forecasts.[22] For example, as suggested by Meltzer [1999], what would happen if the Japanese government announced it would 'continue to pursue a foreign exchange rate level weaker than ¥150 per dollar until deflationary concerns are dispelled?' If the market forecast such a policy was sustainable for a sufficiently long period, then the yen rate would depreciate to ¥150 per dollar within a short period of time. Therefore, within theoretical argument, an introduction of the temporary 'fixed'[23] foreign exchange rate system does have certain effects under a zero interest rate policy.

4 Options for Additional Monetary Easing

This section examines the case when it is considered desirable for a central bank to

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premise of policy credibility is irrelevant for this paper's analysis. On the other hand, it is an important task to theoretically examine how expectations for a return to a floating exchange rate system upon economic recovery being formed in advance would play a role in the actual market, but this goes beyond the scope of this paper.

[22] If the expectations of market participants converge in the short term, then it might be useful to consider the following static equilibrium. However, it is not certain whether such equilibrium would be smoothly realized in a case like the Japan-US relationship where capital transactions are quite active.

In addition to an approach through affecting expectations as this paper focuses on, other approaches to control the foreign exchange rate include the limited taxation of capital inflows. For example, Reinhart and Smith [1997], based on past experience, analyze such policy effects by way of general equilibrium analysis.

[23] One point which deserves attention is that if continuation of the zero interest rate policy in Japan is viewed as almost certain, there would be a significant interest rate differential between Japan and the US, and uncovered interest rate parity would not be compatible with a fixed foreign exchange rate. For example, if the authorities tried to fix the yen rate at ¥150 per dollar, it would not equilibrate unless interest rates in Japan and the US were the same. Therefore, once realizing a depreciation of the yen, it would become necessary to indicate a schedule of drifting the targeted nominal exchange rate: letting the yen moderately appreciate at a constant rate corresponding to the interest rate differential. This paper treats such a case as a 'fixed' exchange rate. On the other hand, Svensson [2000] proposes a scheme to target the exchange rate with a drift corresponding to the inflation rate differential, instead of interest rate differential, in combination with a shift to the price level targeting after reaching the targeted price path.

pursue further monetary easing by shouldering certain risks. We will discuss the possible policy options and effects, as well as risks attaching to each. Based on discussion up to Section 3, among various policy transmission channels, a starting point would be interest rates and the foreign exchange rate; other channels such as portfolio rebalancing and credit are rather regarded as effects accompanying the former two.

We consider the following four policy options via which a central bank can realize additional monetary easing:

(a) Influence the future expected value of short-term interest rates by properly conveying to the market the future monetary policy stance.

(b) Reduce risk premium by diminishing uncertainty pertaining to the future monetary policy stance.

(c) Reduce risk premium by tightening the supply-demand relationship in the bond market through the massive outright purchase of medium- to long-term government bonds (or curtailment of the amount absorbed in the market by the central bank underwriting newly issued government bonds) and increase commercial bank credit to the private sector through portfolio rebalancing.

(d) Shift temporarily to a fixed exchange rate system.

Both options (a) and (b) are policies which work on interest rate expectations as discussed in Section 3.1; (c) works on both the interest rate channel and the portfolio rebalancing channel; and (d) works on expectations with respect to the foreign exchange rate. Since all four options affect real economic variables and, simultaneously, raise asset prices, they are expected to stimulate demand through the credit channel. In the following, we specify possibilities for each option and compare costs and benefits from a central bank's viewpoint.

4.1 Reduction in future expected short-term interest rates

4.1.1 Effects

In order to reduce future short-term interest rates as anticipated by the private sector, a central bank could (a) announce a new policy or (b) commit itself to targeting certain policy variables. Both measures convey to the market the fact that the central bank has further strengthened its monetary easing stance by revising downward its evaluation of economic conditions or changing its stance with respect to policy responses.[24] Bearing

[24] For example, assume that the monetary guideline policy can be described by a policy reaction function (while many central banks, including the Bank of Japan, do not conduct monetary policy automatically following a specific policy response function, such an approach is useful in making a conceptual summary). In the extreme situation where the economy plunges into a zero interest rate environment, we cannot use, either practically or econometrically, the oft-used

in mind the interest rate channel and assuming nominal short-term interest rates as operational variables, both options (a) and (b) would result in a decline in future expected short-term interest rates. Under zero interest rates, market expectation of a prolonged zero interest rate policy and slow tightening after its termination could be the consequence.

Since April 1999, for example, the Bank of Japan has repeatedly announced it would "continue its zero interest rate policy until deflationary concerns are dispelled." Now, suppose the Bank clarified the price index to define deflation. If the market believed this index would trace more deflationary path than the price index which the market normally has in mind, then future expected short-term interest rates would be reduced. Furthermore, assume that the Bank explained more specifically what it meant by "until deflationary concerns are dispelled" and announced the probability distribution of the price index at a certain future rate, as well as the confidence interval on which it would base its policy decision. If that confidence interval turned out to be substantially wider than what the market expected (i.e. the Bank accepts more limited downside risk than expected), the result would be the same as above, namely, a decline in future expected short-term interest rates. This kind of announcement would in any case make it easier for the market to forecast future short-term interest rates.

4.1.2 Risks

The risk attaching to such a policy is that if a central bank, in order to clarify the price index, specified the content of the Bank's announcement based on a specific economic forecasting model and publicized it, flexibility of future policy actions might be impaired if factors not incorporated in the model became significant. The balance between the benefits and costs of such policy will depend on the economic situation. While it might be desirable to pursue strong easing effects at the cost of policy flexibility when the economy is in a serious situation, greater emphasis on ensuring policy flexibility is needed when the economy is in a relatively less serious situation. If, and only if, market expectations about the duration of zero interest rates, as reflected in the term structure of interest rates, significantly diverge from the expectation of a central bank, and the business conditions are too serious for the adverse effects of such diversion to be neglected, it might be worthwhile for a central bank to take such a risk.

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simple linear policy reaction function and thus need to adopt a new non-linear policy function which incorporates a zero interest rate boundary. This is one example which shows that monetary policy is subject to change according to whether a zero boundary of nominal interest rates is binding or not.

4.2 Curtailment of uncertainty about expected short-term interest rates (Containment of risk premium)

4.2.1 Effects

In order to contain risk premium, it is necessary to curtail uncertainty about future expected short-term interest rates, and it is effective for a central bank to make an announcement or commitment so as to further clarify the guidelines of monetary policy management.

A possible option is, as discussed in Section 4.1.1, to make the content of the announcement more detailed. For example, if the central bank made public more specific explanation about its methodology of inflation forecasting,[25] uncertainty about expected interest rates may be reduced further. The announcement could be even more detailed and the Bank may add explanation about the way it would forecast and read other indexes such as output gap.

However, there is a limit to curtailing uncertainty about expected short-term interest rates through announcement. As long as the forecast of short-term interest rates depends on the economic outlook, announcement by the central bank can reduce uncertainty stemming from the public not holding the same view as the central bank (the second component of risk premium θ in formula (1)); however, it cannot reduce uncertainty with respect to any unexpected shocks (the first component of risk premium θ in formula (1)), and in this sense commitment to future policy is limited.

To reduce uncertainty further, one can think of a central bank directly committing to future short-term interest rates so that expected value and realized value will coincide. As for the specific form of such a commitment, an intermediate target over which a central bank has relatively high controllability, namely term interest rate targeting, could be one candidate; announcing a target range of term interest rate and indicating a tolerable risk premium range is another alternative.

4.2.2 Risks

When a central bank makes a stronger commitment than merely announcing a policy reaction and commits to the duration of zero short-term interest rates, it naturally becomes difficult for it to change policy flexibly. When a central bank explicitly indicates a range of future short-term interest rates, the risk of its giving up a flexible

[25] With respect to a methodology of inflation forecasting utilized by a central bank, see Britton, Fisher, and Whitley [1998] and Bank of England [1999] which explain the case at the Bank of England.

policy response in order to cope with sudden events due to a binding of the range might become too substantial to be neglected, since the central bank cannot forecast future economic developments perfectly. Especially under zero interest rates and where room for reducing risk premium is very small, the effect of such a policy is limited; moreover, risk increases if the economy is in a phase where economic forecasting becomes more difficult.

4.3 Increase in the outright purchase of medium- to long-term government bonds

4.3.1 Purpose of the policy: decomposition

Expected effects of an increase in central bank outright purchase can be decomposed as follows:

(a) By changing the portfolio composition of the private sector, funds will flow toward loans, corporate bonds, and stocks in the process of portfolio rebalancing. This is because the operation will generate room for the private sector to take additional financial risks other than holding government bonds such as credit risk and stock price volatility risk.

(b) During the above process, bond market conditions will tighten and long-term interest rates decline, resulting in stimulating demand through the interest rate channel.

(c) A decline in long-term interest rates might also lead to higher demand through the lending channel due to such factors as an increase in collateral value.

(d) Financing the government through issuing money if newly issued government bonds increase.

(e) Rise in expected inflation rate and decline in real interest rates due to factors (a)-(d) above.

It should be noted that the government itself could also effect (a)-(c) above by use of measures such as futures transactions. For example, in order to derive the most fundamental effect (a), we can imagine, instead of purchasing government bonds in the spot market using base money, derivative transactions (whereby the government accumulates a substantial position in medium- to long-term government bond futures) which basically do not need base money. This enables the government to conduct an operation which absorbs the interest rate risk attaching to holding medium- to long-term government bonds.

Specifically, by announcing that the government will continuously roll over futures for a long period, the same effects as from outright purchase operations can be expected: since government bond holdings of the private sector are absorbed by the

government, the operation will have the same effect on the supply-demand situation as purchasing spot government bonds. The essence of policy effects (a)-(c) does not rest on the normal monetary policy function of liquidity control because they do not necessarily require base money manipulation.

How (d) relates to sustainability of government debt and fiscal discipline could be an issue. There might be a possibility that the government expects (d) when it requires a central bank to increase outright purchases of medium- to long-term government bonds without pursuing policies (a)-(c) which the government itself can conduct through futures transactions. At least, if a central bank increases its outright purchase of medium- to long-term government bonds at a time where the sustainability of government debt is in doubt, it is highly likely that the operation would be regarded as a policy support function (d). In contrast, when the sustainability of government debt is not in doubt, then an increase in the outright purchase of medium- to long-term government bonds would be regarded as a policy aiming at effects (a)-(c). In the following, we will summarize discussions according to the status of government debt.

4.3.2 When the sustainability of government debt is in doubt [26]

When the sustainability of government debt is in doubt, the increased purchase of medium- to long-term government bonds is highly likely to be regarded as the central bank's underwriting of newly issued government bonds. When fiscal policy is activated repeatedly in a recession, as has been the case in Japan, a huge fiscal deficit will accumulate and the sustainability of government debt might be put in question. In such circumstances, monetary easing through tightening supply and demand in the government bond market would not only support absorption of newly issued government bonds but also be received as aiming at curtailing existing government debt through the generation of unexpected inflation. In fact, there is an argument which emphasizes the curtailing effect on debt deflation pressure of intentionally creating inflation. Proponents of this policy argue that, if government debt is becoming uncontrollable, it would be more efficient to wipe it out by a one-shot price increase rather than adopting measures such as a tax increase or a reduction in expenditures. The effects of such a measure (i.e., price increase) will be discussed in Section 5 in more detail. Here it should be pointed out that such an action could be interpreted as a loss of fiscal discipline. In such a case, as a historical lesson derived from hyperinflation, there is a risk that the risk premium attaching to government bonds will

[26] This section owes to Fujiki [2000].

rise since the sustainability of government debt is put in question, and the issuing cost of new government bonds, including those for rollover purposes, might substantially increase. In addition, if prices of existing government bonds fell rapidly, the total asset value of a central bank would also decrease substantially, which might erode the credibility of central bank banknotes. In such a case, a reduction in money value would be induced and uncontrollable inflation might be generated. In order to avoid such a serious situation, a central bank should not increase the outright purchase of medium- to long-term government bonds when fiscal discipline is not warranted.

4.3.3 When the sustainability of government debt is not in doubt

4.3.3.1 Effects

In case the sustainability of government debt is not in doubt, an outright purchase of medium- to long-term government bonds would tighten supply and demand and thus likely reduce the risk premium on long-term interest rates (Section 4.3.1 (b)), given that the slope of the demand function in the long-term fund market is sufficiently steep. However, such an effect would be limited if excess reserves continued for a long time and room for a further decline in nominal long-term interest rates were limited. On the other hand, through the portfolio rebalancing as examined in Section 3.2, effects would be transmitted to loan and corporate bond markets (Section 4.3.1 (a)), and increase the outstanding amount of loans and corporate bonds, and a price effect be realized in a direction to reduce credit spread. However, as illustrated in Section 3.2, these effects might be also small in such a situation, as in Japan in 1999, where the risk aversion of economic entities (especially financial institutions fulfilling the financial intermediary function) is quite high (the hoarding of base money is evidence of this); changes in effective frontiers stemming from the tightened supply of long-term government bonds are not likely to lead to substantial price changes.

Besides these supply and demand factors, we can consider the operation affecting expectations of market participants. Such an operation requires a commitment to maintaining the policy in the future. Without this commitment, the effects of the operation would likely to be short-lived such that, as in the case of usual foreign exchange intervention, they would diminish as recognition of the operation being temporary spread in the market.

4.3.3.2 Risks

While the outright purchase of medium- to long-term government bonds has some policy effects, there will be some economic costs attached to the policy implementation

for the central bank, and ultimately for the nation. (Remember that the policies discussed in sections 4.1 and 4.2 were accompanied by policy risks while they were not directly linked with economic costs). When the economy enters a recovery phase, medium- to long-term interest rates would have already risen by the time the central bank absorbed money. Thus, the outright purchase of long-term government bonds would result in unrealized losses in the central bank's bond position at this stage. Even if the central bank absorbed money through different measures, such as bill selling operations, the bond position would lead to unrealized losses (under the cost method) and thus erode the financial condition of the central bank.

Fujiki, Okina, and Shiratsuka [2000] analyzed the current outstanding balance of government bonds issued and the Bank of Japan's balance sheet. They estimated the size of the Bank's likely capital losses by applying certain assumptions with respect to factors such as the degree of interest rate rise upon economic recovery, and reported that the impact of such capital losses would be significant.

They consider two types of operations. The first type would be put in place without declaring an emergency situation, and is called "mild outright purchase of long-term government bonds." It is assumed that the estimated losses could be absorbed by the provision ('reserve for possible losses on securities transactions,' ¥2.4 trillion at the end of March 2000) on the present balance sheet. They then estimate the maximum volume of operation that the bank could undertake.[27] Results are shown in Table 2 (1). For example, when it is assumed that the Bank will sell back government bonds one or two years later, when the long-term interest rates are assumed to be 5% (3-4% long-term real interest rates incorporating term premium plus 1-2% expected inflation), which is not so high compared with rates witnessed in the previous economic recovery phase, the total amount of operation which the Bank could implement would be limited to about ¥12 trillion. If we evaluate an operation of this size based on the estimate in Section 3.2 (Table 1), it would increase domestic bank lending by only 0.2-1.3%.

The second type is considered a response to an emergency situation: the Bank would conduct an operation regardless of the impact on its balance sheet. They called this the "aggressive outright purchase of long-term government bonds." To double the monetary base, the Bank purchases ¥60 trillion in long-term government bonds, which corresponds to 10% of M2+CDs and 20% of long-term government bonds outstanding.

[27] Fujiki, Okina, and Shiratsuka [2000] assumed a long-term interest rate of 2.0% at the time of the operation and estimated the capital loss assuming that the central bank purchased long-term government bonds with a 2% coupon and 10-year time-to-maturity at par (see reference to Table 2).

The authors estimated capital loss at the time the Bank sold back the purchased long-term government bonds, which is shown in Table 2 (2). In case the long-term interest rate rose to 5%, the Bank would incur a capital loss of about ¥12 trillion if it sold back the purchased long-term government bonds within one to two years, and about ¥8 trillion if it sold five years later. Combining this result with our observation in Section 3.2, it is clearly illustrated that the portfolio rebalancing effect of a ¥60 trillion outright purchase operation would be limited, especially if compared with the size of capital loss.[28]

The ratio of monetary base to money supply in Japan has been quite high under the zero interest rate policy. If upward pressure on prices resulted from the above operation and a need arose to absorb back monetary base, that portion of monetary base corresponding to the capital loss could not be totally absorbed just by the Bank selling the government bonds it purchased. The Bank of Japan would thus be forced to sell other assets, resulting in the private sector holding more government debt in the long run. Fujiki, Okina, and Shiratsuka [2000] pointed out that the massive outright purchase of long-term government bonds would, even if successful in rescuing the economy from a deflationary shock, likely result in the central bank incurring a capital loss and lead to an increase in the private sector holding of government debt. They further argued that, in such a case, statements such as "given the government debt situation, fiscal policy has reached its limit. Therefore, monetary policy should step in to take risks and decide on further monetary easing," would not be relevant, and monetary policy would result in aiming at further easing with the fiscal burden accompanied. Furthermore, they argued that if the government tried to avoid such a fiscal burden by monetization after experiencing a deflationary shock, monetary policy would lose control over inflation. Therefore, they concluded that the outright purchase of long-term government bonds should be considered only if the Japanese economy stood on the brink of serious deflation. Some insist that if the outright purchase of long-term government bonds were implemented within both a limited period and amount, it would not erode fiscal discipline and thus would not be problematic. However, such limitation would substantially reduce the effects since they essentially come from the signaling with respect to future monetary policy; the direct effects from

[28] If the announcement by the Bank of Japan to implement massive purchase of long-term government bonds immediately strengthens expectation of the economic recovery and raises the long-term interest rates, the purchasing price of the bonds will probably become cheaper than before the announcement. In such a case, the Bank would incur smaller capital losses than the estimated amount above. The size of saved losses depends on the effect of the Bank's announcement on the market interest rates.

portfolio rebalancing are small as mentioned above. To achieve a meaningful effect, it would become necessary for the Bank of Japan to make clear, in order to send a strong signal to the market, that it would implement massive operations and was prepared to incur a capital loss which is not stipulated in the Bank of Japan Law. In addition, it is necessary for the Bank to examine explicitly with the fiscal authorities how to handle the expected capital loss, and clarify the responses.

With respect to the cost attaching to the increase in the outright purchase of medium- to long-term government bonds, while Okina [1999] emphasized the possibility of the central bank's balance sheet being eroded and suggested it would be a social cost which could not be interpreted in the integrated government model, some counterargued that such a concern was merely self-protection on the part of the central bank. One important implication of Fujiki, Okina, and Shiratsuka [2000] is that, even a scheme which looks on the surface as to warrant fiscal discipline may cause a result which will make such discipline extremely difficult to maintain in the end. Hence, the issue of the central bank's balance sheet might eventually lead to a social cost with integrated government shouldering more of the problem.

4.4 Introduction of temporary 'fixed' foreign exchange rate system

4.4.1 Effects

As mentioned in Section 3.4, a temporary shift to a 'fixed' foreign exchange rate system until the possibility of a deflationary spiral has been eliminated would stimulate aggregate demand through a decline in the real exchange rate. The size of the effect would depend on the level at which the exchange rate was fixed and expectations about the duration of such a 'fixed' exchange rate system. While an exchange rate level can be set freely in theory, in practice there is a constraint that actual decision depends on political negotiation between the countries concerned. In addition, even if we treat the foreign exchange rate level as given, its demand stimulating effect greatly depends on expectations with respect to the duration of the level. If the market expects that the given level will continue for only a very short time, there would be a rush of external demand and a temporary decline in imports[29], and, if a policy to maintain the level is expected to continue for rather a long period, there might be a change in corporate behavior such as domestic manufacturers repatriating production bases from overseas due to expectation of a sustained increase in external and domestic demand.

[29] In this case, there would be a rebound after returning to the floating exchange rate system where external demand (exports) declines and imports increase. Policy duration should be determined by taking into account such a factor.

Depending upon the economic situation, there would be a case that such a foreign exchange policy should be adopted with full understanding of the realistic constraints.

4.4.2 Risks

The risks attaching to the introduction of a temporary 'fixed' exchange rate system might differ depending on whether there had been misalignments among the foreign exchange rates under the former floating exchange rate system.

If there had been no such misalignments, a big risk would be worsening relationships with neighboring countries. While some strongly advocate the adoption of a temporary fixed exchange rate system such as Bernanke [1999] and Meltzer [1999] who hold the recovery of Japan's economy has greater importance for the world economy, Komiya [1999] argues that such a policy violates Article IV of the IMF Agreement[30] which prohibits foreign exchange manipulation to obtain competitive advantage. Okina [1999] and McKinnon [1999] pointed out that it is doubtful that such a beggar-my-neighbor policy would be accepted without any friction not only vis-à-vis the US but also by neighboring Asian countries. In addition, such a policy would not only ignite trade friction but also have serious effects on macroeconomic policy of the country against which the foreign exchange rate is fixed and the pegging country itself.

Next, if such a policy were politically accepted by trading partner countries who assumed that the country concerned would return to a floating exchange rate system after economic recovery, there is a possibility that the exchange rate would appreciate at once to the previous upon return to a "normal" policy setup. Or, if the authorities (the government and the central bank) did not make an explicit commitment to duration in fixing the exchange rate, intensified expectations for return to a floating rate system might trigger speculative transactions, thus resulting in the collapse of the fixed exchange rate system. Unrealized gains on foreign currency-denominated assets, which had been purchased through foreign exchange intervention in the process of the depreciation of the yen, would be eliminated if the yen appreciated and unrealized losses materialized. This can be understood as an analogy of a cost attached to the outright purchase of long-term government bonds. The amount of actual intervention necessary during an initial phase of guiding the yen downwards depends on market expectations. The more credibility given to a fixed foreign exchange rate, the less

[30] Article IV, Section 1 (iii), stipulates that "(each member shall) avoid manipulating exchange rates or the international monetary system in order to prevent effective balance of payments adjustment or to gain an unfair competitive advantage over the members."

need for foreign exchange intervention, and the lower the risk of incurring unrealized losses.

On the other hand, if there were misalignments in the foreign exchange rates which induced deflationary shocks to start with, the above mentioned risks and costs would be deemed quite small.

4.5 How to judge between policy options

This section has discussed individual policy options if a central bank were to adopt additional monetary easing under the zero interest rate policy. To assess the desirability of these policy options, it seems necessary to make an overall judgment taking into account the following four elements:

(1) Stimulative effects of the policy on aggregate demand;
(2) Costs and risks accompanying policy implementation;
(3) Feasibility of the policy;
(4) Assessment of the real economy and future economic outlook (in particular, assessment of the possibility of tumbling into a deflationary spiral).

In general, it is desirable to take a policy where stimulative effects are large, and costs and risks are small. However, it should be noted that an armchair theory tends to neglect feasibility. Adoption of policy option should be determined by comprehensively taking into account elements (1) - (3) based on an accurate assessment of the economy (4). For example, if a central bank judges there is a high possibility that the economy will fall into a deflationary spiral, it should decisively take measures where large effects are expected, even if costs and risks involved are large. In contrast, if deflationary risk is small, a central bank should decide measures involving fewer risks. In Section 4, we have examined each policy option taking especial consideration of (1) - (3) above. The main results are as follows:

- A policy of making policy announcements more specific aiming at reducing future expected short-term interest rates and curtailing future uncertainty has high feasibility but perhaps limited effects.
- When the sustainability of government debt is in doubt, an increase in the outright purchase of medium- and long-term government bonds should not be implemented, since a central bank runs the risk of shouldering loss of credibility in its fiscal and monetary policy. On the other hand, when the sustainability of government debt is expected with fiscal discipline (although a possibility that fiscal discipline is actually warranted might not be as large as it might look), certain effects can be expected while economic costs attached to it are not negligible.

- When there is no foreign exchange rate misalignment, the temporary introduction of a 'fixed' exchange rate system might not be feasible because of the difficulty of accompanying political coordination between the country concerned and its counterpart. When there is misalignment among foreign exchange rates, low costs and relatively large effects can be expected.

5 Inflation Targeting

While the Bank of Japan has been pursuing the zero interest rate policy, whether or not it should adopt inflation targeting as its monetary policy framework has often been discussed. However, such discussions have been raised in different contexts and thus a consensus is yet to emerge.

In considering the adoption of inflation targeting, we believe it necessary to distinguish between the following two questions: first is whether or not to introduce inflation targeting when normal interest rate policy can be implemented; and second is whether inflation targeting should be introduced as a measure for economic recovery when the economy is in a deflationary situation under zero interest rates. We first clarify the definition of inflation targeting and discuss the question with respect to normal times. Then we examine what problems might arise if the economy is in a deflationary situation under zero interest rates.

5.1 Styles of monetary management: the classical approach and inflation targeting

Whether a central bank should adopt inflation targeting in normal times can be generalized into considerations of a monetary policy framework which is consistent with each country's situation. Padoa-Schioppa [1996] called such policy management frameworks "styles of monetary management," among which we are interested in selecting between the 'classical' approach based on an overall consideration and inflation targeting. We agree with the conclusion of Padoa-Schioppa [1996] that it is of utmost importance for a central bank to accumulate credibility through consistent adherence to a coherent style but that style itself is a secondary issue. In order to explain the background to this conclusion, we compare specific policy management components between the classical approach and inflation targeting and examine the essential difference between the two.

5.1.1 Examples of inflation targeting components

When we look at various countries which have introduced inflation targeting, the institutional setting differs from country to country. Here, we define a basic model of inflation targeting based on what we consider to be a typical framework[31], and compare it with the basic classical model, which we define later.

1) Objectives of monetary policy

A central bank sets a target or a target range for the inflation rate (and, possibly, for the output gap) and clarifies the weights attached to each, in order to clarify the policy objective thereby stabilize private sector expectations and enabling more effective monetary policy management.

2) Intermediate targets

A central bank sets the future expected inflation rate (and expected output gap) as intermediate objectives and controls short-term interest rates which are operational variables (i.e., forecast targeting).

3) Transparency and accountability

A central bank announces a target inflation rate range over time and shoulders accountability for ex-post policy results. The bank also regularly announces its judgment on issues such as the future economic outlook. Such announcements are useful in clarifying that policy has actually been pursued so as to maximize the objective of the Bank mentioned in 1) above.

4) Ensuring credibility and offering incentives

It might be possible to devise measures such as legal accountability and penalties if the target is not achieved (including exemption clauses).

5.1.2 Examples of classical components

Next, with reference mainly to Blinder [1998], we define a basic classical model as follows.

1) Objectives of monetary policy

A central bank sets its legal objectives in conceptual forms such as ‘price stability’ and ‘sustainable economic growth.’ Therefore, judgment with respect to specific targets

[31] We considered the basic models with reference to theoretical studies such as Svensson [1997, 1999] and institutions in countries which have adopted inflation targeting such as the UK, New Zealand, Sweden, Canada, and Australia.

such as a target inflation rate is entrusted to the central bank, and the bank thoroughly explains its views and the rationale behind such judgement.

2) Intermediate targets

A central bank determines its current policy stance by analyzing, in a forward-looking manner, the expected future values of various economic variables such as the inflation rate and output gap based on comprehensive information.

3) Transparency and accountability

It is essential for a central bank to communicate voluntarily and closely with the market and the bank is required to make continuous efforts to this end.

4) Ensuring credibility and offering incentives

A central bank does not take any specific measures. Credibility is obtained as a result of coherent policy management over time. The provision of various incentives is expected to have insignificant marginal effects.

5.1.3 Is there any essential difference between inflation targeting and the classical approach?

In this section, we consider what determines the comparative advantage of both approaches by comparing each component of the two basic models above.

We see no major difference in either model with respect to the setting of intermediate targets. As regards monetary policy objectives, while one might focus on whether a government or a central bank should specify objectives, it is not conclusive since there are both cases where the central bank sets the target inflation rate and where the government sets it. Regardless of models, there is no doubt that a central bank should be required to communicate thoroughly with the public from the viewpoint of accountability.[32] Bearing these points in mind, a critical issue for a central bank in

[32] Possible cases in which a central bank intentionally avoids a specific explanation are as follows: (a) due to lack of independence, a central bank might want to avoid potential political pressure, (b) even though sufficiently independent, a central bank might want to avoid the risk of losing its credibility due to such factors as its economic forecast being totally inaccurate, and (c) since a central bank cannot know with 100% certainty what policy is correct due to difficulties in measuring variables such as the optimal inflation rate, national output, and NAIRU, it has to conduct monetary policy according to the circumstances and a rigid commitment might thus become an obstacle. With respect to these cases, (a) is a matter of central bank organization and should not be considered as an issue concerning the policy framework, and (b) is not convincing reasoning since a situation which substantially erodes central bank credibility is a clear case of policy failure regardless of how a central bank announces its economic forecast. As regards (c), one can argue that it is desirable for a central bank to, although it is not aware of the correct policy answer, show its current views as specifically as possible within a range so as not to lose its flexibility with respect to future

choosing between inflation targeting and the classical approach is whether inflation targeting is useful in winning credibility for its explanation, and this largely depends on the financial history of each country and the policy track record of its central bank. As Padoa-Schioppa [1996] and Blinder [1998] pointed out, historical experience tells us that central bank credibility reflects the degree of success in having coherent policy management over time. A central bank which has a good policy track record and credibility has, compared with a central bank which does not, relatively little to gain in adopting inflation targeting and moreover faces the risk of losing flexibility in being able to change policy. On the other hand, for a central bank which has relatively low credibility as an inflation fighter, an attempt to make explicitly known its incentive mechanism even at the risk of losing its flexibility in being able to change policy, might form the basis for a new credibility. If we think of arguments with respect to inflation bias as raised by some, including Barro and Gordon, the offering of incentives might partly, but not completely, substitute for credibility. In addition, the experience of New Zealand during 1994-96 can be cited as an example of the attachment of institutional incentives leading directly to the loss of flexibility in a central bank being able to make policy changes. In this case, the Reserve Bank of New Zealand pursued drastic monetary tightening because the inflation rate diverged from the then target 0-2%. The Bank found this policy only resulted in destabilizing the economy and expanded the target rate range to 0-3%.

A conclusion we have obtained by comparing the seemingly contradicting two policy styles, inflation targeting versus the classical approach, is that there is not necessarily a distinct difference between components of the two as derived from our basic models.

Of course, we can straightforwardly consider that a difference between the two styles is whether a target inflation rate is explicitly indicated or not. In this case, what becomes a critical point in distinguishing advocates of inflation targeting from those of the classical approach is whether one regards the various problems accompanying the introduction of inflation targeting as merely technical issues or as more deep seated, essential ones. Specific points of discussion include to what extent measurement errors in price indexes and the zero boundary of nominal interest rates should be taken into account in setting a target inflation rate, a consideration of asset prices (Japan's experience since the latter half of the 1980s clearly shows that, when asset prices change substantially, containing changes in consumer prices within a certain range does

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policy changes.

not necessarily bring the economy onto a sustainable growth path), and changes in economic structure (academic models of inflation targeting treat economic structure as given and there is so far no consensus in academia and central bank circles as how to define an inflation rate which is consistent with sustainable growth under a rapidly changing economic structure caused by innovation in information technology[33]). For example, in a speech in September 1997, FRB Chairman Greenspan said that the conduct of monetary policy might naturally be discretionary in circumstances where economic restructuring has drastic effects (Greenspan [1997]). In a similar vein, Mr. Laurence H. Meyer, FRB Board Member, presented a viewpoint that uncertainty such as that one cannot accurately observe changes in economic structure is an important factor in monetary policy management (Meyer [2000]).

On the other hand, taking into account the fact that the ECB, which defines price stability as an inflation rate of below two percent, is not necessarily regarded as an example of adopting inflation targeting, it might be the case that mere specifying of price stability does not indicate inflation targeting.

These observations lead us to think that one factor which induces essential changes upon the introduction of inflation targeting is the disclosure of the central bank's commitment and incentive structure behind such inflation targeting, which thereby enhances the credibility of central bank policy management. While there might be a case in which institutional re-defining of accountability by way of introducing inflation targeting is deemed effective in enhancing the credibility of monetary policy management, there might be a case where sticking to a coherent policy management framework by following the classical approach is more effective.

5.2 Introduction of inflation targeting under zero interest rates

5.2.1 Effectiveness of inflation targeting under zero interest rates

Can the introduction of inflation targeting under deflation and zero interest rates contribute to economic recovery? Based on the discussion so far, the essence of this question is to what extent the introduction of inflation targeting will enhance credibility of the central bank's reflation policy in a deflationary phase and help economic recovery. The answer to this question also depends on an evaluation of a central bank's past policy management. If there has been sufficient communication between the central bank and the public and the bank's policy stance has been thoroughly

[33] For example, Hayami [2000] pointed out the problem of only chasing price changes regardless of the content since there is a good price decline which stems from technological innovation.

understood, then there would be little additional benefit to the economy by introducing inflation targeting.

One interesting point at issue in Japan is the mitigation of debt deflation pressure stemming from intentionally created inflation. If government debt has become uncontrollable, one might come to think that canceling out government debt by one-shot inflation would be more efficient than a tax increase or reduction in government expenditure and that creditors should bear the resulting losses. Kousai [1999] pointed out that some believed in such effects during the inflationary period immediately after the end of World War II, when the economy was closed and controlled with strict restrictions on capital transactions and interest rates were not liberalized.

This point is closely related to what advocates of intentionally created inflation argue, namely that, since nominal interest rates cannot be reduced below zero, the inflation rate should be raised in order to reduce real interest rates. The problem here is the argument does not consider sufficiently the possibility that risk premium might change. If a central bank tries to raise the inflation rate intentionally, inflation volatility naturally rises, which, by increasing uncertainty, enlarges the risk premium on long-term interest rates. In addition, if a central bank takes measures which invite suspicion about the credibility of fiscal discipline during the process of forcing the inflation rate to rise, government bonds will be downgraded and bond prices further decline, resulting in an increase in the interest burden on refinancing bonds exceeding a decline in the real value of debt outstanding. Such a process will intensify the more financial markets become liberalized and the more closely global market participants will monitor policy actions.

In this regard, there are some interesting estimations. Itoh and Shimoi [1999] assumed cases where the inflation rate continued at 3% and 5% for 20 years, and simulated the total real value of long-term government bonds, depending on the extent Fisher effect materialized. They reported that if term premium is assumed constant and a rise in the expected inflation rate under zero inflation does not substantially affect nominal long-term interest rates (no Fisher effect), then the refinancing interest rate will not rise and thus there will be a substantial debt reduction effect (46.2% when the inflation rate is 3%, and 64.1% when it is 5%).[34]

Matsui and Fujiwara [2000] made several simulations by considering not only

[34] According to Itoh and Shimoi [1999], the real debt reduction effect will be 13.5% under a 3% inflation rate and 20.7% under a 5% inflation rate even when the Fisher effect completely materializes.

possibilities of Fisher effect materializing but also risk premiums moderately increasing as the inflation rate rises. They assumed three types of future inflation (different inflation rate and risk premium for 10 years as shown in Figure 8) scenarios, and for each simulated how nominal long-term interest rates will be in three cases (without the Fisher effect, with the Fisher effect/without the inflation risk premium, and with the Fisher effect/with the inflation risk premium), results of which are shown in Table 3. With the Fisher effect, the debt reduction effect is equal to or less than 10% for all three inflation scenarios, and such effect further diminishes once risk premium is generated. This leads us to believe that the effects of intentionally generated inflation on reducing the real interest rate and also debt are uncertain and small, and become negligible simply by incorporating a moderate rise in risk premium. Therefore, an aggressive rise in risk premium might easily lead to an increase in the real debt burden.

Against the aforementioned views, it could be suggested that the adoption of inflation targeting might restrain the uncertainty of inflation risk. However, creating inflation intentionally is an unprecedented policy option. It seems impossible for a central bank to reduce the inflation rate at will even in a period of disinflation. Furthermore, if the central bank tried to inflate the economy at any cost, excessive easing would result, and the resulting stop-go policy would lead to a higher variability of interest rates and inflation expectations. Higher uncertainty regarding future inflation would increase long-term interest rates, reflecting the increased risk premium.

An interesting experience in this connection is when the Federal Reserve allowed the short term interest rate to fluctuate largely, adopting a new monetary operation method based on the money supply control in October 1979. In the early 1980's, US long term interest rates stayed at an extremely high level, even in the real term where the expected inflation rates were subtracted from the nominal rates. These two facts are reconciled into a presumption that money market operations to induce higher uncertainty in short-term interest rates resulted in an increase in the risk premium for long-term interest rates. In light of this experience and of the theoretical insights, it is deemed rather optimistic to expect that an intentionally created inflation with a break of inflation targeting would avoid an overshooting of long-term interest rates, thus mitigating balance sheet problems such as government debt.

5.2.2 Risk in adopting inflation targeting

What are the risks and problems accompanying the introduction of inflation of targeting under zero interest rates? Conclusion of the previous section suggests clearly that inflation targeting should not be introduced as a measure to create inflation intentionally

through the central bank committing to realize a target inflation rate even if the economy is in deflationary situation. It should rather regarded as a policy framework which is in contrast to the classical approach. The question should be rephrased as to whether a central bank can overcome the above-mentioned points which divide the advocates of inflation targeting and those the classical approach, and, if successful, whether targeting reflation and disinflation works in the same way, thereby heightening central bank credibility.

Here, we should not overlook the reality that in Japan it has been repeatedly proposed that inflation be intentionally created. If the central bank adopted inflation targeting in such circumstances, a campaign calling for the central bank to achieve a target inflation rate at any cost is very likely to gain momentum. In such a situation it would become quite difficult for a central bank to reap orderly the intrinsic merits of inflation targeting, i.e. adjusting monetary policy flexibly according to economic and employment conditions while committing to a medium-term inflation target. Introduction of the inflation target in such a situation may be used as an excuse to cover up the side effects of unusual measures for the goal, and hamper policy flexibility all the more. It has to be clarified to which extent the central bank could tolerate the technical problems accompanying the introduction of inflation targeting. But a far more important point is whether or not the central bank and the broad public can share an understanding that inflation targeting is not a measure for bringing intentional inflation from the back door, but a framework for assuring flexible policy operations. Deriving a premature conclusion without clearing these points may lead to negative results.

5.3 Price level targeting

We briefly touch upon price level targeting as an additional point of discussion. As a measure to reflate effectively the economy under deflation, Svensson [1999] and Woodford [1999] proposed to introduce price level targeting before deflation intensifies. The idea is that, through factoring in the view into market expectations that monetary policy will be tilted toward inflation (deflation) according to the magnitude of deflationary (inflationary) shocks, monetary policy will actually function smoothly. The difference with inflation targeting is that, when the economy is recovering, inflation targeting will shift the monetary policy stance to neutral in order to achieve the target inflation rate, while price level targeting tolerates inflation until the price level is restored. Therefore, price level targeting can generate strong expectations with respect to the inflation rate when the economy is in a deflationary phase.

Price level targeting is attractive if we focus on its reflationary effects through

expectations during deflation period, while there is room for discussion as to whether it is still the optimal choice when the costs and benefits of inflation in general are taken into account. In discussing such issues, it should be borne in mind that price targeting cannot avoid technical problems such as the definition of a target price and measurement errors. Since powerful reflationary effects stemming from price level targeting expectations can only be achieved by introducing it in advance in normal times, this paper, which aims at examining additional monetary policy measures under a deflationary situation, will not delve deeper into the subject of in the piece level targeting.

6 Concluding Remarks

Based on one and a half year's experience under the zero interest rate policy in Japan, this paper examined various issues surrounding monetary policy under such a special situation. Specifically, it summarized the transmission mechanism of monetary policy under zero nominal interest rates, and examined what would be the likely policy options if a central bank were to conduct further monetary easing. In considering each policy option, the paper compared policy effects and risks from the viewpoint of a central bank.

As a result, as summarized in Section 4.5, a detailed policy announcement is regarded as feasible, less costly, and less risky option, although additional effects of monetary easing through this measure are relatively limited in such a situation that the term interest rates have declined substantially to very low levels (for example, three-month and one-year government bond yields were 0.05% and 0.23%, respectively, on average in the second quarter of the year 2000) with the above-mentioned announcement to 'continue the zero interest rate policy until deflationary concerns are dispelled.' On the other hand, an increase in the outright purchase of medium- and long-term government bonds and introduction of a temporary fixed exchange rate system could induce relatively large effects when implemented on a large scale, although the uncertainty in the effects as well as the accompanied costs and risks are maybe huge. While the effects of these policy measures will depend greatly on nature of shocks to the economy and whether there is any misalignment among the foreign exchange rates to start with, the paper concluded that, in general, such measures are not practical unless the economy is facing a serious risk of tumbling into a deflationary

spiral.

In addition, the paper considered the validity of introducing inflation targeting in the current situation. The paper summarized that inflation targeting is not necessarily easy to distinguish from traditional policy management based on an overall consideration (the classical approach). Furthermore, given recent tendencies in Japan, the paper argued that the introduction of inflation targeting under zero interest rates might impair the conduct of monetary policy because of the absence of preconditions for benefiting from its intrinsic merits.

This paper analyzed the economy under zero interest rates from the viewpoint of monetary policy, for which a central bank should be ultimately responsible. The paper confirmed that while it may be possible for a central bank to take additional measures through monetary policy even under zero interest rates, such measures may be accompanied by substantial risks and side-effects.[35]

For a central bank, a thorough examination of possible measures to reflate the economy under zero interest rate is important. It is equally important to reaffirm how it should avoid being forced to adopt zero interest rates at the first place. In Japan, by reflecting on the generation of the bubble during the late 1980s to early 1990s, the importance of forward-looking policy management so as to avoid not only overheating of the economy but also serious recession following the bursting of any bubble has again been emphasized (Okina, Shirakawa, and Shiratsuka [2000]). Needless to say, the bubble cannot be controlled solely by monetary policy and a method that perfectly identifies the existence of a bubble has yet to be established. However, it is the responsibility of the policymakers, including the central bank, to analyze, as far as possible, the problems arising when economic policy fails to control a bubble. Based on such analysis, it is important not to be satisfied with merely expressing the central bank's commitment to the conduct of policy measures. Capacity for analysis and policy implementation should be accumulated systematically, and every effort should be made to share the outcomes of work with the public, thereby gaining credibility for the central bank.

[35] This point implies that in Japan it has become desirable, more than in the past, to promote policy responses coping with institutional aspects which encourage various structural reforms (such as measures to cope with structural problems in the financial system as well as those in the labor market as pointed out in Tachibanaki, Fujiki, and Nakada [2000]) to proceed, in addition to monetary and fiscal policy.

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Figure 1　Growth of Money Stock and Nominal Output in Japan

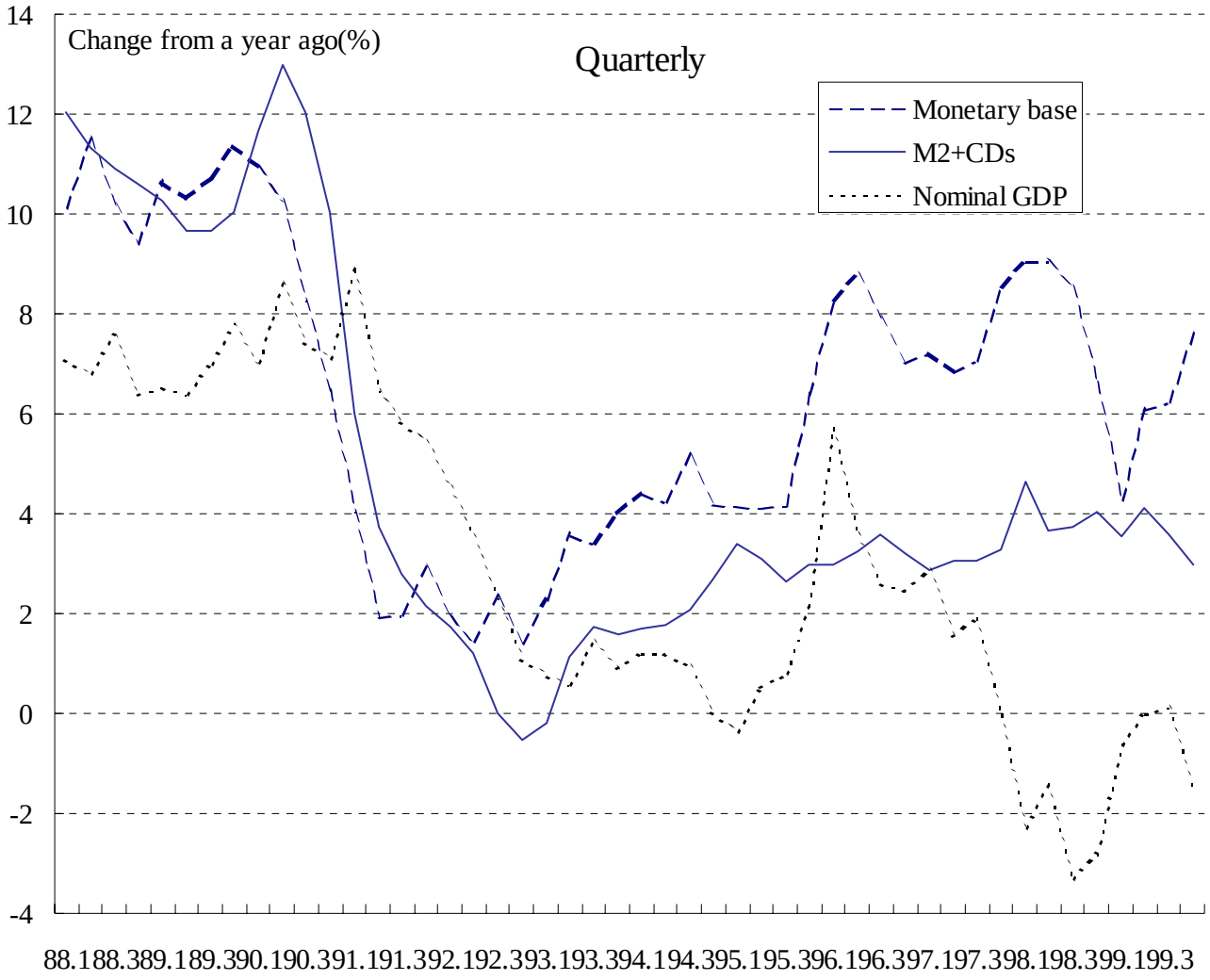


Figure 2 Excess Reserves and Overnight Call Rates on the Introduction of Zero Interest Rates Policy in Japan

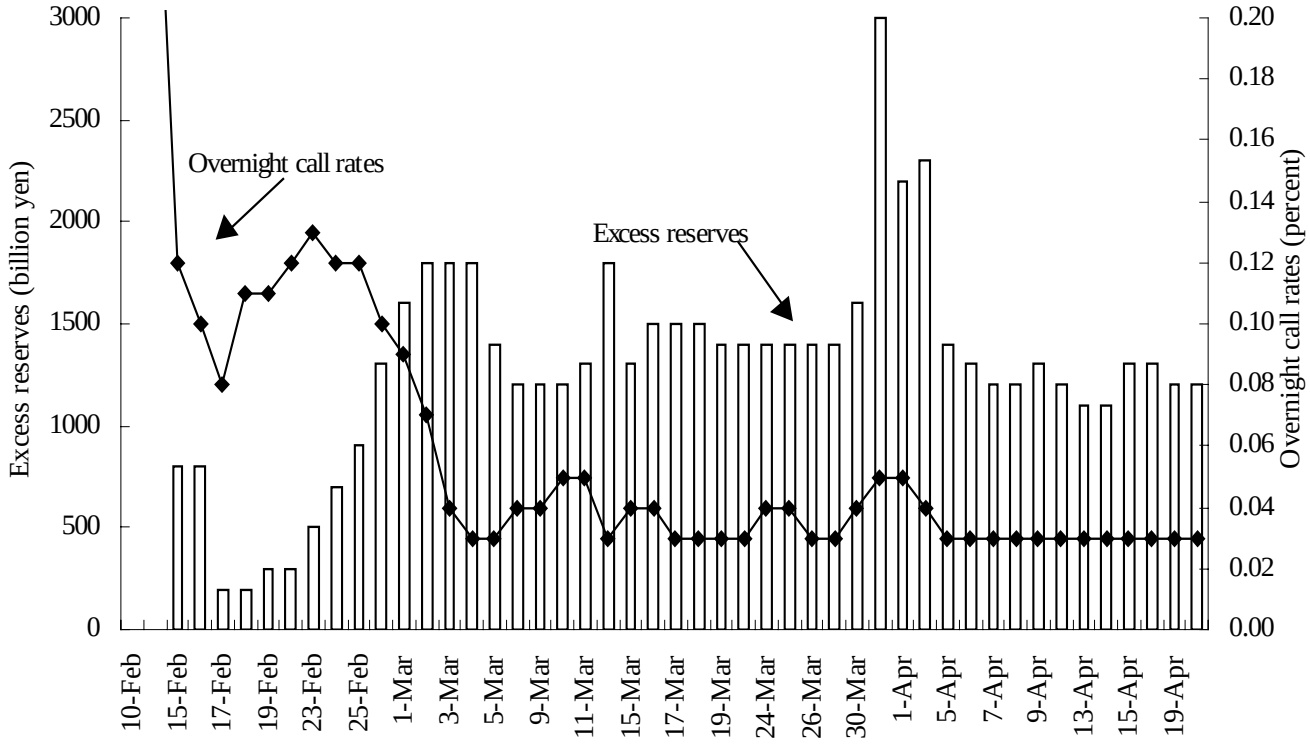


Figure 3 Implied Forward Interest Rates in Japan

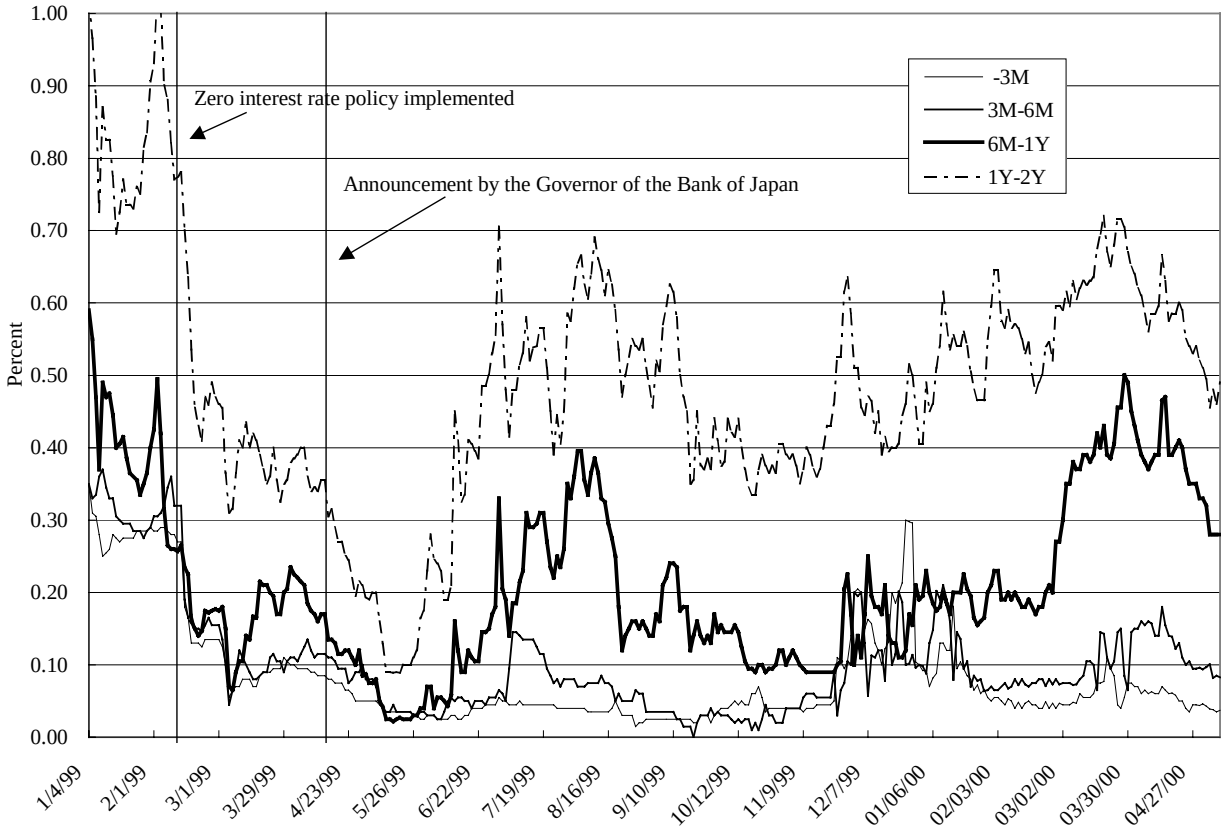


Figure 4 Real Interest Rates Based on the Forecasted Inflation Rates in Japan

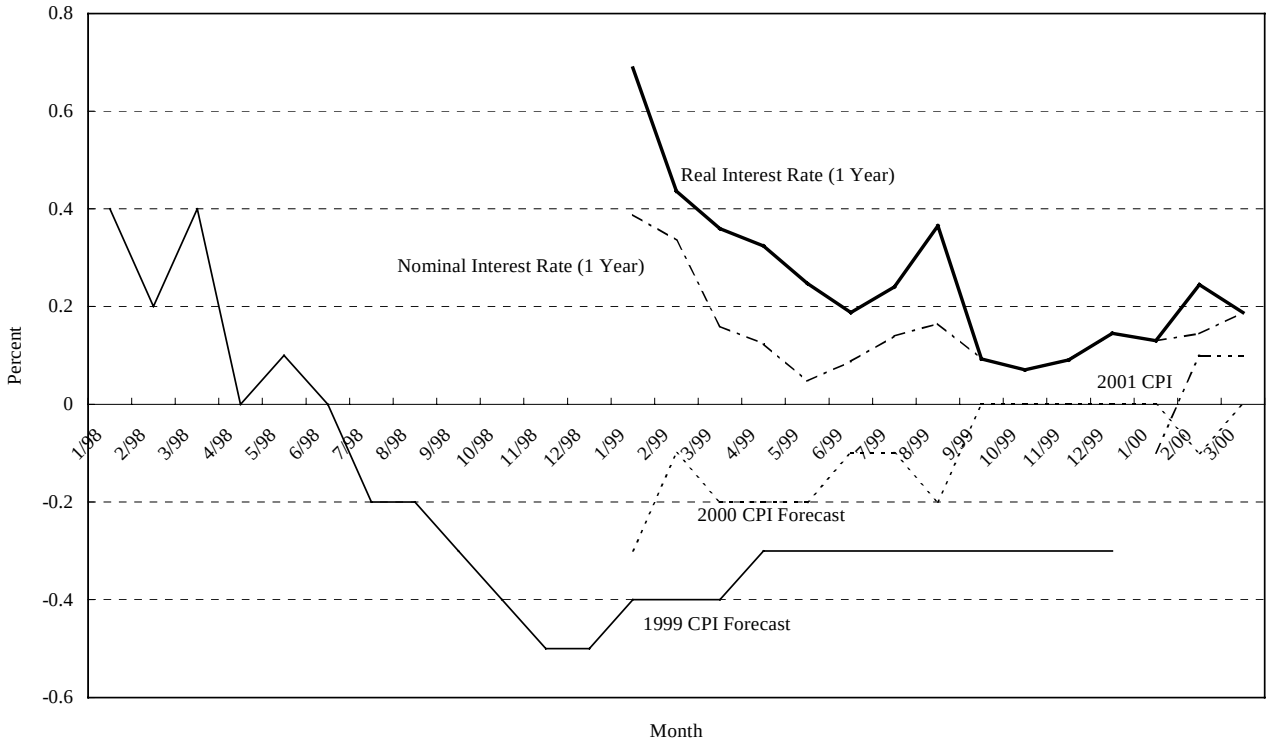


Figure 5 Development of Divisia money index in Japan

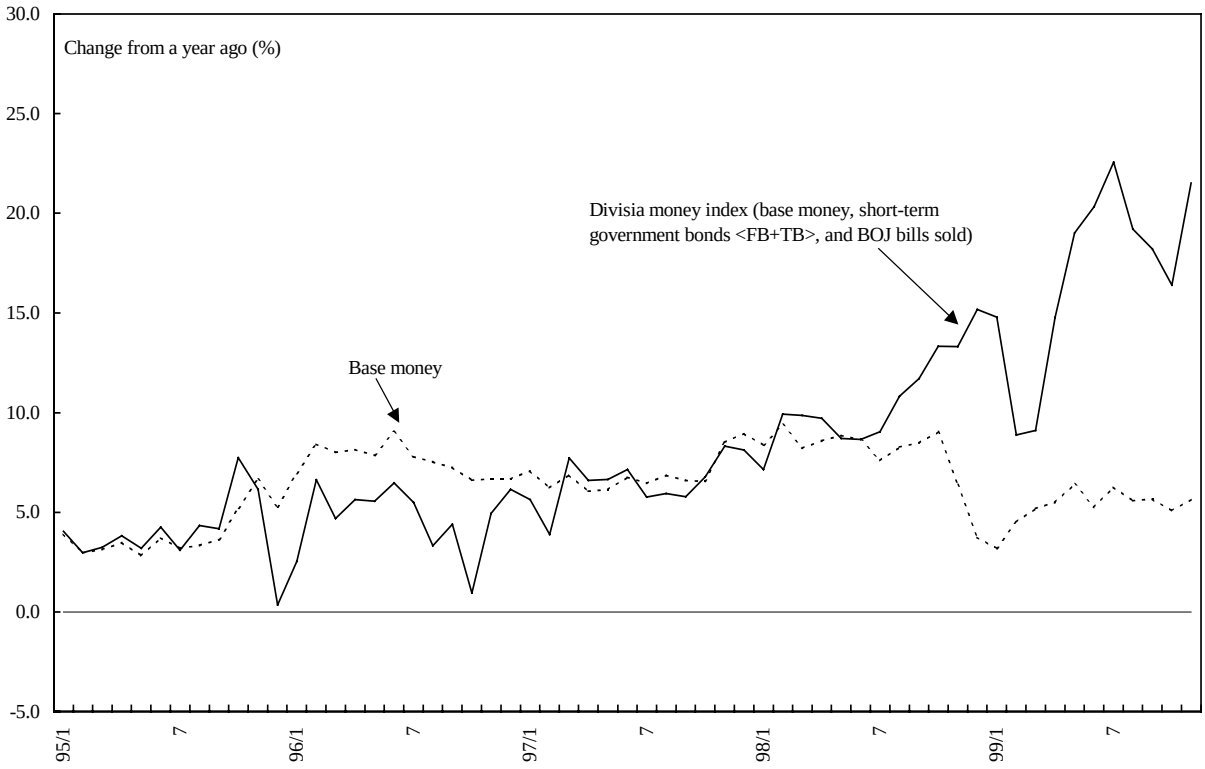


Figure 6　Balance of Current Account Deposit at the Bank of Japan

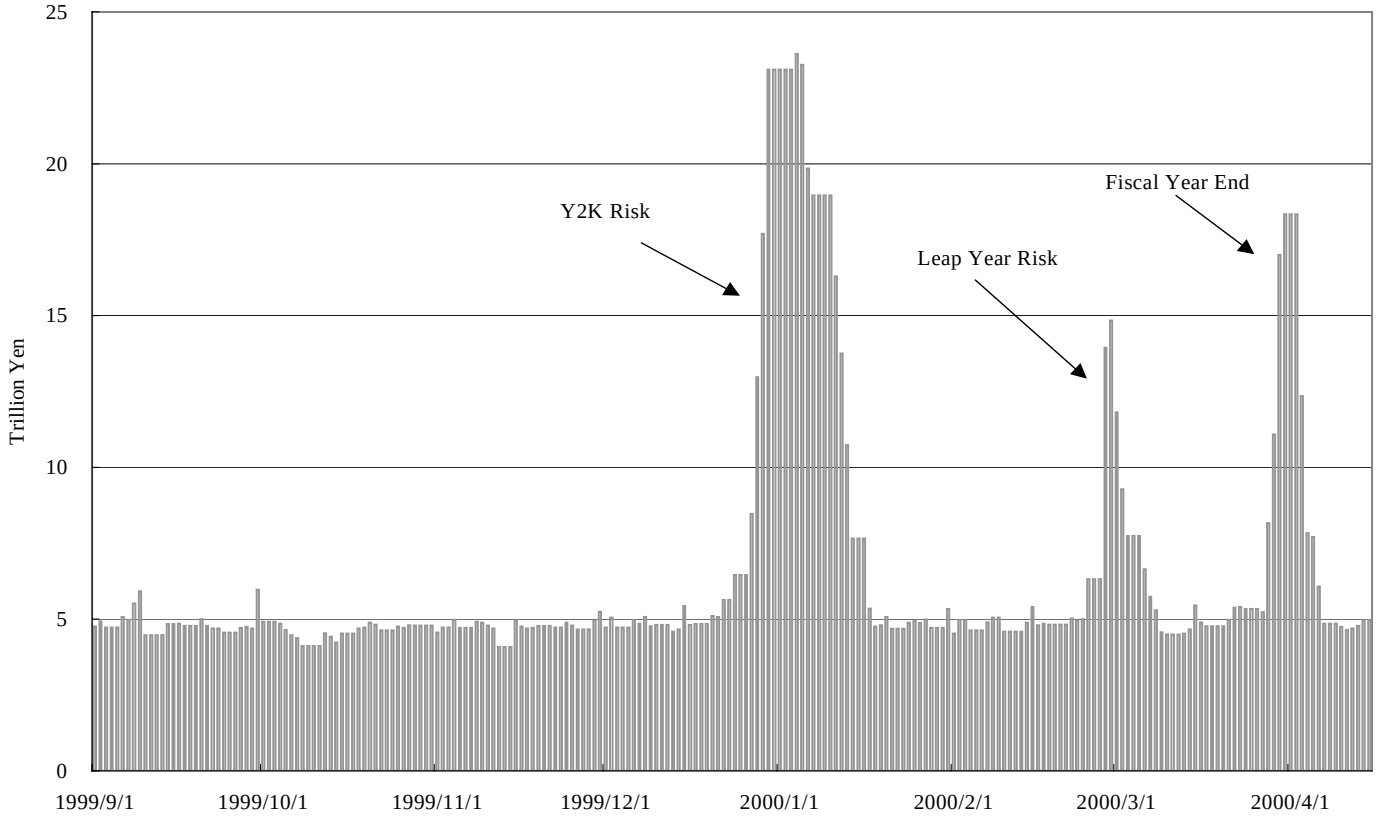


Figure 7 Changes in Money Stock in Japan and Credit Contributions to the Changes

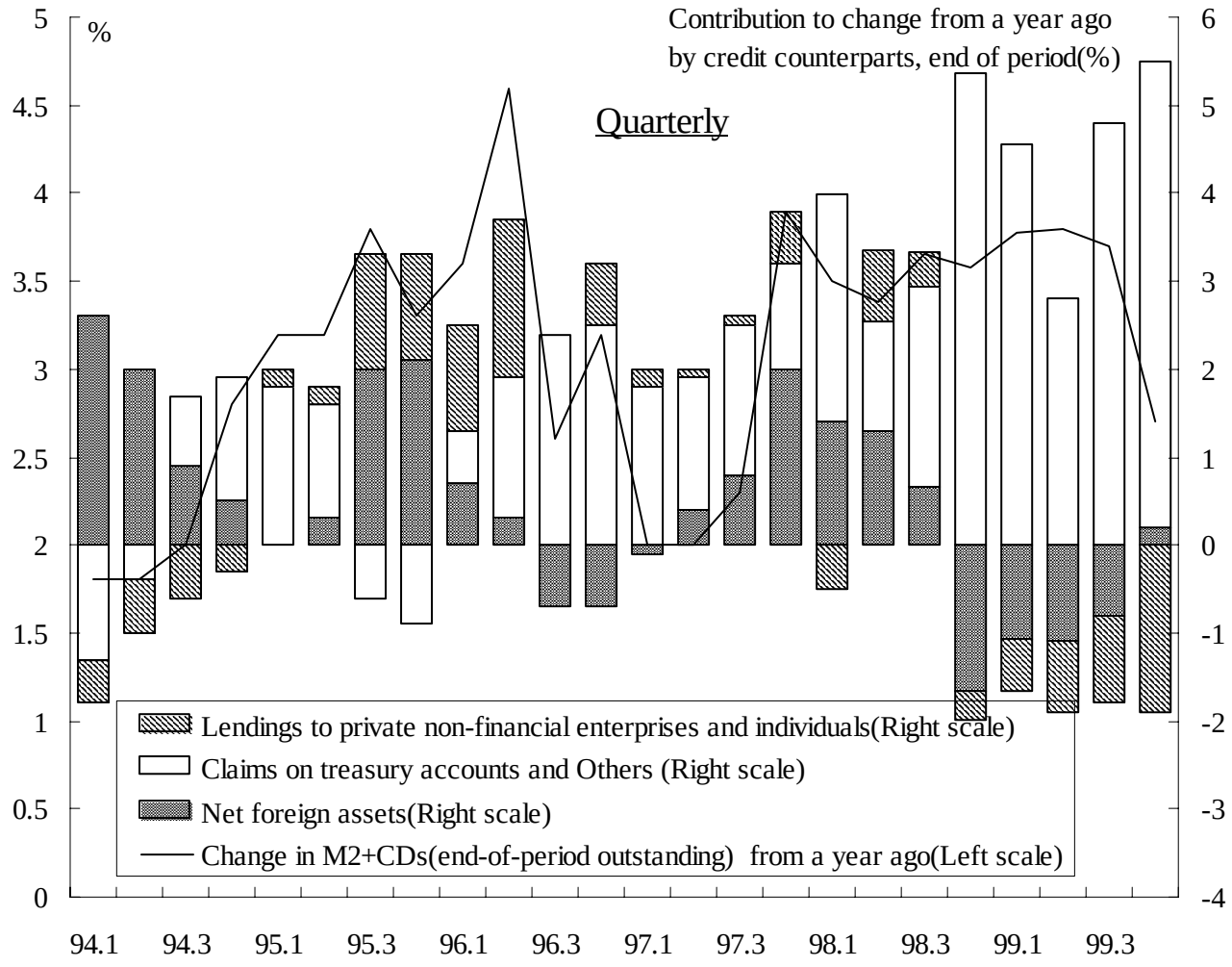
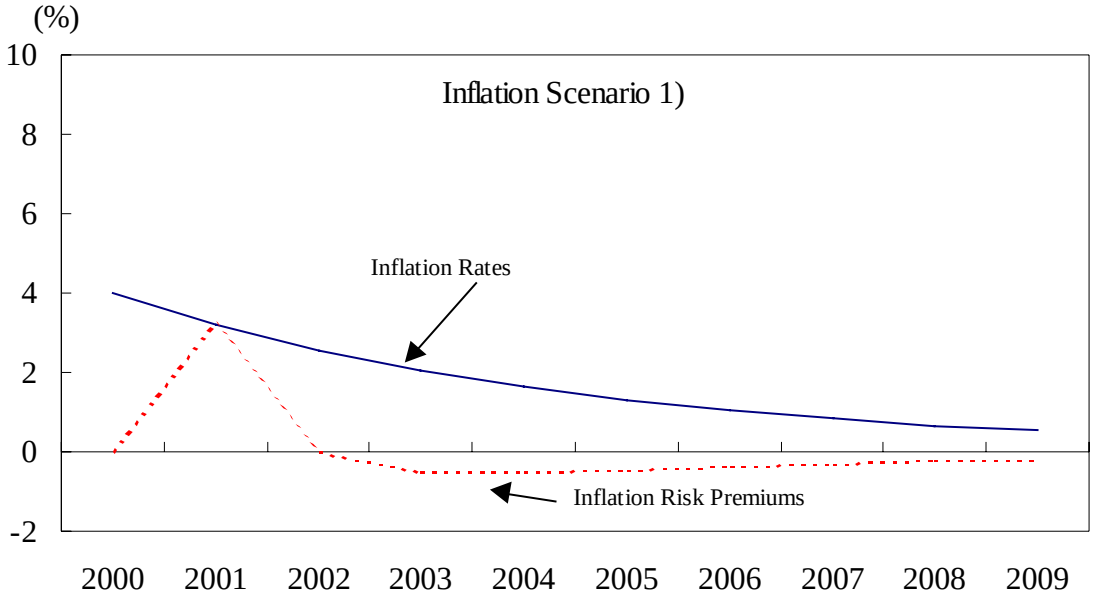


Figure 8 Three Inflation Scenarios for the Simulations in Matsui and Fujiwara [2000]



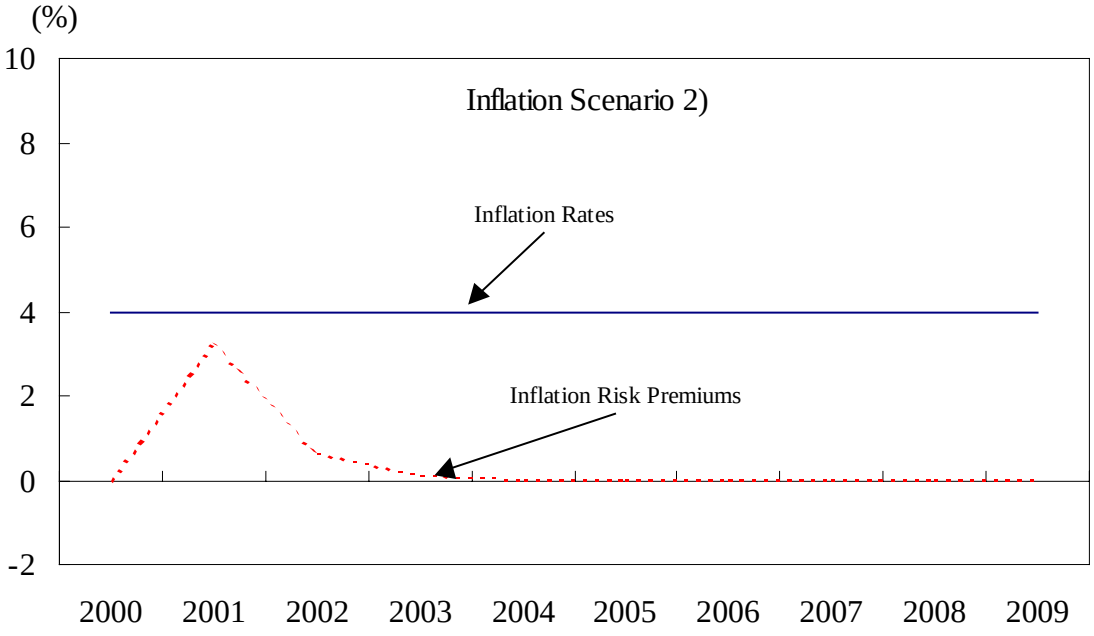
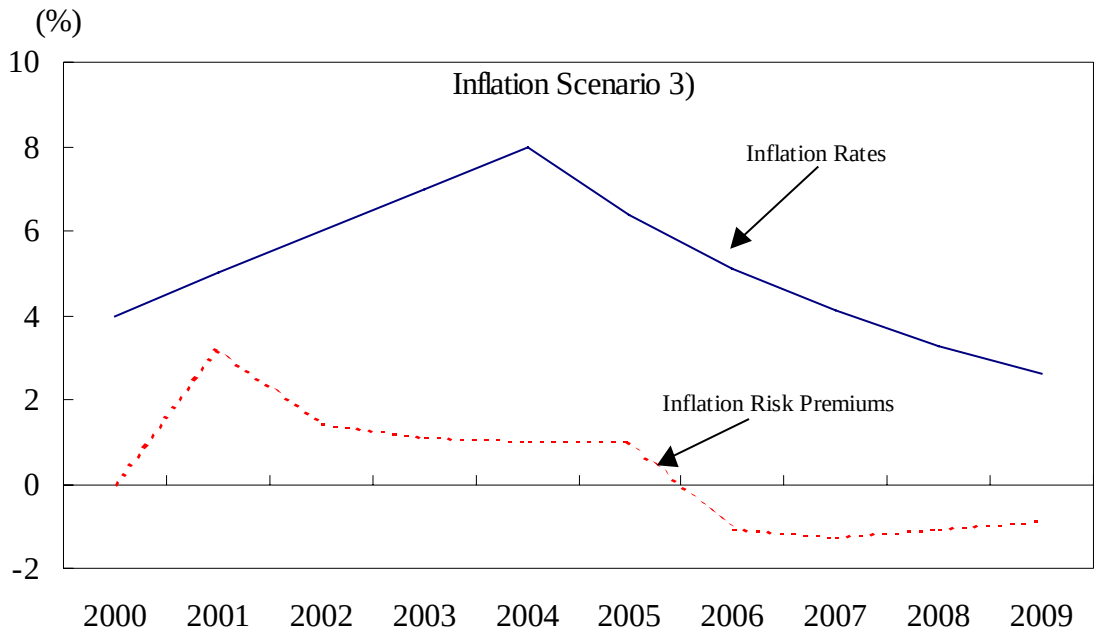


Figure 8 (Continued)



Note: It is assumed in the simulations that the inflation premiums are formed, given a path of inflation rates, according to adaptive expectations: exponentially weighted average of the gaps between realized and expected inflation rates in the past.

$\mu(t) = \sum_{i=0} \lambda(1-\lambda)^i [\pi(t-1-i) - \pi_e(t-1-i)]$ for $t \geq 2$, and

$\mu(1) = 0$,

where $\mu(t)$ is an inflation risk premium, $\pi(t)$ is a realized inflation rate, $\pi_e(t)$ is an expected inflation rate (assumed to be equal to the realized rate a year before), and λ is a constant ($0 < \lambda < 1$). Here λ is set at 0.8.

Source: Matsui and Fujiwara [2000]

Table 1 Percent Increase of Aggregate Lending by the BOJ's Purchase of the JGBs

BoJ's Purchase of Long-term JGB			Ratio of the Interest Rate Risk over the Credit Risk		
Amount (Trillion Yen)	% of Total Outstanding	% of BoJ's Current JGB	1.0	0.5	0.1
12	4%	27%	1.3%	0.9%	0.2%
60	18%	136%	6.5%	4.3%	1.2%
100	30%	227%	10.8%	7.2%	2.0%
200	60%	455%	21.6%	14.4%	3.9%
Increase of Excess Reserve as % of JGB Purchase Amount			50.0%	66.7%	90.9%

Table 2 Results of Simulations on the BOJ's Purchase of Government Bonds (JGBs) in Fujiki, Okina and Shiratsuka [2000]

(1) Total Maximum for the BOJ's to Purchase Long-Term JGBs in Mild Operations

¥Trillion

Long-term interest rate on repurchase	Time of repurchase (years)					
	0	1	2	3	4	5
2.5%	54.8	60.2	66.9	75.6	87.1	103.3
3.0%	28.1	30.8	34.2	38.5	44.3	52.4
3.5%	19.2	21.0	23.3	26.2	30.0	35.4
4.0%	14.8	16.1	17.8	20.0	22.9	27.0
4.5%	12.1	13.2	14.6	16.3	18.6	21.9
5.0%	10.4	11.3	12.4	13.8	15.8	18.5
5.5%	9.1	9.9	10.8	12.1	13.7	16.1
6.0%	8.2	8.8	9.7	10.7	12.2	14.2

(2) Capital Losses from the BOJ's Purchase of ¥60 Trillion JGBs in Aggressive Operations

¥Trillion

Long-term interest rate on repurchase	Time to repurchase (years)					
	0	1	2	3	4	5
2.5%	2.6	2.4	2.2	1.9	1.7	1.4
3.0%	5.1	4.7	4.2	3.7	3.3	2.7
3.5%	7.5	6.8	6.2	5.5	4.8	4.1
4.0%	9.7	8.9	8.1	7.2	6.3	5.3
4.5%	11.9	10.9	9.9	8.8	7.7	6.6
5.0%	13.9	12.8	11.6	10.4	9.1	7.8
5.5%	15.8	14.6	13.3	11.9	10.5	9.0
6.0%	17.7	16.3	14.9	13.4	11.8	10.1

(Reference) Values of a Long-Term JGB with Coupons of 2.0% under Different Interest Rates

Long-term interest rate	Time to maturity (years)					
	10	9	8	7	6	5
2.5%	95.6	96.0	96.4	96.8	97.2	97.7
3.0%	91.5	92.2	93.0	93.8	94.6	95.4
3.5%	87.5	88.6	89.7	90.8	92.0	93.2
4.0%	83.8	85.1	86.5	88.0	89.5	91.1
4.5%	80.2	81.8	83.5	85.3	87.1	89.0
5.0%	76.8	78.7	80.6	82.6	84.8	87.0
5.5%	73.6	75.7	77.8	80.1	82.5	85.1
6.0%	70.6	72.8	75.2	77.7	80.3	83.2

Source: Fujiki, Okina and Shiratsuka [2000]

Table 3 Reduction of the Real Value of Government Debt by the Long-Term Inflation Scenario

(Percent of the Current Government Debt)

	Without the Fisher Effect	With the Fisher Effect	
		Without the Inflation Risk Premium	With the Inflation Risk Premium
Long-Term Nominal Interest Rate	= Real Interest Rate = 1.5% (Constant)	= Real Interest Rate + Inflation Rate	= Real Interest Rate + Inflation Rate + Premium
Inflation Scenario 1)	14%	3%	2%
Inflation Scenario 2)	27%	10%	6%
Inflation Scenario 3)	34%	8%	2%

Inflation Scenario 1): Inflation rate of 4% in 2000. The rate decreases each year by 0.8 times the prior rate.
Inflation Scenario 2): Inflation rate of 4% in 2000. The rate continues to be the same for the next 10 years.
Inflation Scenario 3): Inflation rate of 4% in 2000. The rate increases each yeer by 1% till 2004.
Afterwards the rate decreasess each year by 0.8 times the prior rate.

Source: Matsui and Fujiwara [2000]