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Japan's deflation, problems in the financial system and monetary policy

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Foreword

On 18-19 June 2004, the BIS held a conference on “Understanding Low Inflation and Deflation”. This event brought together central bankers, academics and market practitioners to exchange views on this issue (see the conference programme in this document). This paper was presented at the workshop. The views expressed are those of the author(s) and not those of the BIS.

Third BIS Annual Conference

Understanding Low Inflation and Deflation

Brunnen, Switzerland, 18-19 June 2004

Conference programme

Friday, 18 June **Inflation and deflation dynamics**

09.00 *Opening remarks (William White, BIS)*

Morning sessions (Chair: Lars Heikensten, Sveriges Riksbank)

09.15 *Session 1: Changes in the inflation process (Stephen Cecchetti, Brandeis University and Guy Debelle, BIS)*

Discussants: Ignazio Angeloni, ECB; Jordi Galí, Centre de Recerca en Economia Internacional (CREI)

11.00 *Session 2: Deflation in historical perspective (Michael Bordo, Rutgers University and Andrew Filardo, BIS)*

Discussants: Patrick Minford, Cardiff Business School; Fernando Restoy, Bank of Spain

Afternoon sessions (Chair: Vittorio Corbo, Central Bank of Chile)

14.00 *Session 3: Price setting and deflation in Asia (Hans Genberg, Graduate Institute of International Studies)*

Discussants: Laurence Ball, John Hopkins University; Steven Kamin, Federal Reserve Board

15.45 *Session 4: Panel on 'Deflation and the financial system' (Presenters: Lesley Daniels-Webster, JP Morgan Chase; Takumi Shibata, Nomura Securities)*

Discussant: Philipp Hildebrand, Swiss National Bank

Saturday, 19 June **Implications for monetary policy**

Morning sessions (Chair: David Longworth, Bank of Canada)

08.45 *Session 5: Deflation in Japan: causes, consequences and policy options (Masaaki Shirakawa and Kazuo Ueda, Bank of Japan)*

Discussants: Michael Mussa, Institute for International Economics; Marc Olivier Strauss-Kahn, Banque de France

10.30 *Session 6: Beyond current policy frameworks (Charles Goodhart, London School of Economics)*

Discussants: Edwin Truman, Institute for International Economics; Ignazio Visco, Banca d'Italia

Afternoon session (Chair: Malcolm Knight, BIS)

13.30 *Session 7: Overview panel (Ben Bernanke, Federal Reserve Board; Willem Buiter, EBRD; Lucas Papademos, ECB)*

15.00 *Conference adjourns*

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It would be hard to deny that, Japan's macroeconomic experience during the last two decades has been quite extraordinary. Stock and land prices soared to peak levels in the late 1980s and early 1990s respectively, giving way subsequently to a decade-long correction process. In April 2003, the Tokyo Stock Price Index (TOPIX) reached a low of 773.1, the same level as in 1984. Declining asset prices have hit the banking system severely. Although taxpayers' money, bank earnings and bank capital, in total amounting to about 20% of GDP, have been used to address the non-performing loan (NPL) problem, the banking system has not fully recovered yet. Business fixed investment continued to suffer from the excesses of the late 1980s and the impaired financial system. The economy has grown at a minimal 1.0% rate on average during 1992-2002, a period that has been called a "lost decade".[3]

The weak condition of the economy has been reflected in general prices. The GDP deflator and the consumer price index (CPI) have been declining since 1995 and 1998, respectively. The Bank of Japan (BOJ) started to ease in the summer of 1991, then lowered the call rate by almost 800 basis points in the following four years, bringing the rate to under 0.5% in the summer of 1995. This, however, was not enough to counteract the deflationary forces. Since 1999, the call rate has been lowered to zero with the exception of the August 2000-February 2001 period. In addition, the BOJ went still further in adopting several unconventional policy measures. At the time of the writing of this paper, deflationary forces seem to be finally easing, but the CPI inflation rate has not clearly turned positive yet.

The purpose of this paper is threefold. First, it aims to survey various discussions of the so-called "lost decade" from a macroeconomic perspective. Second, it reviews the sequence of how monetary policy responded to the weak economy during the decade and provides some preliminary analysis of the effects of policy measures adopted. Third, it explains how some of the monetary policy measures adopted were geared to alleviating problems in the financial system and discusses some of the unexpected consequences of such policy measures.

In our survey of Japan's macroeconomic fluctuations, we attempt to show that the deflation of general prices has not been the root cause of the stagnation of the economy, but rather has been just one manifestation of more fundamental problems. The basic driving force of the stagnation seems to have been the need to work off the excesses in capital, labour and debt built up in the late 1980s and early 1990s. Sharp declines in asset prices have added to the need for adjustment by generating various negative financial accelerator effects, including the NPL problem. We will pay more attention to the description of negative financial accelerator effects since they are less well understood aspects of the stagnation.

Next, our analysis of the effects of monetary policy focuses on the attempts to "manage expectations", under the zero interest rate policy (ZIRP) during 1999-2000 and quantitative easing policy (QEP) adopted since March 2001. In these periods, the scope of BOJ policy went further than simply lowering short-term interest rates to zero. We show that such attempts have had some significant

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[1] The views expressed here are those of the authors only and are not those of the Bank of Japan.

[2] The authors gratefully acknowledge helpful comments by Michael Mussa and Marc Olivier Strauss-Kahn on an earlier version of the paper and research assistance by staff members of the Bank of Japan - in particular, Hitoshi Fuchi, Hitoshi Mio, Ichiro Muto, and Yosuke Shigemi.

[3] The average growth rate of OECD economies during the same period was 2.4%. Germany, however, suffering from the aftermath of reunification, registered a growth rate of only 1.3%.

effects on the term structure of interest rates. We also argue that a number of market operations conducted by the BOJ during the periods have been geared, in addition to the conventional purpose of liquidity provision, to alleviating the impaired credit intermediation function of the financial system.

In Section 1, we survey the literature on Japan's macroeconomic problems during the last decade or two. We first discuss some salient features of the recent deflation in Japan, including a short overview of analyses of the causes of the recent deflation of general prices. We then briefly summarise how prices, nominal and real interest rates behaved during the late 1920s and early 1930s in Japan. We also refer to the literature on the causes of the Great Depression, paying particular attention to the so-called debt deflation theory and the role of negative financial accelerators. This discussion provides a benchmark for evaluating Japan's deflation experience since the 1990s. Section 1.2 turns to Japan's deflation itself, and illustrates that the recent deflation experience has not been as serious as the debt deflation experienced in either Japan or the United States during the Great Depression. Currently, there is no evidence of a sharp rise in real interest rates and thus in the real debt burden as a result of the deflation of general prices.

As stated above, it has been the deflation of asset prices, not that of general prices, that has generated serious negative effects on the net worth of borrowers and, over time, on that of lenders. This channel is considered to be a negative financial accelerator, adding to deflationary forces in the economy, which is described in the next section. We then turn to review the literature that emphasises the role of real factors, namely declines in productivity growth, as the main cause of the stagnant economy. Against this view, we point out the possibility that even the declines in productivity growth rates can be understood as a manifestation of the effects of a financial accelerator. Finally, the section conducts an econometric analysis showing the importance of the financial accelerator effects.

In Section 2, we turn to the analysis of monetary policy during the period. We first briefly survey the policy responses to Japan's weak economy since 1998. Then we point out the difficulties the BOJ faced in its combat against deflation. Using a combined macroeconomic model and finance theory approach, we attempt to quantitatively assess the effects of the policy measures on the economy. One particular feature of the analysis is that it explicitly provides an alternative scenario for the policy that would have been adopted in the absence of the ZIRP or QEP. The differences in the behaviour of the economy between the two, ie one with the ZIRP and/or QEP and the alternative scenario, are estimated. Our estimation result shows that the management of market expectations under the ZIRP and QEP has had a significant impact on the term structure of interest rates.

Given the importance of problems in the financial system, the BOJ has naturally tried to address them through its market operations. These aspects of the BOJ's market operations and the consequences are discussed in Section 3. The section argues that the BOJ has successfully contained the liquidity problems of the financial institutions, but has not made much progress in reviving their risk-taking ability. Moreover, the BOJ's measures to this end have caused some unusual phenomena in the money and capital markets. These include a reduced intermediary function of the money market; the emergence of negative interest rates in some corners of the money market; declines in credit spreads, which were already narrow prior to the ZIRP; and a lower-than-expected increase in the issue amount of corporate bonds. Such developments, along with their relation to the financial systems' problems, and their implications for the monetary policy transmission mechanism are discussed in Section 3.3.

Section 4 offers some concluding remarks.

1. Macroeconomics of the "lost decade"

Japan's anaemic annual growth rate of 1% during the period 1991-2002 is something of a puzzle in view of its spectacular growth performance during the previous three decades. A complete analysis of this would be a topic for future research. Below, we provide a brief survey of the data and literature on this period with a particular emphasis on the relationship between the stagnation of the economy and the various facets of deflation.

1.1 Japan's deflation since the 1990s

As a first approximation, prices of final goods and services have been fairly stable in Japan since the early 1990s.[4] Figure 1 shows movements of the CPI and the GDP deflator.[5] The average annual rate of change in the indices is 0.1% and –0.8%, respectively, during the period 1992-2003. The larger decline in the GDP deflator reflects the large secular decline in the investment deflator resulting from technological improvements, as well as its nature as a Paasche-type price index that tends to overstate the contribution of the deflation of goods especially when the quality of the commodity in the basket is improving.[6] The two indices have been falling since the mid- and late 1990s, respectively. Interestingly, deflation stayed at moderate levels, –0.8% to 0.2 % for the CPI and –1.5% to –0.6% for the GDP deflator, even at the bottom of the two most recent recessions, 1998 and 2001. Since early 2003, there has been a tendency for the deflation to ease, at least for the CPI.

Among the components of the CPI, the goods component has been falling faster than that for services. Among services, those sectors that have experienced significant deregulation, such as transportation and communications, have seen larger declines in the rate of inflation. Deregulation in the non-manufacturing sector has certainly been an important background factor for deflation of general prices. A closer look at the goods component of the CPI reveals that goods facing strong competition from imports have suffered larger price declines than the rest, as shown in Figure 2. Such observations lend support to the view that supply side forces have been important.

Turning to demand-side factors, one can immediately point out the potential existence of a large GDP gap as the dominating force behind the deflation of general prices. Most estimates of the GDP gap are very large. For example, assuming a 2% growth rate in trend output and the absence of a gap in the early 1990s, the GDP gap, ie the gap between maximum and actual levels of output, appears to exceed 10% in 2002.[7] This is, however, hard to reconcile with the mild deflation of about 1% and the absence of any apparent tendency for this deflation to accelerate further. One needs to consider the possibility that the gap is much smaller (the growth rate of trend output is much lower), or that the effect of the gap on prices has become increasingly small.

A rule-of-thumb Phillips curve that contains an estimate of the GDP gap term and import prices tracks the inflation performance of the last decade or two well. The response of inflation to the gap, however, is disturbingly small in such a Phillips curve; a 1 percentage point increase in inflation requires 4 to 5 percentage points in real growth above potential.[8]

It seems fair to say that more analyses and, perhaps, more data are necessary to determine the relative contributions of supply-side versus demand-side factors. The seemingly small effect of cyclical factors on inflation remains a puzzle.

In contrast to general prices, the volatility of stock and land prices during the last two decades is worth pointing out. TOPIX went up by almost 400% between 1980 and 1989 and fell by about 70% from its peak to the low in 2003. Similarly, the price index of urban commercial land in six large cities rose by almost 500% between 1980 and 1992 and has declined by 85%.

Asset price volatility has been as high as it was during the Great Depression, but has not been accompanied by volatility in general prices. In fact, this represents a common feature of many industrialised economies with respect to their stock market booms and busts since the mid-1990s. The asymmetry between asset and general prices is surely an important topic for future study.

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[4] Actually, prices were also stable in the 1980s with the exception of the first two years.

[5] In this paper, the CPI and GDP deflators have been adjusted for the effects of the 1997 hike in Japan's consumption tax rate. Specifically, the rate of change in the indices has been adjusted downward by 1.5% for 1997 and by 0.5% for 1998 to compensate for the effects of the tax change.

[6] In Japan, the estimation of the GDP deflator employs the hedonic method to adjust prices for product quality changes, resulting in sharp increases in the quantities of consumption for computers with quality improvements. These goods are weighed using the quantities thus calculated and prices in the base year, currently 1995, which leads to gross overestimates of the contribution of the deflation of such goods. Chain indices that prevent this problem are not published.

[7] This measurement is zero at the maximum level of output and, unlike other gap measures which show zero at the NAIRU, does not display positive numbers even when the inflation rate is positive.

[8] For example, see Hirose and Kamada (2002). Some preliminary evidence suggests that the slope of the curve has flattened further in recent years to about half of the size referred to in the text.

1.2 Has deflation been the major cause of the economic stagnation?

Deflation of general prices, if unanticipated, creates a transfer of purchasing power from debtors to creditors by raising the real interest rate (ex post). Even an anticipated deflation raises the real interest rate, if nominal rates are at the zero bound and cannot be reduced further.

To the extent that debtors have higher propensities to spend out of income than creditors, such transfers reduce aggregate demand, adding to deflationary forces in the economy.[9] In addition, under asymmetric information, banks may reduce lending in response to a decline in the net worth of debtors, setting in motion a negative financial accelerator. The effects of accelerators become more serious if financial institutions' net worth declines sharply due to their exposure to the stock and/or land markets.[10]

Examples of serious debt deflation can be found in the experiences of industrialised countries during the 1920s and 1930s. Figure 3 shows Japan's call rate, the rate of change in the GDP deflator, and the real interest rate (defined as the difference between the two). Deflation exceeded 10% and the real interest rate 15% in the early 1930s. As a result, the debt burden of borrowers rose sharply. For example, net interest payment relative to cash flows rose from about 80% in 1929 to more than 200% in 1930. As is well known, a similar pattern of movement in the variables can be seen in the United States during the 1930s. In addition, as Bernanke (1983) extensively documents, the debt deflation was exacerbated by the decline in the economy's ability to carry out financial intermediation.

Post-1990s Japan is nowhere close to the United States or Japan in the 1930s in terms of the impact of general price deflation on the debt burden of borrowers. Figure 4 plots the real interest rates faced by major borrowers, ie non-financial firms and the government. Real interest rates are calculated as gross interest payments divided by total debt minus the rate of increase in the deflator for domestic demand. It is evident that real interest rates have declined slowly since the mid-1990s. Of course, it would have been better if real interest rates were much lower to stimulate aggregate demand. There is, however, no evidence that deflation has substantially increased real interest rates. Other measurement methods, such as interest payments relative to cash flows, tell the same story. For non-financial firms, this percentage ratio has been falling steadily since the early 1990s. It is now around 12%, a significant fall compared with a level of more than 40% in 1991 and 1992.[11]

1.3 Asset price deflation and associated negative financial accelerators in Japan

Without doubt the sharp fall in asset prices has been the major reason for the recent instability in the Japanese financial system. Less clear is the causality between the financial system's problems and the deflation of general prices. To shed some light on this issue, let us first look at Figure 5, where the relationship between inflation and the degree of seriousness of the NPL problem is shown by industry. The figure clearly reveals that the lower the rate of an industry's inflation, the less serious is the NPL problem for that industry. Although a correct interpretation of the relationship in the figure requires further research, the relationship is evidently at odds with the view that the deflation of output prices has been the main cause of NPLs.

In Figure 6 we show the relationship between land holding as a share of total assets at the peak of the bubble period and NPLs as of March 2000 by industry. Assuming that the real estate industry observation does indeed contain significant information in this regard, there is a positive relationship between the two variables. That is, the larger the land holding, the more serious the NPL problem, providing evidence of causation running from asset price deflation to NPLs.[12]

Turning to the effects of NPLs on the real side of the economy, Nagahata and Sekine (2002) conduct an analysis of the determinants of business fixed investment using a firm level time-series cross

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[9] See Fisher (1933) and King (1994).

[10] For example, see Bernanke (1983) and Bernanke and Gertler (1990).

[11] Of course, deflation decreases this variable by lowering nominal interest payments faster than cash flows. This effect is offset by a rise in the real value of the principal. In order to see the net impact one needs to look at the real interest rate, which is what we have in Figure 4.

[12] See Ueda (2000) for a more careful analysis of this point along with a discussion of other causes of the NPL problem.

section data set. Along with other determinants, their analysis examines the importance of the net worth of both borrowers and their main banks. They find that declines in the net worth of borrowers have had significant negative effects on investment. They also find that lenders' net worth has exerted significant negative effects on the investment of firms without access to the bond market. Declines in net worth can be explained mostly by declines in asset prices and by NPLs (in the case of banks). Moreover, most of the declines in bank lending since the mid 1990s can be attributed to these two factors, together with the liquidity problems of banks during 1997-98. Thus, a negative financial accelerator has clearly been working.[13]

The negative effects of financial instability spread throughout the economy during the credit crunch in 1997-98. The Asian economic crisis, a premature tightening of fiscal policy in 1997, and the Russian crisis in 1998 were the triggers for the crunch. Several financial institutions went under. Risk premiums and the demand for liquidity rose sharply across the financial system. Japanese banks, already suffering from NPLs, found themselves having difficulty in raising funds. Naturally, they started calling in their loans to non-financial firms. Even large companies were feeling the pressure of the credit crunch. Subsequently, the companies had to cut back on their investment. In retrospect, the failure to resolve the NPL problem at an early stage resulted in the credit crunch and became one of the key reasons for the ongoing stagnation of the economy.

1.4 A real business cycle theory view

A different approach to analyzing Japan's lost decade emphasises real factors. For example, Hayashi and Prescott (2002) observe that declines in total factor productivity (TFP) growth coupled with the reduction in the workweek can roughly explain the stagnation of the economy. They also argue that the NPL problem was not the major factor of this stagnation, apart from 1997-98.

Kawamoto (2004) looks more closely at the reasons for this decline in TFP growth. He decomposes the standard Solow residuals into "true" aggregate technical changes and the terms representing the effects of increasing returns, imperfect competition, cyclical fluctuations in utilisation of capital and labour, as well as resource reallocation among different sectors of the economy. He finds little evidence of a decline in the pace of technical change in the 1990s. Rather, most of the declines in measured productivity growth rates are attributed to inefficient use of inputs: a cyclical decline in input utilisation rates and the failure to reallocate resources to more efficient sectors of the economy. His results are consistent with the view that problems in the financial system hindered an efficient reallocation of resources: banks were not extending loans to new efficient projects while continuing to finance many virtually non-viable companies. Nakakuki et al (2004) also decompose changes in TFP growth into various sources including factor-market distortions. They find that factor-market distortions explain about one third of the decline in TFP growth in the 1990s, compared to that of the bubble period.

The analysis of the above papers suggests a mechanism by which the problems in the financial system have adversely affected the economy. This interpretation is perfectly consistent with the evidence, discussed above, that the NPL problem has had negative effects on business fixed investment.

This literature also has some interesting policy implications. If the productivity decline is mainly due to "true" declines in TFP growth, there would be little room for macroeconomic policy to reverse these developments. Even if declines in TFP growth are due to factor market distortions, the correct policy response is to address these distortions directly, for example, by measures to alleviate the NPL problem. In either case, asset prices will go down to match the decline in the rate of profit, followed by a prolonged period of low investment and declining capital stock. This, along with the excesses built up during the bubble period, seems to be one of the reasons for the prolonged nature of the stagnation of post 1990s Japan.

[13] One could say that a similar mechanism was working during the Great Depression, which was only aggravated by the deflation of general prices.

1.5 An econometric analysis of Japan's macroeconomic fluctuations since the early 1990s

The foregoing informal discussion suggests, in one way or another, the importance of the negative effect of a financial accelerator in explaining Japan's macroeconomic problems during the last decade or two. This section offers a more formal statistical analysis in an attempt to gauge the importance of such a mechanism.

As a preliminary check, we ran vector auto regressions (VARs) similar to those employed by Leeper et al (1996). We first estimated simple systems consisting of a price index, real GDP, a short-term interest rate and the money supply. The results are similar to those estimated for the United States. We then proceed to include a variable that represents a financial accelerator effect.

Figure 7 shows impulse response functions for a four-variable model, ie the CPI, real GDP, the collateralised overnight call rate and M1. All variables except for the interest rate are seasonally adjusted and used in logarithmic forms. Identification of the system is based on the assumption of a recursive ordering as in Leeper et al (1996). The assumed ordering of the variables is as described above. The model is estimated over the period 1971/Q1-1999/Q1.[14] A more detailed explanation of the data and estimation method are found in the notes to Figure 7.

The impulse response functions are quite similar to those estimated for the United States. For example, the so-called liquidity and price puzzles are observed. Specifically, the interest rate R does not fall clearly in response to an M shock; the CPI rises for an extended period in response to an R shock. Also in the figure, the CPI responds positively to a Y shock, while Y responds negatively to a CPI shock. This appears to suggest the significance of supply shocks.

Figure 8[15] shows impulse response functions for the system that adds a leverage ratio variable EVR, the ratio of the market value of equity to the value of the firm. We assume that this variable represents the effect of a financial accelerator, which reflects financial market imperfections. This is a key variable in the financial accelerator mechanism, as in the one used in Bernanke et al (1999). Figure 9 shows changes in actual EVR and estimated EVR shocks, where the latter closely follows stock prices. In Figure 8, we find that real GDP responds significantly to an EVR shock. The CPI also responds positively to the EVR shock after about seven quarters. Also, EVR impulse responses indicate that the shocks other than the shock to EVR itself do not have significant effects on EVR. The figure assumes that EVR comes first in the ordering, but it turned out that the ordering of EVR did not matter much for the results.

Figure 10 presents variance decomposition results for the same system. Although EVR shocks explain about 20% of real GDP fluctuations in point estimates, they contribute little to the CPI. The CPI variance is mostly explained by shocks to itself and real GDP shocks.

These results suggest that the stagnation of the economy may have been partially due to accelerator mechanisms that resulted from a fall in stock prices. But the deflation of general prices hardly seems to be related to asset price changes.

We next present an estimation result of financial accelerator effects based on a more structural model. The model is close to the one in Bernanke et al (1999). It incorporates credit market imperfections and is designed to examine the role of the financial accelerator mechanism in the propagation of macroeconomic shocks. Households determine their consumption paths by solving the conventional intertemporal optimisation problem (equation (2) of Appendix 1). Investment determination follows the conventional q-theory (equation (5)). Credit market imperfection is modeled as EVR affecting the cost of capital (equation (7)). Equation (8) describes the evolution of EVR, where capital market imperfections are assumed to make sudden large changes in EVR costly, thus forcing it to move slowly mainly in response to cash flows. The details of the model are provided in Appendix 1. The model has been estimated by the generalised method of moments (GMM) over the 1981/Q1-2003/Q1 period.

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[14] The estimation period ends in 1999/Q1 because the "non-conventional" policy measures adopted after that may have changed the relationship between the variables.

[15] Estimated results are robust to changes in the definition of monetary aggregates, for example, to base money or M2+CDs.

Based on the estimated coefficients, we conduct a simulation that gauges the impact of the financial accelerator. For this purpose we regard the error term of equation (8) as a shock to the balance sheet of the representative firm and estimate the contribution of the term to macroeconomic fluctuations. This procedure requires an explanation. It turns out that the major driver of the error term of equation (8) is the movement of stock prices. Stock price changes, however, seem to be already included, through equation (3), in the return to capital term of the right-hand side of equation (8). But in the estimation and simulations of the model, we assume that equation (5) holds exactly and therefore the capital gain terms on the right-hand side of equation (3) are determined by movements in the investment to capital ratio. Thus, stock price movements that are not correlated with the current investment to capital ratio, but affect the EVR variable are reflected in the error term of equation (8). The simulation considers such stock price movements exogenous and calculates their effects, through the EVR variable, on other variables in the system. Despite the rather strong assumptions, the procedure seems to be effective to identify the magnitude of financial accelerator effects caused by asset price changes.

Figure 11 shows the response of major variables to a negative 1% permanent shock to equation (8). The effects are largely plausible. Fixed investment declines sharply, generating prolonged declines in GDP and the CPI. This is partially offset by the response of monetary policy and its effect on consumption. Figure 12 presents the estimated shocks to equation (8). The figure also shows the EVR shock derived in the VAR analysis presented above. The two estimated error series are almost identical, suggesting that the exogeneity assumption is acceptable. It also shows that large EVR shocks are observed in the bubble years of the late 1980s, the post-bubble years and the years of financial instability during the late 1990s.

Figure 13 then shows the effects of the estimated EVR shocks on major macroeconomic variables. The effects are considerable. The EVR shocks seemed to have raised GDP and the CPI through their effects on business fixed investment in the late 1980s, while they have worked in the opposite direction since the early 1990s. Without the shocks, fixed investment would have been higher by some 30% in early 2003, GDP by 5% and CPI inflation by about 2 percentage points, implying that deflation would have been over by now by a considerable margin.[16]

Although our analysis is not capable of fully decomposing Japan's macroeconomic fluctuations into various sources, the discussion in this section suggests the importance of asset price declines and associated financial accelerator effect. The literature is divided concerning the causes of asset price declines. Some attributed them to the bursting of the bubble formed in the late 1980s, and others saw them as a natural response to underlying declines in the rate of productivity growth. But as we argued in Section 1.4, even the declines in the productivity growth rate could have been partly due to the negative financial accelerator effects.[17]

It is perhaps fair to say, however, that there remains a significant portion of EVR shocks in the above analysis ascribable to slowdowns in growth expectations that are unrelated to financial sector events. These revisions in expectations must have generated significant adjustment pressure irrespective of financial sector problems. Thus, optimistic growth expectations during the bubble period led many firms to build up large production capacities financed by borrowing from banks. Firms also invested huge sums of money in land for speculation and for securing collateral for future borrowing. They also added substantially to their employment pool as they felt a period of labour shortage was in the offing. As firms revised economic growth expectations downward, they had to reverse these activities. The adjustment of real variable such as capital stock, employment and land has taken a painfully lengthy time. Financial sector problems have added to the pain of adjustment. A precise estimation of the contribution of the latter is left as a future task.

The period since the mid to late 1990s has seen the mild deflation of general prices. The negative macroeconomic effects of price declines have also been moderate in the period. Monetary policy,

[16] Ideally, the estimated effects would have to be compared with those of other types of shocks. But the forward-looking and highly non-linear nature of the model has made this task next to impossible. Equation (8) happens to be of the backward-looking form, making the simulation possible.

[17] The statistical analysis in Section 1.5 does not take into account such a possibility because it uses data de-trended by observed productivity changes (See Appendix 1). Hence, it does not capture the possible co-variation of stock prices and productivity changes.

however, has had a tough time stopping this mild deflation. We will now discuss this aspect of Japan's experience in the next section.

2. Policies to deal with the problems

The prescription for 1930s-type debt deflation has been proposed by, among others, Bernanke and Gertler (1990). The financial accelerator problem may be dealt with by transferring income to debtors with promising projects, at least to the extent that such projects exist and borrowers are identifiable. A similar kind of transfer could be applied to banks. Macroeconomic policy can take care of general price deflation.

Meanwhile, the case of Japan since the 1990s has been more complicated. As we have pointed out, the deflation of general prices has not been the major cause of the economic stagnation. Instead, excesses generated during the bubble period, asset price deflation and the cumulative effect of the interaction with the financial system and the economy have been at the centre of the problem. If the condition of the economy worsened beyond a certain extent, measures to bolster asset prices may be justified. It would, however, be difficult to determine whether the economy had reached such a stage.

The role of macroeconomic policy is also not straightforward in this situation. Stopping the deflation of prices for goods and services will surely mitigate the pain of economic adjustment we have just described, but it does not necessarily imply that the economy can dispense with the required adjustment itself. The ratio between asset and general prices has had to be adjusted.[18] Moreover, as we explain below in the case of monetary policy, the problems in the financial system have lowered the effectiveness of macroeconomic policies in stimulating the economy.

Let us now focus on monetary policy. Figure 14 shows the difficulty the BOJ has been facing in combating deflation. The ratio of nominal GDP to base money shown in the figure presents a sharp downward deviation from its trend prior to around 1995. Conversely, the ratio of base money to GDP has roughly doubled since then. Yet deflation has persisted, albeit at moderate rates. This is a clear case of monetarism failing to explain the relationship between money and inflation. Possible reasons for this are also illustrated in the same figure. The rate of growth of bank loans has been either around zero or negative since 1995, in line with the problems of the financial sector.[19] As we mentioned above, this has reduced the ability of low interest rates to stimulate the economy. Moreover, as the figure makes clear, short-term interest rates have hit the zero boundary during this period, depriving the BOJ of additional leeway for using standard monetary policy instruments.[20] As a result, the BOJ has adopted several unconventional monetary policy measures. These include the efforts to generate monetary policy easing effects beyond those from a zero short-term interest rate and to supplant the impaired ability of the financial system to carry out credit intermediation. In the remainder of this section, we focus on the monetary policy aspect of the measures the BOJ has adopted recently and present some quantitative estimates of their effects. The next section describes interaction between monetary policy and financial-sector problems.

2.1 The BOJ's monetary policy during 1998-2004: a brief summary of the policy measures adopted

The major monetary policy actions by the BOJ during the last five to six years are summarised below. In response to the onset of deflation and the deterioration of the financial system, the overnight call rate was first lowered from around 0.43% to 0.25% in September 1998. Then, it was lowered to near 0% in March 1999. In April 1999, the BOJ promised to maintain a zero interest rate "until deflationary

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[18] The ratio of asset prices to the GDP deflator has declined sharply since the peak around 1990 and is now back where it was around 1983 for both stock and land prices. Thus, a fair amount of adjustment has already taken place. As pointed out above, however, it is difficult to determine whether the process is over, incomplete or has gone too far.

[19] Correspondingly, the money supply has grown at much lower rates than base money. That is, the money multiplier has declined sharply.

[20] See Shirakawa (2001), Ueda (2001, 2002) for more detailed accounts of monetary policy during the period.

concerns are dispelled" - the so-called zero interest rate policy (ZIRP). The economy then recovered and grew at 3.3% between 1999/Q3-2000/Q3. Consequently, the ZIRP was abandoned in August 2000. The economy, however, went into a serious recession again led by worldwide declines in the demand for high-tech goods.

The BOJ announced the introduction of quantitative easing policy (QEP) in March 2001. This QEP has consisted of maintaining an ample liquidity supply by using the current account balances (CABs) at the BOJ as the operating policy target[21] and the commitment to maintain ample liquidity provision until the rate of change in the core CPI becomes positive on a sustained basis. The BOJ also announced that it was ready to increase the amount of purchases of long-term government bonds in order to meet the target on the CABs. The commitment regarding future liquidity provision was further clarified in October 2003 with the BOJ committing itself to continue providing ample liquidity until both actual and expected inflation became positive.[22] The target on the CABs has been raised several times, reaching ¥ 30-35 trillion in January 2004, compared to the required reserves of approximately ¥ 6 trillion.[23] In order to meet such targets the BOJ has conducted various purchasing operations such as bills and commercial papers (CPs) in addition to treasury bills (TBs) and government bonds.[24] Since 2003, the BOJ has also started buying asset-backed commercial papers (ABCPs) and asset-backed securities (ABSs).

The three building blocks of the QEP, ensuring ample liquidity provision, commitment to continue such liquidity provision, and the use of various types of market operations, especially purchasing of long-term government bonds, roughly correspond to the three mechanisms pointed out by Bernanke and Reinhart (2004) that can be effective to generate easing effects even at very low interest rates.[25] The correspondence is not an exact one. For example, the BOJ's policy to increase the CAB target may have had an announcement effect of making the liquidity-providing commitment more credible. The BOJ's long-term government bond purchasing operations have functioned as a major tool to meet the target on the CABs. The possibility remains, however, that changes in the composition of the BOJ's balance sheet caused by its market operations have had some effects on the term structure of interest rates. Another difference is that, while Bernanke and Reinhart emphasise a fiscal aspect of the central bank's balance-sheet expansion, ie seigniorage revenue for the government, the BOJ has not taken such an aspect into account.

It should be noted that any one of the three building blocks is not a prerequisite for the others. For example, the liquidity-providing commitment is essentially a commitment to maintain a zero short rate. In this sense, the commitment can be carried out without significantly expanding CABs beyond required reserves. Likewise, purchases of long-term government bonds can be conducted as twist operations without expanding CABs. The large increases in the CABs, however, may not have been possible without increasing the purchases of long-term government bonds.

Put differently, the QEP has consisted of a ZIRP, expansion of the CABs above levels necessary to maintain short-term interest rates at zero (ECAB) and use of purchasing operations of long-term government bonds and other securities in order to meet the CAB target. We will refer to the first component, ie the commitment to maintain high enough liquidity provision to keep the short-term

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[21] Before the adoption of the QEP, the operating target was the uncollateralised overnight call rate.

[22] It was also decided that the dual conditions of both actual and expected inflation turning positive were necessary, but not sufficient, for the termination of the QEP. That is to say, depending on developments in the economy, QEP could be maintained even if the dual condition were met.

[23] The policy directive contains a clause allowing the operations desk to increase liquidity provision beyond the level decided by the policy board should there be a risk of financial market instability and an accompanying surge in liquidity demand. This clause has been applied several times toward the end of fiscal accounting years, immediately after the September 11 terrorist attacks in 2001, and on the occasion of computer system problems at financial institutions.

[24] Funds-providing operations in bank bills and CPs are essentially the BOJ lending to financial institutions with government securities, CPs, and other eligible securities as collateral. For example, CP operations are carried out in a repo manner and thus are not outright purchases by the BOJ. In contrast, in the operations in ABCP and ABS that began in 2003, the BOJ has bought these assets outright.

[25] They called the three mechanisms shaping interest rate expectations, altering the composition of the central bank's balance sheets, and expanding the central bank's balance sheets.

interest rates at zero until the inflation rate turns positive, as the revised version of zero interest rate policy (RZIRP).[26]

Let us now take a closer look at the market operations and the behaviour of interest rates under the QEP framework. The CAB target was set at ¥ 5 trillion in March 2001. Right before the adoption of the QEP, the level of CABs was around ¥ 4 trillion, nearly equal to the required reserves at the time. As of May 2004, the CABs have grown eightfold, with an average annual growth rate of 92%. Figure 15 shows the evolution of the target and actual CABs and required (or excess) reserves. Of the ¥ 27.5 trillion increase in the CABs between the end of February 2001 and April 2004, market operations provided ¥ 27.7 trillion, while autonomous factors such as issue/withdrawal of currency and government deposits subtracted ¥ 0.2 trillion. Among the market operations, purchases of long-term government bonds were ¥ 37.8 trillion.[27] The Ministry of Finance's (MOF) interventions in the foreign exchange market are funded by the issuance of financing bills (FBs) and thus are neutral to the level of the CABs.[28] As a result of aggressive ECAB, the monetary base has grown by 67% during the same period. Currency volume held by the public has also grown substantially as a result of the decline in interest rates. Financial system instability has also stimulated currency holdings by the public.[29]

During the ZIRP period, the overnight call rate declined to at most 0.01%, while in the QEP period, the rate further declined to 0.001%. In both periods, differences in interest rates for individual financial institutions have also come down to minimal levels, at least at the short-term end of the money market (Figure 16).

2.2 Analysis of the effectiveness of monetary policy

At the core of the policy measures common to both the ZIRP and QEP is the commitment to maintain a zero short-term interest rate until, roughly speaking, the inflation rate becomes positive.[30] This enables a stronger monetary easing effect than a zero interest rate alone. A similar notion has appeared in economic literature for some time. Perhaps Krugman (1998) was the first to note the effectiveness of the approach. He argued that a permanent increase in the money supply has the potential to raise inflation expectations and current expenditures. In a liquidity trap, a temporary increase in money supply is not effective because of its incapability to lower interest rates. But if there is a possibility that an increase in the future natural interest rate would be high enough to move the economy out of the liquidity trap, the expected increase in money supply does affect the expected future price level today. Needless to say, a commitment to maintain low interest rates until the natural interest rate rises generates a similar effect. In a similar vein, using a New Keynesian type model, Eggertson and Woodford (2003) presented a version of price level targeting that could be considered an optimal policy in face of a liquidity trap. In their case, the optimal policy is the commitment to maintain a zero rate until the price level is restored to a pre-committed path.

While there exist differences between the policies these authors propose and those adopted by the BOJ, the basic ideas are the same. Even at a zero short-term interest rate, it is possible to pursue further monetary easing that affects expected future short-term interest rates and thus current

[26] Some authors have suggested that the BOJ buy long-term government bonds more aggressively. It is important to note the difference between such policy on its own and when it is used together with the RZIRP. In both cases the purchases can be used as a measure to increase liquidity. But the effects on long-term interest rates are different. When bond purchases are used in isolation, they may affect both expected short-term interest rates and risk premiums. When they are used in combination with the RZIRP, they would mainly affect the risk premiums, given the strong effects of the RZIRP on expected short-term interest rates. The statistical analysis to follow will check these predictions. See Bank of Japan (2003, 2004) for more details on money market operations.

[27] The amount of monthly purchases of long-term government bonds is set and pre-announced by the BOJ. It was ¥ 0.4 trillion per month in March 2001 and has been gradually increased to ¥ 1.2 trillion by May 2004.

[28] It is possible for the MOF to sell the bills to the BOJ, in which case interventions, other things being equal, affect the CABs. There is, however, an MOF-BOJ agreement that the MOF issues bills in the market as soon as possible and retires the debt held by the BOJ, at which point this effect disappears.

[29] The growth rate of currency outstanding has slowed since the second half of 2003, reflecting improvements in the soundness of the banking system. It may decline further in future in the event that interest rates start to rise significantly.

[30] Even under the QEP, liquidity provision well above required reserves has meant a near-zero short-term interest rate. That is, QEP has included the RZIRP, as pointed out above.

long-term interest rates through a commitment to appropriate future monetary policy paths. In fact, since the adoption of the ZIRP in 1999, both the level and volatility of long-term interest rates have remained at very low levels, as Figure 16 shows. As discussed in Section 1.2 above, low nominal interest rates have been one of the reasons for the contained deflation within certain levels during this period.

Whether the ZIRP and/or RZIRP have affected expected future short-term interest rates, however, is a more subtle question than it initially appears to be. Even without any commitment by the central bank, the market normally forms expectations about future monetary policy stances, ie the path of short-term interest rates. An expectation of continuing stagnation in the economy naturally leads to lower expected future short-term interest rates. Thus, it is important to show that the ZIRP and/or RZIRP have affected the market's expectations over and above such a natural response of the market to the economy. Below we present one provisional analysis of this issue, building on Oda and Kobayashi (2003). As a by-product, the analysis allows us to test for the existence of the effects of the other two aspects of the QEP framework besides the RZIRP, ie ECAB and purchases of long-term government bonds.

We use a macro finance model that combines a small macroeconomic model with a finance theory approach to determine risk premiums on long-term government bonds. More specifically, the model consists of aggregate demand and supply equations and a monetary policy rule. The policy rule determines the short-term interest rate, while aggregate demand is dependent on the long-term interest rate.[31] Aggregate demand and supply curves contain error terms that represent demand and supply shocks to the economy. These shocks generate uncertainties concerning future short-term interest rate movements through the policy rule. The size of the resulting risk premiums on government bonds is a function of the parameters of the model. These are estimated so that the term structure of interest rates thus theoretically derived matches the data.

The default monetary policy rule is set as an augmented Taylor rule that incorporates slow policy adjustment and the zero bound constraint on interest rates (equations (3) and (4) in Appendix 2). That is, the short-term interest rate is explicitly assumed to be non-negative. The BOJ's commitment to maintain the short-term interest rate at 0% until consumer price inflation becomes positive (the ZIRP or RZIRP) is modelled as maintenance of a zero interest rate until the inflation rate exceeds a small positive number (henceforth, the threshold rate). We assume that the threshold rate is variable over time and allow the data to determine its time path.[32]

Such a formulation of the policy rule allows us to estimate the effects of the ZIRP and/or RZIRP on interest rates.[33] We can also estimate the policies' effects on the expectations theory and the risk premium components separately.[34] This enables us to evaluate subtle questions about this period's monetary policy. As discussed above, the QEP framework consists of three components. We may therefore attempt to estimate the effects on the economy of each of the three components separately.

We first estimate the model by the maximum likelihood method using data of 1980/Q1-1999/Q1. The choice of the estimation period reflects the adoption of the ZIRP in 1999/Q2. In the simulations reported below, we assume that the parameters of the model remained the same after 1999/Q2.[35] The details of the model and estimation procedure are explained in Appendix 2.

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[31] Actually, it is a weighted average of past short-term interest rates.

[32] An alternative would be to assume that the threshold rate is fixed. This is probably closer to what the BOJ has been saying. Given that the ZIRP was the first implementation of such a policy framework, however, the market's perception about the precise nature of the framework seems to have evolved over time. Under the RZIRP, the nature of the commitment has become more concrete. The commitment to maintain an ample liquidity supply until inflation becomes positive on a sustained basis must mean that the threshold rate is positive rather than strictly zero. The October 2003 change in the commitment, to include a reference to expected inflation, may have raised the threshold rate, although explicit formulation of the policy framework since then requires slightly different modeling. Needless to say, what is estimated as a change in the threshold rate may reflect a change in other parameters of the model that are treated as fixed in this analysis.

[33] The assumption of the Taylor rule as the default policy rule may be too strong, given that the BOJ had not announced the use of any explicit policy rule before the adoption of the ZIRP. Nonetheless, there seems to be no reasonable alternative.

[34] By the former we mean the component of long-term rates that corresponds to the expectations theory of term structure, ie the weighted average of expected future short-term interest rates.

[35] Thus, the monetary policy rule is set to be the modified Taylor rule during the estimation period. An alternative procedure would be to use the entire sample in the estimation, but with the policy rule switched to the commitment rule used as the

We then proceed to the estimation of the effects of the ZIRP and RZIRP. Since we need to estimate the effects of the policies on expected future short rates, we need estimates of the breakdown of long-term interest rates into the expected future short-term interest rate and the risk premium components. Given the market prices of risk associated with demand and supply shocks to the goods market and the value of the threshold rate, we can calculate the distribution of long-term interest rates using Monte Carlo simulations.[36] The resulting theoretical term structure of interest rates is matched with the actual value to derive estimates of the market prices of risk and the threshold rate for the ZIRP or RZIRP is in place.

Figure 17 presents such an estimate of the time path of the threshold rate. Figure 18 shows the estimated expectations theory and risk premium components of medium- to long-term interest rates. Figures 19 and 20 compare the estimated levels of interest rates with and without the zero interest rate commitment. The two figures present the results for the expectations theory and risk premium components separately.

Let us first look at Figures 19 and 20. We find evidence of the effects of the ZIRP and RZIRP on expected future short-term interest rates in Figure 19. The estimated expectations component of the interest rates at all maturities declined in the commitment policy case. The differences between the two cases increased from 2002/Q3. In 2003, expected future short-term interest rates without the zero interest rate commitment went up sharply, probably in response to improving economic conditions. But the commitment seemed to have contained the increases to a large extent. In general, the ZIRP and RZIRP imply a promise to maintain a zero interest rate even after the interest rate under the modified Taylor rule rate turns positive. Thus, the difference in expected three-year interest rates, say, between the modified Taylor rule and ZIRP or RZIRP is small if the interest rate under the Taylor rule is expected to remain negative for three years or more. The difference becomes larger as investors start to consider the possibility that the interest rate under the Taylor rule would turn positive within three years. If the commitment is credible enough to produce a temporary period of higher inflation rates in the future, the difference in rates on the 10-year horizon could be less than on the three-year horizon. This may have been the situation in 2003, as can be seen in the Figure 19.

Figure 20 shows that the effects of the commitment on the risk premium component of interest rates have been limited with the exception of the period after 2003/Q2 for the three-year interest rate. The effects are almost nil for the 10-year interest rate. This seems reasonable if the expected duration of a zero interest rate is relatively short. The commitment reduces uncertainties about the duration of a zero interest rate, hence it affects the risk premiums on bonds of relatively short maturities. Sharp reductions in the risk premiums are observed during 2002/Q3-2003/Q1, either with or without the commitment. This may have been due to the stabilisation of the inflation rate at low levels in late 2002 and 2003. The sudden emergence of the difference between the two cases in 2003/Q2, however, needs other explanations.

The estimate of the threshold rate in Figure 17 exhibits some interesting features. During the ZIRP period the value of the threshold rate decreased over time until the policy was terminated in 2000/Q3. This is consistent with comments made by some BOJ board members in the first half of 2000 about the desirability of discontinuing the ZIRP in the near future. During the QEP period, the estimate of the threshold rate jumps sharply upward in 2002/Q3 and continues to increase until 2003/Q2. As we saw above in the discussion of Figure 19, this was a period of gradual economic recovery and expected future short-term interest rates would have gone up without RZIRP. In reality, however, the rises in medium- to long-term interest rates were largely contained and interest rates continued to fall until the spring of 2003. Hence, the simulation results in higher values of the threshold rate. There is more than one interpretation of this increase in the threshold rate. While no explicit statements were made during this period to enhance the effectiveness of the commitment, the BOJ had been increasing the target on bank reserves, which might have had some signalling effects. An alternative interpretation is that the market's perception of the economy's outlook may have been weaker than assumed in the

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policy rule for 1999/Q2-2000/Q2 and 2001/Q2-present. This would require a fairly complicated estimation method. Hence, we have opted for the simpler approach.

[36] This is done by calculating the risk-neutral measure of supply-demand shocks and associated levels of GDP, inflation and interest rates.

simulation[37]. This may have resulted in higher estimates of the threshold rate than the market really had anticipated.

However, it is not easy to explain the reasons why the estimate of the threshold rate stays around 1% in the second half of 2003. Casual observations suggest that the market became suspicious of the BOJ's intention to continue the RZIRP and pushed up long-term interest rates in the summer of that year. Alternatively, it could be interpreted that even the seemingly sharp rise in interest rates at the time may have been mild relative to improvements in market expectations and thus could be consistent with a higher threshold rate. In addition, the BOJ counteracted by clarifying the commitment in October as described above. These forces may have cancelled each other out, resulting in minor movement in the threshold rate. Still, the estimate of the threshold rate at around 1% seems disproportionately high in light of the current commitment and needs an explanation.

In any case, it is at least clear that the ZIRP and RZIRP have produced stronger effects on the expectations theory component of interest rates than the effects expected from the combination of the modified Taylor rule and stagnant economic conditions. The effects of the commitment on the risk premium component are much smaller, although our estimates suggest three- to five-year interest rates were affected to some extent.

The next question is a somewhat delicate one regarding the QEP period. As we summarised above, the BOJ has been raising the target on the CABs and increasing purchases of government bonds on top of its commitment to continue ample liquidity provision. Therefore, an additional test is needed to clarify whether these measures have had their own effects on either of the two components of interest rates apart from the effect induced by the commitment. .

Specifically, Figure 19 shows regression results whereby we run the difference between the two estimates of the expectations theory component of interest rates on the level of the CABs at the BOJ and the amount of government bonds purchased. We also show the results with the risk premium component as the dependent variable in Figure 20.[38] The results are presented in Appendix 2. To summarise briefly, the only variable that was statistically significant was the level of the CABs in the equation for the expectations theory component of interest rates. The interpretation of this result is not straightforward. One interpretation would be that increases in the target on the CABs provided a signalling effect of the willingness of the BOJ to make a stronger commitment to a zero interest rate. Another interpretation is that other communication channels, such as the governor's comments at press conferences that came out at the same time as the announcement of the changes in the target, have been the driver of the effects found. Or it could be that indicators suggesting economic weakness may have led the market to raise the threshold rate, on the one hand, and the BOJ to increase the target on the CABs. Unless the first interpretation is correct, the correlation we have found could be a spurious one.

We may tentatively conclude that the BOJ's monetary policy has worked mainly through the commitment channel since 1999. The commitments made by the BOJ have affected expected future short rates and, in turn, current medium- to long-term rates on government bonds.[39] The direct effects of liquidity expansion or purchases of long-term government bonds on the risk premiums on government bonds have not been found to be significant. There is some evidence that raising the target on the CABs has enhanced the effects of the commitment, although this interpretation is subject to various qualifications.

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[37] We may note that this was a period when deflation or disinflation was a worldwide threat.

[38] Ideally, we need to model the mechanism by which these measures affect the economy more explicitly and test for the existence of their effects jointly with the commitment effects.

[39] In principle, the model can be used to calculate the effects of the commitment channel on real GDP and inflation. However, as currently formulated, the IS equation contains the lagged values of short-term interest rates and not expected future short-term interest rates or the current long-term interest rate. Hence, the model does not allow us to capture the effects of forward-looking investor expectations on the real side of the economy. In this sense the model is not fully general equilibrium in nature. So far, we have not succeeded in improving the model on this point.

3. Monetary policy, the money market and the financial system

3.1 Overview

Given the nature of the difficulties of the period under discussion, the BOJ has naturally tried to alleviate financial-sector problems through its monetary policy. Below, we discuss these aspects of the policy measures adopted by the BOJ. Many of the BOJ's market operations during this period have had the dual role of providing liquidity and addressing problems in financial intermediation. In the process the BOJ has taken a certain extent of credit risk. Such attempts indeed have succeeded in avoiding a repetition of the 1998-type credit crunch. Actually, risk premiums in the money and corporate bond markets have declined to minimum levels. Such declines in risk premiums, however, have not led to increased risk-taking elsewhere, ie to increased bank lending to those borrowers who have not had access to the open money and capital markets.[40] Thus, the liquidity provided by the BOJ has not flowed into the most damaged part of the financial system. Instead, funds that have shifted outside the Japanese money market have been invested in relatively safe instruments such as Japanese government bonds (JGBs) and US treasury bonds, with the currency position hedged in the latter case. The shortage of funds in the money market has had to be filled by more and longer funds-supplying operations by the BOJ. The chain of events reveals a feature of the QEP that was not foreseen at the time of its introduction. The QEP, which was partially directed toward alleviation of financial institutions' liquidity problems, has led to a decreased intermediation function by private banks in the money market and created a strong reliance on the BOJ's market operation. This increase in the demand for the BOJ's funds-providing operations has made it easier for the BOJ to hit higher targets on the CABs. To the extent that the liquidity provided is absorbed by the increased demand, it has not had significant monetary easing effects.

In Section 3.2 below, we briefly discuss measures adopted by the BOJ to address problems in the financial system. In Section 3.3, we turn to the discussion of some of the unexpected effects of such measures.

3.2 Prudential policy aspects of the BOJ's market operations

Many of the BOJ's recent market operations have aimed at soft spots in the channels of financial intermediation. Thus, since the credit crunch of 1998, the BOJ has extensively used CP operations as its funds-providing operation. Financial institutions holding CPs have been able to use them as collateral to obtain funds from the BOJ. This has added to the liquidity of the CP market and, in turn, led to declines in issuing costs. In addition, the BOJ has started to accept ABSs as collateral since October 1999.

In the spring of 2003, the BOJ went further with its decision to purchase ABCPs and ABSs outright. This reflected the BOJ's perception that the markets for these instruments were still in their infancy and that their development could be stimulated by the BOJ's risk-taking. The development of the market would allow participation by a wider range of investors and ultimately result in declines in fund-raising costs for borrowers and, at the same time, in easier unloading of loans by financial institutions.[41]

In some instances, the BOJ provided explicit incentives for banks to extend loans. For example, in the fall of 1998 the BOJ introduced a scheme whereby banks who increased their lending were eligible to receive back-financing from the BOJ at the official discount rate. For many banks the discount rate was lower than the rate they paid in the market.[42]

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[40] The negative effects of financial sector problems on these borrowers were discussed in Section 1.3.

[41] In retrospect, the introduction of these operations coincided with turnarounds in the stock market and the economy. Thus, banks have felt less need to sell loans they hold. As a result, the amount of instruments the BOJ has bought has remained small.

[42] The discount rate at 0.5% was slightly higher than the overnight call rate, which was between 0.4-0.5%. For many financial institutions, however, three- to six-month funding costs were higher than 0.5%, due to term and credit premiums. This scheme was not extensively used because the ZIRP introduced early in the following year had lowered most banks' funding costs to minimum levels.

More generally, the BOJ has since late 1998 expanded the supply of liquidity whenever there were any serious signs of financial market instability. The BOJ has tried to counteract this pressure by providing longer-term funds to banks.[43] During the QEP period, such operations have been associated with either a rise in the target on the CABs or activation of the contingency clause in the policy directive (see footnote 21). In addition, in some of its operations, the BOJ has been taking, to varying degrees, the credit risk of counterparties or of issuers of instruments traded, as explained above. This has been successful in containing the emergence of large risk premiums in the money market.[44] The BOJ was successful at least in preventing the repetition of the 1997-98 type credit crunch. At the same time, the distinction between monetary and prudential policies has become less pronounced.

Separately, the BOJ has established a standby facility that, since December 2002, allows banks to sell equities they hold to the BOJ. This was also one of the measures to target a soft spot in the financial system, ie banks' vulnerability to declines in stock prices.[45] Although banks could sell stocks in the market, given the low liquidity of the market at that time, they might have been reluctant to sell stocks, as such sales would lower stock prices. Also, banks were reportedly hesitant to sell stocks they owned on a large scale, taking into account the possibility that the stock issuers might consider such actions as a sort of M&A. BOJ equity purchases have been initiated at the request of banks; hence, these purchases have not been used as a measure for providing liquidity by the BOJ.[46]

3.3 Financial markets in a very low interest rate environment: some interesting developments and their implications

As stated above, market operations under the ZIRP and the subsequent QEP regime have directly or indirectly led to various interesting developments in the money and financial markets. Some of them were the natural consequences of monetary easing, but some were not necessarily anticipated at the time the ZIRP/QEP was introduced. In either case, they shed light on the transmission mechanism of monetary policy in a very low interest rate environment. In what follows, we first present these developments. We refer when necessary to the comparison between the current Japanese situation and the US situation in the 1930s, which also was a period of extremely low interest rates.[47] Then, we examine the significance of these and their implications for the effectiveness of monetary policy.

3.3.1 Discoveries in financial markets

The current Japanese call rate, through which financial institutions lend and borrow short-term funds, hardly reflects credit risks as it has been lowered to 0.01% under the ZIRP and to 0.001% under the QEP.[48] This becomes clear if we compare it with the US situation in the 1930s. During that period, the risk-free TB rate declined to approximately 0%. But the federal funds rate, at which financial institutions lend and borrow short-term funds, declined only as far as 0.25% (Figure 21).[49]

Compared with US financial institutions in the 1930s, Japanese financial institutions today face much lower returns on investment in long-term government bonds and larger risks of reversal in long-term interest rates in the future. In Japan, the yield on short-term government securities with maturities of less than one year has declined to levels close to that of the overnight call rate. At several points they reached 0.001%, equivalent to the level of the overnight call rate. During the same period, the average

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43 Many funds-providing operations had terms of three to six months. In some instances, even nine-month funds were offered.

44 Here, we mean horizons of a few months rather than a few days. Under the QEP, the CABs have far exceeded required reserves. Consequently, the overnight rate has seldom showed signs of rising. This has not been the case with term rates because of the decline in banks' risk-taking ability.

45 Japanese banks have been taking a fair amount of risk by holding equities. As of September 2002, the top 15 banks' holdings of equities totaled ¥ 19.8 trillion against Tier 1 capital of ¥ 15.9 trillion. The government has set up a law requiring the banks to reduce equity holdings to below Tier 1 capital by September 2006 (the Shareholdings Restriction Law).

46 As of May 2004, the BOJ has bought about ¥ 2 trillion of equities from the banks.

47 See Orphanides (2004) for US monetary policy in the 1930s.

48 See Borio et al (2003) for the US experience in the 1930s.

49 The source of the US data is the National Bureau of Economic Research (NBER) Macrohistory database.

yield on 10-year JGBs was 1.20%, with the lowest yield at 0.44% in June 2003. In comparison, in the United States during the 1930s, the average yields on both short- and long-term government securities were significantly higher than those on the current JGBs, 0.54% and 2.98%, respectively.

Under the QEP, financial institutions have increased their dependence on the BOJ's money market operations as a means of adjusting their reserve balances. The financial institutions with a funds shortage have become more dependent on the BOJ's funds-providing operations, while those with a funds surplus have come to use the BOJ's funds-absorbing operations as a means of investing funds. Put differently, the BOJ has come to play the role of a money broker. This is the mechanism through which the BOJ has provided ample liquidity. However, when concerns over the financial system's stability have receded and the precautionary demand for liquidity has declined, the BOJ has often faced difficulties in its attempt to supply liquidity. Specifically, it has experienced undersubscriptions in fund-providing operations: the total amount of bids have fallen short of the amount offered by the BOJ even at the lowest bidding interest rate of 0.001%.[50]

As financial institutions have become more dependent on the BOJ's money market operations, the size of the call market, which had already shrunk under the ZIRP, has contracted further since the adoption of the QEP (Figure 22). The daily trading volume in the uncollateralised call market was about ¥ 9.1 trillion before the QEP was adopted in March 2001. Since then, it has gradually declined, reaching ¥ 1.7 trillion in April 2004. The amount outstanding has also declined from ¥ 26.5 trillion to ¥ 18.8 trillion during the same period. This reduction in the size of the call market reflects lowered trading incentives for the following two reasons: first, the returns on investment in the call market have declined to a level that cannot cover trading costs (when the overnight call rate is 0.001%, the return on investment of ¥ 10 billion in the overnight call market is only ¥ 273, which falls short of total trading costs[51]). Second, credit spreads have been narrowed substantially. A call rate of 0.001% means that the average of all borrowing rates is 0.001%, leaving little room for differences in rates between individual borrowers.

Despite the near disappearance of credit spreads in the Japanese money market, differences in the credit standing between Japanese and foreign banks have remained. This has led to the emergence of negative interest rates in some parts of the financial system. Since the adoption of the QEP, the foreign exchange (FX) swap market has almost constantly seen negative interest rates when foreign banks raise yen in exchange for US dollars. Foreign banks have invested the yen funds thus raised in the CABs at the BOJ (Table 1).

The mechanism through which the yen funding costs turn negative is summarised as follows. An FX swap transaction is a contract in which Japanese banks borrow US dollars from, and lend yen to, foreign banks at the same time. Currently, the interest rate at which Japanese banks lend yen to foreign banks is almost zero. As the credit standing of Japanese banks is lower than that of foreign banks, the yen funding costs for foreign banks have become negative. With zero returns on the yen funds under the ZIRP and QEP, the negative yen funding costs have served to sweeten the pie for foreign banks to become counterparties of Japanese banks.[52] Foreign banks have profited from the spread between the negative yen funding costs and zero returns on the BOJ's risk-free CABs.

Against this background, the CABs of foreign banks amounted to ¥ 5.7 trillion as of the end of December 2003, which was approximately one quarter of the excess reserves held by all financial institutions. The ratio of the CABs of foreign banks to their total assets went as high as 13.1%. Foreign banks invested yen funds with negative funding costs in the call and short-term government securities markets, which occasionally led to negative interest rates in these markets as well.[53]

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[50] For example, the outright purchase of short-term government securities on 13 September 2002 resulted in aggregate bids of ¥ 145.6 billion against the offer of ¥ 800 billion with the contracted rate of 0.001%. Fiscal 2003 recorded 75 cases of undersubscription.

[51] The trading costs, excluding excise taxes, include the commission fee for brokers (¥ 137), the charge for using the Bank of Japan Financial Network System (BOJ Net) (¥ 40), and the contract-confirmation fee (¥ 200).

[52] See Nishioka and Baba (2004a) for a more detailed explanation of the mechanism of negative yen funding costs for foreign banks in the FX swap market.

[53] Due to the credit lines set on the dealings with the BOJ, some foreign banks place only limited amounts of funds in the BOJ's CABs. Thus, they lend excess funds to other banks, within the credit limit against these banks, at negative interest

The yen funding costs in the FX swap market can be decomposed into three factors: (i) yen risk-free interest rate; (ii) the credit-risk premium for foreign banks in the US dollar market; and (iii) the difference in credit-risk premium for Japanese banks between the yen and the US dollar markets.[54] Amongst these, the third factor has contributed to the recent negative yen funding costs. That is to say, the credit-risk premium for Japanese banks has been smaller in the yen market than in the US dollar market. Nishioka and Baba (2004a) show how this can lead to negative yen funding costs for foreign banks.

Furthermore, a closer look at the movement of the above-mentioned decomposition of the yen funding costs reveals something interesting (Figure 23). The difference in the credit-risk premium for Japanese banks between the yen and the US dollar markets existed even before the ZIRP was adopted. When the yen risk-free interest rate was significantly above 0%, the yen funding costs were positive. Thus, foreign banks did not increase their CABs at the BOJ. Later on, as yen risk-free interest rate declined to almost 0%, the difference in credit-risk premium for Japanese banks between the yen and the US dollar markets exceeded the sum of the domestic risk-free interest rate and the credit-risk premium for foreign banks in the dollar market, turning the yen funding costs negative.[55]

Credit spreads of corporate bonds and CPs have narrowed as short-term interest rates have declined since the adoption of the ZIRP (Figure 24). The narrowing of credit spreads has extended to CPs and corporate bonds with BBB rating. Recently, credit spreads have barely covered *ex post* default risks (Figure 25). Despite such favourable conditions for issuers, the issue amounts of CPs and corporate bonds have not increased. In contrast, the credit spreads of CPs and corporate bonds in the United States were much higher in the 1930s: the credit spreads of prime-rated CPs were 1.01%, and those of corporate bonds with AAA rating was 0.92%.

So far, we have described several interesting developments in the recent Japanese money and financial markets. These have important bearings on the BOJ's attempts to stimulate the economy. First, the demand for the BOJ's CABs increased as a result of the BOJ's attempts to supply additional liquidity. An increase in the CABs of foreign banks with negative yen funding costs is such an example. Increased dependency on the BOJ's funds-providing operations in the money market is another example. In other words, the BOJ's attempts to push the liquidity supply curve outward has also induced an outward shift of the demand curve for liquidity, making the net effect of the provided liquidity much smaller than it appears.[56]

Second, despite declines in credit spreads of CPs and corporate bonds, the issuing amounts of CPs and corporate bonds have not increased so far (Figure 26). This is in marked contrast to the US experience of monetary easing since 2001; the issuance of corporate bonds with low credit rating has dramatically increased in response to the reduction in credit spreads (Figure 26).

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rates, or purchase short-term government securities. The number of Japanese banks, however, who have been able to borrow at negative rates in this way has been very small.

[54] Foreign banks can raise yen either in the Japanese money market or through FX swap transactions. Thus, in equilibrium their yen funding costs equals the forward discount plus their US dollar funding costs. The same arbitrage condition for Japanese banks implies that the forward discount equals Japanese banks' yen funding costs minus their US dollar funding costs. Taken together, foreign banks' yen funding costs equals their US dollar funding costs plus Japanese banks' yen funding costs minus Japanese banks' US dollar funding costs, which in turn must equal the risk-free yen rate plus foreign banks' risk premium in the US dollar market plus the difference in Japanese banks' risk premium between the yen and the US dollar markets.

[55] The United States has seen a similar phenomenon. In the US repo market from early August to mid-November 2003, special collateral (SC) repo rates became negative. An SC repo rate is defined as the difference between the interest rate on cash loans and the premium for a specified collateral bond determined by its supply and demand. As long as the interest rate on cash loans was sufficiently high, the premium was covered so that the SC repo rate stayed positive. When the interest rate on cash loans declined, however, the SC repo rate also declined, and became negative in 2003. In Japan, the interest rate decline was earlier in timing and larger in magnitude, and the SC repo rate became negative around April 2001. For more details, see Fleming and Garade (2004) and Baba and Inamura (2004).

[56] Negative interest rates themselves are expansionary. As stated in footnote 51, however, only a small number of Japanese banks have been able to borrow at negative rates. Moreover, the amounts borrowed at negative rates have been miniscule. Foreign banks have not taken advantage of negative rates to expand loans to Japanese companies.

3.3.2 *Preliminary analysis of investor behaviour*

Before discussing more fully in Section 3.3.3 the implications of the developments we have ascertained, we present below a microeconomic analysis of Japanese investor behaviour in a low interest rate environment. The key factor is to pay attention to the changes in the nature of investor types in response to changes in the risk-return profile of financial assets. We observe that declines in returns beyond certain levels caused risk-conscious investors to exit from markets, lowering the markets' ability to price risks properly.

Let us briefly review the risk-return profile of financial assets after the ZIRP was adopted (Table 2). First, average returns have declined substantially. As a result, the call market has become inactive because investors cannot cover their trading costs. Second, volatility has declined, weakening incentives to trade. Third, the negative skewness of the distribution of returns has increased. To elaborate on this point, declines in short-term interest rates have forced Japanese investors to look for higher returns by taking various risks in other markets. They have taken the duration risk by investing their funds in long-term government bonds. With the decline in long-term interest rates, however, they expect large potential capital losses in the event of a reversal of interest rates movements, and this in turn caused the negative skewness to increase.

In such circumstances, Japanese investors have turned to credit instruments such as corporate bonds. Their active investment into these instruments has reduced credit spreads. Due to the possibility of default, the distribution of returns on corporate bonds has a *long tail* in the negative zone. Thus, reductions in credit spread have increased the negative skewness of the distribution.[57] Similarly, in the call market, the negative skewness of returns on call loans has increased because of the decline in interest rates to near zero levels.

Investors may be categorised into three types depending on the way they evaluate the risk-return profile of financial assets in their investment decisions.[58] The first type are risk-cautious investors who take the skewness, as well as the mean and the variance, of returns into account.[59] The second type are traditional investors who care about the mean and the variance, but not the skewness. The third type are those who focus on absolute return and are solely interested in the mean of returns. The conventional CAPM assumes second-type investors. However, in an environment in which interest rates are very low and risk-tolerance level of investors is affected by their capital position, investors may become more sensitive to the skewness of returns, especially for debt instruments. If expected returns on financial assets are large, the first-type investors will be able to participate in the market (Figure 27). If expected returns fall, the first-type investors will exit the market and only the second- and third-type investors will remain in the market. If returns decline further, the second-type investors will also exit and only the third-type investors will remain.[60] As the negative skewness of returns on credit instruments has increased in line with the decline in returns, investors will be crowded out from the market in the order of their degree of risk aversion.

[57] Amato and Remolona (2003) point out that in the United States, credit spreads tend to be much wider than would be explained by the expected losses given the default probabilities, which they call a "credit spread puzzle". They show that the skewness in the distribution of returns on corporate bonds calls for an extraordinary large portfolio to achieve the diversification of risks of unexpected large losses even with small probabilities.

[58] See Nishioka and Baba (2004b) for a more detailed analysis of the issue. Appendix 3 provides the summary of the results.

[59] Mathematically, the first type are investors who care about third moments of the distribution of returns. This would be the case if they looked at the second-order, not just the first-order, terms in the Taylor approximation of the first order condition for maximisation. The risk premium they would demand of an asset then rises with the negative skewness of the distribution of returns. See Nishioka and Baba (2004b) for details.

[60] Foreign investors, typically categorised as first-type investors, have not entered the Japanese corporate bond market to begin with, since the returns have not covered the high risk premium that they demand. Domestic institutional investors such as pension funds and life insurance companies, categorised as both first- and second-type investors depending on the degree of risk aversion, have turned to foreign bonds with the currency position hedged, as well as government bonds. Since their liabilities are denominated in yen, they prefer to hedge against foreign exchange fluctuations. Their hedging strategy is to roll over short-term hedges, typically over a three-month period. As a result, the corporate bond market has been dominated by regional financial institutions and retail investors, who may be categorised as third-type investors. In fact, the flow of funds account shows that retail investors increased their holding of corporate bonds from ¥ 46 billion at the end of 1997 to ¥ 118 billion at the end of 2003.

The third-type investors have an incentive to take large credit risks in a very low interest rate environment. Of course, they have been around since long before the ZIRP was adopted. The ZIRP and QEP, however, have lessened the number of active first- and second-type investors, making it possible for the third-type investors to become more influential. As a result, bond yields no longer seem to be reflecting the underlying risks of borrowers properly.

This last point is borne out in the results explained in Appendix 3, especially in Table A3-2. There it is shown that the estimated average degree of risk aversion of Japanese corporate bond investors is generally lower when the sample includes BBB bonds than when it does not. Also, there is little evidence that investors care about the negative skewness of expected returns. These results do not hold for the US bond market. Thus, although narrowing of credit spreads is a favourable development in a stagnant economy, there seems to be a grain of unhealthiness in it. In addition, as we pointed out, issuance of bonds has not increased much.

3.3.3 Implications for monetary policy

The above discussion on credit risk premiums suggests the existence of what might be called a risk premium puzzle concerning Japan's experience with the impaired financial system since the mid-1990s. Here, the puzzle is twofold: first, risk premiums in many areas of the impaired financial system declined rather than increased; second, declines in risk premiums have not produced significant monetary easing effects.

In order to solve this puzzle it seems useful to disaggregate credit markets into two segments. Generally, firms with relatively high credit ratings (equal to an A rating or above) have not faced severe difficulties raising funds from banks or capital markets under the ZIRP and the subsequent QEP periods. The narrow credit spreads in the corporate bond market have been described in the section above. Since lending to high-rated firms has been favourable to banks due to the small risk of damaging their capital position, credit spreads on loans have been narrow as well. Firms in this segment, however, have been undergoing a significant de-leveraging process. Cash flows have stayed higher than investment since around 1999. Thus, issuance of corporate bonds has not increased substantially. Bank loans have continued to decline. The only recent exception was the period of financial instability from 1997 to 1998, in which major banks and securities companies went bankrupt, particularly in the aftermath of the Russian crisis and the failure of LTCM. It was only during this period that the issuance of corporate bonds by firms in this segment increased sharply (Figure 26).

The situation has been quite different in the case of firms with lower credit standings. Many firms in this segment have faced severe credit constraints. They have had only limited access to the corporate bond market. There has been some bond issuance by firms rated BBB, but not by those with lower ratings. In fact, corporate bonds rated BB or below are those of firms who had entered the market with BBB or higher ratings and been subsequently downgraded as a result of deteriorating financial conditions. Consequently, bank borrowing has been a major channel of fund raising for these firms. As we referred to in Section 1.3, Nagahata and Sekine (2002) have shown that firms without access to the corporate bond market have faced significant credit constraints when their main banks experienced financial problems. Given that these firms have had only limited access to the bond market, however, we have not been able to observe these borrowers being charged high risk premiums.[61]

Due to capital limitations banks have been reluctant to extend new loans to this class of borrower. In many cases, however, they continued to roll over existing loans without raising lending rates much. Figure 28 shows that lending rates to lower rated borrowers have been well below those that cover expenses and default risks. Demanding higher lending rates would have made many borrowers insolvent, forcing banks to realise losses; banks, however, lacked capital for such action. As a result, high risk premiums have not been observed here, either. The same reasoning explains the underdeveloped nature of the distressed asset market.

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[61] It is possible to observe some evidence of high risk premiums with these companies. As shown in Figure 24, spreads on BB bonds rose until the middle of 2002 unlike those for other classes of bonds. The amount of such bonds, however, is a very small fraction of the market (0.02% of the amounts outstanding of corporate bonds) and a negligible fraction of the funding needs of firms in this second tier segment of the credit market.

The near absence of the bond and distressed asset markets for, and the unwillingness on the part of banks to extend new loans to, firms in this segment largely prevented them from enjoying the easing effects of monetary policy. The BOJ's monetary easing, as we have reviewed in this paper, did have the effect of lowering, or stopping the rise in, risk premiums in relatively sound parts of the financial system. Resultant declines in risk premiums, however, have gone a bit too far in some areas, for example, in the money market and corporate bond market. In the case of the money market, which has actually been a place with serious credit problems, the BOJ has had to act as an intermediary. In the case of the corporate bond market, some risk-sensitive investors have left the market, but have not taken larger risks elsewhere, perhaps partly because they have also been constrained by capital and partly because the corporate bond market, as well as the secondary market for bank loans for low-credit borrowers, have not been sufficiently developed for the reasons discussed above.

In this sense, the BOJ's market operations have not been able to fully address the problems in the weakest parts of the financial system. In other words, well functioning banking sector and capital markets are a prerequisite for effective monetary policy.

4. Concluding remarks

We have offered three analyses of Japan's macroeconomic experience during the post-1990 period. First, we analysed various facets of deflation during the period. We argued that the deflation of general prices, although it is a serious issue, has by no means been a major factor for the stagnating economy. In contrast, the deflation of asset prices - land and stock prices - was closely related to the economic difficulty of the period. Among others, the negative shocks generated by sharp declines in asset prices in the early 1990s have been propagated and amplified by their interaction with the deterioration in the condition of the financial system. Some statistical evidence supporting this view was presented.

Second, we have reviewed and analysed the effects of monetary policy adopted to fight deflation since the late 1990s. Given that short-term interest rates were already nearly zero in the mid-1990s, policy measures adopted have focused on creating monetary easing effects beyond a mere zero short-term interest rate policy. We have shown that the ZIRP/RZIRP, which involved a commitment to maintain a zero interest rate for a longer period than that for a baseline monetary policy rule, has produced strong effects on expected future short-term interest rates, and thus on the entire yield curve during the use of such a framework. We conjecture, however, that the effects of such a favourable shift in the yield curve on prices and output have been limited. This is because the reduced net worth of both lenders and borrowers, as well as the associated negative financial accelerator, offset the effect of low interest rates and, therefore, an increase in lending and fixed investment was not realised.

Third, we have argued that the BOJ's market operations have been directed partly at addressing the above-mentioned financial sector problems, in addition to their conventional objective of implementing monetary policy. These operations have taken the form of containing risk and liquidity premiums, especially in the money market, through proactively providing liquidity, as well as the BOJ's own risk-taking activity. As a result, the BOJ has succeeded in preventing a repetition of the 1998-type liquidity crisis. The risk-taking ability of private financial institutions, however, has not fully recovered. That is, reductions in risk premiums in the money and corporate bond markets have not spread into other markets where credit constraints have been strict, for example, bank loans to firms with no access to the bond market. Other interesting developments have also been observed. Where reductions in the premiums have been large, for example in the money market, the BOJ has found itself acting as a major player. The risk premium for Japanese banks in the US dollar market has not declined much, resulting in negative yen funding rates for foreign banks as they have entered into yen-dollar swap transactions with Japanese banks. Ironically, these unexpected events have made the provision of large amounts of liquidity easier for the BOJ, but at the same time made the effects of liquidity provision not as large as appeared on the surface.

One unexplored area of macroeconomic policy is coordination between monetary and fiscal authorities to get around the zero rate constraint. Aggressive fiscal policy supported by aggressive monetary expansion could function as a powerful weapon to fight deflation. In a sense, the BOJ has partially provided such a framework by maintaining a near-zero short-term interest rate for almost 10 years. The fiscal authority, however, has stopped shy of exploiting this environment, as can be seen by sharp reductions in public investment since 1996.[62] The degree of commitment by the BOJ, beyond a zero inflation rate, to maintaining the pro-fiscal authority environment has been unclear. The following points, however, need to be considered. First, the increase in seigniorage revenue created by a 1 or 2 percentage point permanent increase in the inflation rate in the neighborhood of reasonable inflation rates is quite limited. Second, a sharp but temporary rise in inflation may produce a large effect on the real value of existing government debt. However, the question is whether the public is willing to tolerate such inflation. Also, it is unclear what the burden for the economy would be after the temporary rise in the inflation rate. Such questions are matters for further study.

[62] Public investment has declined by about 40% from its peak in 1995.

Table1

Current account balances at the Bank of Japan

In trillion of yen

	Domestically licensed banks	Foreign banks in Japan	Other banks	Others	Total
End of 1997	3.3	0.1	0.1	0.0	3.5
End of 2000	5.1	0.2	0.1	1.4	6.8
End of 2003	18.0	5.7	1.9	4.5	30.0

Note: Other banks refer to financial institutions for agriculture, forestry, and fisheries and those for mall businesses.

Source: Bank of Japan, *Flow of Funds Accounts*.

Table 2

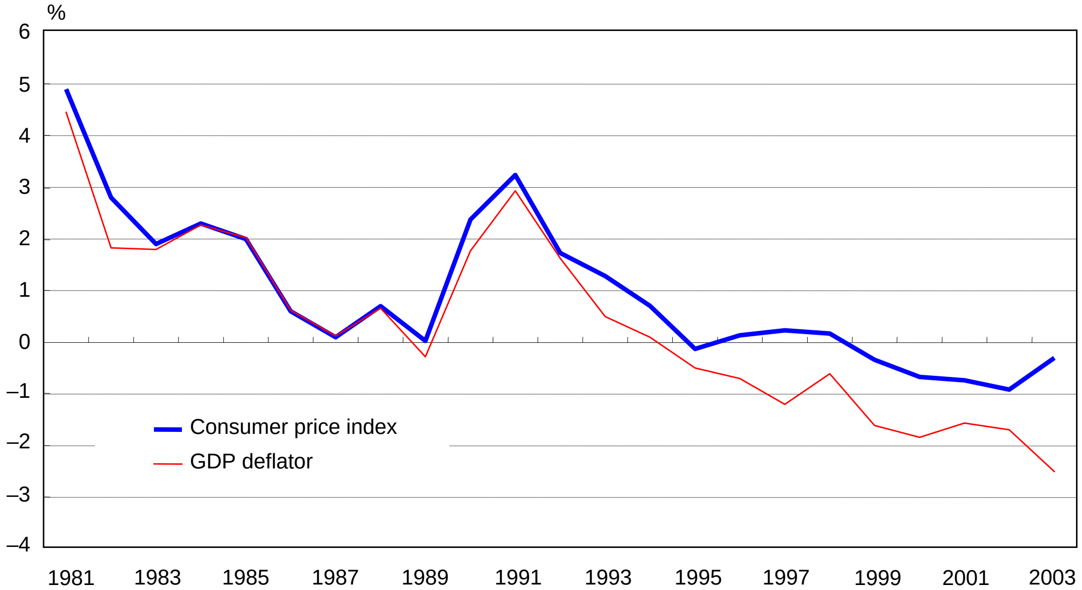
Changes in the distribution of the returns on government bonds and corporate bonds

	Government bond	Corporate bond			
		AAA	AA	A	BBB
(1) From 4 January 1996 to 31 March 1999					
Average	0.056	0.073	0.042	0.034	–0.003
Variance	0.008	0.015	0.007	0.008	0.021
Skewness	–0.936	–0.447	–0.265	–0.198	–1.184
(2) From 1 April 1999 to 9 January 2004					
Average	0.019	0.030	0.025	0.027	0.031
Variance	0.002	0.003	0.002	0.002	0.006
Skewness	–0.975	–0.513	–0.883	–0.488	–0.719

Source: Nikko Security Co, *Nikko Performance Index*.

Figure 1

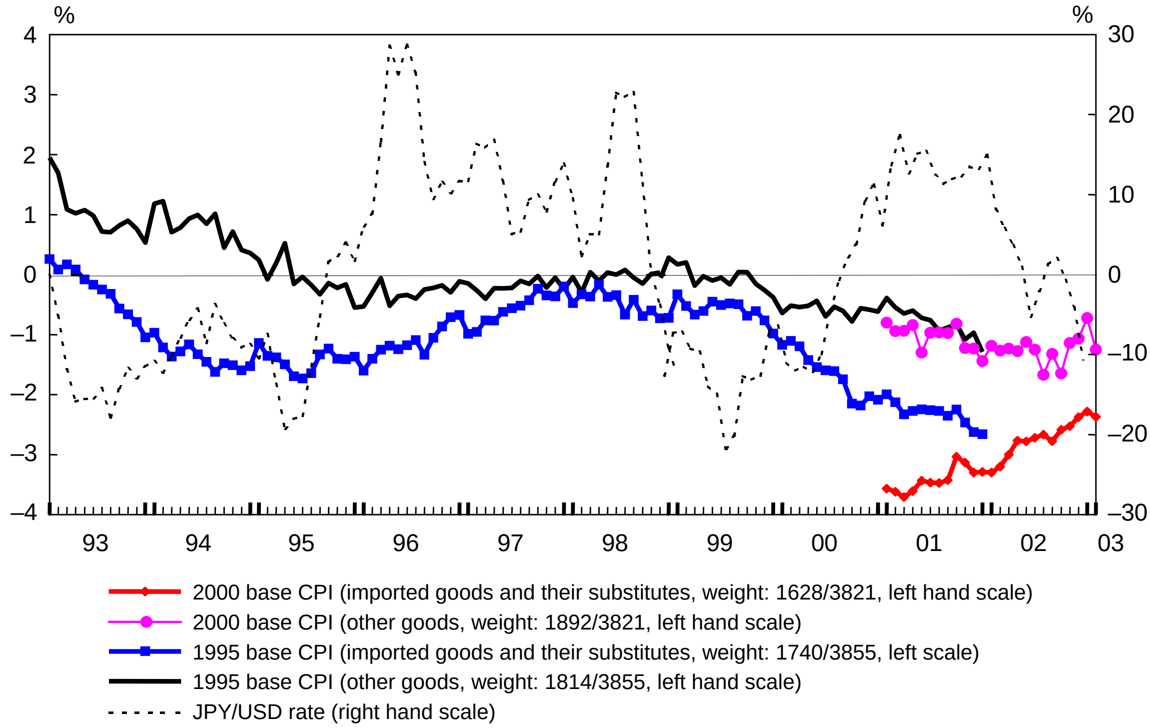
Rate of inflation in Japan



Sources: Economic and Social Research Institute, Cabinet Office; Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications.

Figure 2

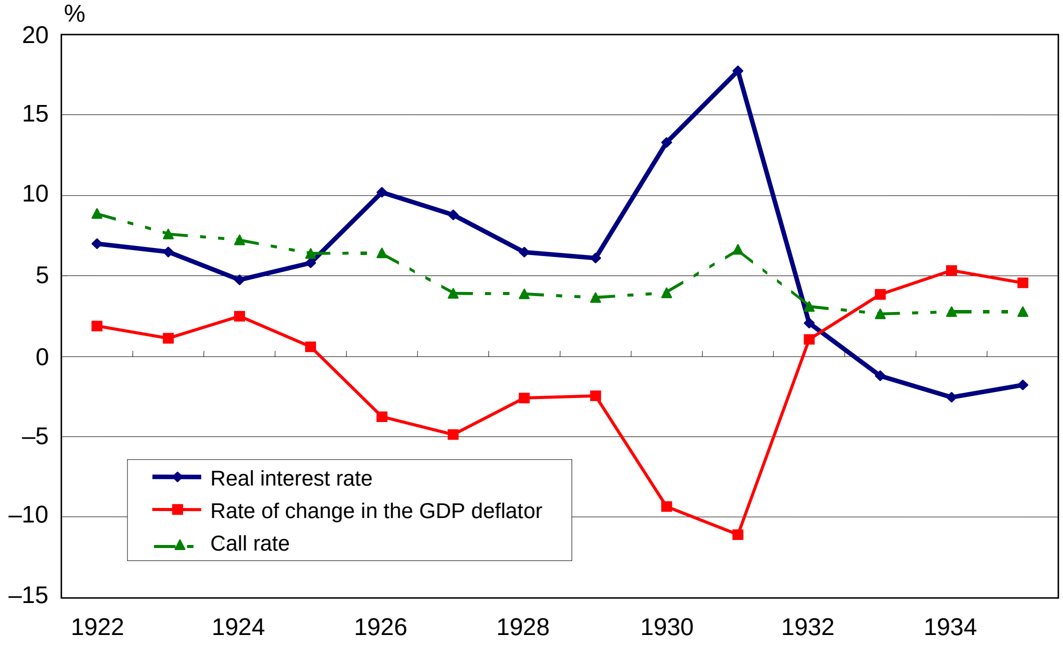
Comparison of imported goods and other goods in terms of CPI



Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications; Ministry of Economy, Trade and Industry; Ministry of Finance; Bank of Japan.

Figure 3

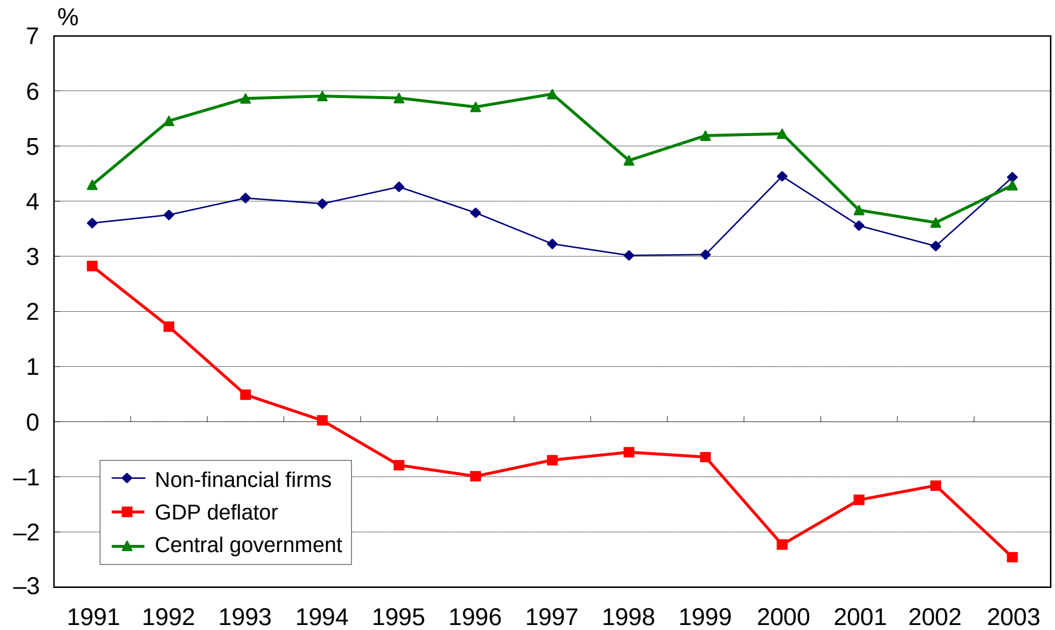
Estimates of real interest rates, 1922-35



Sources: Economic and Social Research Institute, Cabinet Office; Bank of Japan.

Figure 4

Estimates of real interest rates, 1991-2003



Note: Real interest rates are calculated as gross interest payments divided by total debt minus the rate of increase in the deflator for domestic demand.

Source: Economic and Social Research Institute, Cabinet Office.

Figure 5

Deflation vs NPLs

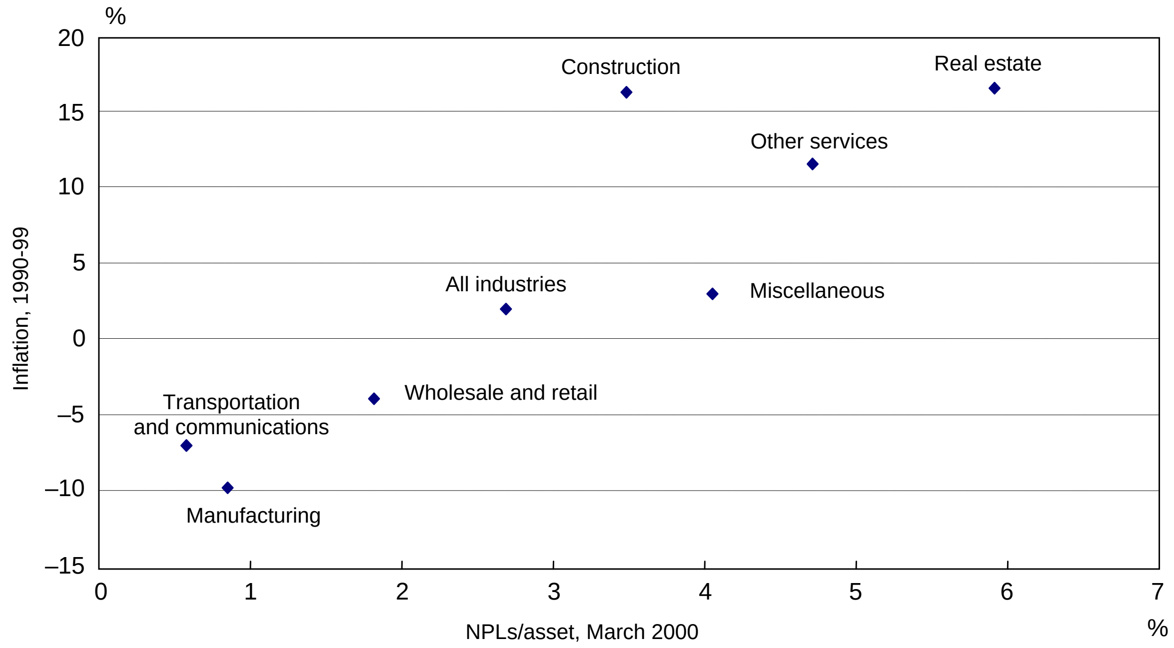
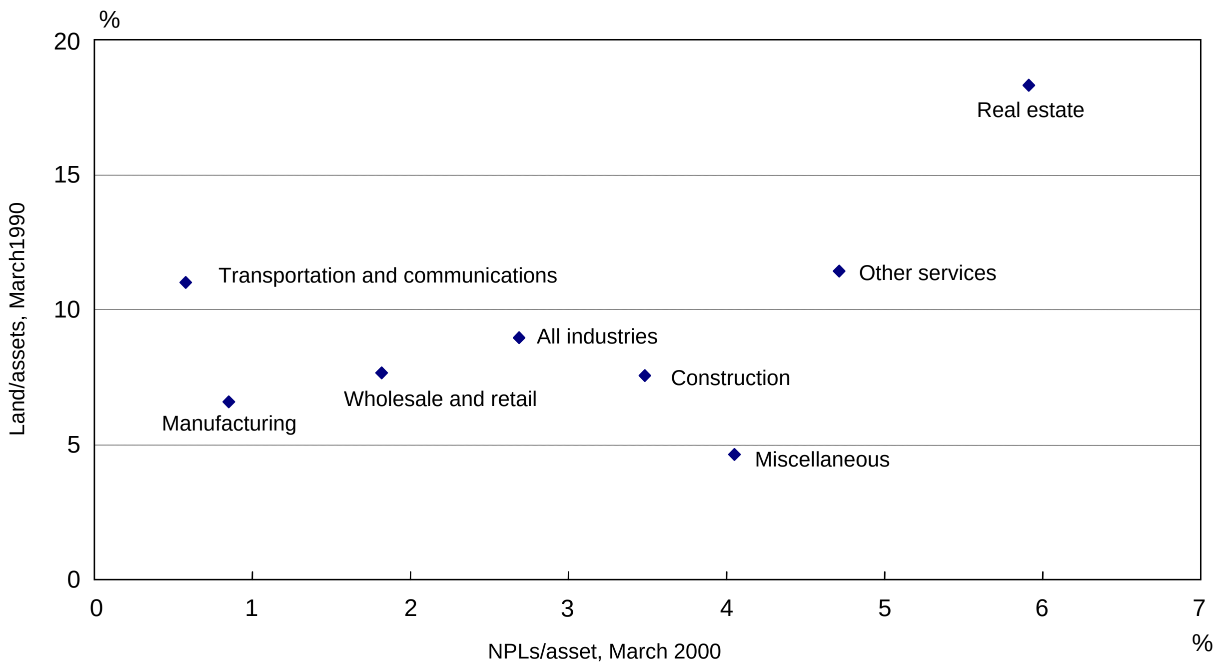


Figure 6

NPLs vs land holding

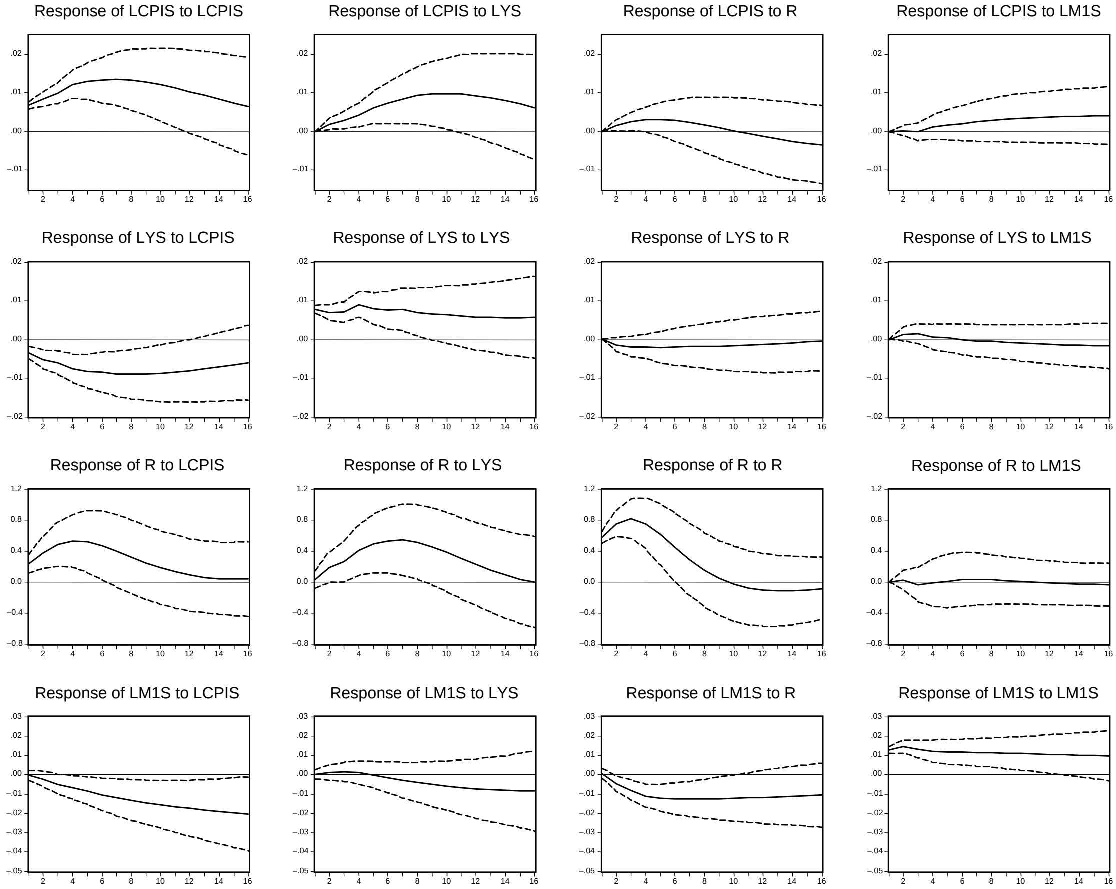


Source: Economic and Social Research Institute, Cabinet Office.

Figure 7

Impulse responses for four-variable VAR

Response to Cholesky One SD innovations ±2 standard errors



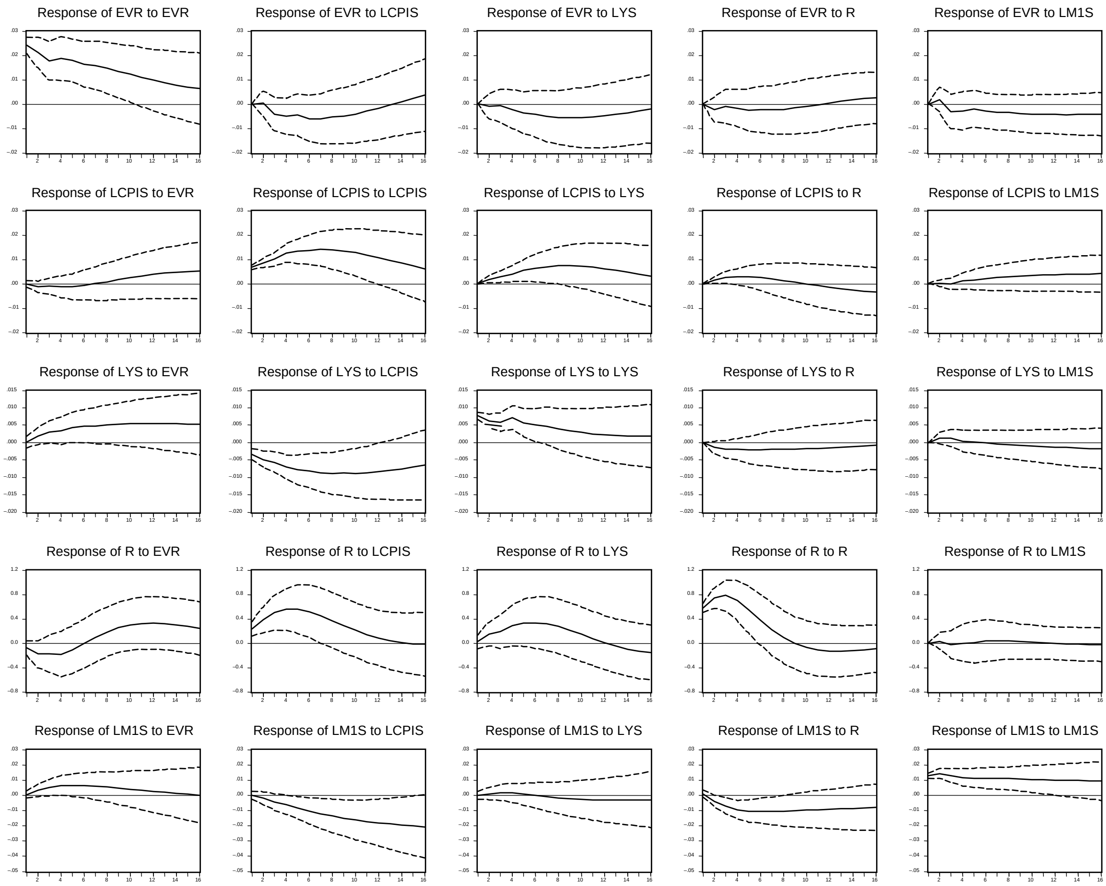
Notes: 1. LCPIS, LYS, R and M1S are CPI, real GDP, collateralised overnight call rate and M1, respectively. CPI, real GDP and M1 are in logarithmic for ed. R is in level form and non-seasonally adjusted. 2. Each panel shows the 16-quarter response of m and seasonally adjusts the given row variable to a shock to a given column variable. Impulse responses are orthogonalised recursively in the order shown above. Dashed lines indicate two standard error bands, calculated by the Monte Carlo method with repetition 10,000 times. 3. The estimation includes four lags and a constant.

Source: Authors' VARs.

Figure 8

Impulse responses for five-variable VAR

Response to Cholesky One SD innovations ±2 standard errors



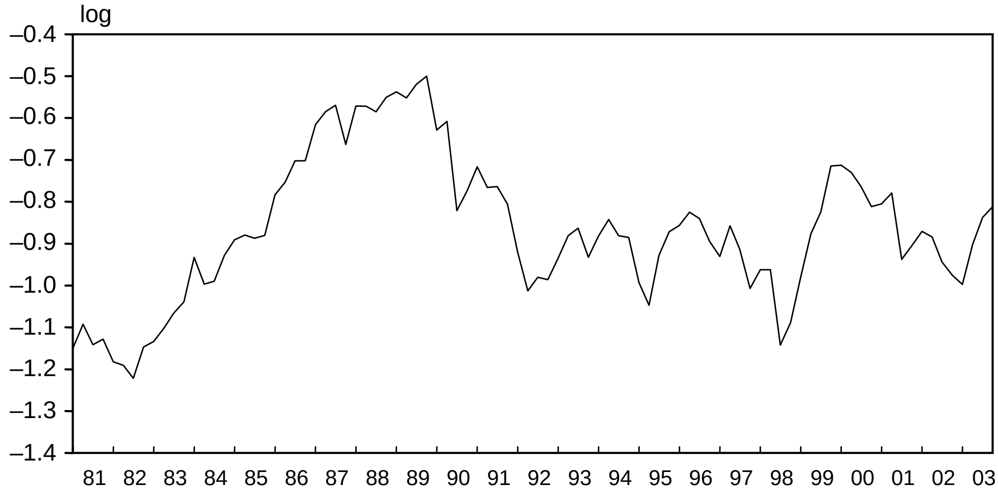
Notes: 1. EVR, LCPIS, LYS, R and M1S are the ratio of the equity value to the value of the firm, real GDP, collateralised overnight call rate and M1, respectively. CPI, real GDP and M1 are in logarithmic form and seasonally adjusted. EVR and R are in level form and non-seasonally adjusted. 2. Each panel shows the 16-quarter response of the given row variable to a shock to a given column variable. Impulse responses are orthogonalised recursively in the order shown above. Dashed lines indicate two standard error bands, calculated by the Monte Carlo method with repetition 10,000 times. 3. The estimation includes four lags and a constant.

Source: Authors' VARs.

Figure 9

Ratio of the market value of equity to the value of the firm (EVR)

(1) Actual EVR



Notes: 1. Value of equity is shares and other equities of private non-financial corporations, Flow of Funds Account. Data up to 1997/Q3 are calculated from total market value of listed stocks (Tokyo Stock Market Exchange, First Section). 2. Value of the firm is the sum of value of debt and value of equity. Value of debt is the sum of loans and securities other than shares of private non-financial corporations, Flow of Funds Account. Data up to 1997/Q3 are calculated from the Flow of Funds Account based on 68SNA.

(2) Changes in equity price and EVR shocks

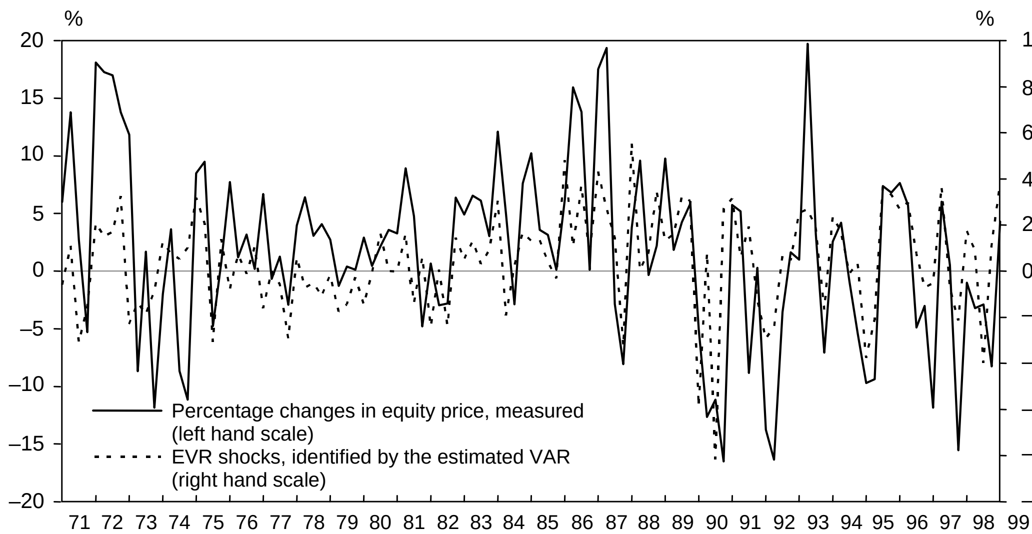
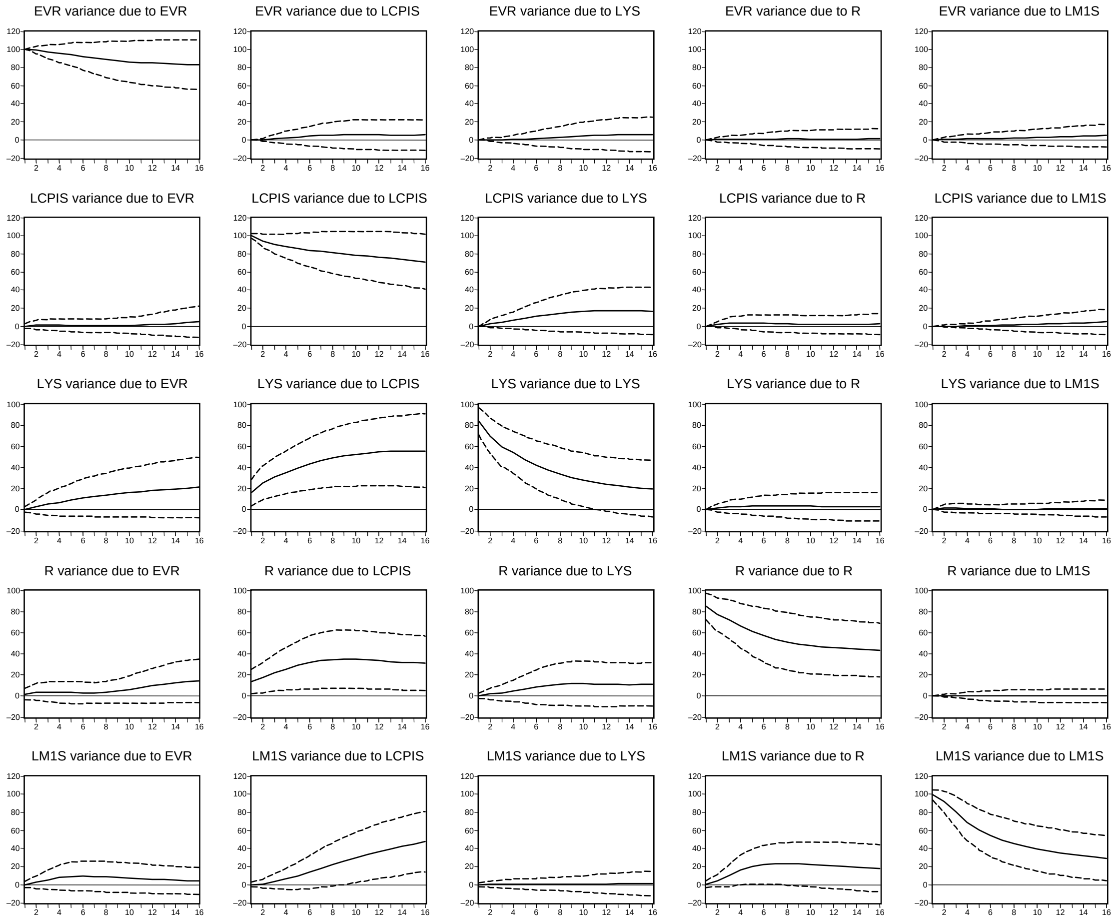


Figure 10

Variance decomposition of five-variable VAR

Variance decomposition ±2 standard errors

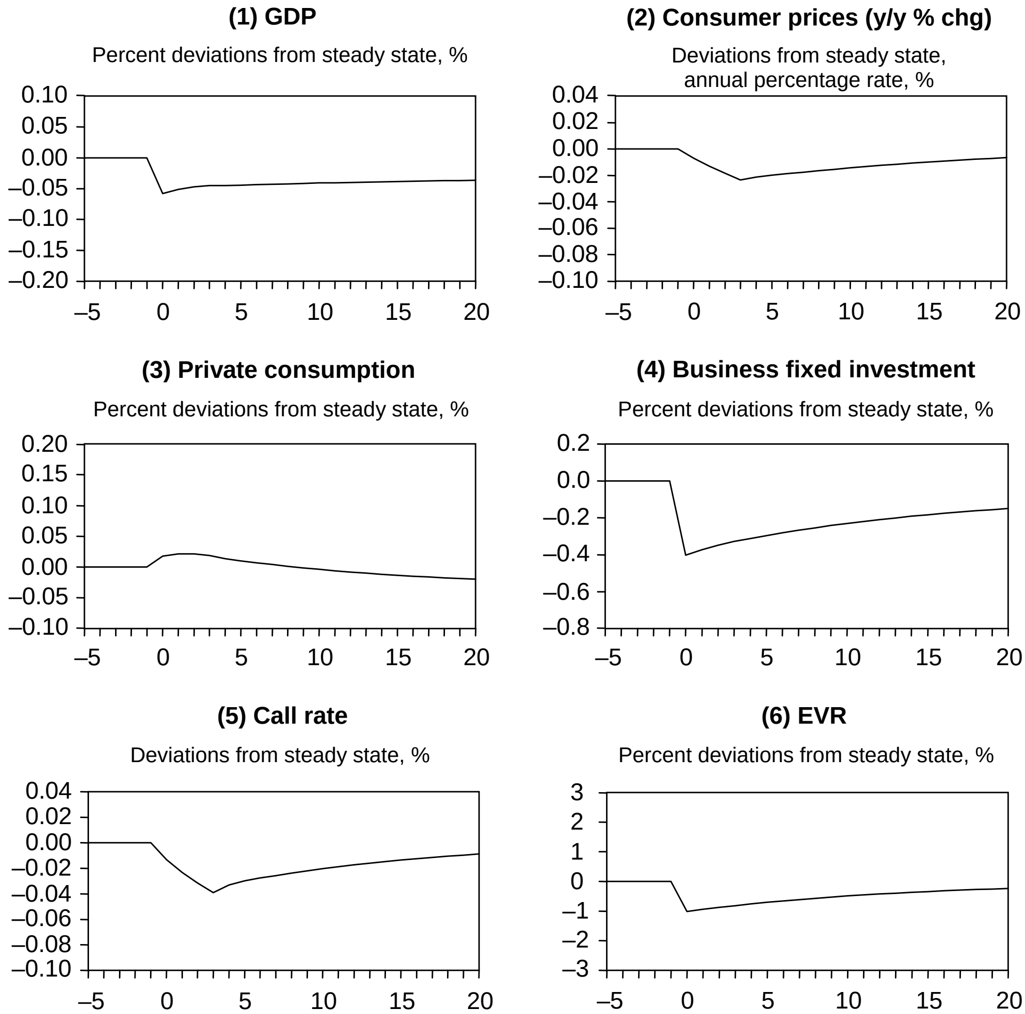


Note: Each panel shows the 16 quarter forecast error variance decomposition, based on the estimation result summarised in Figure 8. Dashed lines indicate two standard error bands, calculated by the Monte Carlo method with repetition 10,000 times.

Source: Authors' VARs.

Figure 11

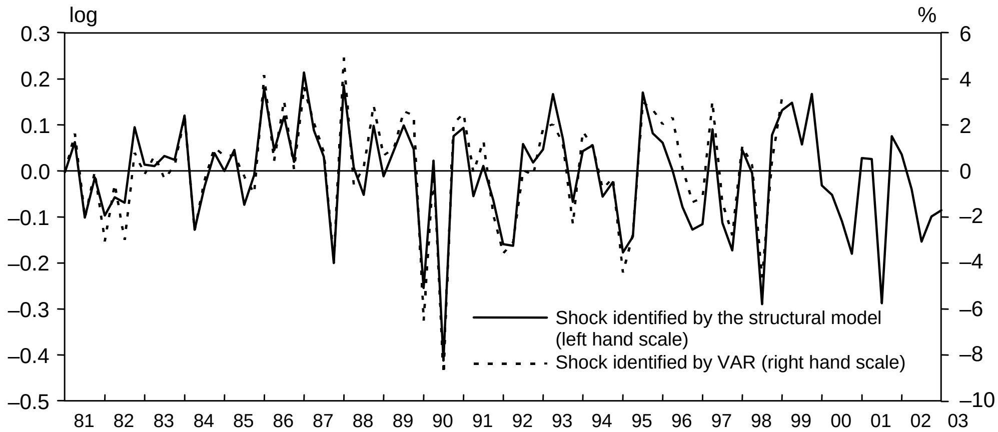
Responses to EVR shock



Note: Responses to negative 1% shock in the error term of equation (8).

Figure 12

EVR shocks

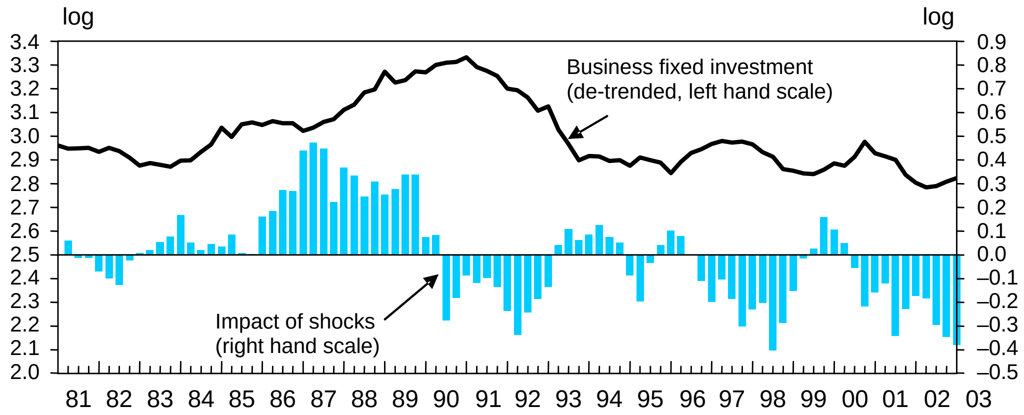


Note: The correlation coefficient of the shocks in a structural model and in VAR is 0.94.

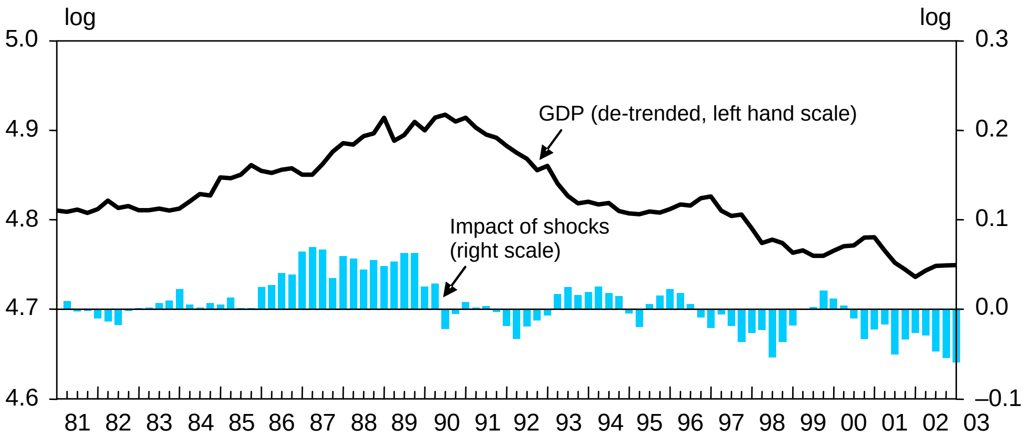
Figure 13

Impact of the estimated EVR shocks (results of simulation)

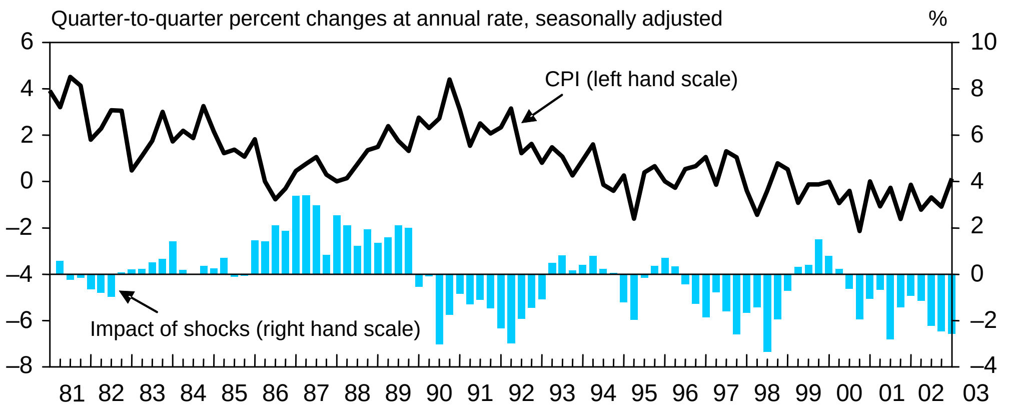
(1) Business fixed investment



(2) GDP



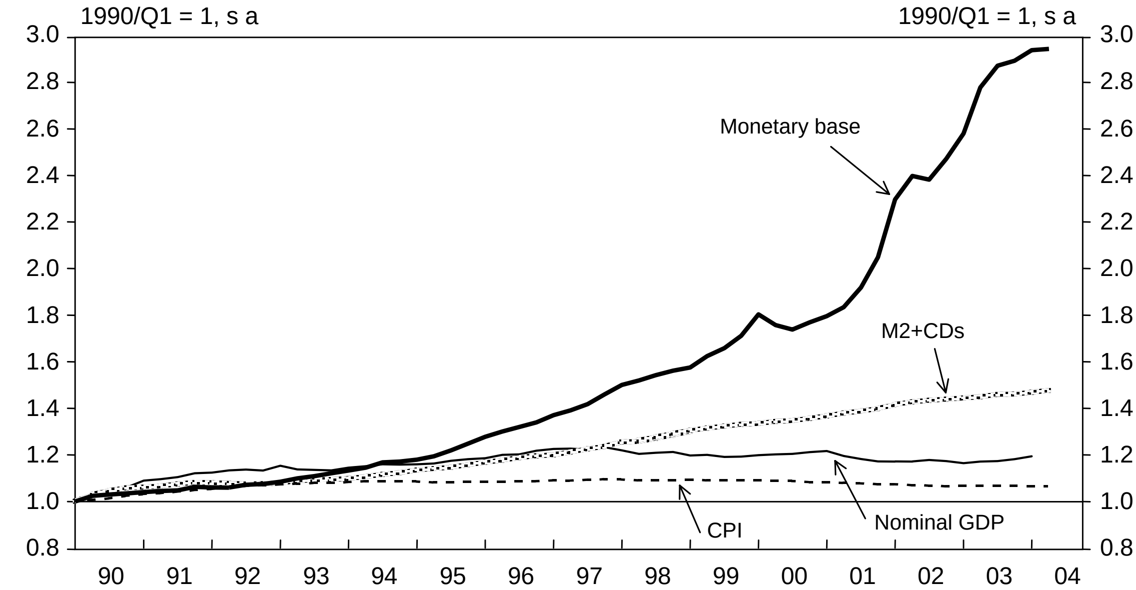
(3) CPI



Note: Impact of shocks shows results of endogenous variable simulation with estimated shocks on EVR and is expressed in deviations from steady state.

Figure 14

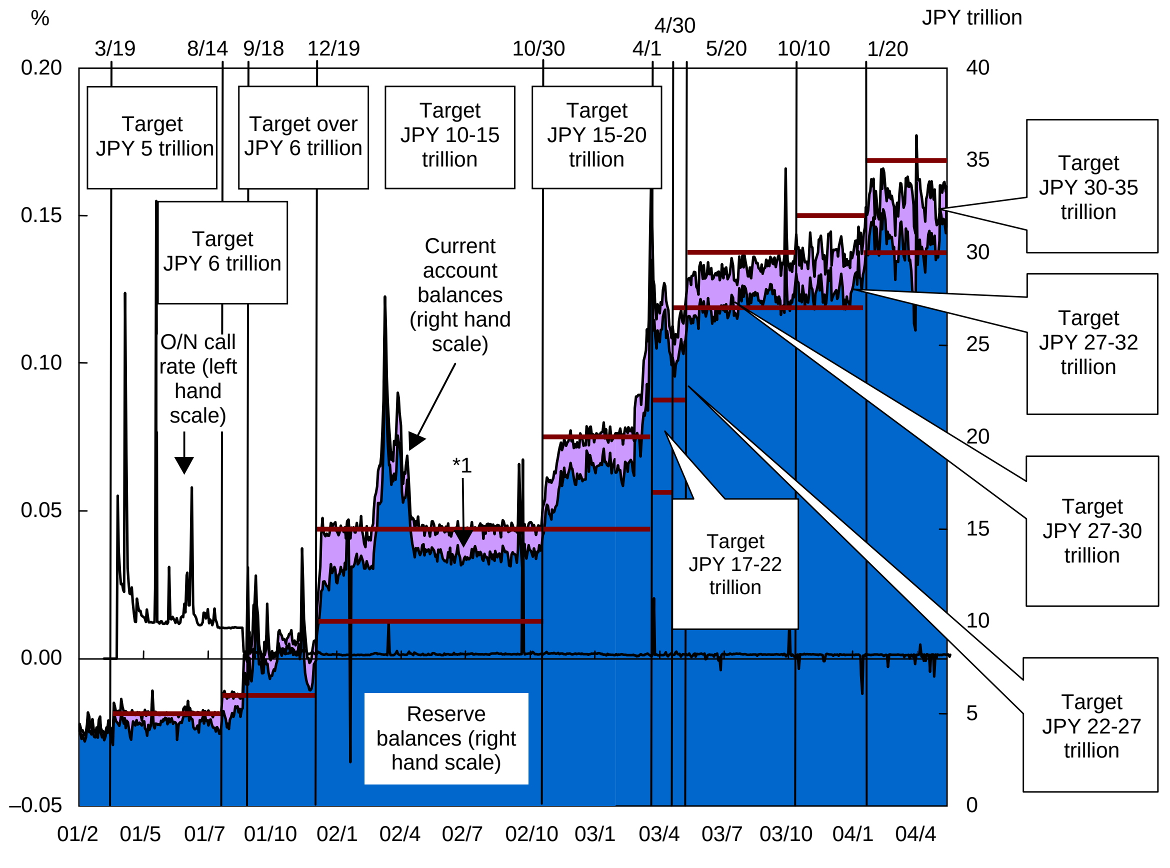
Monetary indicators, economic activity and price developments



Source: Bank of Japan.

Figure 15

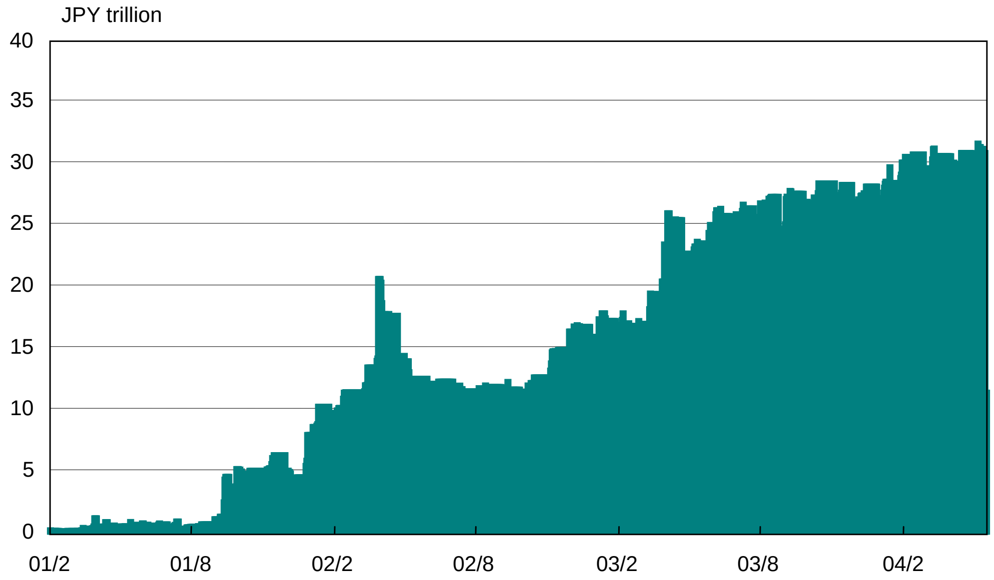
Target reserve and actual balance



Note: *1: Current account balances held by institutions that are not subject to reserve requirements.

Figure 15 (cont)

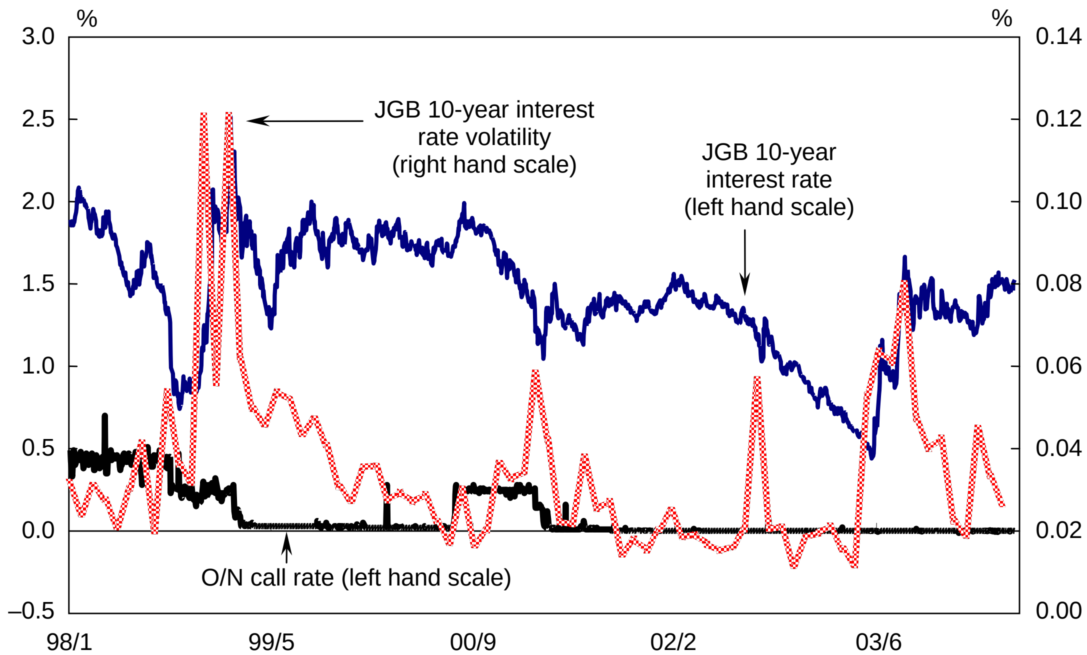
Excess reserves



Source: Bank of Japan.

Figure 16

JGB yield and volatility



Note: Volatility is defined as the monthly standard deviation of daily changes in the interest rate on 10-year JGBs.

Sources: Japan Securities Dealers Association; Bank of Japan.

Figure 17

Estimated value of the threshold inflation rate

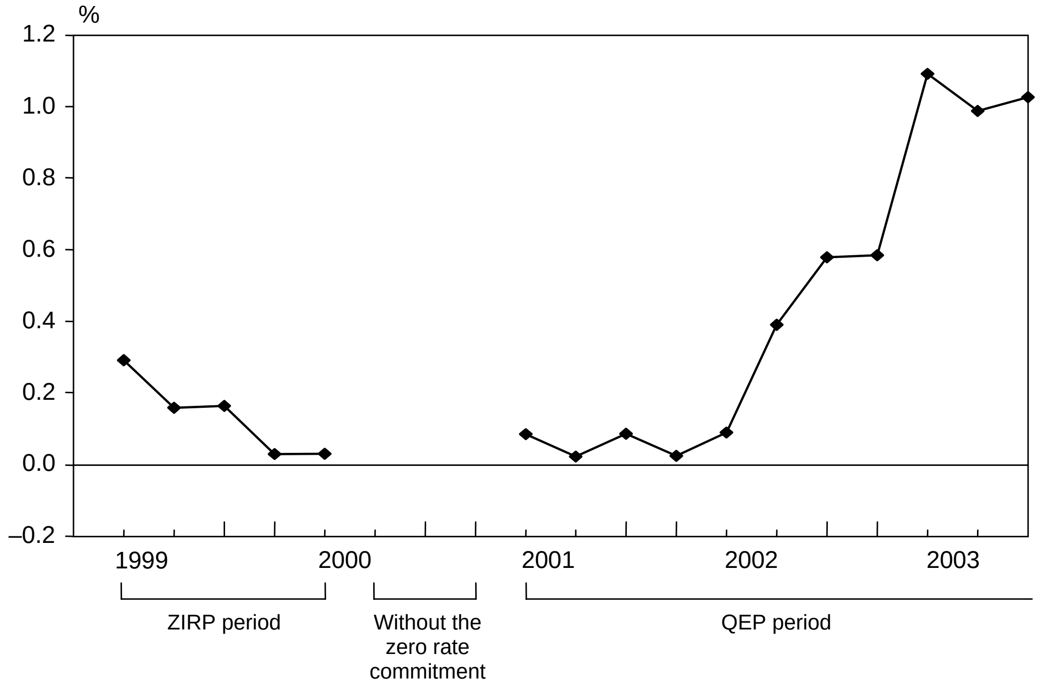


Figure 18

Estimation of expectations theory and risk premium components of medium/long-term interest rates

(1) 10-year interest rate

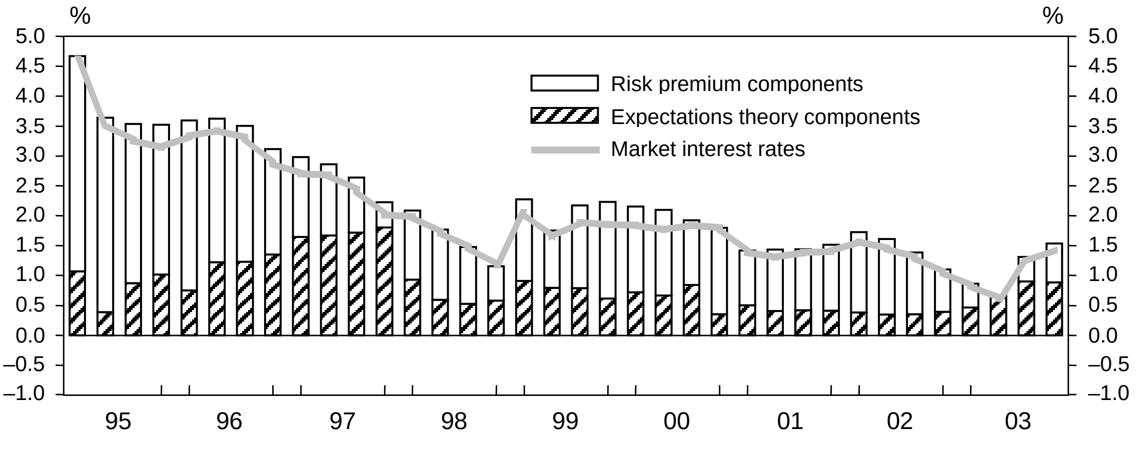
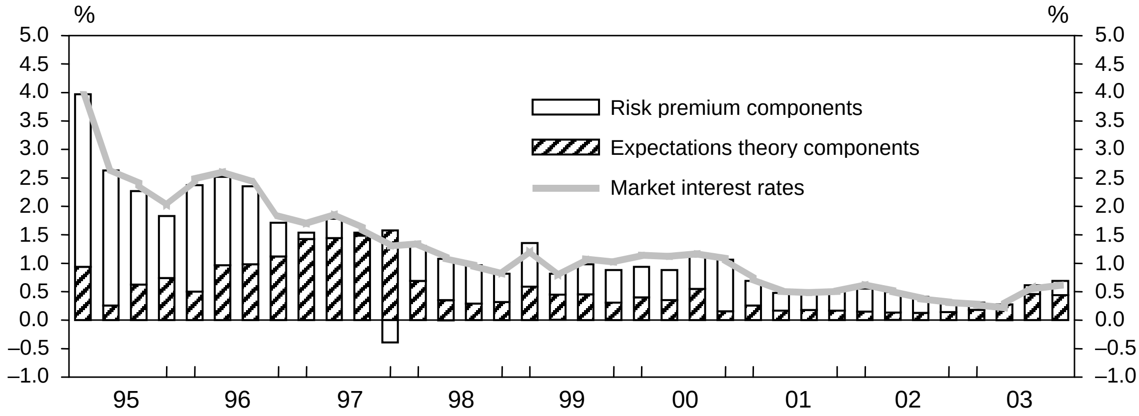


Figure 18 (cont)

Estimation of expectations theory and risk premium components of medium/long-term interest rates

(2) Five-year interest rate



(3) Three-year interest rate

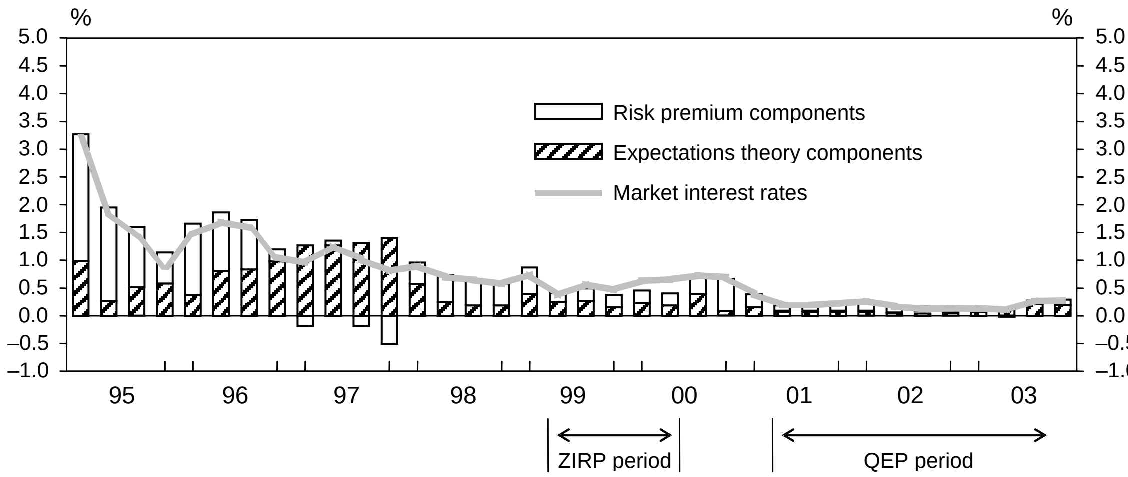


Figure 19

Expectations theory components of medium/long-term interest rates

Effects of the zero rate commitment

(1) Three-year interest rate

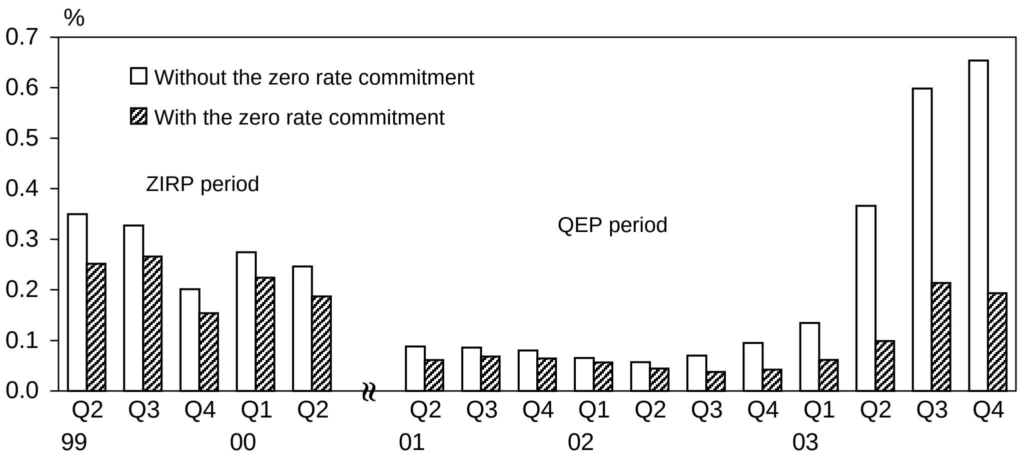
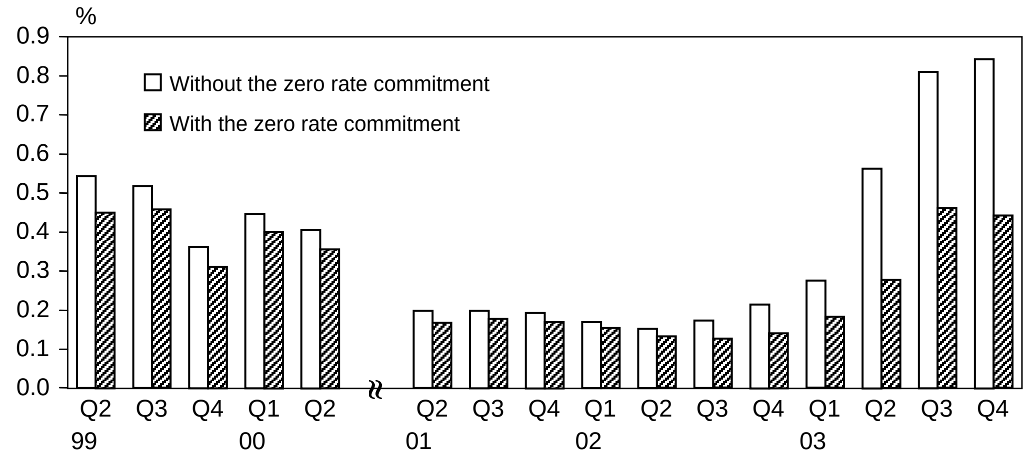


Figure 19 (cont)

Expectations theory components of medium/long-term interest rates

Effects of the zero rate commitment

(2) Five-year interest rate



(3) 10-year interest rate

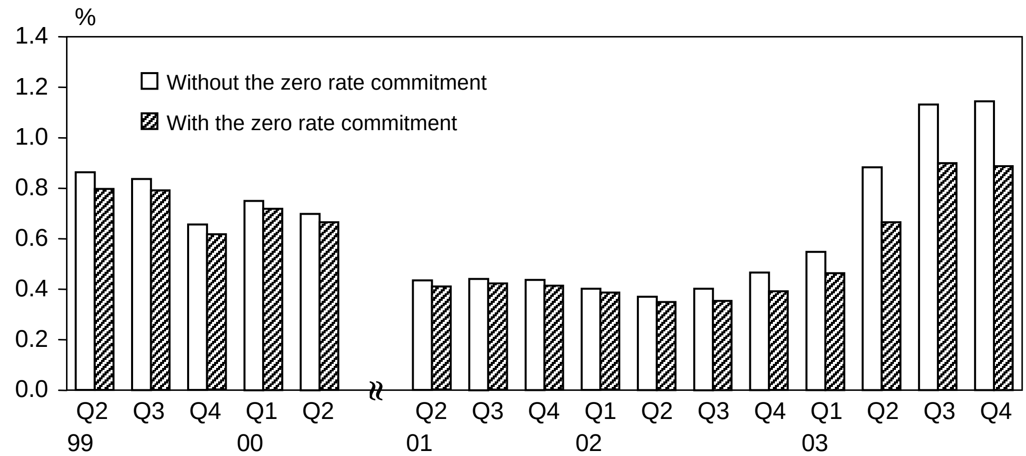


Figure 20

Risk premium components of medium/long-term interest rates

Effects of the zero rate commitment

(1) Three-year interest rate

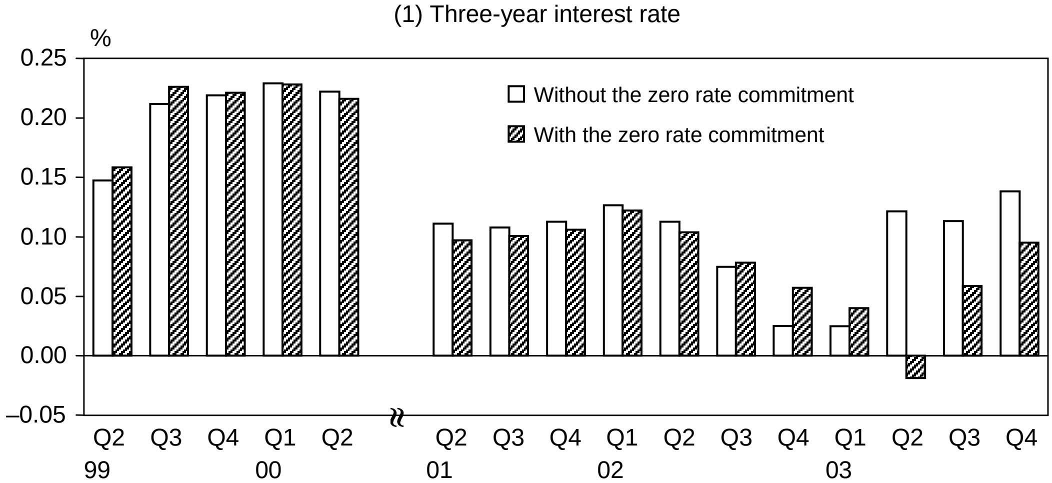
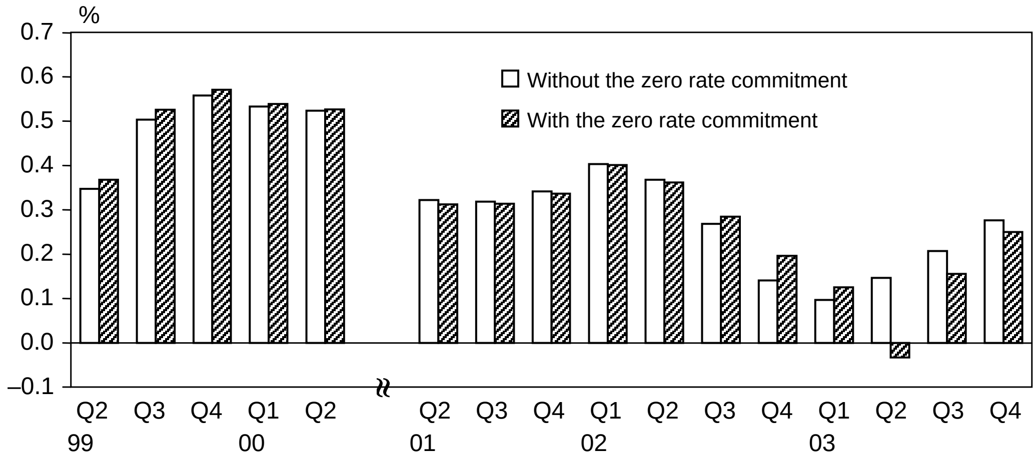


Figure 20 (cont)

Risk premium components of medium/long-term interest rates

Effects of the zero rate commitment

(2) Five-year interest rate



(3) 10-year interest rate

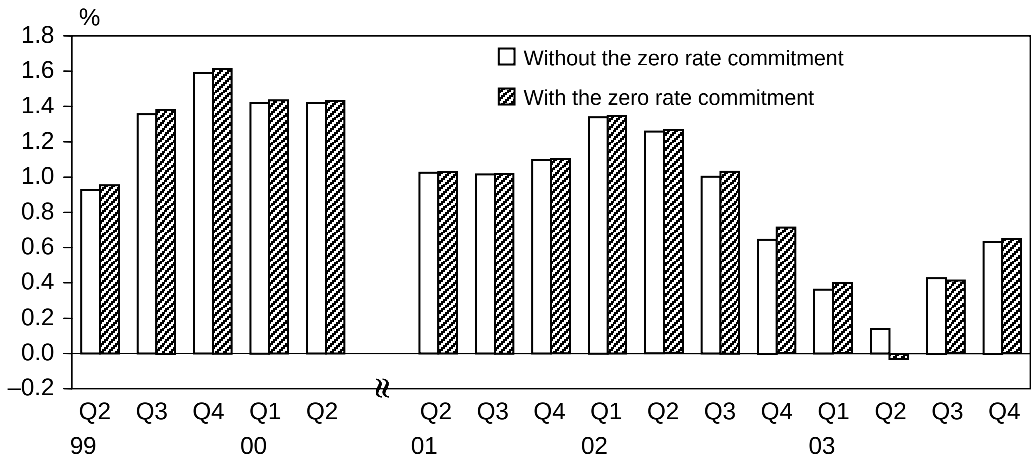
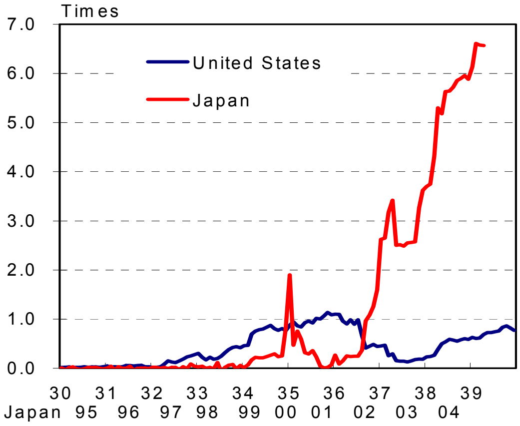


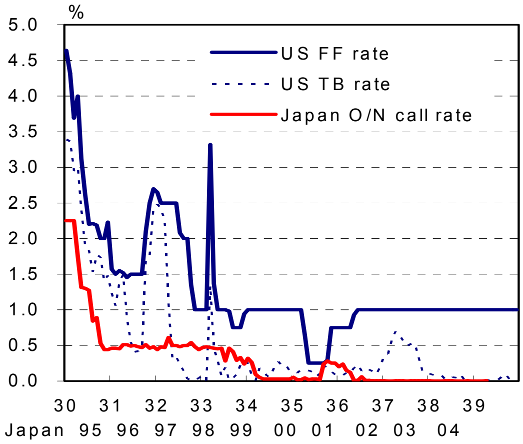
Figure 21

Comparison between the United States and Japan

(1) Ratio of excess reserves to required reserves

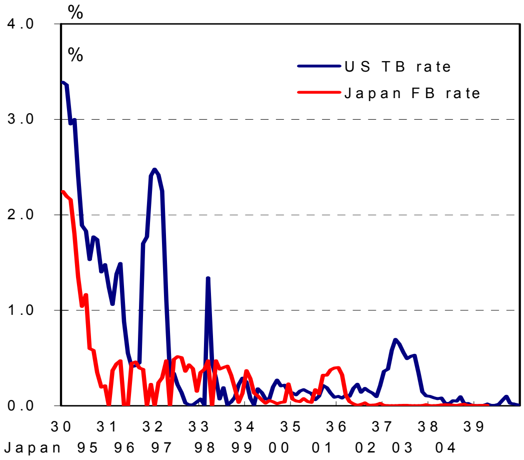


(2) Short-term interest rates

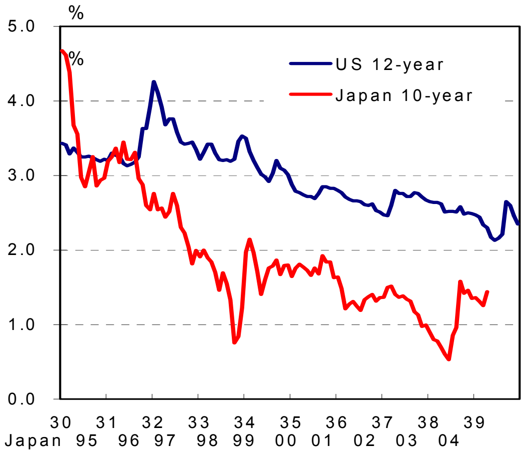


Note: excess reserves = total reserves – required reserves.

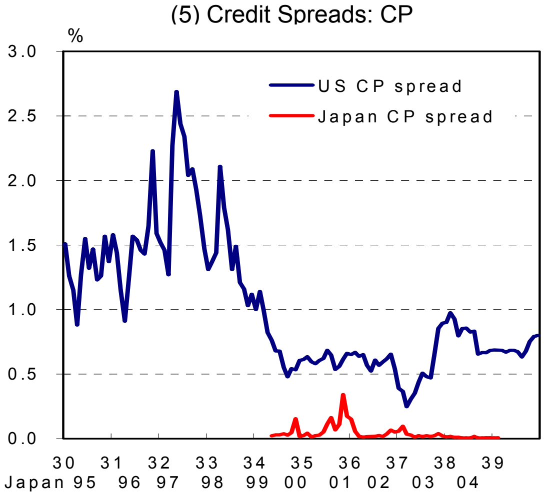
(3) TB/FB rates



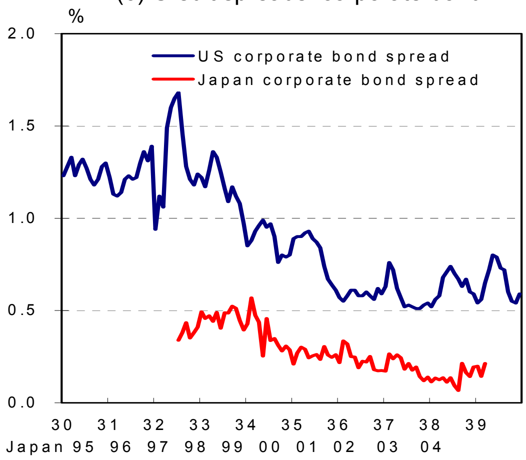
(4) Yields on government bonds



(5) Credit Spreads: CP



(6) Credit spreads: corporate bond

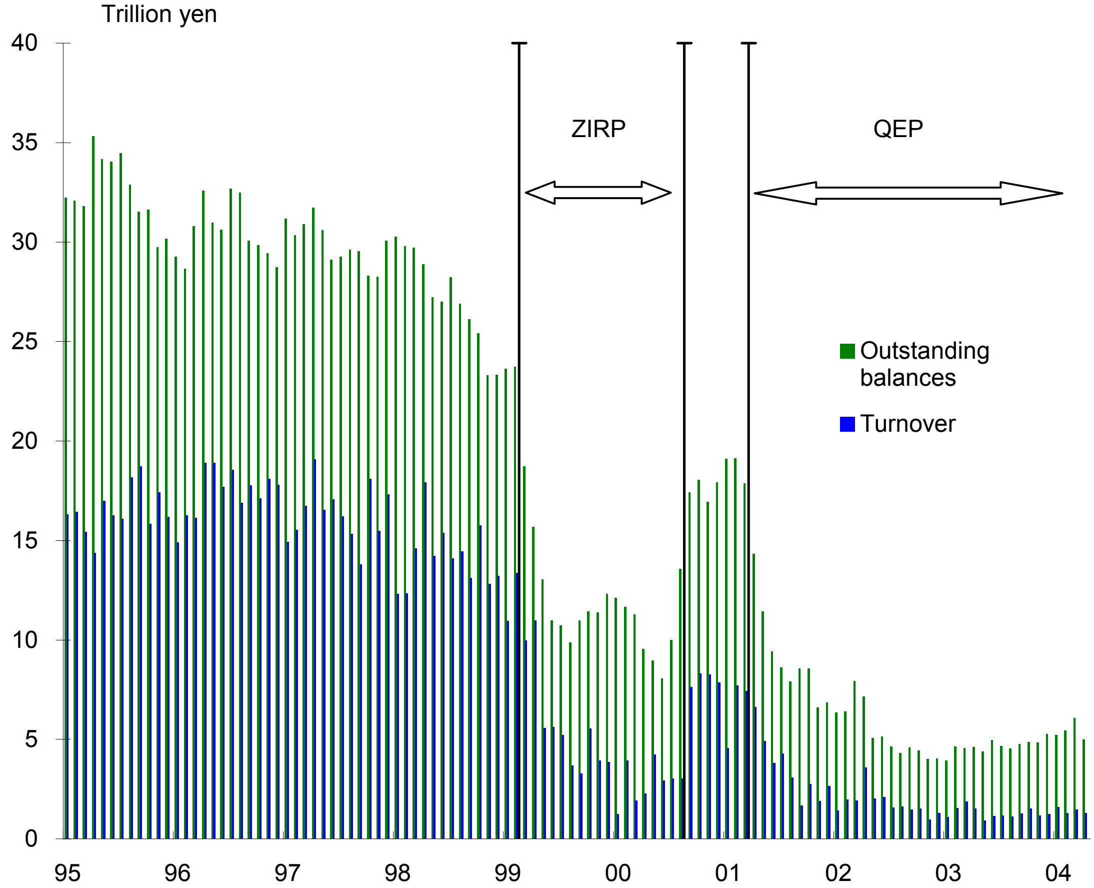


Notes: 1. US CP spread = yields on primary-rated CP (4-6-month) – yields on TBs (3-month). 2. US corporate bond spread = yields on AAA-rated bonds (40-50-year) – yields on government bonds (12-year). 3. Japan commercial paper spread = yields on A-1 + rated CP – yields on FBs (3-month). 4. Japan corporate bond spread = yields on Aa-rated corporate bonds – yields on government bonds (5-year). 5. The indicated ratings are of Moody's (except Japan's CP).

Sources: NBER Macrohistory Database; Bank of Japan; Japan Securities Dealers Association; Bloomberg.

Figure 22

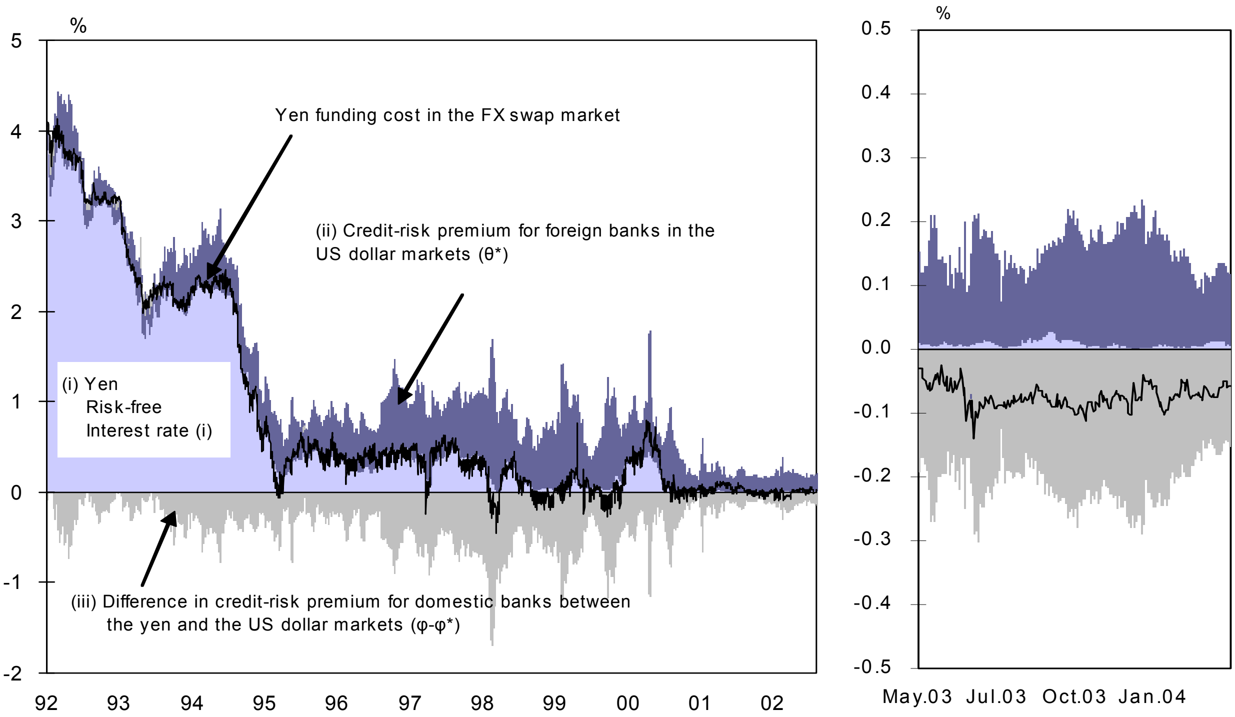
Outstanding balances and turnover in the uncollateralised o/n call market



Source: Bank of Japan.

Figure 23

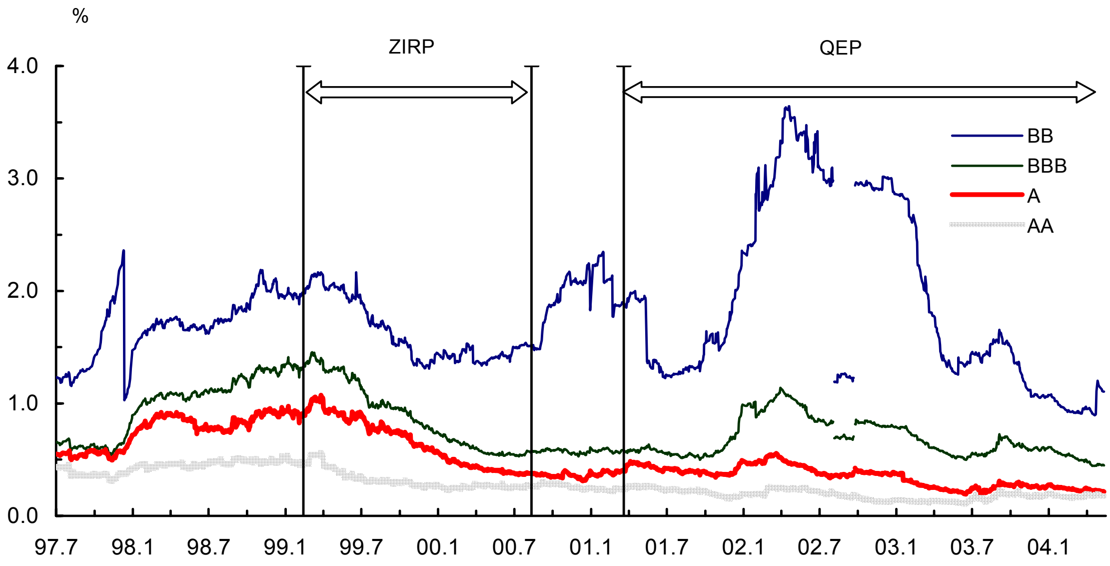
Factor decomposition of yen funding costs of foreign banks



Notes: 1. Credit-risk premiums are defined as the spread between the US dollar/yen interest rates and TB rates. Maturity of interest rates is three-month. 2. Before March 2003, the following proxies are used: yen rates for domestic banks: yen Tokyo Interbank Offered Rate (TIBOR); yen rates for foreign banks: yen London Interbank Offered Rate (LIBOR); US dollar rates for domestic banks: dollar TIBOR rates; US dollar rates for foreign banks: US dollar LIBOR rates.

Figure 24

Spreads between corporate bond and government bond yields



Notes: 1. Yields on bonds with five-year maturity. 2. The indicated ratings are of Moody's.

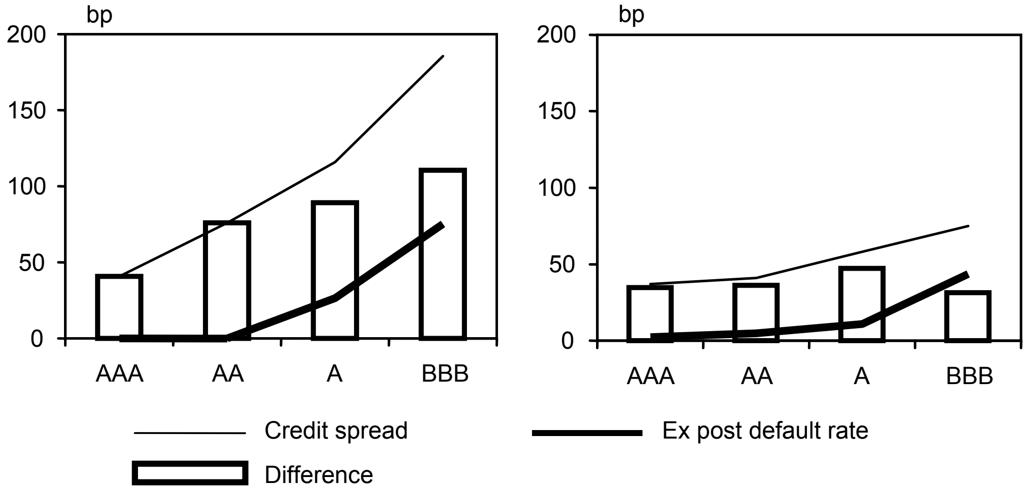
Sources: Japan Securities Dealers Association, *Over-the-Counter Standard Bond Quotations*, *Reference Price (Yields) Table for OTC Bond Transactions*.

Figure 25

Credit spreads and default rates

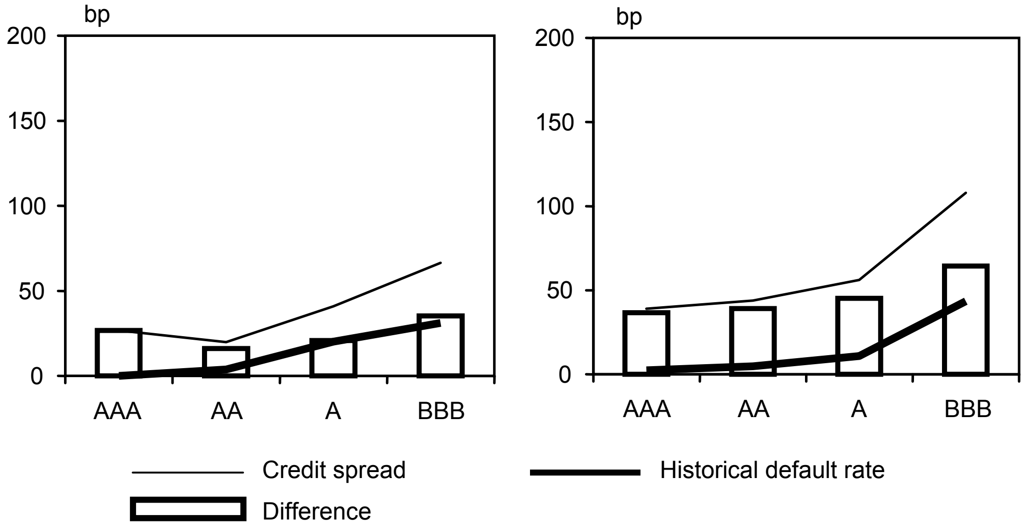
(1) April 1998

(a) Japan (b) United States



(2) May 2004

(a) Japan (b) United States



Notes: 1. Credit spread is the spread between corporate bond and government bond yields. 2. The indicated ratings of Japan are of R&I, and those of the United States are of Moody's and S&P. 3. Ex post default rate is the annualised actual default rate computed by the cumulative default rates of corporate bonds from 1998 to 2003. 4. Historical default rate is the annualised cumulative default rate computed by all issues in the last 21-years (Japan) and 29-years (United States). 5. Recovery rate is assumed to be zero. The default rates in the US charts also cover defaults of non-US corporations.

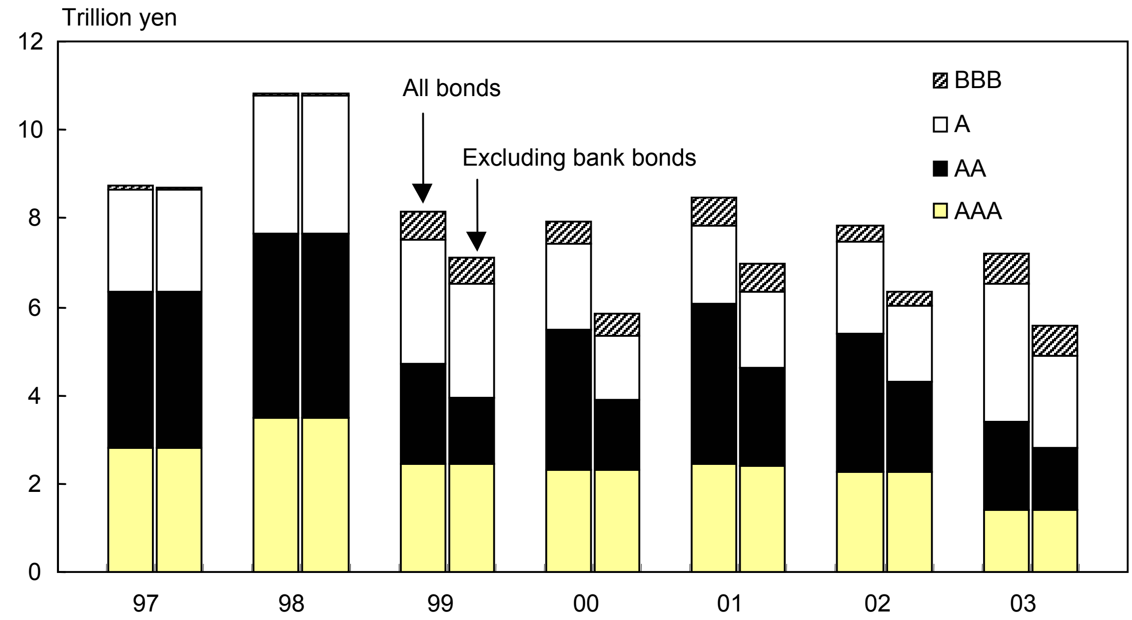
Sources: Japan Securities Dealers Association; Merrill Lynch; R&I; Moody's. S&P

Figure 26

Issue volume of corporate bonds by credit rating

(1) Japan

Issue volume

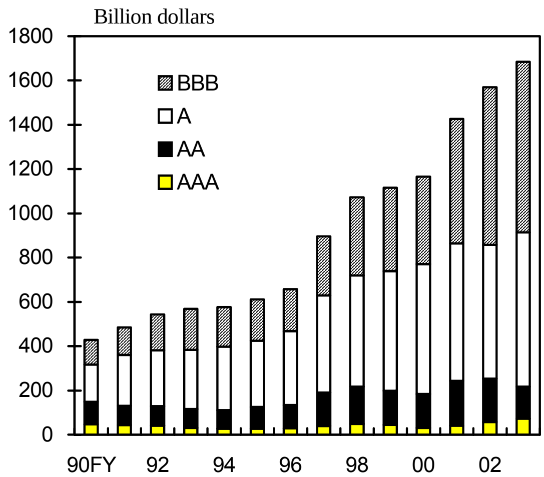


Note: In the case of multiple ratings assigned to a company, the higher one is adopted.

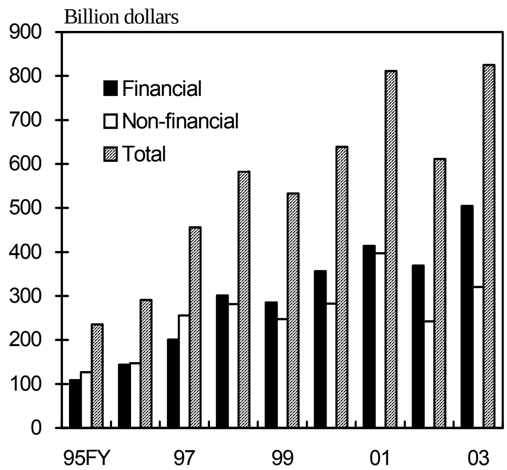
Source: I-N Information Systems.

(2) United States

Amounts outstanding



Issue volume



Note: Figures include financial bonds. Source: Merrill Lynch.

Source: Thomson Financial Securities Data.

Figure 27

Entry and exit of investors

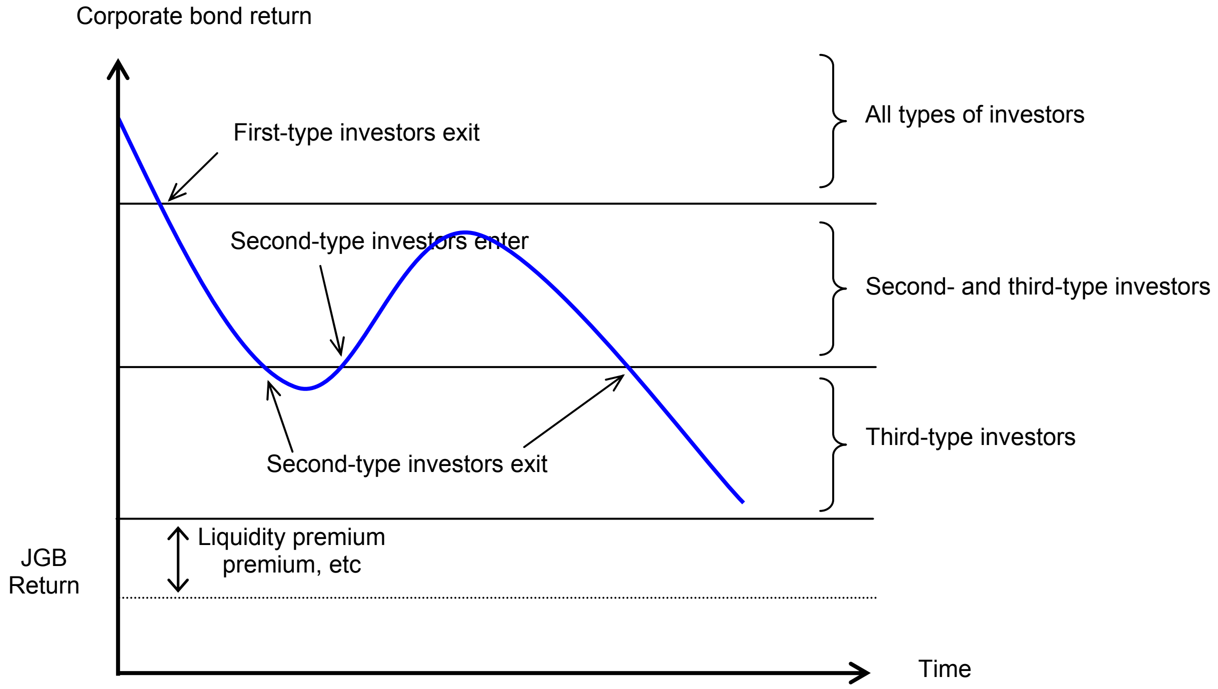
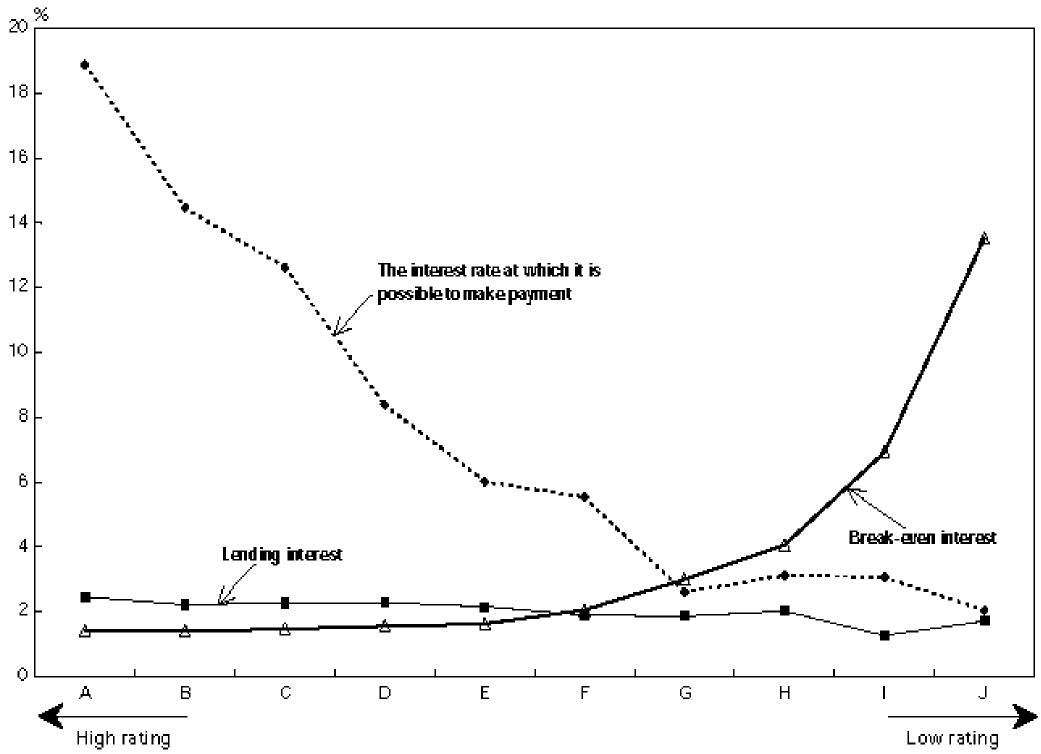


Figure 28

Probability and credit ratings



Lending interest = (borrower's) interest payment/(borrower's) liability with interest.

Break-even interest = rate of credit cost* + short-term prime rate**.

*The ratings below J are defined as a default. The recovery rate is assumed uniformly to be 50 per cent.

**A short-term prime rate is substitution of fund-raising costs and expenses.

The interest rate at which it is possible to make payment = cash flow before interest payment/liability with interest.

The graph was created from the financial data of about 120,000 borrowers that the CRD holds (provided by member institutions). Ratings were assigned by the Bank of Japan on our side based on the marks of the CRD.

In a strict sense, differences between lending interest rates and break-even interest rates show a larger proft than the actual ones for normal borrowers, because there are differences of duration, and banks take greater interest risk. Therefore, it is necessary to take into account this factor. However, it has little impact under the present yield curve.

Break-even interest does not include costs for allocated capital, which covers unexpected credit risks.

Source: "Evaluating the Economic Value of Loans and the Implications: Toward Transformation of the Business Model of Banks and Nonbank Firms," *Bank of Japan Quarterly Bulletin*, August 2003.

Appendix 1
A macro model of the Japanese economy with a financial accelerator

In this appendix, we provide a dynamic general equilibrium model of the Japanese economy incorporating credit-market imperfections, based on the approach of Bernanke, Gertler and Gilchrist (1999). The model contains a financial accelerator mechanism which propagates and amplifies a shock to the financial condition of borrowers.

1. Model

We start with a description of the details of the entire log-linearised system. All data are divided by productivity multiplied by population, and are shown as percentage deviations from the steady state.

1.1 Aggregate demand

$$\hat{y}_t = \varpi^c \hat{c}_t + \varpi^i \hat{i}_t + \left(1 - \varpi^c - \varpi^i\right)\hat{g}_t \tag{1}$$

$$\hat{c}_t = E_t\hat{c}_{t+1} - \left(\hat{r}_t^f - E_t\hat{\pi}_{t+1}^c\right) + E_t\hat{a}_{t+1}^c \tag{2}$$

$$\hat{r}_t^k = \left(1 - \beta^k\right)\left(\hat{y}_t - \hat{k}_t + \hat{x}_t^i\right) + \hat{\pi}_t^i + \frac{\beta^k}{1-\delta}\hat{q}_t - \hat{q}_{t-1} \tag{3}$$

$$E_t\hat{r}_{t+1}^k = \hat{r}_t^{cc} \tag{4}$$

$$\hat{q}_t = \varphi\left(\hat{i}_t - \hat{k}_t\right) \tag{5}$$

where $\hat{y}_t$, $\hat{c}_t$, $\hat{i}_t$ and $\hat{g}_t$ are output, consumption, business fixed investment, and exogenous demand. $\hat{r}_t^f$ is the nominal short-term interest rate, $\hat{\pi}_t^c$ is the CPI inflation rate, and $\hat{a}_t^c$ is the productivity growth of consumption goods. $\hat{r}_t^k$, $\hat{k}_t$, $\hat{x}_t^i$, $\hat{\pi}_t^i$ and $\hat{q}_t$ are the return on capital, the capital stock, the ratio of marginal cost to the price of investment goods, the inflation rate for investment goods, and the ratio of the value of the firm to the capital stock (real), respectively.

Business fixed investment is determined so that the expected return on capital, equation (3), is equal to the cost of capital, equation (4). Given equations (3), (4) and (5), business fixed investment can be expressed as follows.

$$\hat{i}_t = -\varphi^{-1}\left(\hat{r}_t^{cc} - E_t\hat{\pi}_{t+1}^i\right) + \hat{k}_t + E_t\left\{\varphi^{-1}\left(1-\beta^k\right)\left(\hat{y}_{t+1} - \hat{k}_{t+1} + \hat{x}_{t+1}^i\right) + \frac{\beta^k}{1-\delta}\left(\hat{i}_{t+1} - \hat{k}_{t+1}\right)\right\}$$

$$\hat{k}_t = \delta\hat{i}_{t-1} + \left(1-\delta\right)\hat{k}_{t-1} - \hat{a}_t^i - \hat{n}_t \tag{6}$$

$$\hat{r}_t^{cc} = \hat{r}_t^f + \hat{u}_t - \nu\hat{s}_t \tag{7}$$

$$s_t = \beta^s s_{t-1} + \frac{1}{\varpi^s}\hat{r}_t^k - \frac{1-\varpi^s}{\varpi^s}\hat{r}_{t-1}^f - \hat{\pi}_t^i - \left(\hat{q}_t - \hat{q}_{t-1}\right) + \varepsilon^s{}_t \tag{8}$$

where $\hat{a}_t^i$ and $\hat{n}_t$ are the growth rate of productivity in the investment goods industry and the growth rate of population. The cost of capital, $\hat{r}_t^{cc}$, consists of the risk-free rate and a risk premium, which in turn is the sum of an exogenous component, $\hat{u}_t$, and a term that represents the effect of credit market imperfections, $\nu\,\hat{s}_t$, where $\hat{s}_t$ is the ratio of the market value of equity to the value of the firm (EVR) and ν is a positive parameter. A rise in leverage caused by a decline in the stock price is assumed to increase the cost of capital under credit market imperfections. Equation (8) states that EVR is influenced by itself in period $t-1$ and improves gradually when the cash flow of the firm increases. The error term of equation (8), ε^s_t, is an exogenous shock to the ratio of the market value of equity to the value of the firm.

$$\hat{z}_t = \beta^z \hat{z}_{t+1} + \left(1-\beta^z\right)\left(\hat{c}_t - \hat{r}^f_t + E_t\left(\hat{\pi}^c_{t+1} + \hat{a}^c_{t+1} + \hat{n}_{t+1}\right)\right) \quad (9)$$

where $\hat{z}_t$ is real land price.[1]

1.2 Aggregate supply

$$\hat{y}_t = \varpi^h \hat{h}_t + \left(1-\varpi^h\right)\hat{k}_t \quad (10)$$

$$\hat{w}^h_t = \hat{c}_t - \hat{l}_t,\ \hat{h}_t + \eta \hat{l}_t = 0 \quad (11)$$

$$\hat{w}^h_t - \hat{x}^c_t = \hat{y}_t - \hat{h}_t, \quad (12)$$

where $\hat{h}_t$ and $\hat{l}_t$ are labour and leisure. $\hat{x}^c_t$ is the ratio of marginal cost to the CPI. Equations (10) to (12) can be rewritten as follows.

$$\hat{x}^c_t = \frac{\eta^{-1} + 1 - \varpi^h}{\varpi^h}\hat{y}_t + \hat{c}_t - \frac{\left(1+\eta^{-1}\right)\left(1-\varpi^h\right)}{\varpi^h}\hat{k}_t$$

Thus, the ratio of marginal cost to CPI increases when output increases, and decreases when the supply capacity (capital stock) increases.

$$\hat{\pi}^c_t = \beta E_t \hat{\pi}^c_{t+1} + \frac{\left(1-\alpha^c\right)\left(1-\alpha^c\beta\right)}{\alpha^c}\hat{x}^c_t$$

$$\hat{\pi}^i_t = \beta E_t \hat{\pi}^i_{t+1} + \frac{\left(1-\alpha^i\right)\left(1-\alpha^i\beta\right)}{\alpha^i}\hat{x}^i_t \quad (13)$$

The time paths of both the CPI and the price of investment goods follow Phillips curve type equations. They consist of expected inflation rate and the ratio of marginal cost to the price of goods in question. Among them, the ratio of marginal cost to the price of investment goods can be derived from the following definition of relative price.

$$\hat{p}^i_t - \hat{p}^i_{t-1} = \hat{\pi}^i_t - \hat{\pi}^c_t + \hat{a}^i_t - \hat{a}^c_t$$

$$\hat{x}^i_t = \hat{x}^c_t - \hat{p}^i_t \quad (14)$$

where $\hat{p}^i_t$ is the ratio of the price of investment goods to the CPI.

1.3 Monetary policy rule

$$\hat{r}^f_t = \hat{a}^c_t + \phi^\pi \tilde{\pi}^c_t$$

$$\tilde{\pi}^c_t = \left(\hat{\pi}^c_t + \hat{\pi}^c_{t-1} + \hat{\pi}^c_{t-2} + \hat{\pi}^c_{t-3}\right)/4 \quad (15)$$

This policy rule simply assumes that the short rate is a function of the moving average of past CPI inflation rates.[2]

---

[1] Changes in land price can affect the ability of the firm to borrow through the constraint of the collateral, theoretically. However, as the EVR is already modelled to affect the cost of capital, land price is set not to affect other variables.

[2] In the estimation, the monetary policy rule is modified as $\hat{r}^f_t - \phi^{ca} ca_t = \hat{a}^c_t + \phi^\pi \tilde{\pi}^c_t$ where ca_t is excess reserves. This is because the sample includes periods of zero rates when the short rate ceased to respond to inflation rates. Instead, bank reserves have become the operational target of the BOJ. While the BOJ has never stated that excess reserves respond to

2. Data

This model assumes that a balanced growth path exists and that production depends on capital and labour multiplied by the state of technology. In that sense, productivity should have the same trend as the ratio of the nominal wage rate to either CPI or the price of investment goods. We used the Hodrick-Prescott (HP) trend of the ratio of the nominal wage rate to the CPI as a proxy for productivity. Output, consumption, business fixed investment, exogenous demand and capital stock are divided by labour in efficiency units, ie the HP trended population of the age 15 and above multiplied by productivity mentioned above.

All variables are shown as percentage deviations from the steady state. As the steady state value of each variable is not necessarily known, the average trend of the sample period is used except for the steady state value of inflation. The steady state value of CPI inflation is equal to the target rate of the CPI and is calculated from the constant term of the estimated policy rule equation.

3. Estimation results

Figure A1-1 shows results of GMM estimation of the model using quarterly data over the period 1981/QI-2003/QI.

Figure A1-1

Estimation results

(1) System estimation of equations based on behaviours of economic agents

Parameter	Estimate	Standard error
β	0.997	0.000
ν	0.038	0.019
β^k	0.987	0.005
δ	0.019	0.000
α^c	0.742	0.049
α^i	0.824	0.319
φ	0.866	0.053
ϖ^s	0.497	0.016
β^s	0.942	0.011
ϕ^{CA}	0.001	0.000
$\overline{\pi}^c$	0.004	0.001
ϕ^{π}	1.448	0.073
β^z	0.979	0.003

Test of overidentifying restrictions = 28.963 [p-value 0.571].

Notes: Instruments used include one lag of the variables of each equation. A two-lag Newey-West estimation of the covariance matrix is used.

inflation, it sometimes raised the reserve target in response to deteriorating economic conditions. Thus, the modification seems to capture the BOJ's behaviour through the sample period as a rough first approximation. The excess reserve variable, however, does not appear in any other part of the model.

Figure A1-1

Estimation results

(2) System estimation of other equations

Parameter	Estimate	Standard error
η	6.353	0.018
ϖ^c	0.564	0.002
ϖ^i	0.168	0.001
ϖ^h	0.661	0.003

Test of overidentifying restrictions = 37.415 [p-value 0.136].

Notes: Instruments used include two lags of the variables of all equations. A one lag Newey-West estimation of the covariance matrix is used.

Appendix 2:
Testing the effects of the ZIRP and QEP with a macro finance model

This appendix presents the details of the analysis reported in Section 2.2. We use a macro finance model,[3] building on Oda and Kobayashi (2003), that combines a small macroeconomic model with a finance theory approach.

1. Model of the economy

We assume a small backward-looking model consisting of aggregate demand and supply equations and a monetary policy rule. The model is estimated by the maximum likelihood method using data from 1980/Q1-1999/Q1. The choice of the estimation period reflects the adoption of the ZIRP in 1999/Q2. In the simulations reported below to calculate expected future short rates and risk premiums for the period after 1999/Q2 we assume that the parameters of the model remained the same. The equations are

$$\text{(AD)}\; y_t = \underset{(0.102)}{0.735}\,y_{t-1} + \underset{(0.117)}{0.108}\,y_{t-2} + \underset{(0.126)}{-0.159}\left(\frac{i_{t-1}+i_{t-2}}{2} - \frac{\pi_{t-1}+\pi_{t-2}}{2} - \frac{r^n_{t-1}+r^n_{t-2}}{2}\right) + \varepsilon^d_t \qquad (1)$$

$$\text{(AS)}\,\pi_t = 1.552\pi_{t-1} + (-0.552)\pi_{t-2} + 0.008y_{t-1} + \varepsilon^s_t \qquad (2)$$

(Monetary policy)

Type 1: the rule without the zero rate commitment (up through 1999/Q1 and 2000/Q3-2001/Q1)

$$i^*_t = \underset{(0.079)}{0.723}{}_i \cdot i^*_{t-1} + (1-\underset{(0.079)}{0.723})\cdot[(r^n_t + \pi_t) + \underset{(0.134)}{0.139}\,(\pi_t - \pi^*) + \underset{(0.305)}{0.251}\,y_t] \qquad (3)$$

$$i_t = \max\,[i^*_t, 0] \qquad (4)$$

Type 2: the rule with the zero rate commitment (1999/Q2-2000/Q2 and 2001/Q2-2003/Q4)

$$i^*_t = 0.723\cdot i^*_{t-1} + (1-0.723)\cdot[(r^n_t + \pi_t) + 0.139(\pi_t - \pi^*) + 0.251y_t] \qquad (5)$$

$$i_t = 0 \quad \textit{if} \quad i^*_t < 0 \;\text{ or }\; \overline{\pi}_t < x\%$$

$$i_t = i^*_t \quad \textit{if} \quad i^*_t \geq 0 \;\text{ and }\; \overline{\pi}_t \geq x\% \qquad (6)$$

(Disturbances)

$$\text{Demand shock: } \varepsilon^d_{t+1} = \underset{(0.105)}{-0.003}\,\varepsilon^d_t + u^d_t\,,\;\; u^d_t \sim N(0,0.722) \qquad (7)$$

$$\text{Supply shock: } \varepsilon^s_{t+1} = \underset{(0.055)}{0.060}\,\varepsilon^s_t + u^s_t\,,\;\; u^s_t \sim N(0,0.417),\;\; corr(u^d_t, u^s_t) = -0.08 \qquad (8)$$

<Notation>

y_n output gap: deviation from the HP-filtered real GDP (sa)

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[3] Examples of the application of the macro finance approach to studies of the effects of monetary policy are Rudebusch and Wu (2003) and Hördahl, Tristani and Vestin (2003). The analysis in this appendix differs from them in its explicit recognition of the nonlinearity of the monetary policy rule, ie the zero bound on nominal interest rates and the zero rate commitment by the BOJ.

π_t inflation rate: the growth rate of the core CPI

r_t^n natural rate of output: $r_t^n = (y_t^* - y_{t-1}^*) + const$

y_t^* potential output: the HP-filtered real GDP (sa)

i_t nominal short-term interest rate: defined as an overnight call rate

i_t^* nominal short-term interest rate in case without the nominal zero bound or the zero rate commitment

π_t^* targeted inflation rate to be set at 1.81%, which is the average of the realised rate during the estimation period

$\overline{\pi}_t$ two-quarter backward moving average of inflation rate

x the threshold rate of inflation for the zero rate commitment

ϕ_1, ϕ_2, σ, φ, κ: structural parameters

ρ_i, δ_y, δ_π: policy parameters

The default monetary policy rule (Type 1) is set to be a modified Taylor rule that incorporates slow policy adjustment and the zero bound constraint on nominal interest rates. The BOJ's commitment to maintain a zero short rate until consumer price inflation becomes positive (the ZIRP/RZIRP) is modeled as maintenance of a zero rate until inflation exceeds the threshold rate (x) in the Type 2 rule.

2. Decomposition of the long-term interest rates into expectations theory and risk premium components by Monte Carlo simulation

We combine the macro model, estimated above, with the no-arbitrage asset pricing theory in finance in order to derive the model-based yield curve, or medium- and long-term interest rates. We assume that the threshold rate of inflation in the monetary policy rule, as well as the market prices of risk regarding the aggregate demand and supply shocks to the goods market are time-variant and are estimated simultaneously from the yield curve observed in the market at each point in time.

Given the threshold rate and the market prices of risks, the model-based yield curve R_t^T, ie the interest rate at t on a bond maturing at T, can be described as follows.

$$R_t^T \equiv -\frac{1}{T-t}\ln P(t,T), \tag{9}$$

where $P(t,T) = E_t^Q \exp[-\int_t^T \hat{i}_s ds]$ is the price at t of a discount bond maturing at T.

Here, $\hat{i}_t$ denotes the path of the short-term interest rate in the future and E_t^Q is the expectations operator under the Martingale measure (that is, the risk-neutral measure). The stochastic process for $\hat{i}_t$ is determined by the macro model, which is driven by the demand and supply shocks. The shocks can be written as stochastic processes by simply transforming equations (7) and (8).

$$d\varepsilon_t^d = -(1-\rho_d)\,\varepsilon_t^d dt + \sigma_d dB_t^d,\ \rho_d = -0.003,\ \sigma_d = 0.722, \tag{10}$$

$$d\varepsilon_t^s = -(1-\rho_s)\,\varepsilon_t^s dt + \sigma_s dB_t^s,\ \rho_s = 0.060,\ \sigma_s = 0.417, \tag{11}$$

where dB_t^d and dB_t^s denote the increments of a standard Brownian motion. Based on the no-arbitrage pricing theory,[4] these stochastic processes must be transformed into risk-neutral processes, as below, to calculate expectations in equation (9).

4 Examples of standard literature on this issue are Duffie (2001) and Hull (2001).

$$d\hat{\varepsilon}_t^d = [-(1-\rho_d)\,\hat{\varepsilon}_t^d - \lambda^d \sigma_d]\,dt + \sigma_d d\hat{B}_t^d, \tag{12}$$

$$d\hat{\varepsilon}_t^s = [-(1-\rho_s)\,\hat{\varepsilon}_t^s - \lambda^s \sigma_s]\,dt + \sigma_s d\hat{B}_t^s, \tag{13}$$

where λ^d and λ^s denote the market prices of risk regarding the demand and supply shock, respectively, and the hats (^) on the stochastic variables mean that they are defined under the Martingale measure. Given the threshold rate and the market prices of risks, we can calculate equation (9) numerically. That is, we conduct Monte Carlo simulations to derive the future paths of the output gap, inflation and the short-term interest rate under the Martingale measure, starting from the initial value of the endogenous variables at observation time.[5] This leads to the model-based yield curve.

We then estimate the threshold rate and the market prices of risk in such a way that the model-based yield curve best fits the yield curve observed in the market. Specifically, we search for the values that minimise the sum of the square errors at 20 grid points, set at every sixth month on the yield curve, between the two curves. The observed yield curve is derived by McCulloch's (1971) method from the price data of all JGBs outstanding.

Figure 17 shows the estimated value of the threshold inflation rate. Figure 18 shows the model-based interest rates, expectations theory and risk premium components at 10-, five- and three-year horizons. Specifically, by conducting the Monte Carlo simulation mentioned above with both the market prices of risk and threshold rate set at the estimated value, we obtain the model-based interest rates. On the other hand, by conducting the simulation with both the market prices of risk set at zero and with the threshold rate at the estimated value, we obtain the expectations theory components of the interest rates. The risk premium components are defined as the former minus the latter.

In addition, we can calculate the hypothetical long-term interest rates, and their components, that should be realised in the case without the zero rate commitment. These are derived by the Monte Carlo simulation with the Type1 policy rule (the version without the commitment) for the ZIRP/RZIRP periods. The results are shown in Figure 19 and 20. Discussions of the results in Figures 17-20 are provided in the main text.

3. Regression analysis on monetary policy effects

Hypothesis testing regarding the effects of various aspects of QEP can be done by simple regressions using the results of the above section. Specifically, we have already examined the effects of the RZIRP on interest rates. Below, we analyse the effects on interest rates of ECAB, the expansion of the CAB target, and purchases of long-term government bonds. This is done by regressing the commitment effect, ie the differences in the expectations theory component of interest rates between the cases with and without the commitment, and the risk premium on the CAB target and the amount of government bond purchases. While there is no obvious mechanism by which ECAB or purchases of government bonds affect expected future short rates, we may interpret findings of the existence of such effects as signaling effects. That is, these moves may have been interpreted by the market as indicating greater willingness on the part of the BOJ to carry out the RZIRP, thus a rise in the threshold rate. ECAB has been accompanied by increases in various funds-providing operations including purchases of government bonds. It is quite possible that these operations affected the risk premium components of interest rates.

The results of such regressions are as follows. Table A2-1 contains estimation results of the effects of ECAB. We first regressed the effects of the zero rate commitment (Figures 19 and 20) on the CABs assuming that the disturbance term is AR (1). The upper table in Table A2-1 shows that for each of the 10-, five- and three-year interest rates the CAB is statistically significant, although the estimated

[5] We cannot calculate this analytically since the policy rule includes nonlinearity due to the zero rate commitment and the nominal zero bound.

coefficients are not large.[6] This result may imply the existence of signaling effects or it may just be a finding of a spurious correlation as discussed in the text.

We then regressed the risk premium components (Figure 18) of the long-term interest rates on the CAB along with two other variables, assuming again AR (1) structure for the disturbance term. The variables included are the turnover rate of JGBs, as a measure of the liquidity premium, and the spread between TB and banks' CD rates, as a proxy of "flight to quality" effects. The lower table in Table A2-1 presents the results. At all maturities, the relationship is statistically insignificant.

Next, we conduct regressions similar to the ones above, with the amount of the BOJ's purchases of long-term JGBs replacing the CAB. The effects on the expectations theory component of interest rates are shown in the upper table of Table A2-2. At all maturities the relationship is statistically insignificant.

We finally estimate two sets of equations regarding the possible effects of the BOJ's purchases of long-term JGBs on the risk premium. First, we regressed the risk premium components of the long-term interest rates on the share of JGBs held by the BOJ in total JGBs outstanding . As the lower left table in Table A2-2 shows, the variable is statistically insignificant at all maturities. Second, we regressed the risk premium components on the flow amount of the BOJ's purchases of JGBs in each quarter. As shown in the lower right table in Table A2-2, this variable was also statistically insignificant at all maturities.

6 For example, an increase in the current account balance by 10 trillion yen is likely to lower the 10-year interest rate by 0.09%.

Table A2-1

Regression analysis of the effects of the expansion of BOJ current account balances

Regression method: maximum likelihood with AR(1)
Period: 1995/Q1-2003/Q4

	Effects of the zero rate commitment in the expectations theory components[1]		
	10-year	**Five-year**	**Three-year**
BOJ current account	0.009	0.015	0.016
Std err	*0.00*	*0.00*	*0.00*
P-value	*0.00*	*0.00*	*0.00*
Const	–0.04	–0.07	–0.08
Std err	*0.02*	*0.06*	*0.07*
P-value	*0.11*	*0.21*	*0.29*
AR(1)	0.78	0.86	0.88
Std err	*0.14*	*0.13*	*0.13*
P-value	*0.00*	*0.00*	*0.00*
Adj-R2	0.91	0.90	0.89
Std err of equation	0.02	0.31	0.04
DW	1.85	1.50	1.21
	Risk premium components[2]		
	10-year	**Five-year**	**Three-year**
BOJ current account	–0.012	–0.002	0.001
Std err	*0.02*	*0.02*	*0.01*
P-value	*0.60*	*0.92*	*0.95*
Turnover rate of JGBs	–0.19	–0.20	–0.16
Std err	*0.07*	*0.07*	*0.06*
P-value	*0.01*	*0.01*	*0.01*
TB–CD	0.53	0.57	0.45
Std err	*0.56*	*0.53*	*0.46*
P-value	*0.35*	*0.29*	*0.34*
Const	2.28	1.65	1.17
Std err	*0.56*	*0.46*	*0.39*
P-value	*0.00*	*0.00*	*0.01*
AR(1)	0.80	0.73	0.71
Std err	*0.07*	*0.07*	*0.07*
P-value	*0.00*	*0.00*	*0.00*
Adj-R2	0.83	0.75	0.69
Std err of equation	0.31	0.28	0.24
DW	2.59	2.22	2.05

Table A2-2

Regression analysis on the effects of the increase in BOJ's purchase of long-term JGBs

Regression method: maximum likelihood with AR(1)
Period: 1995/Q1-2003/Q4

	Effects of the zero rate commitment in the expectations theory components		
	10-year	**Five-year**	**Three-year**
BOJ's purchase of JGBs	0.00	–0.01	–0.04
Std err	*0.02*	*0.03*	*0.03*
P-value	*0.85*	*0.74*	*0.19*
Const	1.7E2	2.9E2	0.03
Std err	*2.9E5*	*5.6E5*	*0.05*
P-value	*0.99*	*0.99*	*0.53*
AR(1)	0.99	0.99	1.22
Std err	*0.10*	*0.10*	*0.09*
P-value	*0.00*	*0.00*	*0.00*
Adj-R2	0.81	0.81	0.86
Std err of equation	0.03	0.05	0.04
DW	1.90	1.50	2.03

	Risk premium components[1]				**Risk premium components[2]**		
	10-year	**Five-year**	**Three-year**		**10-year**	**Five-year**	**Three-year**
BOJ's share of JGBs	0.06	0.06	0.04	BOJ's purchase of JGBs	–0.15	–0.01	0.03
Std err	*0.07*	*0.04*	*0.04*	*Std err*	*0.09*	*0.06*	*0.06*
P-value	*0.40*	*0.13*	*0.24*	*P-value*	*0.11*	*0.86*	*0.60*
Turnover rate of JGBs	–0.23	–0.16	–0.12	Turnover rate of JGBs	–0.20	–0.17	–0.13
Std err	*0.07*	*0.05*	*0.05*	*Std err*	*0.07*	*0.06*	*0.05*
P-value	*0.00*	*0.00*	*0.02*	*P-value*	*0.01*	*0.01*	*0.01*
TB-CD	0.54	0.12	0.00	TB-CD	0.47	–0.14	0.23
Std err	*0.58*	*0.42*	*0.38*	*Std err*	*0.53*	*0.40*	*0.36*
P-value	*0.36*	*0.78*	*1.00*	*P-value*	*0.39*	*0.74*	*0.53*
Const	1.37	0.24	0.04	Const	2.54	1.35	0.83
Std err	*1.28*	*0.76*	*0.71*	*Std err*	*0.42*	*0.32*	*0.29*
P-value	*0.30*	*0.75*	*0.95*	*P-value*	*0.00*	*0.00*	*0.01*
AR(1)	0.49	0.25	0.29	AR(1)	0.39	0.29	0.33
Std err	*0.13*	*0.14*	*0.16*	*Std err*	*0.15*	*0.16*	*0.16*
P-value	*0.00*	*0.10*	*0.08*	*P-value*	*0.02*	*0.08*	*0.05*
Adj-R2	0.54	0.42	0.32	Adj-R2	0.57	0.36	0.29
Std err of equation	0.28	.21	0.19	Std err of equation	0.27	0.22	0.19
DW	2.46	2.09	1.72	DW	2.35	2.00	1.74

Notes: 1. Regression results are not greatly influenced by excluding the turnover rate or the TB-CD spread. 2. Regression results for five- and three-year rates remain insignificant, not greatly influenced by excluding the turnover rate or the TB-CD spread. There is an exception for the 10-year rate, however, in that the result of regression without the turnover rate shows the statistically significant coefficient (p-value = 0.04) for the BOJ's purchase of JGBs.

Appendix 3: Credit risk premium with skewness as an additional risk factor[7]

1. Model

We derive the asset pricing model with skewness as an additional risk factor. First, the representative investor with the following constant relative risk aversion (CRRA) utility function has a portfolio consisting of a risk-free asset and N risky assets:

$$u(W_{t+1}) = \frac{1}{1-\alpha} W_{t+1}^{1-\alpha}, \quad (\alpha > 0) \tag{1}$$

where α denotes the degree of relative risk aversion, and W_{t+1} denotes the amount of the investor's asset holdings at $t+1$. We can specify the optimisation problem of the investor as follows:

$$\text{Max } E_t[u(W_{t+1})],$$

$$\text{st } W_{t+1} = W_t + \left[r_f + \sum_{i=1}^{N} w_{i,t} \left(r_{i,t+1} - r_f \right) \right] \cdot W_t,$$

where r_f and $r_{i,t+1}$ denote the returns on the risk-free asset and the i-th risky asset at $t+1$, and $w_{i,t}$ denotes the capitalisation weight of the i-th asset holdings at t. The first-order condition can be written as follows:

$$E_t[u'(W_{t+1})(r_{i,t+1} - r_f)] = 0. \quad i = 1, \cdots, N \tag{2}$$

Then, we can derive the following pricing model:[8]

$$E_t[r_{i,t+1}] - r_f = [w \times \beta_{im} + (1-w) \times \gamma_{im}] \times (E_t[r_{m,t+1}] - r_f), \tag{3}$$

where

$$\beta_{im} \equiv \frac{\text{cov}(r_{i,t+1}, r_{m,t+1})}{\sigma_m^2}, \; \gamma_{im} \equiv \frac{\text{cov}(r_{i,t+1}, \sigma_m^2)}{\sigma_m^3 \cdot skew_m}, \; w \equiv \frac{1}{1 - \frac{1}{2}(1+\alpha) \cdot \sigma_m \cdot skew_m},$$

$r_{m,t+1}$ denotes the market return, and σ_m^2 and $skew_m$ denotes the variance and skewness of the market return. β_{im} is referred to as the "beta risk", which expresses the risk from the covariance with market return, as in the orthodox CAPM, while γ_{im} is termed the "gamma risk", which expresses the risk from the co-skewness with the market return. Negative values of $skew_m$ ensure $0 < w < 1$, saying that the risk premium of a risky asset can be expressed as a weighted average of β-risk and γ-risk.

2. Empirical analysis

2.1 Estimation method and data

Using the Japanese and the US data, we estimate equation (3) by the GMM proposed by Hansen (1982). For the Japanese data, we use the Nikko Performance Index with the government bonds and corporate bonds (AAA, AA, A and BBB) as individual asset classes. The sample period is from 4 January 1996 to 6 April 2004. For the US data, we use the BIG Bond in the Citi Group Index with

[7] See Nishioka and Baba (2004b) for more details.

[8] We can obtain equation (3) by deriving the risk premiums of the i-th asset and market portfolio. The risk premiums are derived by approximating equation (2) by the Taylor expansion centred around $E_t[W_{t+1}]$ up to the second order using $W_{t+1} = (1+r_{m,t+1})W_t$. See Nishioka and Baba (2004b) for more details.

Treasury and government supported and corporate bonds (AAA/AA, A and BBB) as individual asset classes. The sample period is from 2 January 1995 to 20 April 2004. Data frequency is daily, and the return period is 20, 60 and 120 business days. Table A3-1 shows the basic statistics of the data in the case of 60 business days.[9]

Table A3-1

Basic statistics

	Japan (from 4 January 1996 to 9 January 2004)						US (from 2 January 1995 to 27 January 2004)				
	r_m	r_{gov}	r_{aaa}	r_{aa}	r_a	r_{bbb}	r_m	r_{gov}	r_{aaa}	r_a	r_{bbb}
Average	0.0328	0.0341	0.0472	0.0321	0.0300	0.0169	0.0781	0.0775	0.0830	0.0873	0.0869
Variance	0.0040	0.0048	0.0083	0.0041	0.0041	0.0126	0.0063	0.0086	0.0086	0.0099	0.0125
Skewness	–0.4300	–0.5415	–0.0255	–0.1706	–0.1685	–1.4826	–0.1448	–0.1228	–0.1941	–0.1482	0.3307

Notes: 1. r_i denotes the return on the *i*-th asset. *m*: bond market portfolio, *gov*: government bonds, *aaa/aa*: AAA/AA corporate bonds, *aaa*: AAA corporate bonds, *aa*: AA corporate bonds, *a*: A CBs, *bbb*: BBB corporate bonds. 2 . The return period is 60 business days. As for the statistics of 20 and 120 days, see Nishioka and Baba (2004b).

2.2 Estimation Results

Table A3-2 shows the estimated values of the degree of relative risk aversion, α, and the risk weight, *w*, in equation (3). We estimated the model with or without the BBB corporate bonds. Also, as for the Japanese case, we estimated the model using the two sample periods, (i) full sample: January 1996 to April 2004, and (ii) the sub-sample: April 1999 to April 2004, during which period the BOJ conducted the ZIRP and QEP.

First, most estimated values of α in Japan are significantly positive, although when excluding the BBB corporate bonds in the sub-sample estimation, α takes a significantly negative value. This result might suggest that Japanese investors have taken excessive risks in the BBB corporate bonds during the sub-sample period. In fact, most Japanese institutional investors such as life insurance companies and pension funds set an internal limit on investment in low-credit bonds including the BBB corporate bonds for their risk-management reasons. Thus, low-credit bondholders in Japan are mainly regional financial institutions and individual investors, who are known as active in credit risk-taking. On the other hand, similar to the Japanese case, the estimated values of α in the United States are significantly positive. Also, their values are higher when all asset classes are included than when excluding the BBB corporate bonds. This result indicates that the US investors have a more cautious attitude toward skewness risk than their Japanese counterparts.

Second, in the Japanese case, the average risk weight of γ-risk, $1-w$, is 3.2%, while in the US case, it is 10.7%. This means that corporate bond pricing in the United States reflects γ-risk much more than that in Japan. Specifically, although the γ-risk of Japanese corporate bonds is statistically significant, the weight of the γ-risk is negligible in its magnitude; Japanese investors care only about the β-risk. On the other hand, the US investors care about γ-risk as well as β-risk.

9 Table 2 in the text shows that γ-risk in the returns on JGBs and corporate bonds rose under the ZIRP.

Table A3-2

Risk weight of β and γ implied by estimation results

	Return period	Sample period	Assets	σ_m	$skew_m$	α		*w*: risk weight of β	1–*w*: risk weight of γ
Japan	20 business days	Full sample: 4 Jan 1996 to 9 Mar 2004	All assets	0.104	–0.232	0.009		98.8%	1.2%
			Excluding the BBB corporate bond			0.802	***	97.9%	2.1%
		Sub-sample: 1 Apr 1999 to 9 Mar 2004	All assets	0.082	–0.643	–3.456	***	109.8%	–9.8%
			Excluding the BBB corporate bond			–2.780	***	106.9%	–6.9%
	60 business days	Full sample: 4 Jan 1996 to 9 Jan 2004	All assets	0.063	–0.430	0.930	***	97.4%	2.6%
			Excluding the BBB corporate bond			0.569	***	97.9%	2.1%
		Sub-sample: 1 Apr 1999 to 9 Jan 2004	All assets	0.046	–1.012	–1.870	***	102.2%	–2.2%
			Excluding the BBB corporate bond			1.596	***	94.0%	6.0%
	120 business days	Full sample: 4 Jan 1996 to 8 Oct 2003	All assets	0.038	–0.098	1.422	***	99.5%	0.5%
			Excluding the BBB corporate bond			1.520	***	99.5%	0.5%
		Sub-sample: 1 Apr 1999 to 8 Oct 2003	All Assets	0.033	–0.441	3.495	***	96.4%	3.6%
			Excluding the BBB corporate bond			10.050	***	91.5%	8.5%
US	20 business days	2 Jan 1995 to 23 Mar 2004	All assets	0.141	–0.183	6.451	***	91.2%	8.8%
			Excluding the BBB corporate bond			7.220	***	90.4%	9.6%
	60 business days	2 Jan 1995 to 27 Jan 2004	All assets	0.079	–0.145	23.994	***	87.5%	12.5%
			Excluding the BBB corporate bond			13.247	***	92.4%	7.6%
	120 business days	2 Jan 1995 to 31 Oct 2003	All assets	0.056	–0.207	41.994	***	80.2%	19.8%
			Excluding the BBB corporate bond			10.093	***	94.0%	6.0%

Notes: 1. The shadowed portion indicates that α is significantly positive. 2. *** denotes significant at the 1% level.

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Remarks on the paper “Japan’s deflation, problems in the financial system and monetary policy”

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Introduction

After the excellent presentation by Kazuo Ueda and the stimulating comments by Mike Mussa, I wonder whether there is still much to say about the Japanese deflation. Of course, I could give the same answer as Zhou Enlai who, when asked to comment on the French revolution, replied that it was still a bit too early to assess! May I at least urge you to read this excellent paper, full of food for thought. Nevertheless, since it is my role to comment on this very thorough analysis, I would first like to say how much I shared the views expressed. I wish then to raise a few questions and discuss some areas for further work.

1. Areas of Agreement

One of the main points stressed by the authors relates to the reasons behind Japan’s economic stagnation. According to them, it is not so much the fact that general price deflation increased the real value of debt, but mainly that asset price deflation negatively impacted lenders’ balance sheets. Indeed, they focus on the volume of non-performing loans, which surged, and the so-called “negative financial accelerator” process. Chart 1 (below) shows that, as measured at the start of 2004, asset prices were indeed around 70-75% below their peak of the early 1990s. By contrast, the CPI started to experience mild deflation only in 1998-99. Between its peak, reached in October 1998, and April 2004, it declined by 3.8%.

The authors offer various measures of the negative financial accelerator effects. Their structural model, based on the work of Bernanke*,* Gertler and Gilchrist (1999), provides impressive results through the measure of EVR (the ratio of the market value of equity to the value of the firm). Admittedly, these results are based on the assumption that the error term of equation 8, describing changes in EVR, expresses an exogenous shock to stock prices, which led to a fall in GDP and the CPI via adverse effects on business fixed investments in the 1990s.

The paper also reminds us that the worst danger from deflation lies in its acceleration, due to expectations of further price declines. This is why it is fundamental to anchor expectations appropriately; and this is what the Bank of Japan has tried and, to some extent, succeeded in doing. According to Krugman and Mishkin, the Bank of Japan should have gone one step further and clearly adopted a positive inflation target. Yet, although the paper by Ueda and Shirakawa does not say so explicitly, the Bank of Japan was right not to commit to a specific rate of inflation at a given time horizon, insofar as it did not have the means to deliver it.

Since this session is on policy options, let us refer briefly to Svensson’s proposal to bring deflation to an end by sharply devaluing the yen. Insofar as the authors do not deal with it, I suppose they doubt the feasibility of the proposal. Among other problems, as Japan is a relatively closed economy, a massive depreciation would be needed to affect demand. This would be unlikely to leave Japan’s trading partners indifferent and would trigger competitive depreciation.

[1] I would like to thank Sylvain Gouteron and Julia Guérin for their help.

Finally, as far as monetary policy is concerned, the authors show that the Bank of Japan was very active. In particular, with a view to alleviating financial sector problems, it implemented unconventional monetary measures. First, it implemented the zero interest rate policy and then it dramatically increased banking liquidity, through “quantitative easing”. The paper provides evidence that expectations and the interest rate structure were significantly affected by the resulting extremely loose financing conditions. Yet, it rightly reminds us that such action was of limited effect, as the weakness of borrowers’ balance sheets did not enable them to take advantage of such conditions.

Although results have to be interpreted with caution given the size of the sample, the paper also shows that liquidity expansion and purchases of long-term government bonds had a limited impact on risk premiums. Moreover, the increased liquidity supply by the Bank of Japan was absorbed by banks’ increased liquidity demand. The authors claim that this was unexpected; this may be a kind of Japanese understatement, as it resulted directly from the reduced size of the money market and the attendant increased dependency of banks on the BoJ’s fund-providing operations! As a result, there were neither large nor prevalent easing effects on the economy.

2. Qualifications and questions

While I share most of the authors’ views, and since it is the rule of the game, I would like to make some qualifications and raise some questions. Let me say briefly that the paper - albeit very thorough - did not deal with three issues: the causes of the emergence and bursting of the bubble, which may be of importance to finding remedies; the role of households, possibly because they helped by reducing their saving ratio; and international factors (the paper assumes a closed economy): in particular, it does not take account of US interest rates, which have surely affected Japanese interest rates and, more specifically, of the impact of the Fed’s communication policy in 2003 (aimed at keeping long-term rates as low as possible).

I would also like to stress that the real cost of credit and moral hazard should not be underestimated. In fig 4, the authors present an interesting calculation of the real cost of credit. It is based on the difference between gross interest payments divided by total debt and the rate of change in the deflator for domestic demand. This real rate lies well below that of the 1930s and did not substantially increase during the period of deflation. Yet, all through the period, it remained well above the real rate of growth! In addition, according to the National Accounts, there has been a major decrease in the financial deficit of Japanese corporations since 1991.This has resulted in the emergence, since 1998, of a net lending position for this sector (see chart 2 below). The corporate sector has repaid around ¥20 trillion of its debt on average per year since 2000, ie 4% of nominal GDP. Of course, some de-leveraging may be welcome. Yet, if the level of the real interest rate has not been a problem, why have corporations been repaying debt so quickly for so many years?

Moreover, this measure of the real cost of credit is based on the total outstanding debt, which is useful for assessing real debt service (RDS). It decreases as old expensive loans are redeemed (eg in 1996-99, fig 4). However, the decision to invest is not primarily based on the cost of past loans, but rather on the cost of new loans. This is why it may also be worth evaluating the real cost of credit as the difference between the current nominal interest rate and the expected inflation rate. As the latter is difficult to assess, it can be estimated approximately using past inflation. In Chart 3, I deducted the deflator of GDP from the long-term interest rate offered by banks. From 1996 to 2000, an increase is obtained, instead of a decrease with the measure of RDS! Nevertheless and for most of the period, the real rate remains above real growth.

Meanwhile, the Bank of Japan has taken a lot of risks and may have increased moral hazard.

First, the Bank of Japan has played the role of a risk-taker instead of merely playing the role of highlighting risks. As Kazuo Ueda mentioned in 2003, buying huge amount of bonds endangers the financial soundness of the central bank. Portfolio investment has risen, to €740 billion; a 100bp-rise in the long-term interest rate would entail a loss of €40 billion if it were not hedged and reflected in accounting. Moreover, as mentioned in the paper, credit spreads have narrowed, barely covering default risk [fig 25]. This is paradoxical in a depressed economy, where risks are more likely to be high. It exacerbates the problem of a dual economy with “lame ducks”. By buying market assets that are usually held by banks or more generally financial institutions, the Bank of Japan may have discouraged them from assessing risk properly.

Secondly, by buying massive amounts of government bonds, the BoJ has contributed to lowering the risk premium on these bonds and to creating moral hazard in terms of the government's behaviour.

Lastly, international markets may also have been affected. The paper shows how foreign banks may take advantage of distorted spreads and risk transfers. More generally, the massive purchase of dollar-denominated assets by the Japanese authorities may distort market discipline. In this way, the Bank of Japan may have contributed to keeping US long-term interest rates very low and may have helped postpone the policy adjustment needed to limit the build-up of global imbalances.

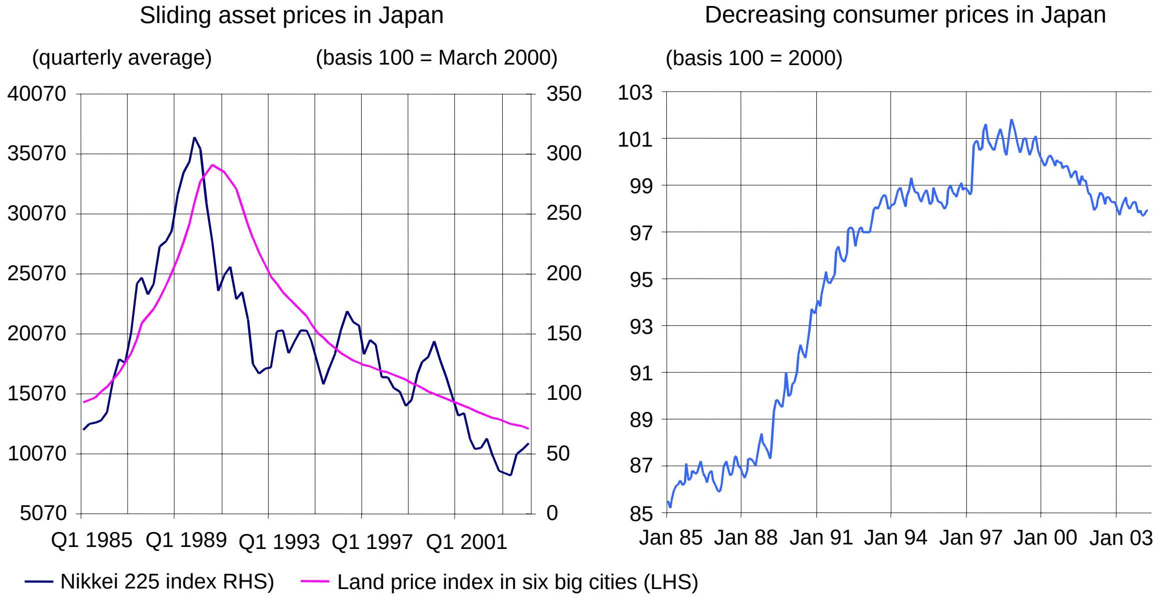
Conclusion

What steps should be taken? First, as monetary policy innovation may have serious drawbacks, it is a priority to restore the smooth functioning of the money market and of monetary mechanisms (including the credit channel). Second, public debt stands at around 160% of GDP, so any further fiscal loosening would be detrimental. Third, structural reforms started too late and proceeded too slowly. The latter largely contributed to the length of the period of deflation (and not vice versa).

This is why the main policy conclusion should remain: "Structural reforms, structural reforms, and more structural reforms".

Chart 1

Comparing deflationary pressures among assets and general prices in Japan

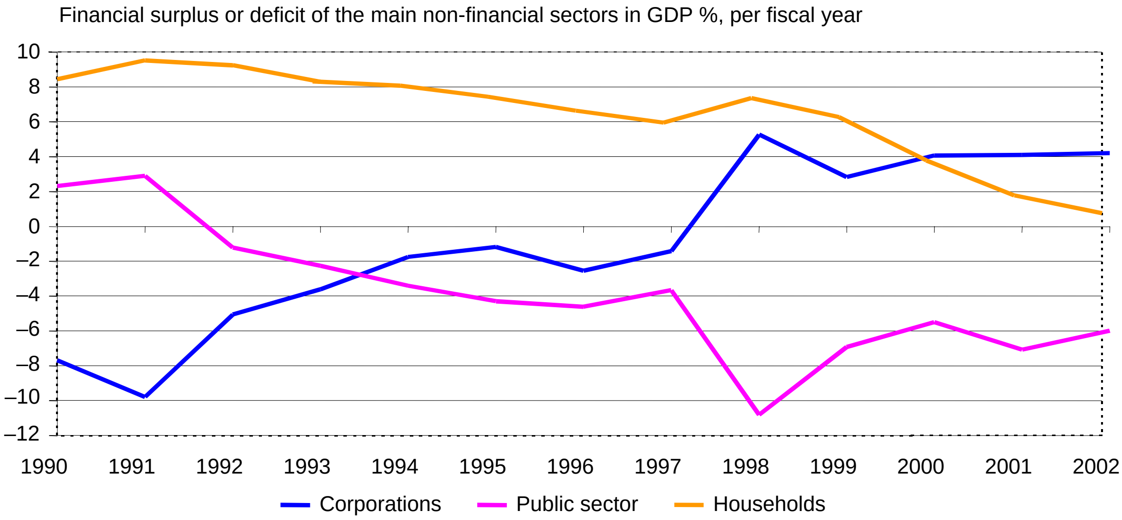


Sources : Nikkei, Japan Real Estate Institute, Ministry of Public Management, Home Affairs, Posts and Telecommunications.

Chart 2

The striking emergence of a financial surplus in the corporate sector in Japan

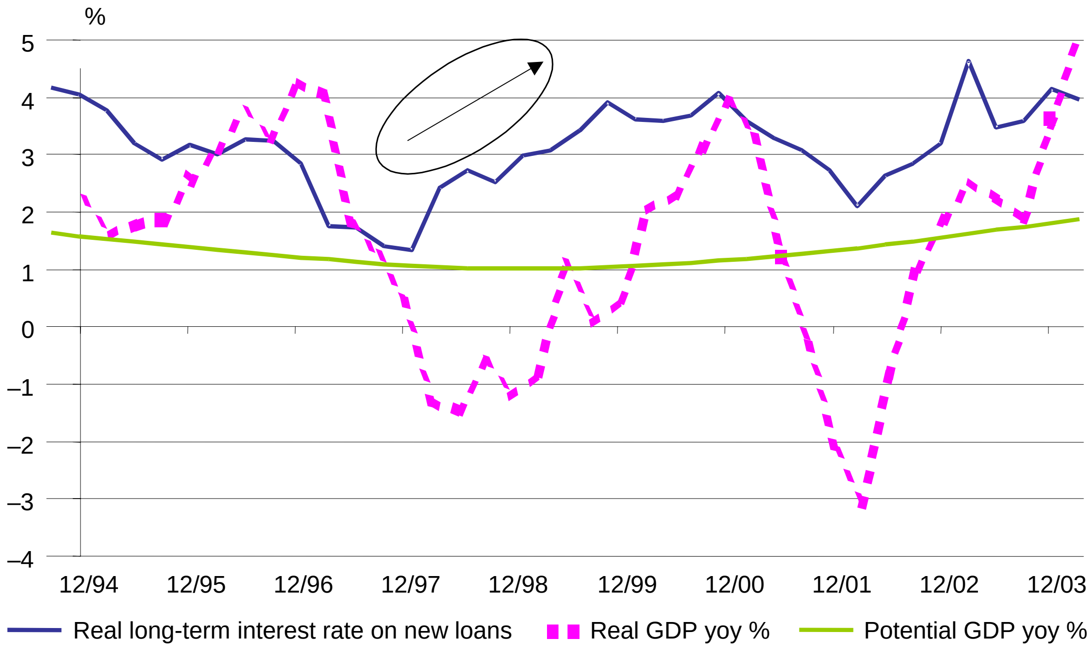
Financial surplus or deficit of the main non-financial sectors in Japan



Source: Annual Report on National Accounts of 2003 (ARO - ESRI).

Chart 3

Real financing conditions on new loans and real growth in Japan



Source : Bank of Japan, CAO - ESRI, Banque of France.