Does Monetary Policy Work under Zero-Interest Rate?

Kazusuke Tsujimura　　Masako Mizoshita

October　2003　ver.1.0
January　2004　ver.1.2

KEO DISCUSSION PAPER　No.87

Abstract

In the spring of 1999, the Japanese call money rate reached to the zero-interest-rate level, and has remained under quarter percent since then. Keynes once suggested that the interest-rate-oriented monetary policy become ineffective under near-zero interest rate level because of the existence of the liquidity trap. How about some other type of monetary policy, then? "Does monetary policy work under zero-interest-rate at all?" is the question to be answered in this tract. We are to examine the effectiveness of so-called Quantitative Easing Policy (QEP) newly introduced by the Bank of Japan in March 2001 using Asset-Liability-Matrix (ALM) derived from the Flow-of-Funds Accounts. The alterations in the object-economy could be derived either from the shifts in the money market operation or from the mutation in the flow-of-funds structure of the economy reflected in the coefficient matrix of the ALM. In this treatise, we are to demonstrate a new procedure to distinguish the former from the latter, so that we can tell the significance of the monetary policy in more precise manner. The conclusions of this article could be summarized as follows. (1) The ALM analysis is useful as a policy-evaluating tool under zero-interest-rate because the structural changes observed in ALM gives relatively small effects. (2) The performance of the QEP conducted by BOJ is improving gradually in recent days, partially because of the introduction of new measures including corporate stock and ABS purchasing operations.

Key Words

Monetary policy; central banking; quantitative easing; flow-of-funds; asset-liability-matrix

JEL Classification Numbers

E500; E580; C670

1. Introduction

Ten years ago, nobody imagined that the interest rate would ever hit the one percent level. Nowadays, we are commonly talking about zero-interest-rate. The U.S. Federal Open Market Committee lowered its intended-federal-funds-rate to one percent on June 25, 2003. Actually the federal funds rate was hovering somewhere around one-percent since then. As early as in the spring of 1999, the Japanese call money rate, an equivalent of the U.S. federal funds rate, reached to the zero-interest-rate level, and has remained under quarter percent since then. (See Fig.1.) In June 2003, even the key long-term interest rate, the yield of the Japanese Government Bond, hit 0.43 percent for a brief time. Keynes (1936) suggests that the interest-rate-oriented monetary policy become ineffective under near-zero interest rate level because of the existence of the liquidity trap. How about some other type of monetary policy, then? "Does monetary policy work under zero-interest-rate at all?" is the question to be answered in this tract.

As Bernanke and Reinhart (2004) suggests, there are three alternative monetary strategies for stimulating the economy that do not involve changing the current value of the policy rate. Specifically, these alternatives involve (a) providing assurance to financial investors that short rates will be lower in the future than they currently expect, (b) shifting the composition of the central bank's balance sheet, and (c) increasing the size of the central bank's balance sheet beyond the level needed to set the short-term policy rate at zero. By these definitions, so-called Quantitative Easing Policy (QEP) then newly introduced by the Bank of Japan (BOJ) in March 2001, was a combination of (b) and (c). (See the following section for the details.) If it is the case, the money market operations conducted by the monetary authorities should be fully reflected in their own balance sheets.

In the System of National Accounts (SNA), the financial surplus (i.e. increment in difference between financial assets and liabilities excluding the changes in market value) is corresponding to the balance of savings and investments in the non-financial economy. Thus, if there are induced changes in the assets and/or liabilities of the economic principals (i.e., institutional sectors including corporations, households, government etc.) as results of the shifting in composition and/or the changes in the size of the central bank's balance sheet, the non-financial economy will be affected as well in terms of capital formation and so on. This might be the channel that the changes in the money market operation give effects on the non-financial economic activities without changing the current value of the policy rate. Since the Flow-of-Funds Accounts (FFA) is a collection of balance sheets of economic principals, by translating those balance sheets into Asset-Liability-Matrix (ALM) that is a sector-by-sector matrix, we must be able to calculate the induced effects of the QEP on the financial as well as non-financial economy by application of Leontief inverse commonly used in input-output analysis. In our experimental study, we were successful to employ ALM derived from FFA to examine the impacts of the introduction of QEP on the stagnated Japanese Economy. (See Tsujimura and Mizoshita (2003).) It was an attempt to apply the concept of Leontief inverse to the ALM originally proposed by Stone (1966) and Klein (1983).

Since the observation period of the previous study was only a little more than half a year (December 2000 through September 2001), we used the ALM of March 2001 as a benchmark to calculate the effects of the money market operation of the respective month. After the publication of the paper, we have received many useful comments and suggestions to which we are more than grateful[1]. Among them, we found some remarks including the one from Professor Laurence Klein himself to question the stability of the parameters implied in ALM in a longer period. If the economic structure represented by ALM is easily changeable, it must be difficult to educe the efficacy of the monetary policy by means of that. The alterations in the object-economy could be derived either from the shifts in the money market operation or from the mutation in the flow-of-funds structure of the economy reflected in the coefficient matrix of the ALM. In this new treatise, we are to demonstrate a new procedure to distinguish the former from the latter, so that we can tell the significance of the monetary policy in more precise manner. The expansion of the observation period up to date, which has been made possible without fearing the confusion of the two causes, put us in position to determine if the QEP adopted by BOJ last two years is a success. This will be a big step forward to examine the usefulness of the monetary policy in a country where zero-interest-rate prevails.

Klein (2003) hints that the portfolio parameter of FFA could be a function of relevant interest rates and the inflation rate. If it is the case, we might be able to construct a model to trace the serial modulation of the ALM itself, which could be a major breakthrough to expand the horizon of the traditional flow-of-funds analysis. However, when we take only the zero-interest-rate situation into account, it is a logical contradiction to follow the approach. Actually, in case of today's Japan, the interest rate remains in the vicinity of nil while the changes in the inflation rate is kept minimal somewhere just below zero. Therefore, we had to develop some other line of procedure to

[1] We thank Prof. Yoshimasa Kurabayashi (Hitotsubashi University), Prof.Koichi Hamada (Yale University), Prof.Erik Dietzenbacher (University of Groningen), Prof. Akio Kuroda (Meiji University), Prof. Kazuo Ogawa (University of Osaka), Prof.Shigeru Nishiyama (Kobe-gakuin University), Dr. Natacha Valla (European Central Bank) and Dr. Shigenori Shirotsuka (Bank of Japan) for their valuable comments.

single out the very effects of the QEP.

In the first place, we have abandoned the idea to explain why the economic structure symbolized in ALM has changed at all. Rather, we opted simple and easy scheme. We have just decomposed the observed changes in the object-economy into two parts: (1) the first component attributed to the shifts in the money market operation, and (2) the second component attributed to the mutation of the ALM itself. The first component is calculated by multiplying the coefficient matrix of ALM of the previous period and the money-market-operation vector of the period; and then subtracting the previous period's observed value afterwards. We can calculate the second component likewise, by multiplying the coefficient matrix of ALM of the period and the money-market-operation vector of the previous period; and then subtracting the previous period's observed value. The procedure is an analogy to the way we make the NIPA chain index. As Fisher (1927) demonstrated more than seven decades ago, the geographic mean of the indices of the first component and the second component is consistent with the observed value.

The second question we are to answer in this tract is how effective is each device adopted by BOJ in its money market operations. In this study, we are to present the subdivided induced NII for each market operation instrument. As we discuss in the following sections, the QEP has failed to give the favourable results on the early stage of its introduction. Therefore BOJ revised its way of money market operation in the course of trial and error. In more recent months, BOJ has introduced drastic measures in face of prolonged recession and plunge in the equity prices. One of the most dramatic decisions is that to purchase corporate stocks from commercial banks, which are obliged to keep the corporate stocks in possession under the value of their owned capital, to cope with the new legislation. Another unprecedented scheme for a central bank is that to purchase Asset-Backed-Securities (ABS) to smooth financing of small and medium-sized enterprises to cover up the shortage of bills in circulation eligible for BOJ operations. The advantage of the present approach is the capability to single out the effect of a particular policy device upon a particular sector so that we can chose the best combination of the operation instruments.

2. The Quantitative Easing Policy

Before going any further, we have to discuss the details of the QEP adopted by BOJ. In the spring of 2001, the bank abruptly announced that it would shift the target of money market operation from the interbank interest rate (overnight call money rate) to the balance of current accounts held by the financial institutions at the central bank. This means that BOJ expect the commercial banks and other institutions to voluntarily hold current accounts well over the legally required minimum reserves. Simultaneously, BOJ proclaimed it was to increase the balance of current accounts (then 4 trillion yen) by one trillion yen to 5 trillion (while keeping the official reserve ratio at the previous level!) [2], and was to add the same amount of Japanese Government Bonds (JGB) on its asset portfolio. The intended-balance-of-current-accounts was raised to 6 trillion yen in August, then to "above 6 trillion yen" in September, and even further to 10-15 trillion in December 2001. That was not the end of the story. In February 2002, BOJ announced that it would "provide more liquidity to meet a surge in demand irrespective of the target of current account balances, (then) around 10 to 15 trillion yen". The target level was lifted to 15-20 trillion yen in October 2002, 17-22 trillion in March 2003, 22-27 trillion in April, and finally to 27-30 trillion yen in May 2003. (See Fig.2.)

Under the zero-interest-rate situation, the means of money market operation could have decisive significance. As we have mentioned earlier, in the first phase of the quantitative policy, it was BOJ's intention to increase the JGB in their asset portfolio. This line of policy was officially maintained at least till October 2002, when it announced that it would increase the monthly outright purchase of JGB from 1 trillion yen to 1.2 trillion yen. Some other measures included the easing of the restrictions on the use of the Lombard-type lending facility (August 2001 and February 2002), more active purchase of Commercial Paper (December 2001) and extension of maturities for bills purchased in operations (October 2002). More dramatic measures were on their way. In October 2002, BOJ asked permission to purchase corporate stocks in the form of "money in trust" and the Ministry of Finance authorized it immediately. More recently, in June 2003, BOJ announced the scheme for outright purchases of ABS, and it was put

---

[2] At ordinary times, the financial institutions try to keep the balance of current accounts at the level of legally required minimum reserve. Since BOJ does not pay interest on the current account balances, the banks do not want to pile up "excess-reserve" while paying interest on the deposit accounts with themselves. Of course zero-interbank-interest-rate does not necessarily mean that all the interest rates on the bank accounts become zero. Actually in case of Japan, the banks are paying small amount of interest on the deposits with them while they receive some interest from their borrowers. In that sense it is magic, even under zero-interest-rate circumstances, if BOJ could persuade its customer banks to accumulate as much funds as it wishes. The results are depicted in Fig.2. After the introduction of QEP in the spring of 2001, BOJ successfully induced the private banks to increase the balance of current accounts not only well above the legally required minimum reserves, but also comfortably above the intended level that they had then proclaimed. One reason must be that Japan is experiencing worst credit crunch ever in the aftermath of the financial bubble of the 1980's, so that the financial institutions are obliged to have excess reserve as a precaution. Another reason could be that the call loan rate (typical interbank interest rate) was in the sub-zero domain from time to time because some foreign banks were able to get profits by borrowing yen against other currencies of higher interest rate and let it to other banks. However these reasoning may explain only a part of the story, and the remainder is left to be answered.

in place by the end of the following month.

Fig.3 and Fig.4 as well as Table1 show the changes in the asset and liability portfolios of BOJ under the QEP. As indicated in the height of the pillars, the total of the assets and liabilities have increased gradually since the introduction of the policy. It is obvious that the balance of current accounts has risen dramatically. However, that is not the only cause to make the monetary base grow. The balance of banknotes have swelled as well, most probably because of the policy shift in April 2002 to allow the liquidation of insolvent financial institutions. On the asset side, there is no doubt that JGB enlarged its magnitude significantly not only in size, but also in the proportion to the total assets. Another instrument that expanded its position is bills-purchased in open market operations, especially in more recent days. In contrast to that, the balance of repurchase agreement and securities borrowing transactions has been slashed after the introduction of QEP.

3. Data

The Bank of Japan publishes *Flow of Funds Accounts of Japan* quarterly. It contains three tables: (1) Financial Transactions, (2) Financial Assets and Liabilities, (3) Reconciliation between Flows and Stocks. The ALM used in this paper has been compiled from the Financial Assets and Liabilities tables of the FFA from December 2000 through March 2003 every three month. Only the summary of compilation procedure from FFA to ALM is shown here, so refer to Tsujimura and Mizoshita (2003) for details. We start from two tables E and R, which are constructed by picking out the assets and liabilities vectors separately from the balance sheets of the FFA. Fig.5 presents components of the E and R tables.

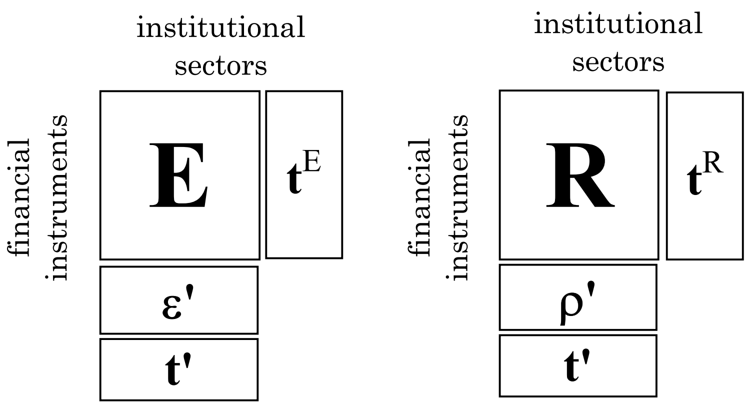


Figure 5 Components of E- and R- tables

$\mathbf{E}$ is a matrix that shows the portfolio of fund-employment of each institutional sector, $\boldsymbol{\varepsilon}$ and $\mathbf{t}^{\mathbf{E}}$ are vectors that represent excess liabilities and the sum of each row, respectively. $\mathbf{t}$ is the vector that consists of either sum of assets or liabilities, whichever is larger.

$$\mathbf{E} = \begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1m} \\ e_{21} & e_{22} & \cdots & e_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ e_{n1} & e_{n2} & \cdots & e_{nm} \end{bmatrix} \quad \boldsymbol{\varepsilon} = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_m \end{bmatrix} \quad \mathbf{t}^{\mathbf{E}} = \begin{bmatrix} \mathrm{t}_1^{\mathrm{E}} \\ \mathrm{t}_2^{\mathrm{E}} \\ \vdots \\ \mathrm{t}_n^{\mathrm{E}} \end{bmatrix} \quad \mathbf{t} = \begin{bmatrix} \mathrm{t}_1 \\ \mathrm{t}_2 \\ \vdots \\ \mathrm{t}_m \end{bmatrix}$$

where, n denotes the number of financial instruments and m denotes the number of institutional sectors. $\mathbf{R}$ is a matrix showing the portfolio of fund-raising of each institutional sector, and $\boldsymbol{\rho}$ and $\mathbf{t}^{\mathbf{R}}$ are vectors that represent excess assets and the sum of each row, respectively.

$$\mathbf{R} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \quad \boldsymbol{\rho} = \begin{bmatrix} \rho_1 \\ \rho_2 \\ \vdots \\ \rho_m \end{bmatrix} \quad \mathbf{t}^{\mathbf{R}} = \begin{bmatrix} \mathrm{t}_1^{\mathrm{R}} \\ \mathrm{t}_2^{\mathrm{R}} \\ \vdots \\ \mathrm{t}_n^{\mathrm{R}} \end{bmatrix} \quad \mathbf{t} = \begin{bmatrix} \mathrm{t}_1 \\ \mathrm{t}_2 \\ \vdots \\ \mathrm{t}_m \end{bmatrix}$$

It is possible to make out two sheets of square matrix, the ALM, using E- and R-tables in alternative procedures. One is the Y table based on the fund-raising portfolio, the other is Y* table based on fund-employment portfolio. Superscript * denotes the case of fund-employment assumption. To compile the Y-table in accordance with the fund-raising portfolio, first matrix $\mathbf{R}$ is substituted for matrix $\mathbf{U}$ and the transposed matrix $\mathbf{E'}$ is substituted for $\mathbf{V}$.

$$\mathbf{U} \equiv \mathbf{R} \tag{1}$$

$$\mathbf{V} \equiv \mathbf{E'} \tag{2}$$

In the case of the Y*-table that represents the fund-employment portfolio, we take matrix $\mathbf{E}$ as $\mathbf{U}^*$ and $\mathbf{R'}$ as $\mathbf{V}^*$.

$$\mathbf{U}^* \equiv \mathbf{E} \tag{3}$$

$$\mathbf{V}^* \equiv \mathbf{R'} \tag{4}$$

Each element of the coefficient matrices $\mathbf{B}$ and $\mathbf{B}^*$ are defined as follows:

$$b_{ij} = \frac{u_{ij}}{t_j} \tag{5}$$

$$b_{ij}^* = \frac{u_{ij}^*}{t_j} \tag{6}$$

In the same manner, each element of the coefficient matrices $\mathbf{D}$ and $\mathbf{D}^*$ are defined as follows:

$$d_{ij} = \frac{v_{ij}}{t_j^E} \tag{7}$$

$$d_{ij}^* = \frac{v_{ij}^*}{t_j^R} \tag{8}$$

The m x m coefficient matrices $\mathbf{C}$ and $\mathbf{C}^*$ are estimated using the institutional sector portfolio assumption.

$$\mathbf{C} = \mathbf{DB} \tag{9}$$

$$\mathbf{C}^* = \mathbf{D}^*\mathbf{B}^* \tag{10}$$

Then each element of transaction quantity matrices $\mathbf{Y}$ and $\mathbf{Y}^*$ are obtained as follows,

$$y_{ij} = c_{ij} t_j \tag{11}$$

$$y_{ij}^* = c_{ij}^* t_j \tag{12}$$

The above procedure leads Y-table and Y*-table depicted in Fig.6.

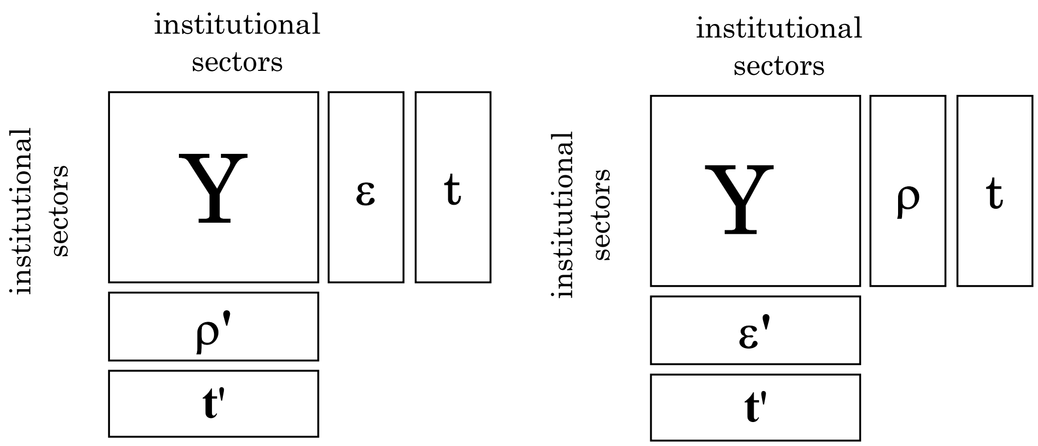


Figure 6　Components of Y- and Y*- tables

4. Methodologies

4.1. Evaluation of Quantitative Easing Policy

It is necessary to deal with BOJ, the central bank, as an exogenous institutional sector in order to analyse the effect of monetary policy by estimating the induced amount of demand and supply of funds through the intersectoral financial transactions represented in Leontief inverse. The fundamental equations respect to Y- and Y*-tables are expressed as follows:

$$\mathbf{C_{BOJ}t} + \boldsymbol{\varepsilon}_\mathbf{J} = \mathbf{t} \tag{13}$$

$$\mathbf{C^*_{BOJ}t} + \boldsymbol{\rho}_\mathbf{J} = \mathbf{t} \tag{14}$$

where $\mathbf{C_{BOJ}}$ and $\mathbf{C^*_{BOJ}}$ are the matrices obtained from matrices $\mathbf{C}$ and $\mathbf{C}^*$, respectably, by removing the row and column containing elements concerning BOJ. $\boldsymbol{\varepsilon}_\mathbf{J}$ is the (m-1) x 1 vector of which element is the sum of excess liabilities and liabilities of BOJ. $\boldsymbol{\rho}_\mathbf{J}$ is the (m-1) x 1 vector which contains the sum of excess assets and BOJ's financial assets. Solving each equation for $\mathbf{t}$ yields

$$\mathbf{t} = (\mathbf{I} - \mathbf{C_{BOJ}})^{-1}\boldsymbol{\varepsilon}_\mathbf{J} \tag{15}$$

$$\mathbf{t} = (\mathbf{I} - \mathbf{C^*_{BOJ}})^{-1}\boldsymbol{\rho}_\mathbf{J} \tag{16}$$

where $\mathbf{I}$ denotes the (m-1) x (m-1) unit matrix, $(\mathbf{I} - \mathbf{C_{BOJ}})^{-1}$ is the (m-1) x (m-1) Leontief inverse matrix, which gives the demand for funds as induced by each institutional sector, and $(\mathbf{I} - \mathbf{C^*_{BOJ}})^{-1}$ is the (m-1) x (m-1) Leontief inverse matrix, by which we can calculate the amount of ultimately induced supply of funds. For simplification let us denote $(\mathbf{I} - \mathbf{C_{BOJ}})^{-1}$ as $\boldsymbol{\Gamma}$ and $(\mathbf{I} - \mathbf{C^*_{BOJ}})^{-1}$ as $\boldsymbol{\Gamma}^*$. From the viewpoint of the non-financial economy, the induced demand for funds means the gross induced savings (GIS), the amount of new savings required, while the induced supply of funds refers to the gross induced investment (GII) that enables us to make still more investments.

It is possible to calculate the effect of QEP carried by BOJ using Leontief inverse in the same framework described above. $\boldsymbol{\varepsilon}_\mathbf{BOJ}$ is the n x 1 vector of which element $\varepsilon_{BOJ,i}$ is liability held by BOJ in the form of financial instrument i. The n x 1 vector

$\boldsymbol{\rho}_{\mathbf{BOJ}}$ is the assets vector where element $\rho_{BOJ,i}$ denotes the financial instrument i held by BOJ. Vectors $\boldsymbol{\varepsilon}_{\mathbf{BOJ}}$ and $\boldsymbol{\rho}_{\mathbf{BOJ}}$ then should be transformed into (m-1) x 1 vectors $\mathbf{f}_{\boldsymbol{\varepsilon}}$ and $\mathbf{f}_{\boldsymbol{\rho}}$, each of which is classified by institutional sector in order to make it possible to use Leontief inverse. The method of transformation adopted here is as follows:

$$\mathbf{f}_{\boldsymbol{\varepsilon}} = \mathbf{D}\,\boldsymbol{\varepsilon}_{\mathbf{BOJ}} \tag{17}$$

$$\mathbf{f}_{\boldsymbol{\rho}} = \mathbf{D}^{*}\,\boldsymbol{\rho}_{\mathbf{BOJ}} \tag{18}$$

Given $\boldsymbol{\varepsilon}_{\mathbf{BOJ}}$ and $\boldsymbol{\rho}_{\mathbf{BOJ}}$ exogenously, the induced savings and the induced investments are calculated as follows:

$$\boldsymbol{\eta}_{\mathbf{S}} = (\mathbf{I} - \mathbf{C}_{\mathbf{BOJ}})^{-1}\mathbf{f}_{\boldsymbol{\varepsilon}} \tag{19}$$

$$\boldsymbol{\eta}_{\mathbf{I}} = (\mathbf{I} - \mathbf{C}^{*}_{\mathbf{BOJ}})^{-1}\mathbf{f}_{\boldsymbol{\rho}} \tag{20}$$

where $\boldsymbol{\eta}_{\mathbf{S}}$ is the (m-1) x 1 vector of induced savings, where element η_{Si} denotes the induced saving generated in institutional sector i, $\boldsymbol{\eta}_{\mathbf{I}}$ is the (m-1) x 1 vector of induced investments, where element η_{Ii} indicates induced investment generated in institutional sector i. Note that GIS [$H_S = \sum_i \eta_{Si}$] is the sum of $\boldsymbol{\eta}_{\mathbf{S}}$, and GII [$H_I = \sum_i \eta_{Ii}$] is the sum of $\boldsymbol{\eta}_{\mathbf{I}}$. Subtracting GIS from GII, we obtain NII as follows:

$$H_N = H_I - H_S \tag{21}$$

NII calculated by (21) have significant economic meanings, that is whether current policy stimulate the capital formation in the non-financial economy or not.

4.2. Decomposition of changes in NII

We have calculated GIS, GII and NII from December 2000 through March 2003 quarterly. It is possible to decompose the cause of increasing or decreasing of these indices into two elements. These are 1) the portion attributed to BOJ's monetary policy, that is $\mathbf{f}_{\boldsymbol{\varepsilon}}$ and $\mathbf{f}_{\boldsymbol{\rho}}$, and 2) the segment attributed to the structural change of financial market, i.e., $\boldsymbol{\Gamma}$ and $\boldsymbol{\Gamma}^{*}$. Let $\mathbf{f}_{\boldsymbol{\varepsilon},t}$ ($\mathbf{f}_{\boldsymbol{\rho},t}$) be the (m-1) x 1 vector of liabilities (Assets) held by BOJ at period t, and $\boldsymbol{\Gamma}_t$ ($\boldsymbol{\Gamma}^*_t$) be the (m-1) x (m-1) Leontief inverse matrix at period t. The decomposition of output change over a period can be calculated as the first difference of H_{Nt}, which is:

$$\Delta H_{Nt} = H_{Nt} - H_{Nt-1} \tag{22}$$

$$\Delta H_{Nt} = (H_{It} - H_{St}) - (H_{It-1} - H_{St-1}) \tag{23}$$

In matrix notation, by using equations (19) and (20), (23) can be transformed to:

$$\Delta H_{Nt} = (\mathbf{i'}\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'}\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i'}\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'}\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1}) \tag{24}$$

There have been many works applied decomposition methodology within the IO framework, surveyed in Liu and Saal (2001). What we have adopted, the arithmetic average of the Laspeyres and Paasche structural decompositions, is based on their original scheme.

$$\Delta \mathrm{H}_{Nt} = \frac{\{(\mathbf{i'}\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'}\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i'}\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'}\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1})\} + \{(\mathbf{i'}\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'}\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i'}\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'}\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1})\}}{2} + \frac{\{(\mathbf{i'}\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'}\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i'}\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'}\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t})\} + \{(\mathbf{i'}\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'}\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1}) - (\mathbf{i'}\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'}\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1})\}}{2} \tag{25}$$

In Appendix we show that equation (24) could be transformed to (25). Thus we can trace the change in NII to two sources. The first term of the right hand of equation (25) represents the effect of the changes in BOJ's fund-raising or fund-employment portfolio; the second term represents the effect of the mutation in Leontief inverse. Denoting Δf_t as the first term, and $\Delta\Gamma_t$ as the second term, (25) can be simplified as:

$$\Delta H_{Nt} = \Delta f_t + \Delta\Gamma_t \tag{26}$$

Furthermore we have another method of decomposition to compare the ratio of NII at t to NII at t-1. The decomposition of GII's change over a period can then be calculated as the ratio of H_{Nt} to H_{Nt-1}, which is:

$$\delta H_{Nt} = \frac{H_{Nt}}{H_{Nt-1}} \tag{27}$$

$$\delta H_{Nt} = \frac{(H_{It} - H_{St})}{(H_{It-1} - H_{St-1})} \tag{28}$$

In matrix notation, using equations (19) and (20), (28) can be transformed to:

$$\delta H_{Nt} = \frac{\mathbf{i'\Gamma}^*_t \mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'\Gamma}_t \mathbf{f}_{\boldsymbol{\varepsilon},t}}{\mathbf{i'\Gamma}^*_{t-1} \mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'\Gamma}_{t-1} \mathbf{f}_{\boldsymbol{\varepsilon},t-1}} \tag{29}$$

Expanding (29) yields (see Appendix):

$$\begin{aligned}\delta H_{Nt} = &\sqrt{\frac{\mathbf{i'\Gamma}^*_{t-1} \mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'\Gamma}_{t-1} \mathbf{f}_{\boldsymbol{\varepsilon},t}}{\mathbf{i'\Gamma}^*_{t-1} \mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'\Gamma}_{t-1} \mathbf{f}_{\boldsymbol{\varepsilon},t-1}} \times \frac{\mathbf{i'\Gamma}^*_t \mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'\Gamma}_t \mathbf{f}_{\boldsymbol{\varepsilon},t}}{\mathbf{i'\Gamma}^*_t \mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'\Gamma}_t \mathbf{f}_{\boldsymbol{\varepsilon},t-1}}} \\ &\times \sqrt{\frac{\mathbf{i'\Gamma}^*_t \mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'\Gamma}_t \mathbf{f}_{\boldsymbol{\varepsilon},t-1}}{\mathbf{i'\Gamma}^*_{t-1} \mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i'\Gamma}_{t-1} \mathbf{f}_{\boldsymbol{\varepsilon},t-1}} \times \frac{\mathbf{i'\Gamma}^*_t \mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'\Gamma}_t \mathbf{f}_{\boldsymbol{\varepsilon},t}}{\mathbf{i'\Gamma}^*_{t-1} \mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i'\Gamma}_{t-1} \mathbf{f}_{\boldsymbol{\varepsilon},t}}}\end{aligned} \tag{30}$$

where $\mathbf{i}$ is the (m-1) x 1 vector, which contains a column of 1s. The first square root on the right hand side of (30) means the effect of change in BOJ's fund-employment or fund-raising portfolio, and the second square root does that of change in Leontief inverse. Denoting δf_t as the first square root, and $\delta\Gamma_t$ as the second square root, (30) can be further simplified as:

$$\delta H_{Nt} = \delta f_t \times \delta\Gamma_t \tag{31}$$

This relation is originated in the property of Fisher index (Fisher (1927)). Although δH_{Nt} is the changing rate from t-1 to t, it can be used as chain index. When we calculate the changing rate from term 0 to term τ, that is given by:

$$\prod_{t=1}^{\tau} \delta H_{Nt} = \prod_{t=1}^{\tau} \delta f_t \times \prod_{t=1}^{\tau} \delta\Gamma_t \tag{32}$$

5. The Results

There is an asymmetry in the propagation of the supply and demand of the funds in the financial system. The demand for funds should be eventually financed by the gross induced savings (GIS), while the supply of funds brings gross induced investments (GII) in due course. The QEP requires the central bank to choose two items simultaneously, one in assets and another in liabilities. The aforementioned action changes GII on the one hand and GIS on the other. The asymmetry in the propagation process gives net induced investments (NII) as a difference between GII and GIS. The sign and the amount of the NII is nothing but the indicator of the effectiveness of the monetary policy made on the non-financial economy. A policy that induces a positive number of NII gives an expansion in the economy, so that it will be welcomed, especially in the course of a recession. In contrast, a money market operation that yields a negative NII, i.e., net induced savings (NIS), weakens the economy so that this should be avoided at any cost while the depression prevails.

The fluctuations in the three indices, GII(H_I), GIS(H_S) and NII(H_N) between December 2000 and March 2003 are depicted in Fig.7. Despite the introduction of QEP in March 2001, the NII stayed in the negative region throughout this period. In that sense, the policy did not help to bail out Japan from its worst recession in more than five decades. However, the magnitude of the NII is not stable at all. In the first half of the observation period, there is a tendency of increment in the absolute magnitude. In contrast to this, there seems a decline in the absolute magnitude in the latter half of the period suggesting that the performance of the money market operation is improving.

The quarterly changes in the NII alongside its decomposition are shown in Fig.8. Despite the negative trend in general, NII moves favourably in December 2001, and also in September and December 2002. The pillars are divided into two parts; the dotted portion indicates the alteration attributable to the changes in the portfolio of the central bank, and the segment with oblique lines attributable to the mutation of the coefficients of ALM. All the pillars exhibit that the effects of the mutation of the ALM are not significant as those of the shift in money market operation reflected in the asset and liability portfolio of the central bank. Same thing is demonstrated in Fig.9 in a different manner. The solid line presents the changes in NII as a proportion to the previous period. Likewise, the broken and dotted lines display those attributable to the bank portfolio and the mutation in ALM respectively. Do mind that the larger the proportion, the absolute magnitude of NII increases in the negative domain. This picture clearly tells us that the shifts in the portfolio of the central bank have absolute significance to the performance of the non-financial economy.

The above-mentioned observation put us in position to determine if the QEP adopted by BOJ last two years is a success without fearing the confusion of the two causes, i.e., the effects attributed to BOJ's monetary policy itself and those attributed to the structural changes in the financial market. Table2 presents per unit GII (in the descending order) and GIS (in the ascending order) generated by each available device of money market operations. Since NII, that is indicative of the general performance of the non-financial economy, is the difference between GII and GIS, the greater is preferred to the smaller in GII while the smaller is preferred to the greater in GIS. It is obvious at the first glance that the newly introduced device, the purchase of the ABS, is far more efficient than any other instruments to push up the NII. Among the traditional money market operation tools, the bill purchasing operation and the loans to the commercial banks are the most powerful of all, followed by repurchase agreement and securities lending transactions by narrow margin. The purchasing of corporate stocks, also a new comer, follows close behind. Unfortunately the JGB, the leading item in the BOJ asset portfolio, gives only small GII. On the liabilities side, bill-selling operation is the best weapon to raise funds because it gives least burden in terms of GIS. The government current accounts at BOJ and repurchase agreement and securities lending transactions give relatively smaller GIS as well. In contrast to that, commercial banks' current accounts with BOJ and the banknotes in circulation are a little more burdensome to the economy.

One advantage of the ALM analysis is that it gives more detailed figures on the sector-by-sector GII and GIS generated by the money market operations. The summarized results are listed in Table3. The non-financial private enterprises are the largest beneficiary of all in terms of relative proportion of GII to GIS. Both of the newly introduced BOJ's weapons of money market operation, i.e., corporate stock and ABS purchasing operations, give large per unit GII to this sector. In sharp contrast to this, money market operations do not benefit households well; rather they give a lot of burden in the form of GIS. Unless the central bank sells bills to finance it, any type of money market operation fail to produce positive NII on the households. The financial institutions are affected a lot by the money market operations in either way. The bill and ABS purchasing operations as well as the central bank loan directed to them give relatively large GII to the financial institutions. However, the commercial banks' own current accounts with BOJ give GIS of 2.6; which will offset GII created by any devices of the market operation. Although both the per unit GII and GIS are generally small in the non-financial public institutions including central and local governments, they tend to be benefited by FB and JGB operations. JGB purchasing operation, BOJ's prominent operation device, gives significant GII to non-financial public institutions while giving minimal GII to the private sectors.

6. Conclusions

In this tract, we have decomposed the observed changes in the object-economy into two parts: (1) the first component attributed to the shifts in the money market operations, and (2) the second component attributed to the mutation of the ALM itself. The analysis suggests that the effect of the former is far greater than that of the latter. This reconfirms the usefulness of the ALM derived from FFA in the assessment of the effects of the money market operations.

To overcome the persistent recession, it is preferable to adopt money market operation devices that create more NII in the non-financial private enterprises rather than in public sectors. In this regards, the open market operation of JGB, the weapon BOJ selected at the first stage of the QEP, was not suitable. JGB creates relatively large amount of NII in the public sector, but gives only small amount in the private sectors. Comparing to this, those traditional money market operation devices like bill purchasing or lending facilities induces more favourable effects on private sectors in terms of NII. Although it is criticized as unusual measures for a central bank, the introduction of new instruments including corporate stocks and ABS to BOJ's asset portfolio widens the opportunity to create more NII in the private sector.

Two years has passed since the introduction of the QEP by BOJ that is fighting against the worst recession in the post-war Japan where zero-interest-rate is a matter of fact. The performance of the QEP conducted by BOJ is improving gradually in recent days, partially because of the introduction of new measures including corporate stock and ABS purchasing operations. As a conclusion it can be said that some type of monetary policy could work even under zero-interest-rate. BOJ, the pioneer in this field, is getting some experiences through trial and error, but still it is a long way to be truly successful. To face zero-interest-rate is an experience certainly categorized as "Close Encounters of the Third Kind" in the universe of economics, to which everyone has to be accustomed in the very near future.

References

Alford, Roger F.G. (1986) *Flow of Funds*, (Aldershot, Gower Publishing).

Alho, Kari (1991) *Financial markets and macroeconomic policy in the flow-of –funds framework*, (Brookfield, Aldershot).

Bank of Japan (1999) *Guide to Japan's Flow of Funds Accounts*.

---------- (2000) *Compilation Method of Japan's Flow of Funds Accounts*.

Bernanke, Ben S. and Vincent R. Reinhart (2004) "Conducting Monetary Policy at Very Low Short-Term Interest Rates," presented at the Meeting of the American Economic Association, San Diego.

Cohen, Jacob (1963) "Circular Flow Models in the Flow of Funds," *International Economic Review*, vol.4, no.2, pp.153-170.

Copeland, M. A. (1949) "Social Accounting for Moneyflows," *The Accounting Review*, vol.24, pp.254-64.

---------- (1952) *A study of Moneyflows in the United States*, (New York, National Bureau of Economic Research).

Dawson, John C. (1958) A Cyclical Model for Postwar U.S. Financial Markets, *American Economic Review,* vol.48, pp.145-57.

Fisher, Irving (1927) *The Making of Index Numbers*, 3rd ed., (Boston, Houghton Mifflin).

Hamada, Fumimasa (1969) "An Econometric Model of Flow-of-Funds," *Keio Economic Studies*, vol.6, no.2, pp.64-115.

International Monetary Fund (2000) *Monetary and Financial Statistics Manual.*

Keynes, John M. (1936) *The general Theory of Employment, Interest and Money*, (London, Macmillan).

Klein, Lawrence R. (1983) *Lectures in Econometrics*, (Amsterdam, North-Holland).

----------(2003) "Some Potential Linkages for Input-Output Analysis with Flow-of-Funds," *Economic Systems Research*, vol.15, no.3, pp.269-277.

Leontief, W. (1941) *The Structure of American Economy, 1919-1939,* (New York, Oxford University Press).

Liu, Aying and David S. Saal (2001) "Structural Change in Apartheid-era South Africa: 1975-93," *Economic Systems Research*, vol.13, no.3, pp.235-257.

Mathews, Russell (1962) "The Australian Flow-of-Funds Accounts," *Economic Record*, vol.38, no.81, pp.94-107.

Powelson, John P. (1960) *National Income and Flow-of-Funds Analysis*, (New York, McGraw-Hill).

Stone, Richard (1966) "The Social Accounts from a consumer's point of view," *Review of Income and Wealth*, vol.12, no.1, pp.1-33.

Tobin, James (1969) "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit and Banking*, vol.1, no.1, pp.15-29.

Tsujimura, Kazusuke and Masako Mizoshita (2003) "Asset-Liability-Matrix Analysis Derived from Flow-of-Funds Accounts: the Bank of Japan's Quantitative Monetary Policy Examined," *Economic Systems Research*, vol.15, no.1, pp.51-67.

United Nations (1968) *A System of National Accounts.*

---------- (1999) *Handbook of Input-Output Table Compilation and Analysis.*

Appendix

Equation (25) in the main text is obtained through the following manipulation of (24):

$$\delta H_{Nt} = (\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1}) \tag{24}$$

$$\begin{aligned}\delta H_{Nt} &= \frac{2(\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}) - 2(\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1})}{2} \\ &+ \frac{(\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1}) - (\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1}) + (\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t}) - (\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t})}{2}\end{aligned} \tag{A-1}$$

Equation (30) in the main text is obtained through the following manipulation of (29):

$$\Delta H_{Nt} = \frac{\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t}}{\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1}} \tag{29}$$

$$\Delta H_{Nt} = \sqrt{\frac{(\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t})^2}{(\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t-1})^2} \times \frac{(\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1})}{(\mathbf{i}'\boldsymbol{\Gamma}^*_t\mathbf{f}_{\boldsymbol{\rho},t-1} - \mathbf{i}'\boldsymbol{\Gamma}_t\mathbf{f}_{\boldsymbol{\varepsilon},t-1})} \times \frac{(\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t})}{(\mathbf{i}'\boldsymbol{\Gamma}^*_{t-1}\mathbf{f}_{\boldsymbol{\rho},t} - \mathbf{i}'\boldsymbol{\Gamma}_{t-1}\mathbf{f}_{\boldsymbol{\varepsilon},t})}} \tag{A-2}$$

Table 1 Balance sheets of the BOJ (100 million yen)

	Dec-00		Mar-01		Jun-01		Sep-01		Dec-01		Mar-02		Jun-02		Sep-02		Dec-02		Mar-03	
	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Banknotes in circulation		676197		628296		652395		639081		732980		720965		724467		714122		798383		753579
Current accounts held by financial institutions		68270		58143		57058		124794		156154		276107		150532		185326		195626		309297
Current accounts held by the government		93827		220725		123691		154797		59651		129284		67229		83418		63311		146135
Loans to private financial institutions	8274		14087		5300		6323		8161		9900		3892		3464		1932		2903	
Bills purchased and sold	40093	28069	98200	43863	148621	65017	173078	4800	207143	3000	295184	0	237496	65804	279974	46188	280422	17014	291261	0
Repurchase agreement and securities lending transactions	463831	172342	461643	191142	248342	224114	154391	187162	145760	180260	118227	206327	68799	192127	60325	176546	80537	133953	140527	163827
Financing Bills	7131		6335		95415		93289		80300		148743		117277		48096		22177		85938	
Central government securities	459559		473900		591537		648498		669833		700916		730202		783031		810412		800646	
Corporate stocks	1202	1	1202	1	1202	1	1202	1	1202	1	1202	1	1202	1	1202	1	2708	1	12807	1
Deposits with agencies	1446	245	34360	235	9383	238	4430	232	3488	237	35487	229	9471	235	5327	227	3137	229	38710	0
Foreign investment in securities	35627		38981		38354		38452		42705		42623		40977		43038		43569		43517	
Gold and SDRs etc.	7537	218	7727	172	8059	9835	8366	10424	8709	9295	9566	12843	9073	11863	9416	12389	9888	13756	9515	11241
Others	56484	7	59236	7	58381	12	54329	12	55674	15	55444	7	54424	7	55722	7	53284	7	54265	7
Financial Surplus or deficit		49288		54034		75890		65299		83357		74732		64354		74627		89052		99912
Total	1089271	1089271	1197410	1197410	1208389	1208389	1186729	1186729	1225165	1225165	1420729	1420729	1276753	1276753	1292993	1292993	1311478	1311478	1484134	1484134

Source: Bank of Japan

Table2　Per unit GII and GIS produceed by each monetary operation option (March 2003)

Assets of BOJ	GII	Liabilities of BOJ	GIS
Asset-Backed-Securities	4.754	Bills sold	0.063
Bills purchased	4.357	Banknotes in circulation	3.626
Loans to private financial institutions	4.237	Repurchase agreement and securities borrowing transactions	3.856
Repurchase agreement and securities lending transactions	3.628	Current accounts held by the government	4.269
Corporate stocks	3.409	Current accounts held by financial institutions	4.485
JGB	2.111		
Financing Bills	1.727		

Note: The amount of GII and GIS produced by increases of 1 unit in asset or liability items.

Table3 Monetary operation options and per unit GII and GIS for each institutional sector (March 2003)

Non-financial private enterprises

Assets	GII	Liabilities	GIS
Corporate stocks	1.615	Bills sold	0.004
Asset-Backed-Securities	1.345	Current accounts held by the government	0.235
Bills purchased	0.820	Repurchase agreement and securities borrowing transactions	0.302
Loans to private financial institutions	0.776	Current accounts held by financial institutions	0.467
Repurchase agreement and securities lending transactions	0.668	Banknotes in circulation	0.721
JGB	0.212		
Financing Bills	0.157		

Households and nonprofit private institutions serving households

Assets	GII	Liabilities	GIS
Asset-Backed-Securities	0.460	Bills sold	0.012
Bills purchased	0.381	Repurchase agreement and securities borrowing transactions	0.808
Loans to private financial institutions	0.345	Current accounts held by the government	0.882
Repurchase agreement and securities lending transactions	0.296	Current accounts held by financial institutions	1.101
Corporate stocks	0.245	Banknotes in circulation	1.193
JGB	0.091		
Financing Bills	0.055		

Financial institutions

Assets	GII	Liabilities	GIS
Bills purchased	2.391	Bills sold	0.043
Loans to private financial institutions	2.358	Banknotes in circulation	1.492
Asset-Backed-Securities	2.345	Current accounts held by the government	1.946
Repurchase agreement and securities lending transactions	2.008	Repurchase agreement and securities borrowing transactions	2.323
Corporate stocks	1.071	Current accounts held by financial institutions	2.615
JGB	0.602		
Financing Bills	0.282		

Non-financial public institutions

Assets	GII	Liabilities	GIS
Financing Bills	1.112	Bills sold	0.003
JGB	1.076	Banknotes in circulation	0.124
Loans to private financial institutions	0.514	Current accounts held by financial institutions	0.166
Bills purchased	0.503	Repurchase agreement and securities borrowing transactions	0.285
Repurchase agreement and securities lending transactions	0.424	Current accounts held by the government	1.110
Asset-Backed-Securities	0.360		
Corporate stocks	0.263		

Note: The amount of GII and GIS produced by increases of 1 unit in asset or liability items.

Figure1 The Overnight Interest Rates

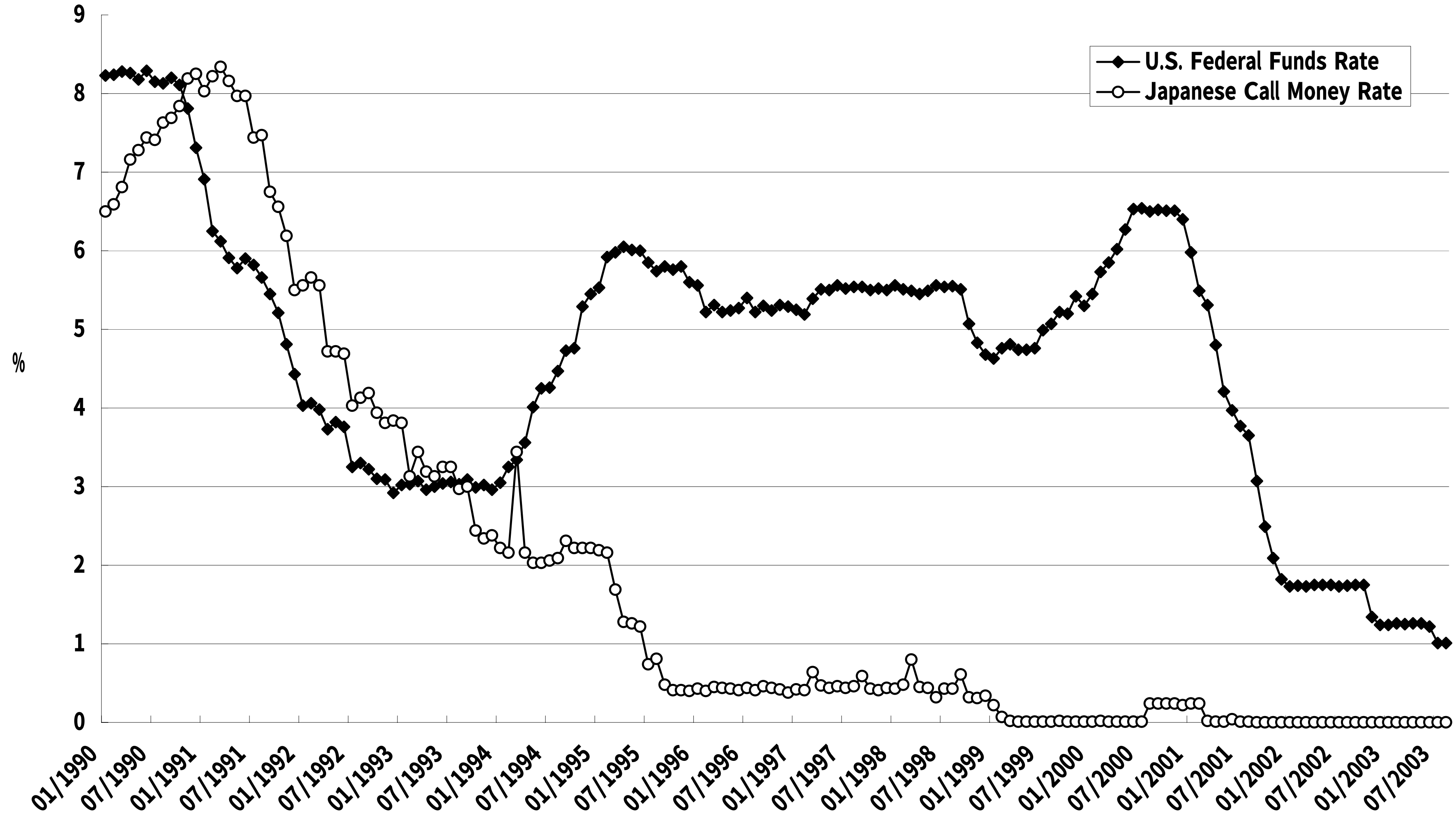


Figure2 The balance of the current accounts held by financial institutions at BOJ

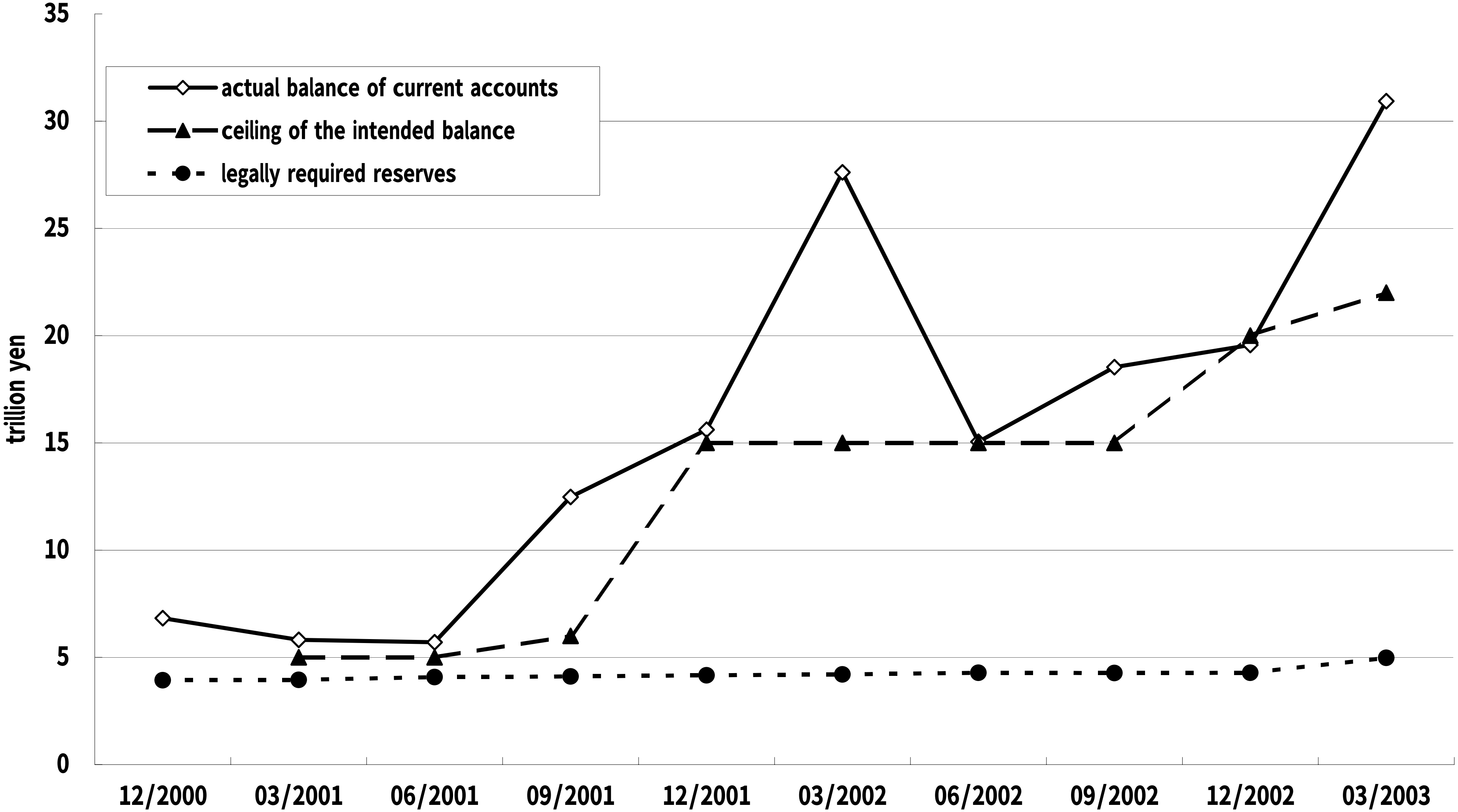
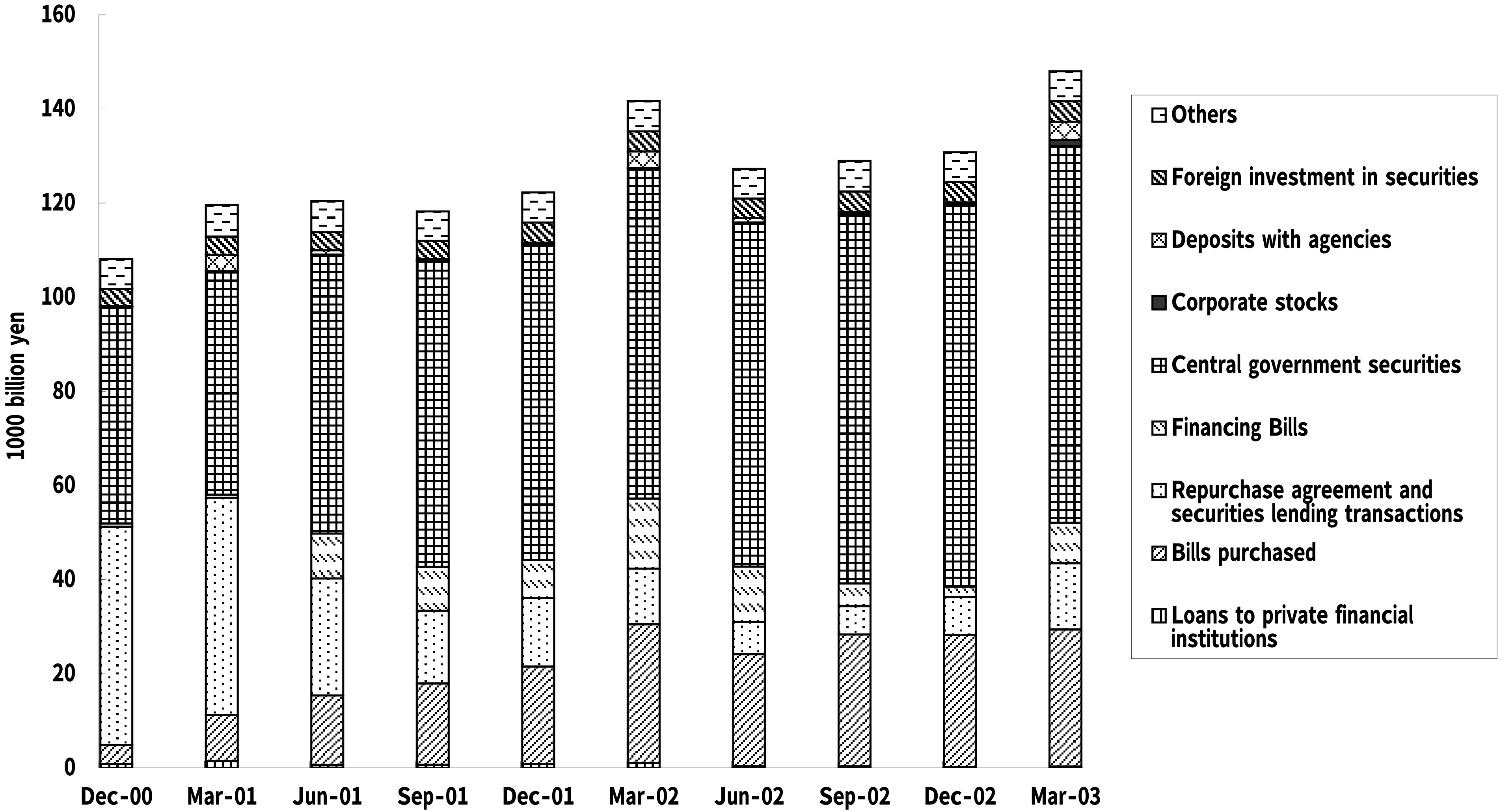


Figure3 Financial Assets of BOJ



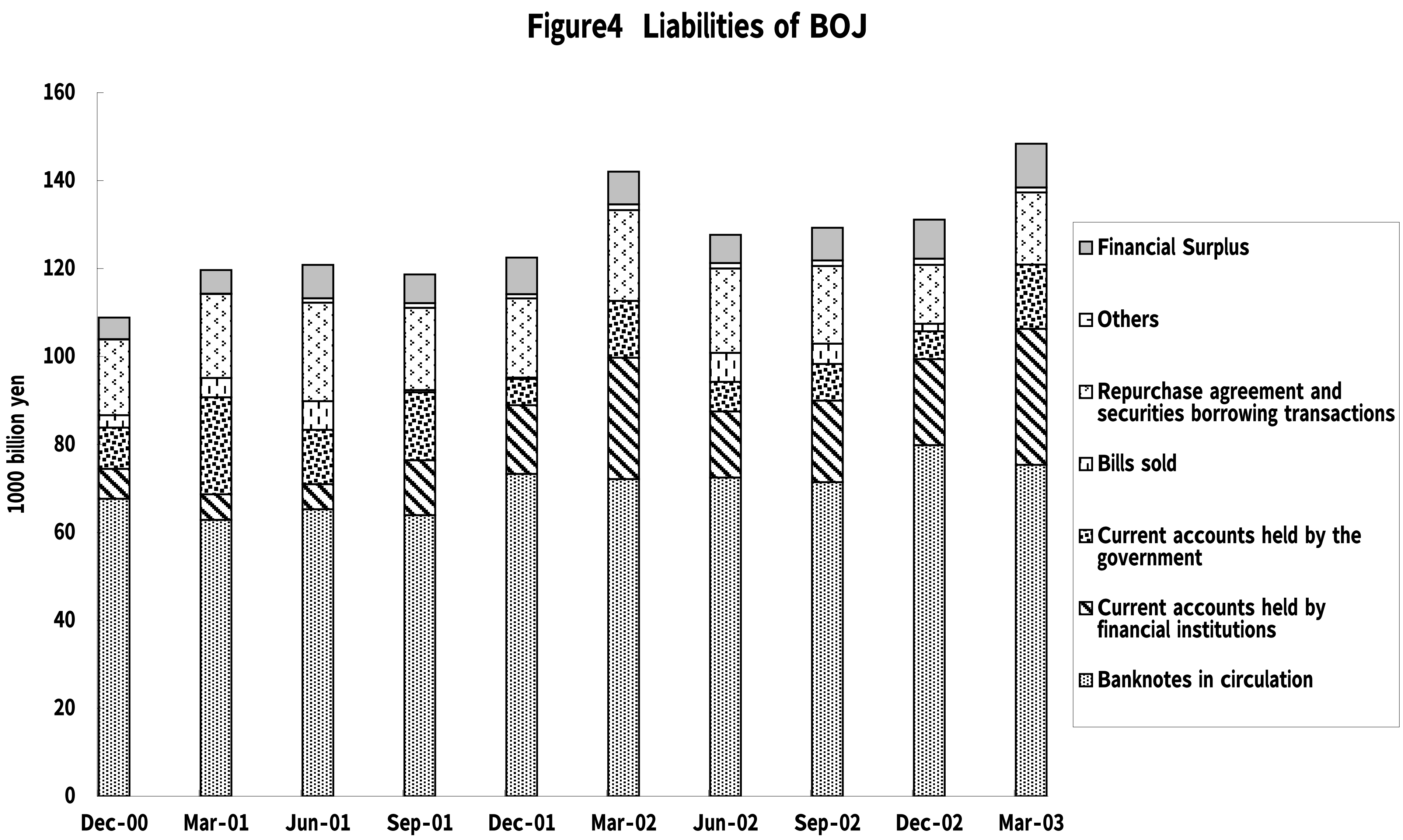
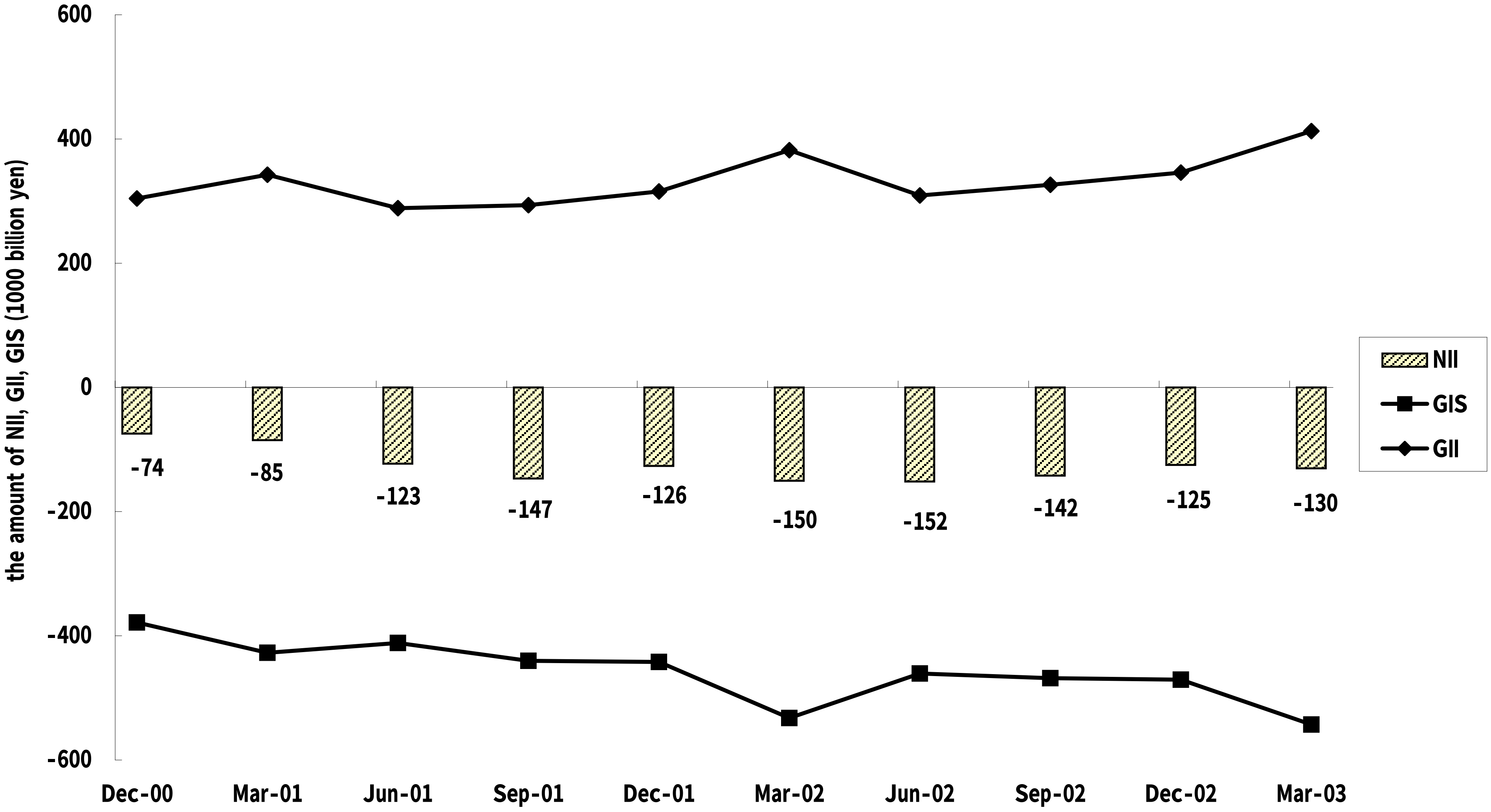


Figure4 Liabilities of BOJ
160
140
120
100
80
60
40
20
0
1000 billion yen
Dec-00
Mar-01
Jun-01
Sep-01
Dec-01
Mar-02
Jun-02
Sep-02
Dec-02
Mar-03
Financial Surplus
Others
Repurchase agreement and securities borrowing transactions
Bills sold
Current accounts held by the government
Current accounts held by financial institutions
Banknotes in circulation

Figure7 Quarterly changes in NII



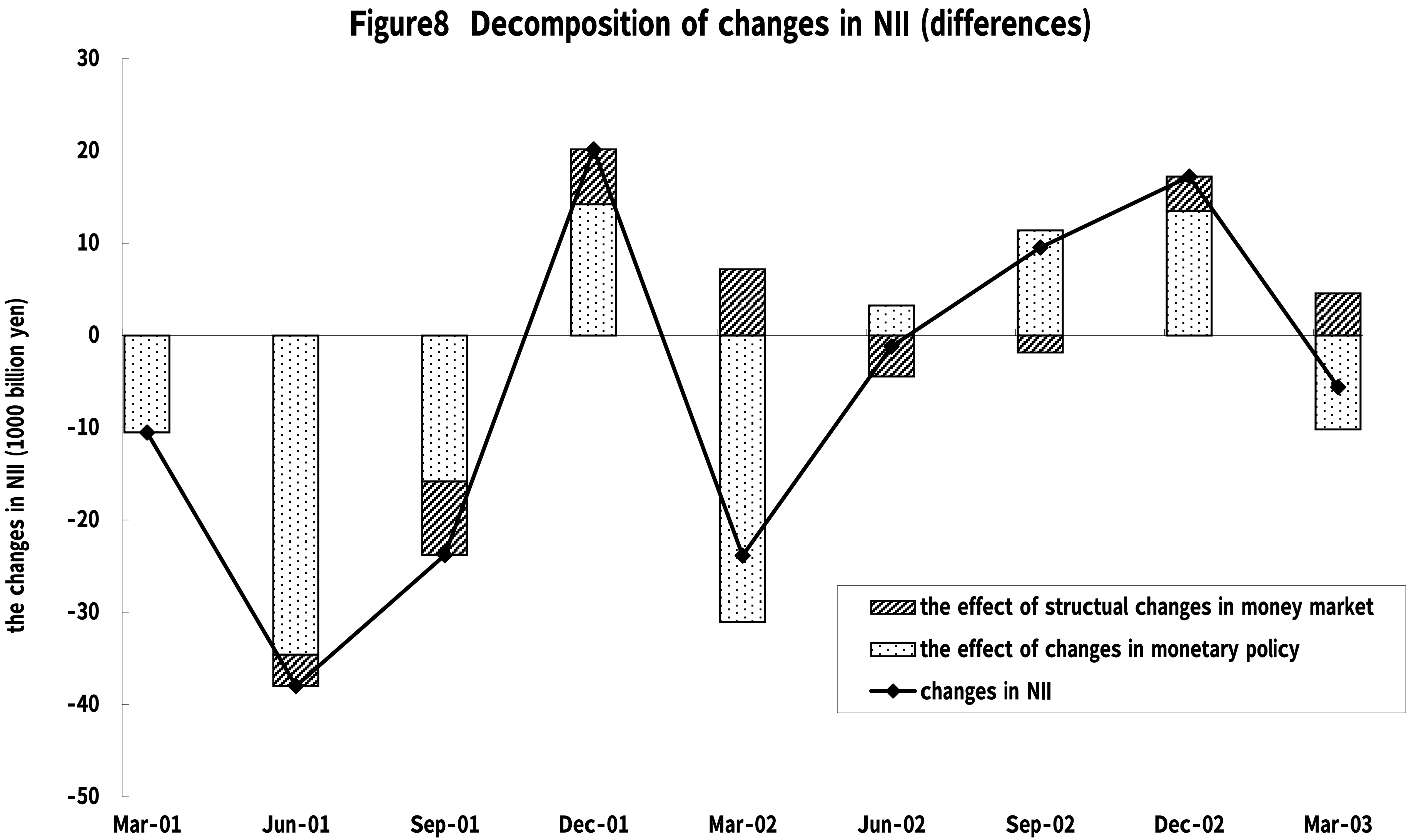


Figure8 Decomposition of changes in NII (differences)
30
20
10
0
-10
-20
-30
-40
-50
the changes in NII (1000 billion yen)
Mar-01
Jun-01
Sep-01
Dec-01
Mar-02
Jun-02
Sep-02
Dec-02
Mar-03
the effect of structual changes in money market
the effect of changes in monetary policy
changes in NII

Figure9 Decomposition of changes in NII (proportion)