The Great Intervention and Massive Money Injection: The Japanese Experience 2003-2004

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June 6, 2007

Abstract

From the beginning of 2003 to the spring of 2004, Japan's monetary authorities conducted large-scale yen-selling/dollar-buying foreign exchange operations in what Taylor (2006) has labeled the "Great Intervention." The purpose of the present paper is to empirically examine the relationship between this "Great Intervention" and the quantitative easing policy the Bank of Japan (BOJ) was pursuing at that time. Using daily data of the amount of foreign exchange interventions and current account balances at the BOJ, our analysis arrives at the following conclusions. First, while about 60 percent of the yen funds supplied to the market by yen-selling interventions were immediately offset by the BOJ's monetary operations, the remaining 40 percent were not offset and remained in the market for some time; this is in contrast with the preceding period, when almost 100 percent were offset. Second, comparing foreign exchange interventions and other government payments, the extent to which the funds were offset by the BOJ were much smaller in the case of foreign exchange interventions, and the funds also remained in the market longer. This finding suggests that the BOJ differentiated between and responded differently to foreign exchange interventions and other government payments. Third, the majority of financing bills issued to cover intervention funds were purchased by the BOJ from the market immediately after they were issued. For that reason, no substantial decrease in current account balances linked with the issuance of FBs could be observed. These three findings indicate that it is highly likely that the BOJ, in order to implement its policy target of maintaining current account balances at a high level, intentionally did not sterilize yen-selling/dollar-buying interventions.

JEL Classification Numbers: F30; E52; E58
Keywords: foreign exchange intervention; sterilization; quantitative easing

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1 Introduction

During the period from 2001 to 2006, the Japanese monetary authorities pursued two important and very interesting policies. The first of these is the quantitative easing policy introduced by the Bank of Japan (BOJ) in March 2001. This step was motivated by the fact that although the overnight call rate, the BOJ's policy rate, had reached its lower bound at zero percent, it failed to sufficiently stimulate the economy. To achieve further monetary easing, the BOJ therefore changed the policy variable from the interest rate to the money supply. The quantitative easing policy remained in place until March 2006, by which time the Japanese economy had recovered. The second major policy during this period were interventions in the foreign exchange market by Japan's Ministry of Finance (MOF), which engaged in large-scale selling of the yen from January 2003 to March 2004. Taylor (2006) has called this the "Great Intervention." The interventions during this period occurred at a frequency of once every two business days, with the amount involved per daily intervention averaging ¥286 billion and the total reaching ¥35 trillion. Even for Japan's monetary authorities, which are known for their active interventionism, this frequency as well as the sums involved were unprecedented.

The main concern of this paper is to examine how these two policies were related to each other. In general, monetary policy and exchange rate interventions are independent policies and, as is often pointed out, not mutually related.[1] With the important exception of Japan since 2001, monetary policy in major economies such as the United States and Europe is conducted by setting a target level for very short-term interest rates (e.g., the Federal funds rate in the US, the overnight call rate in Japan) and adjusting the quantity of base money on a daily basis to maintain that level. Therefore, if the amount of yen funds circulating in the market increases or decreases as a result of foreign exchange market interventions, overnight interest rates will diverge from the target level.[2] In a sterilized intervention, the central bank will then use open market operations to offset the funds in the domestic currency supplied to or absorbed from the market by the foreign exchange intervention. It is said that in practice, the central banks of the advanced economies always sterilize foreign exchange

[1] See, for example, Craig and Humpage (2001).

[2] In order to conduct foreign exchange interventions in which yen are sold and dollars are bought, the MOF has to supply yen funds. One way to do so is to issue financing bills (FBs) on the same day as the intervention is conducted. In that case, because the MOF immediately returns the yen funds that it obtained by issuing FBs to the market through the intervention, the amount of yen funds circulating in the market does not change. However, in practice, there is a time gap of about two months between foreign exchange market interventions and the issuing of FBs; as a result, if the MOF intervenes by selling yen, the amount of yen funds circulating at that point in time actually increases. For details on the practicalities of foreign exchange market interventions in Japan, see Ito (2003).

interventions - an observation that has been confirmed by a large number of empirical studies. And as long as such sterilization is conducted, foreign exchange interventions have no effect on monetary policy.

But did such sterilization also occur during the period of the "Great Intervention"? Looking at this issue from the viewpoint of sterilization as it is commonly understood, it is possible that at least with regard to yen-selling interventions, sterilization did not occur. That is to say, the overnight rate during this period was zero and even if yen funds were supplied to the market by yen-selling interventions, the overnight rate did not fall below zero. Thus, even if the BOJ ignored the yen funds supplied by yen-selling interventions, this does not mean that the interest rate target (i.e., zero interest rates) could not be achieved. On the contrary, it is possible that the yen funds supplied by yen-selling intervention may have effectively helped in achieving the money supply target. If we assume that this is the case, the Bank of Japan did not sterilize, i.e., it actively chose not to sterilize foreign exchange interventions.

Taylor (2006) points out that the reason why the US Treasury, which in the past had been critical of Japan's yen-selling interventions, approved such interventions at this period is that they provided additional support for the BOJ's quantitative easing policy. In other words, according to this view, Japan's Ministry of Finance conducted large-scale foreign exchange interventions, which the BOJ did not sterilize, thus allowing an increase in base money, which eventually led to the recovery of the Japanese economy. The same point was being made at the time both inside and outside Japan.[3] In contrast, the BOJ maintained that there was no causal relationship between large-scale foreign exchange intervention and quantitative easing. For example, responding to reports in August 2003 that both foreign exchange interventions and the increase in the outstanding balance of current accounts at the BOJ since the beginning of the year amounted to about ¥10 trillion, the Deputy Governor of the BOJ, Iwata, simply stated that this was "coincidence."[4]

Using daily data on current account balances at the BOJ and the value of foreign exchange interventions, the purpose of this paper is to examine the relationship between the quantitative easing policy and the "Great Intervention" by estimating the policy response function of the BOJ. The main

[3]See, for example, Svensson (2001) and Hamada (1999).

[4]However, the Governor in a statement in December 1999 acknowledged that the BOJ employed the method of increasing the money base by leaving the funds of yen-selling foreign exchange interventions in the market, saying that "the BOJ has been flexibly providing ample funds to the short-term money market taking account of factors including yen liquidity arising from foreign exchange intervention."

finding of this investigation is that around 60 percent of the yen funds supplied to the market by yen-selling interventions were offset by monetary adjustments by the BOJ (i.e., sterilized), while the remaining 40 percent were not offset. Moreover, the funds that were not offset remained in the market for quite a while. As a result, in contrast with the preceding period when nearly 100 percent were offset, during the quantitative easing period, the extent to which interventions were not sterilized increased remarkably.[5] During the "Great Intervention," interventions totaling ¥35 trillion were implemented, while the outstanding balance of current accounts during this period rose from approximately ¥20 trillion to ¥33.7 trillion. What is interesting is that this increase in current account balances of ¥13 trillion is roughly equivalent to 40 percent of the value of foreign exchange interventions and thus virtually coincides with our estimation result. The results of this paper thus show that it is highly likely that the BOJ intentionally did not sterilize yen-selling/dollar-buying interventions in order to realize its policy goal of maintaining the outstanding balance of current accounts at a high level.

The remainder of this paper is organized as follows. The next section explains the quantitative easing policy and the "Great Intervention" in greater detail. Section 3 investigates the correlation between interventions and changes in current account balances at the BOJ, while Section 4 estimates the policy response function of the BOJ. Finally, Section 5 concludes.

2 The Quantitative Easing Policy and the "Great Intervention"

2.1 The quantitative easing policy

The BOJ decided to introduce its quantitative easing policy on March 19, 2001 (see Table 1 for a chronology of monetary policy measures in Japan).[6] The aim of this policy was to stimulate effective demand by providing ample supplies of base money. The target level of outstanding current account balances at the BOJ was initially set at ¥5 trillion, meaning that the target level exceeded the level of required reserve, which was approximately ¥4 trillion, by about ¥1 trillion.

As indicated, the main purpose of this paper is to examine how the BOJ decided the level of current

[5]Empirical investigations on the sterilization operations of the BOJ during this period can be found, among others, in Ito (2004), Fatum and Hutchison (2005), and Spiegel (2003). However, these studies do not explicitly formulate a policy response function and therefore do not provide firm evidence that interventions were not sterilized.

[6]The BOJ adopted its zero interest rate policy aiming to keep the target level of the overnight interest rate at zero in February 1999 and maintained this until August 2000. Although the zero interest rate policy and the quantitative easing policy have in common that they aim to maintain the overnight interest rate at zero, the latter differs in the way that it affects aggregate demand not through the interest rate channel.

account balances on a daily basis and the relationship this had with foreign exchange interventions. In this context, two important features of the quantitative easing policy need to be highlighted. The first of these is that there were frequent adjustments of the target level of current account balances. After the initial level had been set at ¥5 trillion in March 2001, this was raised to ¥6 trillion less than half a year later, in August 2001. By December of that year, the target level was further increased to a range of ¥10-15 trillion, and this range continued to be raised at relatively short intervals until it finally reached ¥30-35 trillion in January 2004. Thus, what is important is not only that current account balances were at a high level, but also that they continued to increase.

Second, since December 2001, the target for current account balances was no longer a point value but a range. For example, in January 2004, the range was set at ¥30-35 trillion, meaning that fluctuations up to ¥5 trillion were acceptable. Although the BOJ has not explained why it set a target *range* or on what basis it decided that this range would be ¥5 trillion, looking at the BOJ's actual monetary policy conduct (Figure 1), it becomes clear that in practice it permitted fluctuations within this range. This pattern is especially obvious in the period since 2003, the main period of interest for this paper.

In order to examine this point in greater detail, Figure 2 depicts the distribution of the actual values of daily current account balances during the period when the target range was ¥30-35 trillion, i.e., from January 2004 to March 2006. It shows that the mode of the distribution is at ¥33.7 trillion and the frequency declines toward the fringes of the range. Thus, it can be conjectured that even though in the daily operation of monetary policy, the BOJ had set a provisional target level of ¥33.7 trillion, it was prepared to accept divergences from that level at times of large autonomous disturbances through the inflow and outflow of funds, etc.

2.2 The "Great Intervention"

Figure 3 shows the value of foreign exchange interventions between 2001 and 2007. As can be seen, the pattern of interventions is quite remarkable, showing a high frequency of interventions during the period from January 15, 2003 to March 16, 2004. As is well-known, it is the Ministry of Finance, and in particular the Vice Minister of Finance for International Affairs, who plays a leading role in foreign exchange interventions, and it is conspicuous that interventions were concentrated in the period when Zembei Mizoguchi was in this post. Compared with the period of his predecessors, Sakakibara and

Kuroda (who held the post between June 1995 and January 2002), the frequency of interventions increased remarkably from, on average, once every forty days to once every two days. Moreover, whereas the total amount of interventions under Sakakibara and Kuroda came to ¥26 trillion, under Mizoguchi it reached ¥35 trillion, providing further indication of the heavy intervention during a short period.

3 The Correlation Between Interventions and Changes in Current Account Balances

We now turn to examining whether there is a correlation between changes in current account balances and foreign exchange interventions. If there is a positive correlation between the two, this would mean that foreign exchange interventions were not sterilized. Conversely, no correlation would mean that interventions were sterilized.

In order to examine this issue, let us begin by examining the relationship between the two with a simple scattergram. Figure 4 plots daily data with the horizontal axis depicting the value of interventions and the vertical axis showing the change in current account balances. The sample consists of observations from 1992 onward and is divided into the periods before and after December 19, 2001, the date on which the BOJ first set a target range for current account balances. Current account balances at the end of day t are denoted by R_t, while the value of yen sales/dollar purchases conducted on day t is denoted by I_t. The vertical axis shows $\triangle R_t$, while the horizontal axis depicts I_{t-2}. The value of interventions at $t-2$ is used because the settlement of funds typically takes place two business days after interventions were executed.

As can be see from Figure 4, there is almost no correlation between the two in the first half of the observation period. In contrast, in the latter half of the observation period, a weak correlation can be observed. We examine this difference using a simple regression analysis, estimating the following equation for each period:

$$\triangle R_t = \mu + \beta I_{t-2} + u_t \tag{1}$$

The results of the regression are shown in Table 2. As for the first period, we find that the estimated value of β at -0.004 is extremely small and we cannot reject the null hypothesis of $\beta = 0$. In other words, we cannot reject the hypothesis that interventions during this period were completely sterilized.

In contrast, for the latter period, at 0.389, β is positive and statistically significant, suggesting that approximately 60 percent of the value of foreign exchange interventions was sterilized, while the remaining 40 percent was not. During the period of the "Great Intervention" (from January 2003 to March 2004), foreign exchange interventions totaling ¥35 trillion were carried out. At the same time, current account balances at the BOJ during this period increased from ¥20 trillion to ¥33 trillion. Interestingly, the increase in current account balances of ¥13 trillion is equivalent to approximately 40 percent of the value of foreign exchange interventions. Thus the estimation result and the actual figure are almost identical.

The results presented in Table 2 suggest that it is possible that the correlation between interventions and changes in current account balances may differ depending on the observation period. Therefore, we use equation (1) to conduct a rolling regression in order to examine the change in the coefficient β over time. The window of the rolling regression is the preceding 750 days. The results are shown in Figure 5, which shows the estimated value of β as well as the 90 percent confidence interval. The figure indicates that while until 2000, β is zero or below zero, it turns positive in September 2001 and from March 2003 onward becomes large and significantly different from zero. Moreover, after 2003, the value of β is relatively stable at around 0.4.

4 Estimation of the Policy Response Function

Equation (1) represents an estimation equation that has been widely used in preceding studies to measure the extent of sterilization. Examining the most recent period in Japan, Fatum and Hutchison (2005) and Ito (2004), for example, employed a similar specification. However, estimating the conduct of the BOJ during the period of quantitative easing poses the following serious problems.

First, even if there was a positive correlation between interventions and changes in current account balances, such a correlation may be spurious. To illustrate this, let us consider the case where current account balances are at the lower limit of the target range. The BOJ may want to return current account balances to the middle of the target range and is planning operations to supply the market with funds. Let us further assume that at this moment, the Ministry of Finance conducts a yen-selling intervention that was unexpected for the BOJ. Then, because current account balances approach the middle of the target range as a result of the supply of funds to the market via the yen-selling intervention, the BOJ may decide to abandon its planned operation and leave the funds from the

intervention in the market. In such cases, it is possible to observe a positive correlation between interventions and changes in current account balances. However, such a correlation is spurious and does not represent non-sterilization. In order to overcome this problem, it is necessary to estimate a specification that explicitly takes into account how the BOJ changes current account balances within the target range.

Second, equation (1) only looks at the correlation between interventions and the change in current account balances on the specific day on which interventions are settled. Even if the correlation between interventions and changes in current account balances on that specific day is high, it is possible that the relationship weakens with the passage of time. For example, interventions often come unexpected for the central bank and for that reason it is difficult to conduct operations to immediately sterilize an intervention. Another reason why sterilization may not occur on the day of the intervention is to avoid that market participants know that the intervention has taken place. In this case, the central bank may allow current account balances to change in response to the intervention on the settlement day, but may then conduct operations on the next day, or the day after that, to return current account balances to their original level. In other words, looked at not from any particular moment in time but from a dynamic perspective, it is possible that interventions have been sterilized.

Third, even if the estimation results of equation (1) were to show non-sterilization, this does not necessarily mean that the BOJ discriminated between interventions and other government payments and responded differently. The government pays funds to the private sector, for example in the form of pension payments, and also receives funds, such as in the form of taxes. The supply of yen funds to the market through yen-selling/dollar-buying interventions represents one way in which the government pays part of its funds. If the central bank generally does not sterilize government payments, including those in the form of foreign exchange interventions, this would not be a particularly interesting finding. What we are interested in is whether or not the central bank distinguishes between foreign exchange interventions and other government payments and increases the degree of non-sterilization in the case of foreign exchange interventions. In order to examine this, it is not enough to only look at the correlation between interventions and changes in current account balances; instead, it is necessary to also estimate the correlation between other government payments and changes in current account balances and then to compare the two correlations.

4.1 The target range of current account balances

We now turn to the estimation of the central bank's policy response function taking the above three points into consideration. We begin by modeling how the BOJ adjusted current account balances within the target range. In the first specification, the BOJ aims for a specific level within the target range and conducts daily operations to steer balances as far as possible toward that level. In this case, equation (1) should be extended as follows:

$$R_t = \mu + \rho R_{t-1} + \beta I_{t-2} + u_t \tag{2}$$

where ρ is the parameter for the adjustment speed to the desired level and satisfies $|\rho| < 1$. The closer ρ is to 1, the slower is the convergence to the desired level.

In equation (2), the central bank tries to steer current account balances toward the desired level even if they are within the target range. However, another possibility is that the central bank allows current account balances to fluctuate freely as long as they are within the target range and only tries to steer them to the target range when they move outside it. In this case, equation (1) should be extended as follows:

$$R_t = \mu + \rho R_{t-1} + \rho^* R^*_{t-1} + \beta I_{t-2} + u_t \tag{3}$$

where the variable R^*_t is defined as $R^*_t \equiv R_t * 1[R_t > R^{upper}_t$ or $R_t < R^{lower}_t]$ (where R^{upper}_t stands for the upper limit of the target range and R^{lower}_t for the lower limit). That is, R^*_t equals to R_t when R_t is within the target range; otherwise it equals to zero. Equation (3) implies that when R_t is within the target range, it converges to the desired level with speed $1-\rho$, while when it is outside the target range, it converges with speed $1-(\rho+\rho^*)$. For example, if the BOJ permits current account balances to move freely within the target range and there is no convergence whatsoever, but once current account balances are outside the range, they converge to the desired level, this means that $\rho = 1$ and $-2 < \rho^* < 0$.

The estimation results for equations (2) and (3) are shown in Table 3.[7] In the estimation, dummy variables for a change in the target for current accounts were added to both equations.[8]

[7]The estimation period for equation (2) is from December 2001, when the BOJ first set a target range for current account balances, to March 2006, when the quantitative easing policy ended. In contrast, the estimation period for equation (3) begins in May 2003, when the target range was set to ¥27-30 trillion.

[8]Specifically, six dummy variables for the following dates were included: 2002/10/30, 2003/4/1, 2003/4/30, 2003/5/20, 2003/10/10, and 2004/1/20. Each dummy variable takes a value of one from that date onward.

In equation (2), the estimation result for ρ is 0.819, meaning that when current account balances diverge from the desired level, the time required to halve that divergence is 3.5 days ($\approx \ln(0.5)/\ln(0.819)$). In other words, convergence is quite rapid. The estimated value of β, the parameter of main concern for the investigation here, is 0.405, which is only slightly larger than the result obtained in Table 2. From these estimation results, we can conclude that the correlation between foreign exchange interventions and changes in current account balances is not spurious. Next, looking at the estimation results for equation (3), the estimated value of ρ is 0.646 and that of ρ^* is -0.012, indicating that the difference in the speed of convergence outside and within the target range is not that great. Moreover, the estimated value of β is 0.460, showing a high degree of sterilization.

4.2 The dynamic effects of foreign exchange interventions

To consider the dynamic effects of foreign exchange interventions, let us further expand equation (2) in the following manner:

$$R_t = \mu + \rho R_{t-1} + \sum_{k=0}^{K} \beta_k I_{t-2-k} + u_t \tag{4}$$

Unlike equation (2), this specification makes it possible to consider the impact on current account balances not only of interventions two days earlier, but also of interventions three, four, or more days earlier. In the estimation, dummy variables for a change in the target level of current accounts were included.

Using the estimation results from equation (4), Figure 6 shows the effect of a ¥1 trillion foreign exchange intervention on current account balances.[9] The estimation period is December 19, 2001 to March 9, 2006. In the estimation, we set $K = 9$. The figure suggests that the effect at t of the intervention, which was executed at $t-2$, is about 0.5 and gradually declines thereafter and becomes zero at $t+3$; however, from $t+7$ onward it returns to around 0.4. This confirms that the unsterilization of foreign exchange interventions is not an instantaneous phenomenon that occurs only at t.[10]

[9] Specifically, the effect of intervention at $t-2$ upon current account balances at $t+j$ was calculated as $\beta_0+\beta_1+\cdots+\beta_j$.

[10] Another study examining the sterilization of interventions from a dynamic perspective is that by Fatum and Hutchison (2005) who use the same data as this study and conclude that interventions are almost completely sterilized. However, in contrast with the present study, their analysis does not take into account factors such as the lag between interventions and the settlement of funds; moreover, it also differs from the present analysis in that changes in the convergence of R_t to the desired level are not considered.

4.3 Comparison with government financial transactions other than foreign exchange interventions

In addition to foreign exchange interventions, the balance of current accounts at the BOJ also varies as a result of the financial activities of the government. For example, when the government makes pension payments to the private sector, current account balances increases. Conversely, when the government collects taxes from the private sector, current account balances decrease.

Let the payment of government funds on day t be denoted by GP_t, while government receipts are denote by GR_t[11]. Note that while yen-selling/dollar-purchasing interventions are normally included in government payments, let GP_t here denote only government payments other than foreign exchange interventions. Using this definition of variables, equation (3) is expanded to yield the following estimation equation:

$$R_t = \mu + [\rho R_{t-1} + \rho^* R^*_{t-1}] + [\beta I_{t-2} + \beta^* I^*_{t-2}] + [\gamma GP_t + \gamma^* GP^*_t] + [\delta GR_t + \delta^* GR^*_t] + u_t \qquad (5)$$

Equation (5) differs from equation (3) in the following ways. First, government payments other than foreign exchange interventions are explicitly considered as an explanatory variable. If the BOJ does not distinguish between interventions and other government payments, then β and γ should take the same value. In contrast, if the BOJ does distinguish between interventions and other government payments and only leaves interventions unsterilized, β should be positive, while γ should be zero.

Second, equation (5) distinguishes whether current account balances move outside the target range as a result of government payments and receipts or not. Specifically, I^*_t, GP^*_t, and GR^*_t are respectively defined as follows:

$$\begin{aligned} I^*_t &\equiv I_t \; 1[R_{t-1} + I_t > R^{upper}_t]; \\ GP^*_t &\equiv GP_t \; 1[R_{t-1} + GP_t > R^{upper}_t]; \\ GR^*_t &\equiv GR_t \; 1[R_{t-1} + GR_t < R^{lower}_t] \end{aligned} \qquad (6)$$

where I^*_t represents the case where current account balances exceed the upper limit of the target range as a result of intervention. GP^*_t and GR^*_t represent the corresponding cases for government payments and government receipts. If the BOJ more strongly offsets large shocks in which current account balances shoot out of the target range, β^*, γ^*, and δ^* should take negative values.

[11] GP_t and GR_t are defined as $GP_t \equiv G_t 1(G_t > 0)$ and $GR_t \equiv G_t 1(G_t < 0)$

The estimation results for equation (5) are presented in Table 4 and show the following. First, looking at the response in current account balances to foreign exchange interventions, the estimated value for β is 0.545 and that for β^* is -0.465, indicating that when current account balances remained within the target range despite foreign exchange interventions, more than 50 percent of the value of such interventions were not sterilized, which is in line with earlier results. However, in the case of large foreign exchange interventions that would lead current account balances to shoot outside the target range, the impact is actually almost zero ($\beta+\beta^* = 0.08$), meaning that such interventions were almost completely sterilized.

Second, looking at the impact of government payments other than foreign exchange interventions on current account balances, the estimated values of γ is 0.396 and that of $\gamma+\gamma^*$ is 0.208. Comparing β and γ, the former is significantly larger than the latter, indicating that the extent to which foreign exchange interventions are offset is smaller than the extent to which other government payments are offset. However, the opposite is true when current account balances shoot outside target range; i.e., in this case, the extent to which government payments (other than foreign exchange interventions) are offset is smaller than the extent to which foreign exchange interventions are offset.

Third, looking at the impact of government receipts on current account balances, the estimated value of δ is 0.162 and that of $\delta + \delta^*$ is 0.268, indicating that with regard to a shock resulting in current account balances shooting outside the target range, the extent to which this is offset is rather small. Since offsetting a shock that leads to current account balances shooting below the lower limit of the target range required the BOJ to supply funds by purchasing bonds from the market, this result suggests that such purchasing operations may have been technically difficult in a situation where bond yields were very close to the zero lower bound.[12]

Next, using equation (5), let us examine the dynamic effect of government payments including foreign exchange interventions and government receipts on current account balances. The estimation equation looks as follows:

$$R_t = \mu + [\rho R_{t-1} + \rho^* R^*_{t-1}] + \sum_{k=0}^{K}[\beta_k I_{t-2-k} + \beta^*_k I^*_{t-2-k}] + \sum_{k=0}^{K}[\gamma_k GP_{t-k} + \gamma^*_k GP^*_{t-k}] + \sum_{k=0}^{K}[\delta_k GR_{t-k} + \delta^*_k GR^*_{t-k}] + u_t \quad (7)$$

The estimation results are displayed in Figure 7 and suggest the following. First, although the

[12] For details on the situation of funds-supplying operations at that time, see Bank of Japan (2004).

effect of foreign exchange interventions gradually declines until $t+4$, it then remains relatively stable at around 0.4 after that. This result is in contrast with the result shown in Figure 6, where the effect disappears at $t+3$ and $t+4$. It probably reflects the correction of estimation bias as a result of the explicit inclusion of government payments and receipts other than foreign exchange interventions as explanatory variables. Second, comparing the effects of government payments and receipts, the effect of payments becomes insignificant from the third day onward, while receipts have a positive effect all the way through to the tenth day. This pattern also holds in the case where current account balances shoot outside the target range.

Okina and Shiratsuka (2000) argue that because the yen funds required for yen-selling/dollar-buying intervention will in any case eventually be obtained through the issuance of FBs, interventions are always 100 percent sterilized. Generally, the issuance of FBs does not take place at the same time as foreign exchange interventions but occurs about two months later. Therefore, according to their argument, interventions will be sterilized after a period of two months. However, there is no guarantee that the BOJ will remain inactive at the time when funds are absorbed from the market through the issuance of FBs, since it may purchase FBs from the market at the same time that the government issues FBs. If this were the case, the intervention will not be sterilized even from a dynamic viewpoint. Consequently, in order to see whether an intervention was sterilized or not, it is necessary to examine whether there is an increase in current account balances at the time that the government issued FBs.

To this end, we define FB_t as the negative value of FBs issued and GR_t as the receipt of government funds except FBs and expand equation (9) as follows:

$$R_t = \mu + [\rho R_{t-1} + \rho^* R^*_{t-1}] + \sum_{k=0}^{K}[\beta_k I_{t-2-k} + \beta^*_k I^*_{t-2-k}] + \sum_{k=0}^{K}[\gamma_k GP_{t-k} + \gamma^*_k GP^*_{t-k}] + \sum_{k=0}^{K}[\delta_k GR_{t-k} + \delta^*_k GR^*_{t-k}] + \sum_{k=0}^{K}[\zeta_k FB_{t-k} + \zeta^*_k FB^*_{t-k}] + u_t \quad (8)$$

Using the estimation result from equation (10), Figure 8 depicts the change in current account balances associated with the issuance of ¥1 trillion worth of FBs. Even though current account balances decrease on the day that FBs are issued, the effect on current account balances disappears after three days and is no longer significant. This is a noteworthy trend when compared with government receipts (GR_t): while the impact of GR_t remains until the tenth day, that of FB_t quickly vanishes. This suggests that the BOJ did distinguish between and responded differently to a decrease in market

funds linked to the issuance of FBs and other government receipts.

Because substantial quantities of FBs were issued in connection with the large-scale foreign exchange interventions during the "Great Intervention" period, there appears to have been a sense among investors that they held excessive quantities of FBs. The finding here thus can be interpreted as implying that the BOJ kept a close watch on this and decided to maintain current account balances at a high level by purchasing large quantities of FBs from the market. Thus, the results presented here suggest that the BOJ "unsterilized" foreign exchange interventions by purchasing FBs.

5 Conclusion

Using daily data on foreign exchange interventions and current account balances at the Bank of Japan, this paper examined the relationship between interventions and monetary policy during the period from January 2003 to March 2004. The findings can be summarized as follows. First, roughly 60 percent of the funds supplied to the market through yen-selling foreign exchange interventions were offset (i.e., sterilized) by monetary adjustment by the Bank of Japan, while the remaining 40 percent were not offset. Moreover, the funds that were not offset remained in the market for quite a while. This result contrasts with the situation before this period, when 100 percent of the funds of foreign exchange interventions were offset, showing that the extent to which interventions were not sterilized during January 2003 to March 2004 was quite remarkable.

Second, comparing yen funds supplied through foreign exchange interventions and yen funds supplied through other government payments (such as pension payments), it was found that the extent to which such funds remained in the market was greater and the time span was longer in the case of the former. This suggests that the BOJ in its monetary operations distinguished between foreign exchange interventions and other government payments.

Third, the majority of financing bills issued to cover intervention funds were purchased by the BOJ from the market immediately after they were issued. For that reason, no substantial decrease in current account balances linked with the issuance of FBs could be observed. These three findings indicate that it is highly likely that the BOJ, in order to implement its policy target of maintaining current account balances at a high level, intentionally did not sterilize yen-selling/dollar-buying interventions.

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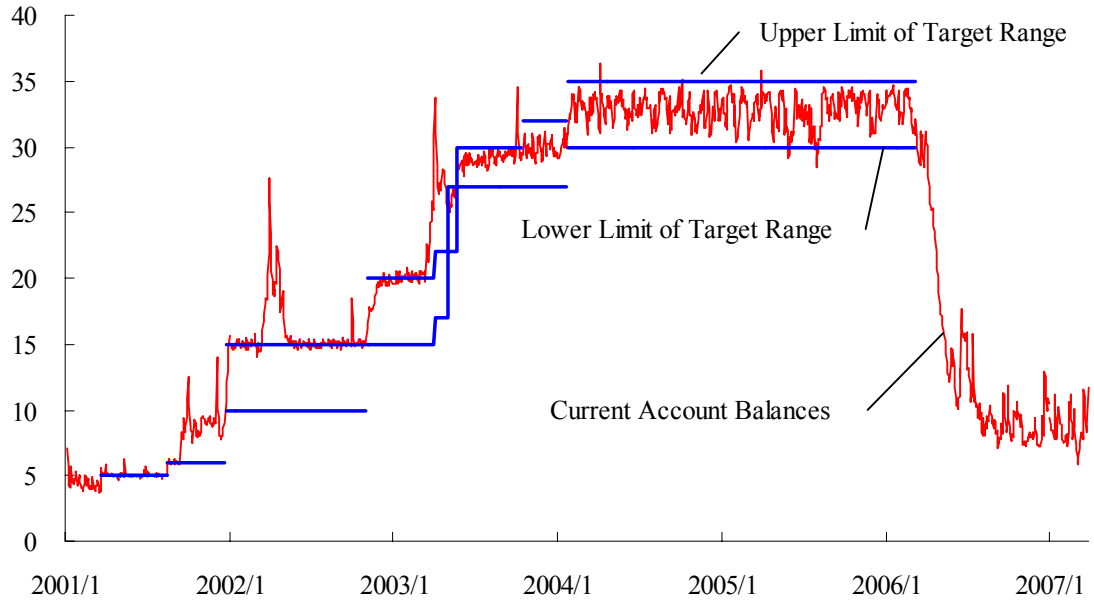
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Figure 1

Current account balances: Target and actual deposits

Trillion Yen

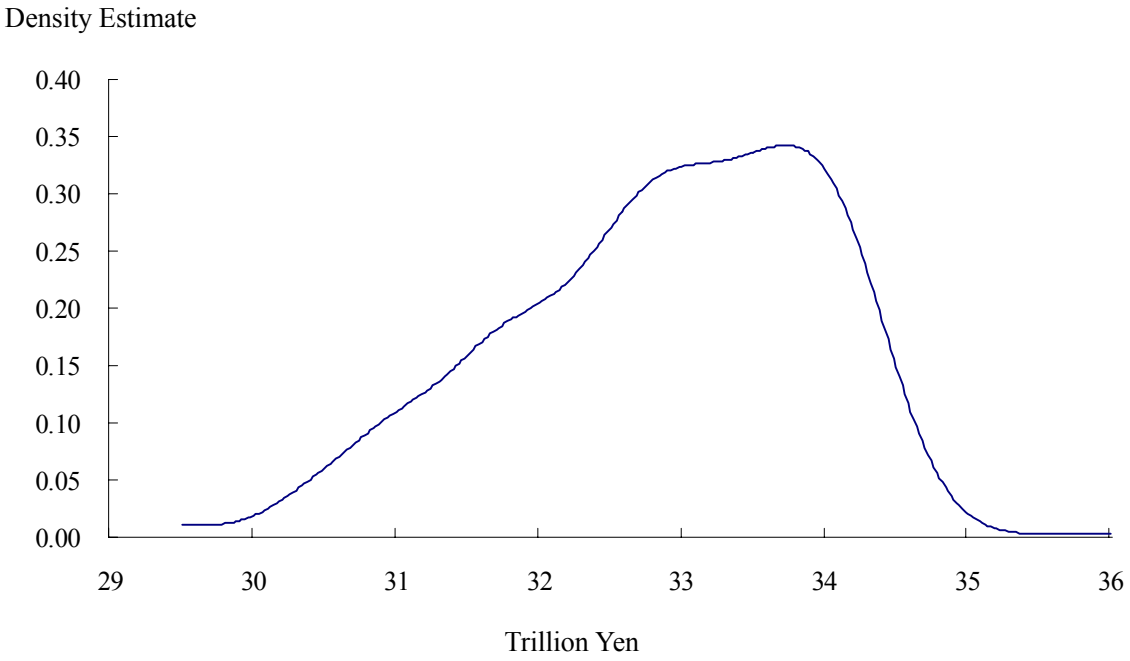


Notes: The BOJ decided to introduce its quantitative easing policy on March 19, 2001. The target level of current account balances at the BOJ was initially set at ¥5 trillion. After the initial level had been set at ¥5 trillion in March 2001, this was raised to ¥6 trillion in August 2001. By December of that year, the target level was further increased to a range of ¥10-15 trillion, and this range continued to be raised at relatively short intervals until it finally reached ¥30-35 trillion in January 2004. See also Table 1 for chronology of monetary policy events.

Source: Bank of Japan.

Figure 2

Frequency distribution of current account balances



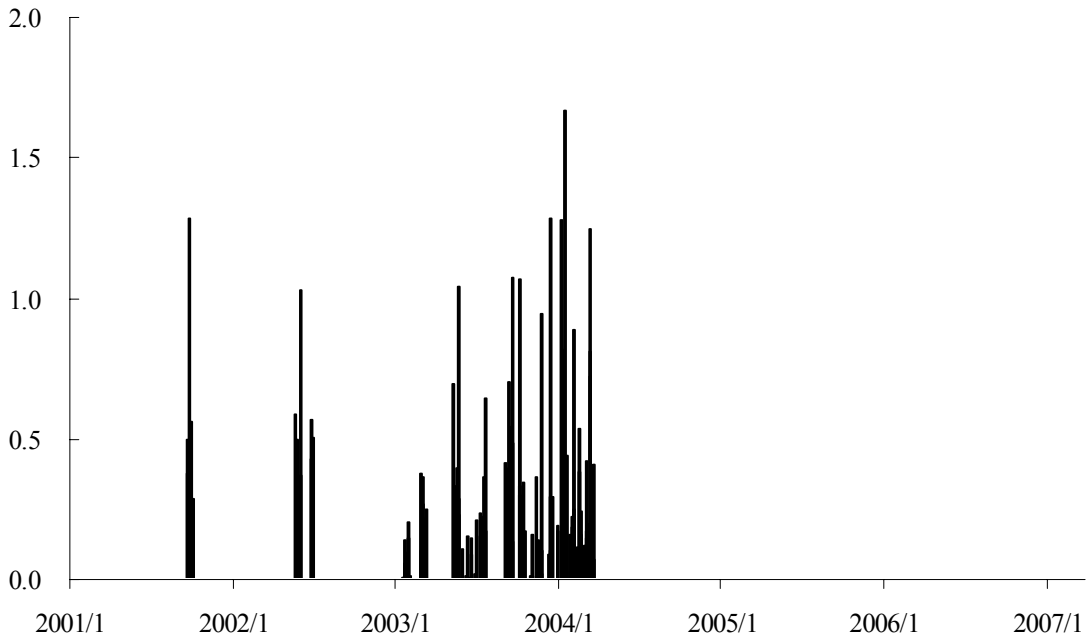
Notes This figure shows the distribution of the actual values of daily current account balances during the period when the target range was ¥30-35 trillion, i.e., from January 20, 2004 to March 9, 2006. To compute the probability density function, we use a normal kernel and the likelihood cross-validation method to select the bandwidth (See Silverman (1986)).

Source: Bank of Japan.

Figure 3

Daily value of foreign exchange interventions

Trillion Yen



Notes: The sample period is from January 1, 2001 to March 31, 2007.

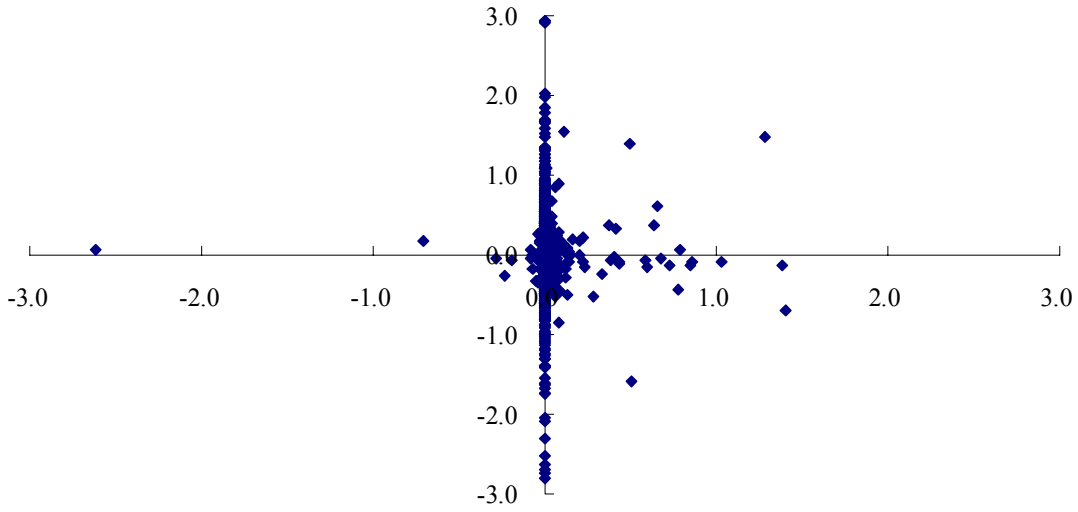
Source: Ministry of Finance.

Figure 4

The correlation between interventions and changes in current account balances

1992/1/1-2001/12/18

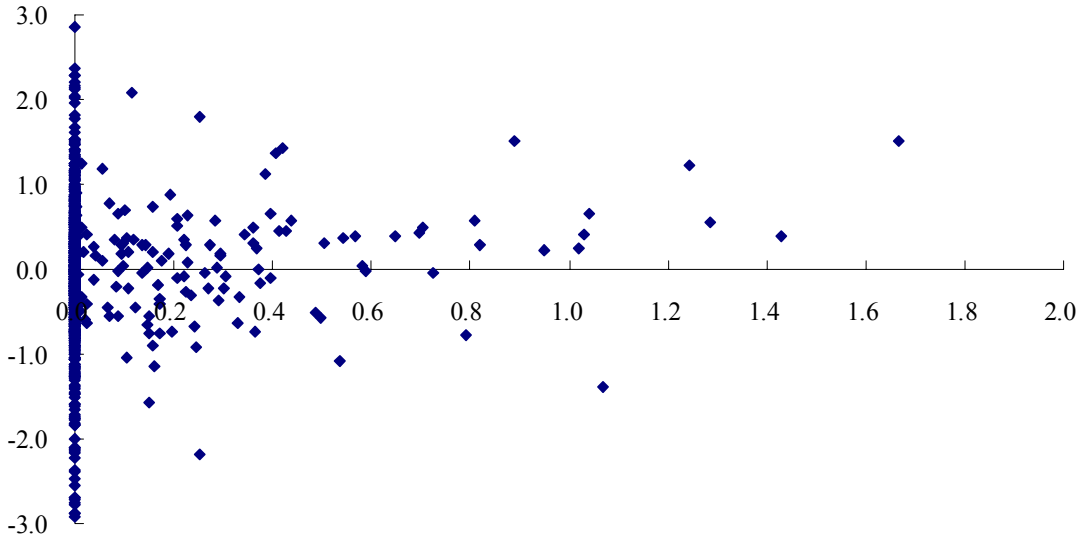
ΔR_t



I_{t-2}

2001/12/19-2006/3/9

ΔR_t



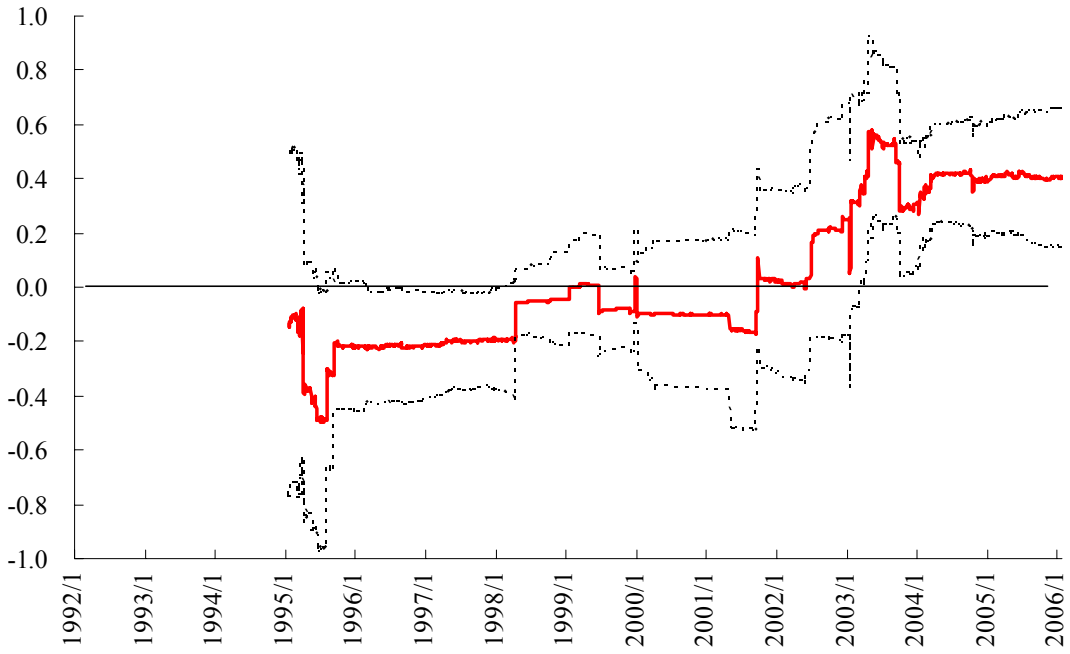
I_{t-2}

Notes: We compare ΔR_t with I_{t-2} to take into account the two day time-lag between implementation of intervention and its settlement.

Figure 5

Estimates of β from rolling regressions of equation (1)

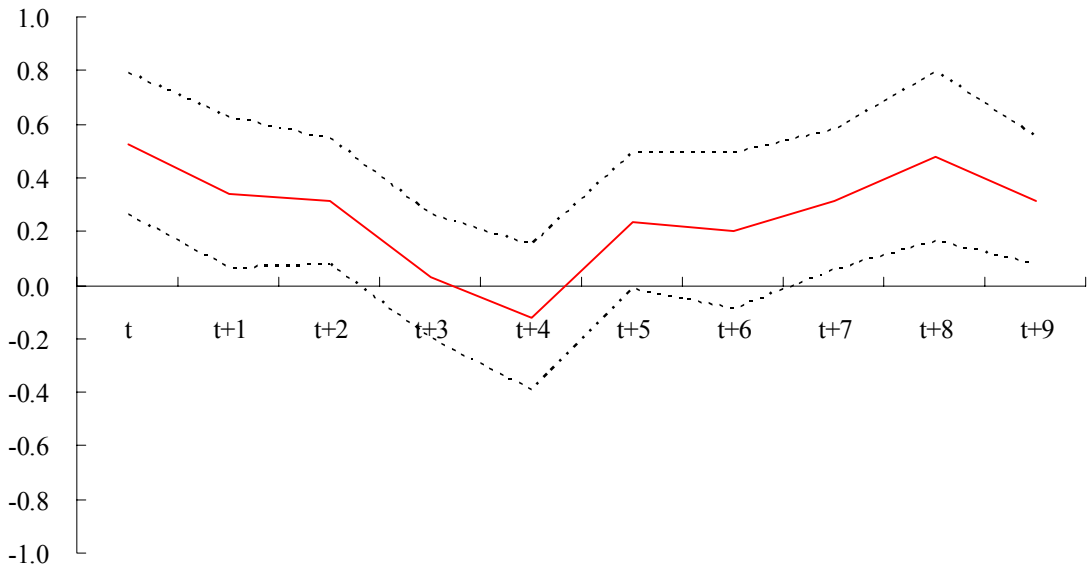
Coefficient on Intervention at t-2



Notes: Bold line is the estimated value of β and the dotted lines are the upper and lower bound of the 90% confidence interval. The window of the rolling regression is the preceding 750 business days.

Figure 6

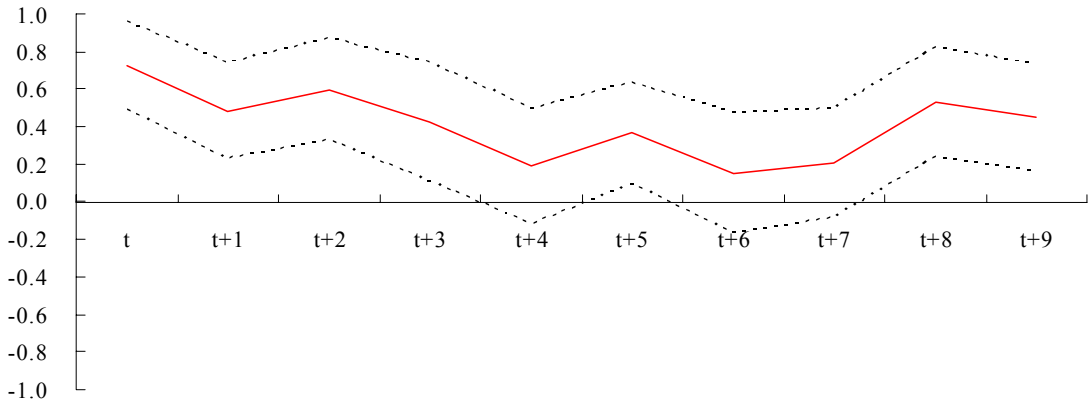
The impact of a ¥1 trillion foreign exchange intervention on current account balances



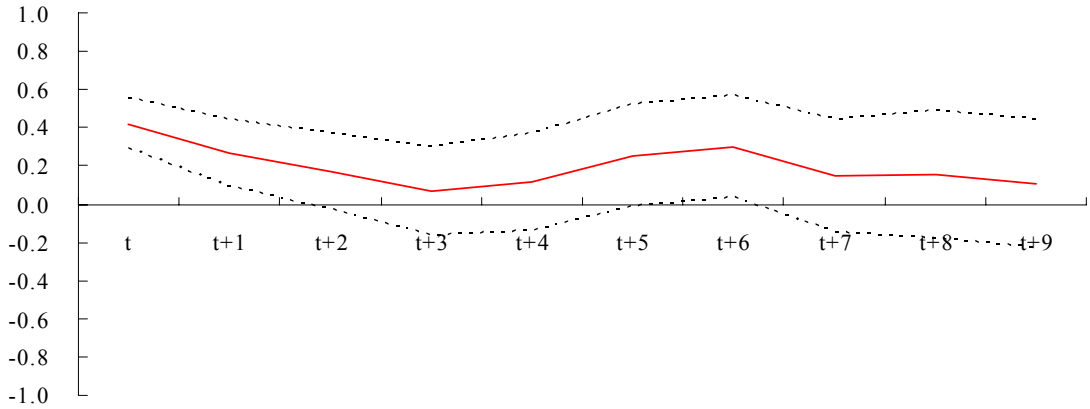
Notes: The zero-period cumulative multiplier is β_1, the one-period cumulative multiplier is $\beta 1+\beta 2$, and the h-period cumulative multiplier is $\beta_1+\ldots+\beta_{h+1}$. Bold line is the estimate of cumulative effect and the dotted lines are the upper and lower bound of the 90% confidence interval. The estimation period is from December 19, 2001 to March 9, 2006.

Figure 7: The impact of government payments and receipts on current account balances

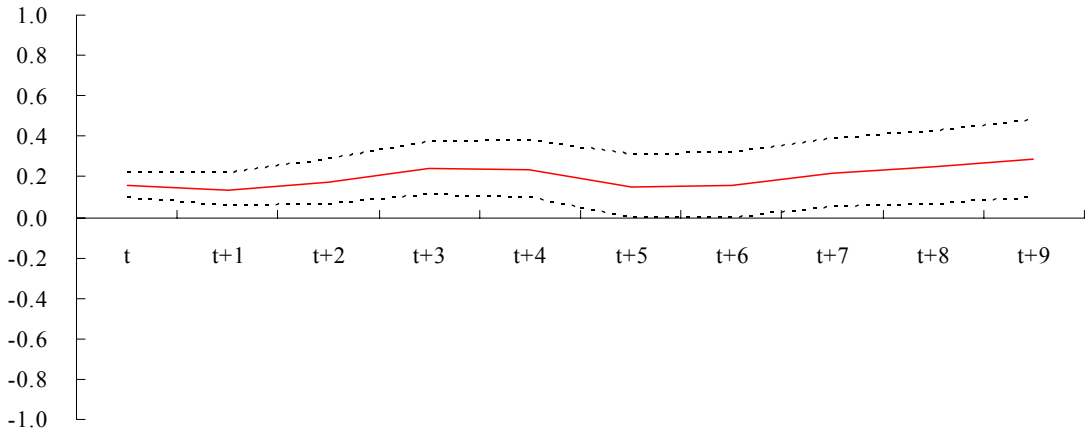
I



GP



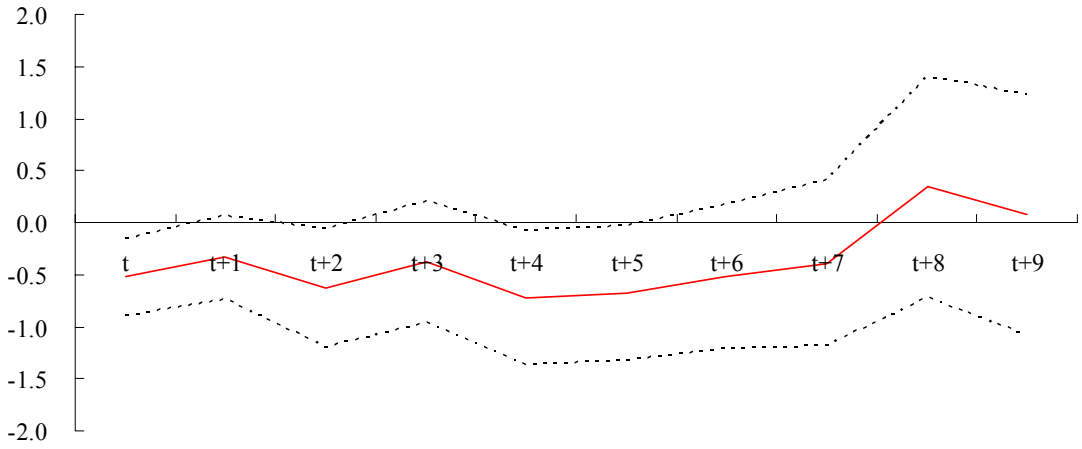
GR



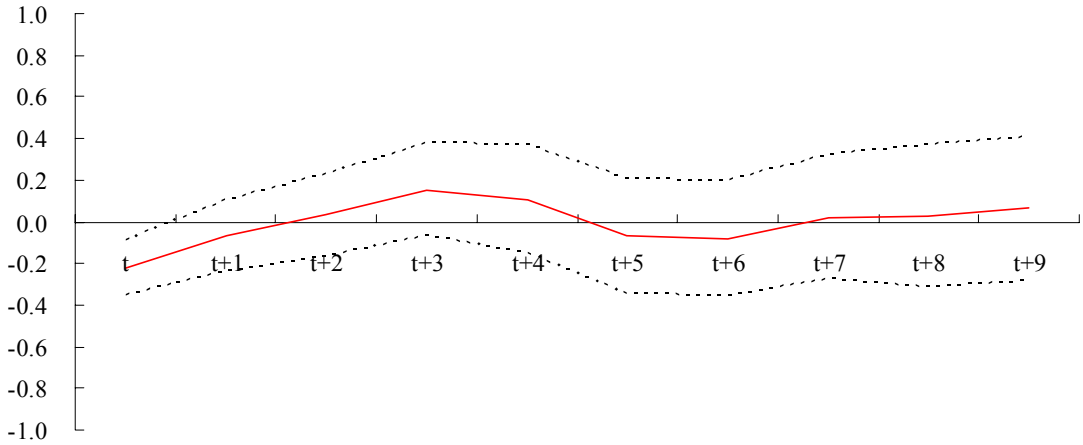
Notes: The estimation period is from May 20, 2003 to March 9, 2006.

Figure 7 (Continued)

I*



GP*



GR*

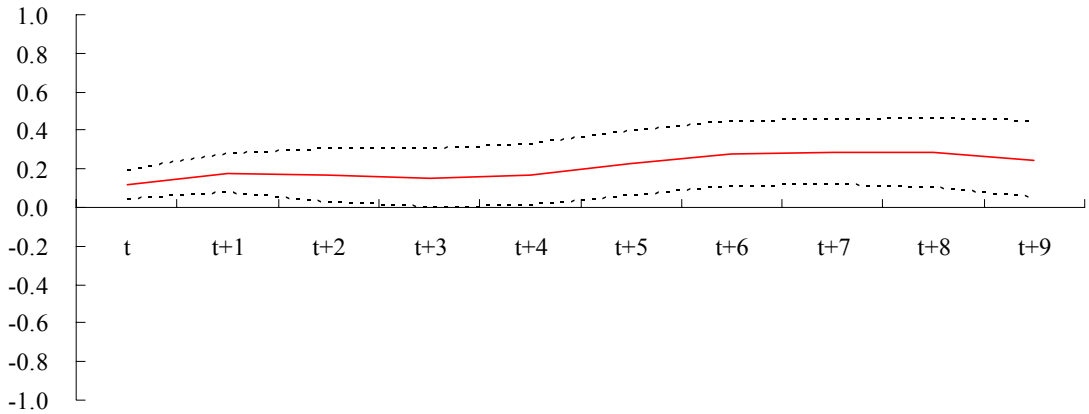
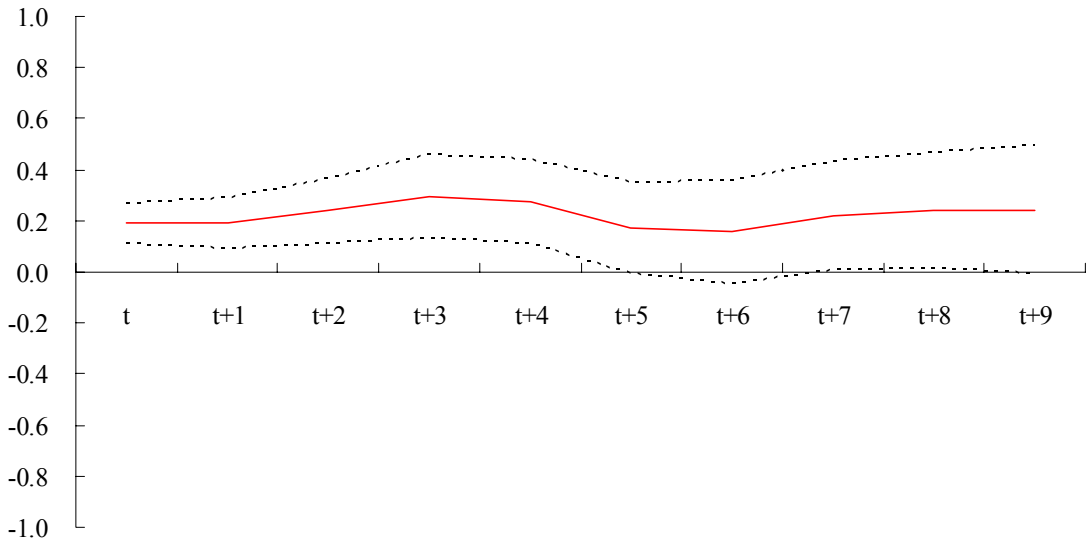


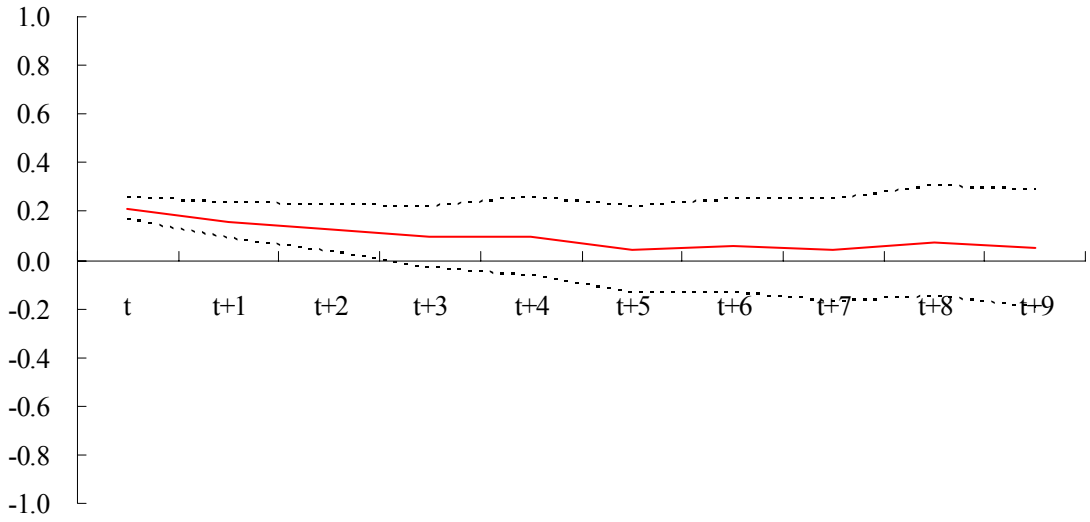
Figure 8

The effect of the issuance of FBs on current account balances

GR



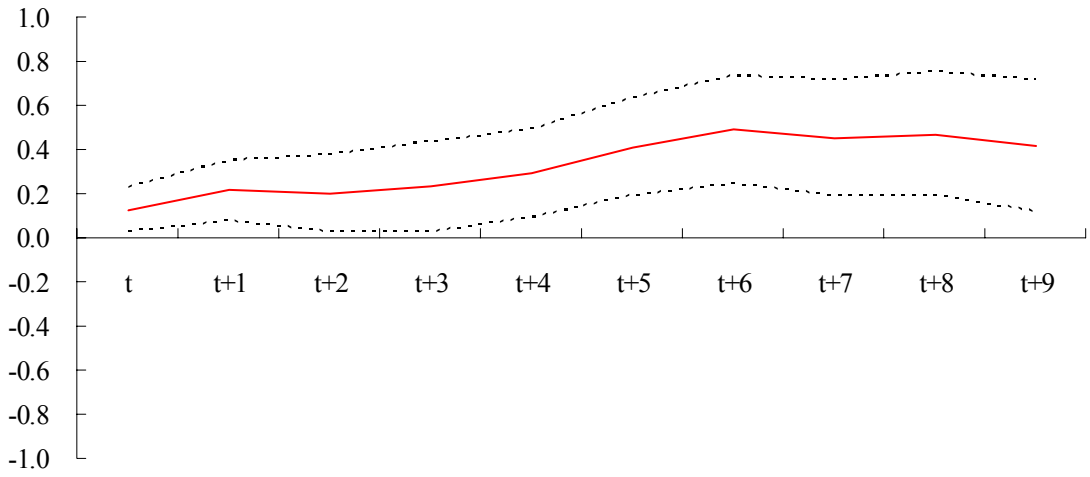
FB



Notes: The estimation period is from May 20, 2003 to March 9, 2006.

Figure 8 (Continued)

GR*



FB*

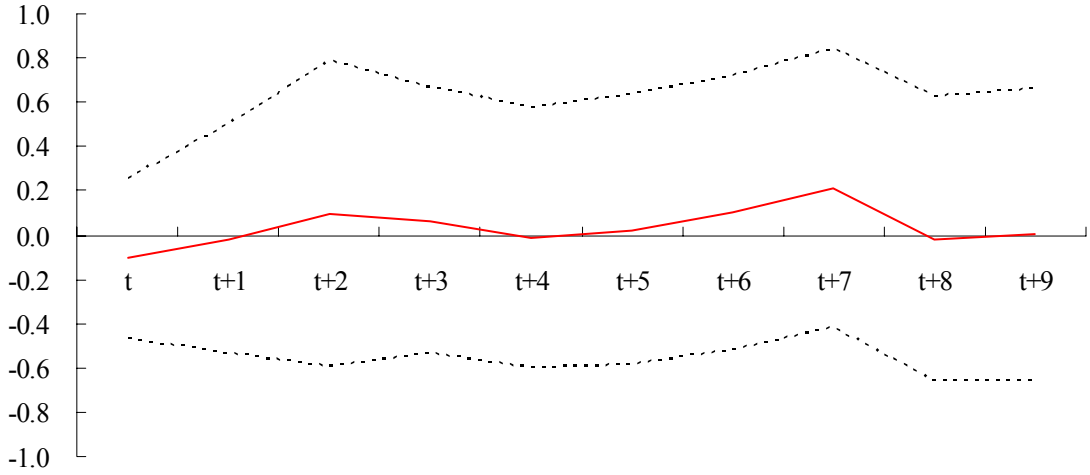


Table 1

Chronology of monetary policy measures, 1999–2006

Date	Major events
09/09/98	The BOJ reduces the target O/N rate to 0.25 from 0.50 percent
02/12/99	The BOJ introduces a zero interest rate policy (ZIRP)
04/13/99	Governor Hayami announces the BOJ will continue the ZIRP until "deflationary concerns are dispelled"
10/13/99	The BOJ expands the range of money market operations
08/11/00	The BOJ terminates the ZIRP. The target O/N rate is set at 0.25 percent
02/09/01	The BOJ introduces "Lombard-type" lending facility and reduces the official discount rate to 0.375 from 0.5 percent
02/28/01	The BOJ reduces the target O/N rate to 0.125 percent and the official discount rate to 0.25 percent
03/19/01	The BOJ announces to introduce "quantitative monetary easing policy" and continue it until "the core CPI records a year-on year increase of zero percent or more on a stable basis." The target current account balance (CAB) is set at 5 trillion yen
08/14/01	The BOJ raises the target CAB to 6 trillion yen
09/18/01	The BOJ raises the target CAB to above 6 trillion yen
12/19/01	The BOJ raises the target CAB to 10-15 trillion yen
10/30/02	The BOJ raises the target CAB to 15-20 trillion yen
04/01/03	The BOJ raises the target CAB to 17-22 trillion yen
04/30/03	The BOJ raises the target CAB to 22-27 trillion yen
05/20/03	The BOJ raises the target CAB to 27-30 trillion yen
10/10/03	The BOJ raises the target CAB to 27-32 trillion yen The BOJ announces more detailed description of its commitment regarding the timing to terminate “quantitative easing policy”
01/20/04	The BOJ raises the target CAB to 30-35 trillion yen
03/09/06	Termination of QMEP
07/14/06	The BOJ terminates the ZIRP. The target O/N rate is set at 0.25 percent

Table 2

The correlation between interventions and changes in current account balances

$$\Delta R_t = \mu + \beta I_{t-2} + u_t \quad (1)$$

	FULL	1992/1/1-2001/12/18	2001/12/19-2006/3/9
μ	-0.016	-0.006	-0.046
	(0.009)†	(0.011)	(0.020)*
β	0.188	-0.004	0.389
	(0.103)†	(0.151)	(0.116)**
R2 Bar	0.052	0.016	0.162
OBS	3496	2461	1035

Notes: Heteroskedasticity-and-autocorrelation-consistent (HAC) standard errors are given in parentheses.

†Statistically significant at the 10-percent level.

*Statistically significant at the 5-percent level.

**Statistically significant at the 1-percent level.

β=0: Sterilization is complete.

0<β<1: Sterilization is Not Complete.

β=1, Interventions are Unsterilized.

Table 3

Estimation of the policy response function (1)

$$R_t = \mu + \rho R_{t-1} + \beta I_{t-2} + u_t \qquad (2)$$

$$R_t = \mu + \rho R_{t-1} + \rho^* R^*_{t-1} + \beta I_{t-2} + u_t \qquad (3)$$

	Eq(2) 2001/12/20-2006/3/9	Eq(3) 2001/12/19-2006/3/9
μ	2.796	10.226
	(0.411)**	(0.966)**
ρ	0.819	0.646
	(0.028)**	(0.033)**
ρ*		-0.012
		(0.007)†
β	0.405	0.460
	(0.106)**	(0.091)**
R2 Bar	0.990	0.832
OBS	1034	690

Notes: Heteroskedasticity-and-autocorrelation-consistent (HAC) standard errors are given in parentheses.

†Statistically significant at the 10-percent level.

*Statistically significant at the 5-percent level.

**Statistically significant at the 1-percent level.

Table 4

Estimation of the policy response function (2)

$$R_t = \mu + [\rho R_{t-1} + \rho^* R^*_{t-1}] + [\beta I_{t-2} + \beta^* I^*_{t-2}] + [\gamma GP_t + \gamma^* GP^*_t] + [\delta GR_t + \delta^* GR^*_t] + u_t \quad (5)$$

	Eq (5) 2003/5/20-2006/3/9	
μ	8.838	
	(0.673)	**
ρ	0.697	
	(0.023)	**
ρ*	-0.024	
	(0.005)	**
β	0.545	
	(0.079)	**
β*	-0.465	
	(0.196)	**
γ	0.396	
	(0.077)	**
γ*	-0.187	
	(0.079)	*
δ	0.162	
	(0.036)	**
δ*	0.106	
	(0.046)	*
R2 Bar	0.882	
OBS	690	

Notes: Heteroskedasticity-and-autocorrelation-consistent (HAC) standard errors are given in parentheses.

†Statistically significant at the 10-percent level.

*Statistically significant at the 5-percent level.

**Statistically significant at the 1-percent level.