The Bank of Japan's Experience with Non-Traditional Monetary Policy*

Kazuo Ueda
Faculty of Economics
The University of Tokyo

Abstract

This paper offers a brief summary of non-traditional monetary policy measures adopted by the Bank of Japan (BOJ) during the last two decades, especially the period between 1998-2006, when the so-called Zero Interest Rate Policy (ZIRP) and Quantitative Easing (QE) were put in place. The paper begins with a typology of policies usable at low interest and inflation rates. They are: strategy (i), management of expectations about future policy rates; strategy (ii), targeted asset purchases; and strategy (iii), QE. Alternatively, QE may be decomposed into a pure attempt to inflate the central bank balance sheet, QE0, purchases of assets in dysfunctional markets, QE1 and purchases of assets to generate portfolio rebalancing, QE2. Strategy (ii), when non-sterilized, is either QE1 or QE2. I summarize the theoretical literature on the effectiveness of such strategies. Using this typology, I then review the measures adopted by the BOJ and discuss evidence on the effectiveness of the measures. The broad conclusion is that strategy (i) and (ii) have affected interest rates, while no clear evidence exists so far of the effectiveness of strategy (iii), or QE0. Strategy (ii) has been effective especially in containing risk/liquidity premiums in dysfunctional money markets; that is, QE1 has been effective. The effectiveness of QE2, however, is unclear. The strategies, however, have failed to bring the economy out of the deflation trap so far. I discuss some possible reasons for this and also implications for the current U.S. situation.

Responding to the severe global financial and economic crisis since the summer of 2007, central banks around the world have been engaging in the so-called non-traditional approaches to stimulate the economies and address problems in the financial system. Although unprecedented measures seem to have been adopted by major central banks since 2007, many of them have been tried in one way or another in earlier periods of financial crises, especially by the Bank of Japan (BOJ) during 1998-2006 and are in this sense not new.

In the following I offer a brief discussion of non-traditional monetary policy measures adopted by the BOJ during the last two decades. I mostly focus on the period between 1998-2006 because this is when innovative policies such as the so-called ZIRP and QE were adopted. In section 1 I begin with a typology of policies usable at low interest and inflation rates. They are: strategy (i), management of expectations about future policy rates; strategy (ii), targeted asset purchases; and strategy (iii), quantitative easing. I also classify QE into three components depending on what types of assets the central bank purchases. Under this classification strategy (ii), when asset purchases are not sterilized, is part of QE. I also summarize the theoretical literature on the effectiveness of such strategies.

In section 2 I explain the measures adopted by the BOJ, using this typology and discuss evidence on the effectiveness of the measures in section 3. The broad conclusion is that strategy (i) and (ii) have affected interest rates, while no clear evidence exists so far of the effectiveness of strategy (iii). Strategy (ii) has been effective especially in containing risk/liquidity premiums in dysfunctional money markets. The strategies, however, have failed to bring the economy out of the deflation trap so far. In section 4 I discuss some possible reasons for this and also implications for the current U.S. situation.

2, Typology of Policy Options near the ZLB

Bernanke & Reinhart (2004) offer a convenient classification of policies near the zero lower bound on nominal interest rates (ZLB). That is, policy measures can be classified as: (i) shaping or managing interest rate expectations—providing assurance to the market that policy rates will be lower in the future than currently expected; (ii) changing the composition of the central bank's balance sheet in a way the central bank's holdings of non-traditional assets increase (targeted asset purchases); and (iii) expanding the size of the central bank's balance sheet beyond the level required for a

zero policy rate (Quantitative Easing: QE) This is summarized in Table 1.

In order to clearly differentiate between (ii) and (iii), it would be useful to think of (iii) as an attempt to expand the balance sheet by purchases of traditional assets, say, treasury bills. Then, an expansion of a central bank balance sheet based on purchases of non-traditional assets is a combination of (ii) and (iii). Strong forms of quantitative easing are accompanied by a target on a measure of central bank balance sheet or quantity of money.

It is interesting to note that all these options were already suggested and discussed in the November 1999 Boston Fed conference. Thus, Reifschneider and Williams (2000) studied what a central bank can do in a low inflation environment and showed that it can do better than, say, simply setting the short rate at the larger of the Taylor rule or zero. That is, it can deliver more economic stability by promising, following a period of deflation and a zero rate, to maintain a zero rate for a while even after the Taylor rule rate became positive. They offered a simulation analysis of this approach based on the FRB-US model, providing evidence of its effectiveness. Ueda (2000) stated that the BOJ had already started using a version of the strategy since the spring of 1999.

Strategy (iii) was discussed by many who attended the conference, but Bryant (2000) and Freedman (2000), among others, did not believe that an exchange of base money for treasury bills with a zero rate produced large effects on the economy. On the other hand, many felt that strategy (ii) might have a chance of being effective, depending on the substitutability of the asset purchased by the central bank for base money. In addition, Goodfriend (2000) advocated taxing the currency in an attempt to generate negative interest rates, but many were skeptical of its feasibility.

In addition to the Boston Fed conference volume there have been numerous analyses of the effectiveness of, and the pros and cons of these strategies, reflecting the experience of the BOJ in the late 1990s and 2000s, and the more recent experience of major central banks during the late 2000s.

Woodford (1999) was one of the first to state the rationale for strategy (i). He argued that "it is unlikely that monetary policy can do much to loosen the constraint imposed by the zero bound, except by changing what people expect policy to be like after the constraint ceases to bind." In other words, central banks can affect today's medium- to long-term interest rates by promising a longer period of a zero rate than is currently assumed by the market.[1] Similarly, Eggertsson and Woodford (2003)

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[1] Krugman (1998) made essentially the same argument, but in terms of the quantity of money.

provided a more comprehensive analysis of the effectiveness of the approach.[2]

On the effectiveness of strategies (ii) and (iii) Curdia and Woodford (2010) provide a useful benchmark. They first explain the neutrality of central bank operations result due to Wallace (1981). When there are no frictions in the financial system, or more precisely, when assets are valued only for their pecuniary returns and when all investors can purchase arbitrary quantities of the same asset at the same price, neither the size nor the composition of the central bank balance sheet matters. With transactions role for base money, however, the size of the central bank balance sheet, but not its composition, matters for macroeconomic equilibrium. Importantly, they also show that this effect of the size of the central bank balance sheet disappears at a zero interest rate, i.e., strategy (iii) is not effective at the ZLB. Finally, by introducing financial disruptions, they show that the composition of the central bank balance sheet matters, i.e., strategy (ii) is effective. This is in accordance with those who call the strategy credit easing. They caution, however, that the exact nature of optimal targeted asset purchases in the face of financial disruptions depends on the nature of the disruptions and is not easy to characterize.

We may also note that the effectiveness of non-traditional monetary policy measures does not quite depend on whether the economy is at the ZLB or not, although that of strategy (iii) depends on a more complicated way on interest rates. Strategy (i) can be carried out at any positive interest rate. For example, the Fed used a version of it during August 2003 to December 2003, when the federal funds rate was one percent, by stating that "the committee believes that policy accommodation can be maintained for a considerable period. Strategy (ii) can also be used under positive interest rates. Even strategy (iii) can coexist with positive interest rates if interest is paid on excess reserves. Curdia and Woodford (2010), however, show that strategy (iii) becomes ineffective even at positive levels of interest rates if the interest rate paid on reserves equals the policy rate because people then are satiated with transactions services. On the other hand, they note that strategy (ii) may be used more aggressively at the ZLB than otherwise because it may substitute for rate cuts which are not possible at the ZLB.

Although such theoretical results provide useful benchmarks against which to consider the effectiveness of alternative non-traditional monetary policy measures, they have to be used with caution. As stated above, the precise nature of policy measures to be used depend on the nature of financial disruptions and thus may be hard to pin down in practice. Moreover, the results of Curdia and Woodford do not seem to lend

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[2] A stronger version of the approach involves price level targeting whereby, say, a zero rate is maintained until the price level, not the rate of inflation, reaches a certain level.

themselves to the justification of central bank purchases of long-term government bonds as an example of strategy (ii). One needs either a more sophisticated argument or the assumption that people do not see through the veil of the central bank/government.

In a similar vein, it seems fair to say that we economists have not quite succeeded in identifying the nature of market failures that justify government provision of transaction services in the form of fiat money. Depending on what they are, we may have a broader justification of strategy (ii) than the one discussed in Curdia and Woodford, which is an exogenous increase in bad loans.[3] This is certainly an area for future study.

One of the interesting messages that come out of these discussions is that the effectiveness of quantitative easing depends on what assets the central bank buys to increase the quantity of money. Strategy (iii) may be ineffective in its pure form, but may become effective if combined with some version of strategy (ii). In other words, the size of the central bank balance sheet per se does not convey much information about the degree of monetary easing that is taking place. It may also be reminded that during the recent financial crisis central banks who purchased non-traditional assets, on the whole, have not tried to sterilize the funds supplied.

This discussion seems to suggest an alternative typology, especially near the ZLB, under the umbrella of quantitative easing (QE). First, there is an expansion of the central bank balance sheet by purchases of treasury bills which are near perfect substitutes for base money at the ZLB, QE0. Then, strategy (ii) without sterilization of asset purchased can be decomposed into purchases of assets whose market is dysfunctional, QE1, and purchases of semi-traditional assets such as government bonds, QE2. Another name for QE1 may be credit easing. To repeat the above discussion, there is some theoretical justification for QE1. In the case of QE2 the intended effect would be portfolio-rebalancing, but its theoretical or empirical foundation is not quit solid. Of course, strategy (i) does not belong in any of the three forms of QE.[4] This typology is also summarized in Table 1.

2, The Bank of Japan's Monetary Policy during 1992-2006

Chronology

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[3] Allen and Gale (2007) and Kiyotaki and Moore (2009) provide another justification of strategy (ii). They show that the central bank purchases of or lending against an asset whose market liquidity falls sharply improves welfare.

[4] Perhaps, there is a sense in which QE0 was used by the BOJ in order to strengthen the commitment contained in strategy (i) during 2001-2006.

Since the early 1990s the Japanese economy has experienced serious negative interactions among declining asset prices, increasingly dysfunctional financial system and deteriorating real economy. The rate of inflation of CPI also fell below 1% by 1994. In response to such developments the BOJ cut the overnight interest rate to below 0.5% already in the summer of 1995, from the high of 8.6% in 1991. The economy did not recover fully despite the 800 basis point reduction in the overnight rate and went into a severe credit crunch in 1997-1998 and the overnight rate was lowered to virtually zero by early 1999. The CPI inflation rate moved into negative territory in the second half of 1998; its core measure has stayed in negative territory since then with minor exceptions. Thus, the economy has been effectively in a "liquidity trap" for about 15 years.

The BOJ continued its exploration for further easing measures in 1999 and the 2000s. The so-called zero interest rate policy (ZIRP)—the core of the BOJ's monetary policy since 1999--was introduced in April 1999. The ZIRP was not just a zero short-term interest rate, but a commitment to maintain it "until deflationary concerns were dispelled".[5]

In August 2000, the BOJ lifted the ZIRP and raised the overnight call rate to 0.25 % based on the judgment that the economy was recovering and showing some signs of overcoming deflation. The world economy, however, fell into a serious recession as the IT bubble burst in 2001, and the BOJ adopted the quantitative easing policy (QEJ) in March 2001. The QEJ consisted of three pillars. First, the BOJ maintained an ample liquidity supply by using the current account balances (CABs) at the BOJ, essentially bank reserves, as the operating policy target. Second, the BOJ committed itself to maintaining the provision of ample liquidity until the rate of change of the core CPI (nationwide, excluding perishables) became zero percent or higher on a sustained basis. Third, the BOJ increased the amount of purchases of Japanese Government Bonds (JGBs) from time to time as a tool for liquidity injection. It was projected that increasing the CAB targets beyond the level of the required reserves would normally keep the call rate near zero percent.[6] Thus, with the commitment to maintain ample liquidity provision until deflation ended, the QEJ contained a version of the ZIRP. Viewed in this way, the QEJ can be regarded as consisting of ZIRP and liquidity provision beyond levels necessary for a zero rate that relied partially on purchases of long-term government bonds.

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[5] Some use the ZIRP to mean only a zero policy rate. Here it refers to the combination of a zero rate and the commitment to maintain it until deflation ends.
[6] In fact, the uncollateralized overnight call rate declined to a minimum of 0.001 percent, during the QEJ period, while it declined to at most 0.01 percent during the ZIRP period.

The target on the CABs was increased from approximately 5 trillion yen at the introduction of the QEJ in March 2001, an amount roughly 1 trillion yen greater than the then-required reserves, to a range of approximately 30-35 trillion yen in January 2004. The increases in CABs were achieved mainly by market operations, including the BOJ's purchases of JGBs. The amount of JGB purchases was 0.4 trillion yen per month in March 2001 and was gradually increased to 1.2 trillion yen by May 2004. The QEJ was finally lifted in March 2006. The extent of the BOJ's balance sheet expansion was huge and is comparable to that of other central banks during the late 2000s. (See Figure 1.)

Use of the three strategies

In terms of the classification of unconventional monetary policy measures into strategies (i)-(iii), there was first the explicit use of strategy (i) under the ZIRP and QEJ. The QEJ also contained strategy (iii).

In addition, the BOJ relied on strategy (ii) extensively to contain the rise in liquidity and risk premiums in the financial system. For example, since the credit crunch of 1998, the BOJ expanded its fund-supplying operations using commercial papers (CPs) as collateral. This move is believed to have added to the liquidity of the CP market and, in turn, led to declines in issuing costs of CPs. In addition, the BOJ had started to accept Asset Backed Securities (ABSs)as collateral for its fund supplying operation since October 1999. In the spring of 2003 the BOJ went further by its decision to purchase Asset Backed CPs (ABCPs) and ABSs outright. Separately, the BOJ had established a standby scheme that allowed banks to sell equities they held to the BOJ since December 2002. Banks could certainly sell stocks in the market. Given the then low liquidity of the market, however, banks may have been reluctant to sell stocks and lower prices themselves.

Even operations under strategy (iii) had an element of strategy (ii). In its pursuit of QEJ, the BOJ increasingly had to lend long in the money market. This was because finding borrowers paying positive interest rate became difficult at short maturities. As of April 2001, the start of the QEJ period, fund supplying operations had maturities of one to three months. In March 2005, some operations were of 11 month maturity. In these operations the BOJ was taking, to varying degrees, the credit risk of counterparties or of issuers of instruments traded. At times of severe financial stress, private financial institutions may lend to each other for very short periods, say, days, but may be reluctant to do so for longer periods. Such long-dated operations by the BOJ then may have had the effect of containing term premiums. In addition, to the extent that the

BOJ's purchases of JGBs are regarded as targeted asset purchases, there was an extensive use of strategy (ii) during the QEJ period.

In terms of QE0-QE2, QEJ can be seen to have contained all of them. Setting of the target on the current account balances formally meant that it was the amount of bank reserves that was important rather than the assets bought to achieve the target, QE0. There were, however, also credit easing type measures, QE1 and purchases of JGBs were a core component of QEJ as well, QE2. All this is summarized in Table 2.

3, Evidence on the Effects of the BOJ's Monetary Policy

Casual look at the effects of the measures

Let us first take a look at the effects of the measures on interest rates at fairly informal levels. Concerning strategy (i), Figure 2 shows the Euro Yen Futures yield curve before and after the introduction of strategy (i) in early April 1999. Clearly, this strategy lowered interest rates at most maturities except for the very short end. Turning to strategy (iii) next, Figure 3 plots implied forward rates from interest rate swaps before and after the adoption of QEJ. It can be seen that interest rates actually rose at many horizons except for contracts starting in very near terms. This pattern of interest rate response, of course, is one possible outcome of monetary easing. In a sense there was optimism about the effectiveness of QEJ. As shown in figure 4, however, the optimism lasted only for a few months and quickly gave way to disappointment about the weak effects of the scheme on the economy and the entire yield curve shifted downward. There was a small, but clear effect of QE0 aspect of QEJ on interest rates. Figure 5 shows the weighted average of the overnight call market rate. It declined to a low of 2 basis points during the ZIRP period, but to a much (?) lower minimum of 0% during the QEJ period. Obviously, some banks paid negative overnight rates on certain days. Thus, there is some room for central banks to generate easing effects even near the ZLB by adopting QE0, but its cost-benefit analysis may not be straightforward.

The effects of strategy (ii), or QE1 and QE2, are more difficult to identify. Figure 6 shows the spread between three month interbank rates and the overnight rate or three month treasury bill rates. It may be seen that the risk premiums declined during the ZIRP and QEJ periods, but slightly more in the QEJ period. Thus, on the whole, the QEJ reduced risk premiums in the money market. We shall see later that this is related to strategy (ii) type operations the BOJ carried out during the period.

More formal analysis

Turning to the more formal literature, Ugai (2007) summarizes it as "the effects of strategy (i) on asset prices, especially, interest rates have been much larger than those of strategies (ii) and (iii)."

More specifically, both Okina & Shiratsuka (2004) and Oda & Ueda (2007) show that the BOJ's commitment to maintain a zero rate until deflation ended produced strong effects on expected future short rates, thus on current medium- to long-term interest rates; that is, strategy (i) was effective. Oda & Ueda (2007) also examine whether or not other aspects of the QEJ, purchases of JGBs and/or expansion of the CAB target, had any effects on interest rates. They fail to find any significant effects of the BOJ's purchases of JGBs on either the expected future short rates or risk premiums. Bernanke, Reinhart and Sack (2004) carry out a macro finance analysis of the ZIRP and QEJ and find that these policies had the effect of lowering a significant range of interest rates. They also carry out an event study of the effects of the BOJ policies and find statistically significant links between the BOJ's purchases of JGBs and JGB yields on the one hand, and between QEJ and stock prices on the other. This second finding of Bernanke, Reinhart and Sack (2004) seems to be an exception.[7] Most other studies have not succeeded in finding significant impacts of JGB purchases on interest rates.

Most of such analyses of strategy (ii), however, focused on the relationship between the BOJ's purchases of JGBs and their yields and/or the economy. One exception is Baba et al (2006), which analyzed the effects of more credit easing aspect of strategy (ii). Below we summarize the results of this study carefully because they seem to illustrate very well the effects on interest rates of the measures adopted by the BOJ.

The study looks at the relationship between the BOJ's monetary policy and risk premiums banks pay in the money market. Figure 7 shows credit curves for the NCD rates for the period of 1997-2005. They became flatter and flatter during the ZIRP and QEJ periods. In order to see what was driving the declines in interest rates, especially for banks with relatively low credit standings, they carried out a regression analysis of NCD rates. Their major result is shown in Table 3. The spread of NCD rates over the weighted average of uncollateralized overnight rate is regressed on measures of banks' credit standing--the yield spread on bonds issued by banks and banks' credit

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[7] The results of even study type analyses need to be taken carefully. For example, the market welcomed the adoption of QEJ in March 2001; stock prices rose, short-term interest rates declined and long-term rates rose-- a typical market reaction when quantitative easing is perceived to be effective. But such a response quickly gave way to a more realistic response-- that is, the rise in stock prices and long-term interest rates were reversed as the market realized that the QEJ did not exert any quick strong effects on the economy.

ratings--along with several monetary policy related variables. The monetary policy variables included dummies for ZIRP and QEJ, the level of the current account balance target during the QEJ period and some others. The sample for estimation consists of weekly data for seven large banks for the period of 1998 to 2005.

The table shows that after controlling for bank bond spreads and credit ratings, monetary policy exerted significant contribution to the declines in risk premiums in the NCD market. More specifically, the ZIRP and QEJ dummies are significant with the right sign. The CAB variable, however, is insignificant. Thus, although interest rates declined during the QEJ period, the declines do not seem to have been a direct result of the expansion of the current account balances. Since the commitment to maintain a zero rate until deflation ends was in place in both periods, the significance of the two dummies seem to at least partially reflect the effectiveness of this commitment or strategy (i).

As discussed in the previous section, the BOJ's operations desk faced increasing difficulty in hitting the CAB target as the target level was increased toward the mid 2000s. The desk had to rely on very long-dated fund supplying operations, which may have affected term rates and risk premiums. In order to address this possibility we ran a similar regression with the TERM variable replacing other monetary policy variables for the QEJ period. TERM represents the monthly average of the maturity of the BOJ's bill-purchasing operations. Tables 4 shows that the variable in fact exerted significant effects on the NCD rates.[8]

To summarize all this, there is evidence that strategy (i) exerted significant effects on interest rates. The effects of strategy (iii) are ambiguous. The strategy did lower interest rates, especially in the money market, but, apart from a small decline in the overnight rate, which was due to QE0, this effect seems to have turned not on the provision of large excess reserves per se, but on increasingly longer dated operations in the money market.[9] Baba et al. (2006) also offers informal evidence of the effects of CP operations, pointing out that rates on CPs which the BOJ bought declined much more than those on CPs that the BOJ did not buy. In other words, beyond a certain point the expansion of the BOJ balance sheets, strategy (iii), required the purchases of non-traditional assets, which is strategy (ii), and through this route affected asset prices.

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[8] The table does not include the dummies for the commitments made by the BOJ given that the sample period of estimation coincided with the period of the commitment under QEJ was in place.

[9] I may add that the adoption of QEJ led quickly to declines in the overnight rate to levels lower than in the ZIRP period. That is, the rate reached 0.001% during the QEJ period compared with 0.01% during the ZIRP period. This seems to have been a traditional effect of expansion of reserves leading to a lower level of interest rate.

Recognizing that these purchases took place in markets with initially large risk premiums, we may say that the QE1 aspect of QEJ was effective.

Some caveats

Two more points may be added to the above discussion of the effects of the BOJ's unconventional monetary policy measures. First, although strategy (ii) seems to have generated some significant effects on interest rates in the money market, researchers have not quite succeeded in finding significant effects of the QE2 aspect of QEJ, that is, the BOJ's purchases of long-term government bonds on interest rates. This may be due to the technical difficulty of separating the effects of JGB purchases from those of the commitment to maintain a zero rate. Alternatively, the failure to find significant effects of QE2 may be a result of the fairly short remaining maturity of the JGBs purchased by the BOJ as pointed out by Gagnon, Raskin, Remache and Sack (2010) who find significant effects of treasury bond purchases by the Fed on the yield curve.[10]

Second, despite some significant effects of the measures adopted by the BOJ on interest rates, the effects on the real economy including prices have been limited. This can be seen most easily by the tendency for deflation to have continued.

Third, there were at least two more significant monetary policy measures adopted that seem to fall under the heading of strategy (ii), the BOJ's purchases of equities from banks (2002-2004) and purchases of ABS (2003-2005).[11] The purchases of ABS were not very successful mainly because the market for ABS was still very small. Against the ceiling of 1 trillion yen, the outstanding amount of the ABS held by the BOJ in 2005 was only 0.12 trillion. "Credit easing" seems to be effective only when there is a large market which experiences a major disruption, say, a significant decline in market liquidity. On the other hand, the BOJ ended up buying roughly the targeted amount, 2 trillion yen in its equity buying scheme. This operation may be seen as an attempt to address a temporary decline in the stock market liquidity and the erosion of bank capital as stock prices plummeted. A more rigorous evaluation of this scheme, however, is a topic for future study.

5, Implications of the BOJ's experience

The review of the BOJ's experience with non-traditional monetary policy

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[10] As they note, the remaining maturity of JGBs bought by the BOJ declined to less than 4 years in 2005. See McCauley and Ueda (2009).

[11] Purchases of equities were explicitly sterilized. That is they were done as strategy (ii). On the other hand, those of ABS were a part of QEJ. Hence, they may be regarded as an example of QE1.

measures carried out above seems to accord fairly well with the predictions of the theoretical literature on the effectiveness of non-traditional monetary policies. That is to say, strategy (i), the management of expectations, seems effective when the intention of the central bank is clearly stated. Strategy (iii), especially, its QE0 aspect, drives the overnight rate literally to zero, but beyond that its effectiveness seems to turn on that of strategy (ii), that is, depends on what assets the central bank chooses to purchase in its attempt to expand the balance sheet. Thus, the size of the central bank balance sheet is not a good indicator of the degree of monetary easing. Targeted asset purchases, strategy (ii), are effective if the market for the asset in question is disrupted, for example, experiences a sharp decline in liquidity. That is, some QE1 seem to be effective. The effects of JGB purchases on interest rates, or QE2, have been unclear at least in the Japanese case.

Fighting deflation with near zero interest rates after financial crisis is mitigated

This seems to place central banks in a difficult situation if a major financial crisis forces them to lower interest rates to near zero levels and adopt non-traditional policies, but deflationary concerns remained even after financial stresses dissipated. This is because the effectiveness of strategy (ii), or QE1, would decline as the financial system gets back to near normal.

In a sense the BOJ was in such a situation in the mid 2000s. Serious stresses in the money market disappeared, but banks were still not lending. CPI inflation became positive only because of rising commodity prices, while its ex food and energy component stayed in negative territory. As the financial system stabilized, it became difficult for the BOJ to find strategy (ii) (QE1) type measures to adopt. QE2 was not producing clear-cut effects.

There were certainly forces that limited the impact of the BOJ's operations on the economy. Not only banks but also non-financial corporations were in a serious de-leveraging mode. Fiscal policy has been tight especially since 2000.

Could the BOJ have done more? Strategy (i) may have been strengthened by stating, say, "maintenance a zero rate until inflation reaches 1%," rather than "until it became positive." CPI inflation exceeded 1% in the spring of 2008, but with such a commitment the BOJ would not have been able to raise rates in the midst of the financial crisis. The BOJ in reality raised rates to 0.5%, but by how much the stronger commitment and /or the difference of 0.5% would have made differences is difficult to determine.

Regarding strategy (ii), the BOJ may have taken larger credit or market risks. This

could have included purchases of bank loans, direct lending by the BOJ or taking properties as collateral. The BOJ can hardly be seen, however, to have comparative advantage in these activities. Also, some of these have the nature of fiscal policy. Either, they should be done by the government or there needs to be an accord between the BOJ and the government about the purpose, size, and loss sharing rule of the operation if the BOJ's balance sheet is to be used.

Similarly, the BOJ could have bought more JGBs. Ten year JGB rates had been, however, in the range of 0.5-2.0% for most of the period. It is unclear by how much, if any, rates would have declined by much larger purchases by the BOJ. Also, such an attempt would also have called for a BOJ-government accord on possible loss sharing.

Timing of the adoption of non-traditional policies

Stimulating an economy is easier if it is not in a serious recession. Raising inflation expectations and actual inflation does not seem to be an easy task after more than ten years of deflation. From this perspective non-traditional monetary policy measures by the BOJ may have come a bit too late. Figure 8 shows CPI inflation rates after the peak of the bubble in Japan and the U.S. As argued above, inflation was already below 1% in the mid 1990s. Adoption of, say, strategy (i) around that time may have had a higher chance of success.

This line of reasoning suggests that the U.S. and European economies may be at a critical point. In terms of inflation they are close to Japan in the mid 1990s. Short-term interest rates are close to zero. Some non-traditional measures, especially QE1, have been tried. But risk of further disinflation remains. Limitations of further use of non-traditional measures cannot be ignored. For example, central banks will have to shift from QE1 to QE2 type measures whose effectiveness is quite uncertain. The limitations of these measures, however, would be even more serious at lower rates of inflation. Adoption of policies to reverse the disinflationary trend is desirable.

Issues concerning exit from non-traditional measures

On the other hand, a successful rise in inflation will prompt attempts to exit from non-traditional monetary easing policies. I offer a few remarks about the BOJ' experience in this regard.

The BOJ decided to exit from its QEP in March 2006. Figure 9 shows that within half a year the current account balances declined by more than two thirds. The figure also shows that this decline in the current account balances were matched by reductions in the outstanding amount of short-term fund supplying operations. That is to say, the

BOJ did not roll over short-term fund supplying operations and reduced the amount of funds in the system. Thus, the process of reductions in the size of the balance sheet was smooth in the BOJ's case as it had large amounts of short-term fund supplying operations at the time of exit. This may not be the case for other central banks, although they can, of course, tighten by raising the interest rate on (excess) reserves.

In contrast to the current account balances, reducing the amount of JGB purchases or selling the equities purchased was not easy for the BOJ as shown in Figures 10 and 11. The BOJ has never sold the JGBs it purchased. In fact, it continued to buy the same amount of JGBs after exit as in the QEP period. The decrease in the amount of JGBs held by the BOJ in the figure is due to the maturing of bonds it held.

Relationships with the fiscal authority may have mattered for the decision to keep the amount of JGB purchases the same even after the exit, while possible market impact may have slowed the pace of the BOJ's sale of equities it purchased. In fact, most of the decline in the amount of equities the BOJ held during 2008 and 2009 came from valuation changes. Such an experience of the BOJ suggests possible difficulties of exit from large scale purchases of non-traditional assets.

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Table 1   Policy Options near the ZLB

Strategy i	managing expectations about future levels of the policy rate	
intended effect	today's medium- and long-term rates will be affected	
Strategy ii	targeted asset purchases	without
	(may include lending against non-traditional assets)	sterilization
intended effect	portfolio rebalancing	QE2
	liquidity premiums in dysfunctional markets will be reduced	QE1
Strategy iii	Quantitative Easing (purchase TBs to raise excess reserves)	QE0
intended effect	inflation expectations may rise?	

Table 2   The BOJ's Non-traditional Operations during 1999-2006

Strategy i	zero rate until deflationary concerns are dispelled (April 1999-August 2000)	
	zero rate until CPI inflation becomes stably above zero (March 2001-March 2006)	
Strategy ii	purchases of equities from banks	
	unusually long-dated fund supplying operations	
	CP repo	QE1
	purchases of ABCP/ABS	
	purchases of JGBs	QE2
Strategy iii	Quantitative Easing (target on the banks' current account balances)	QE0

$$NCD_{it} = (a_0 + a_1 ZIRP + a_2 QMEP + a_3 TRANS$$
$$+ a_4 CAB_t + a_5 BOND_{it})^*(A1)$$
$$+ (b_0 + b_1 ZIRP + b_2 QMEP + b_3 TRANS$$
$$+ b_4 CAB_t + b_5 BOND_{it})^*(A2),$$
$$+ \ldots$$

ZIRP: dummy taking 1 during the ZIRP period.

QMEP: dummy taking 1 during the QE period.

CAB: the amount of the current account balances.

BOND: spread of bank bond yield over JGB.

A1, A2..: credit rating dummies.

TRANS: dummy taking 1 after the BOJ strengthened its commitment

Unconditionalized Overnight Call Rate
Number of Observations: 1,929 (October 5, 1998–May 9, 2005)

Variable	Coefficient	Standard Error
A1	0.056	0.204
A1*CAB	−0.001	0.006
A1*BOND	−0.051	0.261
A2	0.030	0.028
A2*ZIRP	0.032**	0.014
A2*QMEP	−0.047***	0.013
A2*TRANS	−0.014	0.012
A2*CAB	0.001*	0.000
A2*BOND	0.021	0.100
A3	0.047***	0.009
A3*ZIRP	−0.016*	0.009
A3*QMEP	−0.051***	0.009
A3*TRANS	−0.021**	0.008
A3*CAB	0.001***	0.000
A3*BOND	0.002	0.018
Baa1	−0.127	0.159
Baa1*CAB	0.004	0.005
Baa1*BOND	0.047	0.106
Baa2	0.060***	0.008
Baa2*ZIRP	−0.057***	0.009
Baa2*QMEP	−0.068***	0.009
Baa2*TRANS	−0.025**	0.010
Baa2*CAB	0.001***	0.000
Baa2*BOND	0.014***	0.002
Baa3	0.107***	0.003
Baa3*QMEP	−0.166***	0.012
Baa3*TRANS	0.003	0.017
Baa3*CAB	0.002**	0.001
Baa3*BOND	0.039***	0.003
Year-end dummy	0.045***	0.004
Fiscal year-half dummy	−0.004	0.005
Fiscal year-end dummy	0.020***	0.004
Adjusted R-squared	0.388	

Notes: Estimation is by OLS. ***, **, and * denote the 1, 5, and 10 percent significance level, respectively.
Credit ratings are the long-term ratings of Moody's.

Table 3, NCD rate spread equation and its estimation result

Variable	Coefficient	Standard Error
A1 A1*TERM A1*BOND	−0.059 0.010 0.062	0.042 0.007 0.143
A2 A2*TERM A2*BOND	0.018 −0.003 0.019	0.014 0.002 0.047
A3 A3*TERM A3*BOND	0.028*** −0.005*** 0.015*	0.006 0.001 0.009
Baa1 Baa1*TERM Baa1*BOND	0.038 −0.006* −0.020	0.024 0.003 0.061
Baa2 Baa2*TERM Baa2*BOND	0.040*** −0.007*** 0.013***	0.007 0.002 0.003
Baa3 Baa3*TERM Baa3*BOND	0.048*** −0.060** 0.008***	0.009 0.002 0.002
Year-end dummy Fiscal year-half dummy Fiscal year-end dummy	0.002 −0.000 0.015***	0.002 0.002 0.002
Adjusted R-squared	0.167	

Notes: Estimation is by OLS. ***, **, and * denote the 1, 5, and 10 percent significance level, respectively.
ratings of Moody's.

TERM: monthly average of the BOJ's bill purchasing operations

Table 4 Estimation result with the Term Variable

Central Bank Balance Sheet Size

Relative size of central bank balance sheet to nominal GDP expanded most significantly in Japan from 1995 to 2006.

(Ratio to nominal GDP, %)
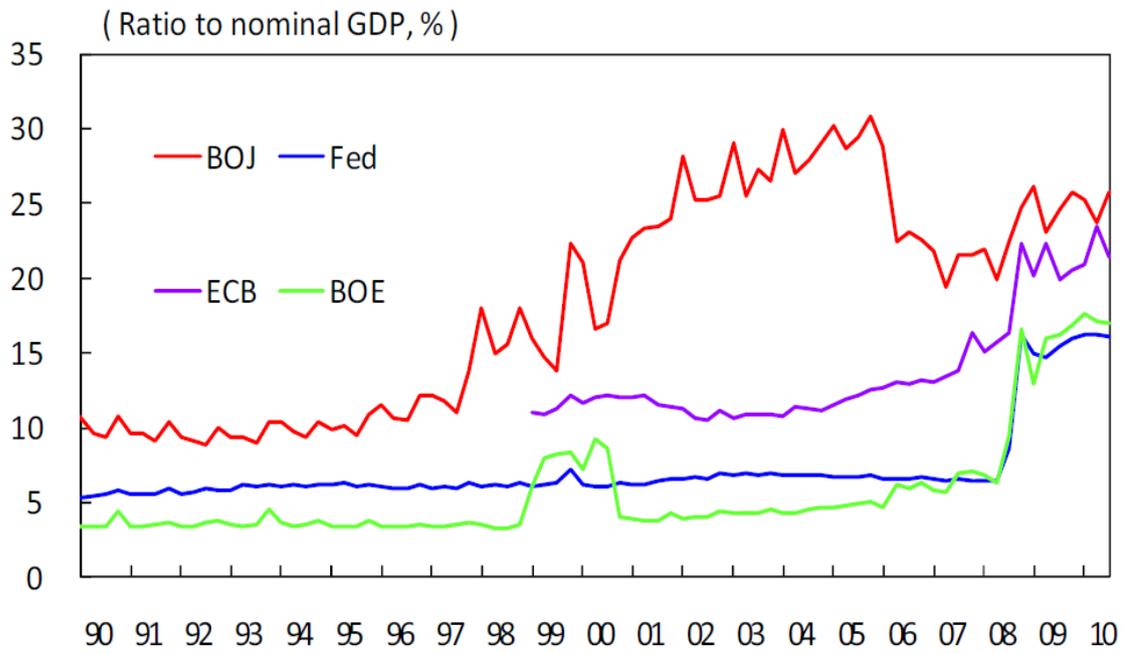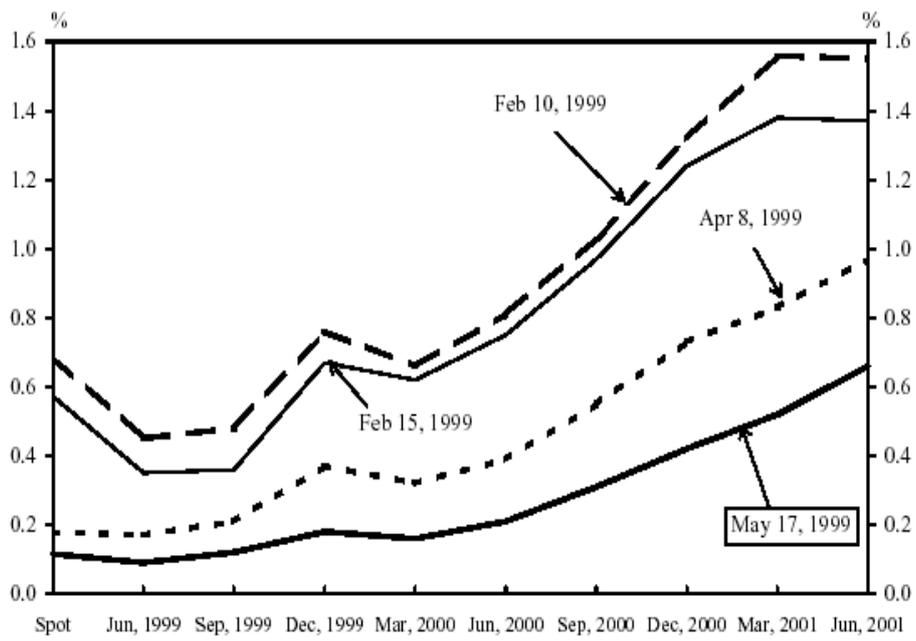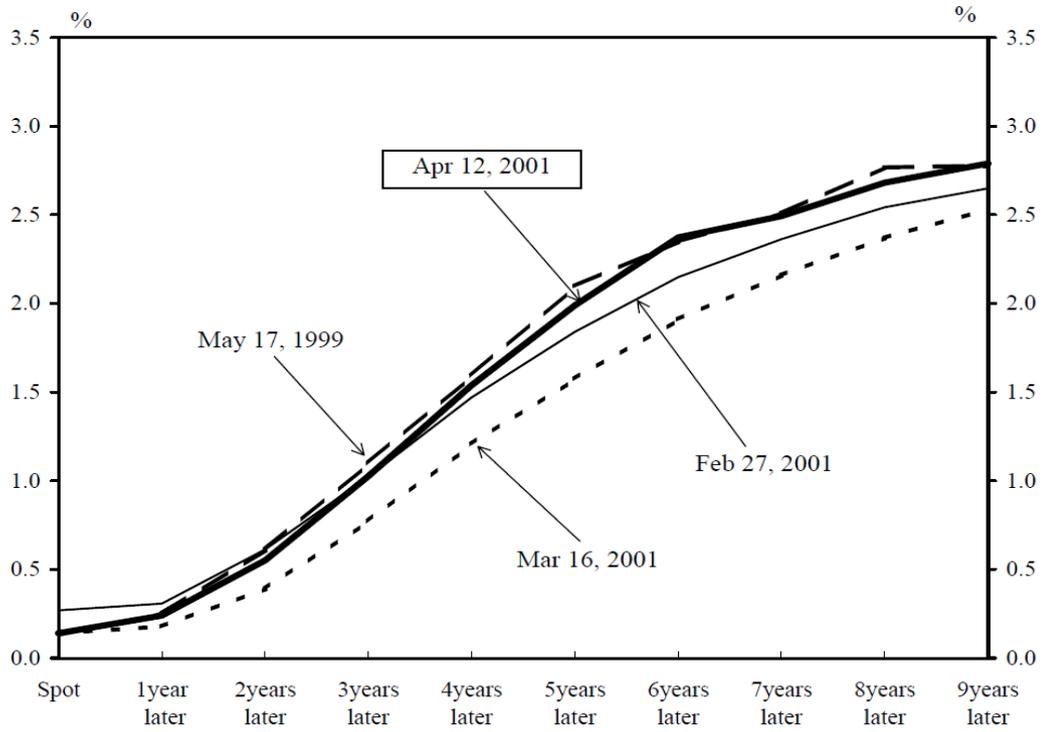
Figure 1
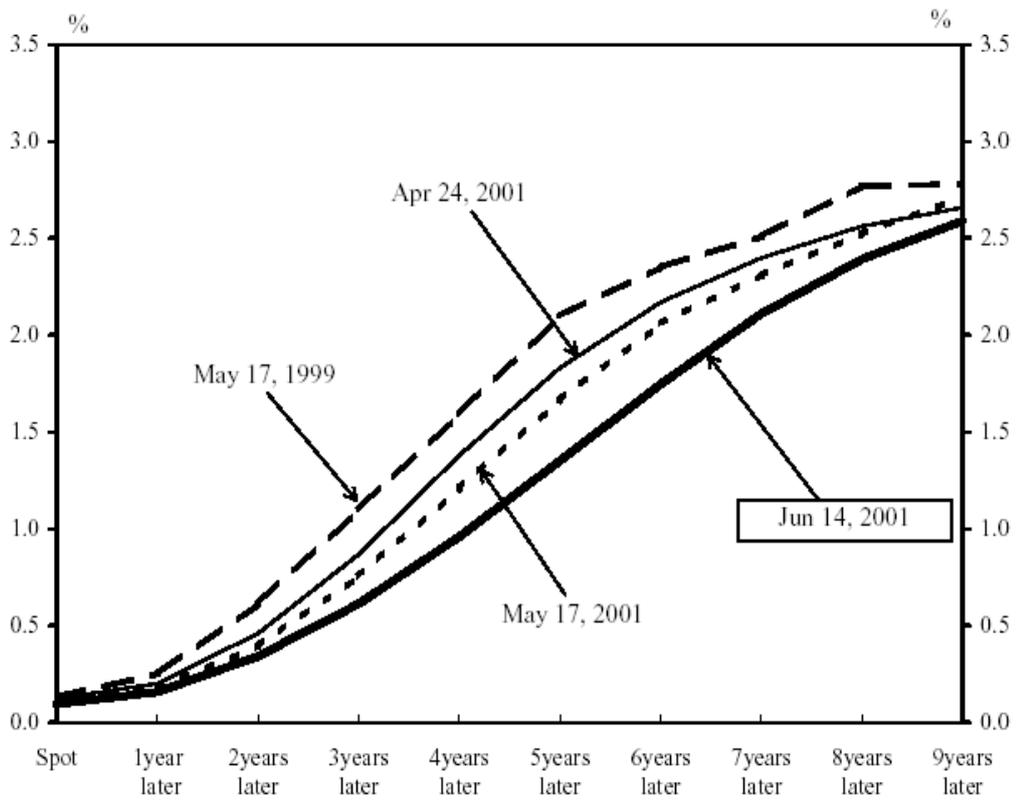
Figure 2

Figure 3

Figure 4
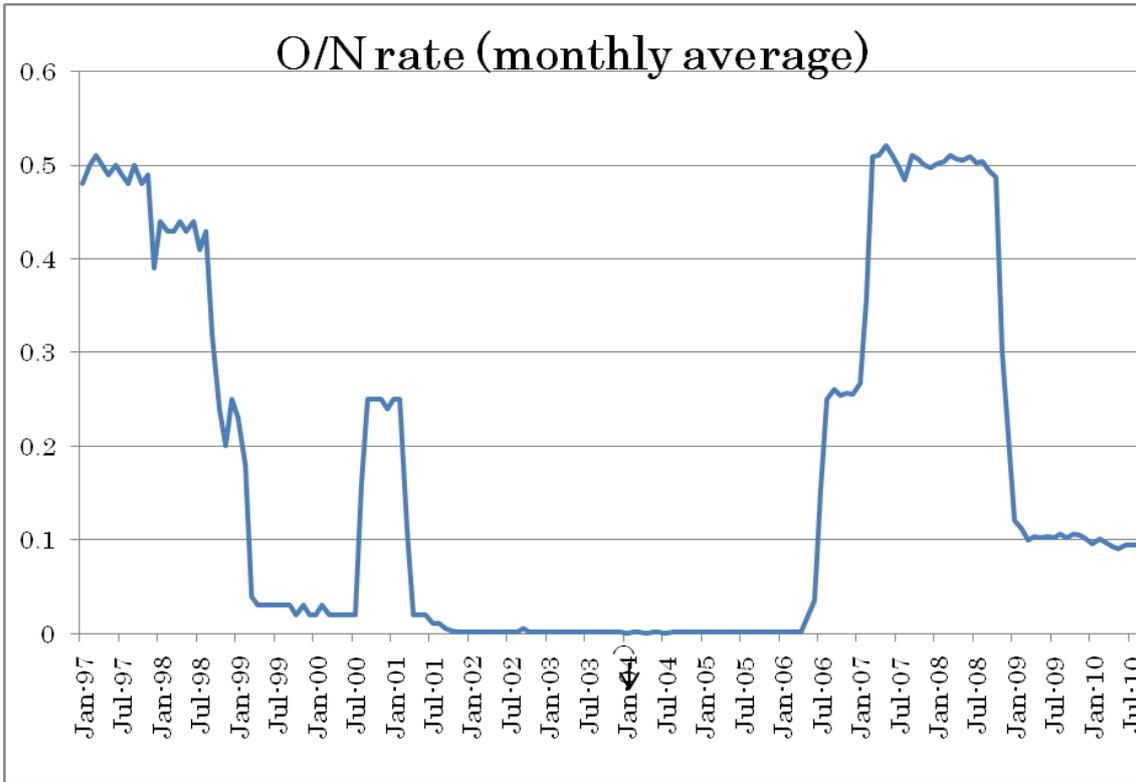
Figure 5

Figure 6

Figure 7

CPI (ex energy, food) Inflation Rates after the burst of bubble
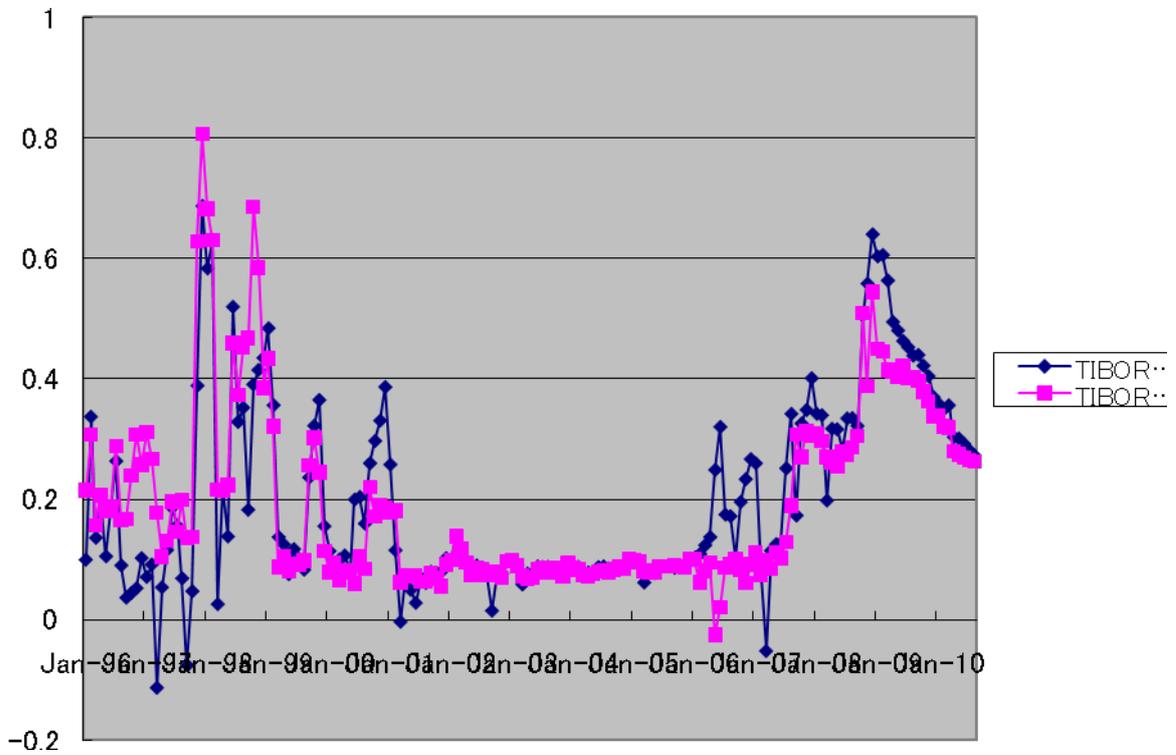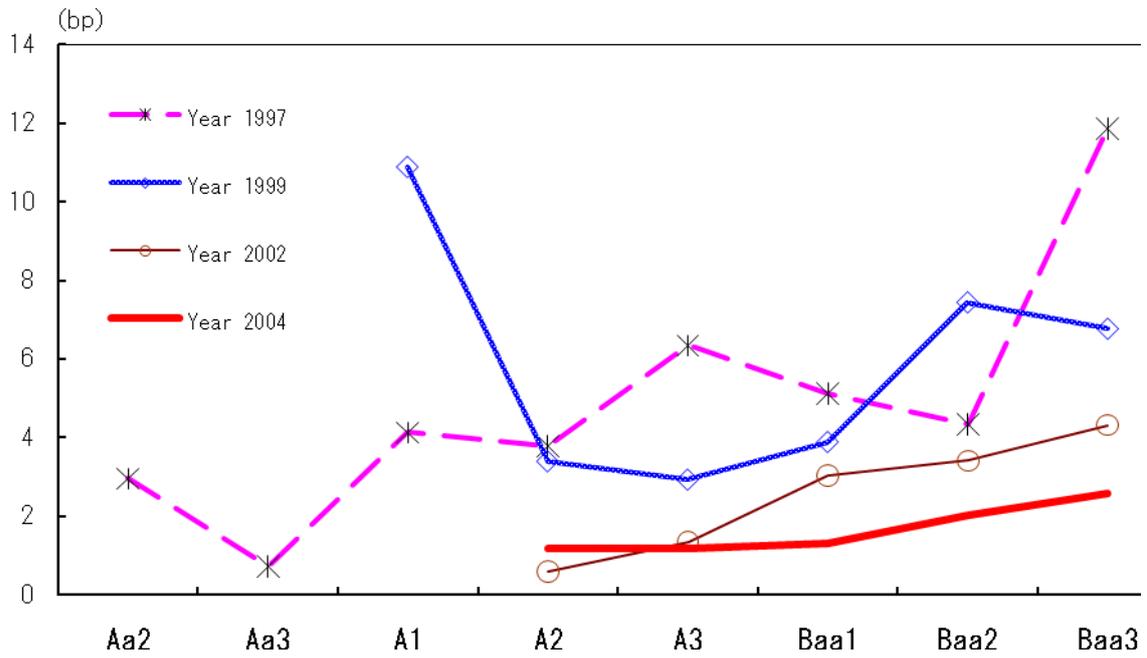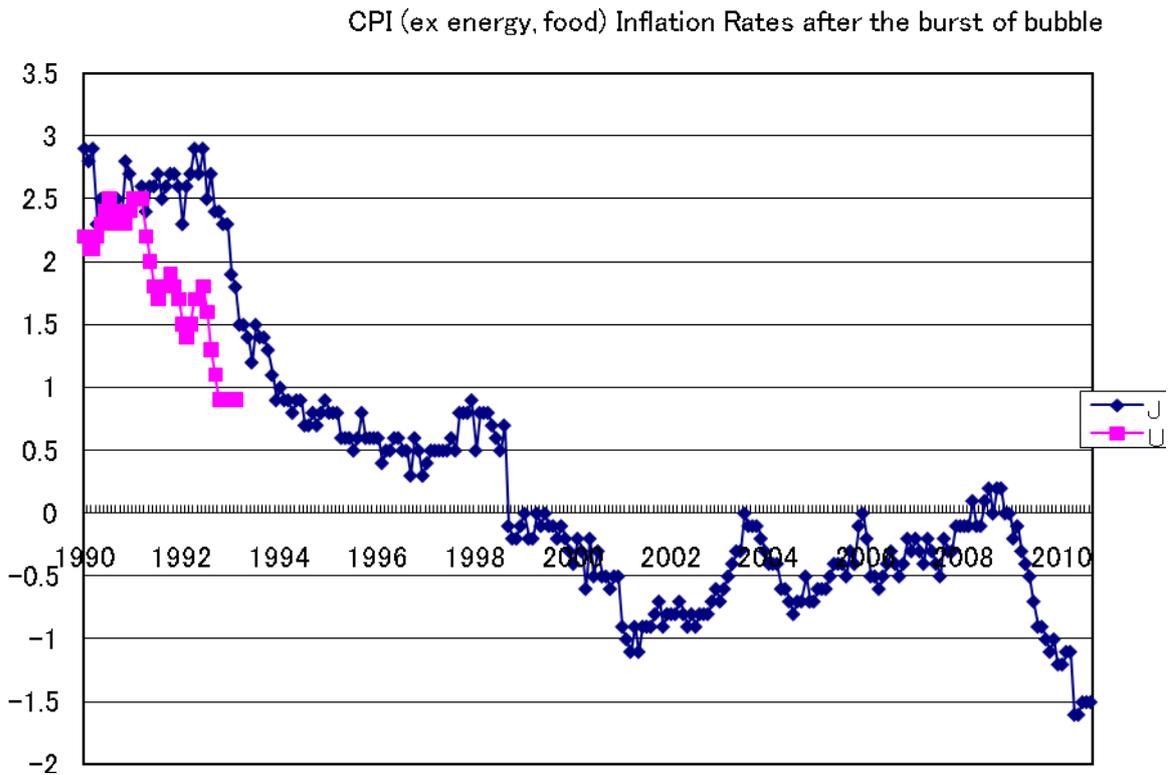
Figure 8

Figure 9 & Figure 10

The amount of equities held by the BOJ

Figure 11