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Abstract

This paper examines how changes in the Bank of Japan (BOJ)'s monetary policy stance affect the short-, medium-, long, and super long-term yield spreads and credit risks during the non-traditional money policy period. We focus on the periods of low interest rate and ample liquidity provision, and analyze the relationships between statements of the BOJ and reactions of the monetary market interest rates, employing the event study approach. The introduction announcement of low interest rate policy raises the medium-term credit risk, and decreases the long-term credit risk and the short-term yield spread. On the other hand, the termination announcement of it increases the short- and medium-term yield spreads. Moreover, our analysis shows that BOJ's ample liquidity provisions decrease the short-, medium-, long-, and super long-term credit risks.

JEL classification codes: **E52; E58; G14**
Keywords: **Term structure of interest rates**; **Credit risk**; **Event study**

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1. Introduction

The Japanese economy has experienced a large and serious recession since the asset bubble burst in the early 1990s. Its banking sector has suffered from huge and severe bad loan problems since the late 1990s. The problems led to the instability of financial system and decreased the growth rate of output and price. To remedy this situation, the Bank of Japan (BOJ) implemented the zero interest rate policy (ZIRP) from February 1999 to August 2000.[1] Two months after the introduction of ZIRP, the BOJ added a commitment on the ZIRP to stabilize the financial system and stimulate the economy. The quantitative monetary easing policy (QMEP) was implemented by the BOJ from March 2001 to March 2006. As with the ZIRP, the BOJ added the commitment to the QMEP. These so-called non-traditional monetary policies were the BOJ's first attempts to ease the financial system. From a theoretical viewpoint, Krugman (1998, 2000), Woodford (1999), Reifschneider and Williams (2000), and Eggertson and Woodford (2003) pointed out the effect of expectation control in terms of the conduct of monetary policy. Woodford (1999) and Reifschneider and Williams (2000) argued that in view of the liquidity trap, the BOJ should continue the low interest rate to improve economic performance, even if the nominal interest rate is just above zero.

In many empirical studies, researchers have attempted to investigate the impacts of this non-traditional monetary policy on the financial and capital markets (Fujiki and Shiratsuka, 2002; Okina and Shiratsuka, 2004; Baba et al., 2006; Kimura and Small, 2006; Kobayashi et al., 2006; Honda et al., 2007; Oda and Ueda, 2007; Hanabusa, 2009b, 2010; Fukuda, 2010; Hanabusa, 2011a, 2011b). Fujiki and Shiratsuka (2002), Okina and Shiratsuka (2004), Oda and Ueda (2007), Hanabusa (2009b, 2010), Fukuda (2010), and Hanabusa (2011a, 2011b) argued that both the ZIRP and QMEP induced changes in the expected interest rate path and were effective in preventing the financial crisis by removing the liquidity risk or credit risk of the financial markets.[2] However, these papers barely discuss the changes of the expectation forms and the credit risks on the financial markets from the short- to long-run perspectives.

Since the BOJ has implemented the ZIRP and QMEP, it is important to investigate and discuss the influences of the BOJ's announcements on the financial markets.

[1] In this paper, we use the term "ZIRP" in a narrow sense, referring to the first ZIRP of the late 1990s, and do not consider the low interest rate policy from March 2001 to July 2006. We consider this period as "QMEP" period. The QMEP is considered to be the extended ZIRP (see Oda and Ueda, 2007).

[2] Adopting a different perspective, Fukuda (2010) suggested that the non-traditional monetary policy caused moral hazard for financial institutions. Okina and Shiratsuka (2004) argued that this policy could not prevent deflation and low economic growth.

Recently, some papers analyzed the relationship between monetary policy and financial markets (Cook and Hahn, 1989; Kuttner, 2001; Bernanke and Kuttner, 2004; Ito, 2005; Honda and Kuroki, 2006; Senda, 2006; Hanabusa, 2009b, 2011a, 2011b; Laeven and Tong, 2012). Laeven and Tong (2012) found that stock prices increased (decreased) following unexpected US monetary loosening (tightening). Ito (2005), Honda and Kuroki (2006), and Senda (2006) analyzed the announcement effects on the Japanese market interest rates during the non-traditional monetary policy regime, but did not identify the monetary policy effect, that is, whether it is a tightening or easing monetary policy. These previous studies investigated whether the ZIRP and QMEP affected the finance variables.[3]

This paper has two aims: First, we reexamine the hypothesis that some announcements of the BOJ affect the expectation component of market rates. Then, we set six announcements: the introduction of ZIRP, the addition of commitment of ZIRP, the termination of ZIRP, the introduction of QMEP, the clarification on the commitment on QMEP, and the termination of QMEP. The ZIRP and QMEP have the same properties. However, we cannot assume that these policies have the same influence on the market. Therefore, we investigate the responses of the short-, medium-, long-, and super long-term interest rates to each announcement, using daily yield spreads.

Second, we investigate the relationship between changes in the monetary policy stance and credit risks. The ZIRP was adopted by the BOJ after the bubble burst, and the financial problems such as the credit crunch, credit withdrawal, bad credit, and the Asian financial crisis occurred before the policy. The BOJ implemented the QMEP after the IT bubble burst. At that time, the weak banks faced the problem of borrowing in the short-term monetary market. When the same financial problem occurred, the BOJ implemented the ultra easing policy and tried to prevent the financial crisis. We analyze how these series of policies affected the risk issue of the banking system.

Our findings are broadly consistent with previous studies in this field. Each announcement—ZIRP introduction, addition of ZIRP commitment, and QMEP introduction—reduces yield spreads, and thus, we confirm that the policy duration effect holds. The termination of ZIRP and QMEP increases market rates, but the market rate response to the clarification on the QMEP commitment is different and statistically significant. In addition, we find that the announcements of the termination of ZIRP and QMEP influence credit risks differently; besides, ample liquidity lowers these risks. Thus, the non-traditional monetary policy is considered to have an important role in the

[3] Honda and Kuroki (2006) and Senda (2006) discuss the influence of expected and unexpected change on market rates.

financial markets.

The rest of the paper is organized as follows: In Section 2, we review the previous literatures on the non-traditional monetary policy and the announcement effect. In Section 3, we explain in detail the non-traditional monetary policy in Japan. Section 4 reports the empirical results on the effects of six non-traditional monetary policy announcements on yield spreads, while Section 5 investigates the effects of these announcements on credit risks and discusses the results. In Section 6, we provide the empirical estimates of the deviations from the BOJ's target levels on credit risks, and finally, we summarize our findings and discuss the policy implications in Section 7.

2. Literature review

2.1. Empirical study of the non-traditional monetary policy in Japan

Many studies investigate and focus on the concept of "policy duration effect." Fujiki and Shiratsuka (2002), Okina and Shiratsuka (2004), and Oda and Ueda (2007) supported the policy duration effect throughout the flatness of the yield curve. Okina and Shiratsuka (2004) define this effect as follows:

> Even though short-term interest rates decline to virtually zero, a central bank can produce further easing effects by a policy commitment. A central bank can influence market expectations by making an explicit commitment as to the duration it holds short-term interest rates at virtually zero. If it succeeds in credibly extending its commitment duration, it can reduce long-term interest rates.[4]

Second, we consider the effect of expanding the BOJ's balance sheet by increasing the CABs. This effect is divided into two types: (i) the portfolio rebalancing effect, which affects the premium portion of the yields of financial assets that are imperfect substitutes for the monetary base; and (ii) the signaling effect, which affects the private sector's expectations for the future path of short-term interest rates.[5] We introduce the empirical studies of the "portfolio rebalancing effect" and the "signaling effect." Kimura and Small (2006) supported the reduction of the credit spread of high-grade corporate bonds. Fujiwara (2006) examined the effect of increases in base money on the aggregate output and prices, and showed only slight increases in these variables after

[4] Fujiki and Shiratsuka (2002) and Fujiwara (2006) also follow this definition of the policy duration effect and examine the effect of the QMEP.

[5] See Ugai (2006) and Oda and Ueda (2007).

expanding the base money at zero interest rates. Oda and Ueda (2007) found that the increase in CABs and the purchase of the long-term Japanese Government Bonds (JGBs) have statistically insignificant effect on the risk premium of JGBs, but have statistically significant effect on the expected future path of the JGBs' short-term interest rates. Honda et al. (2007) suggest that the QMEP stimulated economic activities by increasing the production through the stock price channel and caused the portfolio rebalancing effect.

Third, we explain the "effect on stabilizing financial market." This effect is to dispel the liquidity concerns of financial market. For instance, Baba et al. (2006) argued that the QMEP reduced the dispersion of negotiable certificates of deposit (NCD) issuance rates across banks and flattened the credit spreads for each credit rating category. Kobayashi et al. (2006) found that the QMEP increased the return of the equity values of Japanese banks and benefited financially weaker banks. Fukuda (2010) investigated that the QMEP reduced the spread between the intra-day high and low of the call rate and removed almost all risk premiums from the trading on call market. Moreover, Hanabusa (2009b, 2011a) observed that the increase in the CAB reduced the volatilities of yield spreads.

2.2. Announcement effect of the BOJ

Several studies have investigated the relationship between the term structure of interest rates and monetary policy shocks in Japan (Ito, 2005; Honda and Kuroki, 2006; Senda, 2006; Hanabusa, 2009b, 2011b). Ito (2005) and Honda and Kuroki (2006) investigated the period before the monetary market rate of zero interest, but Senda (2006) and Hanabusa (2009b) studied the period after that.

Ito (2005) found that the market rates from 1-month to 5-year responded significantly to the changes in the call rate target, employing the method of Cook and Hahn (1989). Honda and Kuroki (2006) examined the response of the term structure of interest rates to surprise changes in the call rate, following Kuttner (2001) and Bernanke and Kuttner (2003). Senda (2006) demonstrated that the announcement of BOJ did not affect the expectations of one-year-ahead to four-year-ahead and of ten-year-ahead significantly, but did affect the expectations of five- and seven-year-ahead significantly. Furthermore, Hanabusa (2009b) showed that the QMEP affected the level and volatility of change rate on the short-term interest rates, employing the AR-EGARCH model. Hanabusa (2011b) also investigated the relationships between each announcement about the non-traditional monetary policy and short-, medium-, long-, and super long-term

interest rates, employing the event study.

3. Non-traditional monetary policy

3.1. Zero interest rate policy

The ZIRP is a monetary easing policy and encourages the uncollateralized overnight call rate to move as low as possible. This policy was implemented from February 12, 1999 to August 11, 2000. Its aim is to avoid a possible strengthening of deflationary pressure and an economic downturn. Before the implementation, the BOJ reduces the official discount rate and target level of call rate several times. From 1997, financial institutions failed in domestic economy and the Asian financial crisis occurred in many global financial markets.[6] This caused the credit shortage and financial anxiety. The fundraising problem between firms and banks and the problem of deflation ensued. Under such an economic condition, the BOJ considered to stimulate the demand by providing ample liquidity in the market. Thus, the BOJ introduced the ZIRP in order to recover the economy and to avoid deflation.[7]

On February 12, 1999, the BOJ held the monetary policy meeting and decided to implement the ZIRP. The statement read as follows:

> … ease further the stance of money market operations for the inter-meeting period ahead as follows: The Bank of Japan will provide more ample funds and encourage the uncollateralized overnight call rate to move as low as possible. To avoid excessive volatility in the short-term financial markets, the Bank of Japan will, by paying due consideration to maintaining market function, initially aim to guide the above call rate to move around 0.15%, and subsequently induce further decline in view of the market developments. (BOJ, 1999a)

The BOJ reduced the target of uncollateralized overnight call rate to 0.25% from 0.5%

[6] For example, the crisis led to the closure of Yamaichi Securities (November 1997), the collapse of Hokkaido Takushoku Bank (November 1997), the nationalization of Long-Term Credit Bank (October 1998), and the nationalization of Nippon Credit Bank (December 1998).

[7] As for the other reason to introduce the ZIRP, we believe that the BOJ intends to prevent the economic slump factors, such as the increase of long-term interest rates and appreciation of the yen after 1998.

on September 9, 1998, and, further reduced to 0.1%, that is, approximately 0%.

Masaru Hayami, Governor of BOJ, made the policy period of the ZIRP explicit on April 13 that the BOJ was committed to maintaining the ZIRP "until deflationary concerns are dispelled" (BOJ, 1999b). This statement implies that the BOJ will continue with the ZIRP for a considerable period, and thus it affects the expectations of the financial markets. Reflecting such market expectations, interest rates for term instruments decline rapidly, the yield curve becomes extremely flat, and long-term interest rates move stably.

On August 11, 2000, the BOJ held the monetary policy meeting and decided to end the ZIRP. The statement said, "The Bank of Japan will encourage the uncollateralized overnight call rate to move on average around 0.25%" (BOJ, 2000). The policy decisions regarding the ZIRP are shown in Table 1.

[Insert Table 1 around here]

3.2. Quantitative monetary easing policy

The QMEP is a new monetary easing framework. This policy was implemented from March 19, 2001 to March 9, 2006. On March 19, 2001, the BOJ adopted the policy in response to the economic recession triggered by the world dot-com bubble burst. Its aim is to avoid continuously declining prices as well as to prepare a basis for sustainable economic growth.[8]

On March 19, 2001, the BOJ held the monetary policy meeting and decided to implement the QMEP. The statement is as follows:

> The main operating target for money market operations be changed from the current uncollateralized overnight call rate to the outstanding balance of the current accounts at the Bank of Japan. Under the new procedures, the Bank provides ample liquidity, and the uncollateralized overnight call rate will be determined in the market at a certain level below the ceiling set by the Lombard-type lending facility. (BOJ, 2001)

Ugai (2006) introduces the survey of the QMEP in detail. The following three points are considered as the pillars of the policy: First, the BOJ provides ample liquidity by increasing the current account balance at the BOJ (CAB) as the operating policy target

[8] At that time, Japan's economy headed toward recession triggered by the bursting of the global IT bubble and experienced the decline in stock and commodity prices, and financial instability.

and realizes a CAB target in excess of the required reserves. Second, the BOJ commits to maintain the supply of ample liquidity until the core consumer price index (core CPI)—excluding the perishables on a nationwide statistics—moves stably at zero percent or shows an annual increase. Third, the BOJ increases the purchase of long-term JGBs required to facilitate smooth liquidity injection.

The BOJ expanded the CAB target any time during this period. The first target level was around 5 trillion yen in March 2001. The final upper target level reached 35 trillion yen and the bottom target was 30 trillion yen in January 2004. Figure 1 plots the actual CAB and its target ranges.[9] From this figure, the CAB increaseed to around upper target from 2001 to early 2003. However, the BOJ set the target ranges and kept its monthly CAB within its announced ranges since the late 2003. When the BOJ implemented the QMEP, it added the commitment about the termination of the policy and then clarified the commitment.

[Insert Fig. 1 around here]

On October 10, 2003, the BOJ clarified the condition of the QMEP termination (BOJ, 2003).

First, it requires not only that the most recently published core CPI should register a zero percent or above, but also that such tendency should be confirmed over a few months.

Second, the Bank needs to be convinced that the prospective core CPI will not be expected to register below a zero percent. This point will be described in such materials as the analysis and the forecasts of Policy Board members in the Outlook Report. To be more specific, many Policy Board members need to make the forecasts that the core CPI will register above a zero percent during the forecasting period.

The above conditions are the necessary condition. There may be cases, however, that the Bank will judge it appropriate to continue with quantitative easing even if these two conditions are fulfilled.

The aim of the BOJ's monetary policy is to achieve price stability and contribute the sound development of the national economy. The BOJ ever experienced slowdown of

[9] This value of CAB was increased primarily through monthly purchases of JGBs in open market operation (see Oda and Ueda, 2007).

the economy after the cancellation of ZIRP. From the Minutes of the Monetary Policy Meeting, we consider that the termination condition about the QMEP links to the realization of core CPI and BOJ becomes careful about cancellation of QMEP.

On March 9, 2006, the BOJ terminated the policy. The BOJ announced that the reduction of CAB would be carried out over a period of several months, fully taking into account the conditions in the short-term money market. The reduction plan of CAB proceeded smoothly within a few months. In July 2006, the BOJ terminated the ZIRP and increased the policy rate (BOJ, 2006).

Table 2 shows the policy decisions regarding the QMEP. When the BOJ increases the target level of CAB, it explains the need for a liquidity injection to secure financial market stability. For example, the war in Iraq started in March 2003, and the BOJ increased the target CAB in April 2003.

[Insert Table 2 around here]

Figures 2 and 3 show that the movements of yield spreads from August 14, 2000 to March 9, 2006. The yield spreads between 1-month and 6-month, 1-year, 2-year, 3-year, and 10-year interest rates are depicted by r06, r1, r2, r3, r10, respectively.

[Insert Fig. 2 around here]
[Insert Fig. 3 around here]

4. Policy impact on yield spreads

4.1. Methodology

We investigate how changes in BOJ's monetary policy stance affect financial variables. To measure the effect on the market expectations, we use the event study approach and daily time series of the short-, medium-, long-, and super long-term interest rates. The event study is the standard technique for measuring economic variables' reaction to an announcement, event, or economic shock. This approach assumes that the market is efficient. Thus, the announcement of central bank is likely to change the determination of interest rates as long as it is unexpected by the market. The analysis is based on Campbell et al. (1997). Fama et al. (1969) introduce and apply the event study method. We explain and estimate each reaction of the yield spreads to

announcements. The constant mean return model is as follows:

$$r_{i,t} = \mu_i + v_{i,t} \qquad (1)$$
$$\mathrm{E}[v_{it}] = 0, \quad \mathrm{Var}[v_{it}] = \sigma_{v_i}^2 \ ,$$

where $r_{i,t}$ is the yield spread between the call rate (overnight), *i* is the maturity interest rate, and μ_i is the constant term. $v_{i,t}$ denotes the uncorrelated error term with mean zero and constant variance. First, we define the two-day event window, $t_0 = 0$ and $t_1 = +1$. The terms t_0 and t_1 can be defined as the day of and day after the announcement of BOJ, respectively. Second, we set the estimation window, which is 41 business days before each announcement. We set this period because the interval between the introduction of ZIRP and the addition of commitment of ZIRP is close.[10]

To analyze the effect of each announcement on yield spreads, we calculate the abnormal returns of yield spreads ($AR_{i,t}$) from the equation (1), which is the difference between the estimated return ($\widehat{\mu_i}$) and the realized return ($r_{i,t}$). This is expressed as

$$AR_{i,t} = r_{i,t} - \widehat{\mu_i}, \qquad (2)$$

where $\widehat{\mu_i}$ is the sample mean. Next, using the equation (2), we calculate the cumulative abnormal returns of each firm (CAR_i), which is given by

$$CAR_i = \sum_{t=t_0}^{t_1} AR_{i,t} \ .$$

Finally, to test the null hypothesis that the announcement does not affect the yield spreads, we employ the following J_1 and J_2 statistics:

$$J_1 = \frac{CAR_i}{[\widehat{\sigma_{v_i}^2}]^{\frac{1}{2}}} \quad \text{and} \qquad (3)$$

$$J_2 = [\frac{(L_1-3)}{(L_1-1)}]^{\frac{1}{2}} RACAR_{\mathrm{i}} \ , \qquad (4)$$

[10] The day of the ZIRP introduction and the addition of ZIRP commitment are February 12, 1999 and April 13, 1999, respectively. The change of the policy stance is only 41 business days.

where $RACAR_{\mathrm{i}} = \frac{CAR_i}{\widehat{\sigma_{v_i}}}$, L_1 is the length of the estimation window, and $\widehat{\sigma_{v_i}}$ is the sample variance.

4.2. Data

We use the data on the daily interest rates in Japan. The short-term interest rates are uncollateralized overnight call rate, 3-month, 6-month, and 1-year Tokyo Interbank Offered Rates (TIBORs),[11] while the medium-, long-, and super long-term interest rates are 3-year, 5-year, 10-year, and 20-year JGBs yields. The sample period is 41 business days before each six announcement: the introduction of ZIRP (February 12, 1999), the addition of commitment of ZIRP (April 13, 1999), the termination of ZIRP (August 11, 2000), the introduction of QMEP (March 19, 2001), the clarification of commitment of QMEP (October 10, 2003), and the termination of QMEP (March 9, 2006). The data source is the Thomson Reuters Datastream. In addition, the *i*-month or year yield spread ($r_{i,t}$) is calculated as the difference between the original data series (TIBORs and JGBs) at time *t* and the original data series (call rate) at time *t*.

4.3. Empirical result

Here, we provide the empirical results for the event study method. First, we analyze the effect of each announcement on the short-term money market by using the constant mean return model. Next, we examine the medium-, long-term, and super long-term money markets.

Table 3 summarizes the announcement effect of the introduction of ZIRP on the term structure of interest rates. The reaction of 3- and 6-month yield spreads to the announcement is negative and statistically significant. However, the response of 10- and 20-year yield spreads is positive and statistically significant. This implies that the introduction of ZIRP affected the term structure of interest rates in the short-run money market and lowered the rates immediately. On the other hand, the long- and super long-term yield spreads increased. Apparently, market participants did not expect the

[11] TIBORs are Japanese Yen. The pricing of JGB depends crucially on their convenience, market liquidity, and the difference in the characteristics of each issue (outstanding volume and coupon rate) (see Shigemi et al., 2001 and Fukuta et al., 2002). Moreover, during 1998–2000, there were some problems about the market liquidity (including the Y2K problem). Therefore, we used both TIBORs and JGBs. TIBORS are published daily by the Japanese Bankers Association.

ZIRP effects to sustain in the long run.[12] Thus, this result is consistent with the findings of Fujiki and Shiratsuka (2002), Okina and Shiratsuka (2004), and Hanabusa (2009a, 2010, 2011b) that the policy duration effect occurs in the short run.[13]

Table 4 summarizes the announcement effect of the addition of ZIRP commitment on the term structure of interest rates. The reaction of the 3-month and the 3-, 5-, 10-, and 20-year yield spreads to the announcement is negative and statistically significant.[14] This result suggests that the market rates responded negatively and that the announcement of the commitment surprised the markets. The introduction of ZIRP did not lower medium- and long-term yield spreads, but the addition of the commitment of ZIRP did. Thus, the announcement of the addition of ZIRP commitment is a useful event for considering the change from medium- to long-run expectations on interest rates. It supports the policy duration effect from the medium run to long run.[15] Since it affects the longer market rates, the result is similar to the main results in Ito (2005), Honda and Kuroki (2006), Senda (2006), Oda and Ueda (2007), and Hanabusa (2010).

Table 5 summarizes the announcement effect of the ZIRP termination on the term structure of interest rates. The reaction of the 3- and 6-month and the 1- and 3-year yield spreads to the announcement is positive and statistically significant. Since the ZIRP termination is intended to stop an easing policy, market rates increase. However, the 5-, 10-, and 20-year yield spreads do not respond. Thus, the announcement of termination is not surprising information in the medium and long run.[16] The market may expect that the ZIRP to last at least three years.

Table 6 summarizes the announcement effect of the introduction of QMEP on the term structure of interest rates. The reaction of yield spreads to the announcement is negative and statistically significant for all maturities. The introduction of QMEP decreases interest rates from the short run and super long run when we compare the introduction of ZIRP with that of QMEP. The BOJ is committed to maintaining the

[12] The response of 3- and 5-year yield spreads is negative and positive, respectively, and statistically insignificant. It is possible that the participants believed that the ZIRP effects would sustain in the medium run.

[13] Honda and Kuroki (2006) and Oda and Ueda (2007) did not examine the short-term money market. Ito (2005) and Senda (2006) did not analyze the announcement effect of each change in the BOJ's monetary policy. Ito (2005) argued that BOJ announcements affected 1-month to 5-year interest rates in 1990–1999. Senda (2006) maintained that the BOJ's announcements affected the former policy expectations for 5- and 7-year interest rates in 1998–2004.

[14] The reaction to the 6-month and 1-year yield spreads is negative and statistically insignificant. This may reflect the trading volume. There is much trading volume for 3-month interest rate in the short-run money market.

[15] Okina and Shiratsuka (2004) also pointed out the downward shift in ranges longer than 1- year.

[16] Hanabusa (2011b) found that the response of the 2-, 3-, 5-, and 7-year interest rates to the announcement was positive and statistically significant.

supply of ample liquidity until the core CPI moves stably at zero percent or shows an annual increase, and the operating policy target changes the call rate to the CAB when BOJ implements the QMEP. This policy stance is different from the ZIRP. Thus, we find that these points represent unexpected market information, which changes the expectation of the monetary policy stance in the longer interest rates—from the medium- to the super long-term market rates. Several studies support the policy duration effect during the QMEP (Okina and Shiratsuka, 2004; Ugai, 2006; Oda and Ueda, 2007; Hanabusa, 2011b).[17] Our results are similar to the findings of these studies.

Table 7 summarizes the announcement effect of the clarification of QMEP commitment on the term structure of interest rates. The reaction of the 3- and 6-month and the 1-year yield spreads to the announcement is positive and statistically significant. This announcement signals an easing policy, but the short-term interest rates increase. The response of the 3-, 5-, 10-, and 20-year yield spreads is not statistically significant. The announcement as to the addition of ZIRP commitment decreases the short-, medium-, and long-term interest rates, but the clarification of QMEP commitment does not. In this period, the Japanese economic growth rate is positive, and the price change is near zero percent, as shown in Figures 4 and 5. It may therefore raise the expected short-term interest rates. From these empirical results, the clarification of QMEP commitment was not a policy issue that would cause an easing effect on short-term interest rates. This result is consistent with Hanabusa (2011b). However, Oda and Ueda (2007) suggest that if the BOJ did not adopt a zero-level overnight call rate, market rates would increase.

Table 8 summarizes the announcement effect of the QMEP termination on the term structure of interest rates. The reaction of the 3- and 6-month as well as the 3-, 5-, and 10-year yield spreads to the announcement is positive and statistically significant. The market interest rates respond to the tight monetary policy.[18] This announcement affects the expected future short-term interest rates on maturities beyond the termination of ZIRP. However, the 20-year interest rate did not respond to the announcement. This implies that the market did not expect the QMEP to last for a very long period.

[17] Okina and Shiratsuka (2004) argued that the stimulus impacts of the QMEP were limited from an early stage. Hanabusa (2011a) did not support the policy duration effect, but argued that the decrease in the yield spreads throughout proved the ample liquidity under the QMEP. Interest rates increased in the latter part of the QMEP, reflecting the economic recovery, the stabilization of the U.S. economy, and an expectation of the termination of QMEP

[18] The BOJ stated that the zero level of the call rate would remain after the termination of QMEP. The BOJ took this step in order that the monetary market and the economy are not confused. The BOJ terminated the zero level of the call rate on July 14, 2006.

[Insert Table 3 around here]
[Insert Table 4 around here]
[Insert Table 5 around here]
[Insert Table 6 around here]
[Insert Table 7 around here]
[Insert Table 8 around here]

[Insert Fig. 4 around here]
[Insert Fig. 5 around here]

5. Policy impact on credit risks

5.1. Methodology and data

In the previous section, we investigated the announcement effects of changes on the monetary policy stance. Here, we examine the impacts of each announcement on credit risks, using a similar method. First, using the data on credit risks, we estimate the equation (1). Then, we calculate the abnormal returns of credit risks, J_1 and J_2 statistics.

Again, we use the data on the daily Japanese interest rates. The medium- and long-term interest rates include 3-year, 5-year, 10-year, and 20-year JGBs and SWAPs yields. The sample period is 41 business days before each announcement. The data source is the Thomson Reuters Datastream. In addition, the *i*-year credit risk ($cr_{i,t}$) is calculated as the difference between the original data series (SWAPs) at time *t* and the original data series (JGBs) at time *t*.[19] Figure 6 plots these credit risks.

[Insert Fig. 6 around here]

5.2. Empirical result

We provide the empirical results of the relationship between the BOJ announcements

[19] We call the difference between SWAP and JGB of the same maturity the swap spread. If these markets are efficiently priced, it reflects the risk components of Japanese banking sector (counter party risk and interest rate risk). Here, we regard the swap spread as the credit risk.

and credit risks, employing the event study method. Table 9 shows the results of each medium-, long-, and super long-term money market. Table 9-[A] rank, summarizes the effects of the introduction of ZIRP on credit risks. The reaction of the 10- and 20-year credit risks to the announcement is negative and statistically significant. However, the 5-year credit risk reaction is positive and statistically significant at the 10% level. The introduction of ZIRP decreases the long- and super long-term credit risk, but does not decrease the medium-term credit risk. We find that the introduction of ZIRP reduces the risk for the banking system in the long run.

Table 9-[B] rank, summarizes the effects of the addition of ZIRP commitment on credit risks. The response to the announcement is positive for all maturities, but insignificant only for the 5-year credit risk. This result implies that the market expects the risk of the banking sector to increase when the addition of ZIRP commitment begins to operate, and does not consider the monetary policy effective enough to help the banks. However, Okina and Shiratsuka (2004) point out that the interest rate dropped after 15 business days. Probably, the market needed this period to digest the policy announcement.

Table 9-[C] rank, summarizes the effects of the termination of ZIRP on credit risks. For credit risks of all maturities, the reaction to the announcement is negative, but the reaction of the 20-year credit risk is not statistically significant. This suggests that credit risks respond to the tight monetary policy. This result indicates that the market expects the stabilization and recovery of the banking system to continue even after the termination of ZIRP. Since the economic growth rate in this period is positive owing to the US IT bubble, the market may consider the termination of ZIRP an indication of economic recovery.

Table 9-[D] rank, summarizes the effects of the introduction of QMEP on credit risks. The response of the 3-year credit risk to the announcement is positive and statistically significant, but that of the 10-year credit risk is negative and statistically significant. The introduction of QMEP does not decrease the response of the 20-year credit risk when compared with the introduction of ZIRP. Thus, the ZIRP is an effective monetary policy for the credit risks of longer maturity.[20]

Table 9-[E] rank, summarizes the effects of the clarification of QMEP commitment on credit risks. The reaction to the announcement is negative for all maturities, but statistically insignificant. However, the announcement effect changes with the addition

[20] The effectiveness of ZIRP is related with the financial crisis of 1997–1998. Since the Japanese economy and the banking system were facing a critical situation, the market might have responded unexpectedly to the monetary policy.

of ZIRP commitment. Thus, it is not surprising that this monetary policy is implemented to lower the risk of the banking sector. However, this result could be because the credit risk started to decrease even prior to the clarification of QMEP commitment, possibly reflecting the growing market anticipation of monetary easing.

Table 9-[F] rank, summarizes the effects of the termination of QMEP on credit risks. The response to the announcement is positive for all maturities, and statistically significant. This result implies that the termination of QMEP is an unexpected tight monetary policy for credit risks of the banking sector. During 2001–2006, the BOJ provided ample liquidity to the banking system by purchasing the JGBs. Japanese banks did not have to yield to asset financing during this period. Thus, the market anticipated an increase in the cost and risk of the banking system after the termination of QMEP. Baba et al. (2006) found the reduction of risk premium for banks, using the NCD issuance rates and bond issuance rates of banks during the non-traditional monetary policy period. Fukuda (2010) also found that the QMEP removed almost all types of risk premiums from trading on the interbank market, using the spread between the intra-day high and low values on the market.

[Insert Table 9 around here]

6. Monetary policy and credit risks

6.1. Methodology

In sections 4 and 5, we examined how the announcements about the BOJ's monetary policy stance affect the financial variables. In this section, we discuss the relationship between the deviations of the target level that the BOJ set and the credit risks. First, we focus on the ZIRP period. The BOJ adopts the overnight call rate as a policy instrument. The BOJ changes the call rate target level in response to the economic situation.[21] Hence, the model is specified as follows:

$$cr_{i,t} = c_i + \beta_i \, CALL_t + \gamma_i \, cr_{i,t-1} + \varepsilon_{i,t} \ , \qquad (5)$$

[21] For example, the BOJ considers macroeconomic variables, such as GDP, inflation rates, stock prices, long-term interest rates, and exchange rates, foreign affairs, and domestic and foreign markets. The BOJ changed the basic index of money market operations to the overnight call rate in 1995.

where $CALL_t$ denotes the difference between the call rate target level and the realized call rate.

Second, we examine the period of QMEP. The BOJ changed the policy instrument from the overnight call rate to the CAB target in excess of the required reserves from March 19, 2001 to March 8, 2006. We change the equation (5) to match this situation, and thus the model is as follows:

$$cr_{i,t} = c_i + \beta_i Reserve_t + \gamma_i cr_{i,t-1} + \varepsilon_{i,t} \ , \qquad (6)$$

where $Reserve_t$ (B_t or U_t) denotes the difference between the CAB target level and the realized CAB, and B_t and U_t are bottom target and upper target of CAB, respectively.

6.2. Data

Here as well, we use the same interest rate data as in sections 4 and 5. The medium-, long-, and super long-term interest rates are 3-year, 5-year, 10-year, and 20-year JGBs and SWAPs yields. The credit risk ($cr_{i,t}$) is the difference between SWAP and JGB of the same maturity. The CAB target value from March 19, 2001 to August 13, 2001 is not set. We use the average of realized reserve in each month as target value in this period. The sample analysis period of the ZIRP is from February 12, 1999 to August 10, 2000, while the sample analysis period of the QMEP is from March 19, 2001 to March 8, 2006. The data source is the Thomson Reuters Datastream and BOJ's homepage. Figure 7 plots the overnight call rate and its target level.

[Insert Fig. 7 around here]

6.3. Empirical result

First, we provide the empirical result for equation (5). We investigate how the deviation from the call rate target level affects the financial markets. The BOJ set the call rate target level to 0.15% from February 12, 1999 to October 12, 1999. Table 10 reports the estimates of β_i. The coefficients describing the response of credit risks to the daily changes of the call rates are negative in the 3- and 10-year credit risks and positive in the 5- and 20-year credit risks, but the response is statistically significant

only in the 10-year credit risk.[22] This result shows that the daily change of the call rate does not affect the 3-, 5-, and 20-year credit risks during the ZIRP period.[23] The previous studies investigate whether changes of the monetary policy stance of BOJ affect the medium- and long-term interest rates (Ito, 2005; Honda and Kuroki, 2006; Senda, 2006). These studies suggest that changes in target level of the short-term interbank rate affect the expectation of market rates. However, we find that the decrease of target rate does not help the banking system.

Second, we examine how the deviation from the CAB target in excess of the required reserves affects the financial markets. Tables 11 and 12 show the empirical results of equation (6); these tables are based on the results of the bottom and upper targets of CAB, respectively. From Table 11, the estimates of β_i are negative for all maturities, and the 5-, 10-, and 20-year credit risks are statistically significant. This implies that the medium- and long-term credit risks decrease when the realized CAB exceeds the bottom target of CAB. Moreover, Table 12 suggests that the estimates of β_i are negative and statistically significant for all maturities; thus, the medium-, long-, and super long-term credit risks are lower when the realized CAB exceeds the upper target of CAB. These results suggest that it is important for the BOJ to supply ample liquidity to decrease credit risks. Fukuda (2010) argues that the QMEP further narrows the spread on call rates and removes almost all the risk premiums from trading on call market when he compares the effect of QMEP with that of ZIRP. Considering the flatness of the credit risk curves and an increase in the equity values of banks, Baba et al. (2006) and Kobayashi et al. (2006) also argue that the QMEP has an influence on Japanese banks. Thus, the market would also expect this situation and reduce credit risks when the BOJ provides ample liquidity.

[Insert Table 10 around here]
[Insert Table 11 around here]
[Insert Table 12 around here]

[22] We examine the relationships between the policy instrument and the monetary policy stance change using a dummy variable (2000/2/28).

[23] The sign of the estimate of β_i in the 10-year credit risk is negative. This implies that the credit risk decreases when the call rate is above the target rate. The operations in the short-term monetary market decrease during this super easing monetary policy period. It is believed that the call rate increases when the market works and the market may respond to the normal function. Fukuda (2010) discusses the call market and the market mechanism during the ultra low interest rate policy period.

7. Conclusions

In this paper, we have examined how the changes in the monetary policy stance affected the short-, medium-, long, and super long-term yield spreads and credit risks in Japan during the non-traditional monetary policy period. We used the event study approach with the constant mean return model and the OLS approach with heteroskedasticity-consistent standard error estimators, employing daily market interest rates.

The main findings can be summarized as follows: First, a comparison of the ZIRP and the QMEP shows that the introduction of both policies raised the medium-term credit risk, decreased the long-term credit risk, and lowered the short-term yield spread. Further, the QMEP also decreased the medium- and long-term yield spreads. These monetary policies caused an easing effect on the financial markets. This is consistent with the results of the previous studies (Fujiki and Shiratsuka, 2002; Okina and Shiratsuka, 2004; Baba et al., 2006; Kobayashi et al., 2006; Ugai, 2006; Oda and Ueda, 2007; Hanabusa, 2009b; Fukuda, 2010; Hanabusa, 2011a; Hanabusa, 2011b). The policy duration effect existed for the non-traditional monetary policy period, and this is similar to the result of Fujiki and Shiratsuka (2002), Okina and Shiratsuka (2004), Ugai (2006), Oda and Ueda (2007), and Hanabusa (2009a).

Second, the addition of ZIRP commitment lowered the short-, medium-, long, and super long-term yield spreads, but the clarification of QMEP commitment raised the short-term yield spread. The market rates responded in a tightening direction to the clarification of QMEP commitment. On the other hand, the addition of ZIRP commitment increased the medium-, long-, and super long-term credit risks, while the clarification of QMEP commitment decreased the long-term yield spread. These monetary policies influenced the financial markets differently.

Third, both termination announcements of ZIRP and QMEP increased the short- and medium-term yield spreads. As for their influence on the length of maturity, the QMEP had a bigger influence than the ZIRP. Conversely, their influences on credit risk were different. Credit risks responded negatively to the termination of ZIRP, but positively to that of QMEP. The market witnessed different influences on the banking system from these tightening policies.

Finally, we found that when the CAB exceeded its target level, the short-, medium-, long-, and super long-term credit risks decreased. The result was same when we investigated the response based on the bottom and upper targets. During the QMEP period, the BOJ made an ample provision of money and reduced the liquidity risk

premium. Overall, our findings suggested that the QMEP contributes significantly to reducing the risk of the banking system and to maintaining the stability of financial markets.

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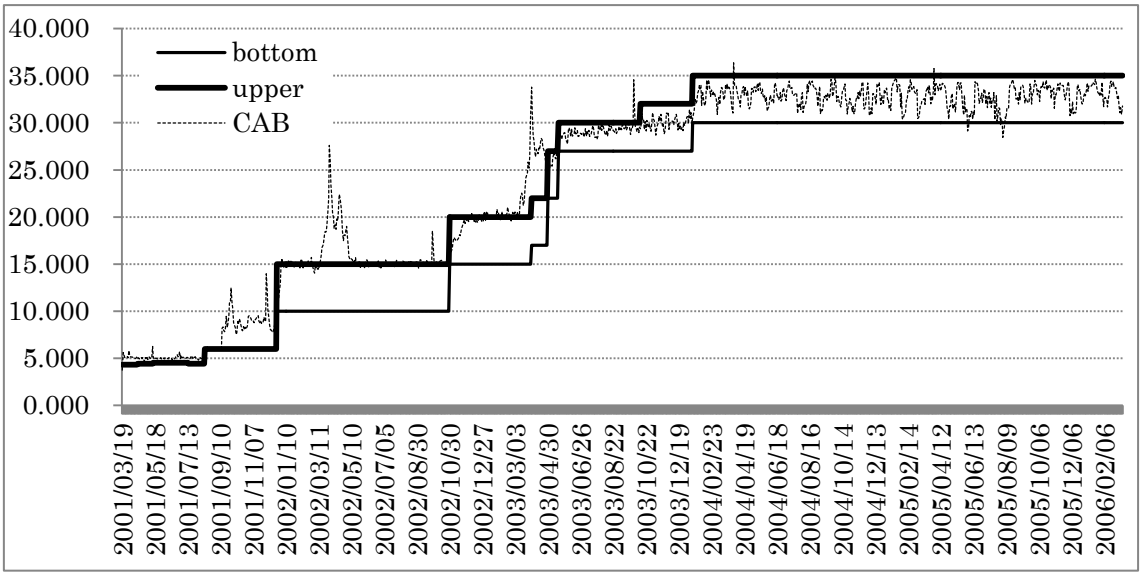

Fig. 1. Policy stance and realized CAB during the QMEP. Current account balance and upper and bottom target ranges (trillion yen).

Source: Bank of Japan

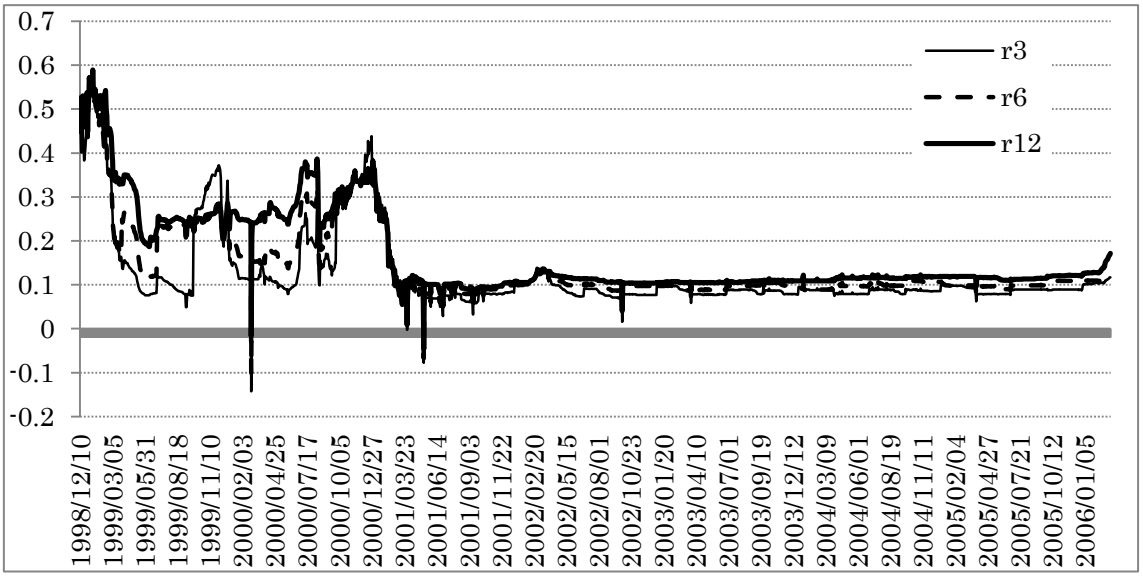

Fig. 2. Yield spreads (short-term). r3, r6 and r12 denote 3- and 6-month and 1-year yield spreads.

Source: Thomson Reuters Datastream.

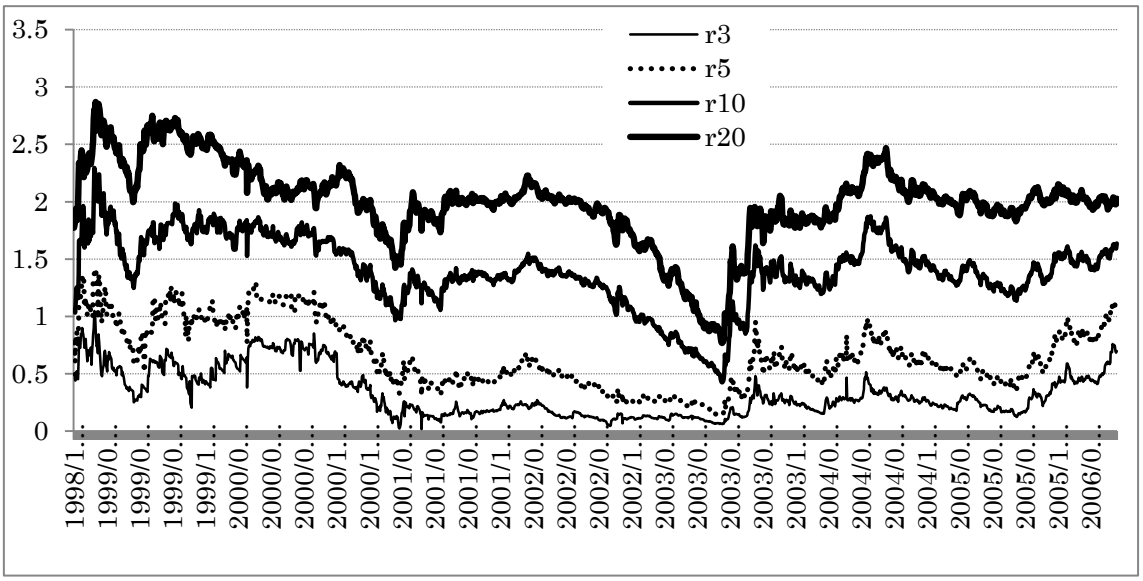

Fig. 3. Yield spreads (middle- and long-term). r3, r5, r10, and r20 denote 3-, 5-, 10-, and 20-year yield spreads.

Source: Thomson Reuters Datastream.

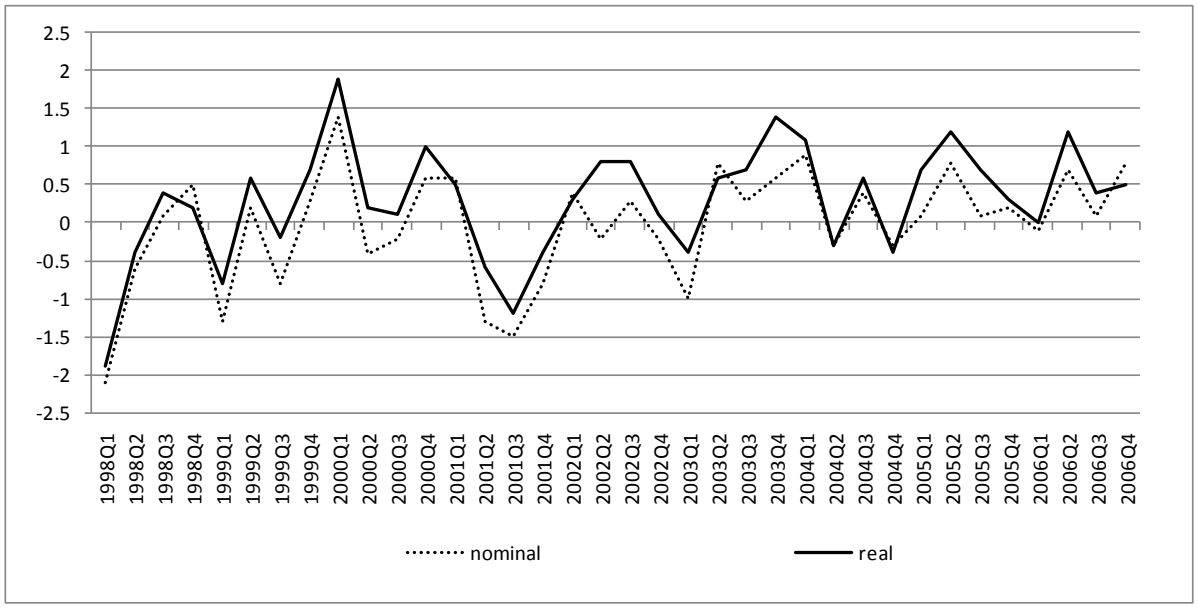

Fig. 4. GDP (nominal and real). Note: GDP is real and nominal (y/y % chg.).

Source: Cabinet Office.

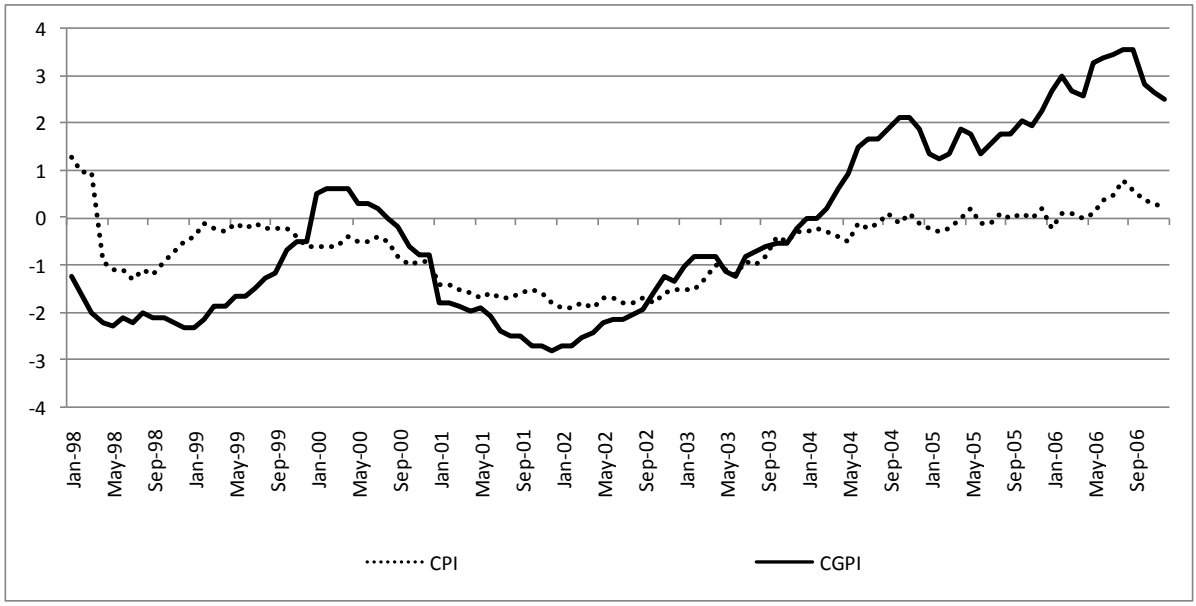

Fig. 5. Price index. CPI denotes the consumer price index (excluding fresh food) and CGPI denotes the corporate goods price index (excluding consumer tax) (y/y % chg.). Source: Ministry of Internal Affairs and Communications and Bank of Japan.

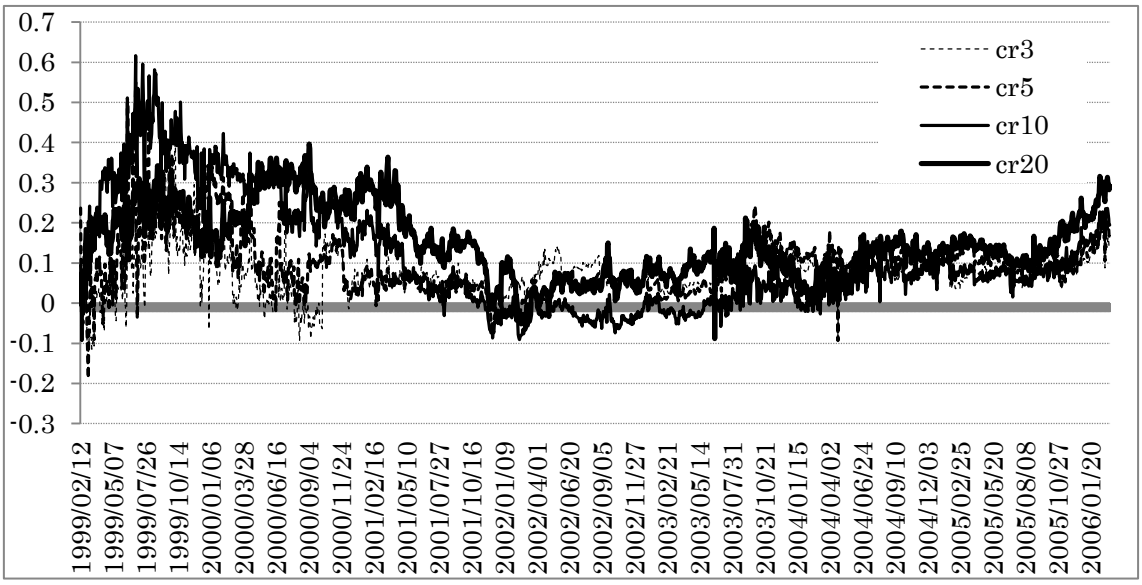

Fig. 6. Credit risks. r3, r5, r10, and r20 denote 3-, 5-, 10-, and 20-year redit risks. Source: Thomson Reuters Datastream.

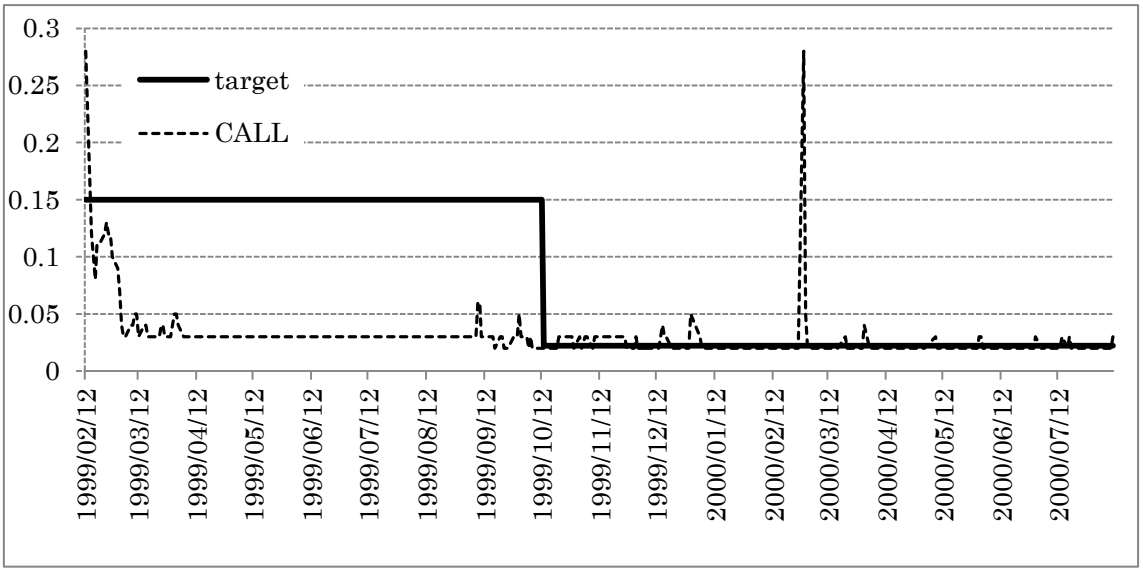

Fig. 7. Policy stance and realized policy rate during the ZIRP. The target denotes the call rate target level and CALL denotes the overnight call rate. The target from October 13, 1999 to August 10, 2000 is the average of CALL in this period. The increase of overnight call rate on February 28 and 29 is the February 29 problem.

Source: Bank of Japan and Thomson Reuters Datastream.

Table 1

Policy events about the zero interest rate policy

Date	Policy Event
1998/4/1	Enforcement of revised Bank of Japan Act
1998/9/9	Decrease in the call rate target level
	(0.5%→0.25%)
1999/2/12	Introduction of zero interest rate policy
	Decrease in the call rate target level
	(0.25%→0.15%)
1999/4/13	Addition of commitment of zero interest rate policy
2000/8/11	Termination of zero interest rate policy

Source: Bank of Japan

Table 2

Policy events about the quantitative monetary easing policy

Date	CAB	JGB
2001/3/19	Introduction of quantitative monetary easing policy	Introduction of quantitative monetary easing policy
	-	Increase in the purchase of JGB
	-	(0.4 trillion yen per a month)
2001/8/14	Increase in the target of CAB	Increase in the purchase of JGB
	(5 trillion yen→6 trillion yen)	(0.4 trillion yen per a month→ 0.6 trillion yen per a month)
2001/9/18	Increase in the target of CAB	-
	(6→above 6 trillion yen)	-
2001/12/19	Increase in the target of CAB	Increase in the purchase of JGB
	(above 6 trillion yen→10-15 trillion yen)	(0.6 trillion yen per a month→ 0.8 trillion yen per a month)
2002/2/28	-	Increase in the purchase of JGB
	-	(0.8 trillion yen per a month→ 1 trillion yen per a month)
2002/10/30	Increase in the target of CAB	Increase in the purchase of JGB
	(10-15 trillion yen→15-20 trillion yen)	(1 trillion yen per a month→ 1.2 trillion yen per a month)
2003/3/20	Installation of Governor Fukui, Bank of Japan	Installation of Governor Fukui, Bank of Japan
2003/4/1	Increase in the target of CAB	-
	(15-20 trillion yen→17-22 trillion yen)	-
2003/4/30	Increase in the target of CAB	-
	(17-22 trillion yen→22-27 trillion yen)	-
2003/5/20	Increase in the target of CAB	-
	(22-27 trillion yen→27-30 trillion yen)	-
2003/10/10	Increase in the target of CAB	-
	(27-30 trillion yen→27-32 trillion yen)	-
2004/1/20	Increase in the target of CAB	-
	(27-32 trillion yen→30-35 trillion yen)	-
2006/3/9	Termination of quantitative monetary easing policy	Termination of quantitative monetary easing policy
		(Maintenance of 1.2 trillion yen per a month)

The target current account balance rises from 15-20 trillion yen to 17-22 trillion yen on April 1, 2003. This increase is necessary adjustment due to the establishment of the Japan Post.

Source: Bank of Japan

Table 3

Estimation Result: the introduction of ZIRP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	-1.391	-1.356	-2.577*	-2.512*	-1.714†	-1.670		
1	-1.689†	-1.646	-3.537**	-3.447**	-1.350	-1.316		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-0.241	-0.235	-0.565	-0.551	0.923	0.899	1.160	1.130
1	0.583	0.568	0.726	0.707	2.520*	2.456*	3.072**	2.994**

The estimation window is from December 10, 1998 to February 10, 1999.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 4

Estimation Result: the addition of commitment of ZIRP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	-0.922	-0.898	-0.271	-0.264	-0.607	-0.591		
1	-1.878†	-1.831†	-0.584	-0.570	-1.260	-1.228		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-1.298	-1.266	-1.556	-1.516	-1.767†	-1.722†	-1.749†	-1.705†
1	-2.239*	-2.183*	-2.754**	-2.684*	-3.299**	-3.215**	-3.234**	-3.152**

The estimation window is from February 12, 1999 to April 12, 1999.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 5

Estimation Result: the termination of ZIRP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	1.547	1.507	1.299	1.266	1.457	1.420		
1	2.663*	2.596*	2.128*	2.074*	1.924†	1.875†		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	1.909†	1.861†	1.518	1.480	1.030	1.004	0.102	0.099
1	2.803**	2.732**	1.371	1.336	0.934	0.910	-1.068	-1.041

The estimation window is from June 14, 2000 to August 10, 2000.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 6

Estimation Result: the introduction of QMEP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	-1.613	-1.572	-1.601	-1.560	-1.592	-1.552		
1	-3.009**	-2.933**	-2.818**	-2.747**	-2.754**	-2.684*		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-1.869†	-1.822†	-1.897†	-1.849†	-1.501	-1.463	-1.237	-1.206
1	-3.399**	-3.313**	-3.643**	-3.550**	-3.274**	-3.191**	-3.006**	-2.930**

The estimation window is from January 18, 2001 to March 16, 2001.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 7

Estimation Result: the clarification of commitment of QMEP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	0.439	0.428	1.812†	1.766†	0.771	0.752		
1	1.781†	1.736†	4.980**	4.854**	3.544**	3.454**		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-0.741	-0.722	-0.362	-0.353	-0.089	-0.087	-0.147	-0.143
1	-1.163	-1.133	-0.307	-0.299	0.622	0.606	0.737	0.718

The estimation window is from August 12, 2003 to October 9, 2003.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 8

Estimation Result: the termination of QMEP (yield spread)

	3- month		6- month		1- year			
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics		
0	3.080**	3.002**	3.438**	3.351**	2.624*	2.558*		
1	6.138**	5.982**	7.039**	6.861**	5.534**	5.394**		
	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	1.229	1.198	1.098	1.070	1.025	0.999	-0.368	-0.359
1	2.574*	2.509*	2.493*	2.430*	2.710**	2.641*	0.655	0.638

The estimation window is from January 11, 2006 to March 8, 2006.

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 9

Estimation Result: credit risk

[A]	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-0.269	-0.262	2.092*	2.039*	-0.700	-0.682	-1.741†	-1.697†
1	-1.020	-0.994	1.801†	1.755†	-1.723†	-1.680	-3.765**	-3.670**
[B]	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	1.192	1.161	0.798	0.778	1.656	1.614	1.212	1.181
1	1.729†	1.685†	1.187	1.157	2.999**	2.923**	2.079*	2.026*
[C]	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-1.533	-1.494	-1.299	-1.266	-1.126	-1.097	-0.199	-0.194
1	-3.493**	-3.404**	-2.668*	-2.600*	-2.676*	-2.609*	-1.032	-1.006
[D]	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-0.004	-0.004	-1.242	-1.210	-1.673	-1.631	-1.306	-1.273
1	2.265*	2.208*	-0.300	-0.292	-1.850†	-1.803†	-0.360	-0.351
[E]	3- year		5- year		10- year		20- year	
T	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	-0.190	-0.185	-0.356	-0.347	-0.791	-0.771	-0.671	-0.654
1	-0.226	-0.221	-0.220	-0.214	-1.645	-1.603	-1.172	-1.142
[F]	3- year		5- year		10- year		20- year	
t	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics	J_1 statistics	J_2 statistics
0	0.511	0.498	0.738	0.719	1.417	1.381	1.872†	1.825†
1	2.102*	2.048*	2.218*	2.162*	3.475**	3.387**	4.294**	4.185**

[A] the introduction of ZIRP, [B] the addition of commitment of ZIRP, [C] the termination of ZIRP, [D] the introduction of QMEP, [E] the clarification of commitment of QMEP, [F] the termination of QMEP

† shows that null hypothesis is rejected 10 % significance level.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 10

Estimation Result: the response of credit risks to call rate changes

	3- year	5- year	10- year	20- year
Constant	0.012**	0.029**	0.047**	0.024**
(p-value)	(0.001)	(0.000)	(0.000)	(0.000)
$CALL_t$	-0.031	0.004	-0.092*	0.004
(p-value)	(0.405)	(0.938)	(0.011)	(0.845)
$cr_{i,t-1}$	0.842**	0.822**	0.841**	0.898**
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R-squared	0.714	0.675	0.743	0.815

The sample period is from February 12, 1999 to August 10, 2000.

P-values (in parentheses) are computed using heteroskedastic-consistent covariance estimates.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 11

Estimation Result: the response of credit risks to CAB changes

	3- year	5- year	10- year	20- year
Constant	0.007**	0.007**	0.004**	0.010**
(p-value)	(0.001)	(0.000)	(0.000)	(0.000)
B_t	-0.00004	-0.0004**	-0.0007**	-0.0008**
(p-value)	(0.728)	(0.003)	(0.000)	(0.004)
$cr_{i,t-1}$	0.920**	0.938**	0.947**	0.933**
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R-squared	0.844	0.888	0.912	0.891

The sample period is from March 19, 2001 to March 8, 2006.

The BOJ's CAB is the bottom target and p-values (in parentheses) are computed using heteroskedastic-consistent covariance estimates.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.

Table 12

Estimation Result: the response of credit risks to CAB changes

	3- year	5- year	10- year	20- year
Constant	0.007**	0.006**	0.002**	0.006**
(p-value)	(0.001)	(0.000)	(0.000)	(0.000)
U_t	-0.0004*	-0.0011**	-0.0008**	-0.0005*
(p-value)	(0.044)	(0.000)	(0.000)	(0.017)
$cr_{i,t-1}$	0.912**	0.918**	0.946**	0.941**
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R-squared	0.845	0.889	0.912	0.890

The sample period is from March 19, 2001 to March 8, 2006.

The BOJ's CAB is the upper target and p-values (in parentheses) are computed using heteroskedastic-consistent covariance estimates.

* shows that null hypothesis is rejected 5 % significance level.

** shows that null hypothesis is rejected 1 % significance level.