



CARF Working Paper

CARF-F-048

The Bank of Japan's Monetary Policy and Bank Risk Premiums in the Money Market

Naohiko Baba
Bank of Japan
Motoharu Nakashima
Bank of Japan
Yousuke Shigemi
Bank of Japan
Kazuo Ueda
University of Tokyo

September 2005

❁ CARF is presently supported by Bank of Tokyo-Mitsubishi UFJ, Ltd., Dai-ichi Mutual Life Insurance Company, Meiji Yasuda Life Insurance Company, Mizuho Financial Group, Inc., Nippon Life Insurance Company, Nomura Holdings, Inc. and Sumitomo Mitsui Banking Corporation (in alphabetical order). This financial support enables us to issue CARF Working Papers.

CARF Working Papers can be downloaded without charge from:

<http://www.carf.e.u-tokyo.ac.jp/workingpaper/index.cgi>

Working Papers are a series of manuscripts in their draft form. They are not intended for circulation or distribution except as indicated by the author. For that reason Working Papers may not be reproduced or distributed without the written consent of the author.

The Bank of Japan's Monetary Policy and Bank Risk Premiums in the Money Market*

Naohiko Baba[†], Motoharu Nakashima[‡], Yousuke Shigemi[§], Kazuo Ueda[¶]

Abstract

Using the interest rates on Negotiable Certificate of Deposit issued by individual banks, we first show that under the Bank of Japan's Zero Interest Rate Policy and Quantitative Monetary Easing Policy, not just the levels of money market rates but also the dispersion of rates across banks have fallen to near zero. We next show that the fall in the dispersion of the rates is not fully explained by a fall in the dispersion of credit ratings of the banks. We also present some evidence on the role of the Bank of Japan's monetary policy in reducing risk premiums.

Key Words: Monetary policy, Zero Interest Rate Policy, Quantitative Monetary Easing Policy, Negotiable Certificate of Deposit, Credit Risk Premium

JEL Classifications: E43, E52

* The authors are grateful to Ben Bernanke for his detailed comments and suggestions on an earlier draft of the paper. We also greatly benefited from discussions with Nobu Kiyotaki and Ken Singleton among others. Any remaining errors are solely our responsibility. Ueda thanks the Center for Advanced Research in Finance of the University of Tokyo for financial assistance. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank of Japan.

[†] Senior Economist and Director, Financial Markets Department and Institute for Monetary and Economic Studies, Bank of Japan, *e-mail*: naohiko.baba@boj.or.jp

[‡] Economist, Financial Markets Department, Bank of Japan, *e-mail*: motoharu.nakashima@boj.or.jp.

[§] Director, Secretariat of the Policy Board, Bank of Japan, *e-mail*: yousuke.shigemi@boj.or.jp

[¶] Professor, The University of Tokyo (formerly, Member of the Policy Board, Bank of Japan), *e-mail*: ueda@e.u-tokyo.ac.jp

I. Introduction

This paper analyzes the effects of the Bank of Japan's (BOJ) monetary policy since the latter half of the 1990s, namely, the so-called zero interest rate policy (ZIRP) and quantitative monetary easing policy (QMEP), on credit risk premiums demanded of Japanese banks in the money market.

The ZIRP, the combination of a zero short-term interest rate and a commitment to maintain it until deflationary concerns are dispelled, was adopted by the BOJ between February 1999 and August 2000.¹ In March 2001, the BOJ introduced the QMEP framework whereby the operational target of policy was changed to the current account balances (CABs) held by the financial institutions at the BOJ from the overnight call market rate. At the same time, the BOJ promised to maintain the level of the balances well above required reserves until core CPI inflation becomes above zero on a sustainable basis. The QMEP can be thought of as a version of the ZIRP plus the provision of reserves well in excess of the levels necessary to achieve a zero short-term interest rate.²

There is growing literature on the effectiveness of monetary policy near the zero lower bound on interest rates.³ The literature mostly focuses on the effects of monetary policy on interest rates on safe assets such as government bills and bonds. An often neglected, yet a significant aspect of the ZIRP and/or QMEP has been their effects on the credit risk premiums financial institutions pay in the market. That is, the BOJ's policy has lowered such risk premiums to extremely low levels, especially in the money

¹ More precisely, on February 12, 1999, the BOJ Policy Board determined to encourage the uncollateralized overnight call rate to move as low as possible. In April 1999, the BOJ promised to maintain a zero interest rate "until deflationary concerns are dispelled". The ZIRP was abandoned on August 11, 2000.

² The QMEP framework is still in place at the time of the writing of this paper.

³ See, for example, Baba et al. [2005].

market. As a result, not just the levels, but also the dispersion money market interest rates among banks have been reduced to near zero. Such reductions in risk premiums have been significant in view of a sharp rise in risk premiums during the 1997-1998 credit/liquidity crunch, which seriously affected the overall economy.

This paper attempts to document such reductions in the dispersion of risk premiums across banks. In doing so, we look at the market for negotiable certificates of deposits (NCDs) where issuance rates of individual banks' NCDs are available on a weekly basis.⁴ Using the data, we first show that the standard deviation of the NCD rates among the banks rose sharply toward the financial crisis of 1997-1998, but has declined since then. In particular, it declined with the introduction of the ZIRP and declined further as the BOJ intensified its easy policy stance with the QMEP. We then show that the declines in risk premiums cannot be fully explained by recent improvements in the creditworthiness of the banks.

In order to further investigate the background behind the declines in risk premiums on NCD rates, we look at spreads and the dispersion of rates on a wider range of credit instruments. We find that spreads and the dispersion of rates have declined in many areas of financial markets since around 1999, including bonds issued by both banks and non-financial corporations. We also find, however, that the decline in spreads on NCD issuance rates has been more significant than spreads on longer-term liabilities. We then carry out a regression analysis to show that the BOJ's monetary policy, especially, the commitment to maintain a zero interest rate until deflation ends under the ZIRP and QMEP, has significantly contributed to the decline in the dispersion of rates in the money market. While we do not find evidence in favor of the direct effect of the

⁴ The BOJ has collected the NCD issuance rates from the domestically-licenses banks on a weekly

higher current account balances (CABs) under the QEMP on risk premiums, we find the possibility that longer-dated money market fund-supplying operations have affected risk premiums.

The rest of the paper is organized as follows. In section 2, we present a brief description of the NCD market in Japan. In section 3, we analyze the movements of the standard deviation of the NCD rates over time. In section 4, we look at the relationship between the risk premiums for individual banks and the banks' credit ratings. We find that the relationship has become looser, that is, risk premiums have declined further since the introduction of the ZIRP in 1999. In section 5, we analyze the relationship between the declines in risk premiums and the BOJ's monetary policy. Section 6 concludes the paper.

II. The Market for Negotiable Certificates of Deposits (NCDs)

(i) The Size of NCD Market

NCDs are debt instruments issued by banks including city, regional, trust, and foreign banks in Japan.⁵ NCDs were the first-ever product with deregulated interest rates in Japan and have been issued since May 1979. Figure 1 shows that the amount outstanding of NCDs issued by Japanese domestically-licensed banks has been moving around 30 trillion yen recently. Of this total, about 80 percent is issued by major banks, namely city and trust banks. Major banks have recently raised around 30 percent of their total funding needs from markets by issuing NCDs. Thus, NCDs can be thought of as one of their principal instruments for raising operating funds.⁶

basis and has released the average rates on its web site.

⁵ For a more detailed description of the Japanese NCD market, see Chapter 7 of Totan Research [2002].

⁶ This observation can be confirmed if one looks at the amount outstanding of the call market,

(ii) NCD Issuance by Maturity

Next, take a look at major banks' issuance of NCDs by maturity. The maturity of NCDs varies from a few weeks to several years. Figure 2 shows that issuances with maturities of less than 30 days account for about 60 percent of the total based on fiscal 2004 averages. Therefore, market liquidity for NCDs with maturities of less than 30 days is likely to be the highest of all the maturity zones.

III. The Dispersion of Interest Rates on Newly Issued NCDs among Major Banks

Interest rates on major banks' newly issued NCDs had served as a main indicator for deregulated interest rates, although they had moved broadly in tandem across banks for some time since the first NCDs were issued in May 1979. That is, the interest rates had not reflected the differences in bank credit risks. Since the 1990s, however, the interest rates had started to reflect the credit risk of individual issuing banks, mostly due to the rising concern over the stability of the Japanese financial system.⁷ Such concern heightened during the period from the late 1997 to 1998. This is shown in Figure 3 by substantial jumps in the degree of dispersion as measured by the standard deviation of the NCD interest rates in November 1997.⁸ The standard deviations declined significantly, however, after the adoption of the ZIRP in February 1999 and have fallen further following the adoption of the QMEP in March 2001.⁹ It is also worth noting that

which is about 18 trillion yen as of the end of 2004.

⁷ See Chapter 7 of Totan Research [2002].

⁸ In November 1997, concern over the financial stability heightened following a series of failures of four financial institutions: Sanyo Securities (November 3), Hokkaido Takushoku Bank (November 17), Yamaichi Securities (November 24), and Tokuyo City Bank (November 26). The concern over the financial instability subsided after the nationalization of Long-Term Credit Bank of Japan (October 23, 1998) and Nippon Credit Bank (December 13, 1998).

⁹ As shown by Appendix Figure, a similar tendency is observed in fund-raising costs via deposits,

under the QMEP, the standard deviations of the interest rates on newly issued NCDs declined to or even below the levels observed before the period of financial instability.

Table 1 reports the result of statistical tests on the difference in the averages of the standard deviations between four sub-periods of the sample; (i) the period before financial instability (up to October 1997) ; (ii) the period of financial instability between November 1997 and December 1998; (iii) the ZIRP period; and (iv) the QMEP period.¹⁰

First, the null hypothesis that the averages of the standard deviations were equal was rejected at the 1 percent significance level between the period of financial instability and the ZIRP period. Second, the same null hypothesis was rejected between the ZIRP and QMEP periods. Third, it was also rejected between the pre-financial instability years and the ZIRP period except for the maturity of less than 90 days. Finally, the average is significantly lower during the QMEP period than in pre-financial instability years at all maturities. Thus, we can statistically confirm the following observation: the dispersion of NCD issue rates that was very high during the period of financial instability declined after the adoption of the ZIRP in February 1999, has fallen further since the adoption of the QMEP in March 2001. Also, the levels of dispersion during the ZIRP and QMEP periods have been lower than that in years preceding the financial instability.

IV. Estimating Credit Curves from Interest Rates on Newly Issued NCDs

The interpretation of the preceding section's finding, declines in the standard deviation

defined as payment of deposit interest rates divided by the amount outstanding of deposits. Note that the standard deviation of the deposit cost lags behind the standard deviation of NCD interest rates by about two years. This is mainly due to longer average maturity of deposits.

¹⁰ Each period is defined as follows; the period before financial instability: April 5, 1993-October, 27, 1997; financial instability: November 3, 1997-December 28, 1998; ZIRP: February 15, 1999-August 14, 2000; QMEP: March 26, 2001-May 9, 2005.

of NCD issuance rates among banks, is not straightforward. One possible interpretation is that financial strains have gradually eased since 1999 and the resultant improvements of the credit ratings for many banks have lowered the standard deviation as well as the levels of credit risk premiums. In order to statistically address this issue, we estimate credit curves at various points in time.

(i) Estimation Method

First, we define the credit spread for a bank as the interest rate on NCDs issued by the bank with each maturity (less than 30 days, 60 days, and 90 days) minus the weighted average of uncollateralized overnight call rate over all banks.¹¹ Then, we run cross-sectional time-series regressions of the credit spreads on dummy variables corresponding to sample banks' credit ratings for each of the following four representative years under study; (i) 1997, the year of the financial instability, (ii) 1999, a year when the ZIRP was in full swing, (iii) 2002, one year after the adoption of the QMEP, and (iv) 2004, the last year of our sample period. We also estimate the credit curve in 2005 with a view to following the most recent development. Note, however, that it only covers the period up to May 9, 2005. Our sample consists of city and trust banks. The data on NCD rates are available weekly, resulting in more than 500 observations for almost all cases.¹² We also include end of March, September and December dummies to control for seasonal market tightness in year-end and annual/semi-annual book-closing months. The credit spreads for each credit rating

¹¹ Precisely, the maturity of less than 60 days denotes the maturity of 60 days to 89 days, and the maturity of less than 90 days denotes the maturity of 60 days to 179 days, respectively.

¹² The number of observations for later years is smaller for the following two reasons: (i) there have been mergers among banks; (ii) some banks were not able to issue NCDs in later years, since their credit ratings fell below the investment grades.

category, derived from the coefficients on credit rating dummies along with the constant term, map out the “credit curve” for each year.

(ii) Estimated Credit Curves

The estimation result is shown in Table 2. Dummy variables for credit ratings are statistically significant in many cases, particularly for the maturity of less than 30 days. Figure 4 draws the credit curves derived by the estimation result. As a general tendency, the credit curves are sloped upward for ratings of A2 or lower for each maturity. It is sloped downward between A1 and A2 for 1999 in the case of less than 30-day maturity. The number of banks with a rating of A1 or higher, however, is very small for 1999. In fact, the coefficient on A1 dummy is insignificant for 1999. Thus, it seems that we do not have to take this part of the result too seriously.

Figure 4 also demonstrates how the slope of the credit curve became flatter over time. A notable exception is the movement of the spread of Baa2 rating between 1997 and 1999 for each maturity. This coefficient, however, is insignificant even at the 5% level in 1999. Except this, it seems fair to say that the credit curves flattened after the introduction of the ZIRP in 1999, flattened further following the introduction of the QMEP in 2002, and almost flattened out in 2004 for all maturities.¹³

The estimation result indicates that the credit risk premiums among major banks are currently close to zero, and that the differences in credit ratings among them

¹³ For the 2004 credit curve, we statistically tested for differences in credit spreads between credit ratings. Although the null hypothesis that the credit risk premiums are the same was rejected between the A2 and Baa2 ratings at the 5 percent significance level for all maturities, the null hypothesis between the A2 and Baa1 ratings was not rejected at the 5 percent significance level for the maturity of less than 30 days. This result shows that the credit curve for this maturity became completely flat between the A2 and Baa1 ratings. We also tested for differences in credit spreads between 2002 and 2004 for the same credit ratings, and found that the null hypothesis that the credit risk premiums are the same was rejected for Baa1, Baa2, and Baa3 for all maturities. This result

are now hardly reflected in their fund-raising costs in the money market. Therefore, the narrowed dispersion of fund-raising costs among banks, shown in Figure 3, is more likely to be a result of declines in risk premiums across the board in the money market, rather than a result of a lowered dispersion of credit ratings among major banks.

V. The Flattening of Credit Curves and the BOJ's Monetary Policy

(i) Three Hypotheses

In this section, we attempt to investigate further the reasons behind the recent flattening of the credit curves for, as well as the declines in the dispersion of, NCD issuance rates. We came up with at least the following three possible explanations for this phenomenon.

First, although as shown by the analysis in the last section, improvements in credit ratings of the banks are not the whole explanation, credit ratings may not be the best indicator of credit risks. Sometimes, they are known to lag behind evolving market perceptions of credit risks. With a more proper measure of credit, credit curves may not have flattened.

Second, the BOJ's monetary policy may have exerted non-negligible effects on risk premiums. There are several possibilities here. Easy monetary policy in general, through lower interest rates, raises asset prices and lowers risk premiums. In addition, the BOJ's increasingly strong commitment to maintain a zero interest rate until deflation ends may have played a role. Under the ZIRP (February 1999-August 2000), the BOJ committed itself to maintain a zero short-term interest rate until "deflationary concerns were dispelled." Under the QMEP (March 2001-present), the BOJ promised to maintain

statistically supports the flattening of the credit curves under the QMEP.

the level of the CABs well in excess of required reserves, thus a zero short-term interest rate until the actual and expected core CPI inflation turns positive. In October 2003, the exit condition was further clarified to read “until at least actual core CPI inflation and its forecast by monetary policy board members exceed zero.” These commitments may have lowered risk premiums in the money market by substantially reducing the risk that banks fail to meet payment obligations, which makes the near-term chance of a default smaller. Furthermore, the BOJ’s attempt to supply huge amount of excess reserves well above the levels necessary to keep short-term interest rates around zero percent may have played a role. In order to abide by the target on the CABs of 30-35 trillion yen, the BOJ has had to increasingly offer long-dated fund-supplying operations in the money market.¹⁴ The average maturity of bill-purchasing operations was 2-3 months at the start of the QEMP, but it rose to close to 9 months recently. Any banks eligible for the BOJ’s money market operations can take such long-term funds from the BOJ with almost zero interest rates. Arbitrage activities across the money markets may have lowered the level and the dispersion of rates even on instruments that are not directly used in the BOJ’s money market operations, NCD rates, for example.

The third possible explanation for the decline in the dispersion of NCD issuance rates is that it is partially irrational. In the environment of easy monetary policy and low returns, investors may have carried out “reach for yield” activities aggressively, buying assets with returns too low to be justified by rational economic calculation. While rigorously distinguishing between these hypotheses is beyond the scope of the present paper, in what follows we offer several pieces of evidence that we think are helpful in speculating on the importance of each.

¹⁴ At the time when the QMEP was adopted in March 2001, the target on the CABs was 5 trillion

(ii) Some Evidence

We first take a look at the evolution of credit curves and the dispersion of rates for a wide range of financial instruments. This exercise will reveal that, while factors common to many instruments have been at work, there is something distinct about the decline in risk premiums in the money market. We then proceed to carry out a more formal analysis concerning whether or not this distinct movement of money market credit spreads is related to monetary policy, and, if so, in what ways.

a. Credit Curves for other Financial Instruments

Figure 5 shows credit curves of bond spreads with maturities of five and ten years for banks and non-financial corporations, respectively, which we estimated using the same methodology as in the case of NCD credit curves.¹⁵ We can see that credit curves have become flatter over time as in the case of NCD issuance rates, but that risk premiums seem to remain other than a few cases for 2004 and 2005: (i) the 5-year spread for banks between the ratings of A and AA and (ii) 5- and 10-year spreads for non-financial corporations between AA and AAA.¹⁶ In general, the curves are flatter for 5-year maturity than 10-year maturity and for banks than for non-financial corporations. Thus, the tendency for spreads to decline does exist even in the long-term bond market for both banks and non-financial corporations, but it is stronger for relatively shorter-dated bonds and for banks.

yen. It was raised several times and reached 30-35 trillion yen in January 2004.

¹⁵ The bond spread is defined as the bond issuance rate minus the Japanese government bond (JGB) yield with the same maturity. Credit curves are derived by estimating credit rating dummies after controlling for year-end, semi-annual, and fiscal year-end dummies. The bond yield data is available only from 2002.

¹⁶ The bond issuance rates for the year 2005 covers the period up to the end of May.

Regarding Japanese corporate bond pricing, Nishioka and Baba [2004] showed that narrowed credit spreads on Japanese corporate bonds under the ZIRP and QMEP cannot be explained unless they assume a risk-loving representative investor. This leads to an underpricing of negative-skewness risk that is inherent in defaultable bonds. Thus, together with our observation that the curves are flatter for banks than for non-financial corporations, the third hypothesis above, excessive risk taking in the money and bond markets, particularly for banks, is likely to hold at least to some extent.

Next, Figure 6 presents credit curves of commercial paper (CP) issuance spreads with 1- and 3-month maturities.¹⁷ As in the case with bond spreads, the curves have become flatter over time. There are, however, significant spreads remaining at ratings of below a-1. In particular, note that the difference in CP spreads between a-2 and a-1 in 2004 amounts to 10 times as large as the largest one-notch difference in spreads for NCD issuance rates. This difference in the slope of credit curves is interesting. It should partially be explained by differences in credit risks perceived by investors; banks vs. non-financial corporations. It is also interesting to look at the tight credit spread between a-1 and a-1+. The BOJ has carried out fund-supplying operations using CP, albeit in a repurchasing form, and market participants seem to recognize that most of the CP eligible for the money market operations has the rating of a-1 or higher.¹⁸ Consequently, the very flat CP credit curve over the zone of a-1 or higher is suggestive of the direct effect of the BOJ's operations on CP rates.

¹⁷ The CP spread is defined as the CP issuance rate minus the uncollateralized overnight call rate. The CP issuance rates are available only from 2002. Credit curves are derived by estimating credit rating dummies after controlling for year-end, semi-annual, and fiscal year-end dummies.

¹⁸ The BOJ officially state the following as eligibility standard for CP; (i) those deemed appropriate in light of relevant conditions including the creditworthiness of an obligor, and (ii) those with an original maturity of up to 1 year.

b. Dispersion of Interest Rates for other Financial Instruments

It is also of interest to compare the dispersion of NCD issuance rates with that of other financial instruments. Figure 7 shows the spreads on bank-issued bond yields over the JGB yields and the standard deviation of those spreads across the banks. It is similar to the case of NCD issuance rates in that the standard deviation has declined sharply since the beginning of 2003. The dispersion of bank bond spreads, however, rose significantly in late 2001 and stayed high until early 2003. There are some corresponding movements in the dispersion of NCD issuance rates, but these are limited to spikes of short duration in March 2002 and March 2003.¹⁹ The period between late 2001 and early 2003 corresponds to a recession following the collapse of the so-called IT bubble and saw many bankruptcies of both financial and non-financial corporations. The bankruptcy of Enron Corporation and the resultant worldwide concerns over mutual funds added to the stresses. The minutes of the BOJ's monetary policy meetings in late 2001 and early 2002 reveal that the policy board was very concerned about the rise in risk premiums in the money and bond markets. In response, the policy board decided to raise the target on CABs in December 2001 and also allowed the CABs to go above the target range temporarily in the spring of 2002. The minutes after the adoption of these measures indicate that the board thought that the measures were successful in containing the risk premiums in the money market, but not those on bonds for banks and non-financial corporations. This episode is again indicative of different impacts of monetary policy on money market instruments from those on others.

Figure 8 presents the movement of the standard deviation of another measure

¹⁹ The other spikes in the dispersion of NCD issuance rates in late 1999 and late 2000 reflect the stress associated with the Y2K problem and the introduction of Real Time Gross Settlement (RTGS) scheme into the settlement of funds and government bonds in early 2001.

of bank risk, that is, the bank default probabilities implied by bank stock prices.²⁰ Again, we can see the general downward trend in the dispersion. The dispersion in default probabilities, however, rose between late 2001 and the middle of 2002, declined somewhat after that, but still remained at fairly high levels until the middle of 2004. This pattern is roughly the same as for bank bond yields and is not quite similar to that for NCD issuance rates.

The foregoing discussion suggests that both the levels and dispersion of interest rates on credit instruments, particularly those issued by banks have declined, as is the case with the NCD issuance rates. The general environment of easy monetary policy probably played some role. There may have been an element of irrational pursuit of yields. The discussion, however, also suggests that the decline in the spreads or the dispersion of rates for NCDs has been more significant than those for other instruments. The rise in spreads seen in bond rates for the period of late 2001-early 2003 is limited to very temporary spikes in the case of NCDs. Bank bond yields and/or bank default probabilities estimated from stock prices may be a better indicator of bank credit risks than credit ratings. The different behavior of the dispersion of interest rates or default probabilities between NCDs and others, however, seems to suggest that problems of credit ratings as a measure of credit risk, the first hypothesis in section V(i) above, are not the whole explanation of our finding of flat credit curves for NCD rates.²¹

It would be the best if we can determine the exact contribution of monetary

²⁰ We used the model of Merton [1974], under which default occurs at the maturity date of debt in the event that the issuer's assets are less than the face value of the debt. We calculated each bank's default probability on a monthly basis using daily stock returns and standard deviations derived from the past half year's returns, together with the balance sheet data. We obtained the data from Bloomberg. The time horizon for default is assumed to be one year.

²¹ We also analyzed the relationship between the NCD spreads and other measures of credit risk such as interest coverage ratio, defined as the ratio of interest payment to earnings, and ROA (Return on Assets), but could not get any robust results.

policy developments, irrational investor behavior and other factors behind the declines in spreads and the dispersion of rates for a wide range of instruments such as bonds for banks and non-financial corporations. This, however, would go well beyond the scope of the present paper. Instead, we focus on the analysis of money market rates, to which we now turn.

c. Regression Analysis on the Role of the BOJ’s Monetary Policy

In what follows, we attempt to investigate the role the BOJ’s monetary policy has played in the behavior of credit spreads for NCD issuance rates. To that end, we extend the year-by-year regression analysis on the credit curves of individual NCD issuance spreads by pooling the entire cross-sectional time-series data and allowing the slope of the credit curves to depend on the variables including those related to the BOJ’s monetary policy.

Specifically, we estimate the following model:

$$\begin{aligned}
 NCD_{it} = & (a_0 + a_1ZIRP + a_2QMEP + a_3TRANS + a_4CAB_t + a_5BOND_{it}) * (A1) \\
 & + (b_0 + b_1ZIRP + b_2QMEP + b_3TRANS + b_4CAB_t + b_5BOND_{it}) * (A2) , \\
 & + \dots
 \end{aligned}$$

where NCD_{it} denotes the spread for NCD issuance rate for bank i at time t over the weighted average of uncollateralized overnight call rate, and $BOND_{it}$ denotes the spread of the bond yield for bank i at time t over the JGB yield with the same maturity. A1 (A2..) denotes the dummy variable that takes 1 if the credit rating for bank i at time t is A1 (A2..) and takes 0 otherwise.²² More importantly, we include monetary

²² We also included seasonable dummies as in the estimation of credit curves in Section IV.

policy-related variables to investigate the relationship between the flattening of NCD credit curves and the BOJ's monetary policy. They are dummy variables corresponding to the BOJ's commitments during the ZIRP and QMEP periods and the level of aggregate CABs. That is,

ZIRP : takes on 1 when the ZIRP is in force (February 12, 1999-August 11, 2000) and 0 otherwise.

QMEP : takes on 1 when the QMEP is in force (March 19, 2001-present) and 0 otherwise.

TRANS : takes on 1 after October 10, 2003, when the BOJ enhanced the transparency of monetary policy and 0 otherwise.

CAB_t : aggregate current account balances at time *t*.

Those interactive terms with credit rating dummies are an attempt to estimate whether or not, and to what extent, monetary policy variables have contributed to the flattening of the credit curves that we saw in Figure 4.²³

The inclusion of bank bond spreads in the credit rating dummy coefficients is an attempt to allow for the possibility that credit ratings are inadequate measures of bank credit. Thus, it is an attempt to address the first hypothesis for the decline in rate dispersion as put forward at the beginning of this section. To the extent that bank bond spreads reflect underlying bank risks more appropriately, declines in spreads at each rating due to such mis-measurement should be captured by the bond spread terms.²⁴

²³ To the extent that bank bond yields have responded to monetary policy, we are underestimating the effects of monetary policy on NCD issuance spreads.

²⁴ We also estimated the equation by including the bank bond spreads as one independent variable, not as an interactive term with credit rating dummies. The results were essentially the same.

The equation is estimated for seven banks for which the bond yield data are available.²⁵ The data frequency is weekly and the sample period is from October 5, 1998 to May 9, 2005.

Table 3 reports estimation results. The results show that, even after controlling for bank bond spreads, monetary policy has significantly contributed to the declines in risk premiums in the NCD market. Specifically, the ZIRP and QEMP dummies are significant with the right (negative) sign in most cases. That is, the commitments to maintain a zero interest rate have contributed to the decline in the NCD credit spreads. Also, the coefficients on bond spreads are significantly positive at credit ratings lower than Baa1 for each maturity. This result suggests that the slope of credit curves is likely to be significantly flatter at those ratings when bond spreads continue to decline like the period under the QMEP.

Figure 9 graphically shows the effects of each commitment on the credit curve. The effects of the first two commitments are larger at lower ratings. For higher ratings, the effects of the QEMP commitment are slightly larger than those of the ZIRP commitment. Thus, the ZIRP and QEMP commitments have flattened the credit curves for, and lowered the dispersion of, NCD issuance rates by mainly reducing risk premiums for banks with relatively low ratings.²⁶

In contrast, the variable *CAB* is either insignificant or significant with a wrong (positive) sign. We tried several variations of the equation reported above, finding essentially the same result. That is, there is no evidence that higher levels of

²⁵ Those banks are the Mizuho Corporation Bank, Shinsei Bank, Aozora Bank, the Bank of Tokyo-Mitsubishi, Sumitomo Mitsui Banking Corporation, UFJ Bank, and Risona Bank.

²⁶ The near absence of the significant effects of the third commitment is not easy to interpret. A casual observation suggests that it stabilized JGB yields after a spike in the summer of 2003. One possibility is that it may have influenced longer-term yields more than money market rates by its clarification of the exit conditions.

CABs have reduced risk premiums in the money market over and above the effect of the QEMP dummy.²⁷

Regarding the above result, one may think that what is important is not quite the level of the CABs *per se*, but its level relative to *ex ante* demand for liquidity. In fact, during the period under study, we experienced significant fluctuations in the banks' demand for liquidity mainly due to a changing perception about the health of the banking system. In order to take account of this possibility, we reran the regression using the variable *TERM* in place of *CAB*. *TERM* represents the monthly average of the maturity of the BOJ's bill-purchasing operations. At times of low demand for liquidity, the BOJ had to offer longer-dated operations to meet the target on the CABs. In this sense, the variable may be regarded as a proxy for an *ex ante* "excess supply" of liquidity in the money market. As shown in Table 4, *TERM* in fact comes in negatively and is significant at many credit ratings below A1 for each maturity. The rest of the estimation results, *BOND* coefficients, are similar to the results reported in Table 3.²⁸ Thus, we cannot deny the possibility that increasingly longer-dated operations in the money market have lowered risk premiums.

To summarize, monetary policy, particularly, the commitments to maintain a zero interest rate until deflation ends under the ZIRP and QEMP, has contributed to the decline in the dispersion of NCD issuance rates. The effect of the quantitative easing aspect of the QEMP on credit spreads, CABs well in excess of the levels necessary to

²⁷ Just as a robustness check on the significance of the commitment dummies, we estimated the above equation without including the CABs and did not find any significant differences in the results.

²⁸ Since *TERM* is only available after January 2001, we estimated the equation using data since then. We excluded the *QMEP* and *TRANS* dummies from the equation since the estimation period almost coincide with the QMEP period. Also, note that the *ZIRP* dummy is irrelevant in this period. *TERM* is available on the BOJ web site.

keep a short-term interest rate zero, was less clear. We do find, however, some evidence that the particular types of operations the BOJ carried out, that is, longer-dated operations in the money market, have exerted the effect of lowering risk premiums in the money market. The informal discussion of the spreads on CP offered in this section also accords well with such a finding.

It is important to note, here, that we have not attempted to estimate the effects of the BOJ's monetary policy on a wider range of instruments. The commitments of the maintenance of a zero interest rate may have had significant effects on longer-term interest rates.²⁹ Quantitative easing and/or targeted asset purchases may have also affected asset prices other than money market rates.³⁰

VI. Concluding Remarks

We have shown that not just the levels of money market rates but also their dispersion have declined since 1999. We have documented this in detail for NCD issuance rates. In particular, the decline in rate dispersion cannot be fully accounted for by improvements in bank credit. That is, risk premiums have declined sharply across the board in the money market. We have found a similar tendency for a decline in spreads for longer-dated bank liabilities and for bonds issued by non-financial corporations. Many factors, including monetary policy, probably played a role behind the declines in risk premiums for such a wide range of instruments.

We have provided evidence, however, for a stronger tendency for risk premiums on NCD issuance rates to decline than for other longer maturity instruments

²⁹ Bernanke, Reinhart and Sack [2004] and Oda and Ueda [2005] present evidence consistent with such a view.

³⁰ Bernanke, Reinhart and Sack [2004] find significant links between the BOJ's JGB purchases and JGB yields and between quantitative easing and stock prices.

as well as for instruments issued by non-financial corporations. We have found that the BOJ's monetary policy has played a role here. In particular, the commitments to maintain a zero interest rate until deflationary pressure ends both under the ZIRP and QEPP have significantly contributed to the declines in the spreads. We have not found a similar effect from increases in the CABs, but have identified the possibility that some particular operations the BOJ carried out to increase the supply of liquidity, for example, longer-dated money market operations, have lowered the spreads.

References

- Baba, Naohiko, Shinichi Nishioka, Nobuyuki Oda, Masaaki Shirakawa, Kazuo Ueda, and Hiroshi Ugai [2005], "Japan's Deflation, Problems in the Financial System and Monetary Policy," *Monetary and Economic Studies*, 23, Bank of Japan, pp.47-111.
- Bernanke, Ben S., Reinhart, Vincent R. and Brian P. Sack [2004], "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment," *Brookings Papers on Economic Activity*, No.2, pp. 1-100.
- Merton, Robert, C., [1974], "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, 29, pp.449-470.
- Nishioka, Shinichi, and Naohiko Baba [2004], "Credit Risk Taking by Japanese Investors: Is Skewness Risk Priced in Japanese Corporate Bond Market?," BOJ Working Paper Series, No.04-E-7, Bank of Japan.
- Oda, Nobuyuki. and Kazuo Ueda [2005], "The effect of the Bank of Japan's Zero Interest Rate Commitment and Quantitative Monetary Easing on the Yield Curve: A Macro-Finance Approach," BOJ Working Paper Series, No.05-E-6, Bank of Japan.
- Totan Research [2002], *Shin Tokyo Money Market* (in Japanese).

Table 1: Test of the Difference in Dispersion of NCD Interest Rates

(i) Between the Period of Financial Instability and the ZIRP Period				
Maturity	Mean of the standard deviation		Difference	<i>p</i> -value
	Financial Instability (A)	ZIRP (B)	C=B-A	Null hypothesis: C=0
Less than 30 days	0.089	0.030	-0.060	0.000
Less than 60 days	0.152	0.045	-0.107	0.000
Less than 90 days	0.124	0.049	-0.075	0.000

(ii) Between the ZIRP and QMEP Periods				
Maturity	Mean of the standard deviation		Difference	<i>p</i> -value
	ZIRP (B)	QMEP (D)	E=D-B	Null hypothesis: E=0
Less than 30 days	0.030	0.013	-0.016	0.000
Less than 60 days	0.045	0.020	-0.025	0.000
Less than 90 days	0.049	0.026	-0.023	0.000

(iii) Between the Period before Financial Instability and the ZIRP Period				
Maturity	Mean of the standard deviation		Difference	<i>p</i> -value
	Before Financial Instability (F)	ZIRP (B)	G=B-F	Null hypothesis: G=0
Less than 30 days	0.097	0.030	-0.067	0.000
Less than 60 days	0.079	0.045	-0.034	0.000
Less than 90 days	0.038	0.049	0.011	0.975

(iv) Between the Period before Financial Instability and QMEP Period				
Maturity	Mean of the standard deviation		Difference	<i>p</i> -value
	Before Financial Instability (F)	QMEP (D)	H=D-F	Null hypothesis: H=0
Less than 30 days	0.097	0.013	-0.083	0.000
Less than 60 days	0.079	0.020	-0.060	0.000
Less than 90 days	0.038	0.026	-0.012	0.000

Notes: 1. Each period is defined as follows; the period before financial instability: April 5, 1993 to October, 27, 1997; financial instability: November 3, 1997, to December 28, 1998; ZIRP: February 15, 1999 to August 14, 2000; QMEP: March 26, 2001 to May 9, 2005.
2. The following dates are excluded as event dates: (i) the end of 1999 (Y2K problem); (ii) the end of 2000 (preparation for the introduction of RTGS [Real Time Gross Settlement]); (iii) the end of fiscal 2001 (the partial removal of blanket deposit insurance).

Table 2: Estimation Results of Credit Curves for NCD Issuance Rates**(i) Maturity of Less than 30 Days**

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

	1997	1999	2002	2004	2005
Constant	-0.075***	0.156***		0.034***	
Aa2	0.105***				
Aa3	0.082***				
A1	0.116***	-0.047		-0.023***	0.011***
A2	0.113***	-0.122***	0.006	-0.023***	0.009***
A3	0.139***	-0.126***	0.015***	-0.022***	0.020***
Baa1	0.126***	-0.117***	0.030***	-0.021***	0.012***
Baa2	0.119***	-0.081*	0.034***	-0.011***	0.023***
Baa3	0.194***	-0.088**	0.043***	-0.008***	
Year-end dummy	0.493***	0.191***	-0.002	-0.000	
Fiscal year-half dummy	0.025**	-0.031**	-0.006	0.004***	
Fiscal year-end dummy	0.030**	0.038***	0.087***	0.003***	0.004***
Adjusted R-squared	0.658	0.253	0.296	0.449	0.197
Number of observations	865	826	667	668	243
Aa2	52	0	0	0	0
Aa3	52	0	0	0	0
A1	80	8	0	47	132
A2	128	78	52	71	19
A3	52	72	202	198	29
Baa1	227	252	109	204	55
Baa2	104	262	155	58	8
Baa3	155	149	149	50	0
No rating	15	5	0	40	0

(ii) Maturity of Less than 60 Days

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

	1997	1999	2002	2004	2005
Constant	-0.043	0.237***		0.044***	
Aa2	0.083				
Aa3	0.071				
A1	0.089			-0.023***	0.018***
A2	0.095	-0.195***	0.005	-0.033***	0.013***
A3	0.100	-0.173***	0.023***	-0.023***	0.033***
Baa1	0.109	-0.166***	0.045***	-0.022***	0.028***
Baa2	0.085	-0.089*	0.071***	-0.008**	0.030***
Baa3	0.179	-0.102**	0.072***	0.006	
Year-end dummy	0.298***	0.278***	-0.002	-0.000	
Fiscal year-half dummy	0.026*	-0.064***	-0.005	0.004***	
Fiscal year-end dummy	0.012	0.147***	0.088***	0.010***	0.006***
Adjusted R-squared	0.371	0.453	0.401	0.554	0.213
Number of observations	723	710	665	640	236
Aa2	52	0	0	0	0
Aa3	48	0	0	0	0
A1	79	8	0	47	133
A2	128	73	52	69	19
A3	52	71	207	193	28
Baa1	205	243	106	202	48
Baa2	56	216	155	56	8
Baa3	102	99	145	44	0
No rating	1	0	0	29	0

- Notes: 1. Estimation is done by OLS. *, **, and *** denote the 1, 5, 10% significance level, respectively.
2. The year 2005 covers the period up to May 9, 2005.
3. Credit ratings are the long-term ratings of Moody's.

(iii) Maturity of Less than 90 Days

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

	1997	1999	2002	2004	2005
Constant	-0.060	0.093**		0.045***	
Aa2	0.125				
Aa3	0.132				
A1	0.134			-0.021***	0.026***
A2	0.128	-0.079*	-0.004	-0.030***	0.031***
A3	0.131	-0.048	0.027***	-0.021***	0.043***
Baa1	0.155	-0.038	0.069***	-0.011**	0.041***
Baa2	0.161	0.056	0.079***	0.003	0.034***
Baa3	0.210*	0.059	0.088***	-0.009*	
Year-end Dummy	0.129***	0.202***	-0.002	0.004*	
Fiscal year-half Dummy	0.021	-0.028*	-0.001	0.006***	
Fiscal year-end Dummy	-0.030**	0.246***	0.070***	0.009***	0.002
Adjusted R-squared	0.194	0.554	0.332	0.321	0.164
Number of observations	588	511	523	497	193
Aa2	52	0	0	0	0
Aa3	50	0	0	0	0
A1	74	8	0	44	126
A2	119	64	40	54	18
A3	50	70	202	177	19
Baa1	160	198	81	151	24
Baa2	31	125	122	40	6
Baa3	51	46	78	20	0
No rating	1	0	0	11	0

- Notes:
1. Estimation is done by OLS. *, **, and * denote the 1, 5, 10% significance level, respectively.
 2. The year 2005 covers the period up to May 9, 2005.
 3. Credit ratings are the long-term ratings of Moody's.

Table 3: Regression Results on the Role of the BOJ's Monetary Policy: I**(i) Maturity of Less than 30 days**

Dependent variable: NCD issuance interest rate-uncollateralized 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: 1. Estimation is done by OLS. *, **, and *** denote the 1, 5, 10% significance level, respectively.
2. Credit ratings are the long-term ratings of Moody's.

(ii) Maturity of Less than 60 days

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

Number of observations: 1,890 (October 5, 1998- May 9, 2005)

Variable	Coefficient	Standard error
A1	-0.022	0.295
A1*CAB	0.001	0.009
A1*BOND	-0.134	0.378

A2	0.077*	0.042
A2*ZIRP	0.055**	0.021
A2*QMEP	-0.092***	0.020
A2*TRANS	-0.014	0.018
A2*CAB	0.001	0.001
A2*BOND	0.020	0.149

A3	0.116***	0.013
A3*ZIRP	-0.026*	0.013
A3*QMEP	-0.117***	0.013
A3*TRANS	-0.018	0.011
A3*CAB	0.001	0.001
A3*BOND	0.015	0.027

Baa1	-0.226	0.230
Baa1*CAB	0.006	0.007
Baa1*BOND	0.142	0.156

Baa2	0.125***	0.011
Baa2*ZIRP	-0.126***	0.014
Baa2*QMEP	-0.146***	0.013
Baa2*TRANS	-0.039**	0.014
Baa2*CAB	0.002***	0.001
Baa2*BOND	0.042***	0.003

Baa3	0.173***	0.015
Baa3*QMEP	-0.242***	0.017
Baa3*TRANS	0.001	0.024
Baa3*CAB	0.002*	0.001
Baa3*BOND	0.051***	0.004

Year-end dummy	0.064***	0.005
Fiscal year-half dummy	-0.004	0.005
Fiscal year-end dummy	0.028***	0.005

Adjusted R-squared	0.506	

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

(iii) Maturity of Less than 90 days

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

Number of observations: 1,540 (October 5, 1998- May 9, 2005)

Variable	Coefficient	Standard error
A1	0.034	0.247
A1*CAB	-0.001	0.007
A1*BOND	-0.081	0.314
A2	0.146***	0.041
A2*ZIRP	-0.021	0.017
A2*QMEP	-0.124***	0.018
A2*TRANS	0.005	0.018
A2*CAB	-0.001	0.001
A2*BOND	-0.071	0.146
A3	0.142***	0.011
A3*ZIRP	-0.047***	0.011
A3*QMEP	-0.146***	0.011
A3*TRANS	-0.010	0.009
A3*CAB	0.001	0.000
A3*BOND	0.041*	0.023
Baa1	-0.271	0.236
Baa1*CAB	0.007	0.007
Baa1*BOND	0.269	0.165
Baa2	0.199***	0.013
Baa2*ZIRP	-0.226***	0.014
Baa2*QMEP	-0.218***	0.013
Baa2*TRANS	-0.023*	0.014
Baa2*CAB	0.001**	0.001
Baa2*BOND	0.059***	0.004
Baa3	0.216***	0.015
Baa3*QMEP	-0.255***	0.017
Baa3*TRANS	0.004	0.023
Baa3*CAB	0.001	0.001
Baa3*BOND	0.050***	0.004
Year-end dummy	0.040***	0.005
Fiscal year-half dummy	0.003	0.005
Fiscal year-end dummy	0.019***	0.005
Adjusted R-squared	0.615	

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

Table 4: Regression Results on the Role of the BOJ's Monetary Policy: II**(i) Less than 30 days**

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

Number of observations: 1,515 (January 4, 2001- May 9, 2005)

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

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

(ii) Less than 60 days

Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

Number of observations: 1,490 (January 4, 2001- May 9, 2005)

Variable	Coefficient	Standard error
A1	-0.154***	0.049
A1*TERM	0.025***	0.008
A1*BOND	0.126	0.165
A2	0.022	0.016
A2*TERM	-0.007***	0.003
A2*BOND	0.054	0.055
A3	0.048***	0.007
A3*TERM	-0.010***	0.002
A3*BOND	0.026**	0.011
Baa1	0.048*	0.028
Baa1*TERM	-0.008**	0.004
Baa1*BOND	-0.015	0.071
Baa2	0.041***	0.008
Baa2*TERM	-0.008***	0.002
Baa2*BOND	0.044***	0.004
Baa3	0.082***	0.010
Baa3*TERM	-0.010***	0.003
Baa3*BOND	0.007***	0.003
Year-end dummy	0.006**	0.003
Fiscal year-half dummy	0.004	0.003
Fiscal year-end dummy	0.035***	0.003
Adjusted R-squared	0.390	

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

(iii) Less than 90 days

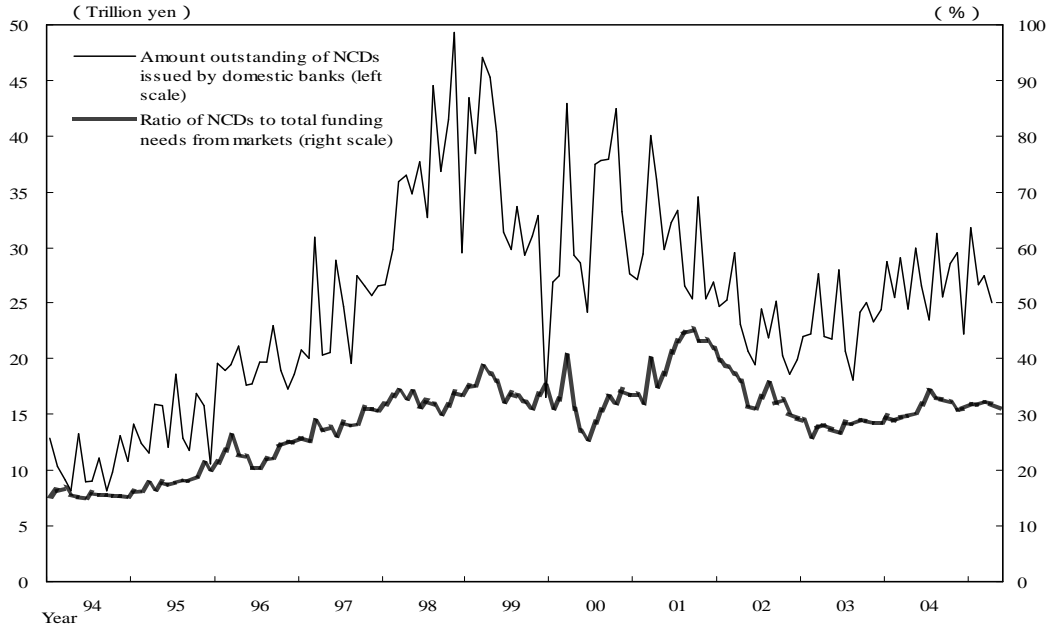
Dependent variable: NCD issuance interest rate-uncollateralized overnight call rate

Number of observations: 1,248 (January 4, 2001- May 9, 2005)

Variable	Coefficient	Standard error
A1	-0.193***	0.053
A1*TERM	0.033***	0.009
A1*BOND	0.095	0.179
A2	0.055***	0.021
A2*TERM	-0.013***	0.003
A2*BOND	-0.028	0.066
A3	0.056***	0.007
A3*TERM	-0.011***	0.002
A3*BOND	0.025**	0.011
Baa1	0.055	0.038
Baa1*TERM	-0.011*	0.006
Baa1*BOND	0.029	0.095
Baa2	0.032***	0.010
Baa2*TERM	-0.006***	0.002
Baa2*BOND	0.059***	0.005
Baa3	0.082***	0.011
Baa3*TERM	-0.011***	0.003
Baa3*BOND	0.014***	0.003
Year-end dummy	0.012***	0.003
Fiscal-year-half dummy	0.008**	0.003
Fiscal year-end dummy	0.048***	0.003
Adjusted R-squared	0.448	

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

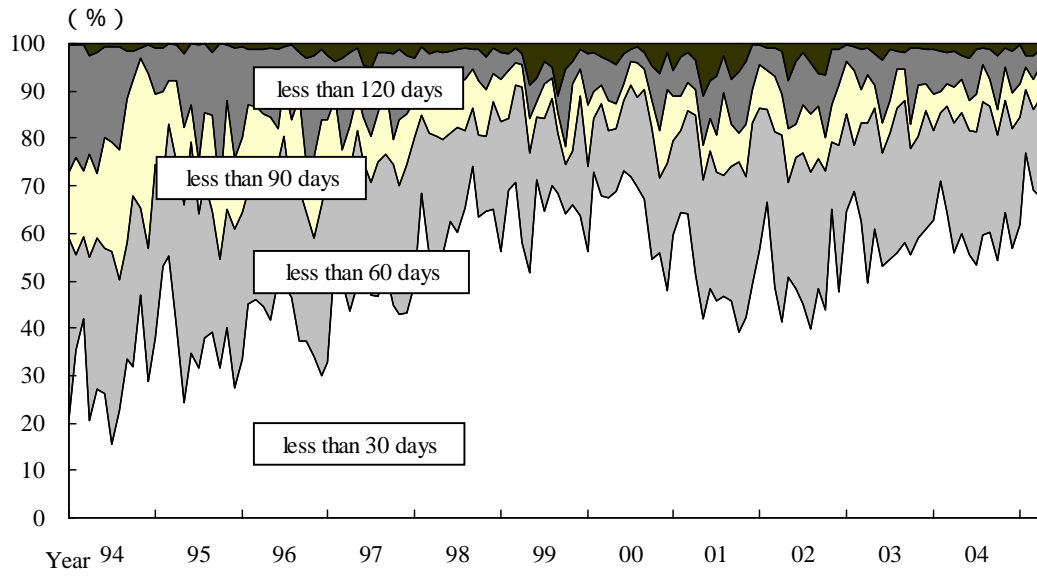
Figure 1: Size of the NCD Market



- Notes:*
1. The amount outstanding is based on the banking account of domestically-licensed banks and the ratio of NCDs to total funding needs from markets is based on city and trust banks.
 2. Total funding needs from markets is defined as the sum of NCDs, CP, call money, bank bonds including bank debentures, and repurchase agreements.

Source: Bank of Japan

Figure 2: NCD Issuance by Maturity

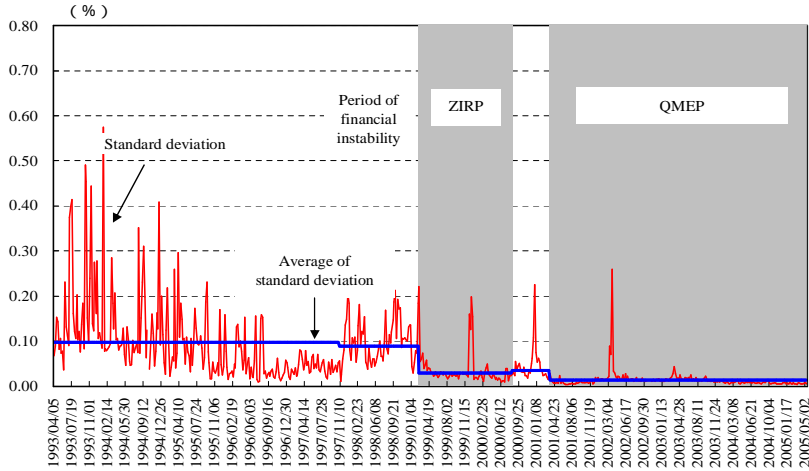


Notes: 1. Calculation is based on city and trust banks.
2. The maturity of less than 60 days denotes the maturity of 60 days to 89 days, and the maturity of less than 90 days denotes the maturity of 60 days to 179 days, respectively.

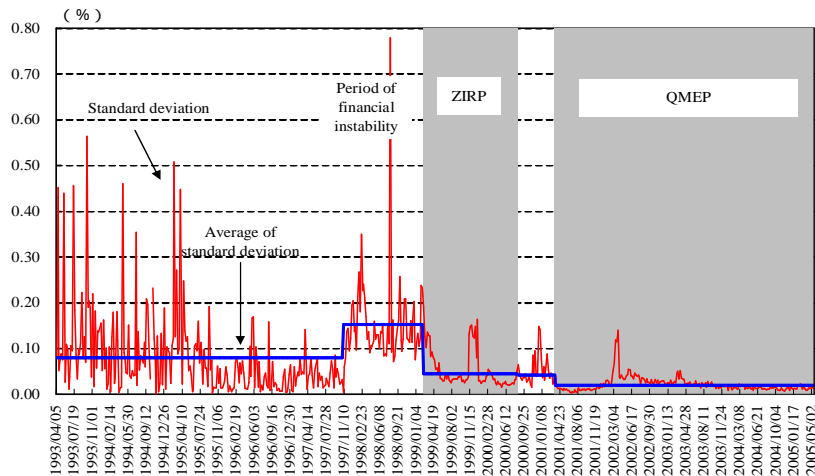
Source: Bank of Japan

Figure 3: Standard Deviation of Interest Rates on Newly Issued NCDs among Banks

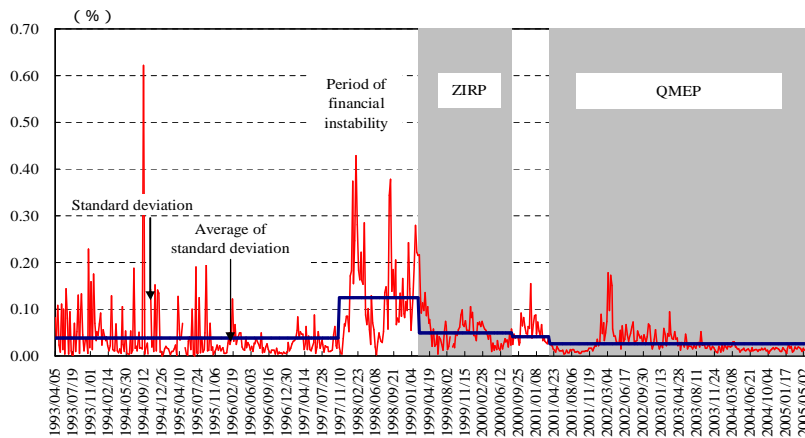
(i) Maturity of Less than 30 days



(ii) Maturity of Less than 60 days



(iii) Maturity of Less than 90 days

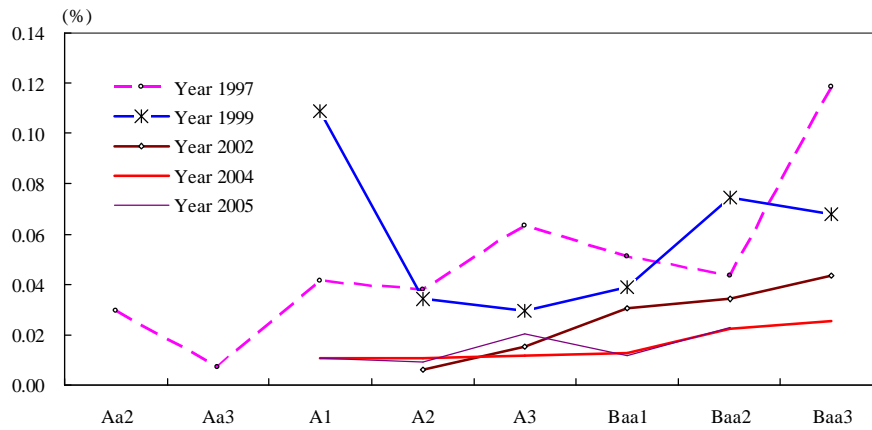


- Notes:*
1. Sample banks are the following banks for which weekly data are available throughout the above period (April 5, 1993-May 9, 2005): Sumitomo Mitsui Banking Corporation, the Bank of Tokyo-Mitsubishi, UFJ Bank, Resona Bank, Shinsei Bank, Aozora Bank, the Mitsubishi Trust and Banking Corporation, the Sumitomo Trust & Banking, Mizuho Trust & Banking, UFJ Trust Bank, and the Chuo Mitsui Trust and Banking Company. Fuji Bank and Mizuho Bank are excluded, as a large portion of their NCDs were issued to local governments. For Sumitomo Mitsui Banking Corporation prior to its merger in April 2001, data for the former Sumitomo Bank are used.
 2. We regarded the following dates as “event dates” and those were excluded in calculating the average of standard deviation: (i) the end of 1999 (Y2K problem); (ii) the end of 2000 (preparation for the introduction of RTGS [Real Time Gross Settlement]); (iii) the end of fiscal 2001 (the partial removal of blanket deposit insurance).

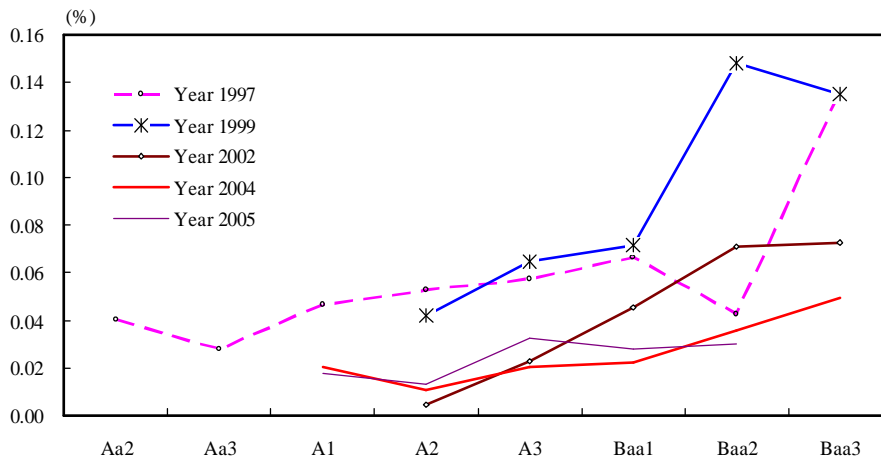
Source: Bank of Japan

Figure 4: Credit Curves of NCD Spreads

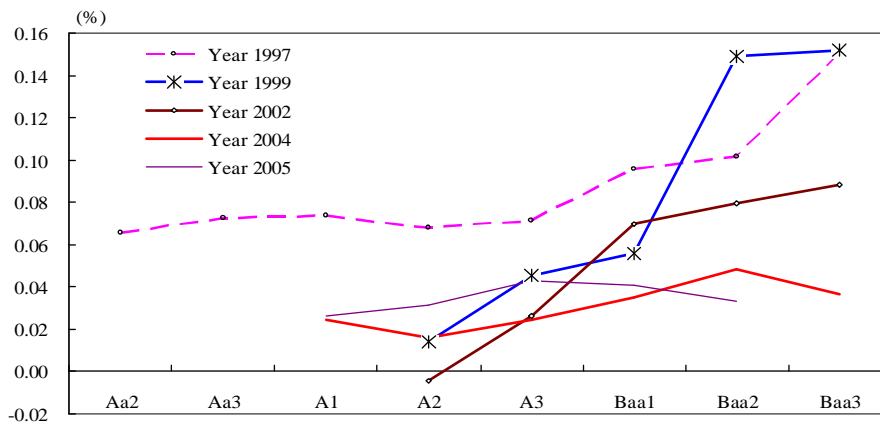
(i) Maturity of Less than 30 days



(ii) Maturity of Less than 60 days



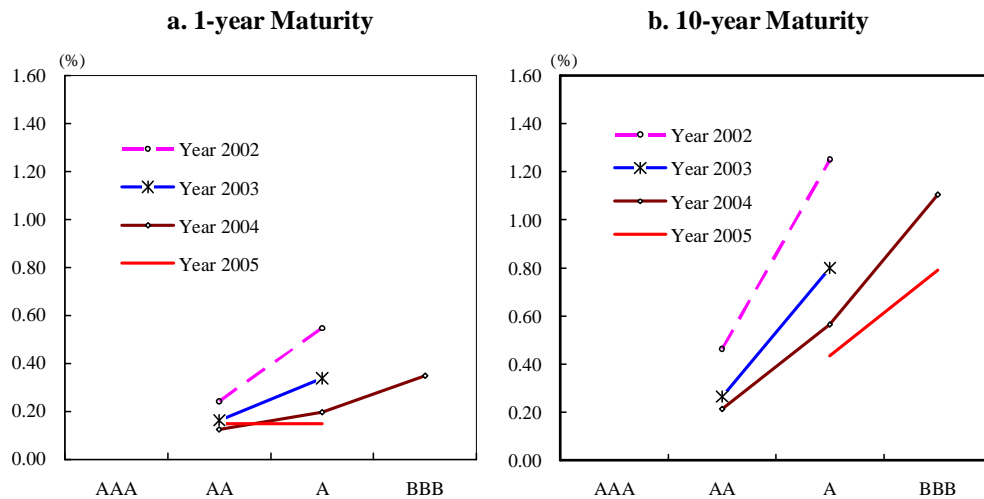
(iii) Maturity of Less than 90 days



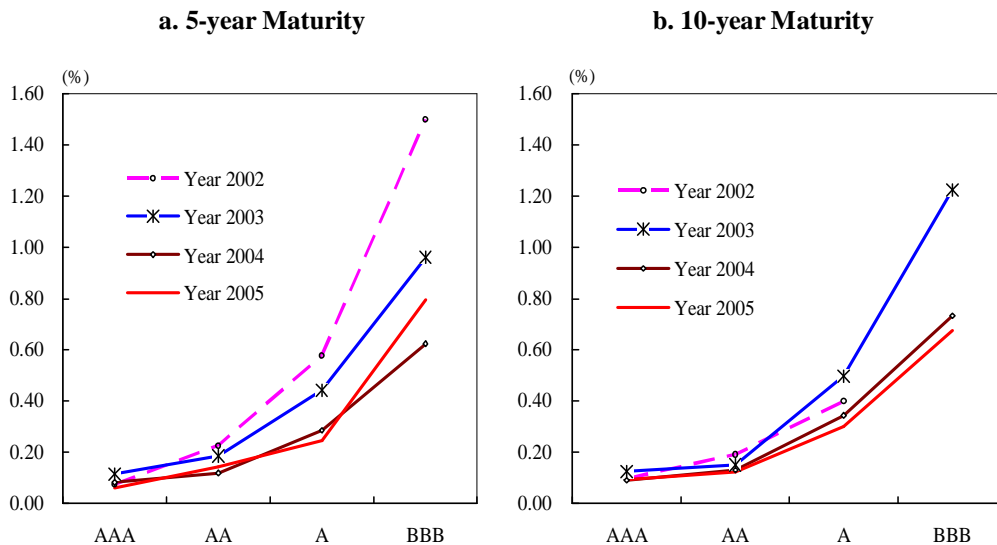
Notes: 1. Each curve is drawn from parameter estimates shown in Table 2.
2. Credit ratings are the long-term ratings of Moody's.

Figure 5: Credit Curves of Bond Spreads

(i) Bonds Issued by Banks



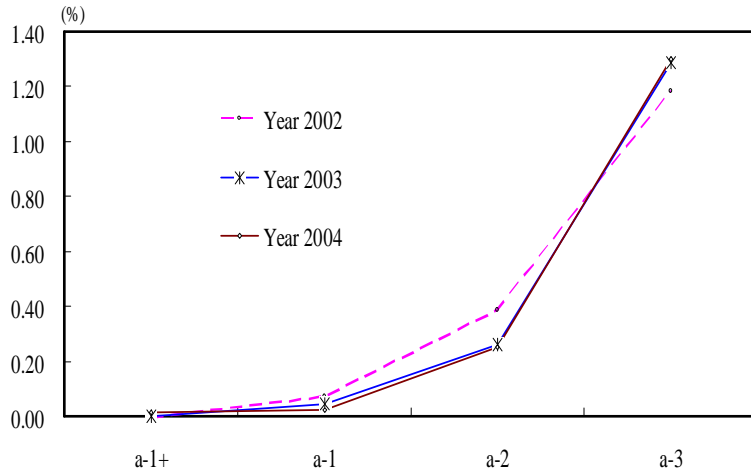
(ii) Bonds Issued by Non-financial Corporations



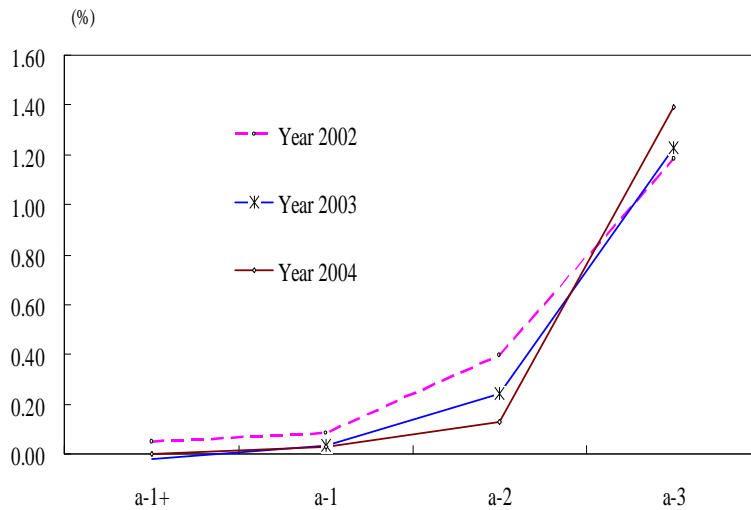
- Notes:**
1. The bond spread is defined as the spread of bond issuance rate over the JGB yields with the same maturity.
 2. Credit curves are derived by estimating credit rating dummies after controlling for year-end, semi-annual, and fiscal year-end dummies.
 3. Credit ratings are the long-term ratings of Moody's.
 4. Number of observations is as follows; (i) bank bonds: 12/4 (5-year/10-year) for 2002, 13/7 for 2003, 12/12 for 2004, and 6/6 for 2005; (ii) non-financial corporate bonds: 66/51 for 2002, 85/67 for 2003, 82/52 for 2004, and 21/ 26 for 2005, respectively.

Sources: Bloomberg, IN data base.

Figure 6: Credit Curves of CP Spreads
(i) 1-month Maturity



(ii) 3-month Maturity

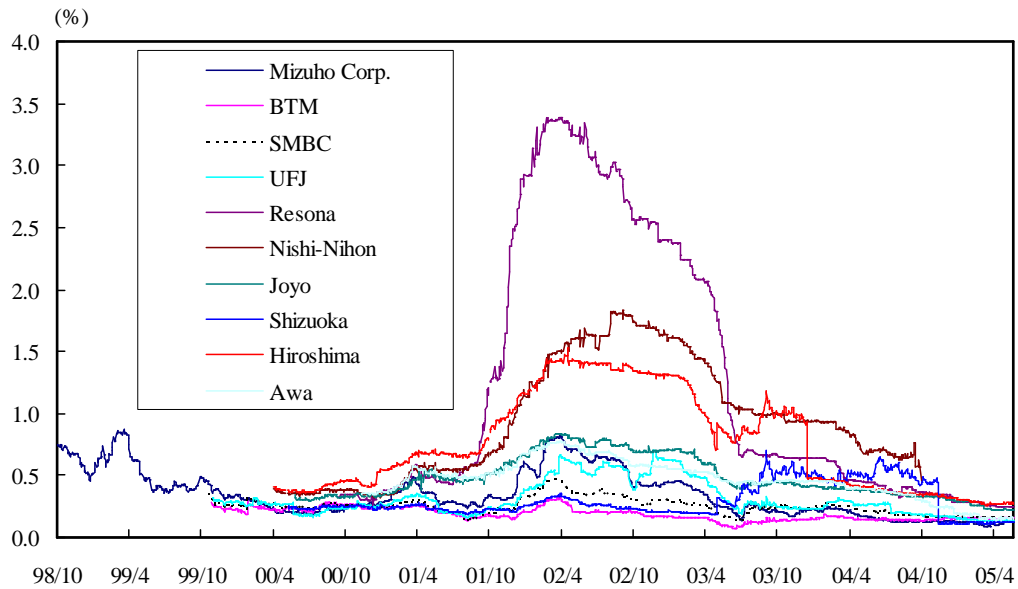


- Notes:*
1. The CP spread is defined as the spread of CP issuance rate over the uncollateralized overnight call rate.
 2. Credit curves are derived by estimating credit rating dummies after controlling for year-end, semi-annual, and fiscal year-end dummies.
 3. Credit ratings are the short-term ratings of Moody's.
 4. Number of observations is 2,327 for 2002, 1,975 for 2003, and 2,006 for 2004, respectively.

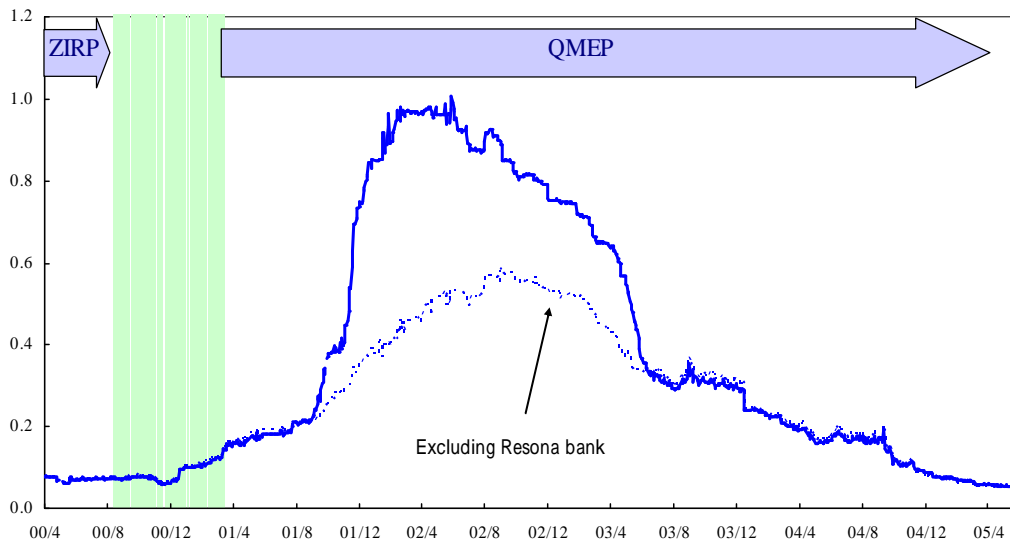
Sources: Finance Facsimile News, Bank of Japan.

Figure 7: Dispersion of Bank Bond Spreads

(i) Bank Bond Spreads



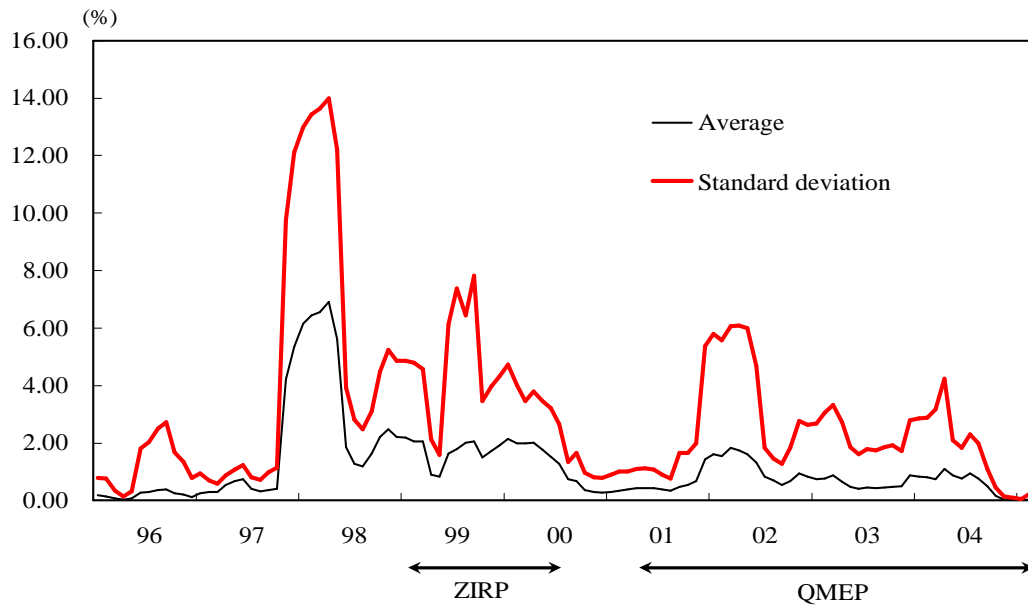
(ii) Standard Deviation of Bank Bond Spreads Across Banks



- Notes:*
1. The bank bond spread is defined as the spread of bank bond yield over the Japanese government bond yield with the same maturity. The maturity of most bonds is five years.
 2. We computed the standard deviation of bank bond yields from the date from which more than four banks' yield data are available.

Source: Japan Securities Dealers Association

Figure 8: Default Probability Implied by Stock Price

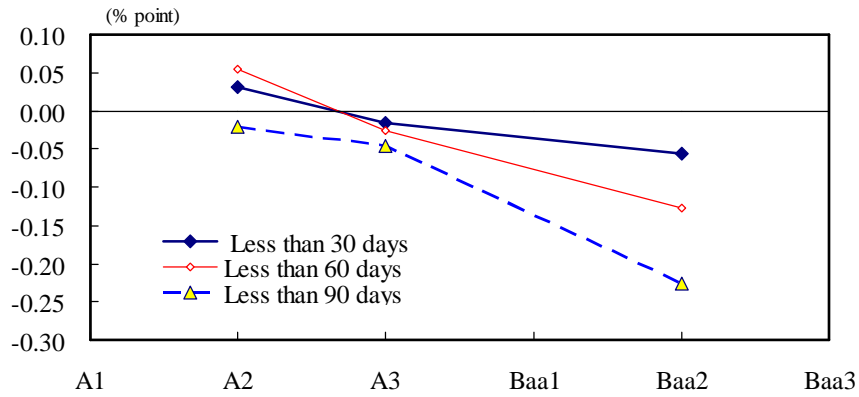


- Notes:*
1. We used the model of Merton [1974] to compute the default probability for each bank. Time horizon is assumed to be 1 year. We calculated each bank's default probability on a monthly basis from daily stock returns, together with the balance sheet data.
 2. The number of sample banks is 102, which include city, trust, regional, and regional II banks.

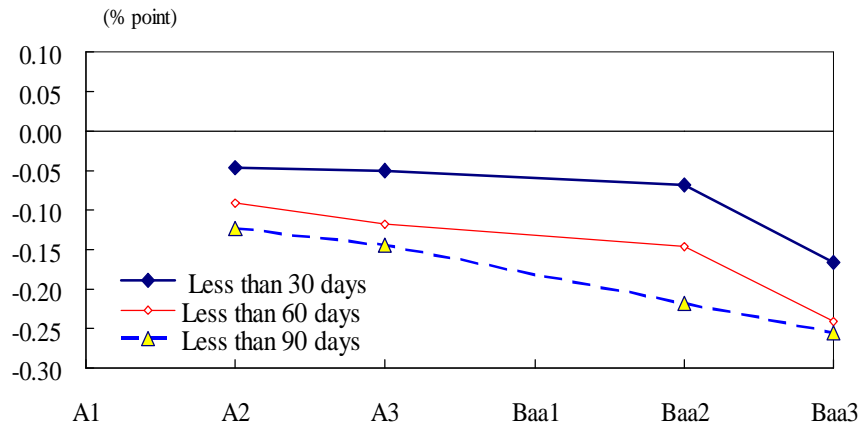
Sources: Bloomberg, Bank of Japan.

Figure 9: Effects of the BOJ's Monetary Policy on NCD Credit Curves

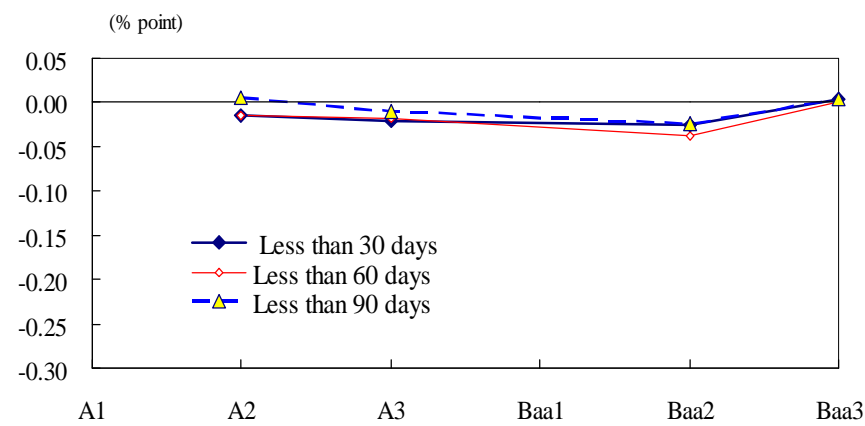
(i) Effect of the ZIRP



(ii) Effect of the QMEP

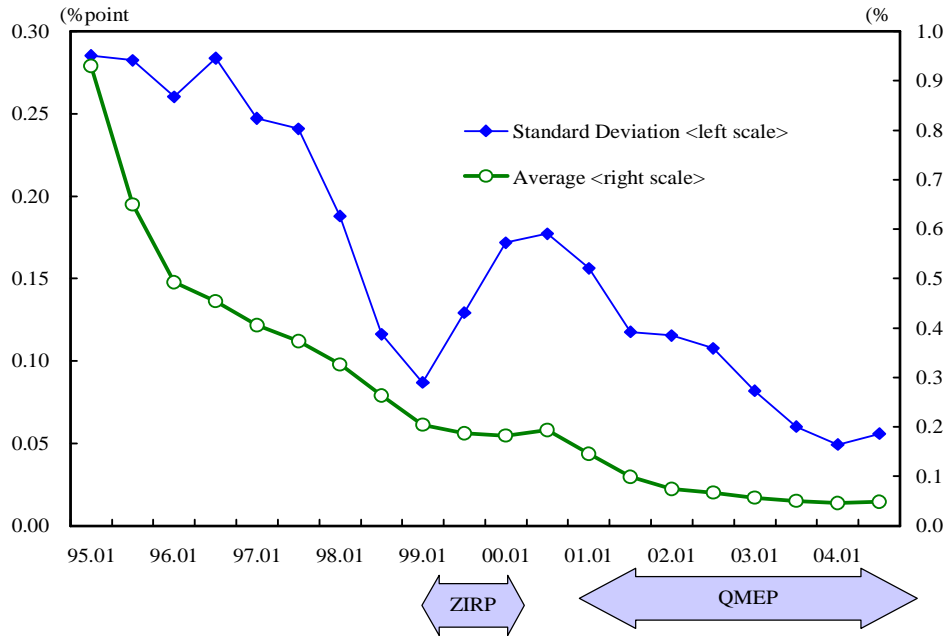


(iii) Effect of the Enhancement of Transparency



Note: 1. Each curve is drawn using parameter estimates reported in Table 3.
 2. Credit ratings are the long-term ratings of Moody's.

**Appendix Figure: Standard Deviation of Fund-raising Costs via Deposits
Among Banks**



Note: Sample banks include city banks, regional banks, and regional banks II.
Source: Financial statements released by each bank.