Interpreting Recent Changes in the Credit Spreads of Japanese Banks

Jun Pan and Kenneth J. Singleton

This paper examines the recent period of relatively low credit spreads in Japan, with particular emphasis on the market's assessments of the credit risks of large Japanese banks implicit in the prices of credit derivatives. We extract the market-price implied likelihood of a credit event in the future, and explore the nature of the default risk premiums underlying recent changes in bank bond and credit derivatives prices. We document substantial increases in the "jump-at-default" default risk premiums for the large Japanese banks examined during the early part of 2006. These patterns in risk premiums are related to the recent patterns in market indicators of global event risk, local equity market volatility, and an estimate of the duration of the Bank of Japan's zero interest rate policy.

Keywords: Default risk premium; Credit default swap; Japanese banks; Zero interest rate policy; Event risk
JEL Classification: G13, G21, G32

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I. Introduction

This paper examines the recent period of relatively low credit spreads in Japan, with particular emphasis on the market's assessments of the credit risks of large Japanese banks implicit in the prices of credit derivatives. We extract the market-price implied likelihood of a credit event in the future, and explore the nature of the default risk premiums underlying recent changes in bank bond and credit derivatives prices. Of particular interest is the market's risk premium associated with a possible jump in bond prices due to a restructuring or other major credit event involving one of the large banks in Japan.

These questions about Japanese banks seem particularly interesting now owing to the confluence of several macroeconomic developments. The Japanese economy is showing signs of recovery after many years of weakness and, concurrently, there has been a substantial increase in the equity prices of Japanese companies, including those of large Japanese banks. Moreover, with the improving economy—and the benefit of hindsight—the Bank of Japan (BOJ) ended its quantitative monetary easing policy (QMEP) toward the end of our sample period, and exited its zero interest rate policy (ZIRP) shortly after our sample period ended. We are interested in how market default-event risk premiums changed over the past few years as market participants reassessed the strength of the Japanese economy, the impacts of the strengthening economy on the policies of the BOJ, and the likely impacts of both of these factors on the financial strengths of the Japanese banking system.[1] Have default risk premiums fallen as a consequence of these economic developments, or have they increased? In either case, how should we interpret the patterns in risk premiums we document subsequently?

The remainder of this paper is organized as follows. Section II describes the credit default swap (CDS) market and provides an overview of the data used in our analysis. Section III examines the properties of Japanese sovereign credit risk through the lens of the prices of CDS contracts on Japanese government debt. This analysis serves to relate changes in the market's assessment of the credit quality of Japan as a whole to local and global risks. Then, in Section IV we turn to the properties of the CDS spreads for four large Japanese banks: Mizuho Bank, Sumitomo Mitsui Banking Corporation (SMBC), Bank of Tokyo-Mitsubishi (BTM), and UFJ Bank. Particular attention is given to the co-movements among these spreads and their relation to both Japanese sovereign risk and equity market risk factors. Finally, Section V examines the properties of the credit event risk premiums of two of these banks.

II. CDS Spreads for Japanese Banks

To extract market information about the credit quality of Japanese banks, we rely on the CDS market. A CDS is essentially an insurance contract between the insurer and the insured in which the latter pays an insurance premium at some regular interval,

1. See Ito and Harada (2006) for a complementary study of bank fragility that uses data on credit default spreads from an earlier sample period. They do not examine default risk premiums explicitly.

usually every six months, in return for being "made whole" in the face of an insured credit event. That is, the purchaser of insurance pays the CDS spread (multiplied by the notional amount of underlying bonds insured) as the premium, and if an insured event occurs, then the insurer pays the insured the difference between the post-event market value of the bonds covered by the CDS contract and their face value.

To price CDS contracts, we follow Duffie and Singleton (1999)—see also the review of CDS contracts in Duffie and Singleton (2003)—and adopt a "reduced-form" pricing model. We let $\lambda^{\mathbb{Q}}$ denote the risk-neutral mean arrival rate of a credit event. One can think of $\lambda^{\mathbb{Q}}$ as approximately the probability of a (covered) credit event over the next, short interval of time under the pricing measure. Additionally, we let $R^{\mathbb{Q}}$ denote the expected fractional recovery of face value that bondholders receive immediately following a credit event, under the pricing measure. The associated loss rate as a proportion of the face value is $L^{\mathbb{Q}} \equiv (1 - R^{\mathbb{Q}})$. Finally, $CDS_t(M)$ denotes the spread on a CDS contract with time to maturity of M years.

Using this notation, the CDS spread satisfies

$$\frac{1}{2}CDS_t(M)\sum_{j=1}^{2M} E_t^{\mathbb{Q}}\left[e^{-\int_t^{t+0.5j}(r_s+\lambda_s^{\mathbb{Q}})ds}\right] = (1-R^{\mathbb{Q}})\int_t^{t+M} E_t^{\mathbb{Q}}\left[\lambda_u^{\mathbb{Q}} e^{-\int_t^{u}(r_s+\lambda_s^{\mathbb{Q}})ds}\right]du. \qquad (1)$$

The left-hand side of (1) is the expected present value of the insurance premium paid by the insured, $CDS_t(M)/2$, semiannually. These payments are made only so long as an insured credit event has *not* occurred, and this accounts for the presence of $\lambda^{\mathbb{Q}}$ in the discount factor. Premiums are made only if the underlying bank survives until the premium payment date. The right-hand side is the present value of the recovery received by the insured if an insured credit event occurs. Since a credit event can occur at any time over the life of the CDS contract, and the underlying bank must survive until date u for the bank to then default at this time, the pricing formula involves the terms $\lambda_u^{\mathbb{Q}} e^{-\int_t^u \lambda_s^{\mathbb{Q}} ds}$. For a given u, this term captures the probability of the bank surviving until date u and then defaulting immediately thereafter. All of the expectations in (1) are taken with respect to the risk-neutral pricing measure.

To interpret the spread $CDS_t(M)$ in terms of developments in credit markets, it is instructive to step back and first review the interpretation of credit spreads on corporate bonds. To a first approximation, the credit spread on an M-year floating rate bond, say, $C_t(M)$, is approximately equal to $\lambda^{\mathbb{Q}}L^{\mathbb{Q}} + l_t^C$, where $\lambda^{\mathbb{Q}}L^{\mathbb{Q}}$ is the mean loss rate associated with holding a corporate bond and l^C captures compensation for liquidity. Heuristically, when holding a corporate bond, the investor is compensated for the time value of money, the mean rate of loss expected to be incurred due to default—the probability of loss ($\lambda^{\mathbb{Q}}$) times the loss given default ($L^{\mathbb{Q}}$), and a convenience yield associated with the provision of liquidity.

Absent arbitrage opportunities and large transactions costs, $CDS_t(M)$ is also approximately equal to $\lambda^{\mathbb{Q}}L^{\mathbb{Q}}$.[2] Thus, a systematic decline in CDS (or corporate) spreads

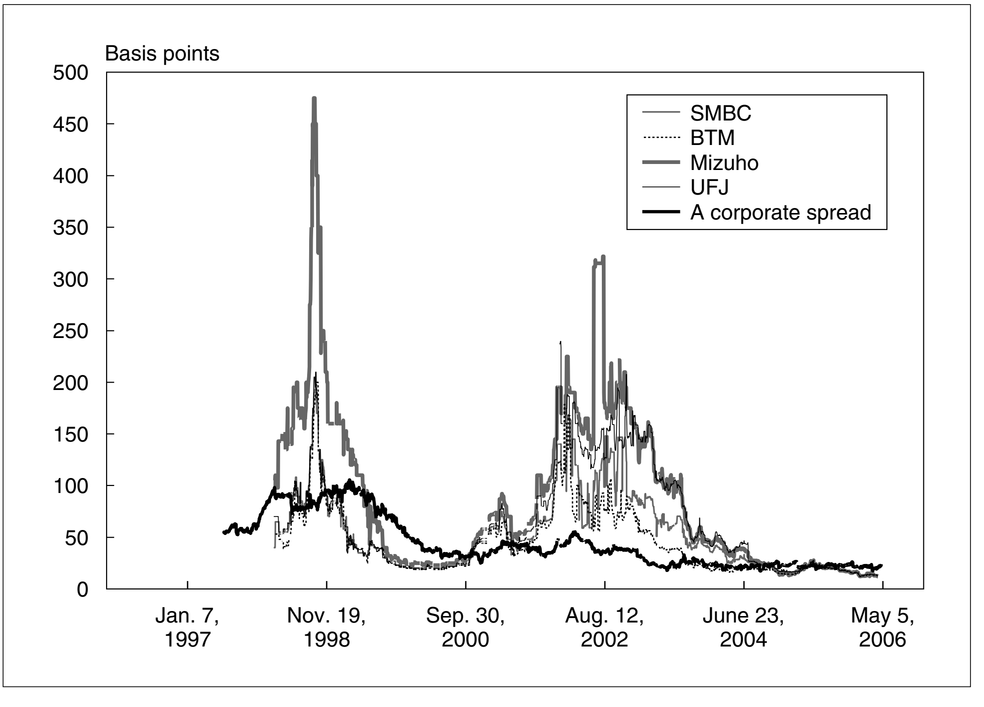
2. We could, as well, include a liquidity adjustment to $CDS_t(M)$. For many issuers the CDS contract is more liquid than their associated bonds, and so many researchers have assumed that liquidity premiums are larger in the bond market than in the CDS market (see, e.g., Longstaff, Mithal, and Neis [2005]). For our analysis, what is important is that the $CDS_t(M)$ spreads for the large Japanese banks are considered to be largely due to credit risk.

typically means one or more of the following occurred: the probabilities of a credit event declined, the risk premiums associated with credit events declined (more on this later), or expected loss rates declined.

Figure 1 displays the U.S. dollar five-year CDS spreads for four large Japanese banks—SMBC, BTM, Mizuho Bank, and UFJ Bank—over the period 1998 through the middle of 2006.[3] For comparison, we have also included the yield on a portfolio of a corporate spread. Clearly, CDS spreads fluctuated substantially over the sample period, with notable spikes upward in the fourth quarter of 1998 and during the banking crisis in Japan in 2002. Most of our attention will be focused on the later part of this period, starting in mid-2003 and running through mid-2006. This was a relatively quiet sub-period in credit markets, but one that witnessed a strengthening of the Japanese economy and, finally, the end of the BOJ's policy of quantitative easing.

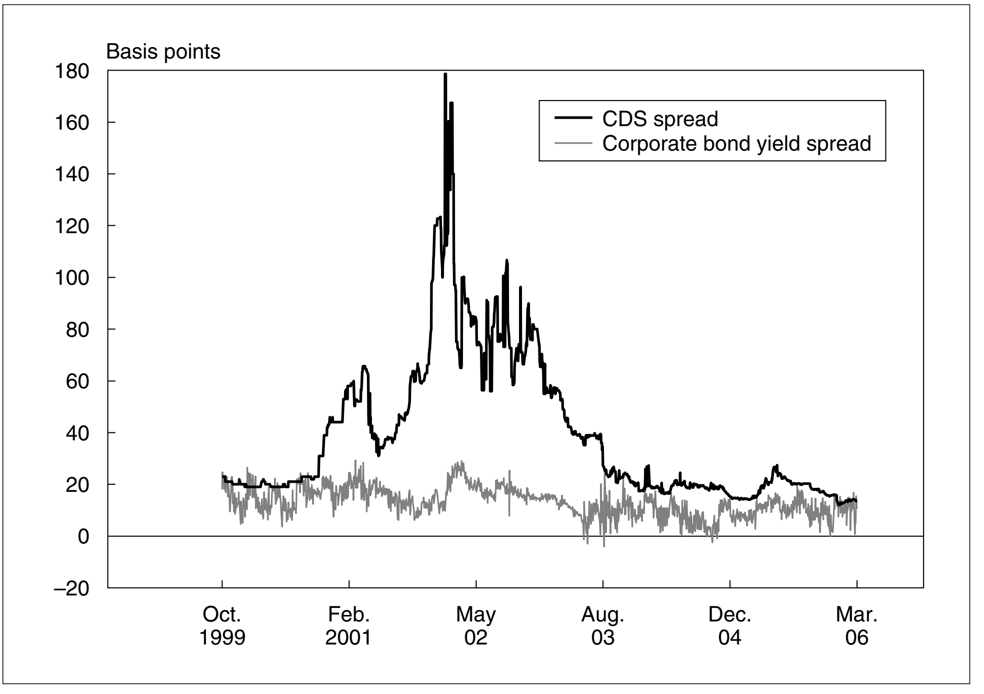
One cannot always translate our findings about CDS spreads immediately into implications for bank debenture spreads, because we often see a nonzero basis ($CDS_t(M) - C_t(M) \neq 0$). In particular, it is often quite expensive to "sell short" corporate bonds, and they are often the bonds that are expensive relative to the CDS spread. This is illustrated in Figure 2, where the five-year CDS spread for BTM is plotted against the yield spread on its five-year bonds. For most of this period, the CDS spread was above the corporate bond spread, and this partly reflects the shorting costs in the corporate market. The CDS-bond basis was particularly large during the banking

Figure 1 U.S. Dollar Five-Year CDS Spreads on Japanese Banks



3. BTM and UFJ merged on January 1, 2006 to form Bank of Tokyo-Mitsubishi UFJ (BTMU).

Figure 2 Five-Year CDS and Corporate Bond Yield Spreads for BTM



crisis in 2002, when there was a notable increase in bond yield spreads. However, given that our focus is on the post-2003 period, most of our findings can be interpreted as applying as well to the yields on bonds issued by Japanese banks.

III. Japanese Sovereign Credit Risk

Before exploring the properties of bank CDS spreads in depth, it will be informative to examine the relation between sovereign risk for Japan and various factors related to global and local event risks. For our analysis, sovereign risk is measured by the spreads on the U.S. dollar five-year CDS contract for Japanese government bonds (JGBs).

Additionally, we examine three risk factors that might be related to variation in the sovereign CDS spread. The first is the VIX option implied volatility index for U.S. equities. This index is often interpreted as a measure of global event risk, an interpretation that is consistent with the very high correlations between emerging market CDS spreads and VIX documented in Pan and Singleton (2005). A second risk factor is the bond market's expected duration of the ZIRP, as computed from JGB yields by the BOJ.[4] A larger value of ZIRP means a longer duration of the policy of zero short-term interest rates. Finally, for our third risk factor we use the implied volatility on the Nikkei index option (Nikkei IV) as an index of local market volatility and risk.

4. We are grateful to the BOJ for providing these data for our analysis. ZIRP is constructed by the Financial Markets Department for monitoring purposes. For more details, see Baba (2006).

Table 1 Regression of U.S. Dollar Japanese Sovereign CDS Spread on VIX, ZIRP, and Nikkei IV

Constant	VIX	ZIRP	Nikkei IV	Adjusted R^2
–6.672 (0.601)	0.960 (0.045)			0.55
3.429 (0.145)		3.855 (0.143)		0.36
0.259 (0.396)			0.381 (0.024)	0.21
–6.438 (0.529)	0.646 (0.059)	2.413 (0.169)	0.096 (0.022)	0.65

Note: Sample period is June 3, 2003 through June 2, 2006. Standard errors are given in parentheses.

Table 1 displays the results from regressing the sovereign CDS spreads for Japan on VIX, ZIRP, and Nikkei IV. All of the coefficients are positive; sovereign CDS spreads widened as either global or local event risk increased (as measured by equity option volatility) or the market believed that it was likely the BOJ would maintain the ZIRP for a longer period. When all three risk factors are included simultaneously, the adjusted coefficient of determination (R^2) is 0.65, indicating that about 35 percent of the variation in the sovereign spread for Japan was due to risk factors not captured by VIX, ZIRP, or Nikkei IV. We will want to keep the high correlation between these risk factors and the Japan CDS spread in mind in interpreting subsequent regressions that include all four of these variables as right-hand-side risk factors.

IV. Bank CDS Spreads

There is, not surprisingly, substantial co-movement among the CDS spreads on large Japanese banks. Accordingly, we begin our exploration of the credit risk implicit in Japanese CDS spreads by computing the first principal component (PC) from the covariance matrix of spreads for Mizuho, BTM, SMBC, and UFJ over the sample period of June 3, 2003 through June 2, 2006. The first PC is then regressed on the risk factors VIX, ZIRP, Nikkei IV, and JapanSov, where the latter is the U.S. dollar CDS spread for Japan (our measure of sovereign risk). The results are displayed in Table 2.

From the first four rows of regression coefficients in Table 2 it is seen that, among VIX, ZIRP, and Nikkei IV, variation in VIX contributes the most to explaining variation in the first PC of bank spreads. At the same time, from the fifth row of results it follows that the first PC of bank spreads behaves very much like Japan risk—the R^2 in the projection of the first PC of bank spreads onto JapanSov is 0.95 percent. When all of the risk factors are included in the same projection (the sixth row of coefficients in Table 2), JapanSov largely drives out ZIRP and the coefficients on VIX and Nikkei IV fall substantially from their values when these variables are the sole regressor. This is in part a manifestation of the high degree of correlation between JapanSov and the other risk factors noted above. It also suggests that investors (in U.S. dollar CDS contracts) interpreted the common "level" factor underlying bank CDS spreads as largely being equivalent to Japanese sovereign risk.

Table 2 Regression of First Principal Component of U.S. Dollar CDS Spread on Risk Factors

Constant	VIX	ZIRP	Nikkei IV	JapanSov	Adjusted R^2
–83.92 (5.345)	9.610 (0.399)				0.61
20.84 (1.444)		35.26 (1.461)			0.33
–21.19 (3.407)			4.170 (0.210)		0.28
83.87 (4.701)	6.290 (0.554)	21.07 (1.503)	1.390 (0.214)		0.69
–11.67 (0.739)				9.29 (0.109)	0.95
–30.17 (1.324)	0.898 (0.165)	0.922 (0.683)	0.590 (0.086)	8.36 (0.171)	0.96
–28.07 (1.338)	1.570 (0.126)			8.39 (0.136)	0.96

Note: Sample period is June 3, 2003 through June 2, 2006. Standard errors are given in parentheses.

Table 3 Regression of the Difference between the First Principal Components of U.S. Dollar and Yen CDS Spreads on Risk Factors

Constant	VIX	ZIRP	Nikkei IV	JapanSov	Adjusted R^2
–3.580 (0.715)	0.779 (0.056)				0.25
3.475 (0.176)		3.912 (0.237)			0.30
0.285 (0.586)			0.386 (0.036)		0.22
–1.267 (0.434)				1.368 (0.079)	0.53
–3.915 (0.555)	–0.128 (0.052)	2.249 (0.363)	0.328 (0.034)	0.771 (0.108)	0.62

Note: Sample period is June 3, 2003 through June 2, 2006. Standard errors are given in parentheses.

An interesting question is whether investors in yen CDS contracts (more likely domestic than foreign entities) view the risks of banks differently than those who invest in U.S. dollar CDS contracts. To examine this question, we computed the corresponding first PC of yen CDS spreads on the same four banks and then projected the difference between the dollar and yen PCs onto our risk factors (Table 3). All three of the risk factors VIX, ZIRP, and Nikkei IV are positively correlated with this difference in PCs, suggesting that as credit event risk increases CDS spreads denominated in dollars widen more than they do in yen. One potential interpretation of this finding is that foreign investors in Japanese bank CDS contracts either assign a higher likelihood to an adverse credit event for Japanese banks following an increase in global event risk (as measured by VIX) or domestic economic risk (as measured by increases in either ZIRP or Nikkei IV), or the risk premiums demanded by these investors increase with increases in the risk factors.

Once JapanSov is included as a regressor, VIX is largely driven out of the projection of differences in PCs onto the risk factors, while the coefficients on ZIRP and Nikkei IV remain large relative to their standard errors. Thus, variation in the difference in (the first PCs of) U.S. dollar and yen CDS spreads is not entirely due to differences in the assessments of how sovereign risk will affect the credit risks of banks. Over and above sovereign risk, increases in the local equity market volatility or the risk of a deterioration in the Japanese macroeconomy (as measured by an increase in ZIRP) are both associated with wider dollar-yen CDS spreads.

V. Default Risk Premiums for Japanese Banks

We turn next to the nature of default risk premiums for large Japanese banks. We suppose the probability of a credit event is state-dependent (varies with macroeconomic and industry conditions), while the loss in value due to a credit event is constant.[5] We set the (risk-neutrally) expected percentage loss in face value owing to a credit event to 0.60, following industry practice in the pricing of CDS contracts on Japanese banks.[6]

There are two distinct types of credit risk that are reflected in CDS spreads and in expected excess returns on bond positions. The first is compensation for the usual risk factors associated with business and macro conditions: movements in interest rates; movements in balance sheets that affect likelihoods of default; movements in regulation or monetary policy by central banks; and so on. The other is compensation for "jump-at-default risk." More concretely, the instantaneous expected excess return on a defaultable zero-coupon bond with price $B(t, T)$ can be expressed as

$$
\begin{aligned}
e_{Bt} &= Comp(\text{risk factors}) + Comp(\text{jump-at-default}) \\
&= \quad \ldots \quad + \frac{w_t - B(t, T)}{B(t, T)} \lambda_t^{\mathbb{P}} (1 - RP(t)). \qquad (2)
\end{aligned}
$$

The first term in (2) captures the compensation investors receive for bearing the risks associated with unpredictable variation in the state variables underlying yield curve movements. These include both the state variables determining the default-free term structure and those that govern variation over time in $\lambda^{\mathbb{Q}}$.[7] Thus, at least a portion of this component of excess returns is capturing risk related to credit.

Separate from the risk related to unpredictable variation in $\lambda^{\mathbb{Q}}$ is the risk of a jump in the price of the underlying bonds in the event that a bank does restructure. It is this jump-at-default risk that we are particularly interested in, and it is the premium associated with this risk that is most often referred to as the *default risk premium*.

5. This assumption is now standard in studies of credit default risk premiums; see, for example, Driessen (2005) and Berndt *et al.* (2005). It is surely not literally true, but rather is made for convenience to focus on the timing risks associated with credit events.
6. See Ueno and Baba (2006) for a discussion of industry practice in Japan for the pricing of bank CDS contracts.
7. There is no presumption that the state variables driving the risk-free yield curve and those determining $\lambda^{\mathbb{Q}}$ are distinct. In general they will not be; the short-term risk-free rate and $\lambda^{\mathbb{Q}}$ are generally correlated over time. See Duffee (1999) for some evidence of negative correlation among these variables in U.S. corporate bond markets.

The compensation for this risk, as reflected in excess returns, is captured in the second term of (2), $(w_t - B(t, T))/(B(t, T))\lambda_t^{\mathbb{P}}(1 - RP(t))$. The term w_t is the recovery value of the bond; $(w_t - B(t, T))/(B(t, T))$ is the percentage loss of value due to default; and RP_t is the market price of default risk. If the risk premium is one, then this last term is zero and does not affect excess returns; there is no concern about jumps at the time of credit events. On the other hand, if the risk premium is greater than one, then $(1 - RP_t)$ is negative. Since the term $(w_t - B(t, T))/(B(t, T))$ is negative if prices jump down when there is a credit event, the overall contribution of this term to excess returns is positive.

Now it turns out theoretically that the risk premium associated with jump-at-default risk is the ratio between the risk-neutral and historical arrival rate of credit events:

$$RP_t = \frac{\lambda_t^{\mathbb{Q}}}{\lambda_t^{\mathbb{P}}}, \tag{3}$$

where $\lambda^{\mathbb{P}}$ is the historical mean arrival rate of credit events (see Yu [2002] for a heuristic discussion of this relation). Typically, this ratio is larger than one since, assuming investors are averse to jump-at-default risk, to obtain the correct market prices using risk-neutral valuation, $\lambda^{\mathbb{Q}}$ must be set larger than λ^{P}. Effectively, the investment environment must, risk-neutrally, be much riskier (default must be more likely) than what has been experienced historically.

Our objective is to compute the risk premiums RP_t and investigate how these premiums have changed recently with the strengthening of the Japanese economy and the changing expectations of market participants about the exit from the BOJ's ZIRP and QMEP. As an approximation to $\lambda^{\mathbb{Q}}$, we use the five-year CDS spread, which we noted is approximately $\lambda^{\mathbb{Q}}L^{\mathbb{Q}}$, divided by 0.60 (by convention, the market's estimate of $L^{\mathbb{Q}}$).

To compute $\lambda^{\mathbb{P}}$, we rely on the estimate of the market's expected probability of default over the next year calculated by Moody's KMV using a Merton-style balance-sheet model of credit events.[8] Letting $EDF(t)$ denote the estimated probability of default over the next year, $1 - EDF(t)$ is the estimated probability of survival. If $\lambda^{\mathbb{P}}(t)$ is the mean arrival rate of default under the historical distribution, then

$$1 - EDF(t) = E_t^{\mathbb{P}}\left[e^{-\int_t^{t+1}\lambda^{\mathbb{P}}(s)ds}\right]. \tag{4}$$

Therefore, approximately,

$$\lambda^{\mathbb{P}}(t) \approx -\log[1 - EDF(t)]. \tag{5}$$

The ratio of our estimated $\lambda^{\mathbb{Q}}$ to the estimated $\lambda^{\mathbb{P}}$ gives our estimate of RP.

8. We are grateful to Moody's KMV for providing us with its default estimates for the two Japanese banks examined in this analysis.

Figure 3 Risk Premium for Mizuho Bank

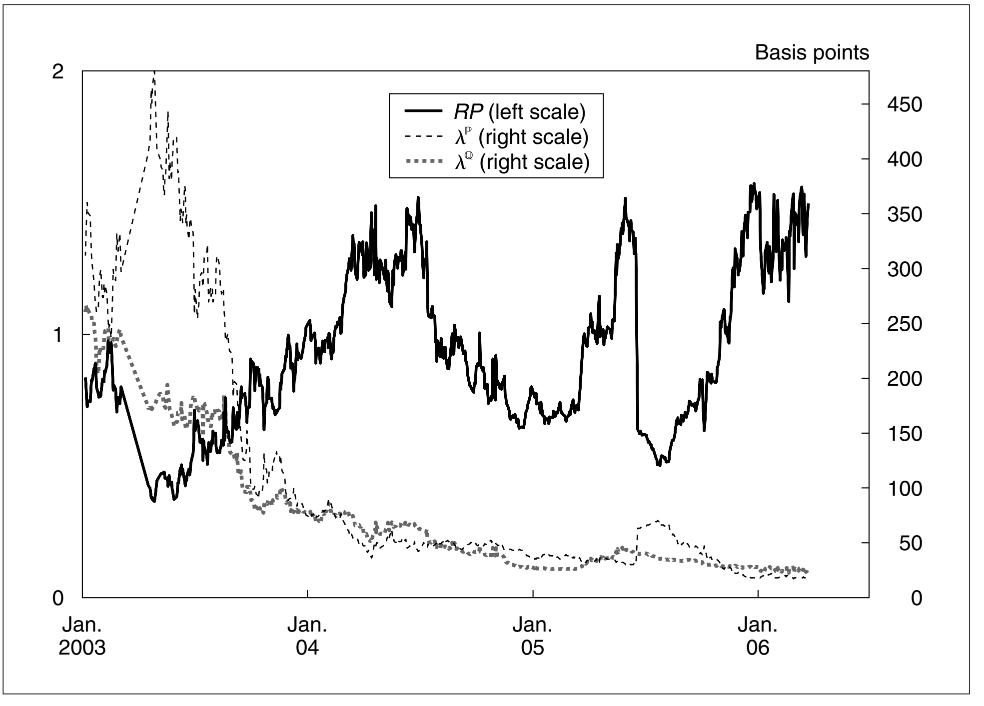


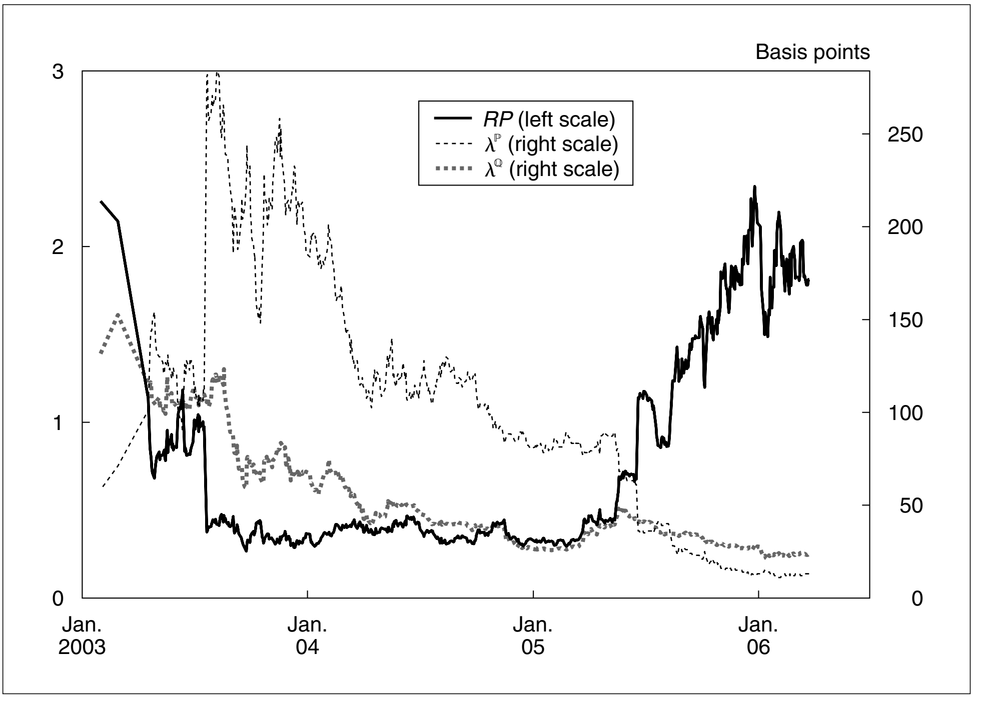
Figure 3 displays *RP*, as well as its components $\lambda^{\mathbb{Q}}$ and $\lambda^{\mathbb{P}}$, for Mizuho Bank. Notice first of all that, aside from the early part of our sample in 2003, λ^{Q} and $\lambda^{\mathbb{P}}$ track each other remarkably closely. The ratio of these variables, *RP*, fluctuates above and below one over the sample period. Toward the end of the sample, during late 2005 and early 2006, there is a substantial run-up in the risk premium in the market. Thus, it appears that as the price of Mizuho Bank's equity was increasing, and as the likelihood that the BOJ would end the QMEP was increasing with the strengthening of the macroeconomy, the risk premium related to jump-at-default risk was *increasing*.

The corresponding results for SMBC in Figure 4 are even more striking. Throughout the period from mid-2003 through mid-2005, *RP* for SMBC stayed roughly constant at a level notably below one. Then there was a steep increase in *RP* that continued through the end of our sample in early 2006.

Two features of these results warrant further discussion: (1) why did we see prolonged periods during which *RP* was substantially below unity and (2) why did the risk premiums increase substantially over the latter part of our sample period when, by most accounts, the Japanese economy was improving, as were the balance sheets of the large banks in Japan?

With regard to the risk premiums being below unity, this may partially reflect mismeasurement of λ^{Q} or $\lambda^{\mathbb{P}}$, or both. Focusing first on $\lambda^{\mathbb{Q}}$, recall that $\lambda^{\mathbb{Q}}$ is extracted from the CDS spread by scaling by $L^{\mathbb{Q}}$ set at 0.60. If we have set $L^{\mathbb{Q}}$ too high, then this will tend to understate both $\lambda^{\mathbb{Q}}$ and *RP*. An interesting question then is: what level of $L^{\mathbb{Q}}$ would ensure that RP_t is greater than or equal to unity throughout our

Figure 4 Risk Premium for SMBC



sample period? We computed these $L^{\mathbb{Q}}_{min}$ values for Mizuho Bank and SMBC and obtained 0.23 and 0.16, respectively. These values, although substantially smaller than market convention, are perhaps not wholly implausible. There have been very few defaults or episodes of restructuring by major financial institutions in Japan. Moreover, if there were a restructuring, then one might argue that regulators would manage such events in a manner which ensured that investors in the bonds of these banks would lose at most a small percentage of the face value of their bonds. Of course, relying on such implicit guarantees makes the run-up in *RP* at the end of our sample, especially for SMBC, even more puzzling unless one also argues that the implicit financial guarantees within the Japanese banking system were weakening with increased liberalization and the recent strengthening of the Japanese economy.

At a mechanical level, the substantial increase in risk premiums toward the end of our sample is simply a reflection of the fact that, in our data, $\lambda^{\mathbb{P}}$ fell more rapidly than $\lambda^{\mathbb{Q}}$ in early 2006. Some insight into the economic forces that were in play during this period comes from inspection of the projections of the risk premiums for SMBC and Mizuho Bank (*RP*) onto the risk factors (Table 4). Most notably, the largest correlation is between *RP* and ZIRP during this sample period. That is, as optimism about the end of the BOJ's ZIRP increased (ZIRP declined), *RP* increased.

This pattern is consistent with the presence of *clientele* effects—essentially, different classes of investors were determining $\lambda^{\mathbb{Q}}$ and $\lambda^{\mathbb{P}}$. More precisely, $\lambda^{\mathbb{P}}$ is determined largely by expected returns and volatility in the Japanese equity market. On the other hand,

Table 4 Projections of Risk Premiums onto Risk Factors

[1] SMBC

Constant	VIX	ZIRP	Nikkei IV	JapanSov	Adjusted R^2
8.604 (0.4267)	–0.375 (0.026)				0.22
5.687 (0.239)		–2.475 (0.235)			0.38
8.066 (0.408)	–0.213 (0.033)	–2.011 (0.235)	0.015 (0.019)		0.43
4.926 (0.220)				–0.250 (0.025)	0.16
9.025 (0.428)	–0.309 (0.036)	–2.371 (0.250)	0.0006 (0.020)	0.149 (0.022)	0.45

[2] Mizuho Bank

Constant	VIX	ZIRP	Nikkei IV	JapanSov	Adjusted R^2
3.677 (0.173)	–0.079 (0.011)				0.08
3.340 (0.046)		–0.778 (0.036)			0.30
3.275 (0.140)	–0.107 (0.013)	–0.563 (0.045)	0.074 (0.007)		0.38
3.299 (0.057)				–0.105 (0.005)	0.23
2.678 (0.161)	–0.047 (0.014)	–0.338 (0.042)	0.083 (0.007)	–0.093 (0.008)	0.44

Note: Sample period is June 3, 2003 through June 2, 2006. Standard errors are given in parentheses.

$\lambda^{\mathbb{Q}}$ was computed from U.S. dollar CDS spreads. Although overseas hedge funds were active investors in both markets (Japanese equities and the CDS markets), our impression is that those focusing on bank equities were funds following macro or directional strategies, while those focusing on the bank CDS market were pursuing arbitrage strategies.[9] From this perspective, the large runups in *RP* through the early part of 2006 could reflect a relatively more optimistic view on Japanese banks by macro/directional investors. That is, the directional investors' perception of the "distances to default" of these banks improved more through early 2006 than the corresponding perceptions of arbitrage traders. Consistent with this interpretation, in the projection of our estimated $\lambda^{\mathbb{P}}$ for SMBC onto the risk factors VIX, ZIRP, Nikkei IV, and JapanSov (Table 5), there is high correlation between $\lambda^{\mathbb{P}}$ and VIX, our measure of global event risk.

Of course, there is the possibility that the recent run-up in *RP* for Japanese banks was also due in part to mismeasurement of the one-year default probability by Moody's KMV. Reliable estimation of expected default frequencies is difficult under the best of circumstances. In the case of large Japanese banks, there were several mergers during our sample period that led to substantial changes in the balance sheets of these banks.[10] Moreover, the high leverage ratios maintained by banks present challenges for the

9. We are grateful to Naohiko Baba for pointing out the different investment focus of these different classes of investors.
10. Because of the merger between BTM and UFJ, we omitted these banks from the analysis of *RP* in this section.

Table 5 Projections of $\lambda^{\mathbb{P}}$ for SMBC onto Risk Factors

Constant	VIX	ZIRP	Nikkei IV	JapanSov	Adjusted R^2
–171.30 (9.941)	18.06 (0.731)				0.53
29.94 (5.200)		62.10 (5.078)			0.25
–80.58 (7.231)			9.248 (0.421)		0.34
–9.068 (5.924)				13.96 (0.897)	0.53
–142.90 (9.843)	5.071 (0.959)	27.31 (6.477)	4.753 (0.526)	5.813 (1.186)	0.65

Note: Sample period is June 3, 2003 through June 2, 2006. Standard errors are given in parentheses.

application of balance-sheet models of default. Particularly challenging is measurement of the appropriate default boundary.

A more extensive exploration of recent patterns of jump-at-default risk premiums for Japanese banks is an interesting topic for future research.

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Comment

HUNG TRAN[11]
International Monetary Fund

I would like to make a few comments, having more to do with interpretations and some technical questions, and conclude by raising issues for further research. Basically, I found the authors' paper to be very interesting, because it is basically in line with the kind of work that our department at the International Monetary Fund (IMF) has been doing. Instead of looking only at Japanese banks' credit risk evolution over time, we look at emerging markets and sovereign borrower credit risk, but a lot of the methodology and issues we encounter and try to resolve are parallel to the kinds of issues confronting the authors.

First, I find that the calculation using the ratio of the risk-neutral mean arrival rate of a credit event, $\lambda^{\mathbb{Q}}$, to the historical mean arrival rate of credit events, $\lambda^{\mathbb{P}}$, as a measure of the risk premium, to be very interesting. I think that it is a more accurate way to try to measure the risk premium, compared to the way in which many market participants use just the spread as a risk premium.

However, if we look at the calculated risk premium for the two Japanese banks that the authors showed, many questions arise. Despite the explanation, I find it counter-intuitive that in the latest period until now the risk premium for both Mizuho Bank and Sumitomo Mitsui Banking Corporation (SMBC) increases rather significantly, because this is the period when banks in Japan have really cleaned up their balance sheets, the volume of nonperforming loans has declined, and profitability has increased. So it is difficult intuitively to reconcile that with the increase in the risk premium.

Certainly, if you look at the regression that the authors used to calculate the risk premium for the two banks, it is also difficult to understand what actually is going on. For Mizuho Bank, the coefficient for VIX is positive and the coefficient for ZIRP is positive, if they are run alone. In the last equation, VIX has a negative coefficient, but a positive coefficient for ZIRP. Now the same factors, VIX and ZIRP, are negative throughout for SMBC.[12] For me, it is difficult to see why a global factor like VIX shows up with a positive coefficient for one bank, and then a negative coefficient for another bank. The same with ZIRP; so that is a question I would like to raise and ask the authors to clarify in their paper.

The second point I would like to raise is as follows. In the authors' Figure 1, it is interesting to see that the basis risk, which is the difference between the credit default swap (CDS) spread and the corporate bond spread for banks, appears to be fluctuating within a very narrow range. That seems reassuring, because market participants tend to use CDSs as a hedge or risk management tool when they invest in the actual underlying bonds or notes from the banks or from the corporate borrowers. However, having said that, I think that the usage of CDSs as a hedge might encounter

11. My comments are my own and do not necessarily reflect the views of the International Monetary Fund.
12. Please note that the comment refers here to material provided by Kenneth J. Singleton during the presentation of the paper at the conference.

some development problem in the future, precisely because of the fact that the issuance of CDSs based on the underlying volume of actual bonds seems to be diverging. In other words, for many companies, the amount of CDSs outstanding is much bigger compared to the volume of bonds outstanding. To the extent that the current documentation of the CDS contract calls for physical delivery of the actual bonds by the buyers of CDSs, when a credit event occurs, to the seller of the CDS contract in exchange for protection, the fact that there is a small number of bonds when the bond of that borrower gets into difficulty—as in the case of Delphi Corporation in the United States in late 2005 and other companies there in recent months—means there is a scramble to get hold of the physical bonds by the buyers of CDSs to deliver to the seller of CDSs. This tends to boost the value of the defaulted bonds well above the recovery value of the bonds, therefore impacting the CDS spread as well.

At an extreme, if you have a company moving to reduce its outstanding bonds, like one European company is planning to do, to zero, that means the company no longer has any outstanding bonds. Then the volume of CDS contracts written on those bonds will face a very uncertain and, up to this moment, difficult to understand future. Because again, the documentation of the CDS contracts calls for a credit event meaning failure to service the outstanding bonds, if there are no bonds there is no such event to be triggered, and therefore whether the CDS will become worthless or not is an issue under debate.

Taking that into consideration, there is a question as to how much the CDS spread and the actual credit spread of the bond will continue to track each other as nicely and with a stable basis risk, as we have seen.

The last point I would like to raise again concerns something that the IMF very much shares with the authors, stemming from our belief in the need for the importance of a measure of volatility in financial markets worldwide. That is the ubiquity of the VIX index. It shows up everywhere in the pricing of all kinds of risk premiums or risky assets, and in all kinds of financial practices, the most important of which is the use of the value at risk (VaR) measure for risk management purposes, and also the pricing of all kinds of financial contracts and products, with embedded optionality, which seem to be very widespread at the moment. So in recent years, if you run a correlation between the VIX index with practically every risky asset, from Japanese banks to high-yield bond spreads, to high-yield corporate bond spreads, to emerging market government bond spreads, such as those for Turkey, Mexico, Russia, or Indonesia, you have a very nice correlation. But that means what is nice on the way down also presents a problem if volatility, again as measured by the VIX index, seems to be on the rise. One can think of many reasons why volatility might be on the rise; namely, more uncertainty in terms of future data on economic growth; more uncertainty in terms of monetary policy response to the data; then the question is, what will happen to the entire range of asset prices, the entire range of financial practices including the application of VaR as a means for risk management and other risk pricing?

To me, this is far more a concern as an outcome of the recent market volatility and corrections than the actual decline in price levels themselves. Price levels have declined in many asset markets, but from a very high, multiyear-high level. More of a question is what will happen when volatility, having risen noticeably in recent weeks, continues to rise, and what the secondary effect of that higher volatility will be in terms of the rest of the asset markets.

Comment

KAZUO UEDA
University of Tokyo

This is a very timely analysis. Needless to say, the credit default swap (CDS) market has recently been growing very rapidly in Japan. It is also timely to analyze questions such as what effect the quantitative monetary easing policy (QMEP) or the zero interest rate policy (ZIRP) has had on various risk premiums, given the fact that the Bank of Japan (BOJ) exited from the QMEP back in March.

The authors estimate bank risk premiums, or default-related risk premiums, by comparing the estimate of the risk-neutral mean arrival rate of a credit event, $\lambda^{\mathbb{Q}}$, derived from the data on CDSs, with the historical mean arrival rate of credit events $\lambda^{\mathbb{P}}$, estimated from stock market data and balance-sheet data. But the results are somewhat counterintuitive. The estimates of risk premiums in many cases are below one, and also they are rising fairly sharply toward the end of the sample.

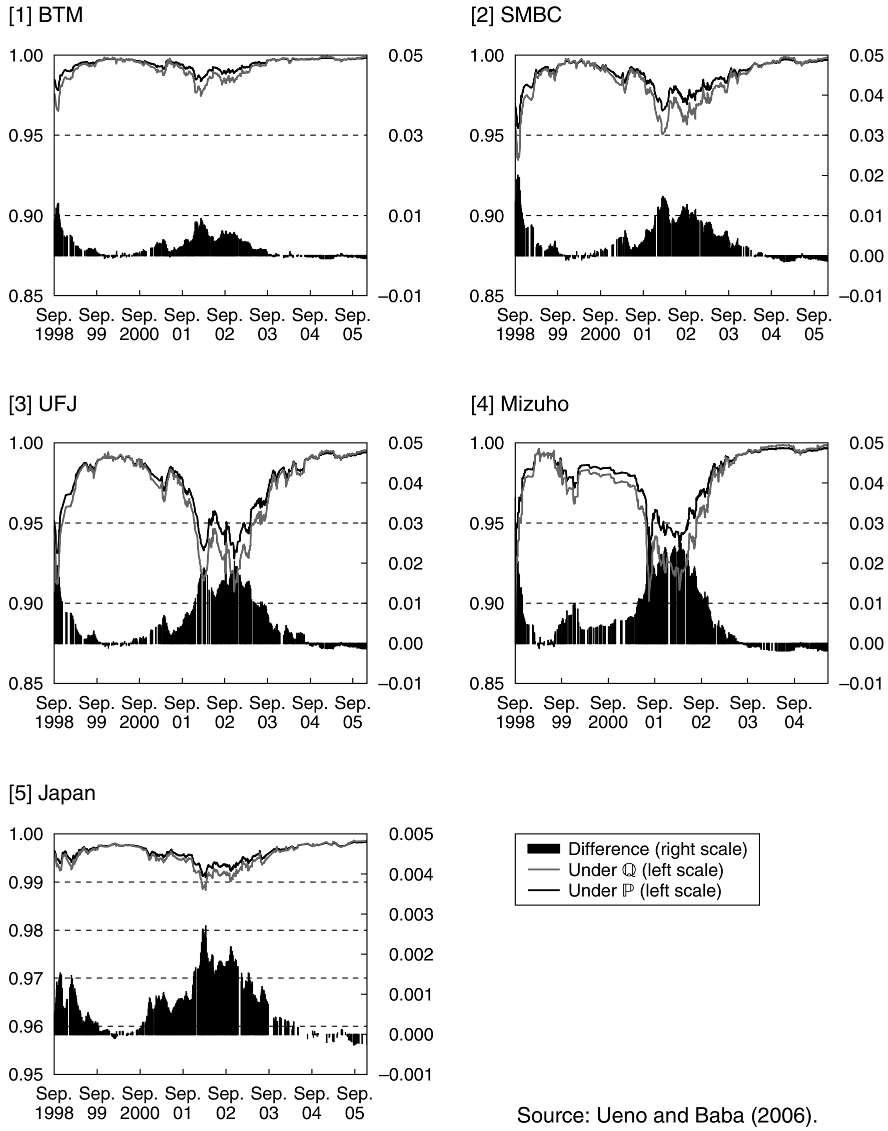
There are other studies of a similar issue. For example, a paper by Ueno and Baba (2006) estimates bank risk premiums by comparing the survival probability under the risk-neutral measure with the survival probability under the so-called pseudo-actual measure.[13] It uses data on the term structure of CDS spreads, not just five-year rates. The results are fairly intuitive; the black bars in Figure 1 show something like risk premiums estimated in this way, and they decline, as more or less expected, toward the end of the sample.

So the results Jun Pan and Kenneth J. Singleton obtain must be driven by the fact that they use the stock market data, or they compare the estimate of the intensities between the stock market and the CDS market. Thus, possible factors driving their results are that there may have been significant undershooting of stock prices in, say, years such as 2002–03, or perhaps overshooting in 2005. Another possibility already stated by the authors is that investors in the CDS market and the stock market differ.

On the CDS market, I would just like to touch on one thing that has already been discussed by the authors. This concerns the Japanese government's policy of protecting all bank debts between sometime in late 1997 to 2004–05. In the case of Ashikaga Bank that arose in late 2003, even all subordinated debt was protected. So one wonders whether the bond market sought to price in risk premiums related to default or default events. At least, it is fair to say that the pricing in these markets ought to be sensitive to changes in perceptions about the degree to which the government is willing to protect bond holders. Essentially, this issue of sensitivity contests the assumption of constancy of the loss rates or the recovery rates.

13. The survival probability under the pseudo-actual measure is based on the risk-neutral default intensity, but evaluated under the actual measure.

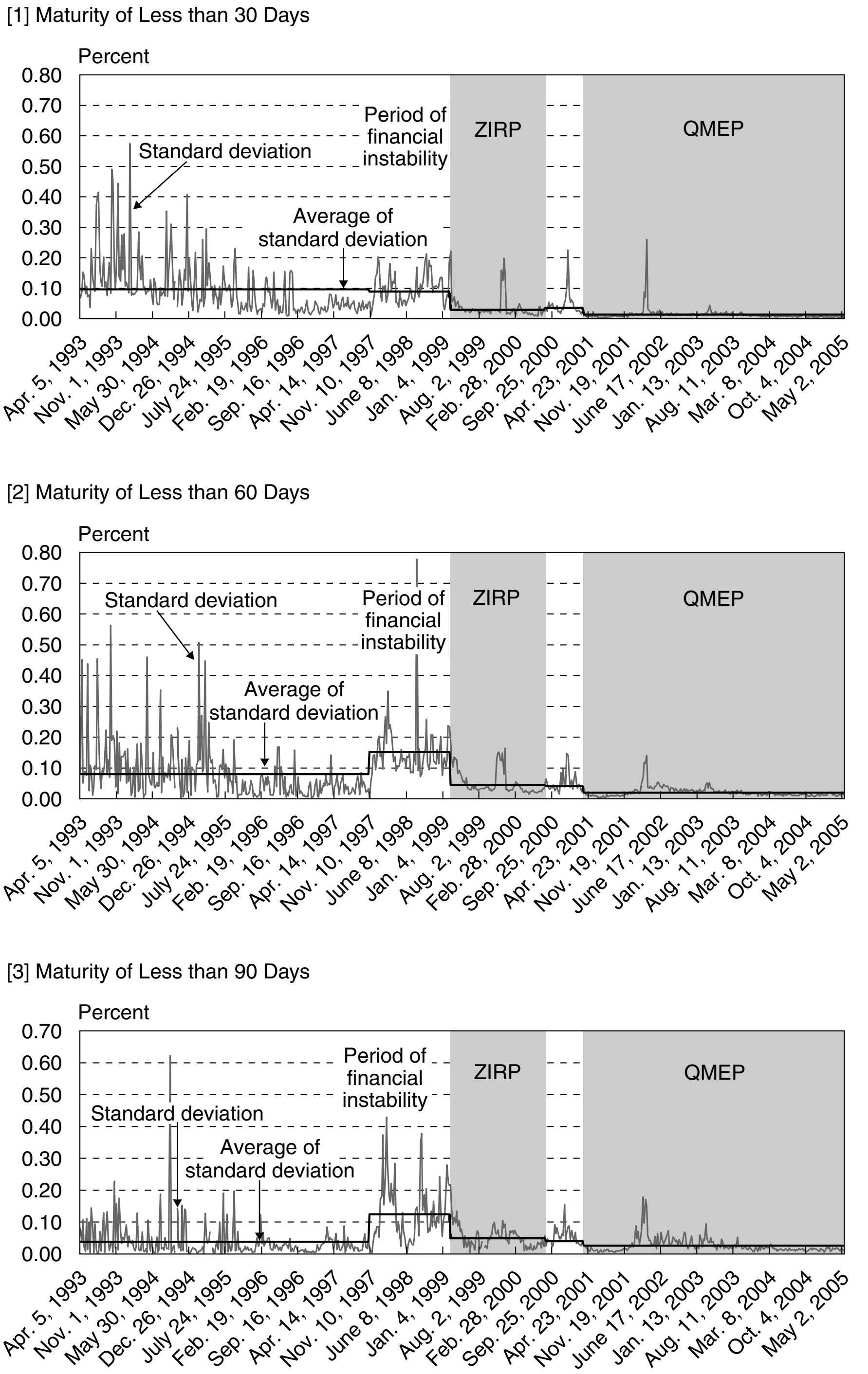
Figure 1 Risk Premiums as the Difference between Risk-Neutral and Pseudo-Actual Measures of Survival Probabilities



Source: Ueno and Baba (2006).

Now I would like to turn to something with which I am more familiar, which is the effect of the BOJ's actions on various market prices, especially risk premiums. It is widely believed that quantitative easing has had fairly significant effects on risk premiums in a wide range of markets. For example, interest rates on negotiable certificates of deposit (NCDs). The standard deviation across banks of interest rates rose sharply during the period of financial instability in 1997–98, while it went down during the ZIRP period in 1999–2000 and declined further under the QMEP. (See Figure 2; for further details, see Baba *et al.* [2006].)

Figure 2 Standard Deviation of Interest Rates on Newly Issued NCDs among Banks



Source: Baba *et al.* (2006).

Looking at the credit curves for NCD rates discussed in Baba *et al.* (2006), we find that as the years progressed the credit curves became flatter and flatter, indicating roughly that risk premiums declined with the QMEP (Figure 3). It is the same for bond spreads or CP.

Next, there are questions such as what aspects of quantitative easing have affected risk premiums in various markets. There are two or three candidates. First, the BOJ increased the supply of reserves, so the amount of the current account balances at the BOJ may have affected risk premiums. Second, there may have been some direct effects of the BOJ's operations on the prices of assets it was buying. Third, the ZIRP was in place, which was the commitment to maintain interest rates at zero for longer than the market would have expected in the absence of such a policy.

Baba *et al.* (2006) tested for the effects of these aspects of quantitative easing using the data on NCDs. We ran regressions of NCD interest rates on monetary policy variables including dummies for the ZIRP and QMEP periods, the amount of current account balances, and the maturity or durability of fund-supplying operations as a proxy for other kinds of non-traditional operations the BOJ was undertaking. The result was that the current account balance variable was insignificant, while the others were significant with the right sign.

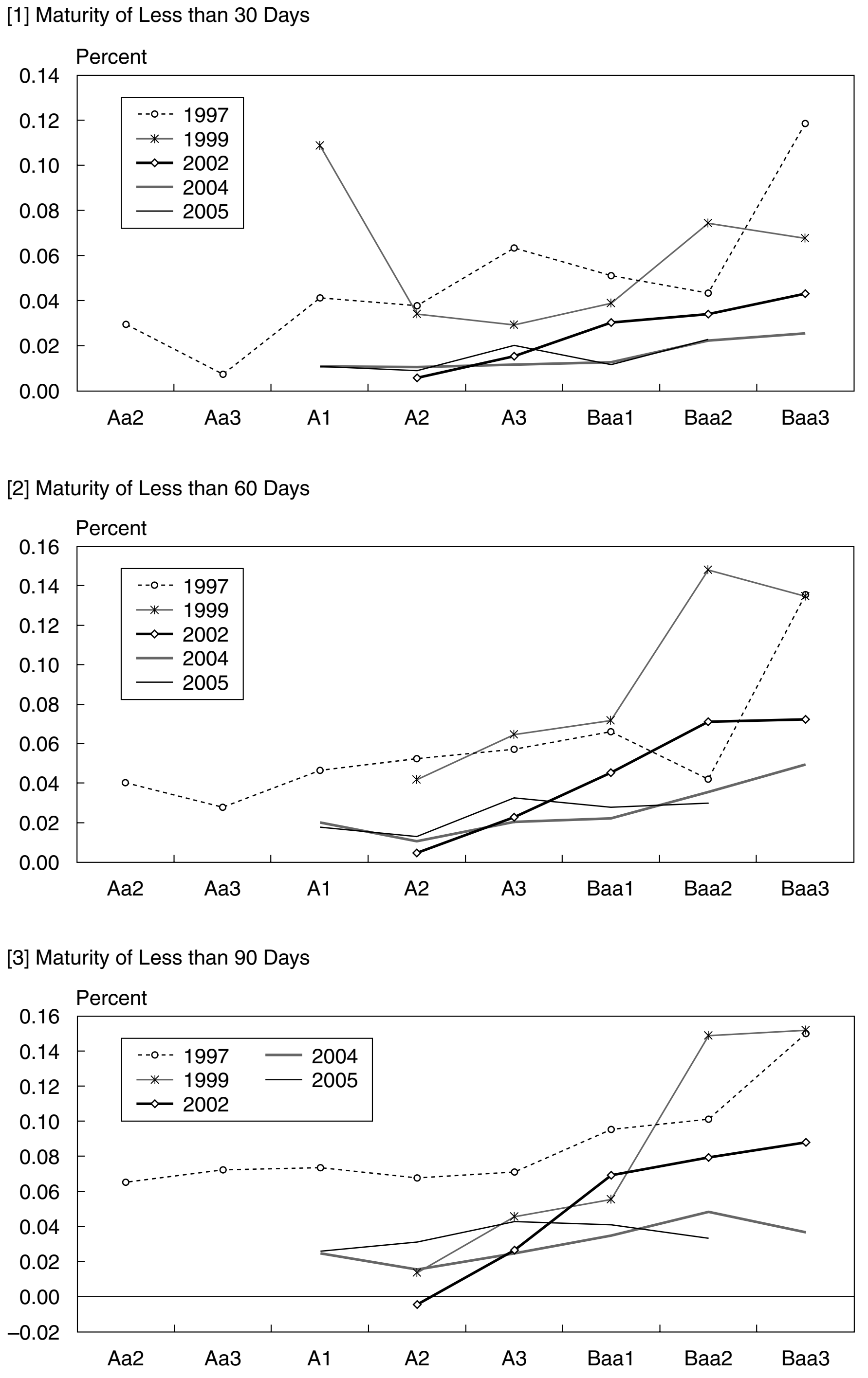
Pan and Singleton find that their ZIRP variable reduced the risk premium for Sumitomo Mitsui Banking Corporation (SMBC) and Bank of Tokyo-Mitsubishi, but raised it for Mizuho Bank.[14] Even for SMBC, the ZIRP variable raised the default intensity variable. I must say some of these results are counterintuitive. The variable they used, ZIRP, is the bond market's expected duration of the BOJ's ZIRP, as computed from Japanese government bond yields. This variable fluctuates in response to essentially two forces. First, it moves in response to changing market views of near-term inflation or growth, and second, it may respond to explicit policy changes or policy statements by the BOJ. But the only time the BOJ said something explicit about the duration of the ZIRP during the period in question (June 3, 2003 to June 2, 2006) was October 2003.

Looking at the movements of the ZIRP variable used, we notice that there are peaks in the fall of 2002 and the spring of 2003, when investors were most pessimistic about the state of the financial system. So I would say the fluctuations in this variable were mostly due to changing perceptions about the economy, which means that there is a potential simultaneous equation bias in the regression the authors carry out. That is to say, shocks that affect the risk premiums may also have affected the ZIRP variable. Negative shocks to the economy or, in particular, to the financial system made ZIRP larger, which should lead to a positive bias for the coefficient. This bias probably is strongest for Mizuho Bank.

So in conclusion, the questions and issues analyzed in the paper are very interesting, but at this point it would be somewhat hasty to take the result at face value. But again, the authors have given us a lot of interesting things to consider.

14. Please note that the comment refers here to material provided by Kenneth J. Singleton during the presentation of the paper at the conference.

Figure 3 Credit Curves of NCD Spreads



Source: Baba *et al.* (2006).

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General Discussion

In his response to the discussants, Kenneth J. Singleton stressed first that the default risk premium he defined was not a measure of the single market's assessment of the likelihood of a credit event. He suggested that the default risk premium could rise if the equity market's assessment or the historical estimate of the probability of default fell more rapidly than that implicit in the credit default swap (CDS) market. He also insisted that there were multiple types of risk premiums.

Regarding Hung Tran's remarks about hedging and the institutional features of the CDS markets and his concerns about global volatility being on the rise, Singleton agreed with Tran and said that some large management firms in the United States were actually designing funds for pension funds and other institutional clients, to enable them to sell off the volatility risk.

In the general discussion, Kenneth N. Kuttner (Oberlin College) questioned the assumption of the constant loss rate over time. He proposed estimating the risk premium as a latent common factor from all the bank credit spreads and then imposing it to those banks, which enables an estimation of the implied time-varying loss rates for each bank. Singleton responded that presuming the risk premiums have the same pattern across all the banks given the historical probability of default, he could estimate the time-varying loss rates.

Ulrich Kohli (Swiss National Bank), the chairperson of the session, questioned the assumption that the loss rate (recovery rate) is 60 percent (40 percent). He said that he would expect recovery rates to be higher for banks. Since banks were regulated more strictly than other firms, the probability was higher that a bank would be liquidated or shut down before it became insolvent. Singleton agreed with Kohli and responded that to get the default risk premiums up around one in the paper, one would use a loss rate closer to about 20 percent, not 60 percent, which corresponds to a very high recovery rate for banks.

Regarding the comments on his work by Kazuo Ueda, Naohiko Baba (Bank of Japan) first clarified the difference in definitions of default risk premiums between Pan and Singleton's work and his own. Then he pointed out the possible perception gap between credit and stock markets about capital injections by the government and repayment by banks, which was likely to cause the recent rise in the jump-at-default risk premium. Singleton agreed with Baba's interpretation and responded that participants had two main concerns. One is a lack of understanding of how the critical factors that affected the likelihood of a bank going into financial distress were going to move over time, and the other is the fear about what would happen if they went into financial distress. He stressed that the paper focused on the second main concern.

Shen Bingxi (The People's Bank of China) asked how the credit markets in Japan, including the corporate bond and CDS markets, developed and would develop in the future. Singleton responded that in Japan, similar to the United States, most corporate bonds are bought and kept in the portfolios of large financial institutions and held to maturity, so that the CDS spreads give a clearer window into the market's perceptions of credit quality than corporate bond spreads.