

Bank Credit Risk, Common Factors, and Interdependence of Credit Risk in Money Markets Observed vs. Fundamental Prices of Bank Credit Risk

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1. Motivation

■ Brief Review: What is Japan Premium?

- It is typically defined as (90-day)

US Dollar-TIBOR minus US Dollar-LIBOR (Ito and Harada [2004])

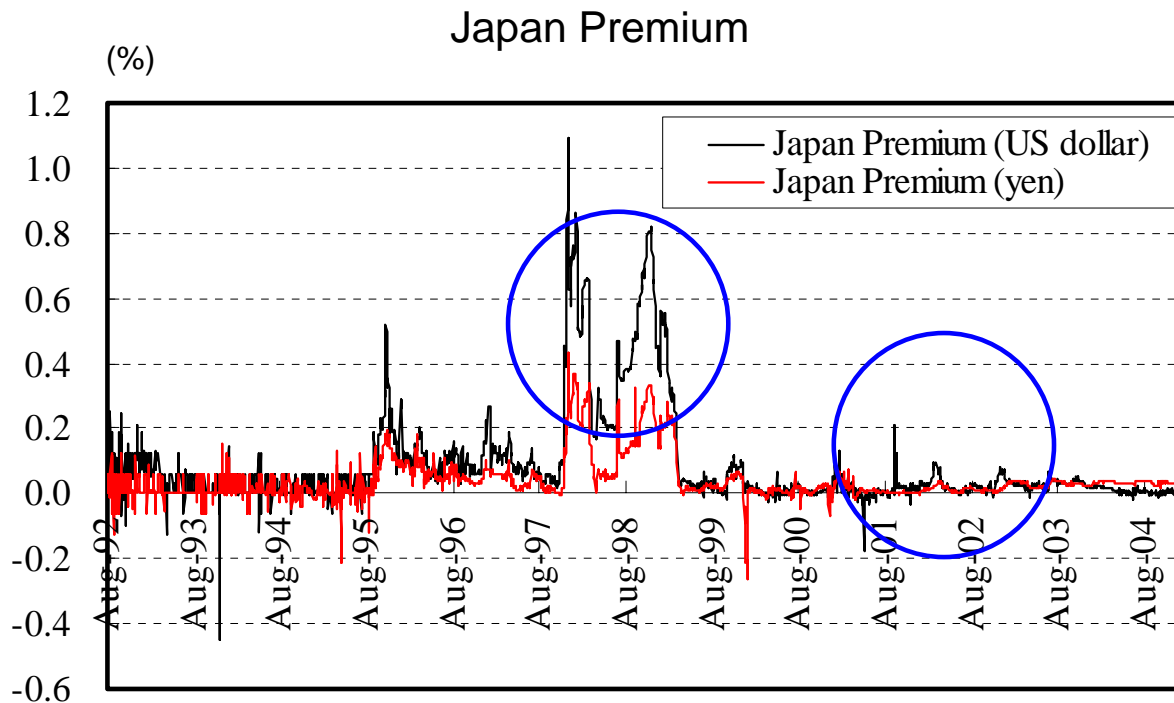
Yen-TIBOR minus Yen-LIBOR (Covrig, Low, and Melvin [2004])

Reference Banks of TIBOR and LIBOR

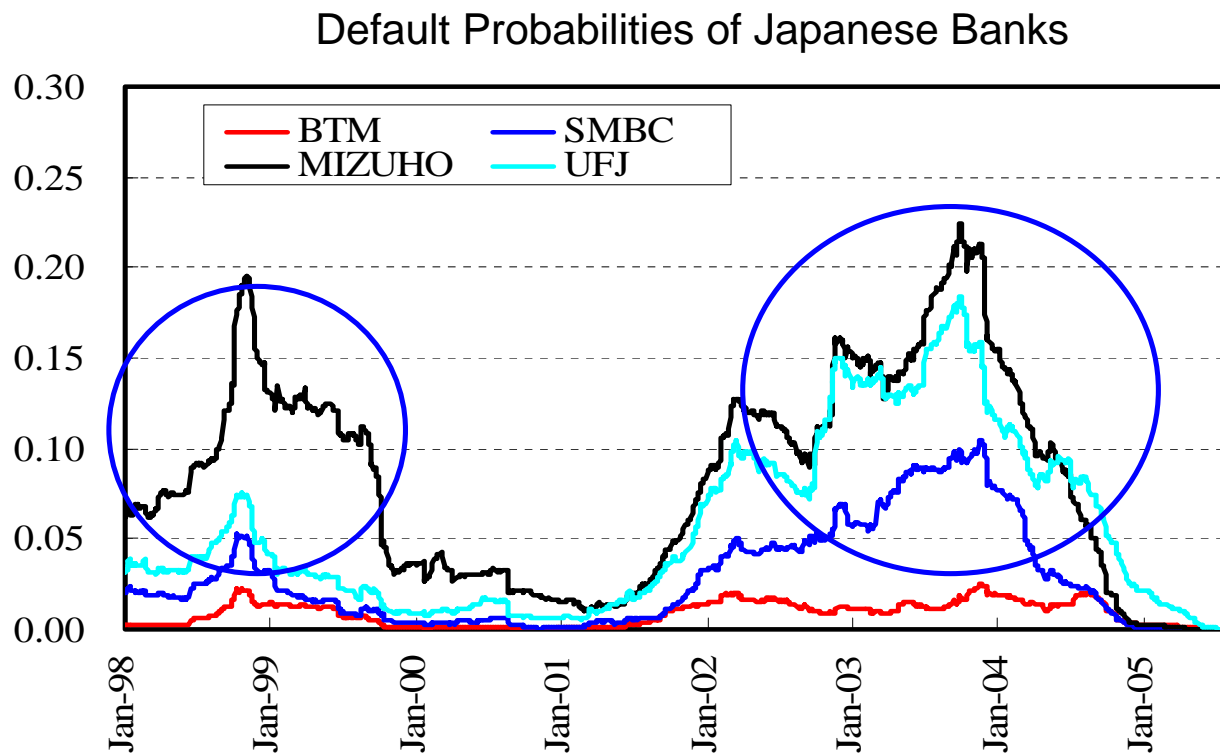
Yen-TIBOR	Mizuho Bank, Sumitomo Mitsui Banking Co., JP Morgan Chase, the Bank of Tokyo Mitsubishi, Saitama Resona Bank, UFJ Bank, Shinsei Bank, the Chuo Mitsui Trust and Banking Co., the Mitsubishi Trust and Banking Co., the Sumitomo Trust and Banking Co., Mizuho Corporate Bank, Mizuho Trust and Banking Co., the Shoko Chukin Bank, UBS AG, Shinkin Central Bank, the Norinchukin Bank
U.S. Dollar-TIBOR	Sumitomo Mitsui Banking Co., the Bank of Tokyo Mitsubishi, UFJ Bank, Mizuho Corporate Bank, the Norinchukin Bank, the Mitsubishi Trust and Banking Co., the Sumitomo Trust and Banking Co., the Chuo Mitsui Trust and Banking Co., Citibank NA, UBS AG
Yen-LIBOR	Bank of America, Barclays Bank Plc, Citibank NA, Deutsche Bank AG, HSBC, JP Morgan Chase, Lloyds TSB Bank Plc, Rabobank, The Royal Bank of Scotland Group, UBS AG, Westdeutsche Landesbank AG, the Bank of Tokyo Mitsubishi, Sumitomo Mitsui Banking Co., Mizuho Corporate Bank, UFJ Bank, the Norinchukin Bank
U.S. Dollar-LIBOR	Abbey National Plc, Bank of America, Barclays Bank Plc, Citibank NA, Credit Suisse First Boston, Deutsche Bank AG, HBOS, HSBC, JP Morgan Chase, Lloyds TSB Bank Plc, Rabobank, The Royal Bank of Scotland Group, UBS AG, Westdeutsche Landesbank, the Bank of Tokyo Mitsubishi, the Norinchukin Bank

■ As a Signal of Bank Credit Risk...

- **Japan Premium: Two** Banking Crises and Just **One** Spike



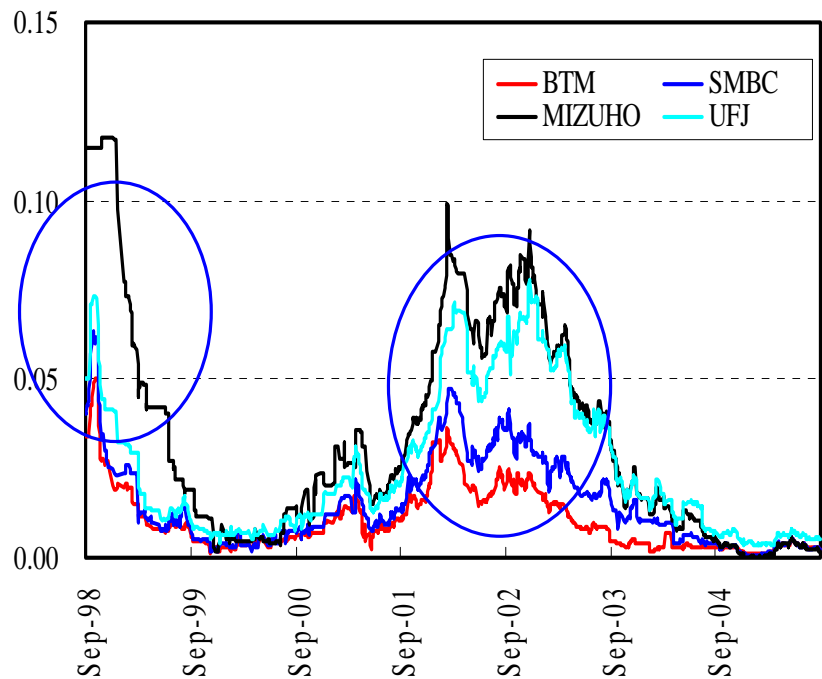
- Default Probability Estimated from **Equity Prices**:
Two Banking Crises and **Two** Spikes



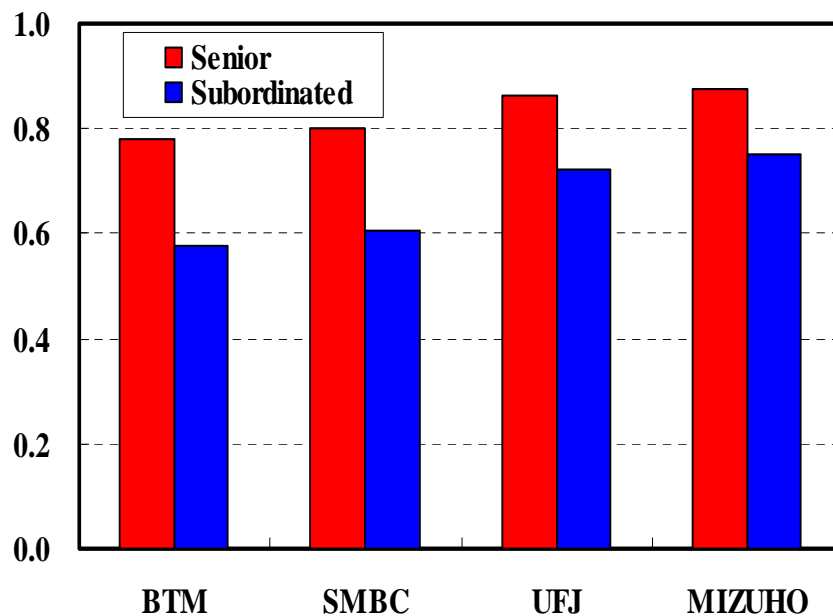
Source: Ueno and Baba [2005]

➤ Default Probability Estimated from **CDS Spreads**:
Two Banking Crises and Two Spikes

Default Probabilities of Japanese Banks



Recovery Ratios of Japanese Banks



Source: Ueno and Baba [2005]

- Japan Premium is no longer a bank credit signal?
 - We decompose risk premiums constructed from TIBOR/LIBOR and quantitatively evaluate the fundamental components of bank credit risk.
 - If not, then what factors move risk premiums?
 - Price discovery functioning of money market interest rates deteriorated?

- What properties the fundamental prices of bank credit risk have in terms of the dynamic interdependence?

2. Methodology to Decompose Risk Premiums

■ **Defining Fundamental Prices of Credit Risk**

- Random-walk prices that are specific to each bank group

■ **Preliminary Step: Factor Analysis**

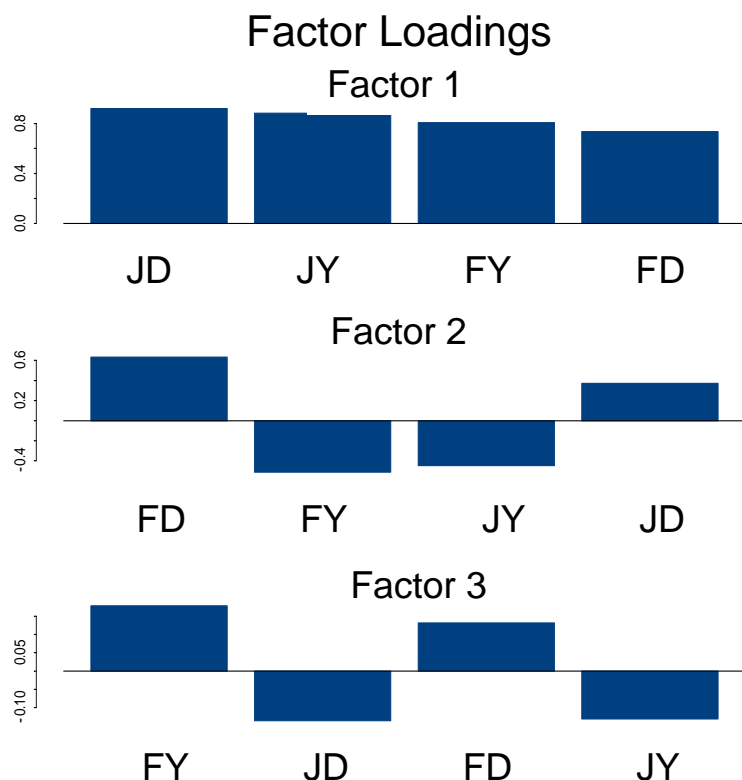
- We derive common factors from four risk premiums, which play a role of “control variables” in a state space model below.

■ **Second Step: State Space Model**

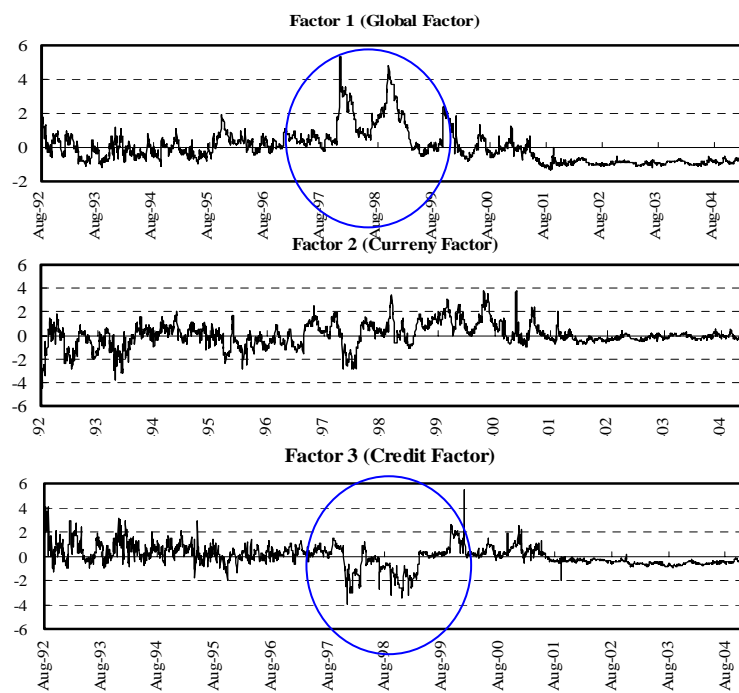
- We construct a state space model in which two random-walk shadow prices are assumed to govern the fundamental prices of bank credit risk in the yen and US dollar markets, respectively.
- Controls for the effects of common factors derived by factor analysis

■ Preliminary Step: Factor Analysis

- Factor analysis successfully extracted two common factors:
 - (a) Global factor: equally common to all of the risk premiums
 - (b) Currency factor: captures the difference between the yen and dollar markets



Time Series of each Factor



JY: yen-TIBOR-Japanese TB rate JD: US dollar-TIBOR-US TB rate
 FY: yen-LIBOR-Japanese TB rate FD: US dollar-LIBOR-US TB rate

■ Second Step: State Space Model

- **J*/F*:** Shadow Prices of Japanese/Foreign Banks' Credit Risk
- **JY(FY)PRICE/JD(FD)PRICE:** Fundamental Prices in the yen and the US dollar markets, respectively
- **Control Variables:** Fg (Global Factor), Fc (Currency Factor)

Japanese banks: $JY_t = JYPRICE_t + a_t^g Fg_t + a_t^c Fc_t + e_t^{jy}$

$$JD_t = JDPRICE_t + b_t^g Fg_t + b_t^c Fc_t + e_t^{jd}$$

Foreign banks: $FY_t = FYPRICE_t + c_t^g Fg_t + c_t^c Fc_t + e_t^{fy}$

$$FD_t = FDPRICE_t + d_t^g Fg_t + d_t^c Fc_t + e_t^{fd},$$

where $JYPRICE_t = a_0^{jy} + a_1^{jy} J_t^* + e_t^{jyprice}$, $JDPRICE_t = a_0^{jd} + a_1^{jd} J_t^* + e_t^{jdprice}$

$$FYPRICE_t = a_0^{fy} + a_1^{fy} F_t^* + e_t^{fyprice}, \quad FDPRICE_t = a_0^{fd} + a_1^{fd} F_t^* + e_t^{fdprice}.$$

3. Empirical Results

■ State Space Model

- Overall model fitting is good, and the sensitivity of fundamental prices to the shadow prices is significantly higher in the US Dollar market than in the yen market for both bank groups.

$$JYPRICE_t = a_0^{jy} + a_1^{jy} J_t^* + e_t^{jyprice}, \quad JDPRICE_t = a_0^{jd} + a_1^{jd} J_t^* + e_t^{jdprice}$$

$$FYPRICE_t = a_0^{fy} + a_1^{fy} F_t^* + e_t^{fyprice}, \quad FDPRICE_t = a_0^{fd} + a_1^{fd} F_t^* + e_t^{fdprice}.$$

	Parameter	Std. error
Japanese Banks		
a_1^{jy}	0.069***	5.01E-07
a_1^{jd}	0.150***	9.47E-09
a_0^{jy}	-0.349***	0.010
a_0^{jd}	-0.650***	0.022
Foreign Banks		
a_1^{fy}	0.020***	3.49E-08
a_1^{fd}	0.105***	1.46E-05
a_0^{fy}	-0.442***	0.108
a_0^{fd}	-2.847***	0.564
Log likelihood	42617.07	

Wald Test	
Null Hypothesis (H0)	χ^2
$a_1^{jd} - a_1^{jy} = 0$	2.74E+10***
$a_1^{fd} - a_1^{fy} = 0$	3.38E+07***

- To summarize,

- Yes, LIBOR/TIBOR contain relevant fundamental prices of bank credit risk. However, the explanatory power of fundamental prices is.....
- Major part of the variance is explained by the global and currency factor.

Importance of Components: Proportion of the Total Variance Explained by Each Component

	Global Factor	Currency Factor	Fundamental Price	Three Factors
JY	0.724	0.250	0.027	0.999
JD	0.805	0.169	0.026	0.999
FY	0.718	0.278	0.005	0.999
FD	0.681	0.293	0.023	0.997

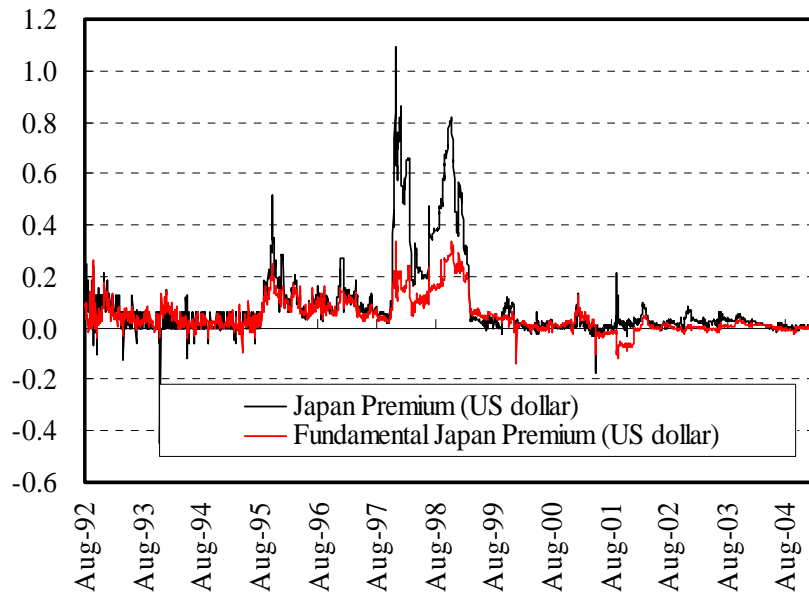
JY: yen-TIBOR-Japanese TB rate	JD: US dollar-TIBOR-US TB rate
FY: yen-LIBOR-Japanese TB rate	FD: US dollar-LIBOR-US TB rate

■ In terms of Japan Premiums...

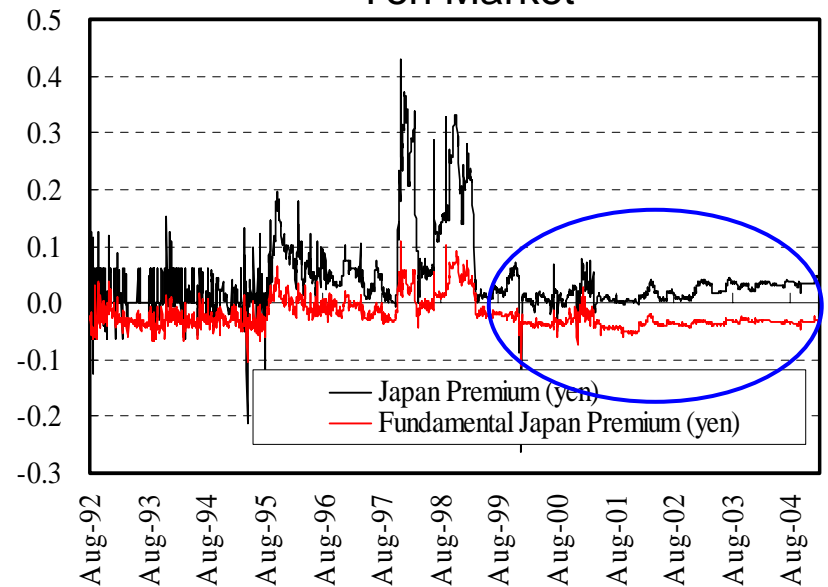
- In both currencies, fundamental Japan premiums experienced much smaller spikes during the banking crisis around 1997-98.
- In yen, Japan premium has been negative since 1999, when the BOJ initiated zero interest rate policy (ZIRP).

Observed and Fundamental Japan Premiums

US Dollar Market



Yen Market

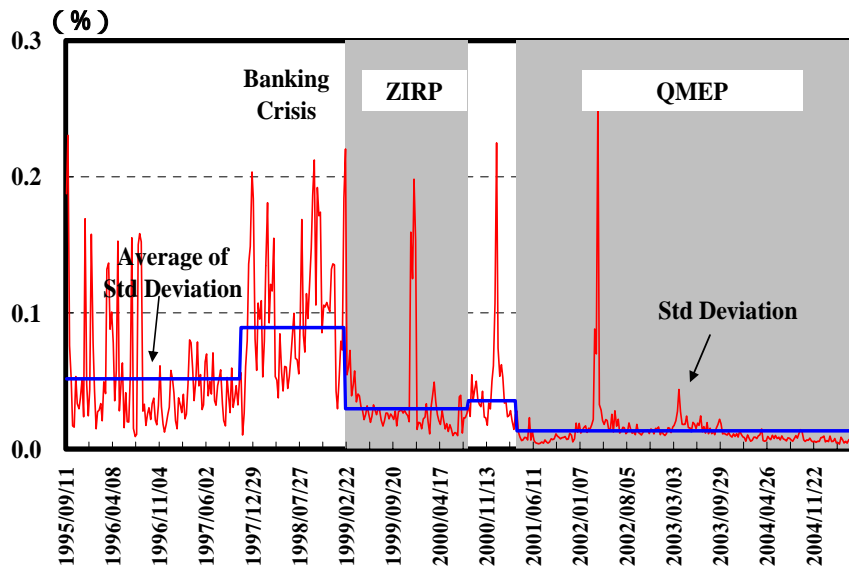


4. Discussions: Policy Implications

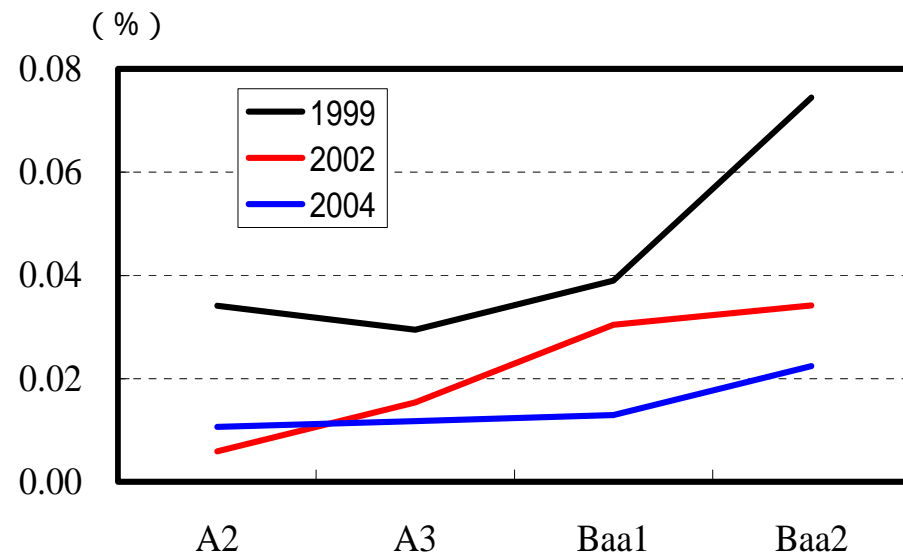
- Then, why the importance of Japan premium as a signal of credit risk was reduced?
- Three Hypotheses: Ito and Harada [2004] and Baba et al. [2005]
 1. Japanese banks have been required to put up cash collaterals to raise dollars in the money markets since around 2000-2001.
 - It might be the case, but not confirmed.
 2. Weaker banks have exited from the international money markets.
 - Then why CDS and equity markets experienced a spike recently?
 3. Money markets gradually lost price-discovery functioning for bank credit risk in a very low interest rate environment, particularly in the Japanese yen markets.
 - Some further evidence from the CD market

- Recent developments of CD Interest rates are likely to support the third hypothesis.
 - Dispersion of CD spreads across the issuing banks has almost vanished under the Quantitative Monetary Easing Policy.
 - Credit curves has flatted out almost completely.

Standard Deviation of CD Interest Rates Across Banks (Maturity: Less than 30-day)



Credit Curves of CD Spreads



■ Quantitative Monetary Easing Policy and Bank Credit Risk

- BOJ's QMEP exerted a non-negligible effect on credit spreads particularly in the money markets (Baba et al. [2005a,b]).
 - Two Possibilities
 1. The policy package under the name of the QMEP substantially reduced the risk that banks fail to meet payment obligations in the near future, which makes the near-term chance of a default much smaller.
 2. The BOJ's policy just paralyzed the market functioning.
 - Which explanation better describes the reality needs further analysis.

References for this Presentation

Baba, N., S. Nishioka, N. Oda, M. Shirakawa, K. Ueda, and H. Ugai [2005a]
Japan's Deflation, Problems in the Financial System, and Monetary Policy,
Monetary and Economic Studies, 23, pp. 47-111.

Baba, N., M. Nakashima, Y. Shigemi, and K. Ueda [2005b]
The Bank of Japan's Monetary Policy and Bank Risk Premiums in the Money Market,
forthcoming in *International Journal of Central Banking*.

Covrig, V., B. Low, and M. Melvin [2004]
A Yen is not a Yen: TIBOR/LIBOR and the Determinants of the Japanese Premiums,
Journal of Financial and Quantitative Analysis, 39, pp.193-208.

Ito, T., and K. Harada [2004]
Credit Derivatives Premium as a New Japan Premium, *Journal of Money, Credit,
and Banking*, 36, pp.965-968.

Ueno, Y., and N. Baba [2005]
Default Intensity and Expected Recovery Implied by Term Structure of CDS Spreads
For Japanese Banks: How are Japanese Banks' Subordinated Bonds Priced in the
CDS Market? mimeo