Two Financial Tsunamis hitting in Japan*

by
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Abstract

Japan was hit by the Japanese and US financial tsunamis. There are two hypotheses by using the number of bankruptcy and profit decreases. The Japanese tsunami damaged the financial industry, while the US tsunami did the manufacturing industry closely related to the US and the other countries through the international trade. We retest these hypotheses by using the evaluation of investor or market: a risk premium for bonds issued by such industries. If both hypotheses are correct, relief should be prescribed with an emphasis in manufacturing industry while the lessons from the Japanese tsunami are not necessarily applicable to the slump by the US tsunami.

Keywords: Financial Tsunami; Japanese financial industry; risk premium
JEL Classification Number: C10; G01; G12

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1. Introduction

Japan was hit by the Japanese and US financial tsunamis.[1] We define financial tsunamis as the inflow of risk. The Japanese tsunami was caused by the Japanese stocks and land price bubble collapses, December 1989. This tsunami with several big waves sunk the Japanese economy down into serious stagnation, so-called "Lost Decade of Japan", until July 2006. The US tsunami was caused by the sub-prime loan problem in USA, June 2007. This tsunami leads the world economy including Japan down into serious depression, i.e., "a second Great Depression" named by Krugman, until now. There are two hypotheses by using the number of bankruptcy and profit decreases. The Japanese tsunami damaged the financial industry and caused the systemic risk in financial markets: Bayoumi (2001), Caballero, Hoshi and Kashyap (2006), Miyakoshi and Tsukuda (2004, 2007) and Miyakoshi (2009). The US tsunami hit the manufacturing industry closely related to the US and the other countries through the international trade, as reported by Mass media.[2]

It will be necessary to retest the hypotheses by using an alternative viewpoint of evaluation by investors or markets. The evaluation by investor or market reflects the truth of economy, and on the other hand will drive the truth. Eg., Nadenichek (2007) and Kim (2008) showed that these push the economies into the crisis through a self-fulfilling expectation. When the appropriate data (for the number of bankruptcy and profit decreases) is not obtained or is not ready yet, this view point is more significant. Furthermore, available data is restricted because the US tsunami is just starting.

The purpose of this paper is to retest two hypotheses (two tsunamis' effects on Japanese economy) by using the evaluation of investor or market: a risk premium for bonds issued by such industries. Retesting is significant. If both hypotheses are correct, relief should be prescribed with an emphasis in manufacturing industry while the lessons from the Japanese tsunami are not necessarily applicable to the slump by the US tsunami.

The paper is organized as follows: Section 2 briefly summarizes the events and monetary-banking policy and corporate policy around the two tsunamis in Japan. Section 3 describes data and does visual inspections. Section 4 explains the statistical methodology and discusses the results of the test hypotheses. Section 5 concludes the paper.

2. Events, monetary-banking policy, and corporate policy around two tsunamis

Table 1A shows events around two tsunamis. By using detailed materials, Miyakoshi (2009, p.28-34) explained the background for events as follow. Japanese banks were strongly supported by the collateral of land and stock evaluations. When the bubble collapsed, land and stock prices fell, pushing down the value of collateral, which in turn

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[1] We saw the word of 'financial tsunami', for the first time, in the theme of All China Economics International Conference held at Hong Kong, Dec.2009.

[2] There are no papers for the US tsunami except for Longstaff (2010), Duchin et. al.(2010), Bordo and Haubrich (2010) which investigate the contagion to the other domestic markets.

meant the banks ceased lending, or called in loans from all companies to which they had loaned money, including risk-averse companies that had not engaged in speculation. The number of business bankruptcies began to increase from 1990 to 1992, and reached a high of 20,000 per year in 2002. The money involved in bankruptcy was much bigger than those that occurred in the 1980s, reaching 26 trillion yen in 2002. On the other hand, the banks caused a credit crunch for other borrowers. The total number of credit crunch claims between the fourth quarter of 2002 and the second quarter of 2005 was 1,786 cases, which created huge turmoil. Many financial institutions failed. The number of Japanese bank and credit cooperative failures rapidly increased during the 1990s. In the 2000s, the bank slump continued and worsened, but the failure of financial institutions finally stopped in 2003. From the 1990s to 2003, 181 failures were recorded. Taking into account the banks acquired and merged, the number of financial institutions in 2003 was 131 banks (compared with 151 in 1991), 306 Shinkin-banks (reduced from 451 in 1991) and 181 credit cooperatives (reduced from 407 in 1991). Thus, the banking industry itself largely descended into bankruptcy. Events around the US tsunami are reported a little since the US tsunami has just started. The Industrial Production Index decreases to 69.5 from 110 at May 2008. Most of export companies announced the current account deficits. The Real GDP (Quarterly) growth shows: -8.9,-5.8,-5.1% and the Real Export growth: -36.5, -29.3, -22.3% at the first to the third quarter in 2009.

We define the period of two tsunamis. The starting point of the Japanese tsunami is Jan 4, 1990 to March 18, 2001, based on the zero interest policy of the BOJ (Bank of Japan). They say that the zero interest rate policy resolute the Japanese tsunami. This policy continues during March 19, 2001 to July 14, 2006. On the other hand, the US tsunami caused by the sub-prime loan problem in June 2007 is actualized by the bankruptcy of Lehman Brothers, Merrill Lynch and the American International Group in September 15 and 17 2008. It is so-called "Lehman Shock". However, we suppose the starting point of the US tsunami as the end of the zero interest rate in Japan (July 15, 2006), since the sample period is not sufficient for analysis.[3]

[INSERT Table 1A]

Table 1B shows monetary-banking and corporate policy around two tsunamis. The Bank of Japan (BOJ) introduced a zero interest rate policy, which encouraged the overnight call rate to fall as low as possible from 1999. However, investment did not respond to the zero interest rates. Consequently, in March 2001, the BOJ introduced a new monetary policy framework. The BOJ's new monetary policy (referred to as 'quantitative easing policy') changed the operating target from the *call rate* to the *current account balance* in order to produce inflation. To do this, the BOJ purchased Japanese Government bonds. The

[3] W should use the "Bank of Japan Monetary Policy Meetings: Announcement of Decisions" as a guide and split our data into three sub-periods. Admittedly, economic situation does not shift overnight. The splitting of our sample, however, is consistent with a broader picture of data in figures in the text.

private bank reserve at the BOJ consisted of legal reserves and excess reserves. The BOJ's purchase of government bonds increased the level of excess reserves, which pushed up the price level and produced inflation. The target level was set at five trillion yen in March 2001, and gradually increased to 30–35 trillion yen in 2004. The CPI eventually began to increase after 2005. The BOJ withdrew from its quantitative easing policy in March and ceased its zero interest rate policy in July 2006. Eventually, the monetary policy provides banks with sufficient money. The Financial Service Agency of Japan publicly announced what is referred to as the Program for Financial Revival (PFR) in October 2002, although the program had begun operating before that date. This is the Banking Policy which consisted of grants, the purchase of assets and capital injections for banks. The grant, amounting to around 19 trillion yen, could not be recovered. However, the purchase of assets (i.e., the government purchases of bad loans from the banks) amounted to about 10 trillion yen. The last main measure was a capital injection. The government injected about 12 trillion yen into many banks between 1998 and 2004. The government purchased the preferred stocks and subordinated bonds issued by the banks. On the other hand, for corporate policy, the Industrial Revitalization Corporation of Japan (IRCJ) purchase bad loans from the 25 big companies approved for assistance from April 2003 until September 2004. The monetary-banking and corporate policies around the US tsunami are follows. The BOJ starts outright purchases of CP and corporate bonds with one trillion yen. The main policy is related to corporate policy for manufacturing industry. There is no other striking policy since the US tsunami has just started.

[INSERT Table 1B]

Thus, the events in Table1A seem to support that the hypothesis that the Japanese tsunami damaged the financial industry, while the US tsunami did the manufacturing industry closely related to the US and the other countries through the international trade. As a result, relief seems to be prescribed with an emphasis in manufacturing industry.

However, the evaluation by investor or market reflects the truth of economy, and on the other hand will drive the truth, as pointed by Nadenichek (2007) and Kim (2008). Then, when the available data (for the number of bankruptcy and profit decreases) is not obtained or is not ready yet because the US tsunami is just starting, the view point of evaluation by investor or market is significant. We retest the hypotheses by using the evaluation of investor or market (a risk premium for bonds issued by such industries).

3. Data and Visual Inspections

How should we define and measure the risk in financial and manufacturing industries? We use four risk premiums for bonds issued by industries.

(1) Nikkei Bond Index (Koshasai Index) spread for all industries in Japan:
9/30/1992/-10/9/2009

The short-term bond index (consisting of bond selected by the Japan Securities Dealers

Association and the Nikkei Media Marketing) is used for new issues with maturities less than three years, a medium-term bond (public and private bonds) index for issues with maturities between three and seven years, and a long-term bond index for those with maturities more than seven years. [4]

(2) Euro JPY bond (AAA) for all industries in other countries: 10/8/1998-11/2/2009
A Euro JPY bond (rated AAA) that is denominated in Japanese yen and issued by a non-Japanese company outside of Japan.

(3) Interest Rate Swap Rate (ISDAFIX®) for financial industries in Japan: 3/29/1996/-9/16/2009
The growth of interest rate derivatives from 1990 to 2006 is conspicuous. Interest rate options increased greatly to 44 trillion USD, while interest rate swaps soared over one trillion to 230 trillion USD.[5] The swap buyer makes a fixed interest payment in exchange for a variable cash flow based upon a floating London Interbank Offered Rate. The interest rate that determines the fixed payment is the swap rate. Its rate includes the risk for main counter party, i.e., financial industry.

(4) Composite AA for manufacturing industries in Japan: 7/12/2004/-11/2/2009
This index includes the bond in Industrial, Telephone, Utilities, Transportation industries with rating AA.

The maturities for bonds are 2-, 3-, 5-, 7- and 10-year. The risk premium for each bond is measured by using the spread with the government-bond (risk-free) and each bond yield with same maturity. Then, the risk for all industries in Japan, is represented by the Nikkei Bond Index spread (1), the risk for non-Japanese company outside of Japan by the Euro JPY bond spread (2), the risk for financial industries in Japan by the Interest Rate Swap spread (3), and the risk for the financial industries in Japan by the Composite AA spread (4).[6] Data (1) is from Nikkei NEEDS Financial Quest, (2)-(4) from Bloomberg.

These risk premiums inflow into the Japanese companies in financial and manufacturing industries like a tsunami with several waves. These tsunamis of risks behave like stock price index (in logarithm form) in a sense that those have a persistent volatility and a spiked peak. As shown in Figure 1, the difference of the risk (risk change), which corresponds to the stock return (the difference of stock price index in logarithm form), may be analyzed by the EGARCH model. We can check the characters of risk change by

[4] The data of Nikkei Bond index from 8/6/2002 to 9/24/2002 are missing. The number of missing data is 33. We omitted these periods from our analysis.
[5] See, Bank for International Settlements (2007, pp.7, Table1).
[6] The Nikkei Bond Index spread two-year(three-year), five-year (seven year) and ten-year is respectively defined as a difference between a short-term bond index, a medium-term bond index and a long-term bond index and government-bond yield two-year(three-year), and ten-year.

examining the summary statistics in Table 2. In general, as well as our definition, the risk premium is defined by Lekkos and Milas (2001), Huang and Chen (2007) and Afonso and Strauch (2007).

Table 2 lists the risk change with several maturities (the bond spread differences) and the non-normality of the unconditional distribution of daily risk changes. The table reports the mean, the standard deviation of risk change, the Kendall-Stuart skewness, the excess kurtosis, and their tests. The Ljung-Box Q-statistics $Q^2(12)$ are reported under the null hypothesis of non-serial correlation tests in daily squared risk changes. At a significance level of five per cent, the null hypotheses (skewness = 0 or excess kurtosis = 0) and non-serial correlation are rejected. Thus, the time series have the same typical features as well as stock returns, displaying a fat tail distribution, a spiked peak, and the persistence of variance.[7] Therefore, the ARCH-type model including such features seems to be appropriate for analyzing these series, compared with the AR model.

[INSERT Figure 1 and Table 2]

Visual Inspection

In Figure 1, Bond Index spreads show risks for all industries in Japan. On the other hand, the Euro JPY bond spreads show risks for all industries in foreign countries, measured in Japanese yen where Japanese yen rate risk is deleted, while the data of the Japanese tsunami is very short. The US tsunami (7/15/2006-) has damaged the foreign countries much more than Japan, because the zero risks for the foreign countries are dramatically increased to 1.2 to 1.4. However, the US tsunami has damaged Japan relatively a little, compared with the Japanese tsunami (1/4/1990-3/18/2001). The exception is a short-run risk with 2-year maturity. Nevertheless, we have to study which industries are more serious by the US tsunami, in order to know in which industry relief should be prescribed with an emphasis.

The swap spreads show risks for financial industries in Japan, while the composite AA spreads show risks for non-financial industries in Japan. If possible in comparison with size, the US tsunami has damaged non-financial industry with much larger risks than financial industry still now: 0.6-0.8 compared with 0.2-0.4. In particular long-run risk with 5-,7-,10-year maturity overcome the short-run risks, suggesting the US tsunami persisting larger risks for a long time. This finding seems to support:

H1: the US tsunami damaged the non-financial industry.

Relief should be prescribed with an emphasis in manufacturing industry. On the other hand, if we can get more data for the early periods of the composite AA spreads and the finding support:

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7 All computations in the paper have been performed with the computer package WinRATS Version 5.

H2: the Japanese tsunami damaged the financial industry.

The previous experiences in the Japanese tsunami are not necessarily applicable to the slump by the US tsunami. We check two hypotheses by using EAGARCH model in a next section.

4. Statistical Methodology and Discussion of Hypotheses Methodology

The specification of risk change process can be expressed as:

$$R_t = \mathrm{a} + \beta^{+}\mathrm{R}^{+}_{\mathrm{t\text{-}1}} + \beta^{-}\mathrm{R}^{-}_{\mathrm{t\text{-}1}} + \varepsilon_t \quad : \mathrm{t}=1,2,\ldots,\mathrm{T} \tag{1}$$

$$\varepsilon_t \,|\, I_{t-1} \sim N(0,\ \sigma_t^2\ ) \tag{2}$$

$$\log\sigma_t^2 = \alpha_0 + \alpha_1(|\,z_{t-1}\,| - E(|\,z_{t-1}\,|)) + \alpha_2 z_{t-1} + \alpha_3 \log\sigma_{t-1}^2 \tag{3}$$

$$\varepsilon_t \equiv \sigma_t z_t : \quad z_t \sim N(0,1) \tag{4}$$

where R_t is the risk change (the first difference of risk), R^{+}_{t-1} = max{ R_{t-1}, 0}, and R^{-}_{t-1} = min{ R_{t-1}, 0}, (a, β^{+}, β^{-}) is the constant in (1) and $\mathrm{I}_{t\text{-}1}$ denotes the information set of the time t-1 in (2). We assume that the disturbance term (ε_t) in (3)-(4) has the EGARCH process proposed by Nelson (1991). We also assume asymmetric returns in (1) proposed by Koutmos (1998, 1999) and Nam et al.(2003,2005). β^{+}, β^{-} are not necessarily equal.

The asymmetric volatility of $\alpha_2 > 0 (\alpha_2 < 0)$ means that the larger volatility happens when the risk is rising (falling). The $\alpha_2 > 0 (\alpha_2 < 0)$ imply the larger movement of risks with pessimistic (optimistic) feeling.

If $\beta^{+}(\beta^{-}) < 0$, it is called "back-stepping" which forces fall (raise) of risk when the risk increases (decreases) in the previous day. As is obvious later, the estimated coefficients show back-stepping $\beta^{+}(\beta^{-}) < 0$ or zero $\beta^{+}(\beta^{-}) = 0$. The back-stepping of $\beta^{+} < 0$ implies investor (market)'s optimistic prospects for risks because of back-stepping against the rising risks. The back-stepping of $\beta^{-} < 0$ implies investor (market)'s pessimistic prospects for risks because of back-stepping against the falling risks. Then, $\beta^{-} < \beta^{+} < 0$ means more pessimistic prospects for risks in particular phases, suggesting more heavy risks. On the other hand, the $\beta^{+}(\beta^{-}) = 0$ means $R_t = a + \varepsilon_t$, which implies that the risk show a random walk. Investors (markets) are uncertain about the movement of risks and anxious for it.

Thus, in order to compliment the degree of damage in a view point of size of risks, we recognize the asymmetric volatility and the persistent volatility:

Financial industry was more damaged than Non-Financial one in a strong volatility persistence when $\alpha_{3F} < \alpha_{3NF}$ (5)

Financial industry was more damaged than Non-Financial one in the larger movement of risks with pessimistic feeling when $\alpha_{2F} > \alpha_{2NF}$. (6)

We also recognize the truth in future from investor's prospects:

Investors have pessimistic (optimistic) prospects, driving the truth so when $\beta^- < \beta^+ < 0$ ($\beta^+ < \beta^- < 0$). (7)

Investors are uncertain about risks, which move randomly when $\beta^+(\beta^-) = 0$. (8)

The required joint density in (9) is obtained.

$$\mathrm{pdf}(R_1, ..., R_T \mid \omega) = \prod_{t \in T} \mathrm{p\ d\ f}(_t R \omega \mid I_{t-1}) \quad (9)$$

The model of (1)-(4) is estimated by the maximum likelihood estimation method using the joint density of (9).The $\omega = (\alpha, \beta^+, \beta^-, a_0, a_1, a_2, a_3)$ are unknown parameters. For the sake of simplicity, the estimated $\hat{\omega}$ is assumed to be consistent and asymptotically normal.

Discussion of Hypotheses

We now discuss the estimation results, in order to support visual inspections and descriptive analysis for two hypotheses H1 and H2, by using (5)-(8).Table 3 reports the estimated results in equation (1)-(4) for each of 2-,3-,5-7-,and 10- year maturity. Most of coefficients are significant at 5% level.

By investigating the Bond Index spreads for Japan risks and the Euro JPY bond spreads for the other countries risks, the volatility persistence on other countries by the US tsunami is larger than that on Japan and more damaged, based on (5). On the other hand, the α_2 in both countries is negative in Japan implying larger movement of risks with the pessimistic feeling, while the results are only seen in two maturities out of five, based on (6). As supported by the volatility persistence, Japan was not so damaged by the US tsunami, compared with the other countries. Finally, $\beta^- < \beta^+ < 0$ (except for 5-year maturity) for the effect of the US tsunami on Japan means more optimistic prospects for risks in future, driving lighter risks than the Euro JPY bond spreads for the other countries risks. Nevertheless, we have to study which industries are more serious by the US tsunami, in order to know in which industry relief should be prescribed with an emphasis.

By investigating the Swap spreads for the financial industry's risks and the Composite AA spreads for the non-financial industry's risks, the volatility persistence on

the financial industry show stronger one (more damaged) than the non-financial industry in short-term risks, while it is weaker (less damaged) in long-run risks, based on (5). On the other hand, based on (6), there is no difference of asymmetric volatility between two industries, suggesting equally damaged in both industries. In these sense, volatility persistence support the visual inspection where the non-financial industry is more damaged in long-run risks. On the other hand, based on (8), $\beta^- = \beta^+ = 0$ (mostly with all year maturities) show a random walk in risks, suggesting that investors are uncertain about the movement of risks and anxious for it. Based on (7), the composite AA for the non-financial industry shows back-stepping in down-turn markets with 2- and 3- year maturity. Also, based on (8), the risks with 5- and 7-year maturity show a random walk (investors are uncertain about risks). Compared with the financial industry, in future the large risks continue.

Thus, we can find some evidences supporting Hypotheses 1 and 2 in the estimation results by EGARCH model.

[INSERT Table 3]

5. Concluding Remarks

We investigated two hypotheses: *H1: the US tsunami damaged the non-financial industry*. *H2: the Japanese tsunami damaged the financial industry.* By using alternative viewpoint from previous research, i.e., by using the evaluation of investor or market (a risk premium for bonds issued by such industries), we can find several evidences supporting two hypotheses in visual inspection and EGARCH estimation with asymmetric risks. The sizes of risks with 2-,3-,5-,7- and 10-year maturity bonds in non-financial industry are larger than those in financial industry. In particular long-run risk with 5-,7-,10-year maturity overcome the short-run risks, suggesting the US tsunami persisting larger risks for a long time. In addition, if we can get more data for the early periods of the composite AA spreads and the finding strongly confirm *H2.* Due to the EGARCH estimation, the composite AA for the non-financial industry shows back-stepping in down-turn markets with 2- and 3- year maturity. Also, the risks with 5- and 7-year maturity show a random walk (investors are uncertain about risks). Compared with the financial industry, in future the large risks continue.

As a result, relief should be prescribed with an emphasis in manufacturing industry while the lessons from the Japanese tsunami are not necessarily applicable to the slump by the US tsunami.

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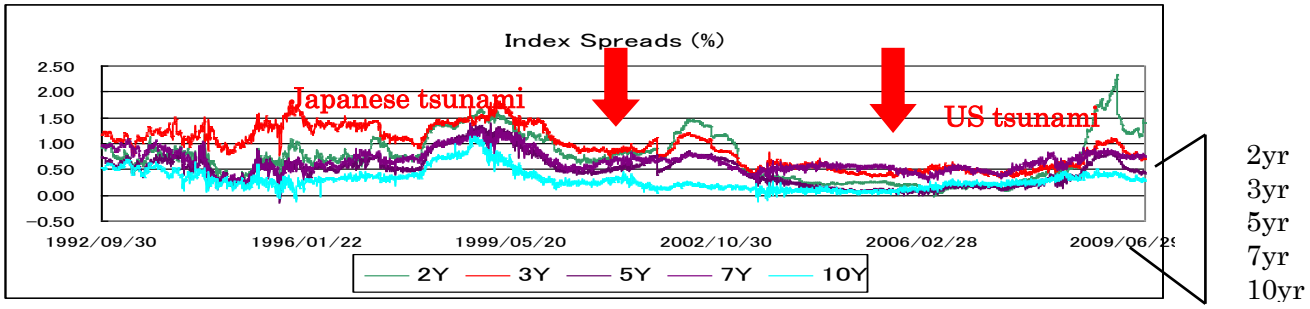
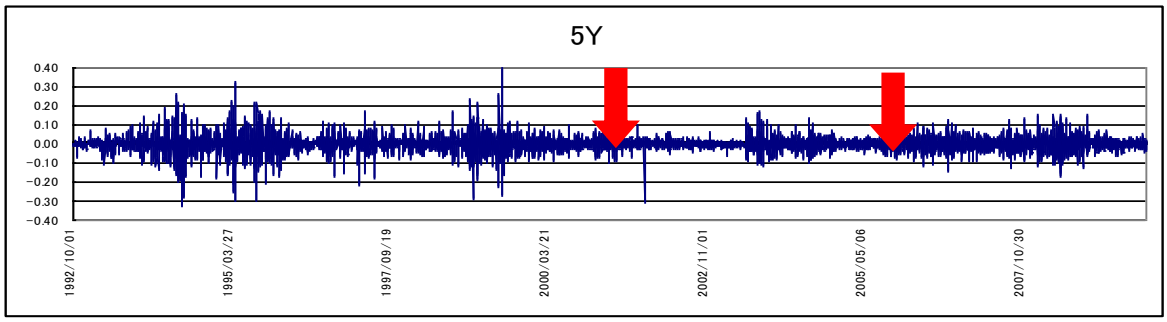
Figure 1. Graphs of variables

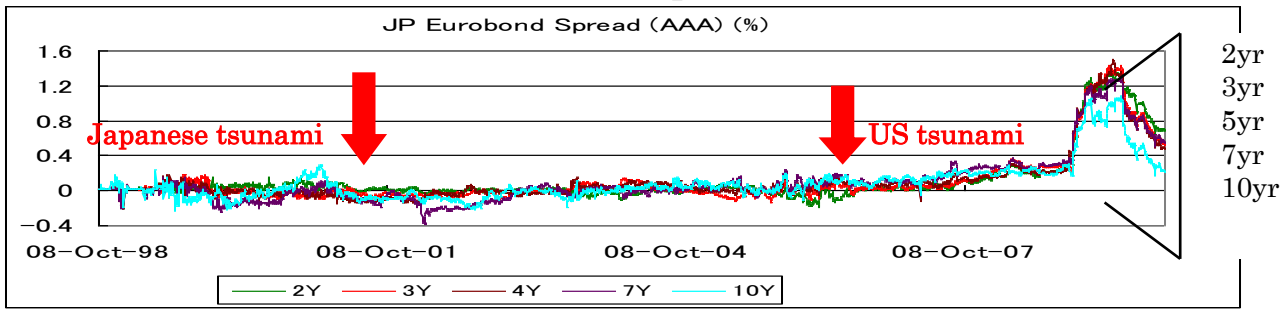
Nikkei Bond Index Spreads



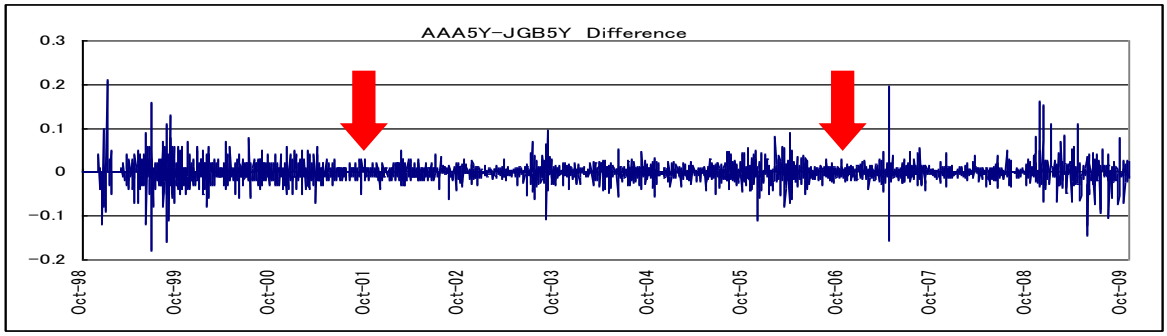
Difference of spread with 5-year maturity



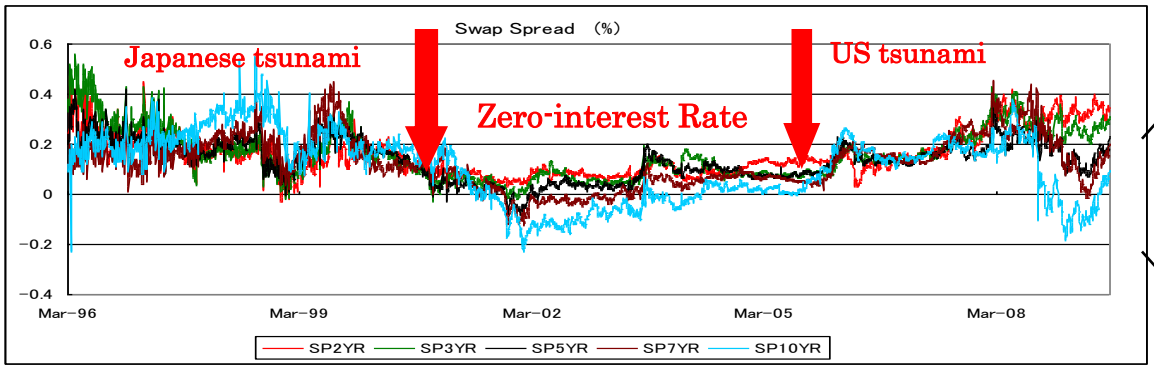
Euro JPY bond spreads



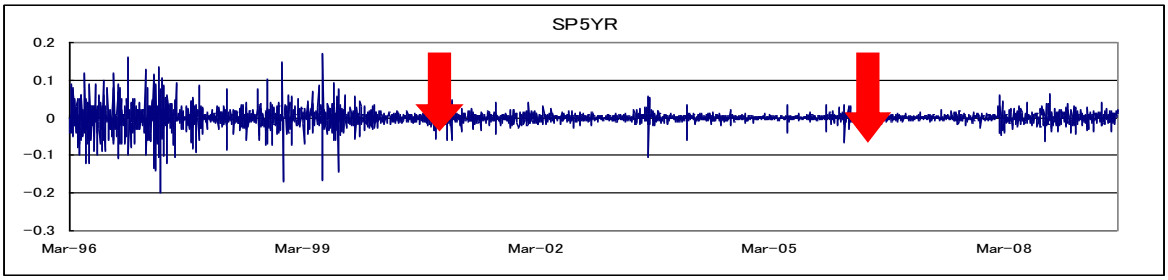
Difference of spread with 5-year maturity



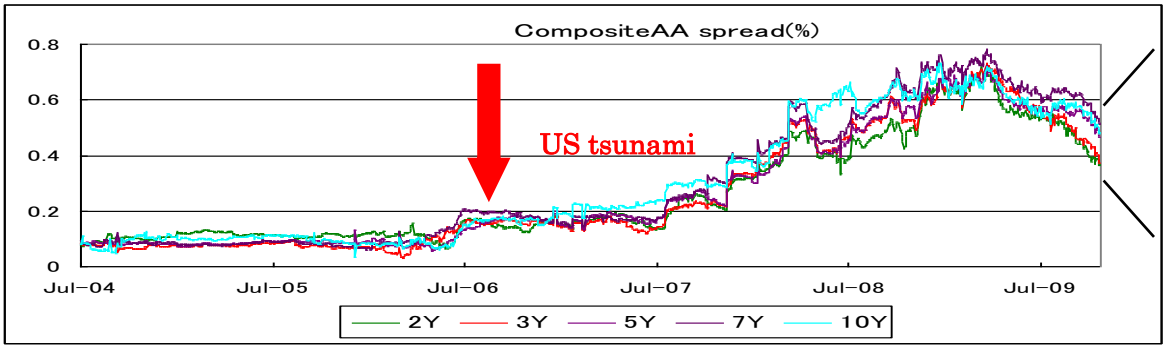
Swap Spreads



Difference of spread with 5-year maturity



Composite AA Spreads



Difference of spread with 5-year maturity

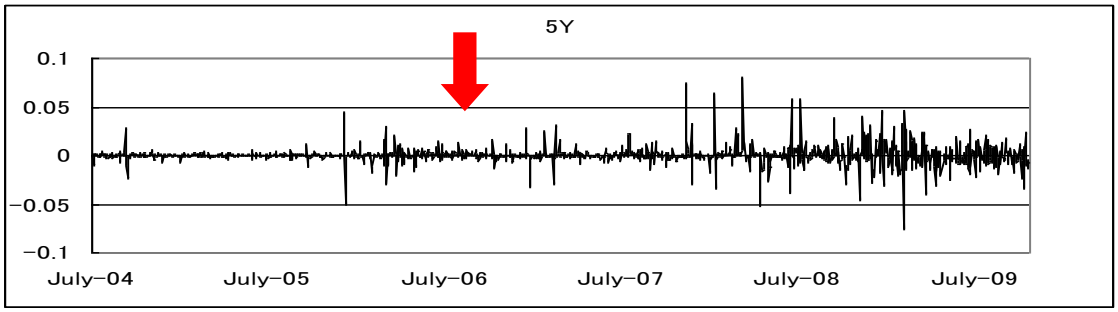


Table 1A. Events around two tsunamis

	Date	Events
1990	Jan.4	**Japanese tsunami happens: the stock price bubble collapses.**
1994	**Dec.1**	**The credit unions began to fail.**
	Dec.9	The government decided to establish a special bank to rescue failed banks.
	Dec.20	The Ministry of Finance announced a decrease in the budget by 2.9% after a 40 year period without any reductions in the budget.
1997	**May 1**	**Small security companies began to fail.**
1999	**Feb. 1**	**The banks began to fail.**
	Feb. 26	The think tank of the prime minister announced the rescue packages.
	Mar. 12	The government injected public money of 7 trillion yen to rescue the big banks.
2001	Apr. 26	Koizumi Cabinet birth
	Dec. 1	**Many private companies began to fail.**
	Dec. 18	Of the companies having special status (Tokushu-hojin, in Japanese), only 17 were abolished and 45 privatized.
2007	**Mar.13**	**The US tsunami happens: the US subprime loan problem appeared by the housing bubble collapse.**
	Jul. 9	Nikkei225 hit 18,261yen after IT bubble collapse at 20,833 yen (April 12,2000)
2008	**Sep. 15.**	**The Lehman Shock (The bankruptcy of Lehman Brothers) prevailed over the world.**
2009	Feb. 1	Industrial Production Index decreases to 69.5 from 110 at May 2008.
	Mar.31	**Most of export companies announced the current account deficits.**
	Sep.16	Hatoyama Cabinet birth
	Dec.9	**Real GDP(Quarterly): -8.9,-5.8,-5.1%. Real Export: -36.5, -29.3, -22.3%**

Table 1B. Chronology of monetary, banking and corporate policies

1999	**Feb. 12**	**Introduction of zero interest rate policy:** Encouragement for overnight call rate to be low to reduce deflation
2000	Aug. 11	Withdrawal of zero interest rate policy
2001	Feb. 13	Reduction in official discount rate to 0.35%
	Mar. 19	**Introduction of new monetary policy framework:** Change in operating target from call rate to current account balance of BOJ, where BOJ changes current account balance until CPI registers zero percent or higher. Raising of current account balance target to 6 trillion yen from 5 trillion yen
	Aug. 14	Reduction in official discount rate to 0.1%
	Sep. 19	Raising of current account balance target to 10–15 trillion yen
2002	**Oct. 30**	**The Program for Financial Revival (PFR) starts. Injected money to banks from government are mainly Grants (19 trillion yen), Purchase of assets (10 trillions),and Capital injection(12 trillions):As of the end of March 2006.**
2004	Jan. 20	Raising of current account balance target to 30–35 trillion yen
2004	**Sep.28**	**Industrial Revitalization Corporation of Japan (IRCJ) purchase bad loans from the 25 big companies approved for assistance from April 2003 until September 2004.**
2006	**Mar. 9**	**Withdrawal of quantitative easing policy** Change in operating target from current account balance to call rate. Retention of zero interest rate policy
	Jul. 14	**Withdrawal of zero interest rate policy.** Raising of overnight call rate to 0.25%
2007	Feb.21	Raising of overnight call rate to 0.5%
2008	Dec.19	Falling of overnight call rate to 0.1%. Official discount rate to 0.3%
2009	**Jan.21**	**Starts of outright purchases of CP**
	Feb.19	**Purchase of corporate bonds with one trillion yen.**

Source: Miyakoshi and Tsukuda (2007) , Miyakoshi (2009), Minutes of the Monetary Policy Meetings in Bank of Japan,. (http://www.boj.or.jp/en/theme/seisaku/mpm_unei/giji/index.htm), Nikkei Kinyu Nenppo (Nikkei Newspaper Company), SNA (Cabinet Office:http://www.cao.go.jp/index-e.html), and the IRCJ at http://www.ircj.co.jp/shien/index.html .
Note: 'Current account balance target' refers to the target for the outstanding balance of the current account at the BOJ

Table 2. Summary Statistics for Daily Change of Risks

Difference of Koushasai Index Spreads for Japan: 9/30/1992–10/9/2009, sample=4103

maturity	mean [a]	t-value(mean=0) [b]	St.dev.	Skewness [a]	Ex-Kurt [a]	$Q^2(12)$ [c]
2-Year	0.116E(-3)	0.177	0.042	-2.46*	77.33*	25.59
3-Year	-0.117E(-3)	-0.170	0.043	-0.23*	12.26*	743.58
5-Year	-0.079E(-3)	-0.103	0.049	-0.09*	8.31*	873.33
7-Year	-0.060E(-3)	-0.070	0.055	0.07	5.64*	1565.62
10-Year	-0.063E(-3)	-0.079	0.051	0.07*	5.41*	1549.45

Difference of Euro JPY Bonds AAA Spreads for the Other Countries: 10/8/1998–11/2/2009, sample=2860

maturity	mean [a]	t-value(mean=0) [b]	St.dev.	Skewness [a]	Ex-Kurt [a]	$Q^2(12)$ [c]
2-Year	0.242E(-3)	0.631	0.021	0.48*	15.71*	367.05
3-Year	0.186E(-3)	0.476	0.021	0.26*	16.86*	463.88
5-Year	0.172E(-3)	0.398	0.023	0.28*	13.05*	448.22
7-Year	0.195E(-3)	0.406	0.026	0.05	9.09*	303.84
10-Year	0.075E(-3)	0.143	0.028	-0.56*	15.14*	219.02

Difference of Japanese Yen Swap Spreads for Japanese Financial Industry: 3/29/1996–9/16/2009, sample=3219

maturity	mean [a]	t-value (mean=0) [b]	St.dev.	Skewness [a]	Ex-Kurt [a]	$Q^2(12)$ [c]
2-Year	0.040E(-3)	0.108	0.021	-0.604*	15.01*	1011.69
3-Year	-0.018E(-3)	-0.048	0.022	-0.637*	17.62*	1196.93
5-Year	0.001E(-3)	0.002	0.022	-0.454*	14.91*	1018.12
7-Year	0.022E(-3)	0.053	0.024	-0.135*	11.66*	1001.76
10-Year	-0.011E(-3)	-0.025	0.025	-1.014*	36.51*	433.36

Difference of Composite Index AA Spreads for Japanese Non–Financial Industry: 7/12/2004–11/2/2009, sample=1361

maturity	mean [a]	t-value (mean=0) [b]	St.dev.	Skewness [a]	Ex-Kurt [a]	$Q^2(12)$ [c]
2-Year	-0.208E(-3)	-0.801	0.010	-1.111*	16.39*	43.69
3-Year	-0.208E(-3)	-0.851	0.009	-1.104*	21.12*	30.00
5-Year	-0.270(-3)	-1.079	0.009	-0.959*	19.25*	39.24
7-Year	-0.312E(-3)	-1.138	0.010	-1.537*	21.77*	23.86
10-Year	-0.292E(-3)	-0.963	0.011	-1.445*	23.94*	21.43

Notes: [a] $E(-x)=10^{-3}$. [b] * Statistically significant at 5% level. [c] Distributed as $\chi 2(12)$ under the null hypothesis of non-serial correlation with lags up to 12. The five per cent critical value is 21.03. JGB=Japanese Government Bond.

Table 3. Japanese Tsunami and the US Tsunami

$$R_t = a + \beta^{+} R^{+}_{t-1} + \beta^{-} R^{-}_{t-1} + \varepsilon_t;\ \log\sigma_t^2 = \alpha_0 + \alpha_1(|z_{t-1}| - E(|z_{t-1}|)) + \alpha_2 z_{t-1} + \alpha_3 \log\sigma_{t-1}^2$$

Bond Spread Difference for Japan

maturity	9/30/1992-3/18/2001: JP Tsunami				3/19/2001-7/14/2006:Zero-interest				7/15/2006 to10/ 9/2009:US Tsunami			
	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3
2-Year	-0.324*	-0.188*	-0.001*	0.966*	-0.068*	-0.726*	-0.002*	0.971*	-0.299*	-0.191*	0.004*	0.999*
	(-6.11)	(-3.26)	(-2.18)	(119.83)	(-2.53)	(-13.03)	(-20.50)	(608.49)	(-9.93)	(-10.80)	(31.63)	(1993)
3-Year	-0.338*	-0.156*	-0.003*	0.957*	-0.268*	-0.527*	0.001*	0.982*	-0.518*	-0.406*	0.001	0.971*
	(-268.24)	(-2.66)	(-2.66)	(61.54)	(-3.39)	(-6.92)	(3.97)	(77.57)	(-6.76)	(-5.85)	(0.78)	(71.24)
5-Year	-0.271*	-0.394*	-0.002*	0.970*	-0.169*	-0.631*	-0.002*	0.820*	-0.434*	-0.438*	-0.001	0.989*
	(-13.31)	(-65.99)	(-3.63)	(127.85)	(-2.57)	(-9.89)	(-2.38)	(26.62)	(-7.00)	(-19.14)	(-1.24)	(1819)
7-Year	-0.334*	- 0.256*	-0.002*	0.966*	-0.328*	-0.530*	-0.004*	0.941*	-0.475	-0.432*	-0.002	0.981*
	(-6.20)	(-4.30)	(-2.47)	(118.16)	(-6.64)	(-7.49)	(-8.11)	(72.19)	(-6.40)	(-5.83)	(-1.42)	(91.08)
10-Year	-0.356*	-0.153*	-0.005	0.926*	-0.337*	-0.427*	-0.005*	0.884*	-0.640*	-0.419*	0.002*	0.988*
	(-7.71)	(-13.93)	(-5.89)	(99.74)	(-6.21)	(-6.26)	(-5.87)	(36.64)	(-9.89)	(-6.52)	(2.63)	(142.21)

Euro JPY Bonds AAA Spread Difference for the other countries

maturity	10/18/1998-3/18/2001:JP Tsunami				3/19/2001-7/14/2006:Zero-interest				7/15/2006-11/2/2009: US Tsunami			
	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3
2-Year	-0.429*	-0.172	-0.007*	0.720*	-0.024	-0.079*	-0.000	0.986*	0.056	-0.639	-0.002*	0.875*
	(-11.80)	(-1.81)	(-5.68)	(15.88)	(-0.11)	(-17.85)	(-1.52)	(206.08)	(30.80)	(-7.13)	(-3.54)	(34.50)
3-Year	-0.103	-0.466*	-0.003*	0.912*	-0.030	-0.183*	-0.000*	0.973*	-0.567*	-0.234*	-0.003*	0.965*
	(-1.17)	(-5.66)	(-3.01)	(32.20)	(-0.53)	(-2.83)	(-2.03)	(110.88)	(-7.47)	(-2.73)	(-8.11)	(79.93)
5-Year	-0.351*	-0.553*	0.002*	0.979*	-0.235*	-0.367*	0.000	0.985*	0.013	-0.245*	0.000	0.993*
	(-4.17)	(-9.14)	(5.10)	(81.67)	(-3.28)	(-6.79)	(0.01)	(109.41)	(0.17)	(-4.15)	(1.87)	(4334)
7-Year	0.059	- 0.507*	-0.003*	0.994*	-0.138*	-0.244*	-0.005	0.977*	-0.012	-0.264*	0.001	0.998*
	(0.84)	(-6.89)	(-16.51)	(920.98)	(-2.16)	(-3.28)	(-1.67)	(174.30)	(-0.16)	(-3.24)	(1.88)	(244.92)
10-Year	-0.301*	-0.394*	-0.002*	0.953*	-0.263*	-0.207*	-0.000	0.955*	0.008	-0.379*	0.000	0.995*
	(-3.75)	(-3.97)	(-4.46)	(670.76)	(-4.11)	(-2.81)	(-1.38)	(79.62)	(0.18)	(-5.00)	(1.48)	(282.94)

Notes: * Statistically significant at 5% level. The number of parentheses is t-values.

Swap Spread Difference for Japanese Financial Industry

maturity	3/29/1996-3/18/2001:JP Tsunami				3/19/2001-7/14/2006:zer-interest				7/15/2006-9/16/2009:US Tsunami			
	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3
2-Year	-0.351*	-0.322*	0.002*	0.956*	-0.252*	0.073	0.000	0.993*	0.120	-0.145	0.001*	0.992*
	(-5.02)	(-4.74)	(3.41)	(83.06)	(-5.51)	(0.96)	(0.62)	(257.12)	(1.27)	(-1.65)	(2.28)	(132.02)
3-Year	-0.519*	-0.128*	0.001	0.976*	-0.163*	-0.074	-0.000	0.989*	-0.000	-0.042	0.001*	0.992*
	(-9.07)	(-2.39)	(0.10)	(167.36)	(-2.36)	(-1.02)	(-0.05)	(258.10)	(-0.00)	(-0.49)	(6.65)	(206.69)
5-Year	-0.337*	-0.168*	0.001*	0.985*	-0.214*	-0.192*	0.000*	0.970*	0.027	-0.084	0.000*	0.980*
	(-5.42)	(-7.22)	(2.41)	(167.79)	(-5.57)	(-3.47)	(5.20)	(618.58)	(1.61)	(-1.07)	(2.38)	(86.31)
7-Year	-0.355*	- 0.378*	0.001	0.960*	-0.360*	-0.181*	-0.000	0.968*	-0.273*	0.098	0.001*	0.967*
	(-7.12)	(-10.61)	(1.49)	(66.83)	(-5.76)	(-11.21)	(-0.50)	(628.04)	(-3.49)	(1.16)	(3.30)	(110.63)
10-Year	-0.281*	-0.197*	0.002*	0.862*	-0.092*	-0.153*	0.000	0.950*	-0.073	0.018	-0.000	0.966*
	(-2.91)	(-2.65)	(2.12)	(21.12)	(-2.93)	(-2.95)	(1.17)	(85.57)	(-0.85)	(0.50)	(-0.30)	(85.12)

Composite AA Spread Difference for Japanese Non–Financial Industry

maturity	3/29/1996-3/18/2001:JP Tsunami				3/19/2001-7/14/2006:zer-interest				7/15/2006-9/16/2009:US Tsunam			
	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3	β^+	β^-	α_2	α_3
2-Year	Data Non				-0.270*	-0.009	0.000*	0.998*	-0.127	-0.112*	0.000*	0.989*
					(-6.86)	(-0.10)	(8.49)	(10540)	(-1.76)	(-2.27)	(2.05)	(367.38)
3-Year	Data Non				-0.674*	0.041	0.000	0.977*	-0.081*	-0.299*	0.000*	0.990*
					(-7.45)	(0.81)	(1.17)	(1549)	(-2.09)	(-3.57)	(6.00)	(501.59)
5-Year	Data Non				0.257*	-0.102*	0.000*	0.642*	-0.200*	-0.155	0.000	0.987*
					(13.19)	(-1.95)	(6.05)	(19.75)	(-2.92)	(-1.84)	(1.60)	(294.46)
7-Year	Data Non				-0.008	0.228	-0.000*	0.994*	-0.127*	-0.135	0.000*	0.995*
					(-0.06)	(0.00)	(-2.28)	(1608)	(-2.77)	(-1.55)	(15.05)	(326.33)
10-Year	Data Non				-0.763*	-0.000	-0.001*	0.900*	-0.141	0.046*	0.000	0.980*
					(-9.96)	(-0.00)	(-3.25)	(55.25)	(-1.68)	(3.14)	(1.50)	(4782)

Notes: * Statistically significant at 5% level. The number of parentheses is t-values.