Japanese Interest Rate Swap Spreads and Monetary Policy in the Framework of VAR ☆

Takayasu　Ito

Summary

This paper investigates the determinants of 2-year, 5-year and 10-year interest rate swap spreads in Japan by considering the difference of monetary policy regimes by the Bank of Japan (BOJ) in the Framework of VAR (Vector Auto Regression). Four determinants of swap spreads – default risk, liquidity premium, the slope of yield curve and volatility - are chosen. Swap spread’s own shocks play a dominant role in the determination of swap spreads in each sample. The slope of yield curve plays an important role for 10- year swap spreads in the period of loosening monetary policy. In the tightening cycle, volatility is a contributor for 10 year swap spread. The default risk is a major contributor only for 5-year swap spread in easing period. On other maturities and samples, default risk is not a determinant of swap spread.

Keywords: Swap Spread, VAR, Monetary Policy

JEL Classifications: E43, E52

☆ The research for this paper is supported by Grant-in Aid for Scientific Research (KAKENHI 9530271) from JSPS.

VAR を用いた日本円金利スワップスプレッドと金融政策の分析

要旨

本稿では日本銀行の金融政策スタンスを考慮に入れて、日本円金利スワップスプレッド（2 年物、5 年物、10 年物）の決定要因を VAR (Vector Auto Regression)を用いて分析する。第 1 期間（標本A、金融緩和期）は 1999 年 2 月 15 日から 2000 年 8 月 11 日である。第 2 期間（標本 B、金融緩和期）は 2001 年 3 月 21 日から 2006 年 3 月 9 月である。第 3 期間（標本 C、金融引き締め期）は 2006 年 3 月 10 日から 2008 年 7 月 31 日である。金融政策の内容をみると、標本 A はゼロ金利政策、標本 B は量的緩和政策、標本 C は量的緩和政策解除後である。スプレッドの決定要因として、倒産リスク、流動性プレミアム、イールドカーブの傾き、ボラティリティーを用いる。スワップスプレッド独自のショックがすべての分析において大きな役割を果たしている。金融緩和期において、イールドカーブの傾きが 10 年物のスプレッドにおいて、重要な役割を果たしている。金融引き締め期においては、ボラティリティーが 10 年物スプレッドの決定要因となっている。倒産リスクは金融緩和期（量的緩和）において、5 年物スプレッドにおいてのみ決定要因となっている。

1.Introduction

This paper investigates the determinants of Japanese interest rate swap spreads in each sub sample by considering monetary policy regimes. Four determinants of swap spreads - corporate bond spread, TED spread, the slope of yield curve and volatility - are chosen. The monetary policy changes tend to exert an impact on financial markets. The asymmetric impacts of monetary policy on interest swap spreads are focused by dividing the whole sample period into three depending on monetary policy regime.

First period is from February 15, 1999 through August 11, 2000. The Bank of Japan (BOJ) adopted the zero interest rate policy to counter deflationary pressure. Second period is from March 21, 2001 through March 9, 2006. The BOJ introduced the quantitative easing policy under deflation caused by bad loan problem and weak domestic demand. Third period is from March 10, 2006 through July 31, 2008.After the BOJ lifted the quantitative easing policy, they hiked uncollateralized call rate twice. In terms of monetary policy regimes, first period and second period are easing, third period is tightening.

An interest rate swap is an agreement between two parties to exchange cash flows in the future. In a typical agreement, two counterparties exchange streams of fixed and floating interest rate payments. Thus fixed interest rate payment can be transformed into floating payment and vice versa. The amount of each floating rate payment is based on a variable rate that has been mutually agreed upon by both counterparties. For example, the floating rate payment could be based on 6 month LIBOR (London Interbank Offered Rate).

The market for interest rate swaps has grown exponentially in the 1990's. According to a survey by BIS (Bank for International Settlements), the notional outstanding volume of transactions of Japanese yen interest rate derivatives amounted to 58,056 billions of US dollars at the end of June 2008[1]. Differences between swap rates and government bond yields of the same maturity are referred to as swap spreads. If the swap and government bond markets are efficiently priced, swap spreads may reveal something about the perception of the systemic risk in the banking sector.

As for the analysis of the interest rate swap spreads in US market, previous studies such as Sun et al (1993), Brown et al (1994), Duffie and Huang (1996), Cossin and Pirotte (1997), Minton (1997),Lang et al (1998), Lekkos and Milas (2001), Fehle (2003), and Huang and Chen (2007) are cited.

[1] Statistics are cited from OTC Derivatives Market Activity in the first half of 2008. At the end of June 1998, the notional outstanding volume of transactions of yen interest rate derivatives was 7,164 billions of US dollars. For details, see BIS (1998) and BIS (2008).

Sun et al (1993) examine the effect of dealers' credit reputations on swap quotations and bid-offer spreads by using quotations from two interest rate swap dealers with different credit ratings (AAA and A). The AAA offer rates are significantly higher than the A offer rates, and the AAA bid rates are significantly lower than the A bid rates. They also document the relation between swap rates and par bond yields estimated from London interbank offered rate (LIBOR) and bid rate (LIBID) data. They identify some of the problems in testing the implications of swap pricing theory.

Duffie and Huang (1996) present a model for valuing claims subject to default by both contracting parties, such as swaps and forwards. With counterparties of different default risk, the promised cash flows of a swap are discounted by a switching discount rate that, at any given state and time, is equal to the discount rate of the counterparty for whom the swap is currently out of the money (that is, a liability). The impact of credit-risk asymmetry and of netting is presented through both theory and numerical examples, which include interest rate and currency swaps.

Brown et al (1994) analyze US swap spreads to find that 1) short- term, 1-, and 3-year swaps are priced differently from longer-term, 5-, 7-, and 10-year swaps; and 2) the pricing dynamics for all five swap maturities changed substantially during the period spanning January 1985 to May 1991. Cossin and Pirotte (1997) conduct empirical analysis on transaction data and show support for the presence of credit risk in swap spreads. Credit ratings appear to be a significant factor affecting swap spreads not only for their pooled sample but for IRS and for CS separately as well. In IRS, the credit rating impact on prices seems to come largely at the detriment of the non-rated companies.

Lang et al (1998) argue that an interest rate swap, as a non-redundant security, creates surplus which will be shared by swap counterparties to compensate their risks in swaps. Analyzing the time series impacts of the changes of risks of swap counterparties on swap spreads, they conclude that both lower and higher rating bond spreads have positive impacts on swap spreads.

Lekkos and Milas (2001) assess the ability of the factors proposed in previous research to account for the stochastic evolution of the term structure of the U.S. and U.K. swap spreads. Using as factor proxies the level, volatility, and slope of the zerocoupon government yield curve as well as the Treasury-bill–London Interbank Offer Rate (LIBOR) spread and the corporate bond spread, they identify a procyclical behavior for the short-maturity U.S. swap spreads and

a countercyclical behavior for longer maturity U.S. swap spreads. Liquidity and corporate bond spreads are also significant, but their importance varies with maturity.

Minton (1997) directly tests the analogy between short-term swaps and Eurodollar strips and finds that fair-value short-term swap rates exist in the Eurodollar future market. However, proxies for differential probability of counterparty default are statistically significant determinants of the difference between OTC swap rates and swap rates derived from Eurodollar futures prices for maturities of three and four years.

Fehle (2003) analyzes 2- year and 5-year swap spreads in 7 countries (US, UK, Japan, Germany, France, Spain and Netherland). They conclude that corporate bond spread, LIBOR spread and slope of the yield curve are components of swap spreads.

Huang and Chen (2007) analyze the asymmetric impacts of various economic shocks on swap spreads under distinct Fed monetary policy regimes. The results indicate that (a) during periods of aggressive interest rate reductions, slope of the Treasury term structure accounts for a sizeable share of the swap spread variance although default shock is also a major player. (b) On the other hand, liquidity premium is the only contributor to the 2-year swap spread variance in monetary tightening cycles. (c) The impact of default risk varies across both monetary cycles and swap maturities. (d) The effect of interest rate volatility is generally more evident in loosening monetary regimes.

On the other hand, the number of previous studies analyzing the market other than US is small. Castagnetti (2004) analyzes the interest rate swap spreads in Germany. Hmano (1997), Eom et al (2000), Ito (2007) focus on the swap spreads in Japanese market. Hamano (1997) focuses not on credit risk but on market factors such as TED spread and finds that swap spreads reflect TED spread and longer term swap spreads are less influenced by TED spread. On the other hand, Eom et al (2000) focuses on the credit risk and concludes that yen swap spread is significantly related to proxies for the long term credit risk factor.

Ito (2007) investigates the determinants of interest rate swap spreads in Japan. Four determinants of swap spreads - TED spread, corporate bond spread, interest rate and the slope of yield curve from July 12, 1995 through January 31, 2005- are chosen. The swap spreads of 2 years through 4 years are mostly influenced by TED spread, interest rate and slope. The swap spread of 5 years is mostly decided by corporate bond spread and slope. The swap spreads of 7 years and 10 years are mostly affected by corporate bond spread. Ito (2009) conducts the analysis of Japanese interest rate swap spreads in different monetary policy regimes by OLS. When monetary policy was tightening, 10 year swap spread decreased in accordance with the increase of corporate bond spread. TED spread contributed to swap spreads positively in all maturities under tightening cycle of the monetary policy. Slope of yield curve contributed more actively to the swap spreads in all maturities in quantitative easing period and to the swap spreads of 5 years, 7 years and 10 years in tightening aspect.

Huang and Chen (2007) is the previous study taking into consideration monetary policy regimes. This paper will be the first one to analyze interest rate swap spreads in Japan in different monetary policy regimes by time series model like VAR. Huang and Chen (2007) analyzes swap spreads of 2 years and 10 years. This paper adds 5 year swap spread for the analysis. This is because Japanese financial institutions actively participate in the 5 year zone of interest rate swap market.

2.Determinants of Swap Spread

2.1 Default Risk

According to Minton (1997), Brown et al (1994), Eom et al (2000), Lekkos and Milas (2001), the default risk in swaps can be proxied with the information from the corporate bond market. Any such proxy is imperfect as mentioned in the previous studies because the characteristics of the swap and corporate bond are not totally comparable. Nevertheless, since swap default spreads are unobservable, the difference between the yield on a portfolio of corporate bonds and the yield on an equivalent government bond can be used as a proxy for the default premium.

2.2Liquidity Premium

For instance, during periods of weak economy, treasury bonds are considered more liquid, and swaps thus command a larger liquidity premium. Liquidity effect may be absent in the aggregate data, but can be arguably pronounced under certain market conditions. Hamano (1997),Minton (1997), Brown et al (1994), Eom et al (2000), Lekkos and Milas (2001) check the influence of TED (LIBOR – T-bill) spread .

Hamano (1997) finds that Japanese yen swap spreads are influenced by TED and their influences get weaker as the maturities of spread get longer from 1992 through 1996. On the other hand Eom et al (2000) find that the influences of TED on Japanese swap spreads get stronger as the maturities of spread get longer from 1990 through 1996.

2.3 Slope of Yield Curve and Volatility

Following the Sorensen and Bollier (1994) framework, in which the slope of the term structure and interest rate volatility determine the value of the option to default, we incorporate these two variables into empirical model. It is notable that the impacts of the yield curve and interest rate volatility on swap spreads may not be symmetrical under various market conditions. For example, due to investors' risk aversion, risk premium may not necessarily be as responsive to the changes in interest rate volatility during periods of little default risk.

Similarly, as Huang and Chen (2007) describes, swap spreads may be more responsive to the shape of yield curve during periods of a steep yield curve due to the "flight to quality" concern. Aggregating time series data over different market conditions, therefore, produces results that are in favor of finding no impact of economic shocks on swap spreads because asymmetrical impacts may cancel out over monetary policy cycles. Eom et al (2000) find that swap spreads are negatively related to the slope of the term structure. Huang and Chen (2007) use slope of yield curve and volatility. They calculate volatility of 2-year US Treasury note by using EGARCH model.

3.Data

A total of more than nine years of daily data ranging from February 15, 1999 through July 31, 2008 are chosen. These data are provided by the Mitsubishi UFJ Securities. Three monetary policy regimes by the BOJ are chosen. The whole sample from February 15, 2000 through July 31, 2008 is divided into three depending upon the monetary policy regimes by the BOJ. First period (Sample A) is from February 15,1999 through August 11, 2000. The BOJ continued the zero interest rate policy during first period. Second period (Sample B) is from March 21, 2001 through March 9, 2006. The BOJ continued the quantitative easing policy during second period.

Third period (Sample C) is from March 10, 2006 through July 31, 2008. The monetary policy was tightening after the BOJ announced the lifting of quantitative easing policy on March 9, 2006. Afterwards the BOJ hiked uncollateralized call rate twice[2]. The period from August 14, 2000 through March 19, 2001 was excluded from the analysis since the daily sample is not long enough for the analysis. In terms of monetary policy, the first and second periods are easing, but the third period is tightening. Variables for the analysis are defined as below.

3.1 Japanese Interest Rate Swap Spread

Japanese interest rate swap rate minus Japanese government bond yield in the corresponding maturity is defined as swap spread. S2 is 2- year swap spread. S5 is 5- year swap spread. S10 is 10- year swap spread.

As for Japanese government bond yield, par rates of Japanese Government Bond (JGB)

[2] The BOJ hiked the target of uncollateralized call rate from 0 % to 0.25 on July 14,2006 and from 0.25 % to 0.5% on February 21,2007.

are used[3]. These par rates for the maturities of 2 years, 5 years and 10 years are calculated by the method mentioned in Adams and Van Deventer (1994) on a daily basis from February 15, 1999 through July 31, 2008. These par rates are provided by the Mitsubishi UFJ Securities.

As for the Japanese interest rate swap market, rates of 2 years, 5 years and 10 years as of 3 pm at Tokyo time are used on a daily basis from February 15, 1999 through July 31, 2008. Bid rates and offer rates are indicated in the market. The swap rates provided by the Mitsubishi UFJ Securities are averages of bid rates and offer rates. The movements of swap spreads in 2 years, 5 years, and 10 years in each sample period are shown in Figure 1. The descriptive statistics of swap spreads in whole sample and in each sample period are provided in Table 1.

In Sample B swap spreads of 5 years and 10 years sometimes became negative. In other words, swap rates sometimes were lower than JGB yields. This phenomenon is peculiar to Japanese interest rate swap market. Japanese banks activated receiving in Japanese Yen Interest Rate Swap market to increase profit[4] in especially from 2001 through 2002. Thus Japanese Interest Rate Swap rates decreased sharply and swap spreads in 5 years and 10 years became negative.

The credit rating of Japanese Government Bond was downgraded a couple times from 2001 through 2003. This increased the risk premium of Japanese Government Bond. Thus the decrease of yield in Japanese Government was smaller in comparison with interest rate swap rate even though the BOJ adopted unprecedented easing policy.

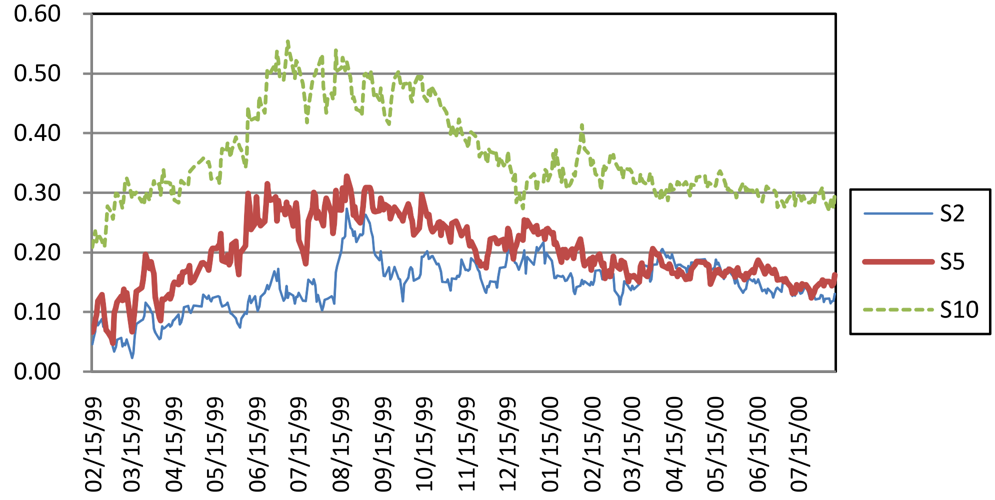
---

3 JGBs are traded on a simple yield. Par rates are compounded yield.

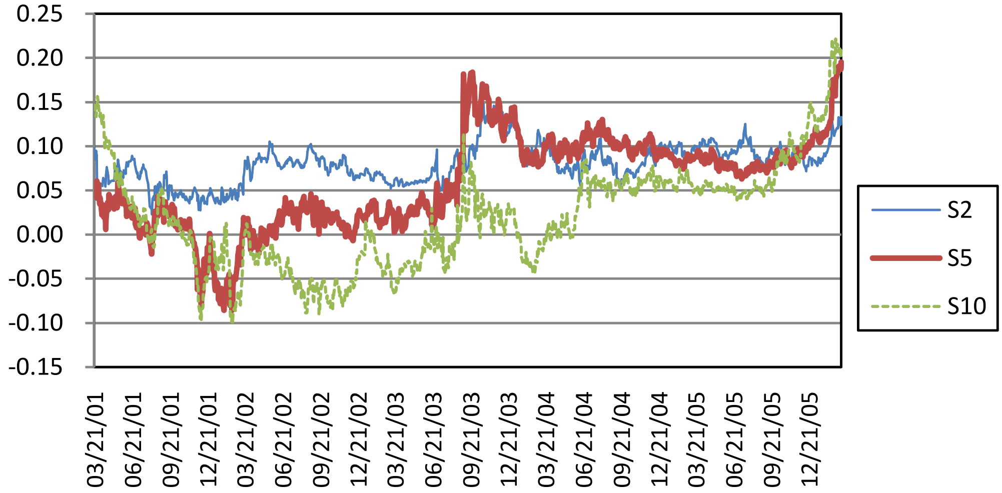
4 The extension of abolishing macro hedge accounting for another year promoted receiving activity. It was abolished on March 31, 2003.

Figure 1 Swap Spreads

% Sample A = from February15, 1999 through August 11,2000.



% Sample B = from March 22, 2001 through March 9, 2006.



% Sample C = from March 10, 2006 through July 31, 2008.

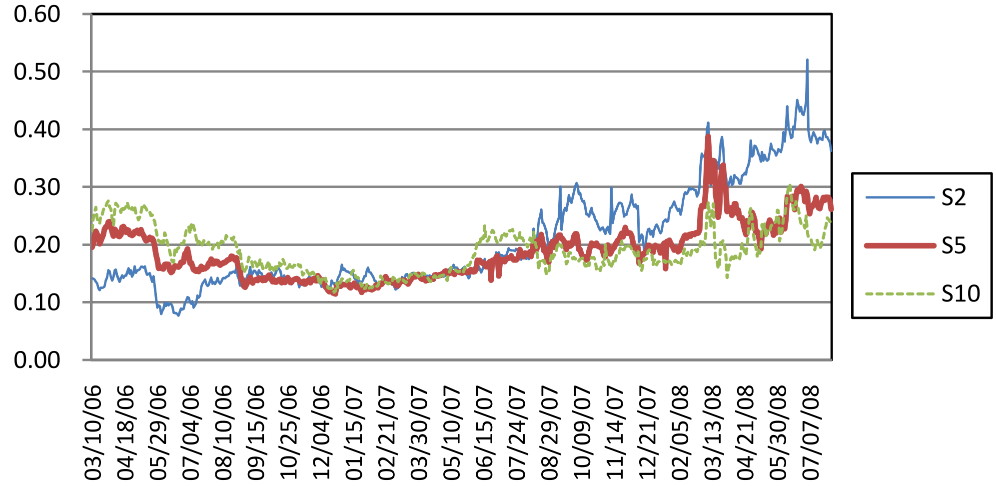


Table 1 Descriptive Statistics of Swap Spreads

Variable	Average	SD	Min	Max	Median
Sample A	n=369				
S2	0.145	0.043	0.023	0.273	0.148
S5	0.199	0.055	0.048	0.328	0.186
S10	0.363	0.078	0.209	0.554	0.336
Sample B	n=1222				
S2	0.080	0.022	0.023	0.148	0.081
S5	0.057	0.052	-0.086	0.191	0.067
S10	0.019	0.059	-0.101	0.221	0.016
Sample C	n=591				
S2	0.207	0.091	0.077	0.521	0.160
S5	0.188	0.049	0.115	0.388	0.180
S10	0.189	0.039	0.117	0.305	0.184

Sample A = from February15, 1999 through August 11,2000.
Sample B = from March 21, 2001 through March 9, 2006.
Sample C = from March 10, 2006 through July 31, 2008.
S2= 2 - year swap spread S5= 5 - year swap spread
S10 = 10 - year swap spread

3.2Determinants of Swap Spread

Default Risk

Default risk is defined as yield spread between 10- year corporate bond issued by the Tokyo Electric Power Company and 10 year JGB par yield. Corporate bond spread is considered to represent credit risk. In Japan corporate bond market is illiquid. Thus 10-year corporate bond issued by the Tokyo Electric Company is the only data available for the analysis. As for the data source the period from February 15,1999 through July 23, 2007 is from Mitsubishi UFJ Securities. The period from July 24, 2007 through July 31, 2008 is provided by Japan Securities Dealers Association (JASDA).

Liquidity Premium

Liquidity premium is defined as TED spread between 6- month TIBOR and 6 month TB (Treasury Bill). TIBOR is provided by the Japanese Bankers Association. TB yields are provided by the Mitsubishi UFJ Securities.

Slope of Yield Curve

Slope of yield curve is defined as the differential between 2 - year and 10 - year JGB par yields as in Huang and Chen (2007). These par rates are provided by the Mitsubishi UFJ Securities.

Volatility

Yield volatility calculated by EGARCH model is defined as volatility[5]. The 2- year JGB par rates provided by the Mitsubishi UFJ Securities are used for the calculation since Huang and Chen (2007) use the 2 year US Treasury note for the calculation of EGARCH volatility.

The descriptive statistics of determinants of swap spreads in each sample period are provided in Table 2.

Table 2 Descriptive Statistics of Determinats of Swap Spreads

Variable	Average	SD	Min	Max	Median
Sample A					
CBS	0.159	0.041	0.044	0.278	0.156
TED	0.157	0.073	0.023	0.404	0.123
SLOPE	1.408	0.115	1.151	1.669	1.401
VOLA	0.081	0.126	0.009	1.367	0.051
Sample B					
CBS	0.092	0.030	0.027	0.203	0.088
TED	0.089	0.011	0.003	0.131	0.088
SLOPE	1.197	0.228	0.417	1.669	1.249
VOLA	0.011	0.020	0.000	0.157	0.004
Sample C					
CBS	0.152	0.047	0.075	0.261	0.150
TED	0.187	0.126	-0.053	0.393	0.154
SLOPE	0.905	0.138	0.666	1.298	0.856
VOLA	0.062	0.050	0.010	0.365	0.048

Sample A = from February15, 1999 through August 11,2000.
Sample B = from March 21, 2001 through March 9, 2006.
Sample C = from March 10, 2006 through July 31, 2008.
CBS=default risk,TED=Liquidity Premium, SLOPE=slope of yield curve
VOLA=volatility

5 See Nelson (1991) as for EGARCH model.

4.Framework of Analysis

Through the analysis of VAR (Vector Auto Regression) model, it's possible to assess the impact of economic factors on swap spreads. As Huang and Chen (2007) describes, the model allows the exogenous variables to have lagged effects on swap spreads, such that many time series data properties are better described. In doing so, instead of estimating each regression equation independently, the VAR permits individual regressions to be estimated within a system where all economic variables are endogenously determined. This point is also important for this analysis of Japanese interest rate swap spreads because many variables are closely and endogenously related to each other. For example, the slope of the yield curve is used as a measurement of economic outlook, but it could also be argued that the slope is a proxy of default risk.

VAR system is written as follows:

$$\begin{pmatrix} y_{1(t)} \\ \vdots \\ y_{5(t)} \end{pmatrix} = \begin{pmatrix} \alpha_{11}(L) & \cdots & \alpha_{15}(L) \\ \vdots & & \\ \alpha_{51}(L) & \cdots & \alpha_{55}(L) \end{pmatrix} \begin{pmatrix} y_{1(t)} \\ \vdots \\ y_{5(t)} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1(t)} \\ \vdots \\ \varepsilon_{5(t)} \end{pmatrix}$$

Here $[y_{1(t)} \cdots y_{5(t)}]'$ is a vector of swap spreads (S2 or S5 or S10), default risk, liquidity premium, slope of yield curve and interest rate volatility. $\alpha_{ij}(L)$ *is* a 5 x 5 matrix of polynomials in the lag operator *L*. $[\varepsilon_{1(t)} \cdots \varepsilon_{5(t)}]'$ is a vector of the corresponding innovation processes with zero mean and a non-diagonal variance-covariance matrix of $\sigma^2\Omega$. The system contains five equations and each one of the five endogenous variables depends on its own lagged values as well as the lagged values of the other four. The optimal lag length is decided by the AIC (Akaike Information Criterion). VAR is supposed to handle stationary data. ALL the data except for interest rate volatility are found to be non- stationary. Thus the first difference of S2, S5, S10, default risk, liquidity premium, slope of yield curve and level data of interest rate volatility are used for the estimation of VAR. After the estimation of VAR, the impacts of economic shocks on swap spreads are investigated by block exogeneity Wald test, variance decompositions and impulse response functions.

5.Result

5.1 Block Exogeneity Wald Test

Table 3 reports whether determinants of swap spreads Granger-cause swap spreads. In Sample A, the causality from liquidity premium on 5 year swap spread and causalities of slope and volatility on 10 year swap spread are confirmed. In Sample B, the causalities of default risk and slope on 5 year and the causalities of liquidity and slope on 10 year swap spread are found. In Sample C, the causality of slope on 5 year swap spread and the causality of volatility on 10 year swap spread are confirmed. In all samples, none of the determinants shows predictive power on 2 year swap spread. The lag lengths decided by AIC in all cases are two. Thus the analysis of prolonged effects of economics shocks on swap spreads are rather limited when the fact is considered that data used in this paper are daily based.

Table 3 Bolck Exogeneity Test

Granger Causality	Chi-sq	Prob	Chi-sq	Prob	Chi-sq	Prob
	Sample A		Sample B		SampleC	
2 year spreads						
CBS→Swap Spread	2.688	0.263	0.776	0.678	3.323	0.190
TED→Swap Spread	0.712	0.701	1.288	0.525	3.267	0.195
SLOPE→Swap Spread	2.575	0.276	3.494	0.174	0.425	0.809
VOLA→Swap Spread	2.989	0.224	4.580	0.101	0.033	0.983
5 year spreads						
CBS→Swap Spread	1.254	0.534	6.891	0.032	1.560	0.450
TED→Swap Spread	4.993	0.082	2.621	0.270	0.110	0.946
SLOPE→Swap Spread	0.231	0.891	18.991	0.000	5.823	0.054
VOLA→Swap Spread	3.874	0.144	4.425	0.109	0.402	0.818
10 year spreads						
CBS→Swap Spread	2.045	0.360	0.722	0.697	0.320	0.852
TED→Swap Spread	1.222	0.543	0.570	0.058	1.233	0.540
SLOPE→Swap Spread	8.899	0.012	23.474	0.000	0.820	0.664
VOLA→Swap Spread	5.340	0.069	0.561	0.756	8.994	0.011

CBS=default risk,TED=Liquidity Premium, SLOPE=slope of yield curve, VOLA=volatility

5.2 Variance Decomposition

Table 4 reports the results of variance decomposition. The variance decomposition method helps gauge the relative contribution of each economic variable to the forecast error variance of swap spreads up to twenty days. In all samples, swap spread's own shock still accounts for more than 97 % of the swap spread variance 20 days after the initial shock except for 10 year swap spread in Sample A. In Sample A 10 year swap spread's own shock accounts for 96 %. The effect of slope in 10 year swap spread explains 2.2% of economic shocks. The impact of liquidity premium contributes to 1.1 % of all economic shocks in 5 year swap spread.

In Sample B slopes of 5 year and 10 year swap spreads explain the economic shocks

1.5% and 1.9 % respectively. The default risk of 5 year swap spread accounts for 0.9% of all shocks. In Sample C slope of 5 year swap spread 0.9 % of economic shocks. The volatility accounts for 1.4 % of all economic shocks in 10 year swap spread.

Table 4 Variance Decomposition

Days ahead	SS	CBS	TED	SLOPE	VOLA
2 year spreads					
Sample A					
5	97.856	0.428	0.235	0.645	0.836
20	97.855	0.428	0.235	0.645	0.837
Sample B					
5	99.126	0.056	0.166	0.327	0.325
20	99.058	0.056	0.172	0.327	0.386
Sample C					
5	98.577	0.771	0.576	0.066	0.010
20	98.576	0.771	0.576	0.064	0.011
5 year spreads					
Sample A					
5	97.647	0.278	1.078	0.151	0.845
20	97.641	0.279	1.079	0.151	0.850
Sample B					
5	97.100	0.934	0.280	1.523	0.162
20	96.886	0.932	0.303	1.522	0.356
Sample C					
5	98.682	0.279	0.041	0.928	0.069
20	98.679	0.278	0.041	0.928	0.071
10 year spreads					
Sample A					
5	96.285	0.976	0.292	2.154	0.294
20	96.067	0.987	0.293	2.156	0.496
Sample B					
5	97.412	0.237	0.478	1.850	0.023
20	97.385	0.237	0.479	1.849	0.049
Sample C					
5	98.005	0.057	0.376	0.127	1.435
20	97.946	0.058	0.377	0.127	1.492

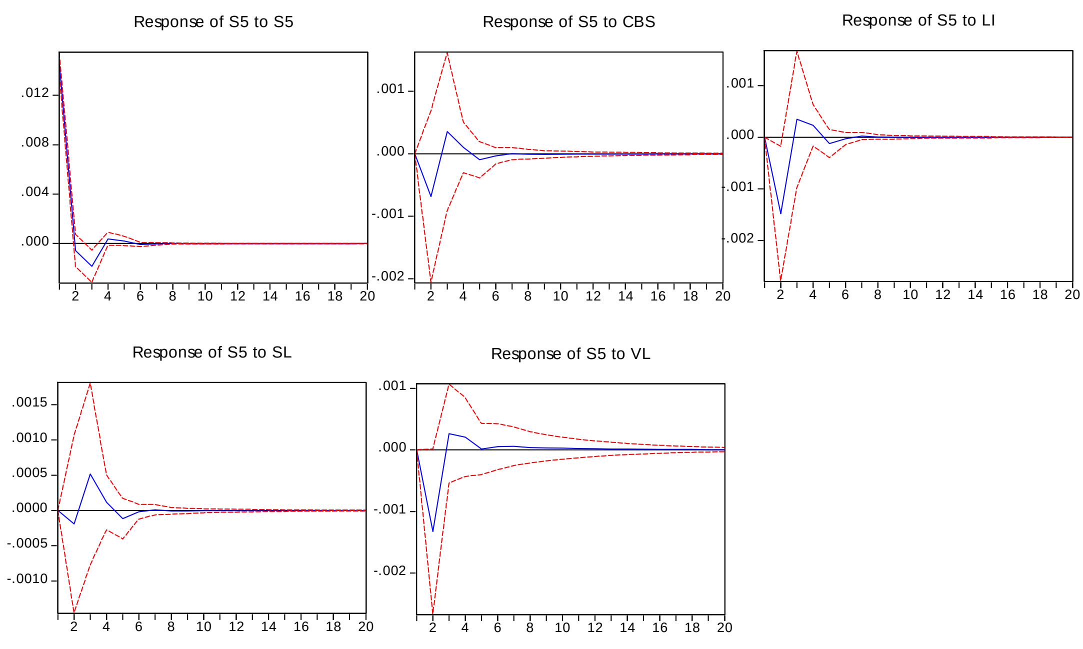
CBS=default risk,TED=Liquidity Premium, SLOPE=slope of yield curve, VOLA=volatility

5.3 Impulse Response Function

Figures 2 through 7 illustrate impulse response functions. Impulse response functions of 2 year spread are omitted here in all samples because impacts of four factors are small in comparison with 5 year and 10 year swap spreads.

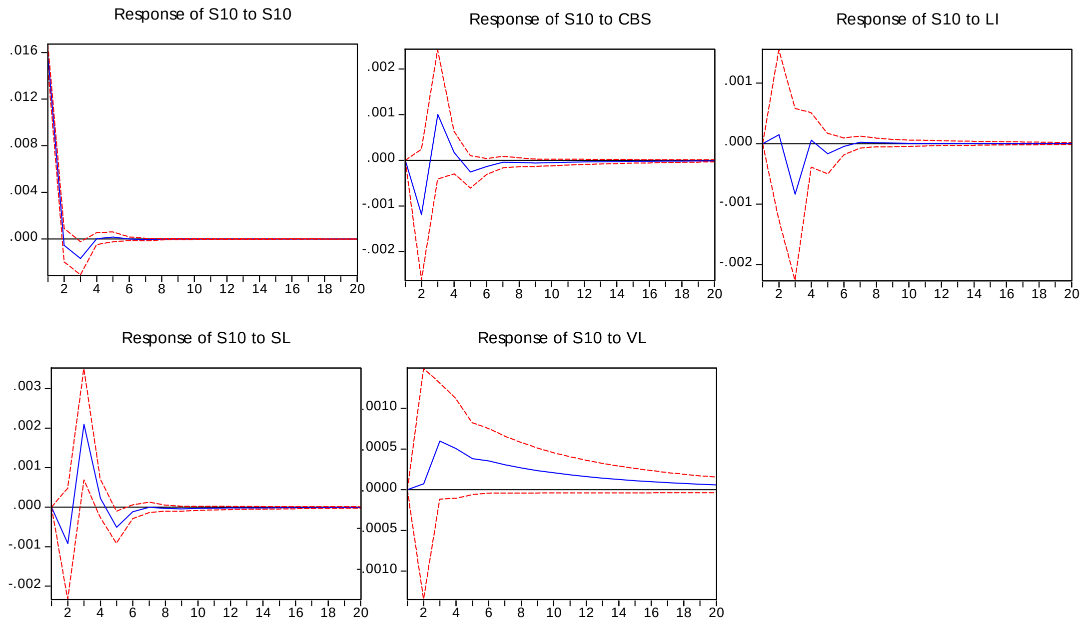
In all samples the initial response of the swap spread to its own innovation is the strongest. In Sample A negative shocks of liquidity premium and volatility contribute to negative response of 5 year spread. The positive shock of slope invokes a positive response of 10 year swap spread. In Sample B the positive shocks of slope contribute to positive response of 5 year and 10 year swap spreads. In Sample C negative shock of slope invokes a negative response of 5 year swap spread. The negative shock of volatility contributes to negative response of 10 year swap spread. This shock is persistent in comparison with other shocks. The result that the initial response of the swap spread to its own innovation is the strongest is consistent with Huang and Chen (2007).

Figure 2 Impulse Response Function 5 year Swap Spread - Sample A



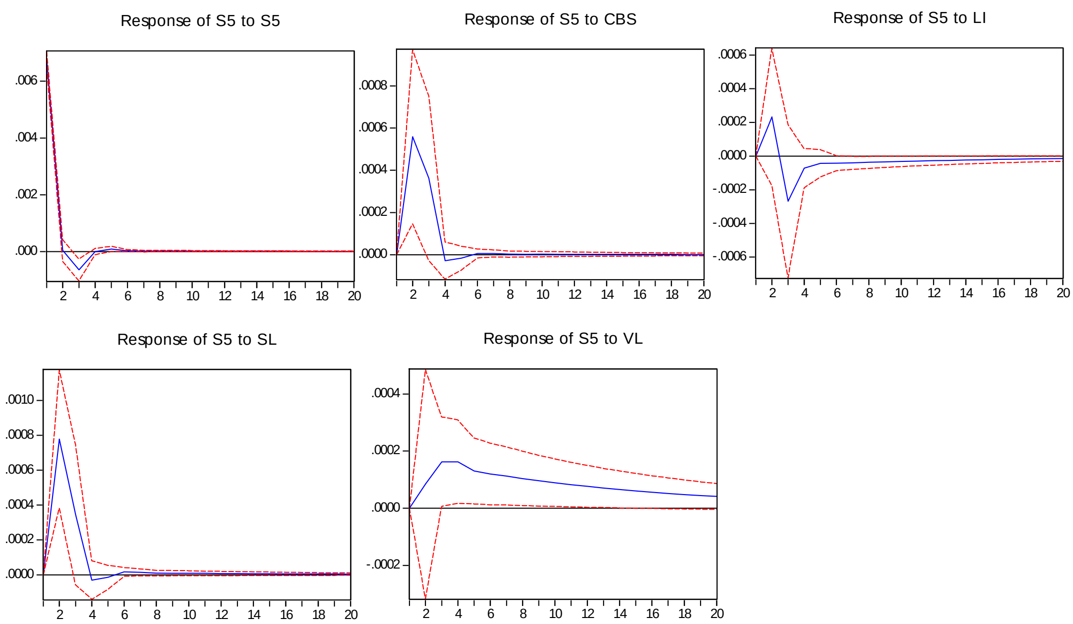
CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

Figure 3 Impulse Response Function 10 year Swap Spread - Sample A



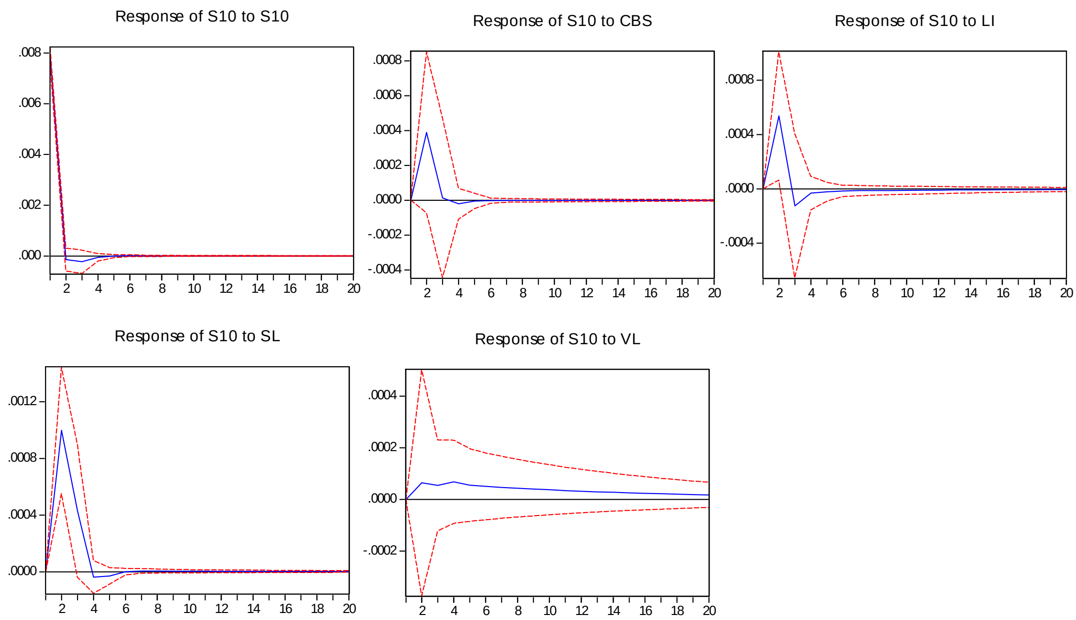
CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

Figure 4 Impulse Response Function 5 year Swap Spread - Sample B



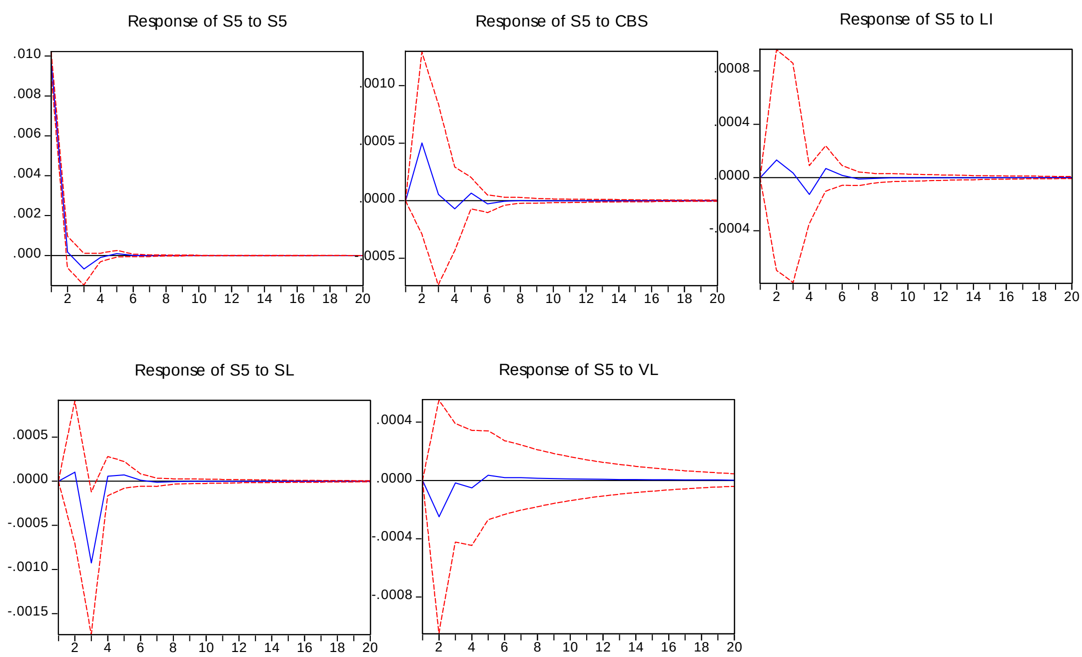
CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

Figure 5　Impulse Response Function 10 year Swap Spread - Sample B



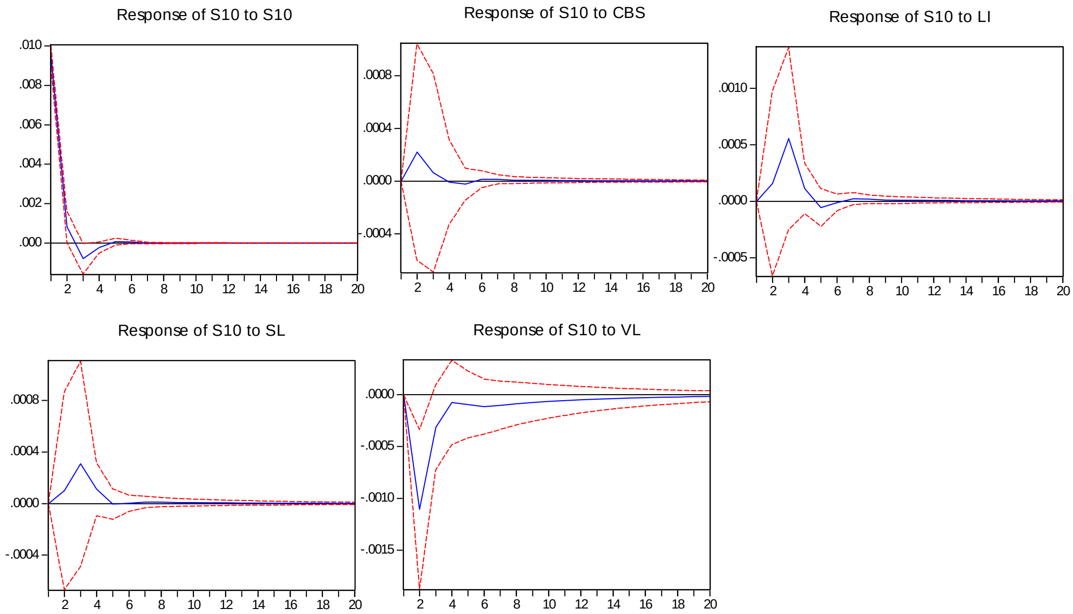
CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

Figure 6　Impulse Response Function 5 year Swap Spread - Sample C



CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

Figure 7 Impulse Response Function 10 year Swap Spread - Sample C



CBS=default risk, LI=Liquidity Premium, SL=slope of yield curve, VL=volatility

6.Concluding Remarks

This paper investigates the determinants of Japanese interest rate swap spreads by considering the difference of monetary policy regimes by the Bank of Japan (BOJ). Four determinants of swap spreads – default risk, liquidity premium, the slope of yield curve and volatility - are chosen. The monetary policy changes tend to exert an impact on financial markets. The asymmetric impacts of monetary policy on interest swap spreads are investigated by dividing the whole sample period into three depending on monetary policy regimes.

First period (Sample A) is from February 15, 1999 through August 11, 2000. Second period (Sample B) is from March 21, 2008 through March 9, 2006. Third period (Sample C) is from March 10, 2006 through July 31, 2007. The BOJ introduced zero interest rate policy in Sample A. They introduced quantitative easing policy in Sample B. They lifted the quantitative easing policy and hiked the target of uncollateralized call rate twice. In terms of monetary policy stance, first period and second period are easing, but third period is tightening.

Four determinants of swap spread give little impact on 2 year swap spread in three sample periods. The default risk is a major contributor only for 5 year swap spread in Sample B. This is because the market participants were cautious of default in 5 year swap transaction where most of the players were Japanese banks suffering from bad loan issue. On other maturities and samples, default risk is not a determinant of swap spread. Thus default risk is considered not to be a major concern. In Sample A the slope of yield curve is a major determinant for 10 year swap spread. In Sample B the slope of yield curve is a major determinant for 5 year and 10 year swap spreads. In Sample C volatility is a main determinant for 10 year swap spread.

In terms of monetary policy, during Sample A, because of the commitment by the BOJ to continue the zero interest rate policy until the deflationary pressure is erased, Japanese long term interest rates decreased. This caused the flattening of yield curve. In this situation the slope of yield curve is a major contributor for 10 year swap spread in Sample A.

The BOJ announced stronger commitment in the quantitative easing policy during Sample B. They announced that the BOJ would continue the quantitative easing policy until the consumer price index (excluding perishables, on a nationwide statistics) registers stably a zero percent or an increase year on year. Japanese banks activated receiving in Japanese Yen Interest Rate Swap market to increase profit especially from 2001 through 2002[6]. Thus Japanese Interest Rate Swap rates decreased sharply and swap spreads in 5 year and 10 year became negative. On the other hand, when the monetary policy change was anticipated, players were hurry in selling Japanese Government Bond market and paying in Japanese Yen Interest Rate Swap market especially in 5 year and 10 year zone. This caused the steepening of the yield curve. In this situation the slope of yield curve is a major contributor for 5 year and 10 year swap spread in Sample B.

In Sample C volatility is a major contributor for 10 year swap spread. After the BOJ lifted the quantitative easing policy, they hiked the uncollateralized call rate twice totaling 0.5%. Policy changes were very moderate. Thus the slope of yield curve did not change as drastically as in Sample A and Sample B. In this sense, volatility is considered to be a major contributor in the changes of 10 year swap spread.

The results of this paper are partially similar to Huang and Chen (2007). I would like to mention similarities for both Japan and US. Swap spread’s own shocks play a dominant role in the determination of swap spreads. The slope of yield curve plays an important role for swap spreads in the period of loosening monetary policy .The major different point is as follows. The role of volatility is totally opposite. In this paper, in the tightening cycle, volatility is a contributor for 10 year swap spread. On the other hand, volatility is more visible in the analysis of 2 year swap spread in US in loosening monetary cycle.

---

[6] The extension of abolishing macro hedge accounting for another year promoted receiving activity. It was abolished on March 31, 2003.

References

Adams,K.J. and Van Deventer,D.R. (1994) Fitting yield curves and forward rate curves with maximum smoothness, *Journal of Fixed Income*,June,52-62.

Bank for International Settlements (1998) *Global OTC derivatives market at the end of June 1998.*

Bank for International Settlements (2008) *OTC derivatives market activity in the first half of 2008.*

Brown,K., Harlow,W. and Smith,D.J. (1994) An empirical analysis of interest rate swap spreads, *Journal of Fixed Income*, March,61-78.

Castagnetti,C. (2004) Estimating the risk premium of swap spreads. Two econometric GARCH-based techniques, *Applied Financial Economics*,14,93-104.

Cossin,D. and Pirotte,H. (1997) Swap credit risk : an empirical investigation on transaction data, *Journal of Banking & Finance*,21,1351-1373.

Duffie,D. and Huang,M. (1996) Swap rates and credit quality, *Journal of Finance*, 51, 921-949.

Eom,Y.H. Subrahmanyam,M.G. and Uno,J. (2000) Credit risk and the yen interest rate swap market *Unpublished manuscript, Stern business School, New York.*

Fehle,F. (2003) The components of interest rate swap spreads: theory and international evidence, *Journal of Futures Markets*,23, 347−387.

Hamano,M. (1997) Empirical study of the yen interest rate swap spread, *Gendai Finance (Modern Finance)*,1,55-67.

Huang,Y. and Chen.C.R. (2007) The effect of Fed monetary policy regimes on the US interest rate swap spreads, *Review of Financial Economics*, 16, 375–399.

Ito,T. (2007) The analysis of interest rate swap spreads in Japan, *Applied Financial Economics Letters*,Vol.3, pp.1-4.

Ito,T.(2009) The Japanese interest rate swap spreads under different monetary policy regimes, *Icfai Journal of Applied Finance, forthcoming.*

Lang,L.H.P., Lizenberger,R.H., and Liu,L.A. (1998) Determinants of interest rate swap spreads, *Journal of Banking and Finance*,22,1507-1532.

Lekkos,I. and Milas,C. (2001) Identifying the factors that affect interest rate swap spreads: some evidence from the United States and the United Kingdom, *Journal of Futures Markets*, 21,737-768.

Minton,B.A. (1997) An empirical examination of basic valuation models for plain vanilla U.S. interest rate swaps, *Journal of Financial Economics*,44,251-277.

Nelson,D.(1991) Conditional heteroskedasticity in asset returns: A newapproach', *Econometrica,* 59, 347–70.

Sorensen,E.H. and Bollier,T.F. (1994) Pricing swap default risk, *Financial Analysts Journal*, 50, 23-33.

Sun,T., Sundaresan, S. and Wang, C. (1993), Interest rate swaps : an empirical investigation, *Journal of Financial Economics*,34,77-99.