

Pricing in the Japanese Bond Markets*

---Using asset swap spreads to identify relative-value of fixed-income---

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Abstract

Both in the theoretical and applied literature of finance the difference in yield-to-maturity between corporate bonds and government bonds has been used as a measure of the risk of the former over the latter. While this approach has sometimes provided interesting results, the usefulness of yield spreads is lessened by ignoring the term structure of interest rate.

This paper presents an alternative measure, “Asset swap spread”, use asset swaps to convert fixed income cash flows to floaters which refer LIBOR plus spread as index coupon rate. This spreads show much broader characteristics as well as riskiness of each corporate and government bonds. Effectively by using the swap curve to create a set of equal and opposite fixed-rate cash flows, we create a synthetic floating rate note (FRN) with an index coupon rate. Moreover, this value is now being captured through the trading of bond asset swap packages.

Based on these ideas,

- We provide an introduction to government and corporate bond asset swaps, explaining their basic mechanics
- The use of asset swap spreads in identifying and capturing relative value is discussed
- The market drivers of asset swaps spreads are examined

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1 Introduction

In recent years Japanese bond markets, as a whole, expanding in its volume of transaction, and its variety. The Japanese Government Bonds (JGBs) are issued in various maturities, just from two types of long-term bonds: 10YRs and 20YRs in maturity, to more long and mid term maturities. Also corporate straight bonds began to have their varieties. In this paper, we investigate how the Japanese bonds are priced in the relative-value view, from the estimation of “asset swap spread”.

Asset swaps are ideal for expressing relative-value views. The matching of fixed-rate cash flows limits exposure to the overall level of interest rates and incorporates coupon effects. Furthermore, both positions will roll down the curve at the same rate, limiting exposure to curve shape. At any point the NPV of the asset swap package will be determined by cost of unwinding the swap and selling the bond - a value driven by the yield spread between bonds and swaps and termed the asset swap spread of the bond.

For the reason above, practitioners commonly use the asset swap spreads for the analysis of bond markets, there are few articles to investigate the pricing of bond markets using the asset swap spreads. Tonge, D. (2001) estimated asset swap spreads and main driver for them, and tried to apply for CEEMEA Fixed Income Strategy. For the Japanese markets¹, Ieda and Ohba (1998) estimated the asset swap spreads in the Japanese straight corporate bond markets from May 1997 to Mar 1998, and investigate the factors which mostly affect the spreads. They found the years to maturity, coupon rates, and the credit ratings are the major determinants to the spreads. Takahashi (1999) investigated the asset swap spreads for the JGB market.

Swap spreads, showing the quoted spreads of the yields on government bonds, mainly T-notes, and the interest rate swaps are widely investigated. Grinblatt (2001) attributes the swap spread to the liquidity difference between Treasury bonds and Eurodollar borrowings. Longstaff and Schwartz (1995), Duffie and Huang (1996), Lekkos and Milas (2001), Blanco, et al. (2005), In, Brown and Fang (2003), and Afonso and Strauch (2007) model swap spreads as a risk premium to compensate swap counterparties for various risks. Their results were supported by the empirical tests. However, Lekkos and Milas (2001) have noted that the impact from changes in the term structure on swap spreads is not uniform across swap maturities. Huang and Chen (2007) find that liquidity premium is the only contributor to the 2-year swap spread variance in monetary tightening cycles, and the impact of default risk varies across both

¹ Asset swap spreads in Japanese markets are mostly called “LIBOR spreads”. Ieda and Ohba (1998) and Takahashi(1999) are the examples.

monetary cycles and swap maturities. They have analyzed whether the relative importance of these determinants and consequently the swap spreads generating process vary according to the different monetary policy regimes in the USA.

For the Japanese market so far except for a few recent studies by Eom, et al. (2000), Eom, et al. (2002), Fehle(2003) and Huang et al. (2008). These authors examined the determinants of the Japanese swap spreads and provided empirical evidence that some risk factors such as default risk of counterparty, interest rate volatility, liquidity risk of LIBOR and slope of term structure affects the swap spreads depending on the length to maturity of the swap contract and the sample periods they analyze. The Japanese economy has experienced two major financial crises of the “Lost Decade of Japan” originated by the stock prices bubble collapse from 1990 to 2001 and the global financial crisis initiated by subprime loan problem from 2007, in the last two decades. The monetary policy and market condition in Japan are very different among the regimes of the pre-zero-interest-rate period, the zero-interest-rate period and the post-zero-interest-rate period. However, neither Eom et al. (2000) nor Fehle (2003) investigated the effects of regime changes on the determinants of swap spreads. Only Huang et al. (2008) explicitly analyzed the effects of regime changes by applying a smooth transition vector autoregressive model. Moreover their study only used the sample data up to 2005 and did not deal with the sample period of global financial crisis. Shimada et al (2010) investigated three risk factors which have been taken as determinants of swap spreads on the Japanese markets and compare the relative importance of factors between the three different regimes of Lost Decade of Japan, zero-interest rate period and global financial crisis classified by the Japanese economic condition. They apply a standard static regression model with the GARCH error terms as well as an alternative regression model which allows the coefficients possibly change along with time.

This paper is broken into following sections. In section2 we take a brief look at the Japanese secondary bond markets from its transaction data. We also investigate the interest rate swap market in Japan. Section3 reviews the mechanics of a bond asset swap, and studies the use of asset swaps in identifying and capturing relative value. Section5 interpreting the asset swap spread (2004--2009), and analyzes factors that influence asset swap spreads. Finally, section5 summarizes our conclusions.

2 Japanese bond markets

Just take a brief look at Japanese bond OTC markets, from the “Reference Statistical Prices [Yields] for OTC Bond Transactions” published by the Japan

Securities Dealers Association for the bond trading data². Figure 1 shows the variety of fixed income traded in the OTC markets, from Dec 1998 to Nov. 2005. Every figures are denominated in 100million yen, left axis for JGB and right axis for other fixed-incomes.

<Figure 1>

This figure shows the trading volume is expanding in this period, showing a little cyclical movement. Figure 2 shows the components of JGB sales. This figure shows long-term JGB has the biggest trade volume, and sales in mid-term JGB is growing dramatically, and also short-term JGB is also growing rapidly.

<Figure 2>

Next, we can see the annual trading share 1 year from Dec. 2004 in Figure 3. This chart shows that the share of JGB in fixed income trading is the biggest and other securities are traded under 10%. Trading in corporate bonds is growing, but still the trades are mostly concentrated to JGB.

<Figure 3>

We also show the other public bonds in Figure 4. This is also supporting that the share of JGB is extraordinary big, and in the JGB trading, long-term bonds have the largest share.

<Figure 4>

The market for interest rate derivatives, in general, and for swaps, in particular, has grown exponentially in the last decade. Recent estimates indicate that in the notional outstanding volume of transactions of privately negotiated (over-the-counter) derivatives at the end of December 2007, the total notional amount of interest rate swaps outstanding amounted to \$310trillion from that of \$29 trillion at the end of 1997³.

Among the major players, Japanese yen interest rate swap plays a pivotal role in the global interest rate derivatives market. It amounts to an average of 17% of the total

² From the website of Japan Securities Dealers Association
<http://www.jsda.or.jp/html/toukei/index.html>

³ At that period, All counterparties (net)Notional amounts outstanding is Euro 119, US dollar 96, Japanese yen, 49, Pound sterling 23 (in millions of US dollars). And interest rate swap market share by currency is Euro 40%, USD 34%, Yen 17% and Pound sterling 8%. Source: BIS(2009) OTC derivatives market activity in the second half of 2008

outstanding interest rate derivatives worldwide. Given the importance of the yen in international trade and finance, it is not surprising that yen interest rate swaps form a substantial proportion of this volume, next to those denominated in US dollars. The expansion in the Japanese yen interest rate swap speaks for the importance of understanding the yen swap pricing mechanism.

Interest rate swaps are sometimes quoted at a margin or spread above the government bond nearest in maturity to the final date of the swap. This is because the government bonds are often used as a partial hedge for mismatched swap portfolios or books. But in JPY swaps, we have the different quotation system. Interest rate swaps in Japan are not quoted by spread, but are quoted by absolute level. This is partly because of the historical background of JPY interest rate swaps.

In mid 1980's interest rate swap in Japan has launched. Many Japanese banks started to run Swap desks, to hedge their swap position. In 1986, a US bank started market make of the interest rate swaps in the Japanese market. At that time, JGB was thought to be "kinky" market. Transactions are concentrated on "benchmark issue"(*shihyo meigara*), arbitrages were insufficient. For these reasons, the Japanese interest rate swap rates, not the JGB rate, plays as a reference rate for mid to long term transaction, quotation was not based spreads over JGB yields. The situation began to change in late 1990's. The financial deregulation accelerates, and the Ministry of Finance came to issue JGB of various varieties in maturity. Trades dispersed, and the arbitrage became active and the role of the "benchmark issue" was over by the end of March 1999.

3 Relative-value analysis using asset swaps

3.1 Asset swap spreads

The essence of relative-value analysis is replication of cash flows at cheaper cost - usually by taking "basis risk". This contrasts with yield curve analysis that is centered on the valuation of mismatched cash flows. Asset swaps are ideal for relative-value analysis of government bonds because the process of constructing a synthetic FRN creates a level playing field.

- For government bonds there are no variations in credit risk
- By replicating bond's fixed cash flows with swaps, we hedge mismatches in
 - coupon
 - interest-rate duration (directional risk)
 - curve exposure
- The asset swap package can be transacted

The price of the complete package and the notional are fixed at par. Typically there will be an up-front exchange of cash flows to compensate for the non-par price of the

bond. Par asset swap packages are transacted more commonly than any other asset swap. In this case, synthetic FRN cash flow will be that of <Figure 5>.

<Figure 5>

In Figure 5, $l_{i,j} = 100(L_{i,j} + \alpha_i) \frac{t_{i,j} - t_{i,j-1}}{360}$

This synthetic FRN will contain the package of underlying bond and asset swap, which pays index rate (LIBOR plus spread) and receive the equivalent amount of cash flow to the coupon payment. This will be realized by the asset swap trade shown in Figure 6. And net present value: NPV of an asset swap cash flow should satisfy the following equation⁴.

<Figure 6>

$$\frac{C_i}{2} \sum_{j=1}^n d(t_{i,j}) + 100 = 100 \sum_{j=1}^n (L_{i,j} + \alpha_i) \cdot \frac{t_{i,j} - t_{i,j-1}}{360} \cdot d(t_{i,j}) + (P_i + A_i) \quad (1)$$

Thus asset swap spread of bond i α_i can be estimated using the following equation⁵.

$$\alpha_i = \frac{\frac{C_i}{2} \sum_{j=1}^n d(t_{i,j}) + 100 - (P_i + A_i) - 100\{1 - d(t_{i,n})\}}{100 \sum_{j=1}^n \frac{t_{i,j} - t_{i,j-1}}{360} \cdot d(t_{i,j})} \quad (2)$$

The asset swap spreads estimated by the equation above indicate a relative value of bonds by showing the return from investment on the bonds. If the asset swap spreads are high, the returns on investments are high, so the relative values of the bonds are

⁴ Symbols in equation(1) represent;

n : number of coupon payment to maturity of bond i

$t_{i,j}$: number of days at the j th coupon ($j = 1, 2, \dots, n$) of bond i

C_i : coupon payment of bond i

$d(t)$: discount factor at t

P_i : clean price of bond i (at face value ¥100)

A_i : accrued interest rate of bond i

$L_{i,j}$: LIBOR index at the period of $[t_{j-1}, t_{j-1}]$ which corresponds to the cash flow of bond i

α_i : asset swap spread of bond i

⁵ Asset swap spread in equation (2) shows in the decimal numbers. Most practitioners show the spreads in basis point (bp = 0.01%), and we also follow this customs multiplying the result from equation (2) by 10000.

low.

3.2 Data and estimation

We estimated the asset swap spreads in the Japanese bond markets on 20th of every month (in case of holidays, the following business day) from January 2004 to December 2009, using the following data:

- “Reference Statistical Prices [Yields] for OTC Bond Transactions” Published by the Japan Securities Dealers Association for the bond trading data.
- BBA LIBOR and TSR for the JPY money market and interest rate swap trading data to estimate the swap curve (discount factor for the JPY cash flows) ⁶.
- Credit rating published by JCR and R&I⁷.

4 Main driver for fluctuations

4.1 Visual inspections

Figure 7 shows asset swap spreads for the period of Jan 2004 to Dec 2005. Horizontal axis is in the years to maturity (Years) and vertical axis is the asset swap spreads (bps), and shows asset swap spreads of every individual bonds. We also show these spreads separately by date and credit rating. For the asset swap spreads on 20 Jan 2004, we show separately by the credit rating from Figure 8 to Figure 18. On 20 Dec 2004, from Figure 19 to Figure 29, on 20 Jan 2005 from Figure 30 to Figure 40, respectively. Figure 41 to Figure 43 shows the time series movement of average asset swap spread for each credit rating.

<Figure 8> to <Figure 43>

These figures show that if the ratings become lower, asset swap spreads seem to be higher and its volatility also be higher.

4.2 Regression analysis

We try to investigate the drivers for the asset swap spreads by cross sectional regression more precisely. The drivers we thought were years to maturity (YR), current yield (CY), and credit rating. We used dummy variable for each credit including + or – sub-notches. As we mentioned earlier, when the years to maturity became longer, the credit for bonds might be lower, so the investors need higher return i.e. higher asset swap spreads, because the probability to default will be higher, if other things are being

⁶ BBA stands for British Bankers Association and TSR for Tokyo Swap Reference Rate. We estimated the JPY discount factor from the real cash flow data, using linear interpolation estimation method for market data and discount factors. See Takahashi[2002] for the details of the estimation method.

⁷ The results are shown only those that has BBB–(2004-2005) or BB+(2008-2009) or higher ratings.

equal. This will lead the coefficient for YR positive. Current yield shows the rate of coupon return from bond investments, coupon payment divided by the market price of the bonds. Usually, coupon payment will set higher for the lower grade bonds issued in the same period, current yields tend to be higher. And lower credit bonds will have higher asset swap spreads, the coefficient for CY will be positive. Credit ratings are, of course, shows directly the default level. This will lead the coefficient for credit rating dummy will be positive.

Table 1 to Table 3 show the regression results, denoting the significance of 5% level by the shadowed cells (pinks are the same direction, and grays are opposite direction to our expectation.). Looking into the results shown in these table, we found that those of 2005-2006 are quite different from 2008-2009. Table 2 show the coefficients of CY are not significant or significantly negative, except Aug, Sep, Oct, Dec 2007, contrary to our expectation. These results may show that the “current yield preference” of Japanese investors, especially institutional investors, was not prevailing any more. Other coefficients are all significant and the directions of effect form drivers are as we expected. The negative signs of constant show the base asset swap spreads, i.e. those of JGB with zero year to maturity, are negative. This is quite familiar for the government bond markets. Positive YR and Credit rating dummy coefficients are showing that the graphs in year to maturity and spreads are positively sloped and shifted upward by the rating get low.

Looking at the Table 1 to Table 3, we see the adjusted R^2 decreased dramatically, and coefficients of YR and credit ratings became insignificant or even negative and significant which are inconsistent to the theory. Many CY coefficients became positive and significant.

<Table 1>

<Table 2 >

<Table 3>

5 Concluding remarks

In this paper we provide an introduction to government and corporate bond asset swaps, explaining their basic mechanics and use the asset swap spreads in identifying and capturing relative value. Visually inspected by the average asset swap spreads in each credit rating, their trends show that the low credit ratings tend to be high spreads. This is quite a normally expected result.

After that the market drivers of asset swaps spreads are examined. The years to

maturities, current yields, and credit rating (in dummy variables) are used as a dependent variables in cross-sectional regressions. The result coefficients are quite different between 2005-2006 and 2008-2009.

In 2005-2006 results, years to maturities are positive and significant in all periods, as we expected. And those of current yields are positive and significant only on Jan and Feb 2004 and Dec 2005. These results may show that the “current yield preference” of Japanese investors, especially institutional investors, was not prevailing any more. Other coefficients are all significant and the directions of effect from drivers are as we expected. Credit ratings affected positive and significant to the asset swap spreads. The negative signs of constant show the base asset swap spreads, i.e. those of JGB with zero year to maturity, are negative. This is quite familiar for the government bond markets. Positive YR and Credit rating dummy coefficients are showing that the graphs in year to maturity and spreads are positively sloped and shifted upward by the rating get low.

For the estimated coefficients of 2008-2009, we see the adjusted R^2 decreased dramatically, and coefficients of YR and credit ratings became insignificant or even negative and significant which are inconsistent to the theory. Many CY coefficients became positive and significant.

We make an investigation to the markets as a whole in this paper. Looking much closer, we can find interesting sub-groups in each credit rating groups, especially in the low grade. This could be an interesting source of arbitrage and should be investigated carefully. These are for our future research topics.

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Figures and Tables

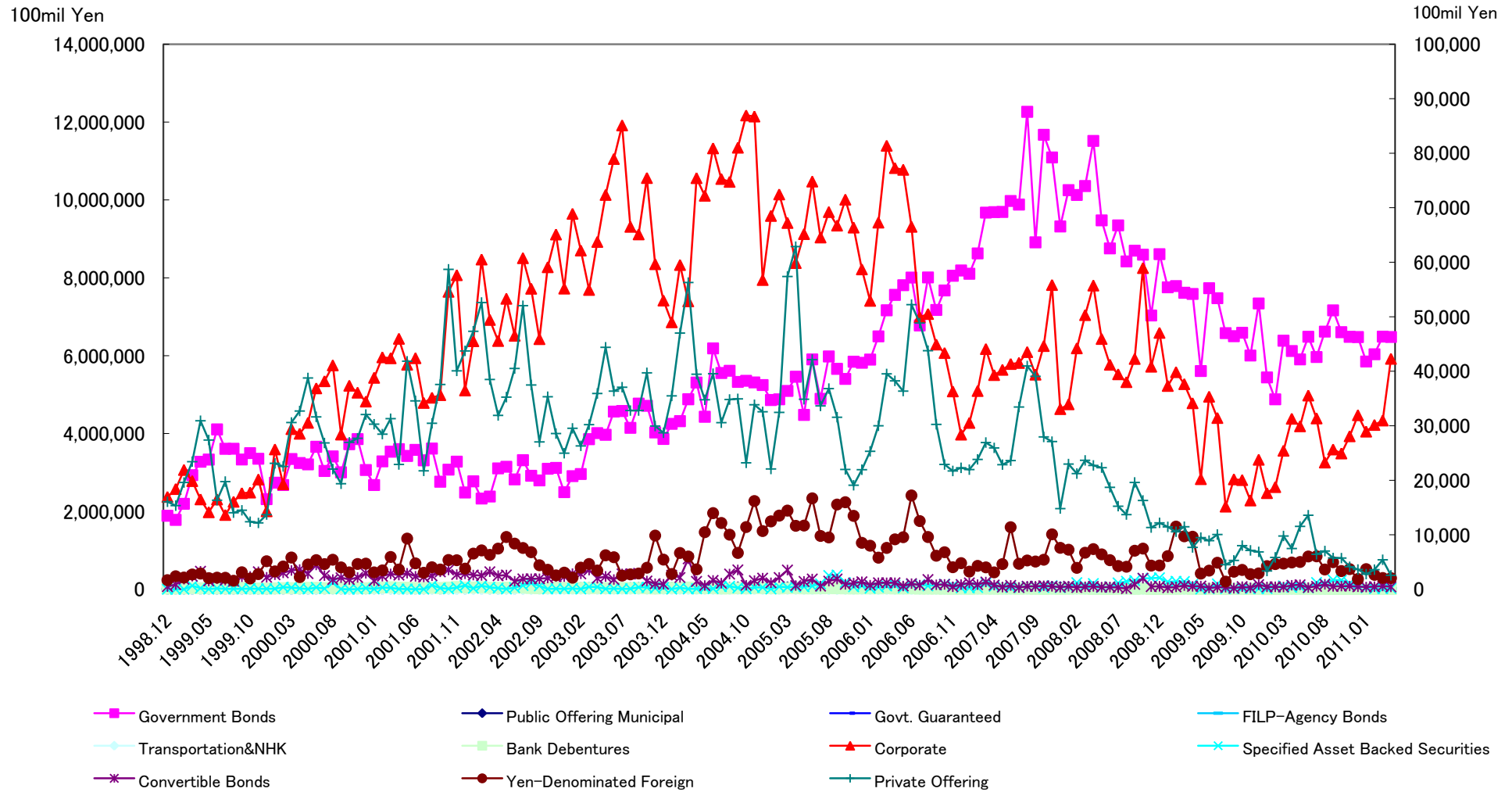


Figure 1 Trading Volume of Over-the-Counter Bonds

source : The Japan securities dealers association <http://www.jsda.or.jp/html/toukei/index.html>

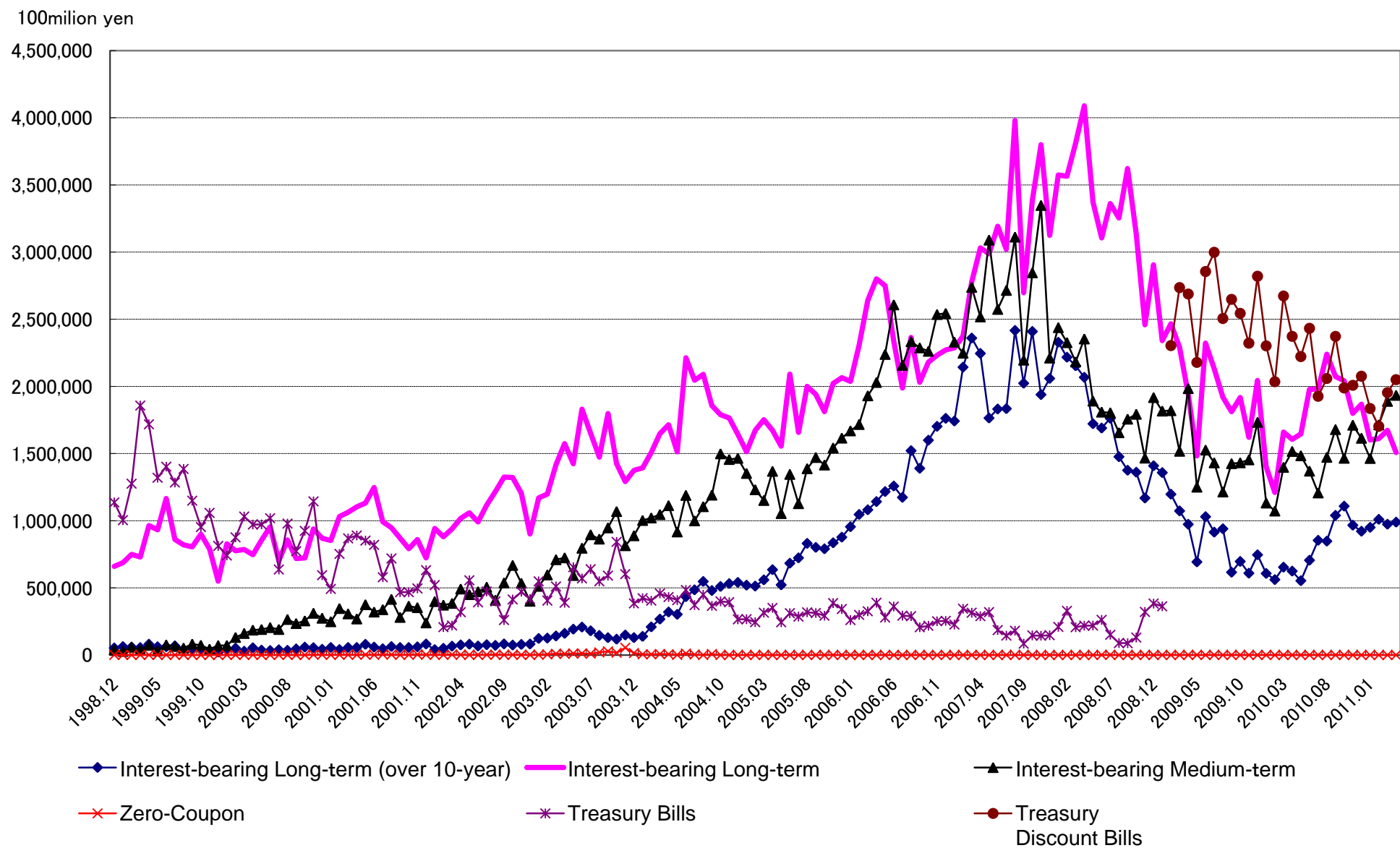


Figure 2 Share of JGB in the trade of bond markets

source : The Japan securities dealers association <http://www.jsda.or.jp/html/toukei/index.html>

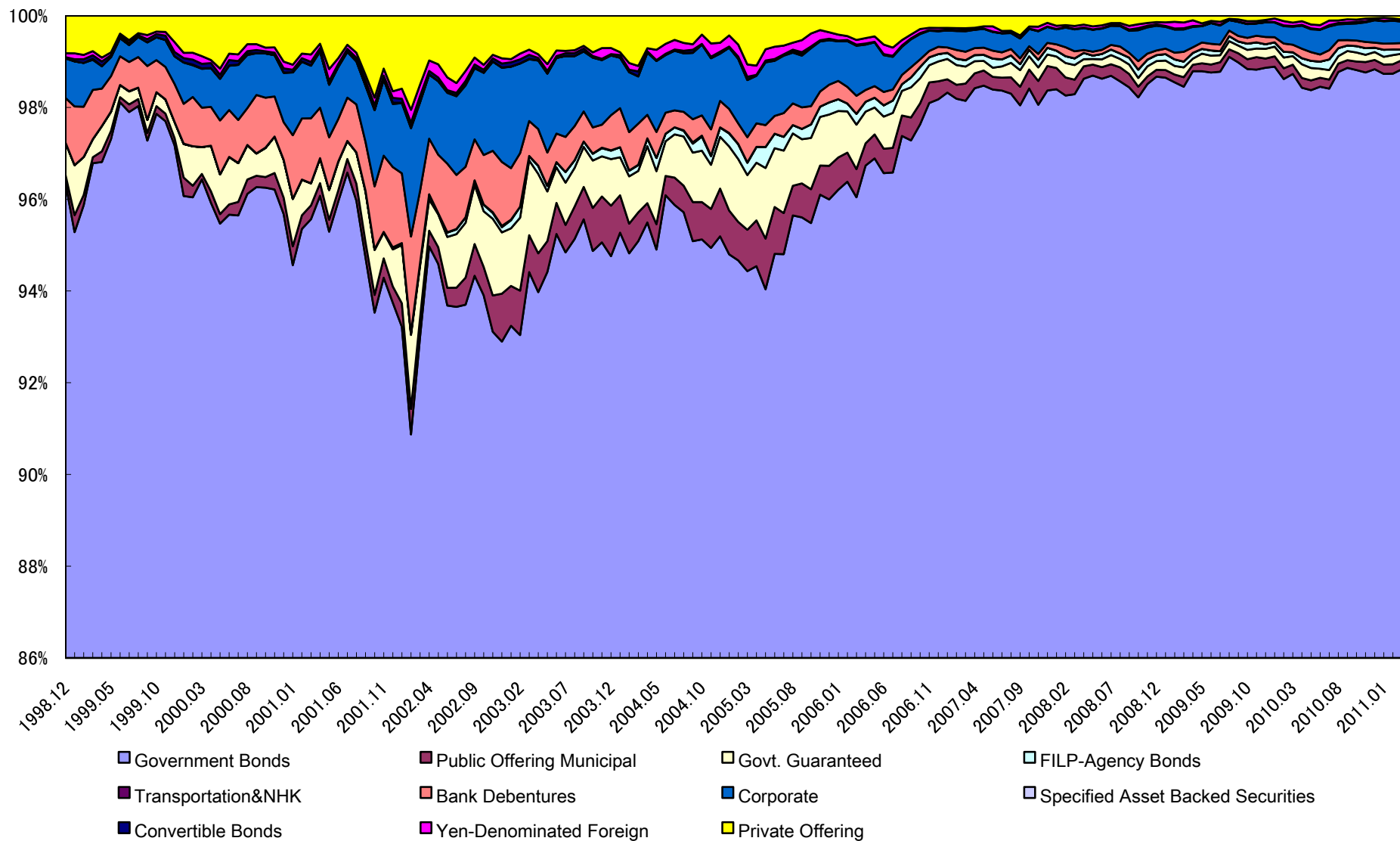


Figure 3 Share in trading volume in bond markets

source : The Japan securities dealers association <http://www.jsda.or.jp/html/toukei/index.html>

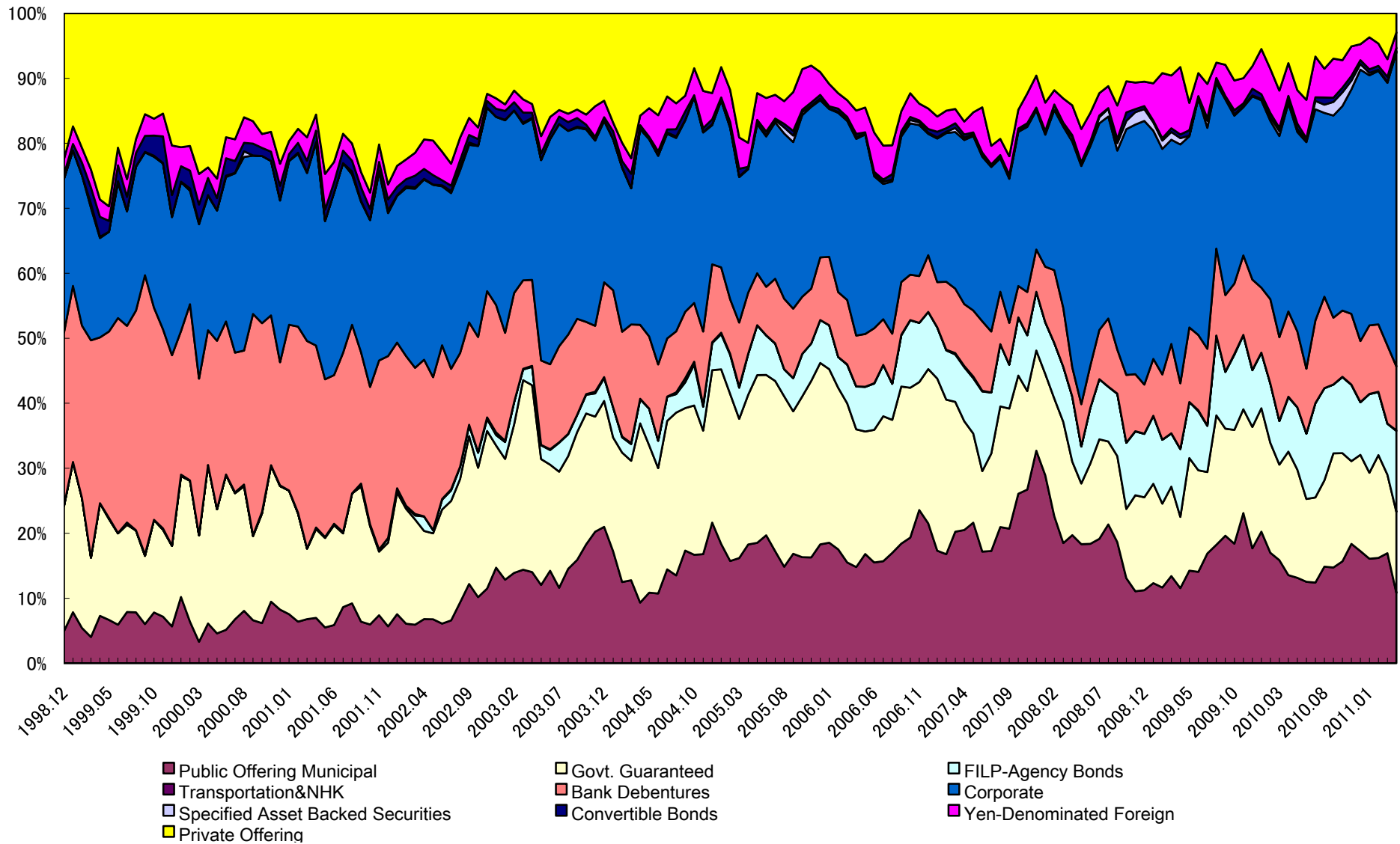


Figure 4 Share in trading volume (other than JGBs)

source : The Japan securities dealers association <http://www.jsda.or.jp/html/toukei/index.html>

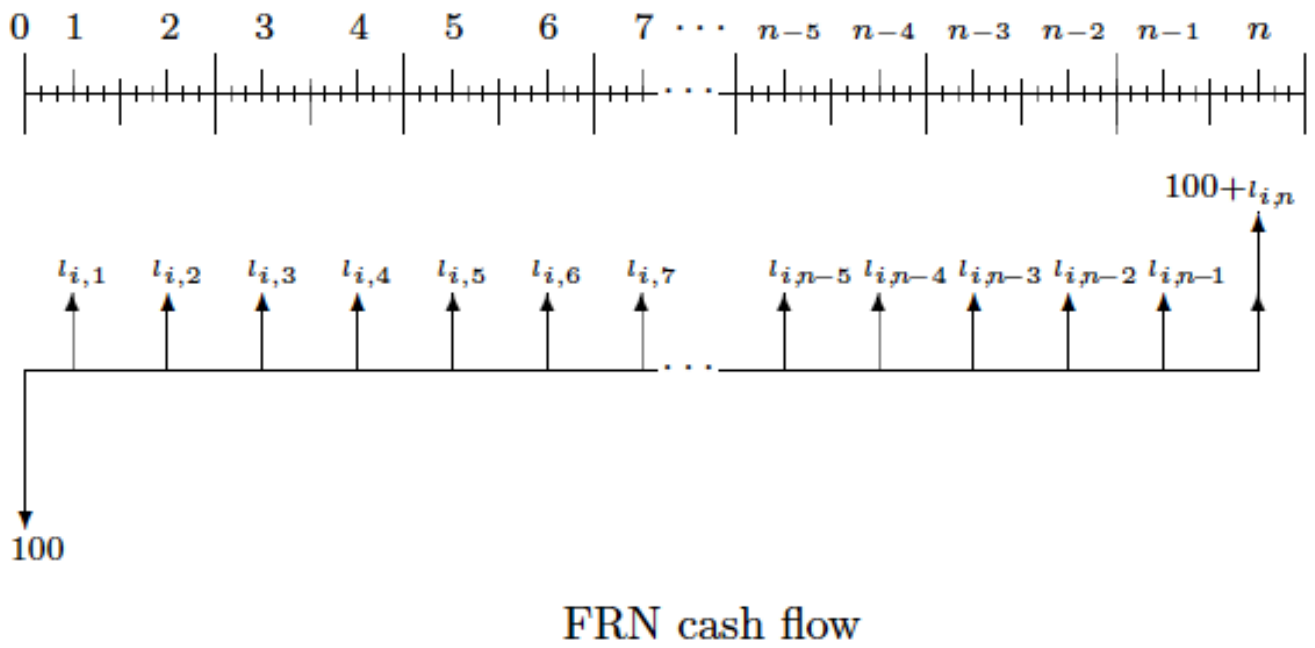


Figure 5 Synthetic FRN cash flow

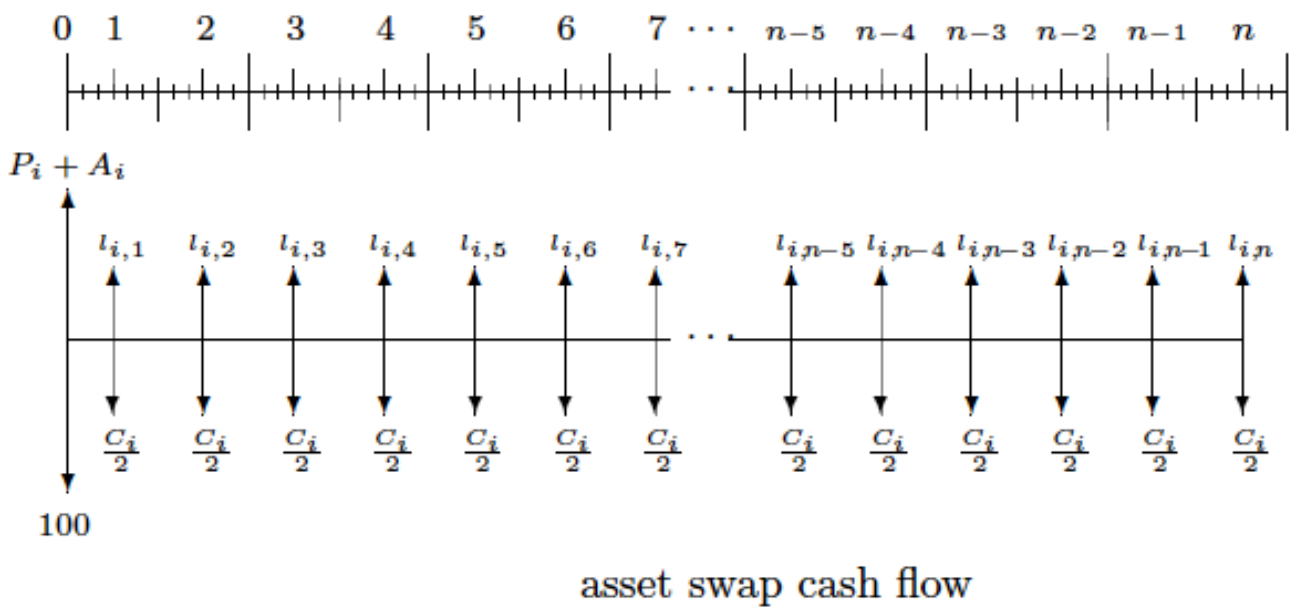


Figure 6 asset swap for synthetic FRN

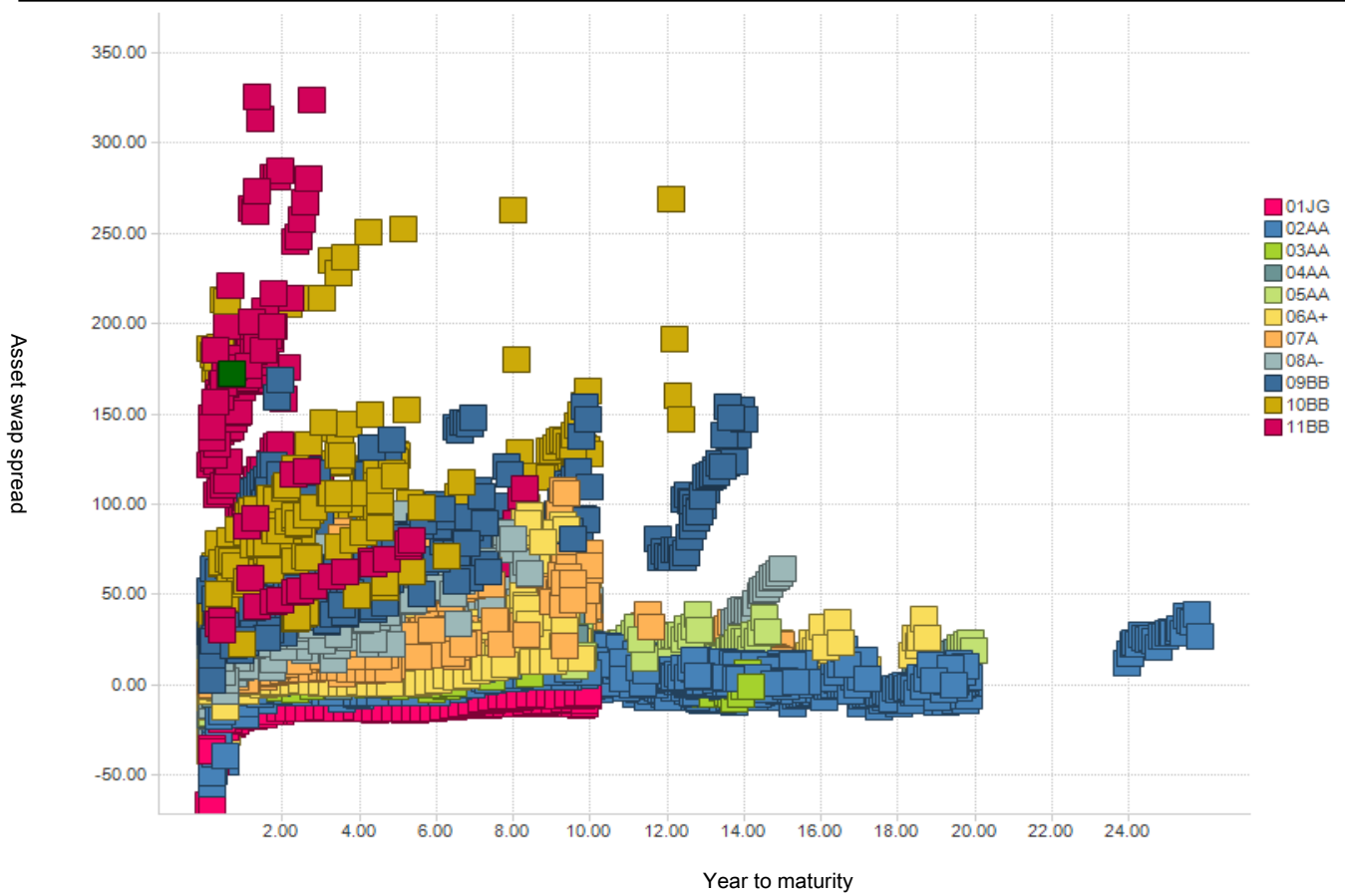


Figure 7 asset swap spread(2004/1~2005/12)overall

LIBOR Spread

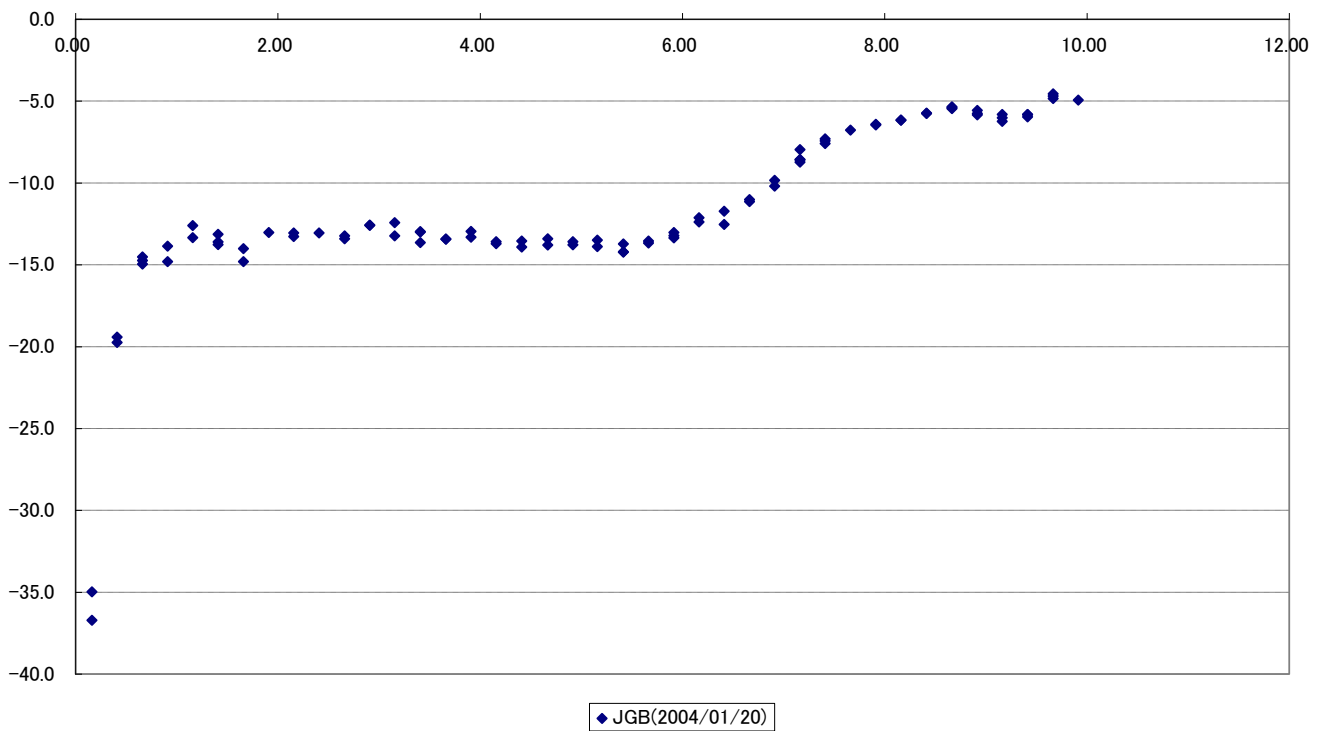


Figure 8 asset swap spread(2004/1/20) JGB

LIBOR Spread

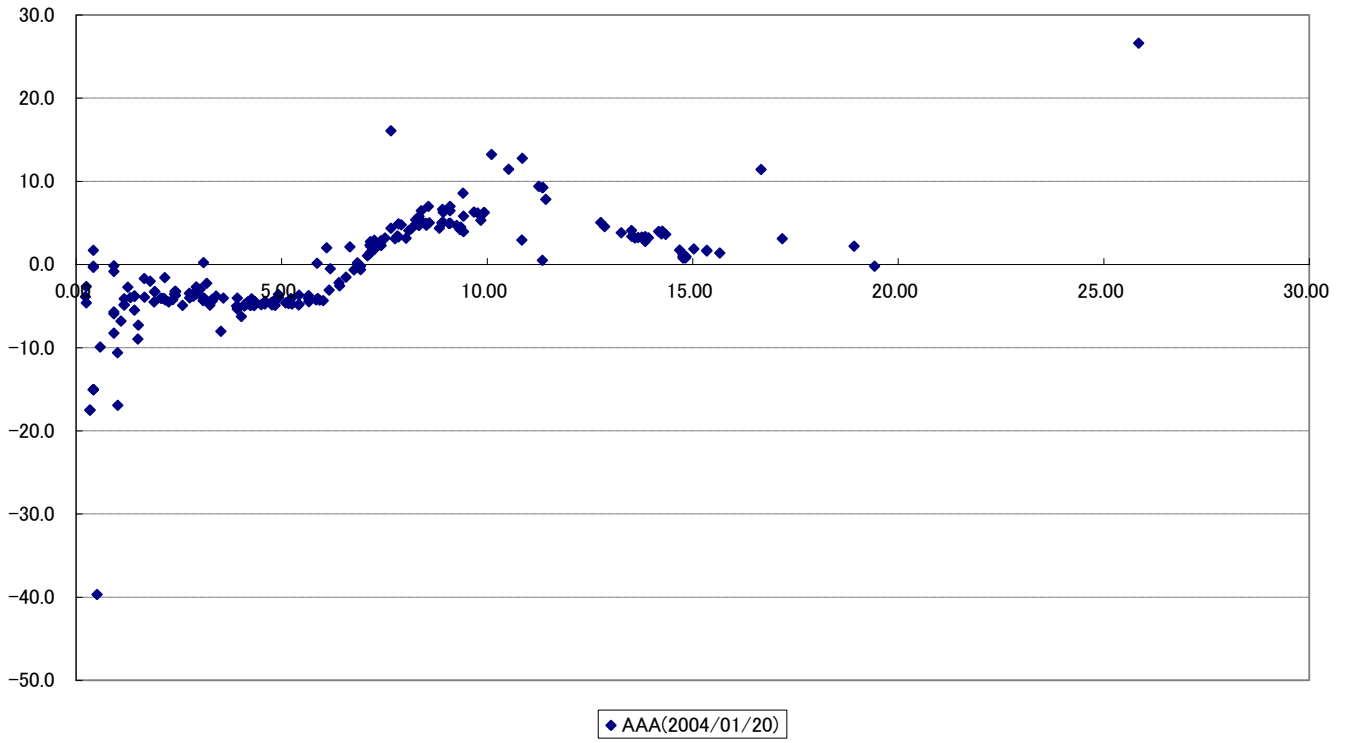


Figure 9 asset swap spread(2004/1/20) AAA

LIBOR Spread

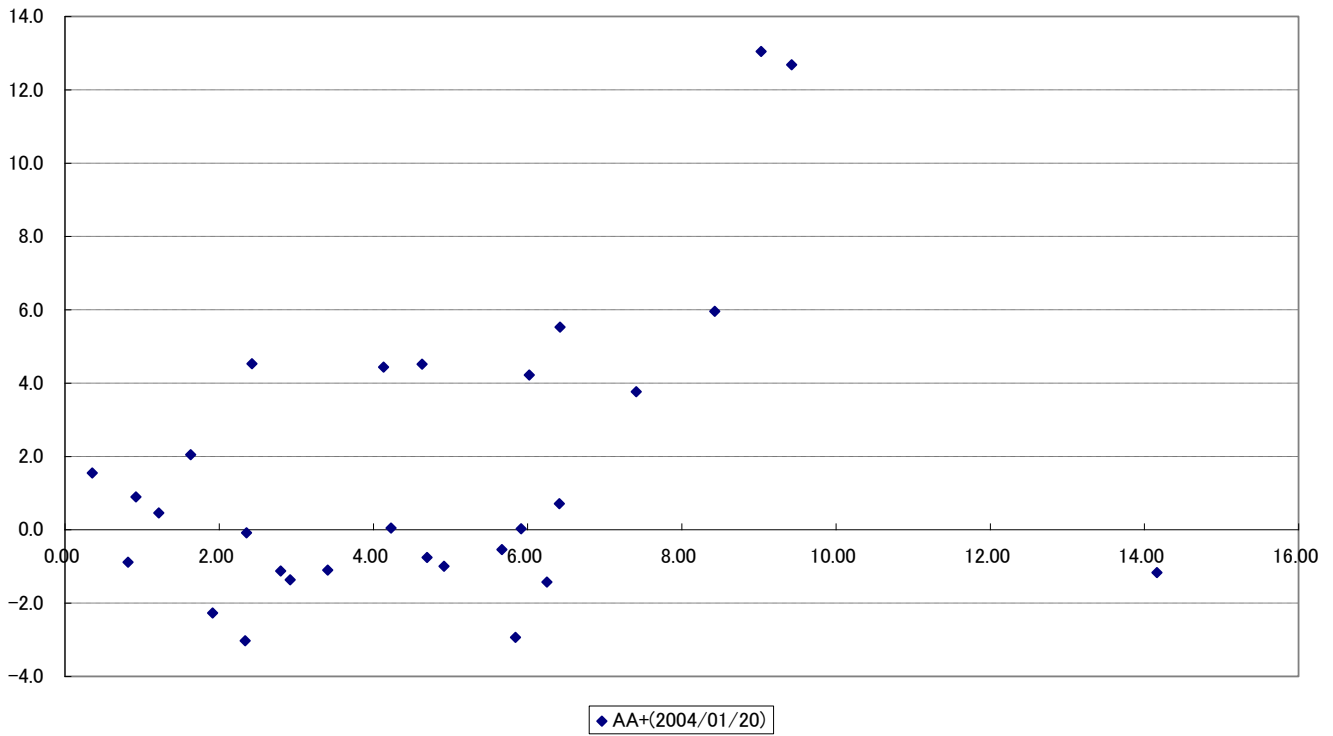


Figure 10 asset swap spread(2004/1/20) AA+

LIBOR Spread

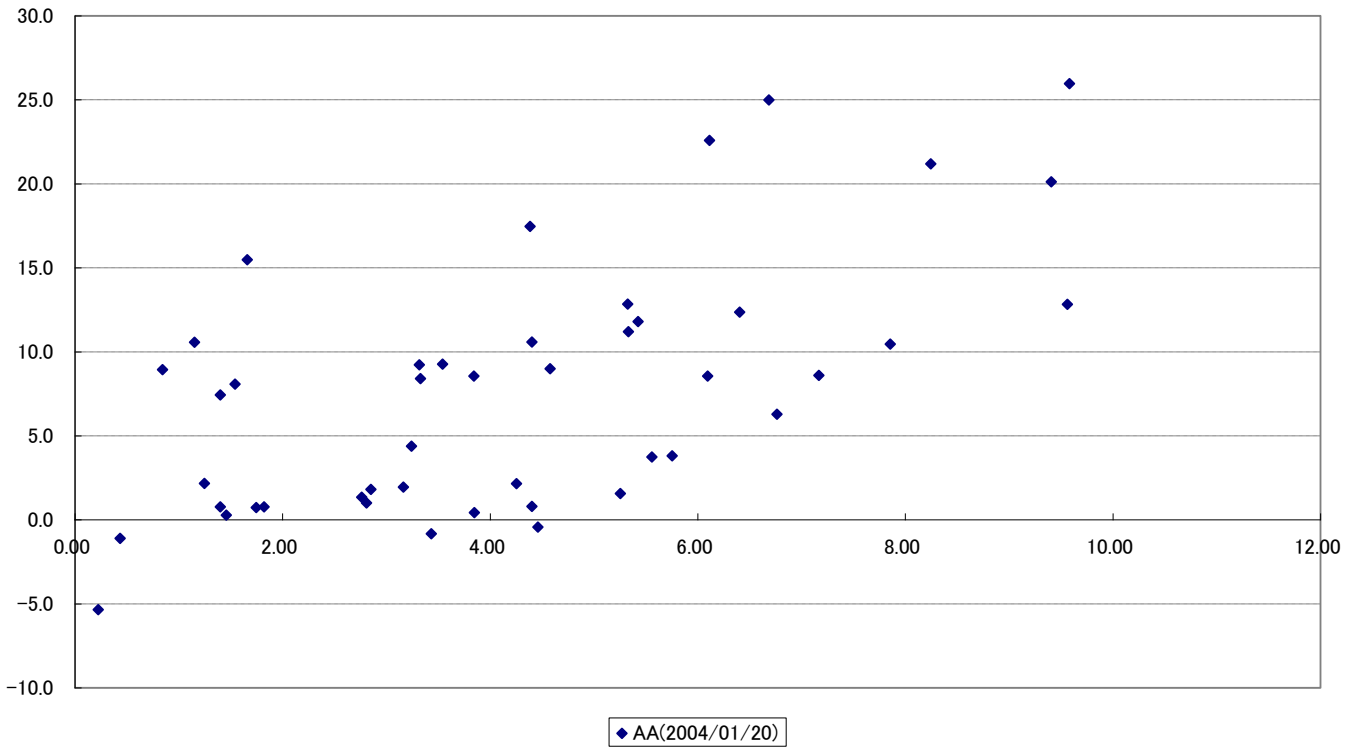


Figure 11 asset swap spread(2004/1/20) AA

LIBOR Spread

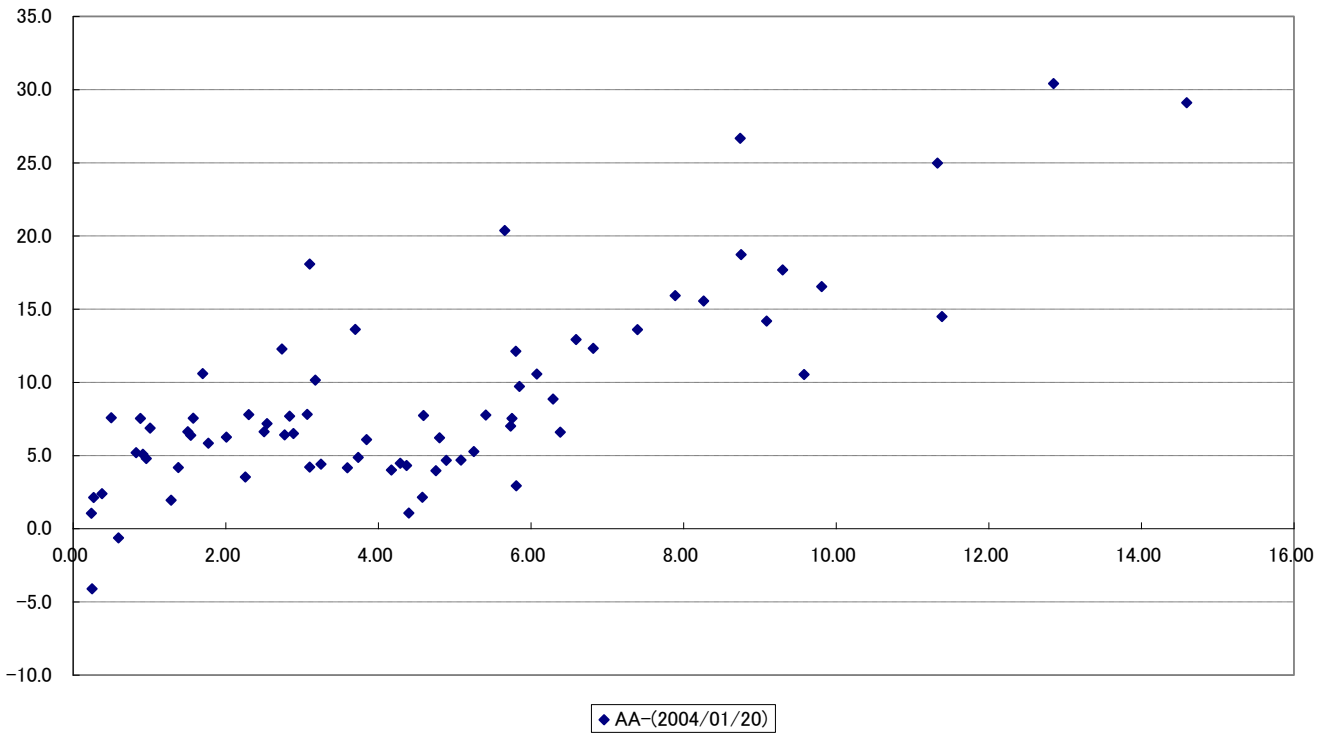


Figure 12 asset swap spread(2004/1/20) AA-

LIBOR Spread

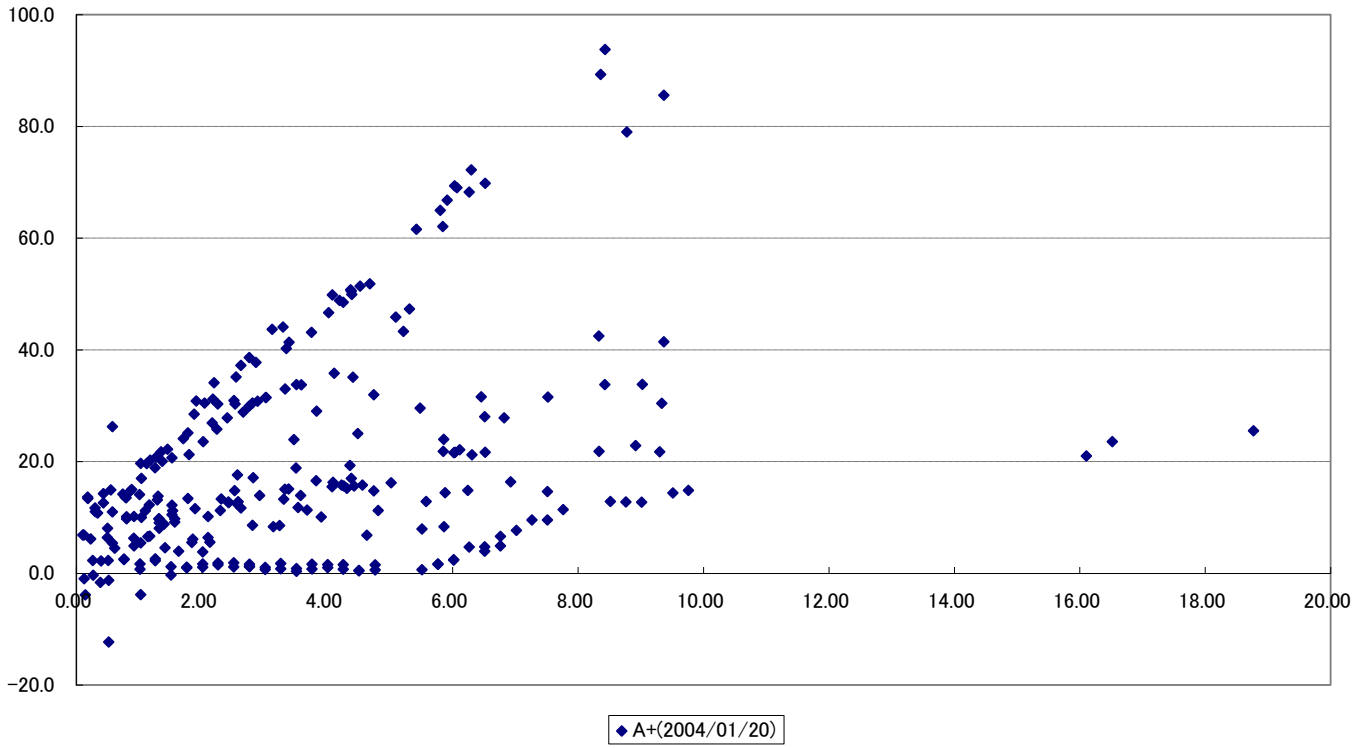


Figure 13 asset swap spread(2004/1/20) A+

LIBOR Spread

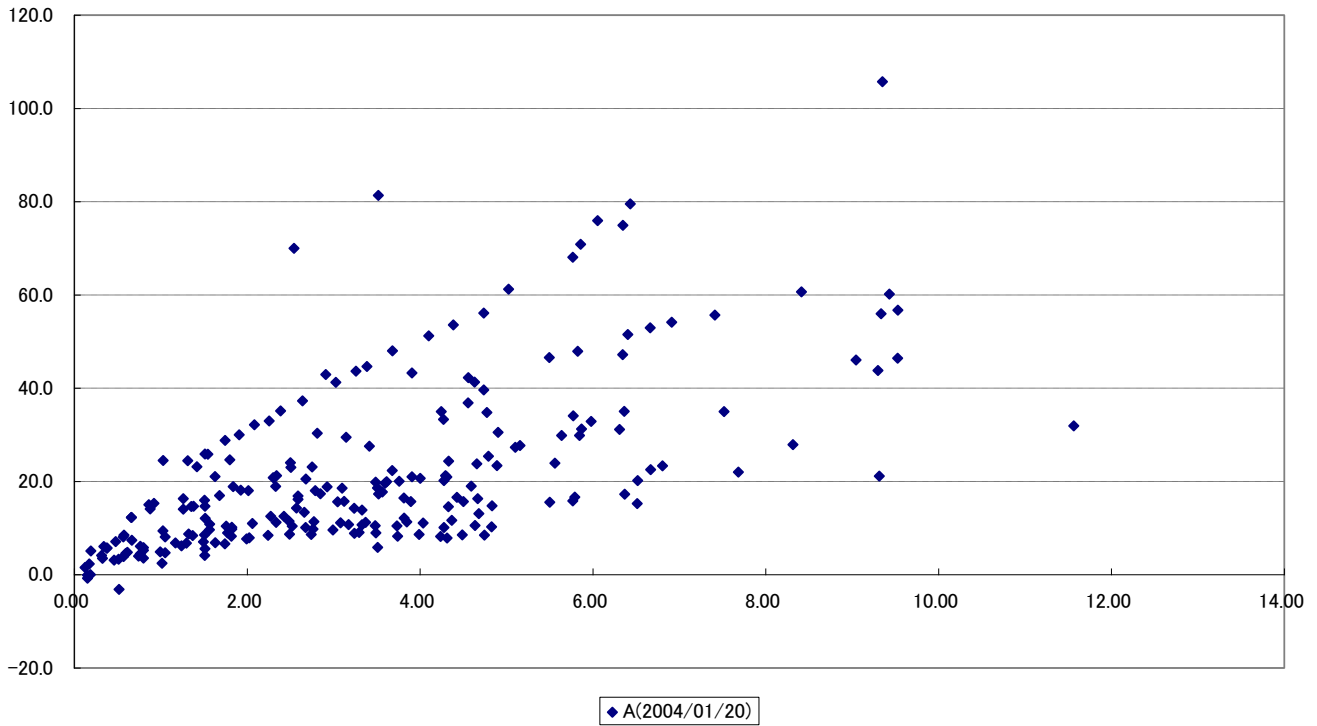


Figure 14 asset swap spread(2004/1/20) A

LIBOR Spread

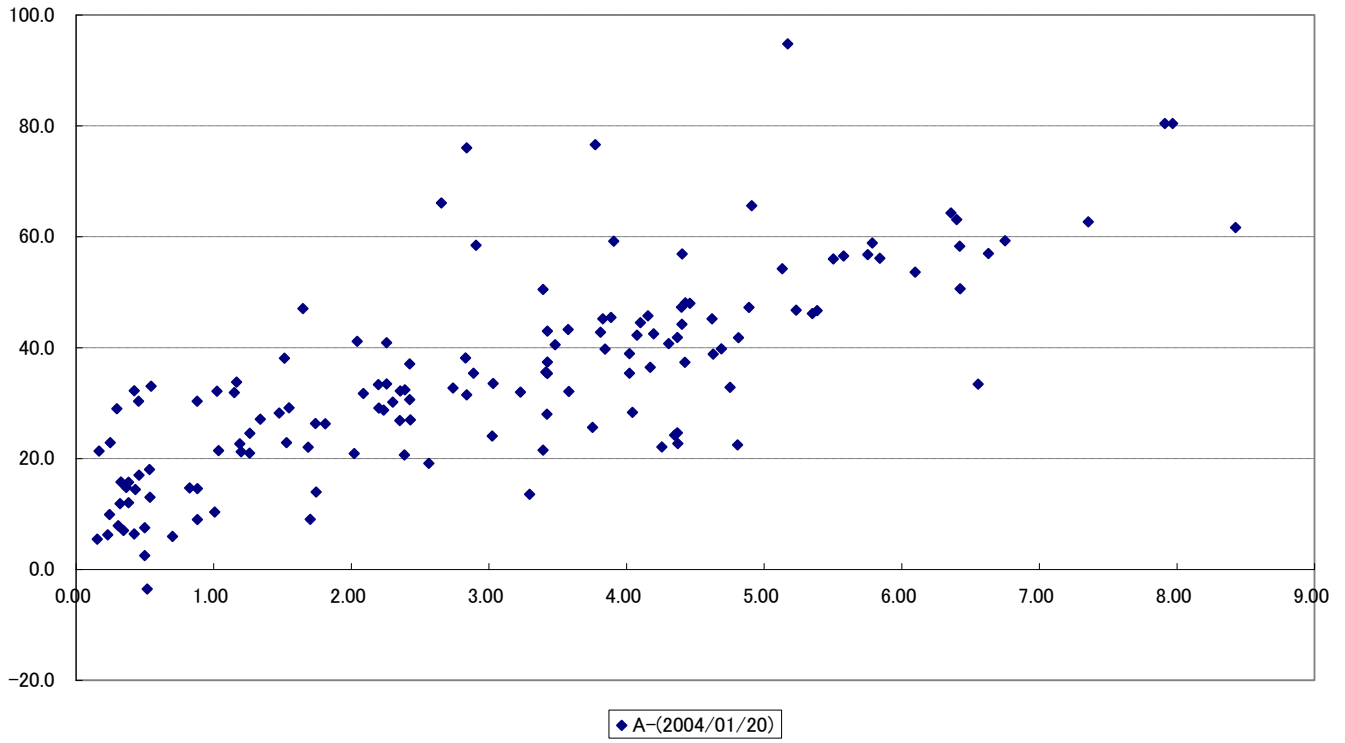


Figure 15 asset swap spread(2004/1/20) A-

LIBOR Spread

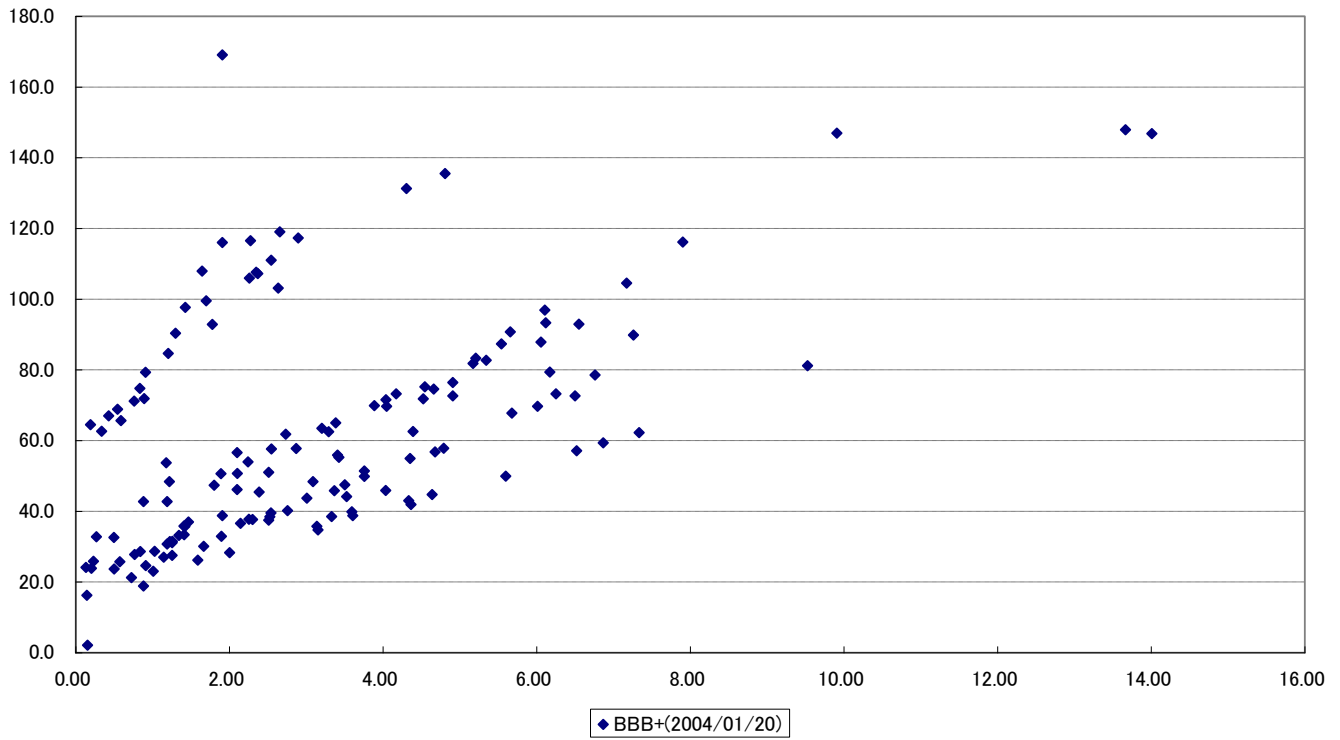


Figure 16 asset swap spread(2004/1/20) BBB+

LIBOR Spread

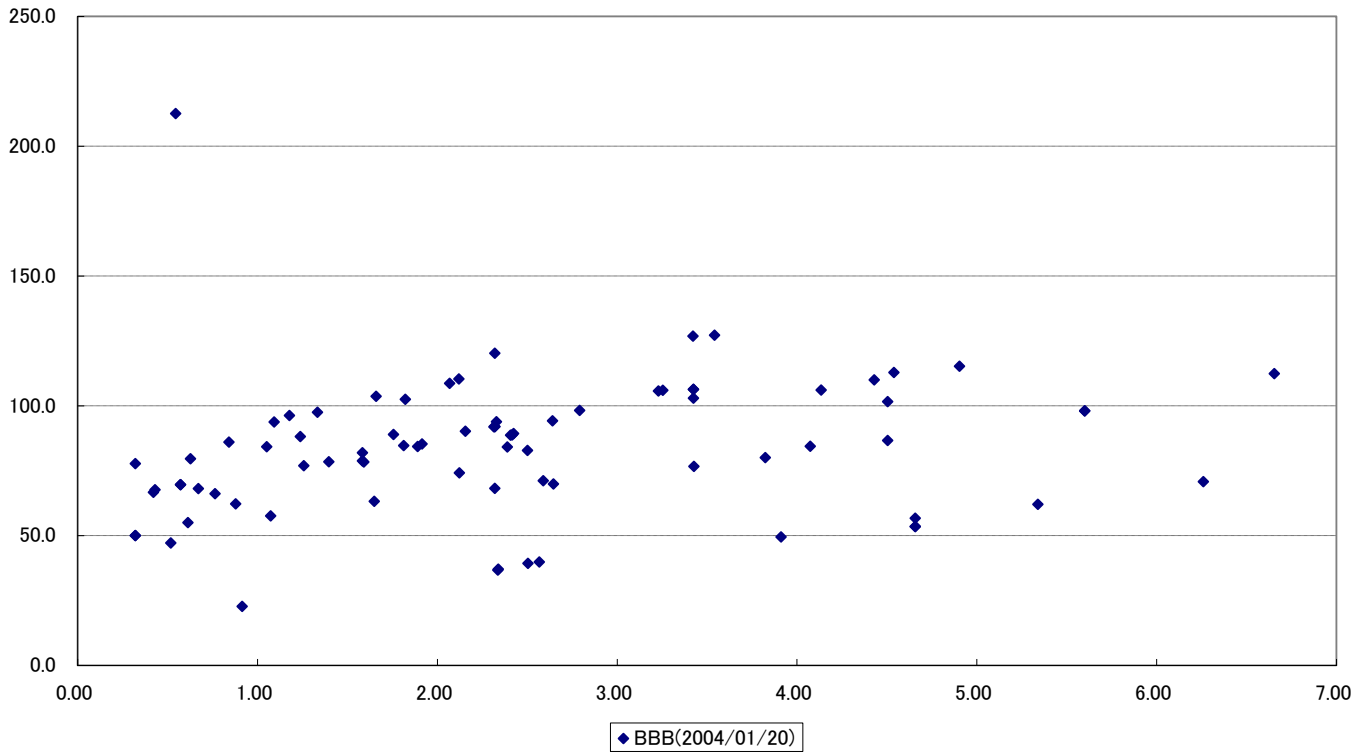


Figure 17 asset swap spread(2004/1/20) BBB

LIBOR Spread

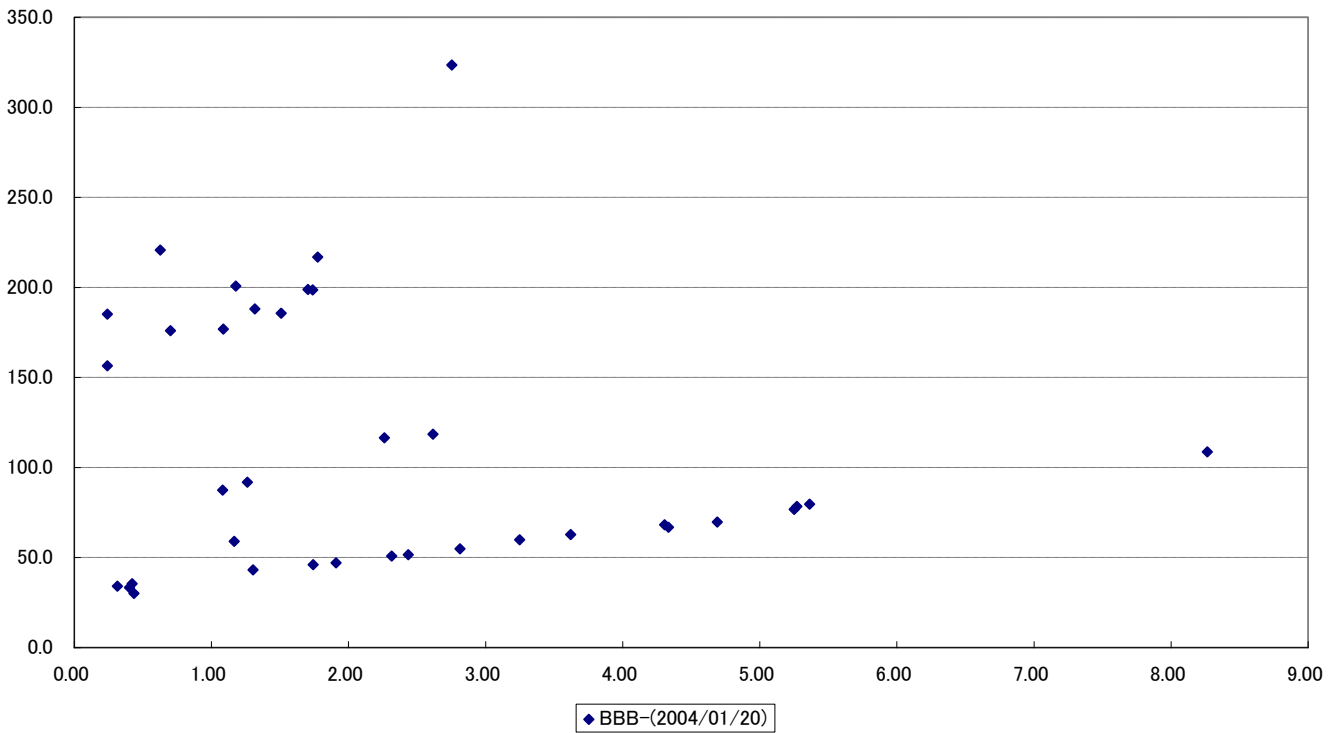


Figure 18 asset swap spread(2004/1/20) BBB-

LIBOR Spread

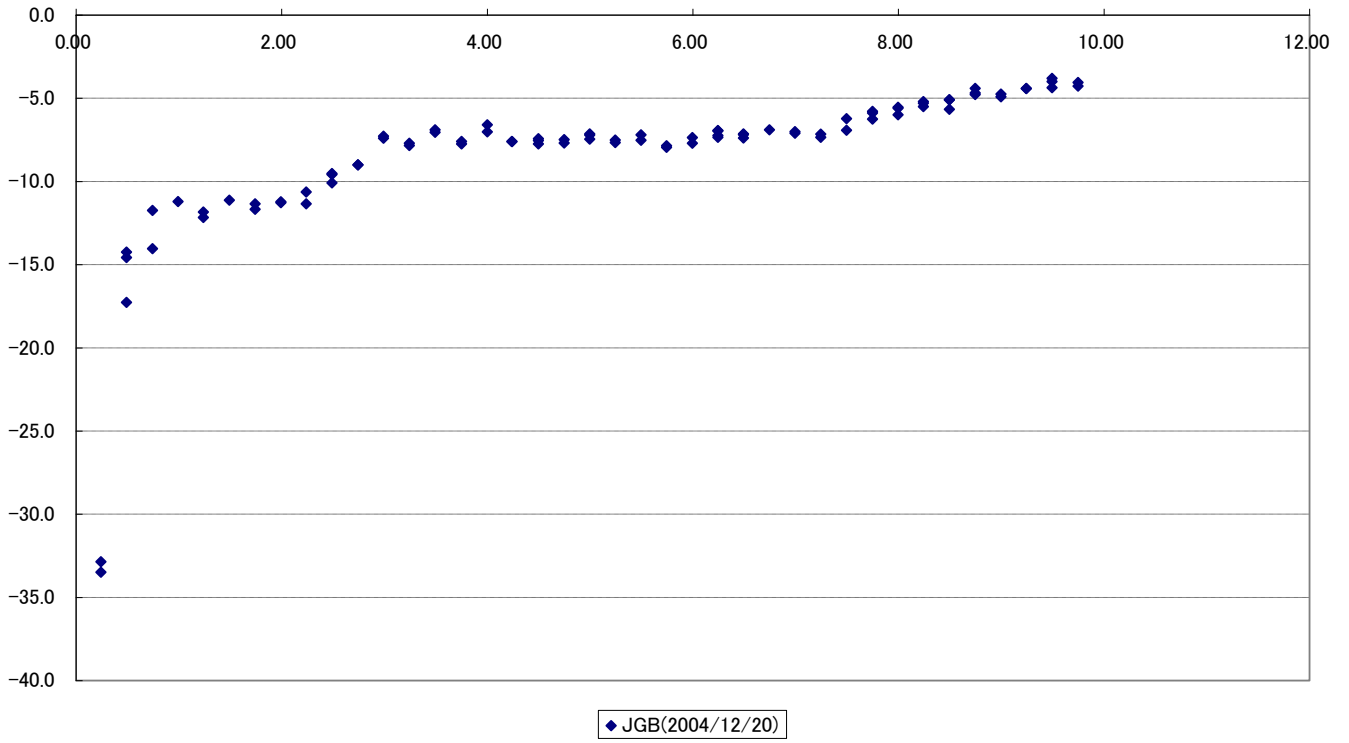


Figure 19 asset swap spread(2004/12/20) JGB

LIBOR Spread

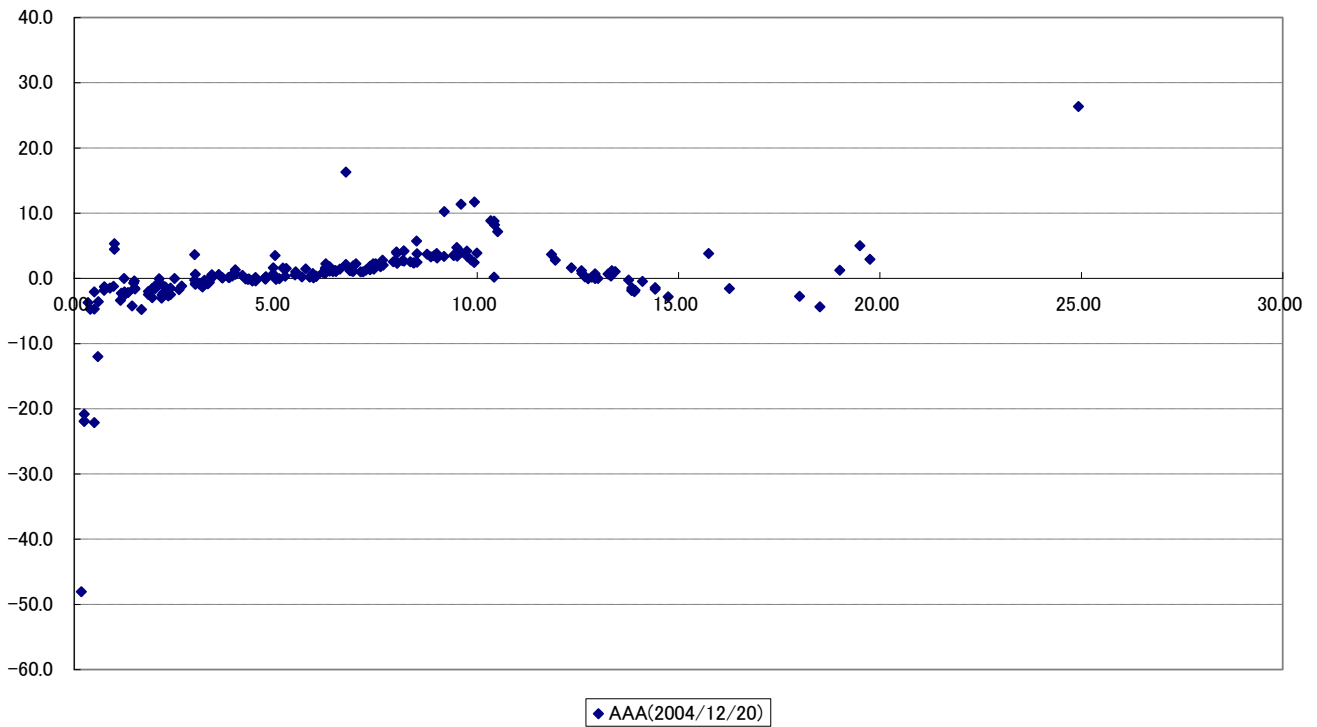


Figure 20 asset swap spread(2004/12/20) AAA

LIBOR Spread

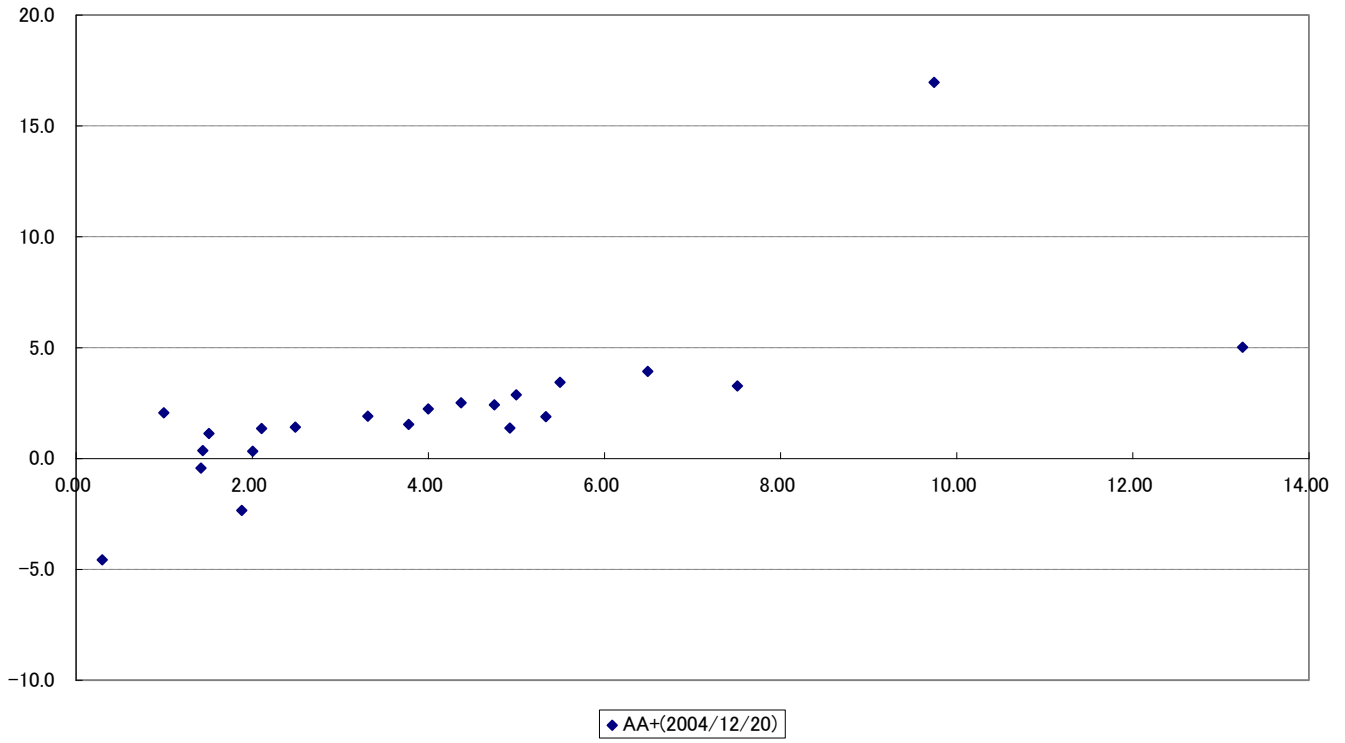


Figure 21 asset swap spread(2004/12/20) AA+

LIBOR Spread

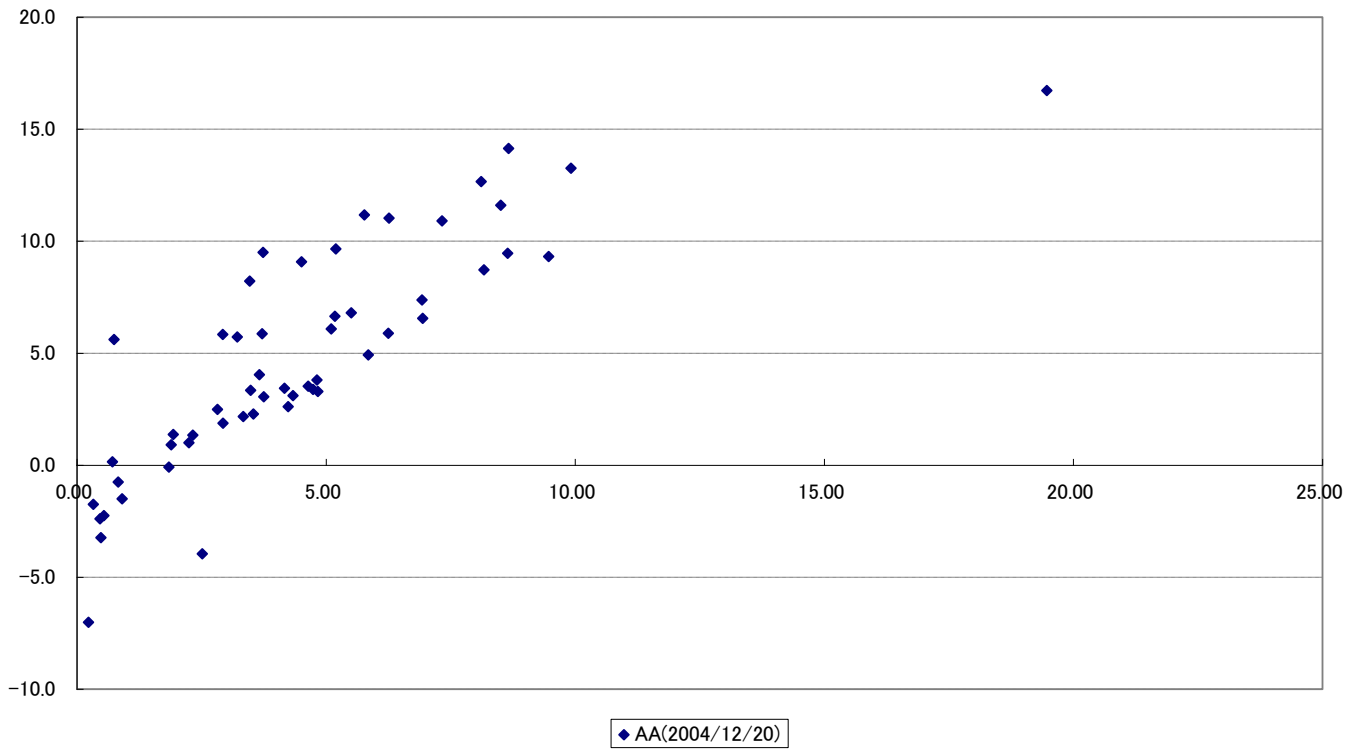


Figure 22 asset swap spread (2004/12/20) AA

LIBOR Spread

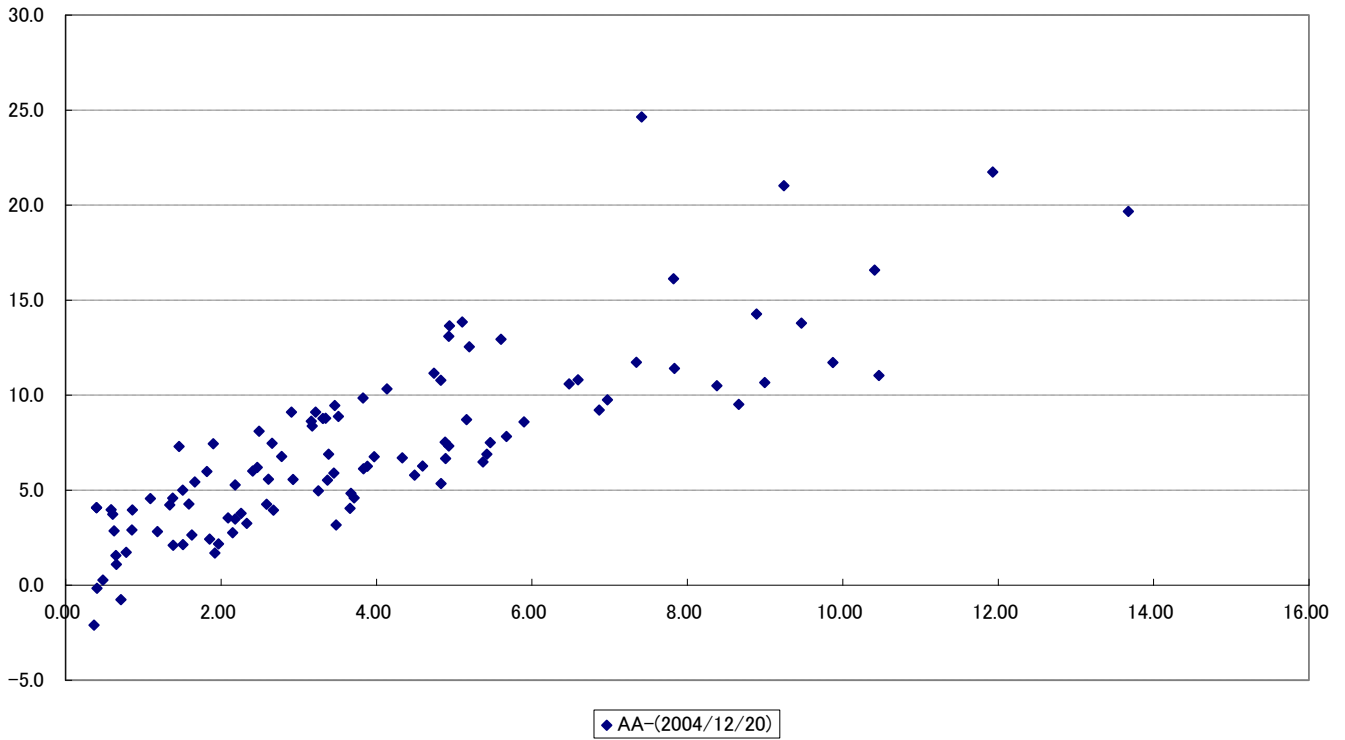


Figure 23 asset swap spread(2004/12/20) AA-

LIBOR Spread

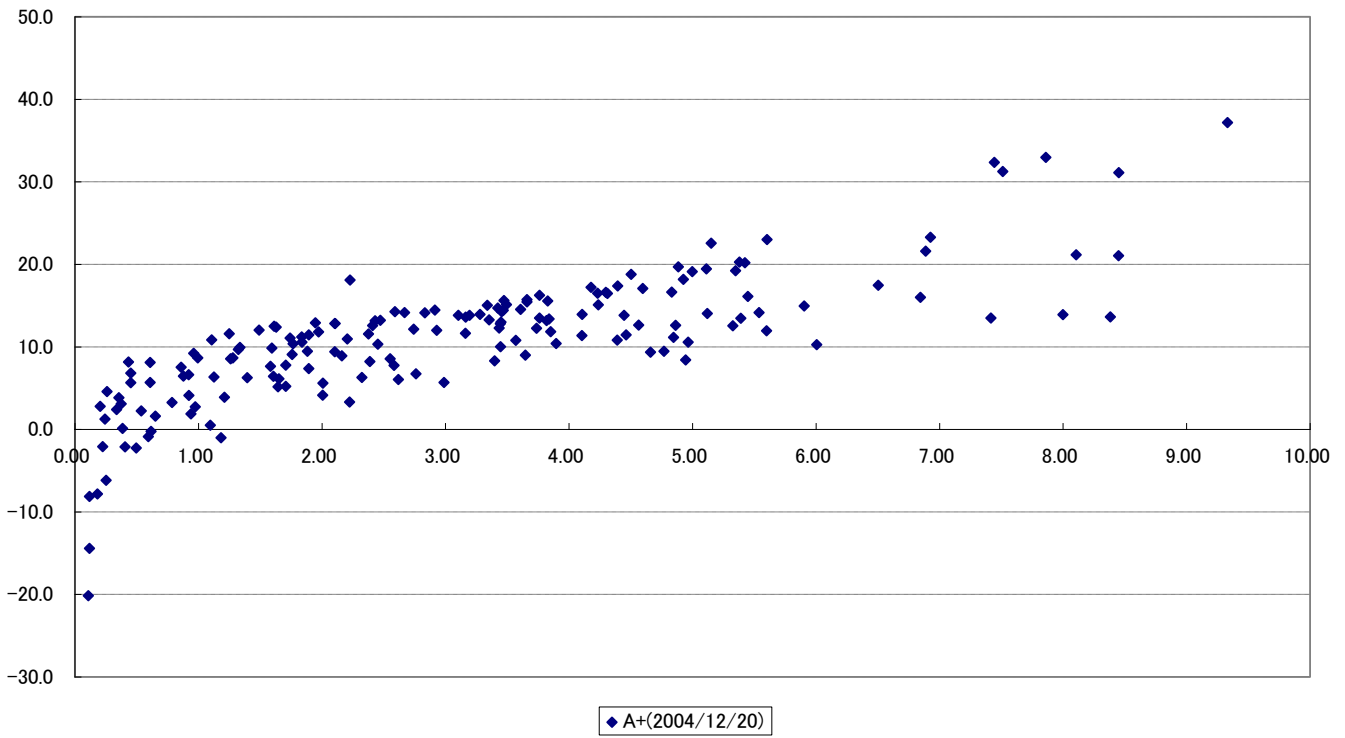


Figure 24 asset swap spread(2004/12/20) A+

LIBOR Spread

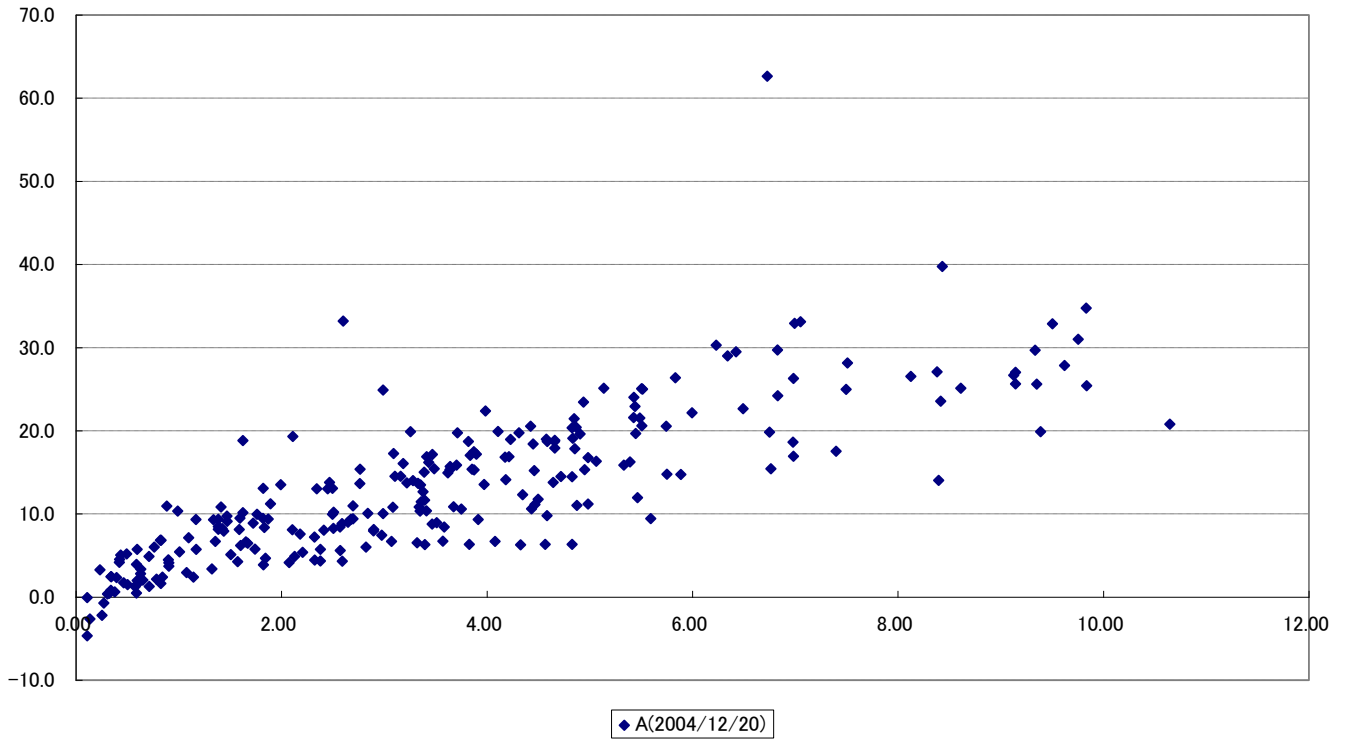


Figure 25 asset swap spread(2004/12/20) A

LIBOR Spread

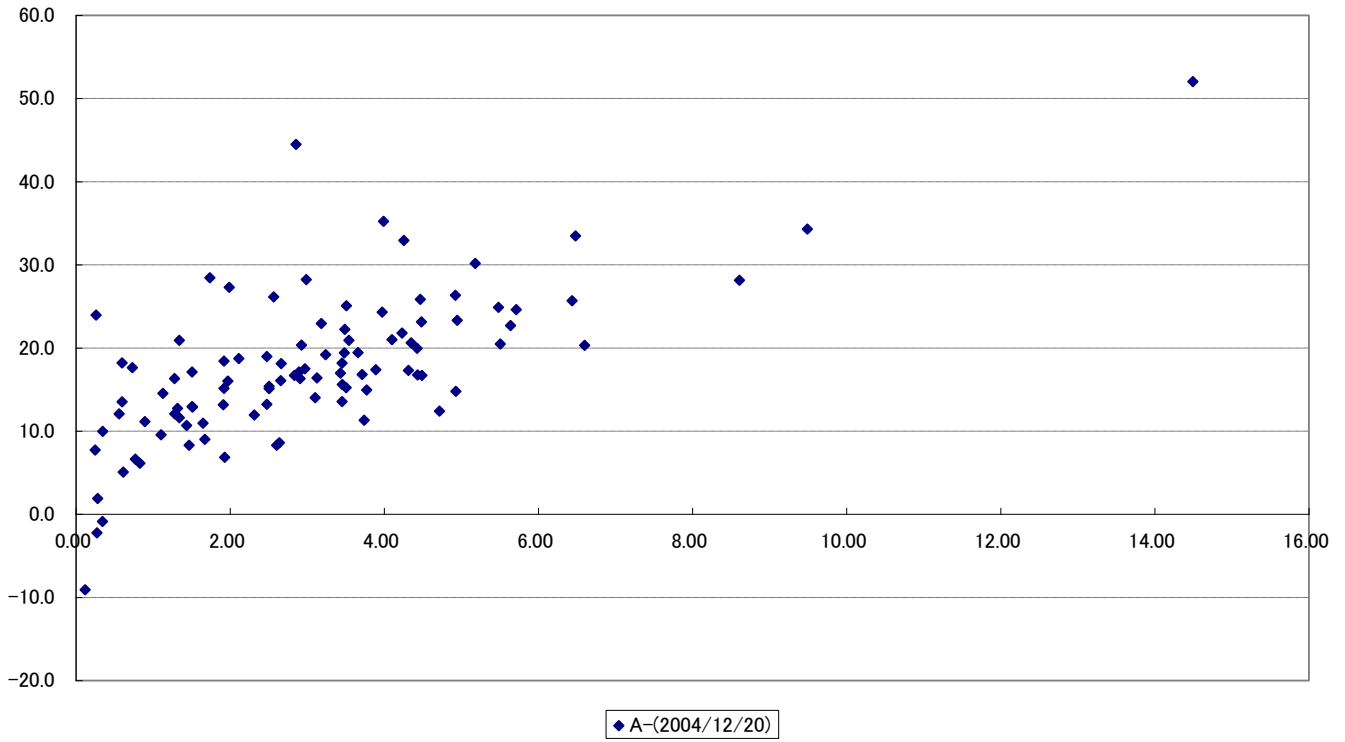


Figure 26 asset swap spread(2004/12/20) A-

LIBOR Spread

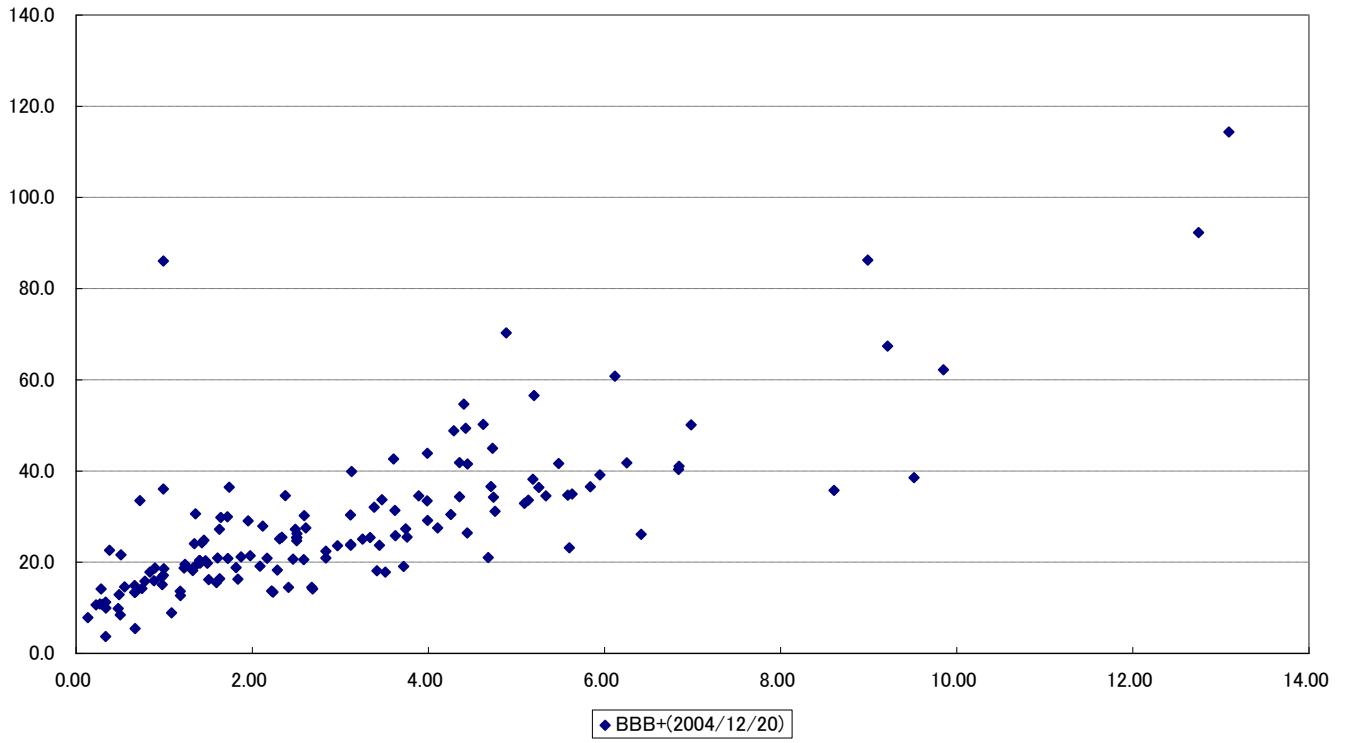


Figure 27 asset swap spread(2004/12/20) BBB+

LIBOR Spread

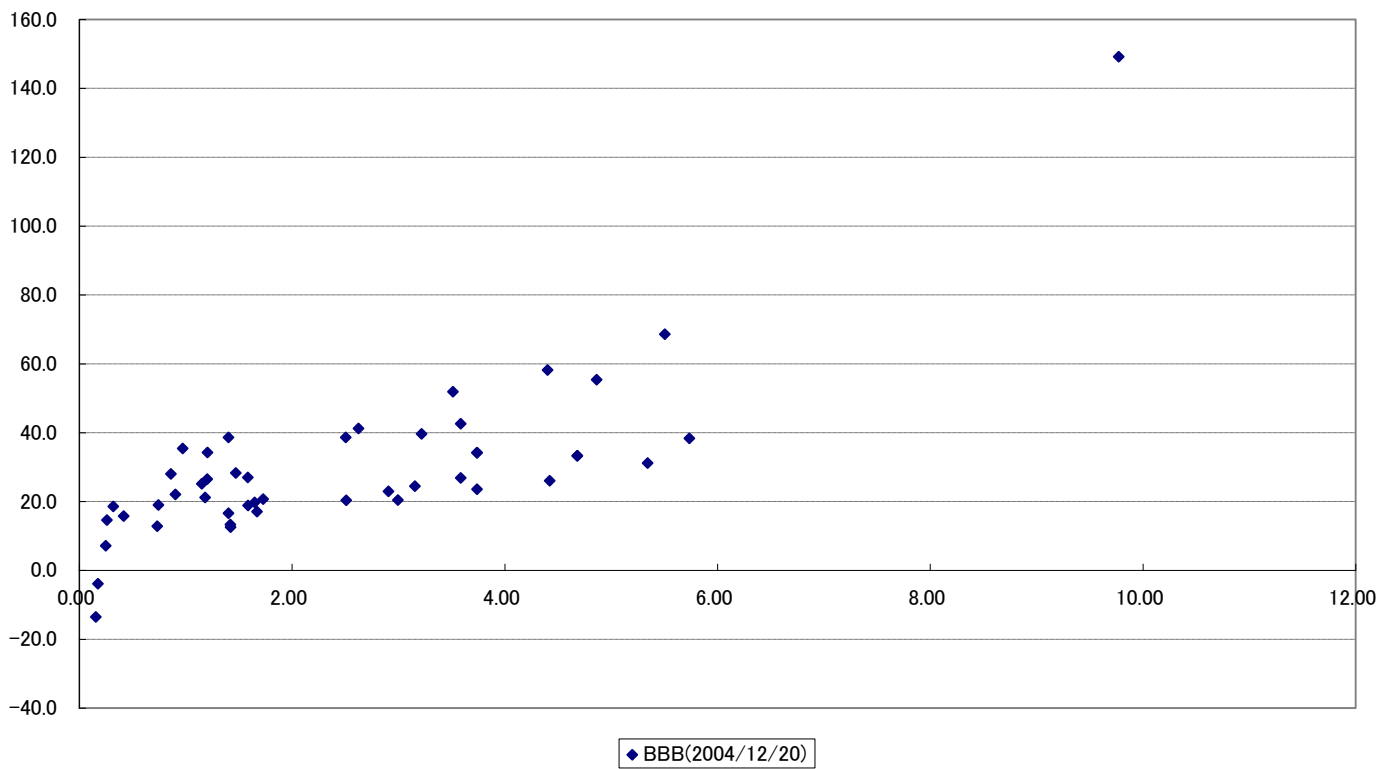


Figure 28 asset swap spread(2004/12/20) BBB

LIBOR Spread

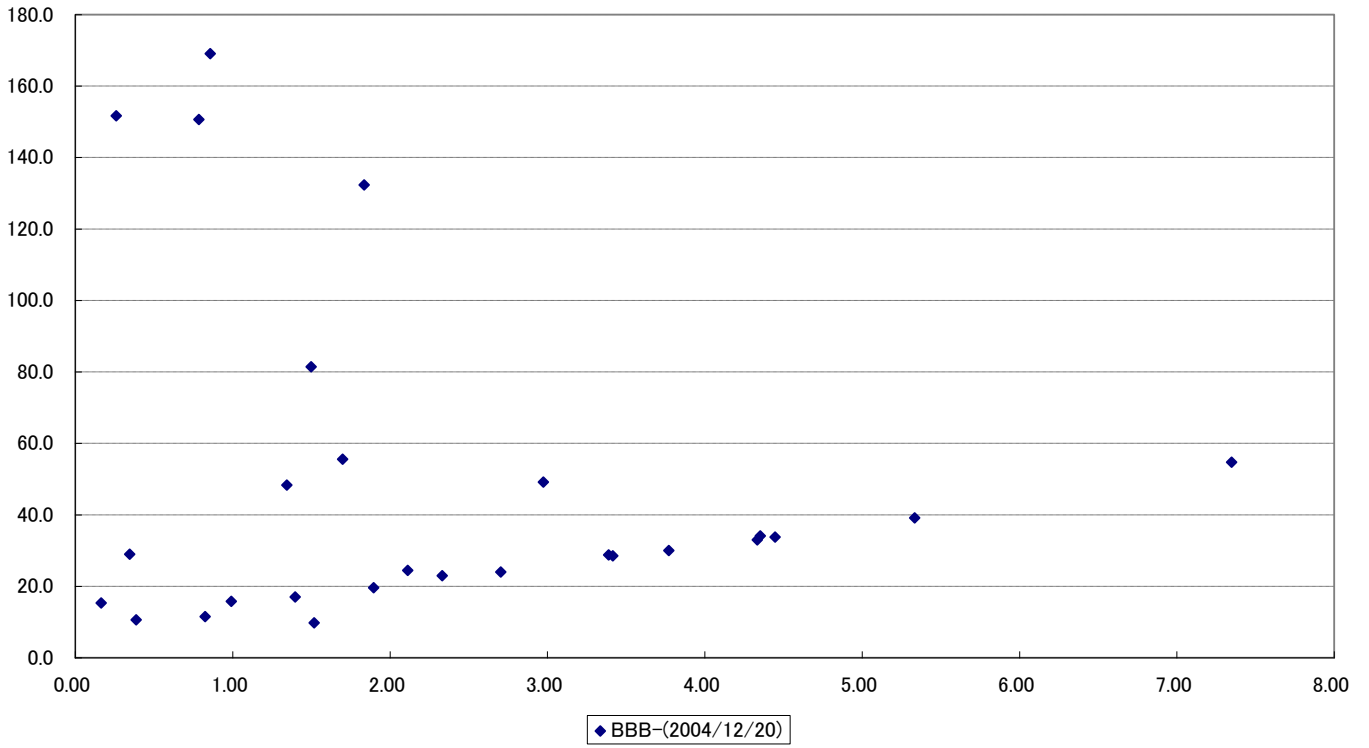


Figure 29 asset swap spread(2004/12/20) BBB-

LIBOR Spread

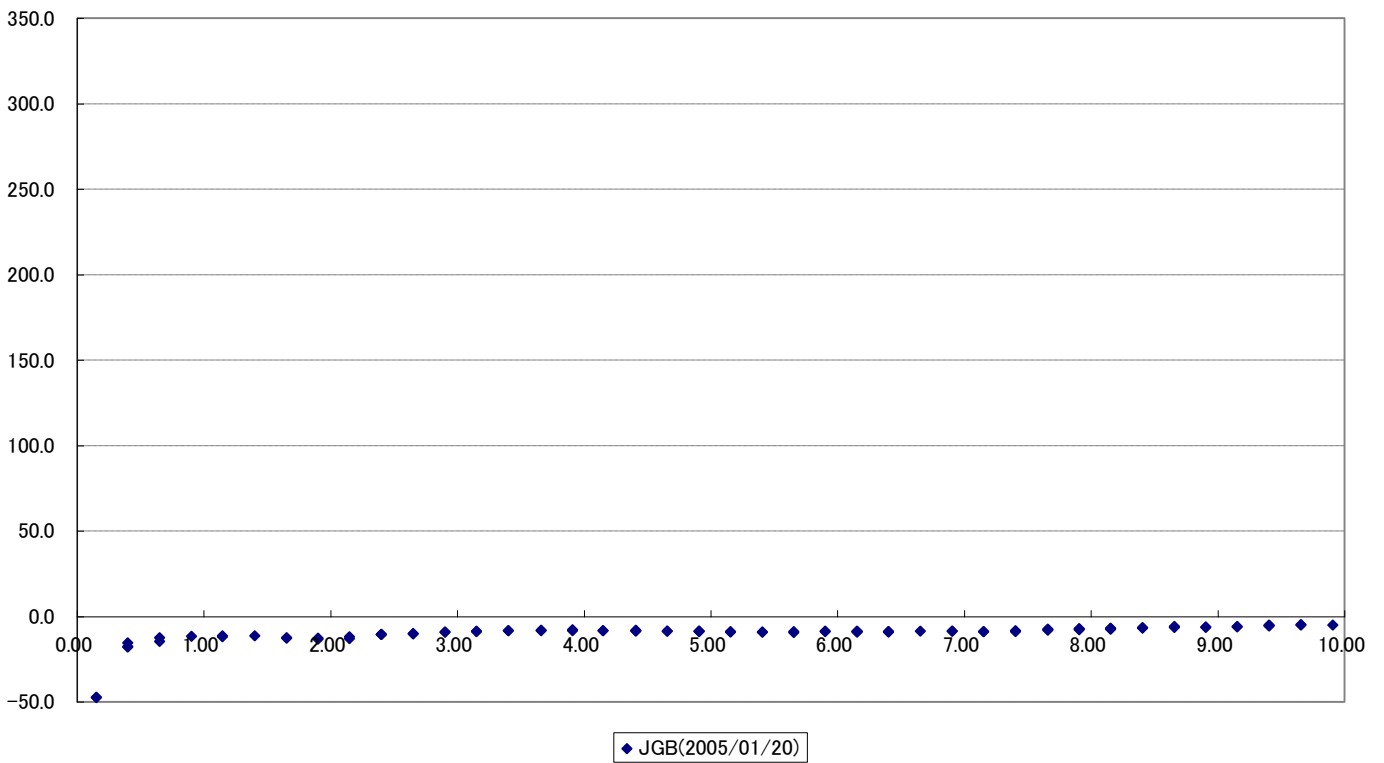


Figure 30 asset swap spread(2005/1/20) JGB

LIBOR Spread

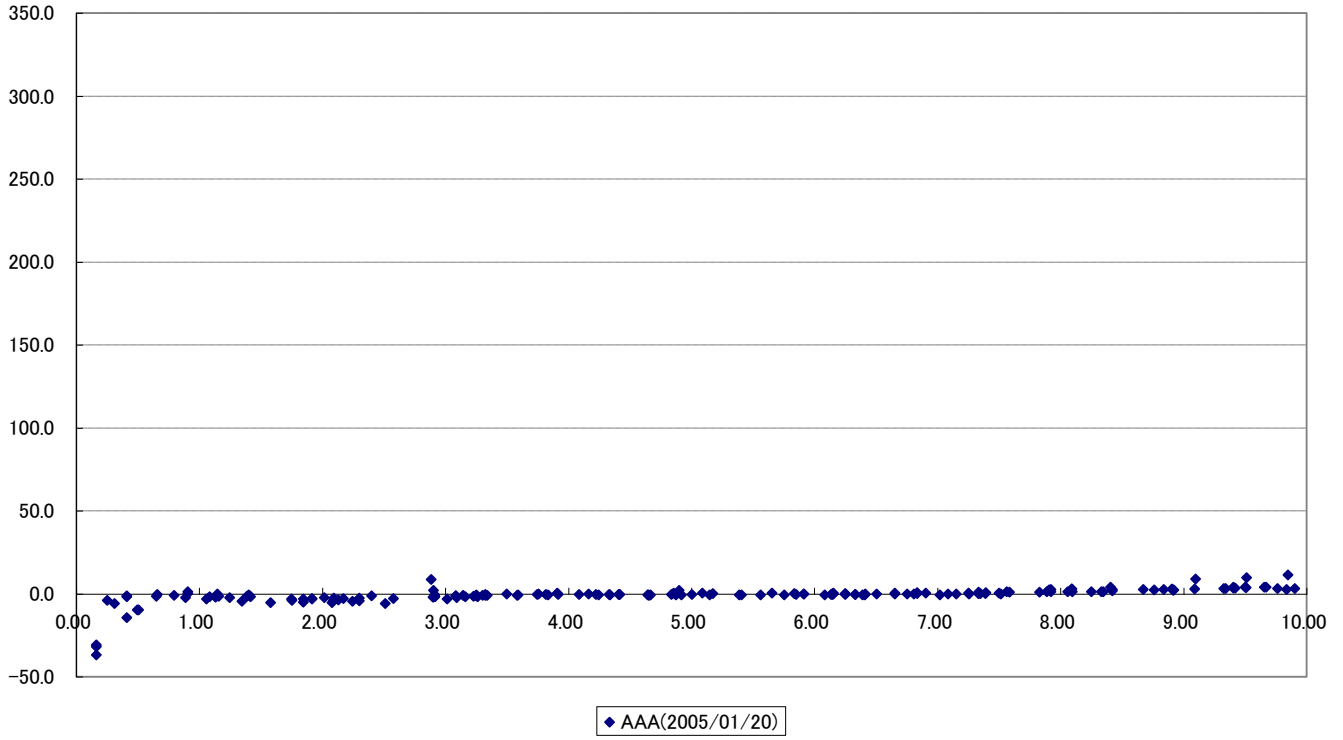


Figure 31 asset swap spread(2005/1/20) AAA

LIBOR Spread

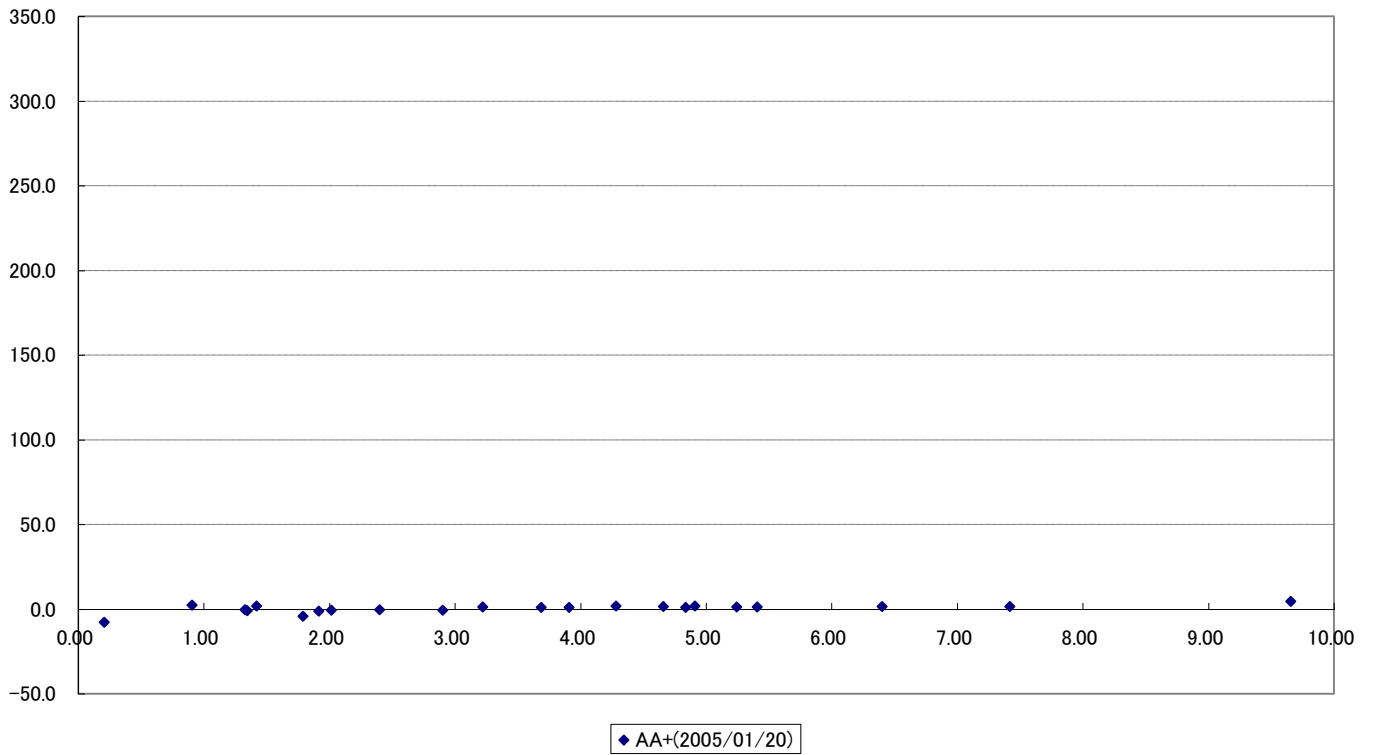


Figure 32 asset swap spread(2005/1/20) AA+

LIBOR Spread

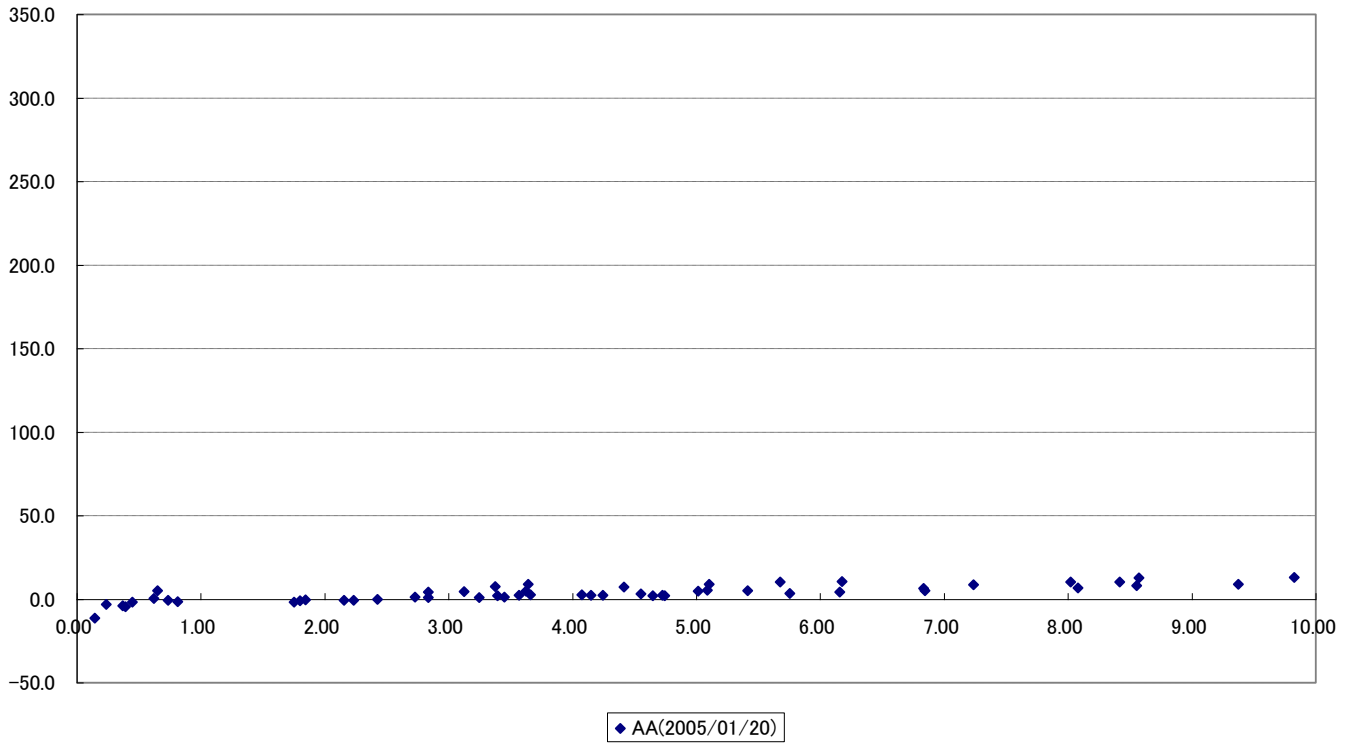


Figure 33 asset swap spread(2005/1/20) AA

LIBOR Spread

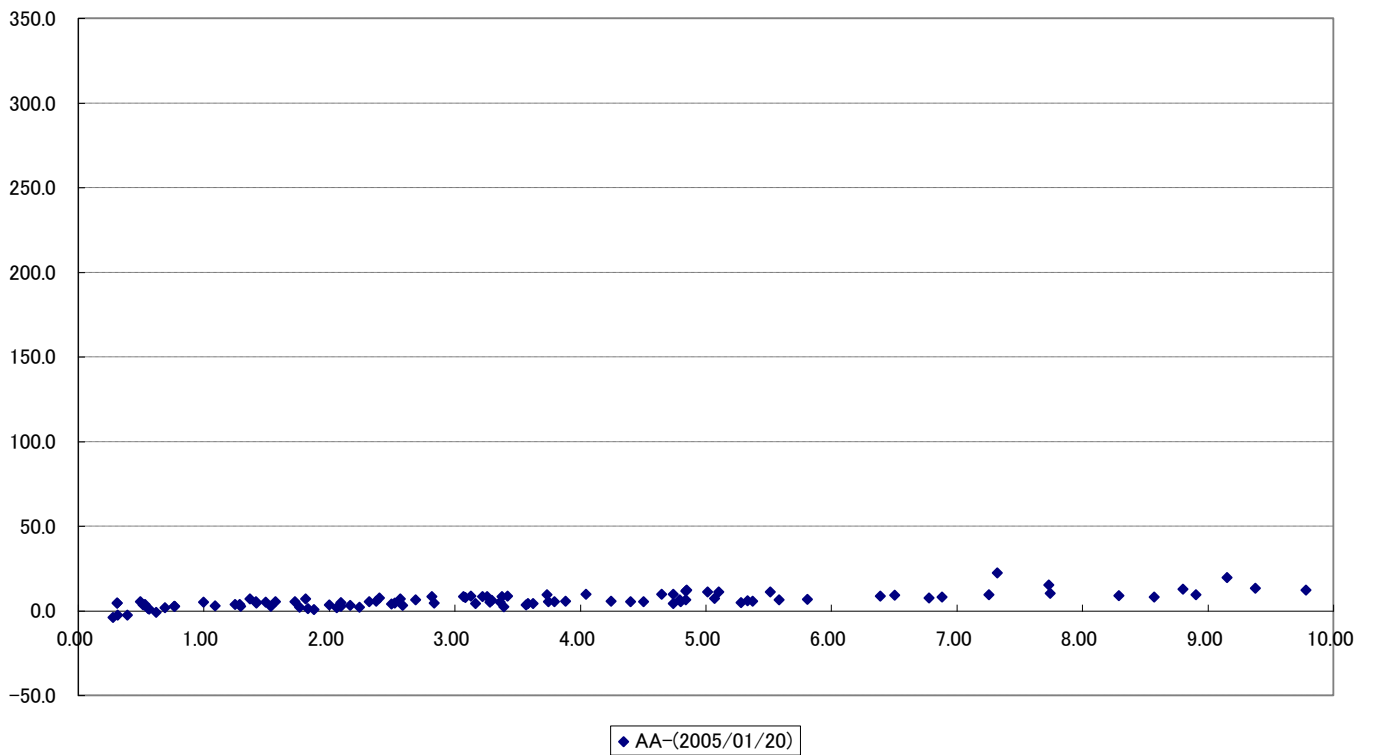


Figure 34 asset swap spread(2005/1/20) AA-

LIBOR Spread

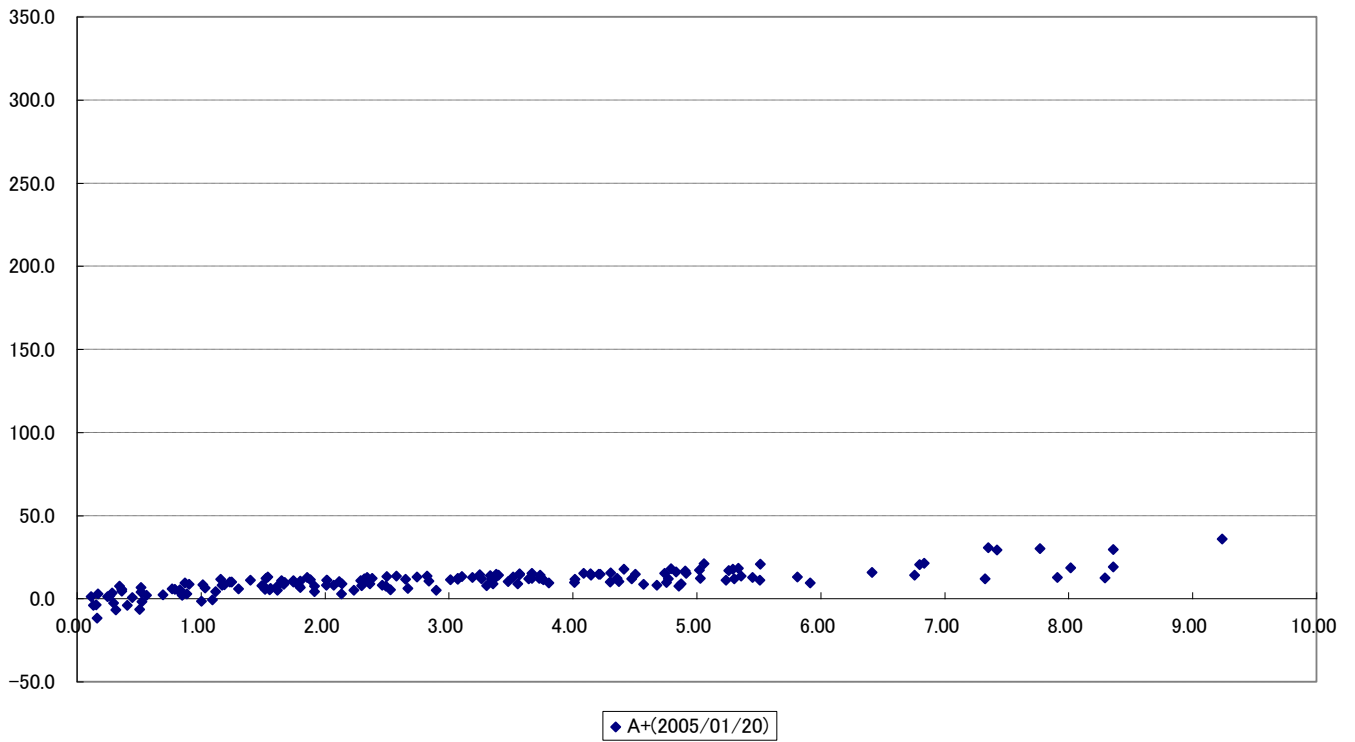


Figure 35 asset swap spread(2005/1/20) A+

LIBOR Spread

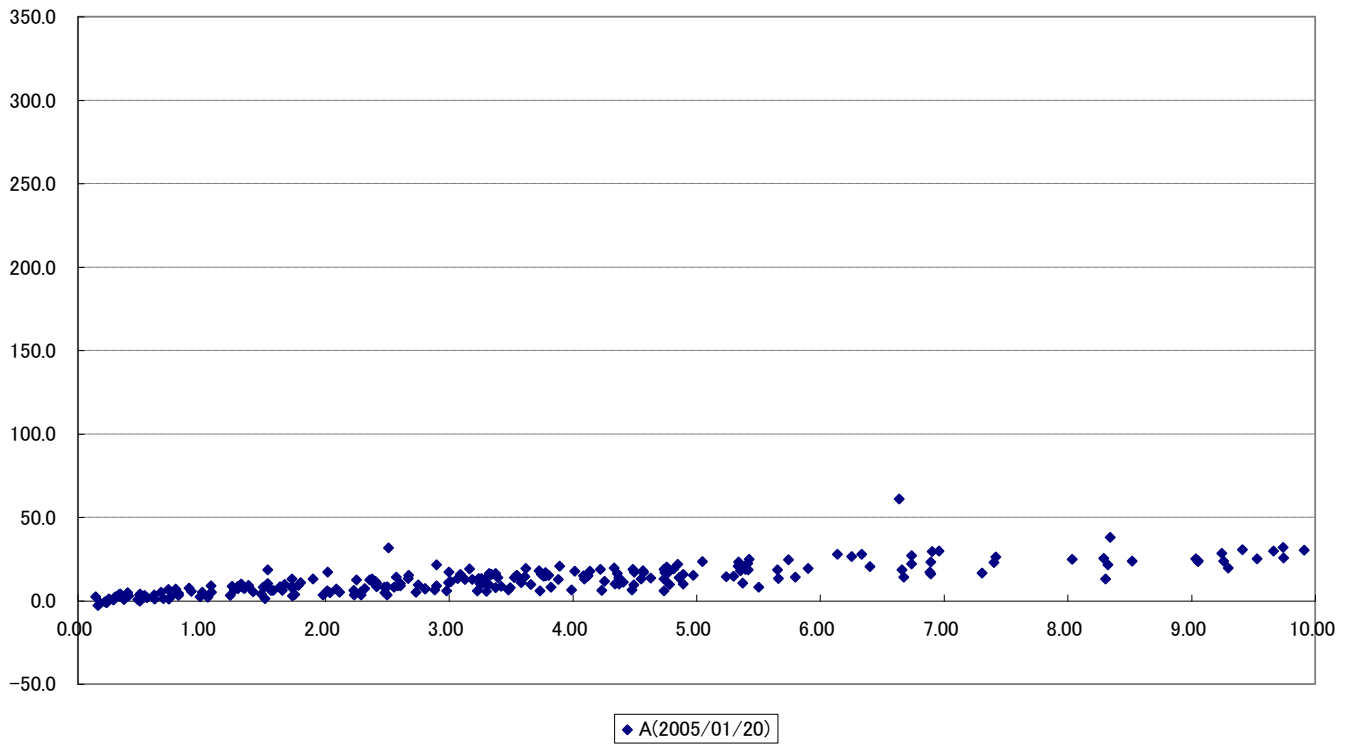


Figure 36 asset swap spread(2005/1/20) A

LIBOR Spread

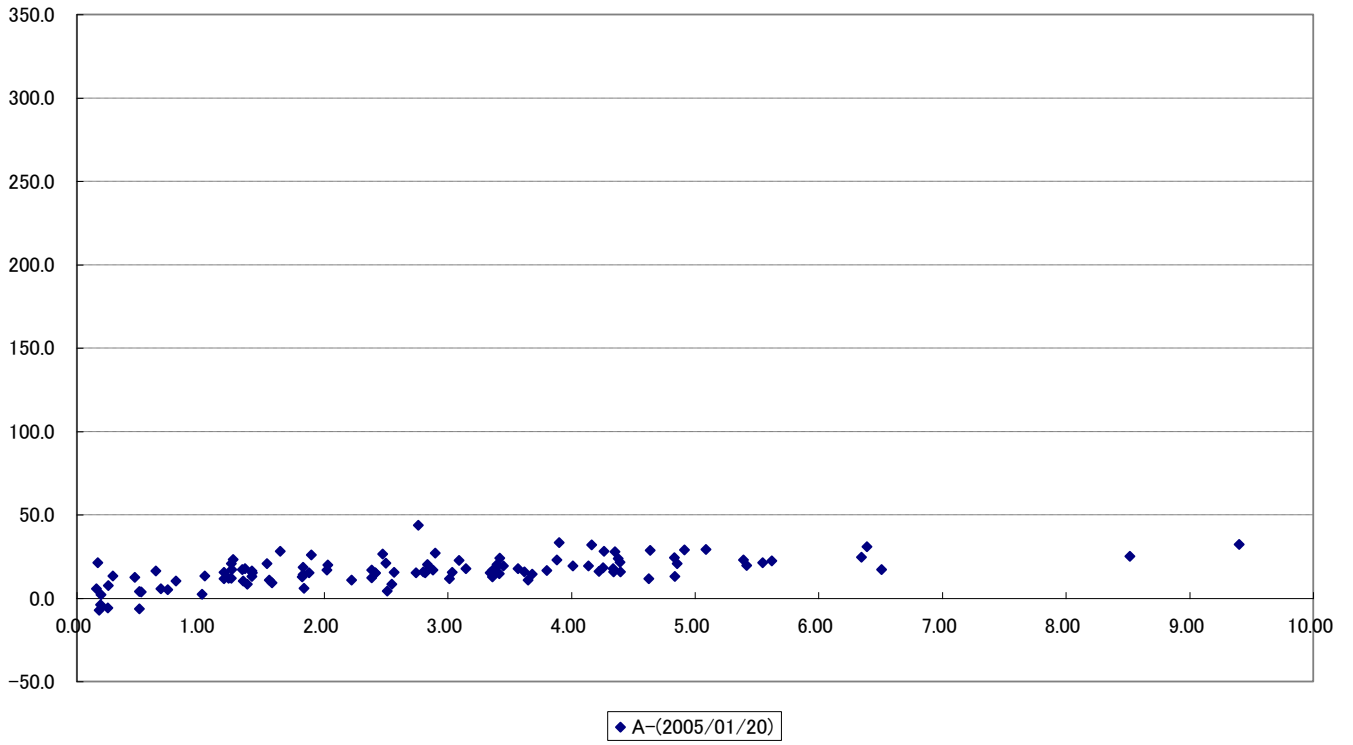


Figure 37 asset swap spread(2005/1/20) A-

LIBOR Spread

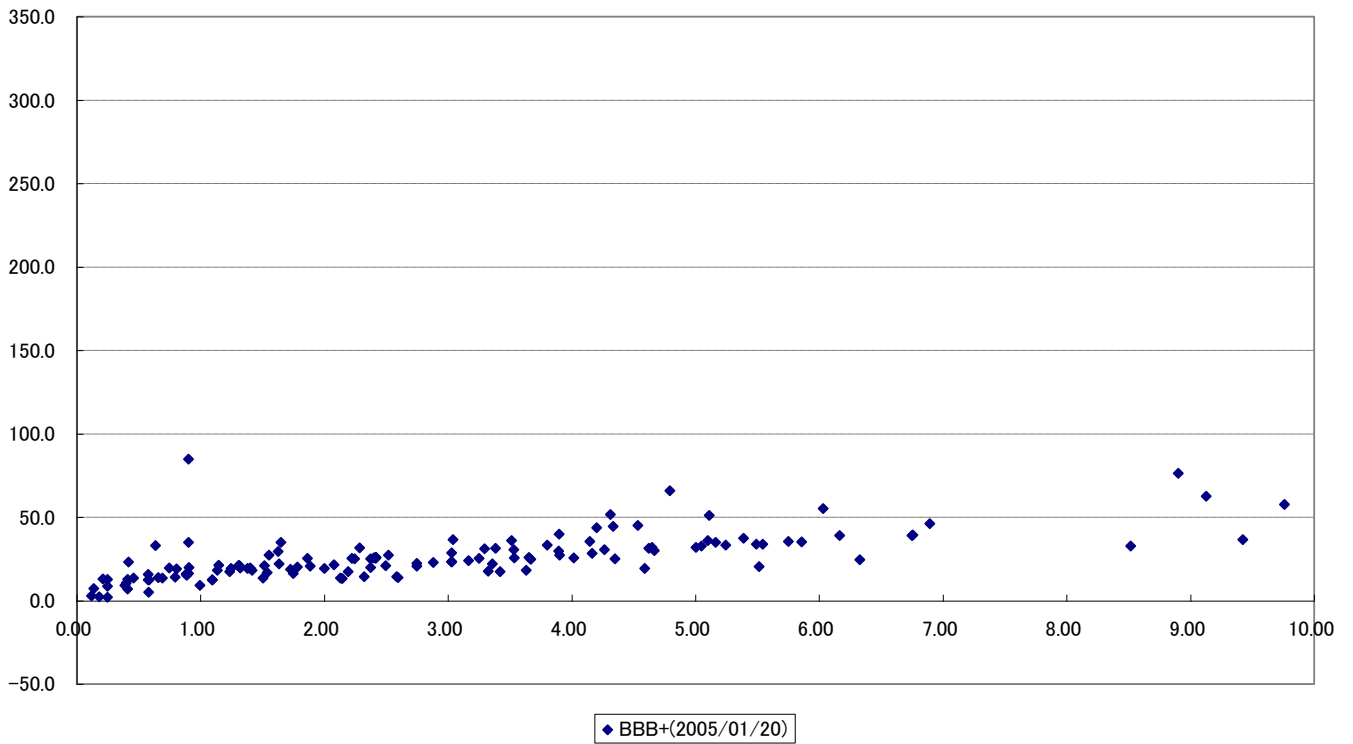


Figure 38 asset swap spread(2005/1/20) BBB+

LIBOR Spread

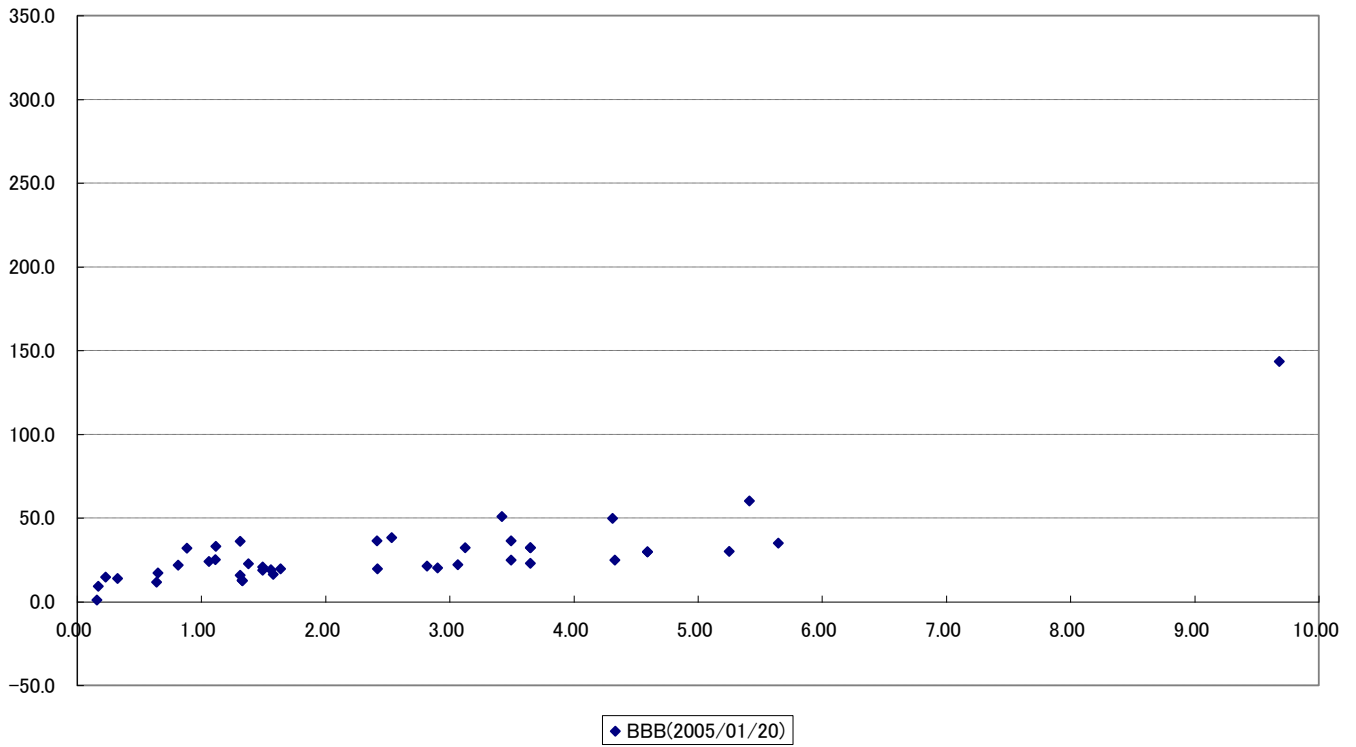


Figure 39 asset swap spread(2005/1/20) BBB

LIBOR Spread

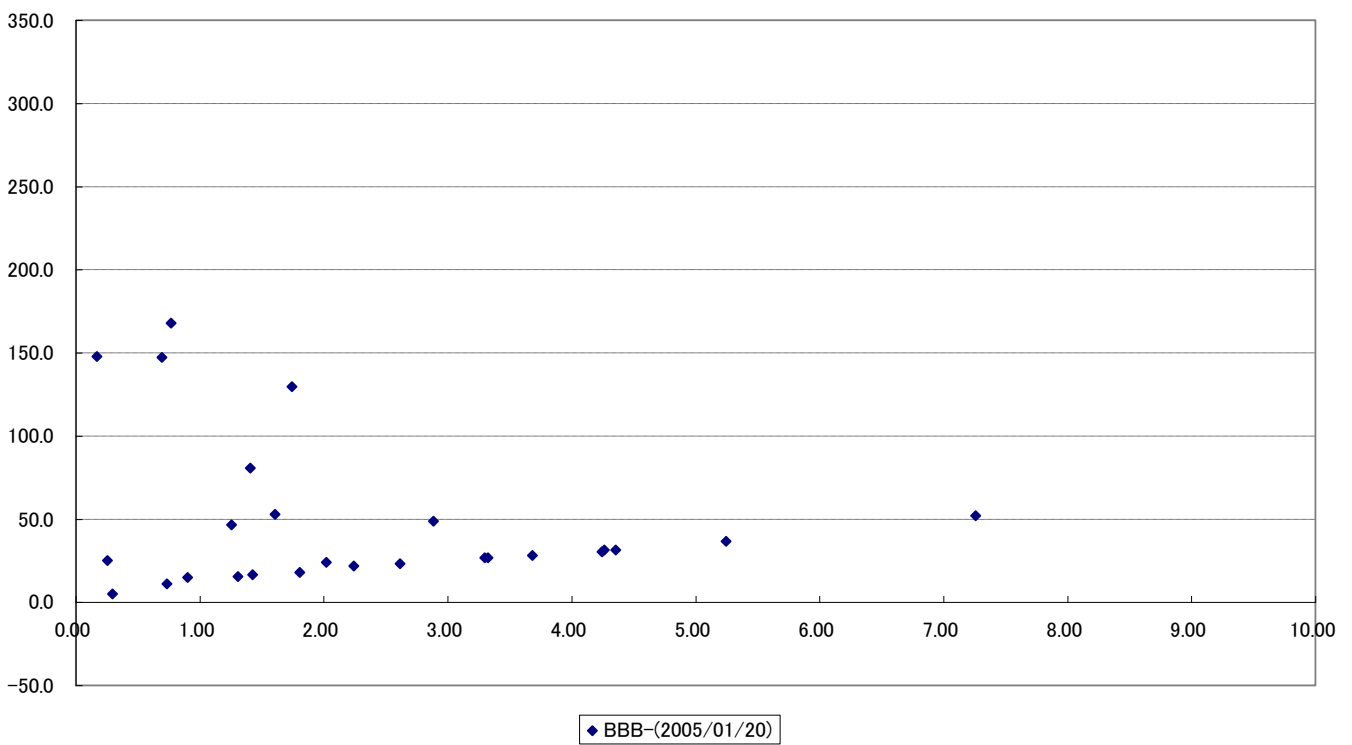


Figure 40 asset swap spread(2005/1/20) BBB-

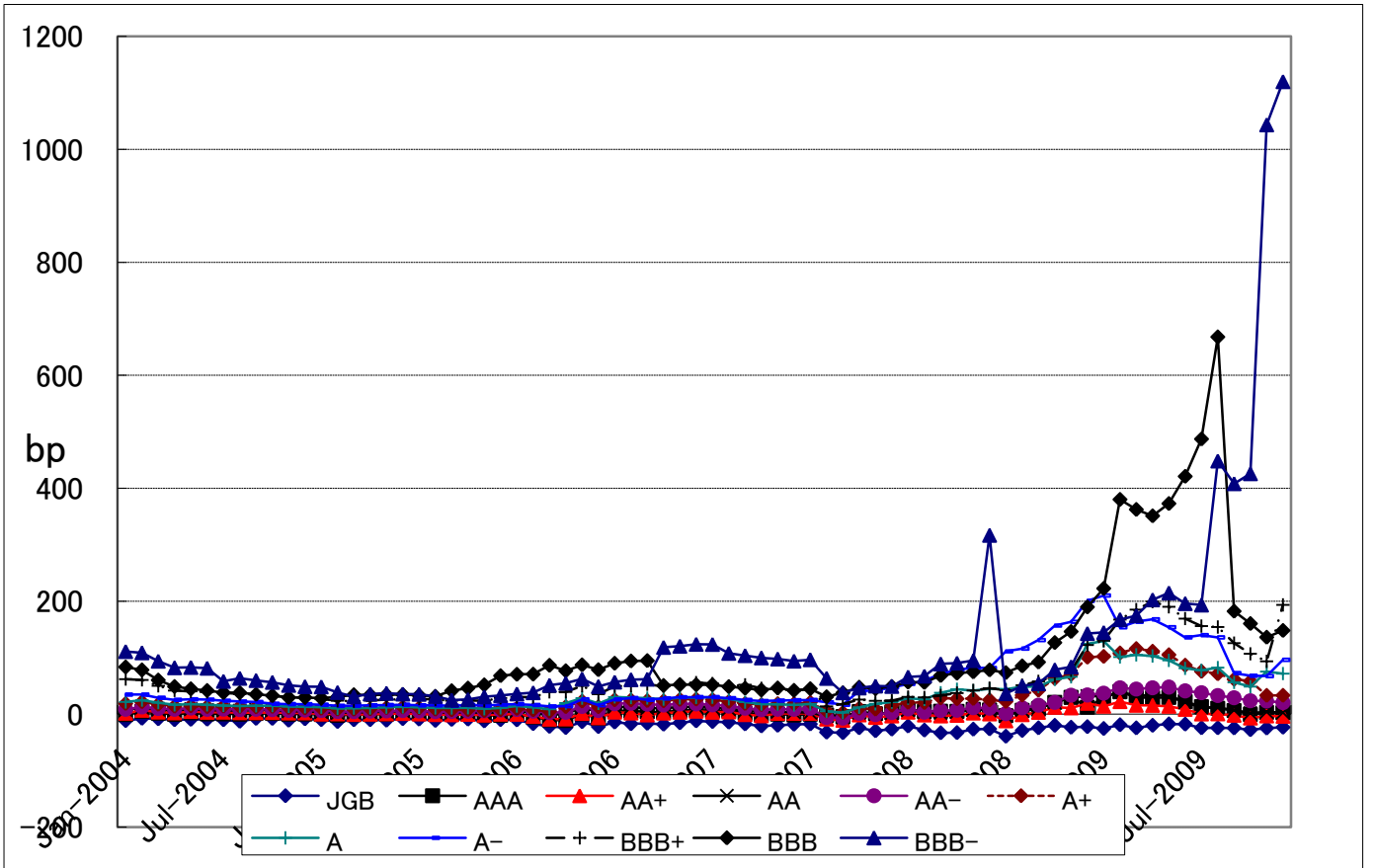


Figure 41 average asset swap spread (2004~2009 JGB~BBB-)

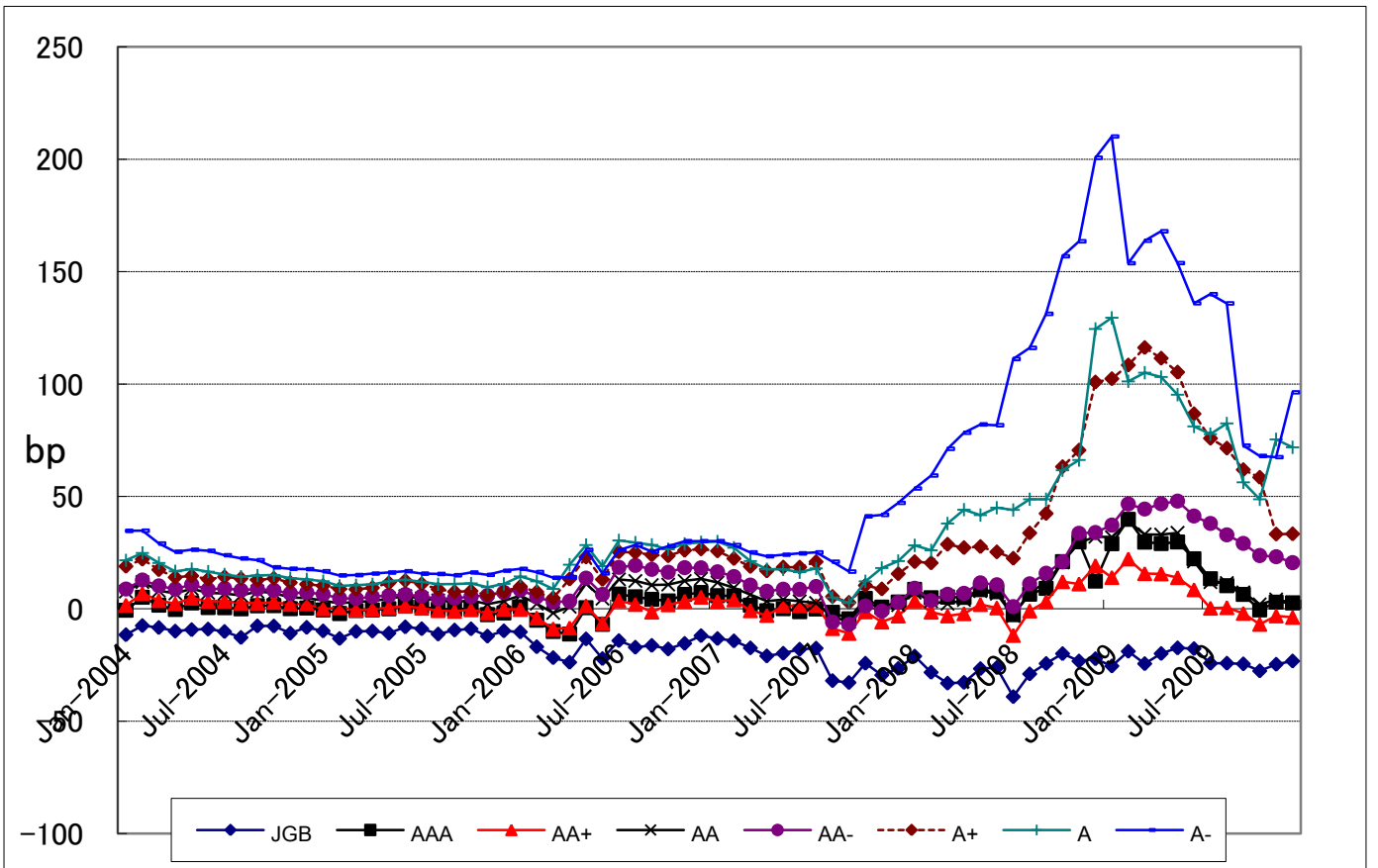


Figure 42 average asset swap spread (2004~2009 JGB~A-)

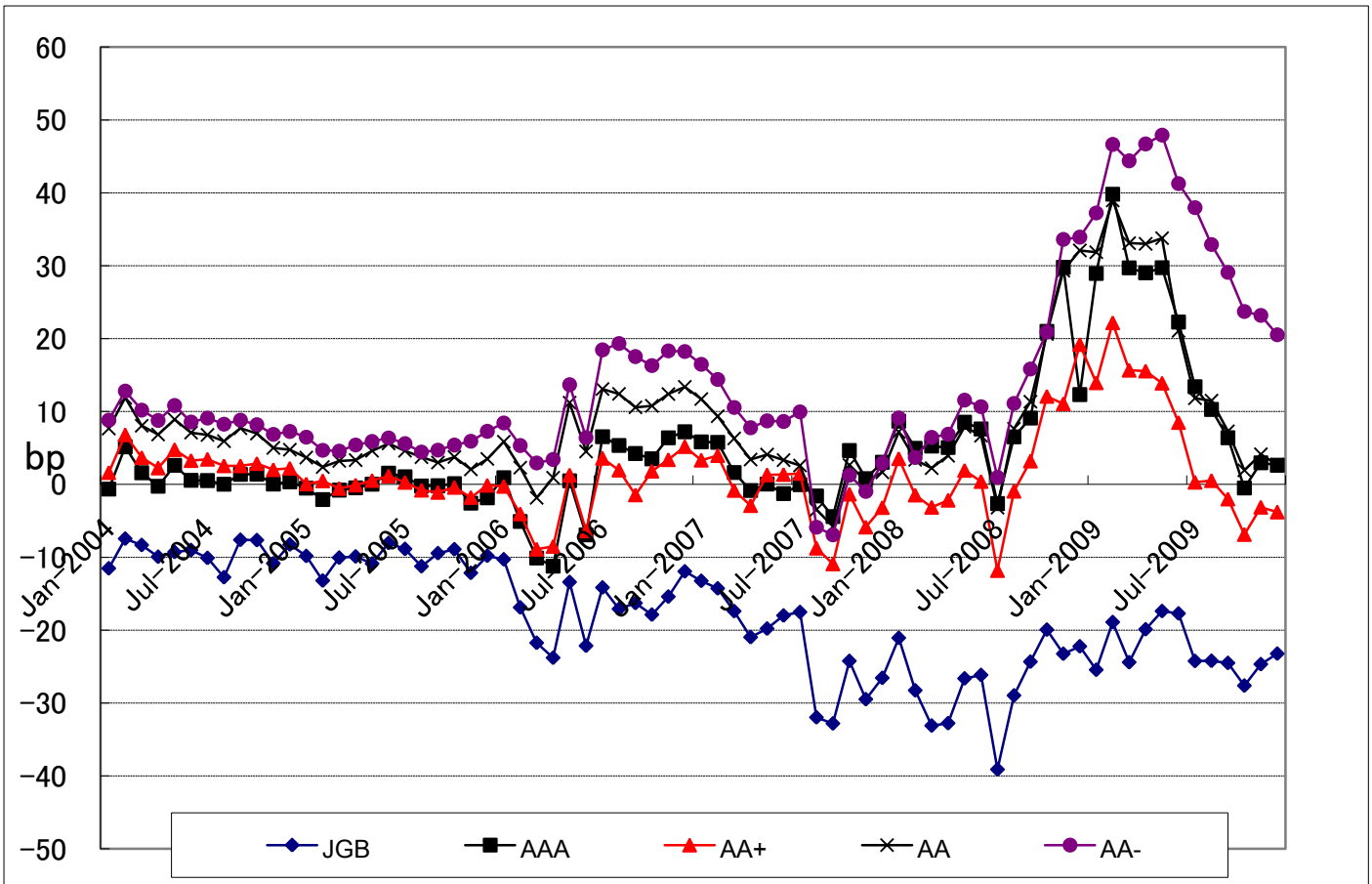


Figure 43 average asset swap spread (2004~2009 JGB~AA-)

date	CNST	YR	CY	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	\bar{R}^2
2004/1/20	-29	2	251	8	16	22	24	36	39	52	79	102	129	0.6831
2004/2/20	-28	3	141	8	17	23	24	36	39	49	75	95	126	0.6236
2004/3/22	-25	3	55	6	15	20	21	31	34	44	65	77	110	0.6046
2004/4/20	-21	2	57	7	14	19	21	27	30	39	56	64	97	0.5701
2004/5/20	-22	2	22	8	16	21	22	28	32	40	55	61	98	0.5661
2004/6/21	-21	2	84	7	14	19	19	26	29	38	53	56	95	0.5601
2004/7/20	-22	2	-49	7	15	20	20	29	30	38	53	55	74	0.6474
2004/8/20	-24	2	-48	9	17	21	22	31	31	39	53	57	82	0.6159
2004/9/21	-19	2	-34	6	13	18	18	25	26	34	48	49	73	0.6212
2004/10/20	-19	2	-41	6	13	17	18	26	27	31	45	47	71	0.5888
2004/11/22	-20	2	-69	8	14	17	20	26	28	33	45	46	68	0.5857
2004/12/20	-17	2	-11	6	12	14	18	23	24	30	41	43	62	0.5876
2005/1/20	-18	2	-28	7	12	15	18	24	25	30	40	43	63	0.5974
2005/2/21	-18	1	-77	9	15	16	19	24	25	31	40	47	56	0.5639
2005/3/22	-18	2	-54	7	11	14	17	22	24	29	37	49	46	0.5566
2005/4/20	-18	2	-43	7	13	14	17	23	23	29	38	48	51	0.5511
2005/5/20	-19	2	-67	8	15	17	19	26	26	31	40	50	53	0.5591
2005/6/20	-17	2	-34	7	13	15	17	24	24	29	38	47	49	0.5591
2005/7/20	-18	2	-38	7	13	15	17	24	24	29	40	47	50	0.5545
2005/8/22	-19	2	-48	9	14	17	18	23	25	30	40	47	48	0.5397
2005/9/20	-18	2	-38	7	13	15	17	20	23	28	37	55	40	0.5677
2005/10/20	-18	2	-5	7	13	16	16	20	23	29	37	59	40	0.5779
2005/11/21	-20	1	43	8	14	17	21	21	24	30	39	67	47	0.5206
2005/12/20	-20	1	221	6	13	16	20	20	23	30	41	80	46	0.4249

Shadowed cells show 5% significance level

Table 1 Regression results for asset swap spread (2004-2005)

date	CNST	YR	CY	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	\bar{R}^2
2006/1/20	-21	2	158	9	14	19	22	24	27	31	44	84	51	0.4502
2006/2/20	-24	1	151	10	16	21	24	27	31	35	49	89	58	0.4776
2006/3/20	-29	1	181	11	15	21	27	28	32	37	63	109	75	0.4518
2006/4/20	-30	0	277	12	16	26	29	38	44	39	64	100	79	0.3921
2006/5/20	-23	1	185	12	17	27	30	40	44	43	66	102	80	0.3924
2006/6/20	-30	1	238	14	18	28	31	38	42	40	59	101	73	0.4008
2006/7/20	-24	1	168	19	21	29	36	43	46	43	66	106	75	0.4059
2006/8/21	-25	2	16	20	22	31	39	46	48	48	70	114	83	0.5015
2006/9/20	-26	2	68	18	19	29	37	44	47	45	72	114	83	0.5201
2006/10/20	-28	1	181	19	24	31	37	45	46	48	70	71	139	0.5546
2006/11/20	-26	2	154	19	23	30	37	45	46	48	69	70	139	0.5313
2006/12/20	-24	2	233	17	21	27	34	42	43	45	71	66	139	0.5061
2007/1/22	-24	2	203	17	21	27	33	43	45	46	70	68	140	0.5219
2007/2/20	-26	2	114	17	23	26	32	41	44	46	67	67	127	0.5222
2007/3/20	-29	2	253	16	20	26	31	40	40	45	71	65	124	0.5424
2007/4/20	-31	1	166	18	22	26	31	41	40	47	69	66	123	0.5147
2007/5/21	-29	1	196	18	24	25	31	41	38	46	66	68	119	0.4986
2007/6/20	-25	1	261	15	21	22	28	38	35	44	60	60	112	0.4717
2007/7/20	-28	1	324	15	21	21	30	40	36	44	63	63	115	0.4760
2007/8/20	-38	2	-130	24	22	27	26	38	40	55	48	66	100	0.4502
2007/9/20	-36	1	-211	24	21	26	27	36	38	52	53	73	75	0.4788
2007/10/20	-31	2	-80	22	21	25	26	35	39	68	53	75	75	0.3648
2007/11/20	-36	1	84	25	22	28	28	39	49	73	54	76	81	0.3614
2007/12/20	-31	1	-144	24	22	26	30	43	50	76	53	78	80	0.8462

Shadowed cells show 5% significance level

Table 2 Regression results for asset swap spread (2006-2007)

date	CNST	YR	CY	AAA	AA+	AA	AA-	A+	A	A-	BBB+	BBB	BBB-	\bar{R}^2
2008/1/22	-31	1	206	24	22	26	30	42	51	77	53	80	89	0.3942
2008/2/20	-54	2	756	28	24	32	38	62	73	107	67	103	122	0.3546
2008/3/21	-54	2	756	28	24	32	38	62	73	107	67	103	122	0.3229
2008/4/21	-51	1	884	31	26	35	38	60	77	112	69	104	121	0.2893
2008/5/20	-43	1	781	30	25	33	37	54	68	109	68	100	119	0.2885
2008/6/20	-58	0	2119	28	19	31	33	49	67	106	66	97	326	0.2674
2008/7/22	-399	-17	30251	45	-46	41	-14	13	2	84	-28	-26	-9390	0.2038
2008/8/20	-51	0	1590	33	23	36	37	61	74	143	76	108	74	0.2342
2008/9/22	-52	0	2044	31	22	35	36	64	68	152	77	107	71	0.2144
2008/10/20	-60	0	2640	34	23	38	35	80	76	174	81	136	90	0.2173
2008/11/20	-74	1	3185	36	21	47	48	90	83	184	93	158	98	0.2364
2008/12/22	-79	1	3681	18	24	46	45	114	136	216	132	194	151	0.3054
2009/1/20	-89	0	4298	38	27	53	53	120	144	228	143	227	155	0.2986
2009/2/20	-76	1	3582	40	29	53	58	121	112	169	176	383	176	0.3704
2009/3/23	-75	0	3357	40	30	53	61	134	121	183	198	370	187	0.3954
2009/4/20	-70	1	3238	34	25	48	59	125	116	183	209	355	213	0.3976
2009/5/20	-68	1	3194	30	20	46	57	117	105	167	197	375	224	0.3878
2009/6/22	-71	1	3377	23	15	34	52	99	92	150	176	422	205	0.3534
2009/7/21	-89	-1	4755	25	12	33	51	92	90	154	163	484	200	0.3171
2009/8/20	-116	-4	7647	28	9	34	43	82	88	139	147	635	438	0.2631
2009/9/24	-54	2	1474	17	16	28	49	85	79	99	148	204	433	0.4071
2009/10/20	-53	1	1562	18	15	27	48	84	74	96	131	182	450	0.3647
2009/11/20	-52	1	1571	17	15	26	44	56	98	92	114	156	1069	0.5228
2009/12/21	-73	-1	3770	17	10	23	38	50	88	113	200	151	1132	0.4208

Shadowed cells show 5% significance level

Table 3 Regression results for asset swap spread (2008-2009)