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Macroeconomic Indicator Announcements, Liquidity, Volatility and Effective Half Spread in JGB Futures

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Contents

1. Introduction

This paper presents an investigation of whether liquidity, volatility and effective half spread are changing on an event days, when macroeconomic indicators are announced.

Until now, many studies related to liquidity research have been described in the literature. Research in this field has progressed since Kyle (1985). The study of latent liquidity is one example. Mahanti and et al. (2008) estimated latent liquidity of corporate bonds as the weighted average efficiency of the investment horizon of a corporate bond holder, and reported that correlation exists that is strong between latent liquidity and transaction cost, or and spread. Moreover, ILLIQ of Amihud (2002) used for this study is one which are researched. The liquidity in the market is high, which means that an investor's market participation is easy. When liquidity is low, it will be difficult for an investor to carry out market participation. Then, the liquidity definition is checked again here. As O'Hara (1995) shows, the state in which trade can be conducted at the minimum cost is a high-liquidity state, transaction cost becomes small, and liquidity will improve.

The purpose of this paper is to clarify liquidity and the announcement of macroeconomic indicators. To date, many studies have verified the announcement effects, specifically examining volatility. They analyze market efficiency. For example, Arshanapalli et al. (2006), Wang, Wang, and Liu (2005), and Ederington and Lee (2001) investigated whether a difference would have occurred in return volatility when macroeconomic indicators are announced. This paper clarifies the mutual relation of macroeconomic indicator announcement, liquidity, and volatility.

Consequently, the following is shown for the macroeconomic announcements event effect. First, regarding ILLIQ, which is an indicator of liquidity, ILLIQ increases by announcing macroeconomic indicators, which means that liquidity in the JGB Futures market falls.

Key words: Macroeconomic Announcement, Liquidity, Volatility, Effective Half Spread

Moreover, when transaction cost (effective half spread) is investigated, transaction cost becomes small by announcements of macroeconomic indicators. Therefore, the market liquidity rises. Furthermore, as for risk (volatility) in JGB Futures market, volatility becomes large by announcements of macroeconomic indicators, which means that liquidity falls in the JGB Futures market.

This paper proceeds as follows. Section 2 explains each measurement used for this study. Section 3 presents models of the empirical framework used for this study. Section 4 explains the data used for analyses. Section 5 presents empirical results. Finally, Section 6 concludes this study.

2. Measurements of Liquidity, Volatility and Effective Half Spread

ILLIQ (Liquidity)

Many previous studies have described market microstructure, liquidity and volatility in securities market[1]. Therefore, in this paper, the liquidity index (ILLIQ) proposed by Amihud (2002) is used. The ILLIQ advocated by Amihud is a liquidity index showing the influence (Price impact), that it has on the stock price per trading value unit. This price impact becomes small, as liquidity increases.

ILLIQ in this paper is the averaged value per day. The absolute value of a return per minute is divided by the volume at the interval. This also expresses the rate of change of the market price to volume of JGB Futures: ILLIQ computed by the following formula will be so small that the price impact is small. A small ILLIQ signifies that market liquidity is high.

Liquidity measure: ILLIQt

$$ILLIQ_t = \frac{1}{I}\sum_{i=1}^{I}\frac{|R_{t,i,j}|}{Volume_{t,i,j}}$$

In that equation, *R t, i, j: j* represents the *j*-th day in the entire sample period; *i* denotes the *i*-th data on the *j*-th day; *t* signifies the *t*-th sample in all numbers of samples. Therefore, *R t, i, j* expresses the return of the JGB Futures price of the *t*-th interval in all numbers of samples. *Volume t, i, j* expresses the *t*-th volume in all numbers of samples.

Effective half spread (Transaction cost)

O'Hara (1995) defines liquidity as follows. The state in liquidity is high when trading can be conducted with minimum costs. The minimum costs mean that a bid-ask spread is narrow. Furthermore, the minimum cost means that volatility is low. Usually the spread is defined by the difference of the bid-price and ask-price. The following effective half spread is used for this study[2].

Transaction cost measure: Effective Half Spread (*EHSt*)

$$EHS_t = |P_t - Q_t|$$
$$Q_t = (a_t + b_t)/2$$

Therein, *EHSt* represents an effective half spread, *Pt* expresses a contracted price, *Qt* signifies a middle quote, *at* denotes ask-price, and *bt* stands for the bid-price. Moreover, in terms of market microstructure, a spread is interpreted as an investor's transaction cost. The spread widens, which means that transaction cost becomes large. In contrast, concomitantly with the spread narrowing, transaction cost becomes small.

Transitory volatility (Risk)

Volatility, a risk index of dealings, is measured by the standard deviation of returns. If an investor is risk-averse she might like to perform dealings at trading hours when volatility is low. Liquidity is low at the time when volatility increases and liquidity is high at the time when volatility decreases. In this paper, the transitory volatility described by Ranaldo (2004) is used. In Ranaldo, the standard deviation is calculated at t-interval using the 20-lag return. Then he uses those as a representation of volatility (*Volat*). This paper adopts the same representation (vola20)[3].

3. Models

As described in this paper, the influence on the liquidity by the announcement of macroeconomic indicators is analyzed. This section explains each index and the models used for this study. OLS is used to estimate equation (1) -(3).

To analyze the event effect, each index is measured, respectively, on an event day and on a non-event day. Furthermore, whether a significant effect in each index exists is verified using a dummy variable of macroeconomic announcements. The verification methodology of the event effect is explained.

Hypothesis 1
H1: ILLIQ is bigger on an event day than on a non-event day.

As described in this paper, by event generation, risk increases, which implies that liquidity becomes lower: Therefore, on a non-event day, ILLIQ is smaller; ILLIQ takes a larger value on an event day.

Model 1 $$\ln(ILLIQ_t) = a + b_p \ln(ILLIQ_{t-p}) + c\ AD_t + e_t \quad (1)$$

Therein, *Dt* is a dummy variable that takes a value of 1 on the day when macroeconomic indicators are announced; it takes a value of 0 on other days. *ILLIQt−p* is the p-lag value of *ILLIQt*[4]. ILLIQ adopted the 24-lag periods model, based on AIC and SIC (BIC). If the coefficient (C) of this dummy variable (*ADt*) is positive and significant, then ILLIQ increases by event generation. From this result, it can be proven that liquidity decreases because of the announcement of macroeconomic indicators.

Hypothesis 2
H2: Effective half spread (transaction cost) is bigger on an event day than on a non-event day.

As described in this paper, it is considered that the effective spreads become large by event generation. However, when the announcement is an expected event (i.e., when an announcement's information is expected or the information is already discounted in the market price), an investor's reaction might become uniform and the effective spreads might become the same level or become narrower than on a non-event day.

Model 2 $$\ln(EHS_t) = a + b_p \ln(EHS_{t-p}) + c\ AD_t + e_t \qquad (2)$$

In that equation, *ADt* stands for a dummy variable that takes a value of 1 on the day when macroeconomic indicators are announced and which takes a value of 0 on other days. Furthermore, *EHSt−p* is p-lag value of *EHSt*. *EHS* adopted the 24-lag periods model, based on AIC and SIC (BIC). If the coefficient (C) of this dummy variable is positive and significant, then *EHSt* increases by event generation. According to O'Hara's definition, by this result, it is proved that liquidity falls by the announcement of macroeconomic indicators.

Hypothesis 3
H3: Volatility (Risk) is bigger on an event day than on a non-event day.

As described in this paper, it is considered that volatility becomes large by event generation. However, because it is the same as the effective spreads, when the announcement is the expected event (i.e., when an announcement's information is expected or the information is already discounted in the market price), an investor's reaction might become uniform and the effective spreads might become the same level or become narrower than on a non-event day.

Model 3 $$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + c\ AD_t + e_t \qquad (3)$$

In that equation, *ADt* is a dummy variable that takes a value of 1 on the day when macroeconomic indicators are announced and which takes a value of 0 on other days. Moreover, *Volat-p* denotes the p-lag value of *Volat*. Volatility (Vola20) adopted the 22-lag periods model, based on AIC and SIC (BIC)[5]. If the coefficient (C) of this dummy variable is positive and significant, then *Volat* increases by event generation. According to O'Hara's definition, by this result it can be proven that liquidity falls by the announcement of macroeconomic indicators.

Expected Sign conditions

Table 1 shows that the expected signs of coefficients of the event dummy (Dt) used by the model 1-3 are positive.

Table 1. Expected Sign condition in event effects

	a	b	c
Model 1	Positive negative	Positive Negative	Positive
Model 2	Positive Negative	Positive Negative	Positive
Model 3	Positive Negative	Positive Negative	Positive

4. Data

Sample period

The sample period used for this study is from April 2, 2003 to March 31, 2004. The transactions business days in this sample period constitute 244 days.

Trading hours of data used for this study

When the data sample is created for each minute through following three transaction sessions, they will include 417 samples in a single day: morning session, 9:01 a.m. - 10:59 a.m.; afternoon session, 12:31 p.m. - 14:59 p.m.; and evening session, 15:31 p.m. - 17:59 p.m.

There are 244 transactions business days in this study's sample period. The total number of samples is 101,748. Table 3 presents statistics related to each variable. For this study, the following data are removed: 9:00, 11:00, 12:00, 12:30, 15:00, 15:30, and 18:00. Then, this paper uses the data in 9:01 a.m. - 10:59 a.m. and 12:31 p.m. - 14:59 p.m. and 15:31 p.m. - 17:59 p.m. Because of it is conducted the matching "ITAYOSE" system in these time.

Macroeconomic indicators

This paper presents consideration of 12 different macroeconomic indicator announcements that provide a characterization of the macroeconomic. Macroeconomic indicator announcements are the following: Money Supply, Trade Balance (Trade Statistic), Trade Payment, Corporate Goods Price Index (CGPI), Bank of Japan's Quarterly Economic Survey

(Tankan), GDP, Industrial Produce Index (IIP), New Residence Starts (New Dwellings Started), Machinery Orders, Family Income and Expenditure Survey, Unemployment Rate, and the Consumer Price Index (CPI). This study's sample period has 244 transaction business days. There are 77 days on which macroeconomic indicators were announced.

Each variables statistics are shown in Table2.

Table 2. Statistics of Each Variables

Series	Mean	Std Error	Minimum	Maximum
ILLIQ	0.00003	0.00002	0.000005	0.0001
EHS	0.60756	0.34637	0	5.0000
VOLA10	0.00010	0.00012	0	0.0031
VOLA20	0.00011	0.00011	0	0.0022
VOLA30	0.00011	0.00011	0	0.0018
VOLA50	0.00012	0.00010	0	0.0014

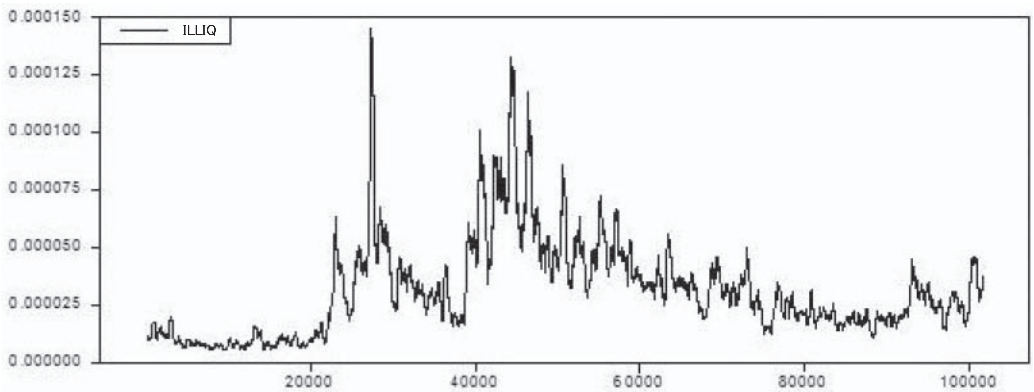
5. Empirical Results

First, here, the changes of ILLIQ, effective half spreads, volatility10, volatility20, volatility 30, volatility50 in entire sample can be observed from Figs. 1-6.

ILLIQ

The pattern of ILLIQ is depicted in Fig. 1.

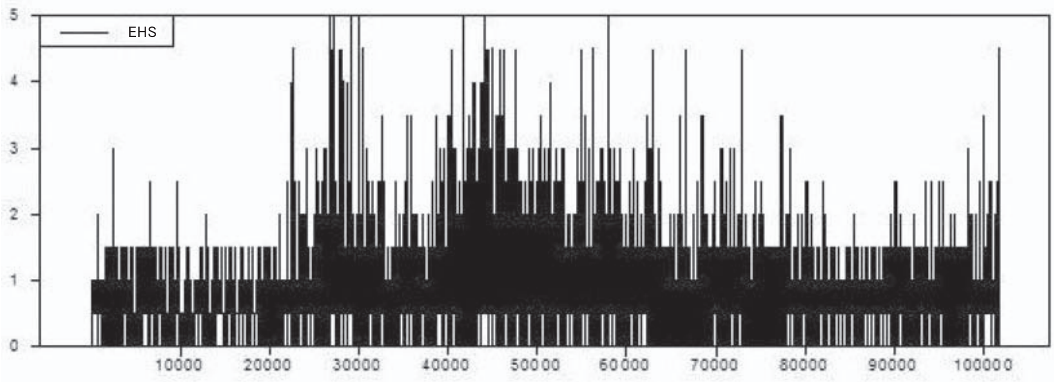
Fig. 1 ILLIQ.



Effective half spread

The pattern of effective half spread is depicted in Fig. 2.

Fig. 2 EHS.



Volatility

The patterns of volatility10, volatility20, volatility30, volatility50, are portrayed in Fig. 3-6.

Fig. 3 volatility 10.

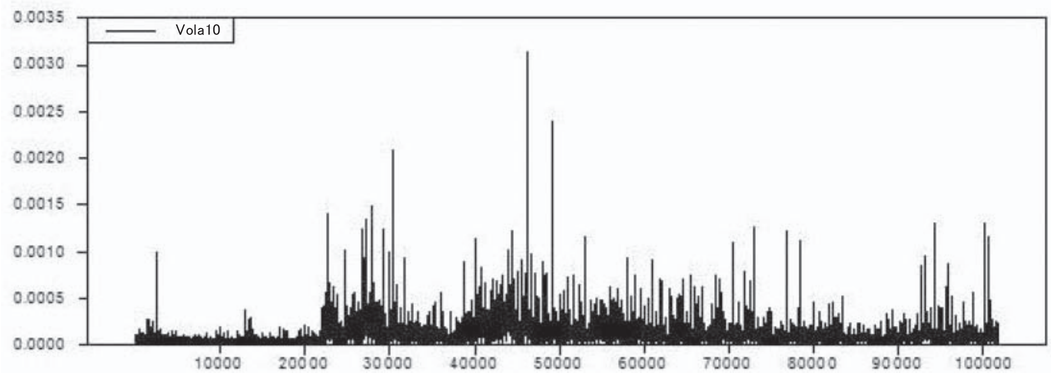


Fig. 4 volatility 20.

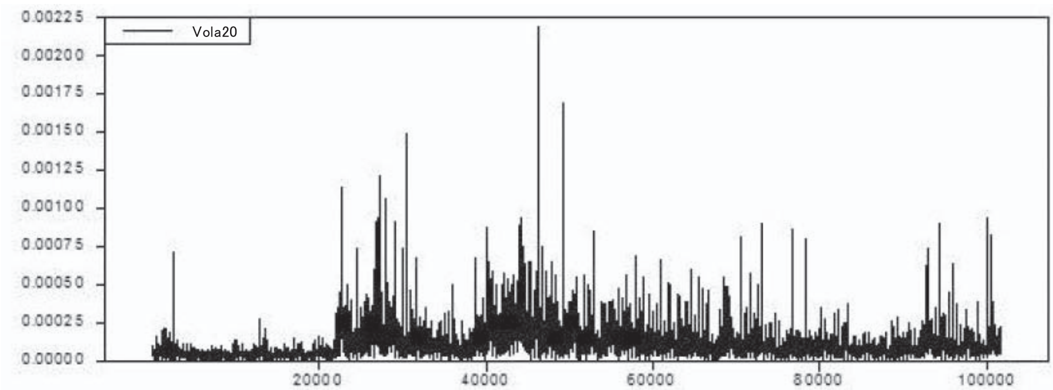


Fig. 5 volatility 30.

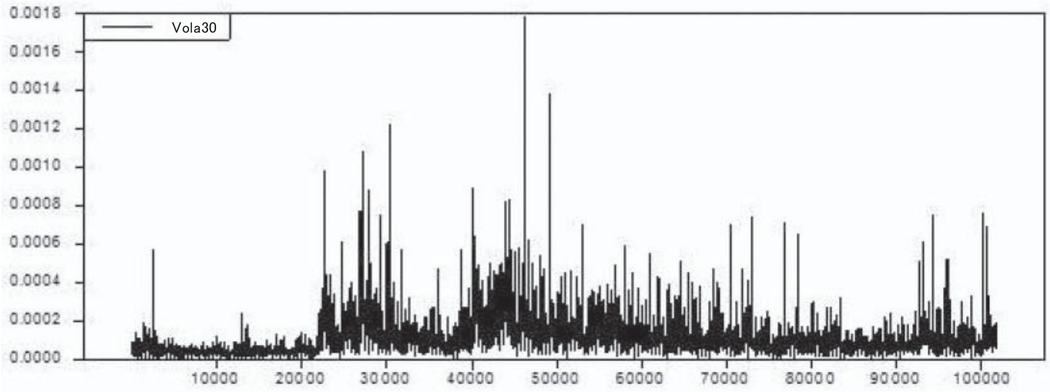
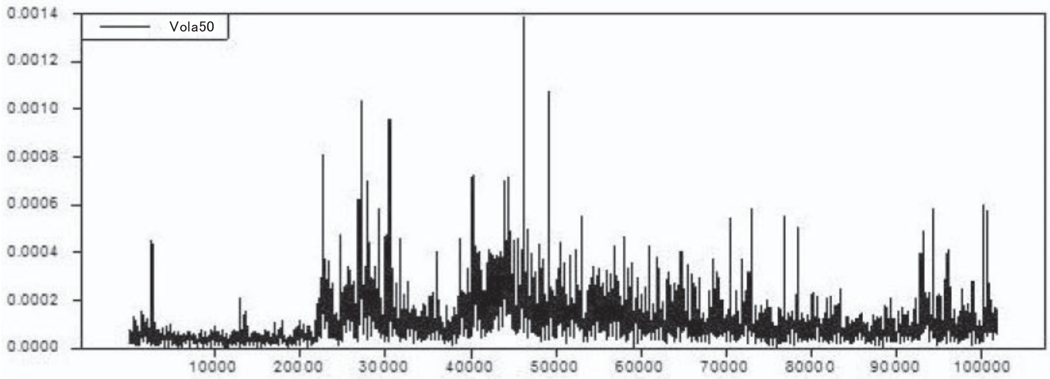


Fig. 6 volatility 50.



Results of estimations

Next, the announcement effects are verified using the event dummy of macroeconomic indicators. Table 4, Table 6, Table 8, Table 10, Table 12, and Table 14 respectively present results obtained using model 1, model 2, and model 3. Consequently, although ILLIQ has been affected significantly and positively on the event days is confirmed, the significant event effect is not reflected in the transaction cost (effective half spread) and in the risk (volatility).

Liquidity (ILLIQ)

This paper verifies that ILLIQ is bigger on an event day than on a non-event day (Hypothesis 1). As described, risk increases by event generation, which implies that liquidity becomes lower. Therefore, ILLIQ is smaller; ILLIQ takes a larger value on an event day. From results, it can be proven that liquidity decreases because of the announcement of macroeconomic indicators.

As shown in Table 4, the coefficient of the event dummy is positive and significant. As this result clarifies, ILLIQ increases when an announcement of macroeconomic indicators occurs, which reflects that the liquidity in the market falls on the days with announcement of macroeconomic indicators. Liquidity changes clearly on those days.

Table 3 shows the result of estimation equations (1) without announcement effects. The result was confirmed to be consistent with the result of estimation equations (1) with announcement effects.

Table 3. Model 1 non-announcement effects

$$\ln(ILLIQ_t) = a + b_p \ln(ILLIQ_{t-p}) + e_t$$

Explained variable, lnILLIQ (t);

Explanatory variable, lnILLIQ (t−p)

Adjusted R^2 0.99

Variable	Coefficients	P-value	
1. Constant	-0.0010	0.0073	***
2. LNILLIQ{1}	1.0320	0.0000	***
3. LNILLIQ{2}	0.0020	0.6541	
4. LNILLIQ{3}	-0.0098	0.0299	**
5. LNILLIQ{4}	-0.0044	0.3255	
6. LNILLIQ{5}	-0.0024	0.6017	
7. LNILLIQ{6}	-0.0007	0.8696	
8. LNILLIQ{7}	-0.0056	0.2125	
9. LNILLIQ{8}	0.0067	0.1399	
10. LNILLIQ{9}	-0.0026	0.5701	
11. LNILLIQ{10}	-0.0003	0.9516	
12. LNILLIQ{11}	-0.0010	0.8158	
13. LNILLIQ{12}	-0.0080	0.0765	*
14. LNILLIQ{13}	0.0014	0.7549	
15. LNILLIQ{14}	0.0045	0.3148	
16. LNILLIQ{15}	-0.0054	0.2337	
17. LNILLIQ{16}	-0.0002	0.9681	
18. LNILLIQ{17}	0.0028	0.5293	
19. LNILLIQ{18}	-0.0026	0.5689	
20. LNILLIQ{19}	0.0042	0.3526	
21. LNILLIQ{20}	-0.0013	0.7728	
22. LNILLIQ{21}	0.0053	0.2358	
23. LNILLIQ{22}	-0.0013	0.7673	
24. LNILLIQ{23}	-0.0013	0.7778	
25. LNILLIQ{24}	-0.0123	0.0001	***

***, **, * are significant at 1%, 5%, 10% significance level.

Table 4. Model 1 announcement effects

$$\ln(ILLIQ_t) = a + b_p \ln(ILLIQ_{t-p}) + c\, AD_t + e_t$$

Explained variable, lnILLIQ (t);

Explanatory variable, lnILLIQ (t−p) and AD

Adjusted R^2 0.99

Variable	Coefficients	P-value	
1. Constant	-0.0010	0.0057	***
2. LNILLIQ{1}	1.0319	0.0000	***
3. LNILLIQ{2}	0.0020	0.6541	
4. LNILLIQ{3}	-0.0098	0.0300	**
5. LNILLIQ{4}	-0.0044	0.3255	
6. LNILLIQ{5}	-0.0024	0.6016	
7. LNILLIQ{6}	-0.0007	0.8698	
8. LNILLIQ{7}	-0.0056	0.2125	
9. LNILLIQ{8}	0.0067	0.1399	
10. LNILLIQ{9}	-0.0026	0.5704	
11. LNILLIQ{10}	-0.0003	0.9519	
12. LNILLIQ{11}	-0.0010	0.8158	
13. LNILLIQ{12}	-0.0080	0.0765	*
14. LNILLIQ{13}	0.0014	0.7550	
15. LNILLIQ{14}	0.0045	0.3149	
16. LNILLIQ{15}	-0.0054	0.2336	
17. LNILLIQ{16}	-0.0002	0.9679	
18. LNILLIQ{17}	0.0028	0.5294	
19. LNILLIQ{18}	-0.0026	0.5689	
20. LNILLIQ{19}	0.0042	0.3524	
21. LNILLIQ{20}	-0.0013	0.7726	
22. LNILLIQ{21}	0.0053	0.2361	
23. LNILLIQ{22}	-0.0013	0.7677	
24. LNILLIQ{23}	-0.0013	0.7776	
25. LNILLIQ{24}	-0.0122	0.0001	***
26. AD	0.0001	0.0075	***

***, **, * are significant at 1%, 5%, 10% significance level.

Transaction Cost (Effective half spread)

This paper verifies that EHS (Transaction cost) is bigger on an event day than on a non-event day (Hypothesis 2). From results, it is proved that liquidity falls by the announcement of macroeconomic indicators.

As presented in Table 6, the coefficients of the event dummy are not significant. However, the coefficient of an event dummy is negative in the effective half spread, which shows the possibility that transaction cost will decrease when an event occurs. This result means the following. Liquidity in market becomes higher, as spreads become smaller on event days.

Table 5 shows the result of estimation equations (2) without announcement effects. The result was confirmed to be consistent with the result of estimation equations (2) with announcement effects.

Table 5. Model 2 non-announcement effects

$$\ln(EHS_t) = a + b_p \ln(EHS_{t-p}) + e_t$$

Explained variable, lnEHS (t);

Explanatory variable, lnEHS (t-p)

Adjusted R^2 0.29

Variable	Coefficients	P-value	
1. Constant	-0.0999	0.0000	***
2. LNEHS{1}	0.2940	0.0000	***
3. LNEHS{2}	0.1113	0.0000	***
4. LNEHS{3}	0.0695	0.0000	***
5. LNEHS{4}	0.0308	0.0000	***
6. LNEHS{5}	0.0309	0.0000	***
7. LNEHS{6}	0.0254	0.0000	***
8. LNEHS{7}	0.0256	0.0000	***
9. LNEHS{8}	0.0206	0.0000	***
10. LNEHS{9}	0.0231	0.0000	***
11. LNEHS{10}	0.0162	0.0000	***
12. LNEHS{11}	0.0178	0.0000	***
13. LNEHS{12}	0.0100	0.0069	***
14. LNEHS{13}	0.0144	0.0001	***
15. LNEHS{14}	0.0169	0.0000	***
16. LNEHS{15}	0.0186	0.0000	***
17. LNEHS{16}	0.0085	0.0220	**
18. LNEHS{17}	0.0124	0.0008	***
19. LNEHS{18}	0.0033	0.3671	
20. LNEHS{19}	0.0072	0.0514	*
21. LNEHS{20}	0.0179	0.0000	***

Table 6. Model 2 announcement effects

$$\ln(EHS_t) = a + b_p \ln(EHS_{t-p}) + c\ AD_t + e_t$$

Explained variable, lnEHS (t);

Explanatory variable, lnEHS (t-p) and AD

Adjusted R^2 0.29

Variable	Coefficients	P-value	
1. Constant	-0.0997	0.0000	***
2. LNEHS{1}	0.2940	0.0000	***
3. LNEHS{2}	0.1113	0.0000	***
4. LNEHS{3}	0.0695	0.0000	***
5. LNEHS{4}	0.0308	0.0000	***
6. LNEHS{5}	0.0309	0.0000	***
7. LNEHS{6}	0.0254	0.0000	***
8. LNEHS{7}	0.0256	0.0000	***
9. LNEHS{8}	0.0206	0.0000	***
10. LNEHS{9}	0.0231	0.0000	***
11. LNEHS{10}	0.0162	0.0000	***
12. LNEHS{11}	0.0178	0.0000	***
13. LNEHS{12}	0.0100	0.0069	***
14. LNEHS{13}	0.0144	0.0001	***
15. LNEHS{14}	0.0169	0.0000	***
16. LNEHS{15}	0.0186	0.0000	***
17. LNEHS{16}	0.0085	0.0220	**
18. LNEHS{17}	0.0124	0.0008	***
19. LNEHS{18}	0.0033	0.3673	
20. LNEHS{19}	0.0072	0.0515	*
21. LNEHS{20}	0.0179	0.0000	***

22. LNEHS{21}	0.0146	0.0001	***
23. LNEHS{22}	0.0081	0.0289	**
24. LNEHS{23}	0.0142	0.0001	***
25. LNEHS{24}	0.0141	0.0001	***

***, **, * are significant at 1%, 5%, 10% significance level.

22. LNEHS{21}	0.0146	0.0001	***
23. LNEHS{22}	0.0081	0.0290	**
24. LNEHS{23}	0.0142	0.0001	***
25. LNEHS{24}	0.0141	0.0001	***
26. AD	-0.0007	0.7352	

***, **, * are significant at 1%, 5%, 10% significance level.

Risk (Volatility)

This paper verifies that volatility (Risk) is bigger on an event day than on a non-event day (Hypothesis 3). As described, it is considered that volatility becomes large by event generation. However, because it is the same as the effective half spreads, when the announcement is the expected event, an investor's reaction might become uniform and the effective half spreads might become the same level or become narrower than on a non-event day. From results, it can be proven that liquidity falls by the announcement of macroeconomic indicators.

As presented in Table 8, 10, 12, 14, the coefficient of an event dummy is not significant. However, the coefficient of an event dummy is positive, except for table 12. Then, the possibility is shown that risk will become large when an event occurs. This result means the following. Liquidity becomes low, as the volatility becomes larger on event days.

Table 7, Table 9, Table 11 and Table 13 show the results of estimation equations (3) without announcement effects. The results were confirmed to be consistent with the results of estimation equations (3) with announcement effects.

Table 7. Model 3 non-announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + e_t$$

Explained variable, lnVola_10 (t);

Explanatory variable, lnVola_10 (t-p)

Adjusted R^2 0.94

Variable	Coefficients	P-value	
1. Constant	-0.1997	0.0000	***
2. LNVOLA 10{1}	1.0205	0.0000	***
3. LNVOLA 10{2}	-0.0251	0.0000	***
4. LNVOLA 10{3}	-0.0045	0.3741	
5. LNVOLA 10{4}	-0.0023	0.6399	
6. LNVOLA 10{5}	0.0036	0.4670	
7. LNVOLA 10{6}	0.0013	0.7991	
8. LNVOLA 10{7}	-0.0056	0.2600	
9. LNVOLA 10{8}	-0.0039	0.4266	

Table 8. Model 3 announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + c\ AD_t + e_t$$

Explained variable, lnVola_10 (t);

Explanatory variable, lnVola_10 (t-p) and AD

Adjusted R^2 0.94

Variable	Coefficients	P-value	
1. Constant	-0.2000	0.0000	***
2. LNVOLA 10{1}	1.0205	0.0000	***
3. LNVOLA 10{2}	-0.0251	0.0000	***
4. LNVOLA 10{3}	-0.0044	0.3741	
5. LNVOLA 10{4}	-0.0023	0.6398	
6. LNVOLA 10{5}	0.0036	0.4672	
7. LNVOLA 10{6}	0.0013	0.7991	
8. LNVOLA 10{7}	-0.0056	0.2600	
9. LNVOLA 10{8}	-0.0039	0.4267	

10. LNVOLA 10{9}	-0.0006	0.8954	
11. LNVOLA 10{10}	-0.3693	0.0000	***
12. LNVOLA 10{11}	0.3753	0.0000	***
13. LNVOLA 10{12}	-0.0067	0.1714	
14. LNVOLA 10{13}	-0.0090	0.0654	*
15. LNVOLA 10{14}	0.0062	0.2064	
16. LNVOLA 10{15}	0.0024	0.6180	
17. LNVOLA 10{16}	0.0000	0.9927	
18. LNVOLA 10{17}	-0.0043	0.3752	
19. LNVOLA 10{18}	-0.0011	0.8170	
20. LNVOLA 10{19}	0.0022	0.6527	
21. LNVOLA 10{20}	-0.1259	0.0000	***
22. LNVOLA 10{21}	0.1257	0.0000	***

***, **, * are significant at 1%, 5%, 10% significance level.

10. LNVOLA 10{9}	-0.0006	0.8952	
11. LNVOLA 10{10}	-0.3693	0.0000	***
12. LNVOLA 10{11}	0.3753	0.0000	***
13. LNVOLA 10{12}	-0.0067	0.1713	
14. LNVOLA 10{13}	-0.0090	0.0654	*
15. LNVOLA 10{14}	0.0062	0.2064	
16. LNVOLA 10{15}	0.0024	0.6179	
17. LNVOLA 10{16}	0.0000	0.9929	
18. LNVOLA 10{17}	-0.0043	0.3750	
19. LNVOLA 10{18}	-0.0011	0.8171	
20. LNVOLA 10{19}	0.0022	0.6530	
21. LNVOLA 10{20}	-0.1259	0.0000	***
22. LNVOLA 10{21}	0.1257	0.0000	***
23. AD	0.0008	0.5490	

***, **, * are significant at 1%, 5%, 10% significance level.

Table 9. Model 3 non-announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + e_t$$

Explained variable, lnVola_20 (t);

Explanatory variable, lnVola_20 (t-p)

Adjusted R^2 0.98

Variable	Coefficients	P-value	
1. Constant	-0.1094	0.0000	***
2. LNVOLA 20{1}	1.0457	0.0000	***
3. LNVOLA 20{2}	-0.0281	0.0000	***
4. LNVOLA 20{3}	-0.0095	0.0310	**
5. LNVOLA 20{4}	-0.0016	0.7131	
6. LNVOLA 20{5}	0.0049	0.2689	
7. LNVOLA 20{6}	-0.0030	0.4966	
8. LNVOLA 20{7}	-0.0034	0.4418	
9. LNVOLA 20{8}	-0.0009	0.8374	
10. LNVOLA 20{9}	-0.0083	0.0585	*
11. LNVOLA 20{10}	-0.0003	0.9469	
12. LNVOLA 20{11}	0.0032	0.4666	
13. LNVOLA 20{12}	0.0006	0.8817	
14. LNVOLA 20{13}	-0.0004	0.9237	
15. LNVOLA 20{14}	-0.0008	0.8510	

Table 10. Model 3 announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + c\ AD_t + e_t$$

Explained variable, lnVola_20 (t);

Explanatory variable, lnVola_20 (t-p) and AD

Adjusted R^2 0.98

Variable	Coefficients	P-value	
1. Constant	-0.1095	0.0000	***
2. LNVOLA 20{1}	1.0457	0.0000	***
3. LNVOLA 20{2}	-0.0281	0.0000	***
4. LNVOLA 20{3}	-0.0095	0.0310	**
5. LNVOLA 20{4}	-0.0016	0.7131	
6. LNVOLA 20{5}	0.0049	0.2689	
7. LNVOLA 20{6}	-0.0030	0.4965	
8. LNVOLA 20{7}	-0.0034	0.4418	
9. LNVOLA 20{8}	-0.0009	0.8375	
10. LNVOLA 20{9}	-0.0083	0.0585	*
11. LNVOLA 20{10}	-0.0003	0.9469	
12. LNVOLA 20{11}	0.0032	0.4666	
13. LNVOLA 20{12}	0.0006	0.8817	
14. LNVOLA 20{13}	-0.0004	0.9237	
15. LNVOLA 20{14}	-0.0008	0.8510	

16. LNVOLA 20{15}	0.0021	0.6354	
17. LNVOLA 20{16}	-0.0003	0.9372	
18. LNVOLA 20{17}	-0.0017	0.6931	
19. LNVOLA 20{18}	0.0027	0.5330	
20. LNVOLA 20{19}	-0.0006	0.8978	
21. LNVOLA 20{20}	-0.3343	0.0000	***
22. LNVOLA 20{21}	0.3435	0.0000	***
23. LNVOLA 20{22}	-0.0212	0.0000	***

***, **, * are significant at 1%, 5%, 10% significance level.

Table 11. Model 3 non-announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + e_t$$

Explained variable, lnVola_30 (t);

Explanatory variable, lnVola_30 (t-p)

Adjusted R^2 0.98

Variable	Coefficients	P-value	
1. Constant	-0.1057	0.0000	***
2. LNVOLA 30{1}	1.0441	0.0000	***
3. LNVOLA 30{2}	-0.0199	0.0000	***
4. LNVOLA 30{3}	-0.0094	0.0416	**
5. LNVOLA 30{4}	-0.0053	0.2518	
6. LNVOLA 30{5}	-0.0006	0.9020	
7. LNVOLA 30{6}	0.0008	0.8546	
8. LNVOLA 30{7}	-0.0016	0.7239	
9. LNVOLA 30{8}	-0.0010	0.8330	
10. LNVOLA 30{9}	-0.0040	0.3845	
11. LNVOLA 30{10}	0.0006	0.8902	
12. LNVOLA 30{11}	0.0028	0.5448	
13. LNVOLA 30{12}	-0.0079	0.0831	*
14. LNVOLA 30{13}	-0.0024	0.6014	
15. LNVOLA 30{14}	0.0007	0.8713	
16. LNVOLA 30{15}	0.0031	0.4941	
17. LNVOLA 30{16}	-0.0036	0.4334	
18. LNVOLA 30{17}	0.0030	0.5187	
19. LNVOLA 30{18}	-0.0023	0.6130	

16. LNVOLA 20{15}	0.0021	0.6354	
17. LNVOLA 20{16}	-0.0003	0.9372	
18. LNVOLA 20{17}	-0.0017	0.6931	
19. LNVOLA 20{18}	0.0027	0.5330	
20. LNVOLA 20{19}	-0.0006	0.8978	
21. LNVOLA 20{20}	-0.3343	0.0000	***
22. LNVOLA 20{21}	0.3435	0.0000	***
23. LNVOLA 20{22}	-0.0212	0.0000	***
24. AD	0.0001	0.8626	

***, **, * are significant at 1%, 5%, 10% significance level.

Table 12. Model 3 announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + c\ AD_t + e_t$$

Explained variable, lnVola_30 (t);

Explanatory variable, lnVola_30 (t-p) and AD

Adjusted R^2 0.98

Variable	Coefficients	P-value	
1. Constant	-0.1057	0.0000	***
2. LNVOLA 30{1}	1.0441	0.0000	***
3. LNVOLA 30{2}	-0.0199	0.0000	***
4. LNVOLA 30{3}	-0.0094	0.0416	**
5. LNVOLA 30{4}	-0.0053	0.2518	
6. LNVOLA 30{5}	-0.0006	0.9020	
7. LNVOLA 30{6}	0.0008	0.8546	
8. LNVOLA 30{7}	-0.0016	0.7239	
9. LNVOLA 30{8}	-0.0010	0.8330	
10. LNVOLA 30{9}	-0.0040	0.3845	
11. LNVOLA 30{10}	0.0006	0.8902	
12. LNVOLA 30{11}	0.0028	0.5448	
13. LNVOLA 30{12}	-0.0079	0.0831	*
14. LNVOLA 30{13}	-0.0024	0.6014	
15. LNVOLA 30{14}	0.0007	0.8713	
16. LNVOLA 30{15}	0.0031	0.4941	
17. LNVOLA 30{16}	-0.0036	0.4334	
18. LNVOLA 30{17}	0.0030	0.5187	
19. LNVOLA 30{18}	-0.0023	0.6130	

20. LNVOLA 30{19}	0.0012	0.7876	
21. LNVOLA 30{20}	0.0044	0.3377	
22. LNVOLA 30{21}	-0.0142	0.0000	***

***, **, * are significant at 1%, 5%, 10% significance level.

20. LNVOLA 30{19}	0.0012	0.7876	
21. LNVOLA 30{20}	0.0044	0.3377	
22. LNVOLA 30{21}	-0.0142	0.0000	***
23. AD	-0.0001	0.9210	

***, **, * are significant at 1%, 5%, 10% significance level.

Table 13. Model 3 non-announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + e_t$$

Explained variable, lnVola_50 (t);

Explanatory variable, lnVola_50 (t-p)

Adjusted R^2 0.99

Variable	Coefficients	P-value	
1. Constant	-0.0639	0.0000	***
2. LNVOLA 50{1}	1.0459	0.0000	***
3. LNVOLA 50{2}	-0.0164	0.0003	***
4. LNVOLA 50{3}	-0.0075	0.1004	
5. LNVOLA 50{4}	-0.0057	0.2057	
6. LNVOLA 50{5}	0.0013	0.7719	
7. LNVOLA 50{6}	-0.0068	0.1357	
8. LNVOLA 50{7}	0.0011	0.8144	
9. LNVOLA 50{8}	0.0018	0.6939	
10. LNVOLA 50{9}	-0.0053	0.2435	
11. LNVOLA 50{10}	-0.0016	0.7213	
12. LNVOLA 50{11}	0.0020	0.6556	
13. LNVOLA 50{12}	-0.0029	0.5252	
14. LNVOLA 50{13}	-0.0010	0.8278	
15. LNVOLA 50{14}	0.0038	0.4031	
16. LNVOLA 50{15}	-0.0156	0.0000	***

***, **, * are significant at 1%, 5%, 10% significance level.

Table 14. Model 3 announcement effects

$$\ln(Vola_t) = a + b_p \ln(Vola_{t-p}) + c\,AD_t + e_t$$

Explained variable, lnVola_50 (t);

Explanatory variable, lnVola_50 (t-p) and AD

Adjusted R^2 0.99

Variable	Coefficients	P-value	
1. Constant	-0.0639	0.0000	***
2. LNVOLA 50{1}	1.0459	0.0000	***
3. LNVOLA 50{2}	-0.0164	0.0003	***
4. LNVOLA 50{3}	-0.0075	0.1004	
5. LNVOLA 50{4}	-0.0057	0.2057	
6. LNVOLA 50{5}	0.0013	0.7719	
7. LNVOLA 50{6}	-0.0068	0.1357	
8. LNVOLA 50{7}	0.0011	0.8143	
9. LNVOLA 50{8}	0.0018	0.6938	
10. LNVOLA 50{9}	-0.0053	0.2435	
11. LNVOLA 50{10}	-0.0016	0.7212	
12. LNVOLA 50{11}	0.0020	0.6555	
13. LNVOLA 50{12}	-0.0029	0.5252	
14. LNVOLA 50{13}	-0.0010	0.8278	
15. LNVOLA 50{14}	0.0038	0.4031	
16. LNVOLA 50{15}	-0.0156	0.0000	***
17. AD	0.0002	0.6457	

***, **, * are significant at 1%, 5%, 10% significance level.

6. Conclusion

This paper presented an investigation of whether liquidity, volatility and effective half spread change on an event day, on which macroeconomic indicators are announced, in the

Japanese Government Bond (JGB) Futures market of the Tokyo Stock Exchange (TSE).

Consequently, the following results were shown for the macroeconomic indicator announcements event effect. First, as for ILLIQ, which is an indicator of Liquidity, results showed that ILLIQ increases by announcing macroeconomic indicators, which means that liquidity falls in a market. Moreover, when transaction cost (EHS) was investigated, results showed that transaction cost decreases by announcing macroeconomic indicators. Therefore, liquidity rises in a market by announcing macroeconomic indicators. Furthermore, as for risk (Volatility) in the JGB Futures market, volatility increases by announcement of macroeconomic indicators, which means that liquidity falls in the JGB Futures market.

This paper adopted AR (p) models by OLS, however it might be need to adopt another approach. It might to need to separate the entire data to the data on announcement days and the data on other days. This is the challenge in next revision.

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[1] For instance, Garman (1976), Copeland and Galai (1983), Glosten and Milgrom (1985), Easley and O'Hara (1987), Amihud and Mendelson (1987, 1991a,b), Admati and Pfleiderer (1988), Subrahmanyam (1991), Stoll and Whaley (1990), and Huang and Stoll (1994), Mahanti et al. (2008).

[2] Effective half spreads are also used in this paper. The transaction cost is usually measured using the bid-ask spread. However, when that measure is used, the transaction costs of the investor who orders the bid and the investor who orders the ask are calculated twice, as a "round-trip transaction".

[3] To check robustness, the volatility of 10-lag (Vola10), 30-lag (Vola30) and 50-lag (Vola50) are also calculated and analyzed in this paper.

[4] This paper adopted the p-order auto-regressive model in ILLIQ, EHS and Volatility as well.

[5] Vola10 adopted the 24-lag periods model, Vola30 adopted the 21-lag periods model, Vola50 adopted the 15-lag periods model, based on AIC and SIC (BIC).

Reference

Admati, A., and P. Pfleiderer [1988] "A Theory of Intraday Trading Patterns," *Review of Financial Studies* 1, 3-40.

Amihud,Y., and H. Mendelson [1987] "Trading Mechanisms and Stock Returns: An Empirical Investigation," *Journal of Finance* 42, 533-553.

Amihud,Y., and H. Mendelson [1991a] "Market Microstructure and Price Discovery on the Tokyo Stock Exchange," in Japanese Financial Market Research edited by W. T. Ziemba. 169-196.

Amihud,Y., and H. Mendelson [1991b] "Volatility, Efficiency, and Trading: Evidence from the Japanese Stock Market," *Journal of Finance* 46, 1765-1789.

Amihud, Y. [2002] "Illiquidity and Stock Returns: Cross-section and Time-series Effects," *Journal of Financial Markets*, Vol.5, 31-56.

Arshanapalli, B., d'Ouville E., Fabozzi, F., & Switzer, L. [2006] "Macroeconomic news effects on conditional volatilities in the bond and stock markets," *Applied Financial Economics*, 16, 377-384.

Copeland, T., and D. Galai [1983] "Information Effects on the Bid-Ask Spread," *Journal of Finance* 38, 1457-1469.

Ederington, L., & Lee, J. [2001] "Intraday Volatility in Interest-Rate and Foreign-Exchange Markets: ARCH, Announcement, and Seasonality Effects," *The Journal of Futures Markets*, 21, 517-552.

Easley, D., and O'Hara, M. [1987] "Price, Trading Size, and Information in Securities Markets," *Jorunal of Financial Economics* 19, 69–90.

Glosten, L., and P. Milgrom [1985] "Bid, Ask and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders," *Journal of Financial Economics* 14, 465–474.

Graman, M. B. [1976] "Market microstructure," *Journal of Financial Economics* 3, 257–275.

Huang, R., and Stoll, H [1994] "Market Microstructure and Stock Return Predictions," *The Review of Financial Studies* 7, 179–213.

Kyle, A [1985] "Continuous Auctions and Insider Trading," *Econometrica,* Vol.53, No.6,1315–1335.

Mahanti S, A. Nashikkar, M Subrahmanyam, G. Chacko, and G Mallik [2008] "Latent Liquidity: A new measure of liquidity, with an application to corporate bonds," *Journal of Financial Economics*, Vol.88, 272–298.

O'Hara, M [1996] Market Microstructure Theory, Blackwell Publishers.

Ronaldo, A [2004] "Order aggressiveness in limit order book markets," *Journal of Financial Markets*, 7, 53–74.

Stoll,H. R. and R. E. Whaley [1990] "Stock Market Structure and Volatility," *Review of Financial Studies*3, 37–71.

Subrahmanyam, A [1991] "Risk Aversion, Market Liquidity, and Price Efficiency," *Review of Financial Studies* 4, 417–442.

Wang, P., Wang, P., & Liu, A [2005] "Stock Return Volatility and Trading Volume: Evidence from the Chinese Stock Market," *Journal of Chinese Economic and Business Studies* 3(1), 39–54.

［Abstract］

Macroeconomic Indicator Announcements, Liquidity, Volatility and Effective Half Spread in JGB Futures

Takeo MINAKI

This paper presents an investigation of whether liquidity, volatility and effective half spread change on event days, when macroeconomic indicators are announced in the Japanese Government Bond (JGB) Futures market of the Tokyo Stock Exchange (TSE). Consequently, the following shows the macroeconomic indicator announcement's event effect. First, as for ILLIQ, which is an indicator of liquidity, ILLIQ increases along with the announcement of macroeconomic indicators, which means that liquidity falls in a market on announcements. Moreover, regarding effective half spread, there is a possibility the spread decreases with the announcement of macroeconomic indicators. Therefore, liquidity rises in a market on announcements. Furthermore, as for volatility, there is a possibility volatility becomes large by announcement of macroeconomic indicators, which means that liquidity falls with announcements in the JGB Futures market.

Key words: Macroeconomic Announcement, Liquidity, Volatility, Effective Half Spread