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Occurred Uncertainty by 'News' in Japanese Short- and Long-Term Financial Markets

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Abstract

This paper empirically examines the role of uncertainty occurred by 'news' in Japanese financial markets. A GARCH-MIDAS model is used for estimation. It finds that news-based implied volatility performs well in predicting long-term aggregate market volatilities. A subsample analysis provides that the predictive power of news-based volatility is continuing, as most of the coefficients are positive and significant. So, in general, the news based implied volatility model is associated with high market volatility. Moreover, stock market prices go on rising, different effects that appeared in each subsample period. On the recent period, when Abenomics was conducted, the effect decreased. Also, the effect of exchange rates decrease in short time. When stock prices decrease, volatilities of the stock prices in the past period increase. There is some possibility that markets were too unstable about the movements because of the low prices. Also, the volatility of long-term interest rates increases when the interest rate declines in the recent period under Abenomics. Although interest rates have been quite low in both sample periods, the Bank of Japan (BOJ) started to manage long-term interest rates in the recent period, so market participants seem to begin noticing the movements.

Keywords: Exchange rate; GARCH; Interest rate; Stock price; News; Volatility.

1. Introduction

Uncertainty in markets has been discussed a lot. In the past, this problem, which seems eternally unable to find answers, had not been examine. However, this problem has begun to be tackled. Recent crises in financial markets also have spurred discussion. There are not so many studies, but uncertainty in markets has been examined from various aspects. This problem has been discussed among academics and market participants. Examining uncertainty has been one of the main topics in finance, but there is still no consensus.

The impact of uncertainty on asset pricing has been discussed. Some uncertainty proxies have been provided, but most of them provide conditional variances of economic fundamentals (Bekaert *et al.*, 2009). This paper focuses on occurred volatility by news in Japanese short-and long-term financial markets using GARCH-MIDAS that is explained later. Suliman and Suliman (2012) used GARCH (1, 1) and found that ten out of nineteen currencies have volatility that has an explosive process, but there are not many studies including Japanese cases.

The relationship between news and uncertainty has not been examined extensively. Conrad and Loch (2015) showed that the news measure has strong predictive power for U.S. stock markets. Baker *et al.* (2016) proposed newspaper convergence frequency. This paper, such as Baker *et al.* (2016), employs uncertainty/volatility in financial markets from newspapers. Kamal and Haque (2016) showed that stock price and foreign exchange rate volatility diminishes immediately after crisis. After that positive news occurs more volatility than negatives. This paper is similar with this approach, but this paper discriminates the cases of rising value and declining value and analyzes them. Rossetti *et al.* (2017) demonstrated that bad news leads to a higher increase in the volatility than good news. Instead of good news and bad news, this paper focuses on price rising and price declining. Other studies, such as Kaplanski and Levy (2009); Manela and Moreira (2017); Strobl (2011); and Su *et al.* (2017) used news-based implied volatility (NVIX) as it receives market's perception on uncertainty in financial markets.

Recently, exchange rates have been examined using GARCH models. Shah *et al.* (2009) revealed that exchange rate volatility in Pakistan intervention in the foreign exchange market is effective using the GARCH-X model. Alam and Rahman (2012) demonstrated that past volatility of exchange rate occurs to current volatility using the GARCH model. Khan and Azim (2013) showed that using an international vehicle currency is favorable in Pakistan using the GARCH (1, 1) model. Cermeno and Sanin (2015) indicated that depreciation of exchange rates is related with high exchange rate volatility. Heqerty (2015) showed that oil prices have influence throughout Central and Eastern Europe. Pilbeam and Langeland (2015) indicated that the implied volatility forecasts outperform the other three GARCH models in low and high volatility sample periods. Derbali and Sy (2016) showed the existence of high dependence between the U.S. dollar and some African currencies. Kulu and Ngalawa (2016) showed that the GARCH model under the Student's t distribution leads to fitting for exchange rate volatility and global shock in Russia. Najafzadeh *et al.* (2016) indicated that the variables of real exchange rate and inflation have negative effects on stock markets, but oil prices had positive effect on the market. On the other hand, interest rates and gold prices do not have any effects. Pino *et al.* (2016) demonstrated that exchange rate volatility has effects on international trade (exports) flows in the short-term as well as in the long-term. Tsen (2016) revealed that real exchange rate volatility has significant impacts on international trade (exports) using the GARCH (1, 1) model. Caporale *et al.* (2017)

showed that high exchange rate volatility is related with bond inflows from Asian countries to the United States with the exception of the Philippines using GARCH and Markov switching specifications. Among these studies, I have a common point that this paper here employs the discrimination of appreciation and depreciation in exchange rates.

Also, stock prices have been started to be examined using the GARCH model. Moon and Yu (2010) revealed that the GARCH (1, 1)-M model finds significant evidence of a symmetric and asymmetric volatility spillover from the United States to China's stock market. Asharian *et al.* (2013) showed that including low-frequency macroeconomic information by using the GARCH-MIDAS model improves the prediction accuracy. It also indicates one interesting point that prediction ability is associated with the long-term variance. Ulici *et al.* (2014) demonstrated the relationship between shock and stock return volatility in Romanian banks' returns. Sharma (2015) showed that the standard GARCH model outperforms advanced GARCH models in 21 stock price indexes in the world. Al-Najjar (2016) showed that ARCH/GARCH models can understand characteristics of stock market returns in Amman stock exchange. Kambourroundis *et al.* (2016) indicated that implied volatility shows a predictable pattern and reveals the existence of a relationship between implied volatility in stock returns and the index returns. Molner (2016) found that a range-GARCH (1, 1) model performs better than the standard GARCH model when examining stock returns. Reher and Wilfling (2016) revealed significant Markov-switching structures in German stock markets. Tripathy (2017) showed the presence of asymmetric and leverage effects in all BRIC countries' stock market returns using GARCH, CHARMA, APARCH, and CGARCH model. Valera *et al.* (2017) showed that there is a significant relationship between stock market uncertainty and interest rate volatility. This paper analyses the cases of rising and declining stock price returns and employs the GARCH-MIDAS model. The GARCH-MIDAS model is explained later.

Finally, various uncertainty proxies are employed in empirical studies on the relationship between uncertainty and asset pricing (Ko and Lee, 2015). Arabi (2012) showed the relationship between exchange rate and uncertainty and showed the response of the exchange rate from news about CPI, money stock, and current account. Su *et al.* (2017) showed that uncertainty only focuses on macroeconomic conditions data and disregards the important role of media and investor's attentions. They concluded that news is more flexible and timely than economic data. In this paper, newspaper is used for estimation.

2. Recent Japanese Economy

Japan enjoyed high economic growth in the 1980s, and stock and land prices spurred greatly. The Japanese currency, yen, appreciated largely. However, exports that have been strongly related to Japanese economic growth did not decrease. Fortunately, the inflation rate did not rise strongly, so households were not damaged. However, the so-called bubble economy, during which stock and land prices rose, collapsed at the beginning of the 1990s, and the Japanese economy has experienced serious economic conditions since. In the 1990s, Japan suffered another serious recession. The reason that the recession occurred is said to be the fragile Japanese financial system and structural problems such as delays in political and economic systems and reforms and deregulation in many area. The BOJ conducted a new financial policy, the quantitative easing policy, in March 2001. However, the BOJ quit quantitative easing in March 2006, as there were some bright signs.

Around 2008, a global financial crisis occurred. It caused a serious economic condition in Japan, too. The BOJ increased the purchases of Japanese government bonds aggressively to flow money into the markets. Declines in stock prices and yen appreciation occurred at the same time. Under this serious condition, the Japanese government changed to a new and drastic policy called *Abenomics*, named after Japan's prime minister. Abenomics is distinguished by a set of policies that comprises three branches: (1) aggressive monetary policy, (2) fiscal consolidation, and (3) growth strategy. In 2013, the BOJ and the Japanese government published a joint statement. At that time, under huge debt, the government demanded more aggressive financial policy. The BOJ started to conduct monetary policy based on the principle that the policy shall be aimed at achieving price stability (combating deflation in reality), thereby contributing to the sound growth of the economy. The government would revitalize Japan's economy by implementing flexible management of macroeconomic policy and by formulating measures to strengthen the competitiveness and growth potential of Japan's economy. In addition, by strengthening coordination between the government and the BOJ, the government would steadily promote measures aimed at the establishment of a sustainable fiscal structure to ensure the credibility of fiscal management (Cabinet Office, Ministry of Finance, and Bank of Japan, 2013). Japanese fiscal expansion again began to increase. Also, recently, Abe announced a nominal GDP target of \600trn (from around \500trn now) by promoting Abenomics.

This paper focuses on 2008 and 2013. In 2008, a worldwide crisis occurred, and it hit the Japanese economy. In 2013, Abenomics started, and the rising of stock prices, yen's depreciation, and lowering interest rates occurred.

3. Empirical Methodology

This paper empirically examines the playing role of uncertainty occurred by news in Japanese financial. GARCH-MIDAS model is used for estimation. There are many kinds of GARCH model, and some of them have recently appeared. In exponential GARCH (EGARCH), the leverage effect is not quadratic but exponential, and the forecasts of the conditional variance are kept to be nonnegative. Power GARCH (PGARCH) employs a power parameter. The power parameter, which is the standard deviation, is estimated rather than imposed. Component GARCH (CGARCH) employs the variables in the transitory estimation. The have an impact on the short-term movements in volatility while the variables in the permanent equation have influence on the long-term levels of volatility.

Mixed Data Sampling (MIDAS) estimation is one of the estimation methods among GARCH models that can use data at different frequencies in the same regression. The goal of this method is to incorporate the information from the higher frequency data into the lower frequency estimation in a parsimonious form. MIDAS estimation occupies the middle ground between these approaches by allowing for non-equal weights but decreasing the number of coefficients by fitting functions to the parameters of the higher frequency data. Engel *et al*. (2013) proposed the GARCH-MIDAS model. It specifies the conditional variance of daily asset returns as the figure of a short-term and a long-term component, which allows us to combine data with a long-term volatility component that is made by low-frequency endogenous variables.

This paper takes weighting into consideration as the long-term component is driven by the weighted average of the lagged endogenous variable. Using weighting method, beta is used for estimation, while restricting the endpoints coefficient to be zero. The beta function is flexible and can take many shapes, including gradually increasing or decreasing, flat, humped, or U-shaped, depending on the values from the MIDAS.

4. Data

This paper uses daily financial markets data, NIKKEI 225 (Japanese indexed price of stock market), exchange rate (Japanese yen/USD), short-term interest rate (overnight interest rate), and long-term interest rate (Japanese government 10-year bond). All of the data used in this paper are returns. One reason is to avoid the unit roots explained in the next section. The sample period is from 2008 (beginning of February) to 2018 (the end of January). The period is divided into two periods. First (past) period is from February 1, 2008 to March 31, 2013 and the second (recent) one is from April 1, 2013 to January 31, 2018. Abenomics is said to be started from the beginning of April 4, 2013. On the day, drastic monetary expansion was announced from the BOJ. A GARCH-MIDAS model with stock price, exchange rate, short-term interest rate, and long-term interest rate as the dependent variables and a lagged value of them as a regressor is used for estimation.

Manela and Moreira (2017) used front-page coverage of the Wall Street Journal as a proxy for investor concerns. The big event day is a newspaper-based uncertainty for measuring public perception on future uncertainty. This paper uses the Japanese newspaper, Nippon Keizai Shinbun (Nikkei). The words, rising and losing (stock prices), appreciation and depreciation (exchange rate), and rising and lowering (short-term and long-term interest rates) are used for estimation. All of the data are from NIKKEI database. These ones are used as a set of higher-frequency regressors. The lag is checked by AIC.

5. Empirical Results

Before conducting GARCH-MIDAS analyses, each descriptive statistics values were reported in Table 1. Also, unit root tests were performed. Table 2 shows that all of the data have no unit root at the 1% level using the ADF test. So, only the rate of each variable is used for estimation. The estimation results using ordinary least squares is in Table 3. Almost all of the cases show that the regressions are appropriate.

Table-1. Descriptive statistics values

	Stock price		**Exchange rate**		**Short-term interest rate**		**Long-term interest rate**	
	Rate	Level	Rate	Level	Rate	Level	Rate	Level
Mean	0.0003	13614.13	3.40E-05	98.98	-0.0009	0.31	0.01	0.74
Median	0.0006	13367.79	0.00	100.10	0.000	0.29	0.00	0.77
Maximum	0.14	24124.15	0.04	125.35	0.33	0.91	15.00	1.88
Minimum	-0.11	7054.98	-0.04	75.86	-0.25	0.05	-2.50	-0.29
Std. Dev.	0.01	4258.52	0.007	13.71	0.01	0.22	0.41	0.51
Skewness	-0.25	0.38	0.05	-0.006	3.91	1.07	24.95	-0.11
Kurtosis	11.13	1.88	7.36	1.90	472.44	3.44	815.82	1.87
Jarque-Bera	8783.56	188.12	1943.68	123.22	22512182	492.34	67726500	134.21

Table-2. Unit root tests (ADF test)

Stock		**Exchange rate**		**Short-term interest rate**		**Long-term interest rate**	
Level	Rate	Level	Rate	Level	Rate	Level	Rate
-0.07	-52.22***	-1.13	-52.53***	-2.53	-12.43***	-1.07	-10.21***

Note: Parentheses are t-statistic. ***, **, and * are significant at 1, 5, and 10% level.

Table-3. OLS estimation

		c	One-time lag	Prob (F-statistic)	Durbin-Watson
Stock	Whole	0.0003 (1.1454)	-0.0541*** (-2.6828)	0.0073	1.9982
	First part	8.17E-05 (0.1622)	-0.0506* (-1.8013)	0.0718	1.9988
	Latter part	0.0006* (1.7077)	-0.0613** (-2.1148)	0.0346	1.9960
Exchange rate	Whole	3.60E-05 (0.2545)	-0.0598*** (-2.9651)	0.0030	2.0024
	First part	-7.58E-05 (-0.3597)	-0.0769*** (-2.7434)	0.0061	2.0067
	Latter part	0.0001 (0.8049)	-0.0355 (-1.2235)	0.2213	1.9981
Short-term interest rate	Whole	-0.0008*** (-3.5292)	0.16671*** (8.3640)	0.0000	2.0258
	First part	-0.0006*** (-4.4086)	0.3583*** (13.6429)	0.0000	2.0706
	Latter part	-0.0008* (-1.8844)	0.1439*** (5.0003)	0.0000	2.0203
Long-term interest rate	Whole	0.0108 (1.2823)	-0.0762*** (-3.7848)	0.0001	2.0124
	First part	-0.0005 (-0.9662)	-0.0415 (-1.4770)	0.1399	1.9987
	Latter part	0.0230 (1.3189)	-0.0770*** (-2.6574)	0.0079	2.0127

Note: Parentheses are t-statistic. ***, **, and * are significant at 1, 5, and 10% level.

This paper conducts the GARCH-MIDS model with unrestricted weighting schemes and chooses K=4. The lag is determined by AIC. The results are in Table 4 and Table 5. Table 4 is the case of rising case. For the exchange rate, it means appreciation. Also, Table 5 is the case of declining case. For the exchange rate, it denotes depreciation.

Table-4. Rising (appreciation) case

	Stock		Exchange rate		Short-term interest rate		Long-term interest rate	
	First	Latter	First	Latter	First	Latter	First	Latter
C	-0.0007* (-1.70)	0.0002 (0.67)	0.0002 (1.13)	0.0003* (1.72)	-0.001*** (-7.21)	-0.001*** (-4.44)	-0.01*** (-3.26)	-0.01*** (-2.82)
One time lag	0.007 (0.25)	-0.01 (-0.46)	-0.08*** (-3.10)	-0.05* (-1.86)	-0.34 (-1.39)	-0.33*** (-7.32)	-0.22*** (-22.24)	0.01 (0.41)
Beta1	1.12*** (10.62)	0.03*** (24.99)	0.99*** (3.22)	2.51*** (13.22)	2.06*** (4.35)	2.00*** (21.88)	2.09*** (85.50)	0.75 (0.08)
Beta2	19.99*** (78382.76)	1.11 (0.43)	19.99*** (139407.60)	-1.90*** (-10.93)	-1.13** (-2.31)	-1.16*** (-12.45)	-1.32*** (-54.40)	19.99*** (687446.60)
Beta3	-0.08** (-2.12)	-0.05 (-0.50)	0.06** (2.12)	0.32*** (9.36)	0.16* (1.65)	0.16*** (8.74)	0.20*** (40.97)	-0.01** (-2.17)
AIC	-5.44	-5.84	-7.14	-7.40	-7.73	-6.14	-0.86	-0.27
D.W.	1.99	1.99	1.98	1.92	1.28	1.46	1.37	1.80

Note: Parentheses are t-statistic. ***, **, and * are significant at 1, 5, and 10% level.

Table-5. Declining (depreciation) case

	Stock		Exchange rate		Short-term interest rate		Long-term interest rate	
	First	Latter	First	Latter	First	Latter	First	Latter
C	0.0005 (1.37)	0.0005 (1.25)	-0.0001 (-0.79)	0.0002* (1.70)	-	-	-	0.02 (1.59)
One-time lag	-0.11*** (-4.53)	-0.04 (-1.61)	-0.05* (-1.92)	-0.02 (-1.04)	-	-	-	-0.12*** (-4.28)
Beta1	2.78*** (19.19)	0.91*** (15.98)	1.82*** (11.88)	0.95* (1.84)	-	-	-	1.64*** (16.51)
Beta2	1.99*** (14.79)	1.37 (0.57)	-1.51*** (-10.48)	19.99*** (123407.40)	-	-	-	1.02*** (385.36)
Beta3	0.30*** (11.57)	-0.17*** (-11.46)	0.26*** (9.18)	-0.10*** (-3.28)	-	-	-	0.90*** (15.94)
AIC	-5.54	-5.56	-7.06	-7.41	-	-	-	1.52
D.W.	1.90	2.02	1.95	1.93	-	-	-	2.00

Note: Parentheses are t-statistic. ***, **, and * are significant at 1, 5, and 10% level. '-' denotes no results of the data owing to the lack of the data.

The results are not so robust, but there are some interesting and important points to see. In general, most of the coefficients are positive and significant, so the NVIX is associated with higher market volatility (Boom, 2009; Mclean and Pontiff, 2016; Su *et al.*, 2017).

In Table 4, when stock markets rise, opposite effects appeared in each subsample period. On the recent period (Abenomics), when the stock prices rise under Abenomics, the effect is decreasing. Also, the effect of exchange rate volatility is decreasing. Market volatilities of stock prices and exchange rates, which are main concerns for market participants and policymakers, disappear shortly.

Table 5 shows the cases of declining (depreciation). Volatilities of stock prices in the past period increase. There is some possibility that markets were very nervous about the movements of stock prices as the prices were quite low. Also, the volatility of long-term interest rates increase with the recent period increases. Although interest rates have been quite low in both sample periods, the BOJ started to manage long-term interest rates, so market participants seem to begin noticing the movements.

6. Conclusions

This paper empirically examined the playing role of uncertainty occurred by news in Japanese financial markets. The results are not so robust, but there are some interesting and important points. In general, most of the coefficients are positive and significant, so the NVIX is associated with higher market volatility.

There are some interesting results to consider. When stock markets rose, opposite effects appeared in each subsample period. In the recent period, when Abenomics is conducted, the effect decreases. Also, the effect of exchange rates decreases in short time.

When stock prices decrease, volatilities of the stock prices in the past period increase. There is some possibility that markets were too concerned about the movements because of the prolonged low prices. Also, the volatility of long-term interest rate increases when the interest rate declines under Abenomics. Although interest rates have been quite low in both sample periods, the BOJ started to manage long-term interest rates in the recent period, so market participants seem to begin noticing the movements.

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