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DOES ONLINE TRADING INCREASE THE VOLATILITY OF THE KOREAN STOCK MARKET?

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Abstract: This study examines the impact of online trading on the stock returns and volatility in the Korean stock market using the multivariate EGARCH model. The data selected are KOSPI, and the research period extends from January 2004 to December 2016. Major findings are as follows: First, the increase of traditional trading value significantly increased the stock return. These results were the similar both before and after the global financial crisis, but these effects weakened in the period after the global financial crisis. The increase of traditional trading value increased the volatility but the significance was low. Second, the effects of online trading on the return and volatility of KOSPI also show similar patterns. However, the effect of online trading on the returns and volatility of the stock market was rather smaller than that of traditional trading. This result is inconsistent with the claim that online trading increases the stock market volatility. Third, the effects of online selling and buying trading on the index returns and volatilities of KOSPI were almost similar, and their effects were generally weaker in the period after the global financial crisis. The main implication of our findings is that there is no significant relationship between online trading and volatility in the Korean stock market.

Keywords: Online trading, Volatility, EGARCH model

I. INTRODUCTION

Recent developments of IT technology have enabled online trading to become a generalized trading in global stock markets. The convenience of transaction, low transaction cost, and ease of information acquisition seemed to play a major role in the rapid increase of online trading. In most stock markets, the proportion of online transactions continues to increase. With the rapid progress of the information society, online transactions are expect to continue to increase. However, online transactions are often mistaken for increasing volatility in the stock market, such as pointed as one of the causes of the stock crash in 1990s. Online trading of stocks through the Internet and the World Wide Web has been proposed as a cause of excessive trading, excessive herding, higher volatility in the stock market, excessive risk-taking, the Internet bubble of the late 1990s, and the bursting of this bubble in 2000 (Choi *et al.*, 2002). Although online transactions are continuing to increase and discussions about the effects of online transactions on the stock market continue to be debate, detailed research on this issue is very few. Therefore, this study attempts to analyze in detail the effect of online trading on stock market volatility in the Korean stock market.

Choi *et al.* (2002) examine the impact of Web-based trading channel on trader behavior and performance in two large corporate 401(k) plans and find no evidence of a Web impact on speculative behavior such as positive feedback trading, herding, or short-term trading. Oh *et al.* (2008) examine the trading behavior and performance of online equity investors in comparison to non-online equity investors in Korea and find that online investors perform poorly in comparison to non-online investors. Brogaard *et al.* (2014) examine the role of high-frequency

traders in price discovery and price efficiency and find that high-frequency traders facilitate price efficiency by trading in the direction of permanent price changes and in the opposite direction of transitory pricing errors. Hruska & Linnertova (2015) examine the relationship between market liquidity of futures traded on EUREX Exchange and HFT activity on European derivatives markets and find the relevance of the HFT trader's main argument about creating liquidity. Caivano (2015) examines the impact of high frequency trading on stock price volatility over the period 2011-2013 and finds that an exogenous increase of high frequency trading actively causes a statistically and economically significant increase in volatility.

In this paper, we examine whether online trading increase the market volatility in the Korean stock market, and extends existing relevant studies by yielding some new evidence for the impact of online trading on the stock returns and volatility. We explore the impact of online trading on the stock returns and volatility using EGARCH (1, 1) model.

The remainder of this paper is organized as follows. The next section describes the data used in this study and models used to examine the impact of online trading on the stock returns and volatility. Section 3 presents the empirical results. Section 4 is a conclusion in this study.

II. METHODOLOGY

This paper investigates the impact of online trading on the stock returns and volatility in the Korean stock market. The data selected are KOSPI (Korea Composite Stock Price Index) was launched in 1983 with the base value of 100 as of January 4, 1980. The Korea Exchange (KRX) is an order driven market with trading facilitated by the Automated Trading System (ATS). There are no designated market makers or specialists. Stock trade orders are placed through stockbrokers. A combination of lower transaction costs and easy access to information not only encouraged new investors to enter the market but apparently also increased trading frequency and the participation of day traders in the Korean stock market (Oh *et al.*, 2008). We obtained the monthly online trading values, and sample period is from January 2004 to December 2016.

The descriptive statistics of the variables are as follows. As shown in Table 1, the skewness recorded negative values for KOSPI only. The kurtosis are higher than online trading value, online buying trading value, and online selling trading value. Jaque-Bera values for all variables are rejected a normal distribution at 1% significant level.

In general, time-series variables are known to be a non-stationary process, so prior to empirical analysis, it is necessary to test whether the time-series data is stationary via a unit root test. In other words, the stationarity of the variables need to be tested prior to analysis of time-series data. The Schwart information criterion-based Augmented Dickey Fuller (ADF) test and the Phillips-Perron (PP) test were used to perform unit root tests. Test run for level and first difference cases, with two lags applied.

Table 1
Descriptive Statistics

	Mean	*Maximum*	*Minimum*	*Std. Dev.*	*Skewness*	*Kurtosis*	*J-B*
KOSPI	1666.29	2192.36	735.34	398.55	-0.83	2.41	20.11*
CD	3.32	6.03	1.58	1.17	0.43	2.36	9.89*
REER	109.53	131.85	83.57	11.94	0.34	2.48	9.78*
TT	9338.89	19034.21	3417.47	3207.81	0.49	2.99	9.29*
OT	4292.69	9717.22	1561.66	1721.69	0.66	3.05	11.34*
OB	4287.24	9718.20	1594.41	1715.05	0.64	3.01	10.62*
OS	4298.14	9716.24	1528.91	1729.97	0.68	3.10	12.13*

Notes: KOSPI, CD, REER, TT, OT, OB, and OS each represent Korea composite stock price index, traditional trading value, online trading value, online buying trading value, and online selling trading value. * indicate a significance level of 1%.

As shown in Table 2, the test results of all level variables do not reject the null hypothesis that all variables have a unit root, but the test results of first-differenced variables reject the null hypothesis when both the ADF test and the PP test. Accordingly, the log-differenced variables for all variables are confirmed to have stationary time-series at a significance level of 1%. Based on the test results, this study used first-differenced variables. In addition, the Johansen cointegration test was performed to see whether there is a cointegration relation between the first-differenced variables. The lags of cointegration were set to 2 based on Schwart information criterion, and the results showed that there is a cointegration relation at a significance level of 1%, proving a long-term relation between the variables. Due to the results, this study adopt the GARCH-family model developed by Bollerslev (1986) and Nelson (1991) for analysis. The AIC, BIC, and HQIC information criteria-based analyses were performed to determine a suitable model to examine the volatility-trading volume relation, and the results showed that the EGARCH (1, 1) model would be most suitable. Accordingly, this study uses that model to examine the impact of algorithmic trading on the Korean stock market. In the Ljung-Box Q-statistics analysis, performed to identify the volatility clustering properties of all variables, the properties were found to be significant and suitable for the GARCH model.

Table 2
Unit Root Test Results

	ADF		*KPSS*	
	Level	*1st Difference*	*Level*	*1st Difference*
KOSPI	-1.9606	-12.3532*	-1.9951	-12.3706*
CD	-1.3199	-6.6954*	-1.2471	-5.9385*
REER	-1.5719	-8.6401*	-1.5439	-8.5537*
TT	-2.6217	-14.2220*	-3.4087	-18.0303*
OT	-2.7655	-13.8882*	-3.5361	-16.5071*
OB	-2.7529	-13.8284*	-3.4973	-16.5151*
OS	-2.7627	-13.3564*	-3.5906	-16.5445*

Notes: KOSPI, CD, REER, TT, OT, OB, and OS each represent Korea composite stock price index, traditional trading value, online trading value, online buying trading value, and online selling trading value. * indicate a significance level of 1%.

To investigate the asymmetric role of online trading in the Korean stock market, we consider traditional trading (or non-online trading) values, online trading values, online selling trading value, and online buying trading values. Model for examine the asymmetric role of online trading on the stock returns and volatilities is as follows.

$$KOSPI_t = a_0 + b_1 CD_t + b_2 REER_t + b_3 TT_t + \varepsilon_t \quad (1)$$

$$\ln h_t = a_1 + \beta \ln(\sigma_t^2) + \gamma \left| \frac{\varepsilon_{t-1}}{h_{t-1}} \right| + \delta \frac{\varepsilon_{t-1}}{h_{t-1}} + c_1 \ln \varepsilon_{CD_t}^2 c_2 + \ln \varepsilon_{REER_t}^2 c_3 + \ln \varepsilon_{TT_t}^2 \quad (2)$$

Where, $KOSPI_t$ indicates the KOSPI index at time t. α_0 and a_1 are constant terms. b_1, . b_2 , and b_3 represent a parameter of CD interest rate, real effective exchange rate, and traditional trading (or online trading) value at time t. c_1, c_2, and c_3 represent the parameter of the log values of the square of the residual of CD interest rate, real effective exchange rate, and traditional trading value at time t. Parameter γ and δ denote leverage effects. This means if is a positive value, the conditional variance increases when the size of market innovation is larger than expected; if δ is a negative value, it indicates the presence of an asymmetric volatility effect.

III. EMPIRICAL RESULTS

Table 3 shows the effects of traditional or non-online trading on the index returns and volatilities of KOSPI. In the Korean stock market, the increase of short-term interest rates decreased the stock return but was not statistically significant. The increase of real effective exchange rates, that is, appreciation of domestic currency significantly increased the stock return. The increase of traditional trading value significantly increased the stock return. These results were the similar both before and after the global financial crisis, but these effects weakened in the period after the global financial crisis.

The increase of short-term interest rates increased the volatility but was not statistically significant. The increase of real effective exchange rates significantly decreased the volatility. The increase of traditional trading value increased the volatility but the significance was low.

Table 3
The Effects of Traditional Trading on KOSPI

	Total Period	*Before Crisis*	*After Crisis*
a_0	0.0048	0.0093	0.0025
b_1	-0.0793	-0.1014	-0.0038
b_2	0.5731***	0.6848*	0.2733**
b_3	0.0782***	0.1152***	0.0424**
a_1	-5.7222***	-5.8983***	-5.4617**
β	0.8064***	0.9236***	0.8652***
γ	0.1291	0.0058	-0.3017
δ	-0.0969	-0.2348	0.0191
c_1	3.3097	4.1088	11.1371
c_2	-22.3096***	-25.8197***	-31.8340***
c_3	1.6758*	1.0854*	1.5655
$\overline{R^2}$	0.1965	0.2836	0.1263
Log-L	271.04	113.23	173.04

Note: *, ** and *** indicate a significance level of 10%, 5% and 1% respectively.

Table 4 shows the effects of online trading on the index returns and volatilities of KOSPI. The effects of the increase of short-term interest rates, real effective exchange rates, online trading value on KOSPI was similar to that of Table 3 above. The effects of these variables on volatility of KOSPI also show similar patterns.

Table 4
The Effects of Online Trading on KOSPI

	Total Period	*Before Crisis*	*After Crisis*
a_0	0.0043	0.0085	-0.0009
b_1	-0.0884	-0.0964***	-0.0790
b_2	0.6157***	0.7205***	0.2794**
b_3	0.0640***	0.0923***	0.0415***
a_1	-5.8976***	-5.0185***	-4.9723**
β	0.8992***	0.9256***	0.9108***
γ	0.0725	-0.3312	-0.2599
δ	-0.1455	-0.3421	-0.3412
c_1	3.9715	4.0322	9.5338*
c_2	-20.2864***	-25.2966***	-23.4159**
c_3	1.3182*	0.8489*	0.5182
$\overline{R^2}$	0.1900	0.2755	0.1139
Log-L	269.19	113.41	173.05

Note: *, ** and *** indicate a significance level of 10%, 5% and 1% respectively.

However, the effect of online trading on the returns and volatility of the stock market was rather smaller than that of traditional trading. This result is inconsistent with the claim that online trading increases the stock market volatility.

Table 5
The Effects of Online Selling Trading on KOSPI

	Total Period	*Before Crisis*	*After Crisis*
a_0	0.0045	0.0083	-0.0031
b_1	-0.0877	-0.1019	-0.0955
b_2	0.6180***	0.7228**	0.2767*
b_3	0.0718***	0.0982***	0.0512*
a_1	-5.9351***	-5.0977***	-4.8170***
β	0.8722***	0.9209***	0.9185***
γ	0.1078	-0.2939	-0.1734
δ	-0.1106	-0.3286	-0.1662
c_1	3.7895	4.3384	9.5754**
c_2	-21.3991***	-26.2422***	-18.9661*
c_3	1.2755**	0.9109*	0.2859
$\overline{R^2}$	0.2091	0.2948	0.1173
Log-L	271.51	114.37	174.70

Note: *, ** and *** indicate a significance level of 10%, 5% and 1% respectively.

Table 6
The Effects of Online Buying Trading on KOSPI

	Total Period	*Before Crisis*	*After Crisis*
a_0	0.0039	0.0095	0.0004
b_1	-0.0944	-0.0916	-0.0439
b_2	0.6130***	0.6938**	0.3441**
b_3	0.0554***	0.0883***	0.0332*
a_1	-5.8256	-4.3377***	-4.9447**
β	0.8743***	0.8380***	0.9316***
γ	0.0562	-0.3190	-0.1871
δ	-0.1877	-0.3075	-0.1959
c_1	4.4025	2.6461	9.6012
c_2	-19.1358***	-22.3253***	-25.1029**
c_3	1.3730	0.7275	0.7317
$\overline{R^2}$	0.1727	0.2516	0.1171
Log-L	267.15	112.30	171.88

Note: *, ** and *** indicate a significance level of 10%, 5% and 1% respectively.

Table 5 and Table 6 show the effects of online selling and buying trading on the index returns and volatilities of KOSPI respectively. The effects of online selling and buying trading on the index returns and volatilities of KOSPI were almost similar, and their effects were generally weaker in the period after the global financial crisis.

IV. CONCLUSION

This paper investigates the impact of online trading on the stock returns and volatility in the Korean stock market using multivariate EGARCH (1, 1) model. The data selected are KOSPI, and sample period is from January 2004 to December 2016.

The findings are as follows. First, the increase of short-term interest rates decreased the stock return but was not statistically significant. The increase of real effective exchange rates, that is, appreciation of domestic currency significantly increased the stock return. These results were the similar both before and after the global financial crisis, but these effects weakened in the period after the global financial crisis.

Second, the increase of short-term interest rates increased the volatility but was not statistically significant. The increase of real effective exchange rates significantly decreased the volatility.

Third, the increase of traditional trading value significantly increased the stock return. These results were the similar both before and after the global financial crisis, but these effects weakened in the period after the global financial crisis. The increase of traditional trading value increased the volatility but the significance was low.

Fourth, the effects of online trading on the return and volatility of KOSPI also show similar patterns. However, the effect of online trading on the returns and volatility of the stock market was rather smaller than that of traditional trading. This result is inconsistent with the claim that online trading increases the stock market volatility.

Lastly, the effects of online selling and buying trading on the index returns and volatilities of KOSPI were almost similar, and their effects were generally weaker in the period after the global financial crisis.

The main implication of our findings is that there is no significant relationship between online trading and volatility in the Korean stock market.

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