

HETEROGENEOUS INVESTOR TRADING BEHAVIORS AND VOLATILITY OF KOSPI

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Abstract: This study examines the volatility-trading volume relation in the Korean stock market using the multivariate EGARCH model. We investigate whether the trading activities of different investor groups, such as domestic institutions, domestic individuals and foreign investors can explain the distinct volatility effects. The research period extends from January 2004 to December 2016.

Major findings are as follows: First, the increase in domestic institutional and foreign investor trades increase the stock return, while the increase in domestic individual investor trades decrease the stock return. Second, the trade inflows of domestic individual investors increase the stock market volatility, while the trade inflows of foreign investors decrease the stock market volatility. Third, even when the trading share measure used, the effects of three investor groups' trading on the stock return and stock market volatility is similar as is the case of trading value measure. Fourth, the effects of three investor groups' trading on the stock return and stock market volatility is more pronounced during the net buying period of individual investors.

Keywords: volatility-trading volume, trading value, investor groups, KOSPI.

I. INTRODUCTION

The relationship between trading volume and volatility has been consistently studied in capital market research. Despite the numerous studies on the volatility-trading volume relation, general consensus has yet to be reached. In the process of liberalization of the capital market, the inflow of foreign investment funds is inevitable, and the inflow of foreign investment funds has also contributed to the development of emerging markets. Korean capital market is fully open, and the proportion of foreign investors is higher than that of domestic institutional investors. Therefore, the trading behavior of foreign investors in the Korean capital market may have a significant impact on the volatility of the KOSPI.

It is well documented that trading volume and stock market volatility are positively related. However, since the total trading volume is the sum of the trading volume of various investor groups, it is necessary to analyze the effect of the trading volume of each investor group on the

stock market volatility in order to study the volatility-trading volume relation in detail. Recently, more studies are being conducted to analyze the different characteristics of each investor group in the volatility-trading volume relation (Daigley & Wiley, 1999; Li & Wang, 2010; Umutlu & Shackleton, 2017).

It is reasonable to assume that each investor group invests in different information and shows different trading behavior. Therefore, this study analyzes the volatility-trading volume relation of Korean capital markets, one of the emerging economies with fully open capital markets. The Korea Exchange (KRX) provides daily trading volume data for three investor groups: domestic institutional investors, domestic individual investors and foreign investors. Therefore, this study makes a detailed analysis of the effect of each investor group's transaction on stock market volatility for Korean capital markets, one of the emerging markets where capital markets are fully open.

There are few studies on the volatility-trading volume relation. Daigler & Wiley (1999) examine the volatility-trading volume relation in futures markets using volume data categorized by type of trader. They find that the positive volatility-trading volume relation is driven by the general public traders, a group of traders who are without precise information on order flow. Choe *et al.* (1999) examines the impact of foreign investors on stock returns in Korea using order and trade data and find no evidence that foreign investors' trades had a destabilizing effect on Korea's stock market over their sample period. In particular, they find that the market adjusted quickly and efficiently to large sales by foreign investors. Li & Wang (2010) examine the dynamic relation between daily institutional trading and stock price volatility in emerging market and find a negative relation between volatility and institutional net trading. They find the price volatility-institutional trade relation differs for institutional buys and institutional sells. Huang & Yang (2010) examine whether market liberalization leads to more stock price volatility in ten emerging markets using daily returns. They find South Korea, Mexico, and Turkey suffered from greater volatility, Argentina, Chile, Malaysia, and the Philippines experienced diminished volatility and no significant pattern for Taiwan, Thailand, and Brazil. Nguyen & Le (2013) examine the impacts of foreign trades on Vietnamese stock market volatility and find significant relationships between foreign trades and market volatility. Umutlu *et al.* (2013) examine whether there is a relationship between foreign equity trading and average total volatility in the Istanbul Stock Exchange and find that net equity flow is positively associated with average total volatility. Yosuke (2017) examines the relation between stock market volatility and trading activities of different investor groups and finds that trading flows of foreign investors are negatively correlated with the subsequent volatility.

This study extends existing relevant studies by yielding some new evidence for the volatility-trading volume relation in the Korean stock market. We explore the similarities or differences in the volatility-trading volume relation by three investor groups. We find that the increase in domestic individual investor trades decrease the stock return and increase the stock market volatility, and the increase in foreign investor trades

increase the stock return and decrease the stock market volatility.

The remainder of the paper is organized as follows. Section 2 describes the data used in this study and models used to examine the volatility-trading volume relation. Section 3 presents the empirical results. Section 4 is a conclusion in this study.

II. METHODOLOGY

The main data in this study is the monthly trading value of three investor groups, namely domestic institutional investors, domestic individual investors and foreign investors. The analyzed variables are KOSPI (Korean composite stock price index), total trading value, trading values of three investor groups, the trading share of three investor groups. The data set is obtained from the Korea Exchange (KRX).

As shown in the standard deviations in Table 1, institutional and foreign investors showed more fluctuations than individual investors. The skewness recorded negative values for KOSPI, the trading share of institutional and foreign investors. The kurtosis was higher than three for domestic institutional investors and domestic individual investors only. Jaque-Bera values for KOSPI, total trading value, and trading values of three investor groups are rejected a normal distribution at a 5% or 1% significant level.

Prior to analysis, a unit root test needs to be run to confirm the stationarity of the time-series data. As it may be possible that each time-series variable is a non-stationary process, the stationarity of the variables must be examined 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. Separate tests were run for level and first difference cases, with two lags applied. As shown in Table 2, the test results of level variables for total trading value, trading values of three investor groups 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. However the test results of level variables and first differenced variables for the trading

share of three investor groups reject the null hypothesis that all variables have a unit root when both the ADF test and the PP test. Accordingly, the log-differenced variables for total trading value, trading values of three investor groups and level variables for the trading share of three investor groups are confirmed to have stationary time-series at a significance level of 1%. Based on the test results, this study used first-differenced variables for total trading value, trading values of three investor groups, and used level variables for the trading share of three investor groups. 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 Schwartz information criterion, and the results showed that there is a cointegration relation at

a significance level of 5%, proving a long-term relation between the variables. Due to the results, this study adopted 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)-student's t model would be most suitable. Accordingly, this study uses that model to examine the volatility-trading volume relation in the Korean stock market. In the Ljung-Box Q-statistics analysis, performed to identify the volatility clustering properties of the four returns, the properties were found to be significant and suitable for the GARCH model. The descriptive statistics of the variables are as follows.

Table 1
Descriptive Statistics

	<i>Mean</i>	<i>Maximum</i>	<i>Minimum</i>	<i>Std. Dev.</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>J-B</i>
KOSPI	1666.3	2192.4	735.3	398.6	-0.82831	2.40932	20.1065**
TV	96269.2	193231.4	34904.7	32644.3	0.47662	2.99675	5.9064*
IS	21676.2	45848.6	58212.1	7842.6	0.38531	3.08552	3.9076*
ID	11087.8	24228.4	25686.9	4174.0	0.48859	3.32373	6.8880**
FR	25693.7	54499.4	10492.4	9979.5	0.71836	2.97261	13.4217**
TS_IS	0.22422	0.27803	0.15803	0.02807	-0.33399	2.21228	1.9335
TS_ID	0.11548	0.17629	0.05207	0.02320	-0.01542	2.86987	0.1163
TS_FR	0.26464	0.34187	0.18958	0.03019	0.00920	2.67626	0.6835

Notes: KOSPI, TV, IS, ID, FR, TS_IS, TS_ID and TS_FRUS each represent Korea composite stock price index, total trading value, the institutional investors' trading value, the individual investors' trading value, the foreign investors' trading value, the trading share of individual investors, and the trading share of foreign investors. *, ** indicate a significance level of 5% and 1% respectively.

Table 2
Unit Root Test Results

	<i>ADF</i>		<i>KPSS</i>	
	<i>Level</i>	<i>1st Difference</i>	<i>Level</i>	<i>1st Difference</i>
KOSPI	-1.9606	-12.3532**	-1.9951	-12.3706**
TV	-2.6212	-14.3193**	-3.4205	-16.0267**
IS	-2.1521	-14.6671**	-3.3087	-16.0132**
ID	-2.4486	-13.5099**	-3.0275	-15.3484**
FR	-2.7895	-13.6335**	-3.2149	-17.3679**
TS_IS	-3.9644**	-14.6408**	-3.7785**	-19.6627**
TS_ID	-5.9887**	-11.2421**	-5.9015**	-27.9604**
TS_FR	-3.8987**	-14.7683**	-3.7565**	-15.3872**

Notes: KOSPI, TV, IS, ID, FR, TS_IS, TS_ID and TS_FRUS each represent Korea composite stock price index, total trading value, the institutional investors' trading value, the individual investors' trading value, the foreign investors' trading value, the trading share of individual investors, and the trading share of foreign investors. *, ** indicate a significance level of 5% and 1% respectively.

To investigate the trading behaviors of three investor groups, we consider the measure of trading behaviors. First, we use the average values of purchasing and selling values as the trading values of each investor type. Model 1 examines the effects of three investor group trades on KOSPI.

Model 1:

$$KOSPI_t = \alpha_0 + b_1 TV_t + b_2 IS_t + b_3 ID_t + b_4 FR_t + \varepsilon_t \quad (1)$$

$$\ln h_t = \alpha_1 + \beta \ln(\sigma_t^2) + \gamma \left| \frac{\varepsilon_{t-1}}{h_{t-1}} \right| + \delta \frac{\varepsilon_{t-1}}{h_{t-1}} + c_1 \ln \varepsilon_{TV_t}^2 + c_2 \ln \varepsilon_{IS_t}^2 + c_3 \ln \varepsilon_{ID_t}^2 + c_4 \ln \varepsilon_{FR_t}^2 \quad (2)$$

Where, $KOSPI_t$ indicates the KOSPI index at time t . α_0 and α_1 are constant terms. b_1, b_2, b_3 and b_4 are parameters of the total trading value at time t , the domestic institutional investors' trading value at time t , the domestic individual investors' trading value at time t , and the foreign investors' trading value at time t respectively. And c_1, c_2 and c_3 each represent the parameters of the log values of the square of the residual of KOSPI, total trading value at time t , the domestic institutional investors' trading value at time t , the domestic individual investors' trading value at time t , and the foreign investors' trading value at time t respectively. Parameter γ and δ denote leverage effects. This means if γ is a positive value, the conditional variance increases when the size of market innovation is larger than expected; if γ is a negative value, it indicates the presence of an asymmetric volatility effect.

To investigate the trading behaviors of three investor groups, we consider another measure of trading behaviors. We use the share of trading values as the trading values of each investor type. We define the share of trading values the ratio of the average trading value divided by the total trading value. Model 2 examines the effects of three investor groups trade shares on KOSPI.

Model 2:

$$KOSPI_t = \alpha_0 + b_1 TV_t + b_2 TS_IS_t + b_3 TS_ID_t + b_4 TS_FR_t + \varepsilon_t \quad (3)$$

$$\ln h_t = \alpha_1 + \beta \ln(\sigma_t^2) + \gamma \left| \frac{\varepsilon_{t-1}}{h_{t-1}} \right| + \delta \frac{\varepsilon_{t-1}}{h_{t-1}} + c_1 \ln \varepsilon_{TV_t}^2 + c_2 \ln \varepsilon_{TV_IS_t}^2 + c_3 \ln \varepsilon_{TV_ID_t}^2 + c_4 \ln \varepsilon_{TV_FR_t}^2 \quad (4)$$

Where, $KOSPI_t$ indicates the KOSPI index at time t . α_0 and α_1 are constant terms. b_1, b_2, b_3 and b_4 are parameters of the total trading value at time t , the domestic institutional investors' trading value share at time t , the domestic individual investors' trading value share at time t , and the foreign investors' trading value share at time t respectively. And c_1, c_2 and c_3 each represent the parameters of the log values of the square of the residual of KOSPI, total trading value at time t , the domestic institutional investors' trading value share at time t , the domestic individual investors' trading value share at time t , and the foreign investors' trading value share at time t respectively.

III. EMPIRICAL RESULTS

Table 3 shows the effects of three investor group trades on the index returns and volatilities of KOSPI. In the Korean stock market, the increase in total trading value significantly decreased the stock return. By investor group, domestic institutional investors and foreign investors' trading values significantly increase stock prices, while domestic individual investors' trading value significantly led to stock price decline. These phenomena were the same both before and after the global financial crisis, but its effects have weakened in the period after the global financial crisis.

In both periods before and after the global financial crisis, the increase in the trading value of domestic individual investors significantly increased the volatility of KOSPI, while the increase in the trading value of foreign investors significantly reduced the volatility of the KOSPI. The results show that trading flows of foreign investors are negatively correlated with the volatility of KOSPI. Trading flows of foreign investors produces a negative volatility effect. This is consistent with the results of Umutlu & Shackleton (2015) on the Korean stock market and the results of Yosuke (2017) on the Japanese stock market.

Table 4 shows the effects of three investor groups' trade shares on the index returns and volatilities of KOSPI. The effects of three investor group trade shares on the index returns and volatilities of KOSPI was similar to the effects of three investor group trades on the index returns and volatilities of KOSPI. However, the effects

Table 3
The Effects of Three Investor Group Trades on KOSPI

	Total Period	Before Crisis	After Crisis
a_0	0.0047	0.0176**	0.0046*
b_1	-0.3266***	-0.5400***	-0.2232***
b_2	0.2343***	0.2370***	0.1819***
b_3	-0.1316***	-0.1584***	-0.1242***
b_4	0.2431***	0.4995***	0.1938***
a_1	-0.3761	-9.4963***	-6.6740***
β	0.9734***	-0.5992**	0.0541
γ	0.2424*	0.0345	-0.5393
δ	-0.1210	-0.1205	-1.2095***
c_1	5.0269	-14.1943	20.1937***
c_2	-3.6734	3.5538	-7.8044*
c_3	2.3564*	2.0994*	4.4760**
c_4	-1.7304*	-11.6529***	-13.2830***
$\overline{R^2}$	0.1202	0.0711	0.2827
Log-L	287.98	131.51	192.63

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

Table 4
The Effects of Three Investor Group Trade Shares on KOSPI

	Total Period	Before Crisis	After Crisis
a_0	-0.2059***	-0.3046*	-0.1351***
b_1	-0.0651***	-0.0913***	-0.0262***
b_2	0.8075***	0.9591**	0.6672***
b_3	-0.7701***	-0.8335***	-0.8751***
b_4	0.4604***	0.7073**	0.3184***
a_1	-12.0093***	-5.3953	-7.0886***
β	0.2660*	0.3083	0.4125***
γ	-0.6740**	-1.1997**	-1.2194**
δ	-0.6538***	-0.6599**	-0.8123**
c_1	-1.4924*	1.3935	0.4140
c_2	4.2874	-5.1770	3.7518
c_3	15.4942**	18.6442**	11.7660**
c_4	-4.6740	-4.2230	-6.3645*
$\overline{R^2}$	0.1296	0.1411	0.1560
Log-L	280.06	113.49	194.99

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

of domestic institutional investors and foreign investors decreased in the period after the global financial crisis, while the influence of domestic individual investors increased. The increase in the trading value share of domestic individual investors also significantly increased the volatility of KOSPI, while the increase in the trading value share of foreign investors significantly reduced the volatility of the KOSPI.

Table 5
The Effects of Three Investor Group Trades on KOSPI in Net Buying or Selling Period of Individual Investors

	Net Buying Period of Individual Investors	Net Selling Period of Individual Investors
a_0	-0.0005	0.0149***
b_1	-0.4068***	-0.0496
b_2	2.2763***	0.1143
b_3	-0.1844***	-0.0734**
b_4	0.3102***	0.0672
a_1	-0.5617	-1.9201*
β	0.8394***	0.7771***
γ	-0.3797	0.5506*
δ	0.3345	0.0806
c_1	10.2182**	8.2366
c_2	3.9770	-7.8425
c_3	8.4956**	2.9251
c_4	11.9929***	2.8002
$\overline{R^2}$	0.1169	0.0905
Log-L	117.73	189.87

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

Table 5 shows whether the effects of three investor group trades on the index returns and volatilities of KOSPI is different for the domestic individual investors net buying or selling period. The effects of three investor group trades on the index returns and volatilities of KOSPI was larger in the domestic individual investors net buying period than in the domestic individual investors net selling period.

When all of these findings are considered, we conclude that foreign investors' trade inflows does not increase the volatility of Korean stock market.

IV. CONCLUSION

This study examines the volatility-trading volume relation in the Korean stock market using EGARCH (1, 1)-student's t model. The data set is obtained from the Korea Exchange (KRX), and the research period extends from January 2004 to December 2016.

The findings are as follows. First, domestic institutional investors and foreign investors' trading values significantly increase stock prices, while domestic individual investors' trading value significantly led to stock price decline. These phenomena were the same both before and after the global financial crisis, but its effects have weakened in the period after the global financial crisis.

Second, in both periods before and after the global financial crisis, the increase in the trading value of domestic individual investors significantly increased the volatility of KOSPI, while the increase in the trading value of foreign investors significantly reduced the volatility of the KOSPI.

Third, the effects of three investor group trade shares on the index returns and volatilities of KOSPI was similar to the effects of three investor group trades on the index returns and volatilities of KOSPI.

Fourth, the effects of three investor group trades on the index returns and volatilities of KOSPI was larger in the domestic individual investors net buying period than in the domestic individual investors net selling period.

When all of these findings are considered, we conclude that foreign investors' trade inflows does not increase the volatility of Korean stock market. Drawing upon the findings above, this study suggests that policy makers in the Korean stock market need to find a system that allows foreign investors to operate their funds for a

longer period of time, rather than seeking a system to limit the inflow of foreign investors.

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