Competition between Online Stock Message Boards in Predictive Power: Focused on Multiple Online Stock Message Boards

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A B S T R A C T

This research aims to examine the predictive power of multiple online stock message boards, namely, NAVER Finance and PAXNET, which are the most popular stock message boards in South Korea, in stock market activities. If predictive power exists, we then compare the predictive power of multiple online stock message boards. To accomplish the research purpose, we constructed a panel data set with close price, volatility, and number of posts in 40 companies in three months, and conducted a panel vector auto-regression analysis. The analysis results showed that the number of posts could predict stock market activities. In NAVER Finance, previous number of posts positively influenced volatility on the day. In PAXNET, previous number of posts positively influenced close price, volatility, and PER on the day. Second, we confirmed a difference in the prediction power for stock market activities between multiple online stock message boards. This research is limited by the fact that it only considered 40 companies and three stock market activities. Nevertheless, we found correlation between online stock message boards and stock market activities and provided practical implications. We suggest that investors need to focus on specific online message boards to find interesting stock market activities.

Keywords: Online Stock Message boards, Efficient Market Hypothesis, Stock Market Forecasting, Predictive Power Competition, Unit Root Test, Vector Auto-Regressive

I. Introduction

The informational value on online stock message boards has often been debated as many information regarding investment decisions exists on online stock message boards. Online stock message boards have opinion and advice, which are potentially addressed by domain experts who can inform investment decisions through posts (Gu et al., 2006; Kim et al., 2014; Kim et al., 2016; Park et al., 2013).

According to efficient market hypothesis, the information on online stock message boards does not
reflect stock market activities because financial market efficiently reflects information about individual stocks and the market as a whole. In other words, an “efficient market” explains that it is impossible for an investor to beat a well-diversified market portfolio because all available information is already absorbed into all stock prices (Fama, 1970; Fama, 1991). Investors who agree with this statement tend to apply a passive investment strategy by holding index funds to track overall market performance. In contrast, investors who disagree with this statement tend to employ an active investment strategy by identifying and holding mispriced securities to surpass market portfolio returns (Zhang, 2014).

However, in online stock message boards, we can often observe that many cases and news are contradict the efficiency market hypotheses. That is, some investors successfully manipulated stock price by using online stock message boards. Stock price manipulation can occur in various ways, from action taken by certain shareholders that influence the stock price to trading volume to release information or rumors (e.g., accounting and earning manipulation such as in the Enron case) on online stock message boards. Especially the case of Jonathan Lebed, a teenager in New Jersey who successfully manipulated stocks 11 times by posting message on Yahoo! Finance message boards and made profits of $800,000 is well known (Lewis, 2002). Like this case, online stock message boards have become popular venues to distribute false information. From January 2000 to October 2001, about 39% of all stock price manipulation cases used the virtual communities to spread rumors (Aggarwal and Wu, 2003). It has been the subject of punishment from Securities and Exchange Commission in America (SEC). Also, we observe that individual investors may have accurate information and predictive power. Some investors regularly post on discussion boards in virtual communities. One user on PAXNET stock message board spreads his opinions related macroeconomic environment forecast, including the bankrupt of Lehman Brothers and the sudden rise in exchange rate in South Korea, which became true and made him a public hero in Korean stock market (The Christian Science Monitor, 2009). Despite posting anonymously on an online stock message board, his posts were influential than public disclosure in the press for stock investment. These examples surely contradict the efficiency market hypotheses. In this regards, research explicating relationship between online stock message boards and stock market activities is still evolving to find a more meaningful results (Antweiler and Frank, 2004; Bagnoli et al., 1999; Baker and Wurgler, 2006; Das and Chen, 2007; Hirschey et al., 2000; Kaniel et al., 2004; Kumar and Lee, 2006; Sankaraguruswamy and Mian, 2008; Tetlock, 2007; Tumarkin and Whitelaw, 2001).

In the previous studies, there are no studies comparing the predictive power on stock market activities between multiple online stock message boards. In our last study, we showed empirically that online stock message boards have two roles, specifically sharing of useful information of investment decision and sharing of past investment experience (Kim et al., 2014; Kim et al., 2016). That is, if online stock message plays a role of sharing of past investment experience, it may not have a predictive power on the stock market activities. In context research, if each online stock message board plays different a role, its predictive power on stock market activities can vary from online stock message board to online stock message board.

In order to verify more accurate predictive power considering two roles, research of relationship between online stock message boards and stock market activities should be studied based on various stock
message boards. Therefore, our research focuses on multiple online stock message boards, which are the most popular and largest stock message boards in South Korea.

It is important to study competitiveness between multiple online stock message boards through comparison of predictive power. Individual investors want seek and read others’ opinions and advice on online stock message boards. However, this type of information investor’s need is different. Some investors want seek reputation of company before decision making of stock investment, some they want read information for return on investment after decision making of stock investment. Other investors need information on risk management related to stock price falls. To provide information value of online stock message boards with the information they want, we want to compare predictive power for competition between online stock message boards if the multiple stock message boards can predictive stock market activities.

In this context, we raise two interesting questions regarding online stock message boards:

1. Can information on online stock message boards predict stock market activities?

2. If so, is there a difference in predictive power on stock market activities among online stock message boards?

To answer this questions, we investigate empirically predictive power of online stock message boards on stock market activities. If stock market is efficient, the information on online stock message boards should have no predictive power over stock market activities experience (Kim et al., 2014; Kim et al., 2016). On the other hand, the presence of significant predictive power would indicate that online stock message boards contain predictable and valuable information on future stock movement.

We examine the correlation between multiple online stock message boards and stock market activities to determine whether online stock messages have predictive power toward stock market activities. We focused multiple online stock message boards because most of the previous research of relationship between online stock message boards and stock market activities focused one stock message boards, or two stock message boards at different times. Furthermore, we compare competition between multiple online stock message boards, the largest online stock message boards in South Korea, in the predictive power toward stock market activities.

In this regard, we selected the 40 companies on the KOSPI (Korea Composite Stock Price Index) in sector of IT services, auto parts, semiconductors, chemicals and foods, which are exceeded 1 trillion KRW in market capitalization over the past five years (News1, 2013). We collected data of 95,714 messages from NAVER Finance and PAXNET, close price, volatility, PER of the 40 companies for three-month period. And then, vector auto-regression analysis was performed with our panel data sets to see the correlation among the number of posts and close price, volatility, PER.

This paper aimed to contribute to IS (information systems) literature. Our research does support or not support influence of the information system for efficient market hypothesis. the debate on studies of relationship between information system and efficient market hypothesis is still issue (Chen et al., 2012; Gu et al., 2006; Liu et al., 2010). An efficient market hypothesis suggests that all investors perceive all available information in precisely the same manner. However, the online stock message board
based virtual community can spread investment information quickly and share high-quality information that does not spread from offline WOM (Word-Of-Mouth). Also, our research will explain the individual motivation and behavior for participating in online stock message boards.

## II. Literature Reviews

The efficient market hypothesis means that stock prices reflect all known information. In other word, stock prices aggregate all publicly available information and instantly reflect new public information to the markets. According to this theory, investors cannot earn profits from investment strategies based on public information (Fama, 1970; Fama, 1991). Nevertheless, there may be possibilities to do so, and thus many researchers have studied whether information on online stock message boards influence stock market activities. However, the results were mixed. Some studies showed that there is a significant relationship between information on online stock message boards (Antweiler and Farank, 2004; Sabherwal et al., 2008; Wysocki, 1999) while other studies do not (Das and Chen, 2007; Gu et al., 2006; Tumarkin and Whitelaw, 2001).

Wysocki (1998) analyzed a number of posts on Yahoo!Finance message boards, one of the most popular sites in the late 1990s. He found that the number of posts were higher for stocks with high market capitalization. For 50 companies with a large number of posts between January and August 1998, his findings showed that overnight posting activity had a positive impact on the next day’s trading volume, abnormal return variance, abnormal returns. To the contrary, however, daytime posting activity did not have any significant impact on the stock market activities. He attributed these findings to the quick representation of information on stock prices. Antweiler and Frank (2004) used linguistic content analysis to analyze Internet postings on Yahoo! Finance and RagingBull.com. They similarly found that stock postings can predict market volume and volatility, but not actual returns. Antweiler and Frank (2004) empirically showed that the impact of message volume on stock returns was negative and, although statistically significant, still economically small. Sabherwal, Sarkar, and Zhang (2008) reported that, in the case of Internet message boards of thinly traded micro-cap stocks, the most talked about stocks were associated with high contemporaneous abnormal returns and statistically significant positive returns on the next day. These studies have the result to support the efficient market hypothesis.

On the contrary, Tumarkin and Whitelaw (2001) found no evidence that discussion board messages contained valuable information for the prediction of stock market activity. The researchers collected a sample of posts from the popular message board, RaingBull.com. The board posts in this sample contained special fields in which the users expressed their sentiment toward certain stocks directly. They conducted an event study to determine the impact of high message volume on security prices and trading volume. An event was triggered when the message volume exceeded a certain threshold. Additionally, the authors used a one-day-lagged VAR-model to explore the dependencies between stock price, trading volume, the number of board messages, and the sentiment measure. Gu et al. (2006) found that informed investors existed on stock message boards, but that investor information was neither fully incorporated into the market, nor fully acknowledged by peers on the stock message boards. The results of these studies do not support the efficient market hypothesis.
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In this regard, research explicating the correlation between information on online stock message boards and stock market activities (e.g., trading volume) is still evolving to find a more meaningful results. So, it is important to ask whether the information on online stock message boards influence stock market activities. Therefore, we investigate the predictive power of NAVER Finance and PAXNET at the same time, the most popular online stock message boards in South Korea. In addition, previous study has not yet been studies of competition between online stock message boards in predictive power at the same time. We thus compare competition between online stock message boards in predictive power.

III. Methodology and Empirical Analysis

3.1. Sample

Wysocki (1998, 1999) confirmed that firms with high market value (e.g., high price-earnings and market-to-book ratios) has highest message-posting activity. Based on his research findings, we selected the 40 companies on the KOSPI in sector of IT services, auto parts, semiconductors, chemicals and foods, which exceed 1 trillion KRW in market capitalization over the past five years (News1, 2013).

Next, NAVER Finance and PAXNET stock message boards, the most popular online stock message boards in South Korea, were selected for this research. NAVER Finance and PAXNET provide the large sets of online stock message boards and high number of page views in South Korea. They also offer an independent online stock message board for each stock, which matches the need of this research to collect specific information about companies.

Our data set, consisting of 40 companies on the KOSPI, was collected from May 6, 2013 to July 26, 2013 for all trading days for three months and included weekdays except for designated holidays. A total of 95,714 messages were collected from both NAVER Finance and PAXNET stock message boards.

We employed three stock market activities. We consider close price that are associated with monetary benefits since one of the most important reasons for people to invest in the stock market is making profit (Antweiler and Frank, 2004; Barder and Odean, 2002; Dewally, 2003; Liu et al., 2006; Tumarkin and Whitelaw, 2001; Wysocki, 1998). Especially, stock market manipulation cases were associated with stock price and volatility, according to report of U.S. Securities and Exchange Commission (SEC) during 1990 through October 2001 (Aggarwal and Wu, 2006; Hillion and Suominen, 2004). We also consider volatility to capture individual investors’ risk behaviors. The volatility most frequently refers to the standard deviation of the continuously compound returns of financial instrument with a specific time horizon (Dichev and Tang, 2009; Donelson and Resutek, 2015; Graham et al., 2005). Next, we also consider Price-Earnings Ratio (PER), which is ratio for valuing a company that measures its current share price relative to its per-share earnings. The PER is most widely used key performance indicators by investors. If a stock has low PER, then it is considered to be cheap or undervalued (Banz and Breen 1986; Fuller et al., 1993; Lakonishork et al., 1994; Mburu, 2014; Pettersen, 2011).

The data on daily close price, volatility and PER of each company collected from the KISVALUE (www.kisvalue.com) of online stock information service in South Korea.
3.2. Unit Root Test

In estimation for time series models, the validity of the statistical estimates depends on stationarity of the data series. In other words, the variables used in the estimation must be stationary in order to avoid spurious estimated results. To ensure that all data sets were stationary, we employed five panel unit root tests. We first used the tests suggested by Levin, Lin, Chu (2002) and Breitung (2000). Although this test is essentially a pooled Augmented Dickey-Fuller (ADF) test, it allows us to include individual fixed effect as well as time effect. That is, the major limitation of these tests is that each cross-section in the panel is assumed to share the same auto-regressive coefficient. Thus, rejection of the null of non-stationarity implies that rate of convergence is same across all units. Im, Pesaran, Shin (2003) who estimated individual-specific ADF tests and then computed the mean of the different t-statistics overcame the assumed homogeneity of the unit root. Their test does not assume that all series are stationary under the alternative. In addition, Fisher-ADF test and Fisher-PP test are similar to the Im-Pesaran-Shin test in the sense that they combine independent unit root test of the individual series (Choi, 2001; Madalla and Wu, 1999). Therefore, we employed the LLC and Breitung tests that designed for cross-sectional independent panels with common unit root process, and IPS, ADF-Fisher, PP-Fisher test that avoid the assumption of cross-sectional independence with individual unit root process.

In the panel unit root test, we confirmed that some variable has stationary in first-difference. We thus performed the two-differences for all variable. The following Table 2 report the results of unit root tests applied to two-differences of all variables. The Table 2 shows that the unit-root null cannot be rejected for any of the data series, although stationarity is achieved by two differencing.

3.3. Vector Auto-Regression

Vector auto-regression (VAR) models were introduced by Christopher Sims (1980) and are well established in applied macroeconomics. In ARIMA models, we only derive the actual value from past values for an endogenous variable. However, there is often no theoretical background available. In VAR models, all variables are treated as endogenous and interdependent both in a dynamic and in a static sense. The idea underlying forecasting with VAR model is first to summarize the dynamic correlation pattern among observed data series, and then use

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Daily Average</th>
<th>Standard Deviation (overall)</th>
<th>Standard Deviation (between)</th>
<th>Standard Deviation (within)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information on Online Stock Message Boards</td>
<td>Number of posts On NAVER Finance</td>
<td>9.69</td>
<td>30.38</td>
<td>23.43</td>
<td>19.68</td>
</tr>
<tr>
<td></td>
<td>Number of posts On PAXNET</td>
<td>10.36</td>
<td>39.91</td>
<td>30.01</td>
<td>26.72</td>
</tr>
<tr>
<td>Stock Market Activities</td>
<td>Close Price</td>
<td>63197.08</td>
<td>217262.5</td>
<td>219346.2</td>
<td>15597.37</td>
</tr>
<tr>
<td></td>
<td>Volatility</td>
<td>55.08034</td>
<td>28.17254</td>
<td>28.40389</td>
<td>2.499125</td>
</tr>
<tr>
<td></td>
<td>PER</td>
<td>37.69145</td>
<td>37.69155</td>
<td>37.99359</td>
<td>4.455147</td>
</tr>
</tbody>
</table>

<Table 1> Descriptive Statistics of Variables
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this summary to predict likely future values for series. Mathematically, a VAR expresses the current value of each of \( m \) series as a weighted average of the recent past of all the series plus a term that contains all the other influences on the current values (Gujarati, 2012). That is, VAR analysis is tool that is widely used among empirical researchers for studying the underlying dynamic relationship among economic variables.

To verify the correlation between the number of posts on online stock message boards and stock close price, volatility, PER in stock market activities, we used a panel vector auto-regression (VAR) approach. We can investigate the impact of number of posts on stock market activities (i.e., close price, volatility, PER) and the impact of stock market activities on number of posts, using panel vector auto-regression model. All variables in our VAR models taken logarithm. The estimated coefficient of the log-transformed data is an elasticity (Gujarati, 2012).

Equation (A) is panel VAR model to examine the correlation between the number of posts and close price. All variables taken two difference and logarithm.

\[
\Delta \ln \text{Close Price}_{i,t} = \mu_i + \tau_t + \sum_{j=1}^{n} \beta_j \Delta \ln \text{Close Price}_{i,t-j} + \sum_{j=1}^{n} \gamma \Delta \ln \text{Number of Posts}_{i,t-j} + \epsilon_{i,t}
\]

Equation (B) is panel VAR model to examine the between the number of posts and volatility. All variables taken two difference and logarithm.

<table>
<thead>
<tr>
<th>Unit Root Test</th>
<th>Common unit root process (homogeneous)</th>
<th>Individual unit root process (heterogeneous)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>LLC (t-test)</td>
<td>Breitung (t-stat)</td>
</tr>
<tr>
<td>Number of posts on NAVER Finance</td>
<td>-26.3286*** (0.000)</td>
<td>-18.0462*** (0.000)</td>
</tr>
<tr>
<td>Number of posts on PAXNET</td>
<td>-44.468*** (0.000)</td>
<td>-18.5387*** (0.000)</td>
</tr>
<tr>
<td>Close Price</td>
<td>-43.5577*** (0.000)</td>
<td>-33.1823*** (0.000)</td>
</tr>
<tr>
<td>Volatility</td>
<td>-45.4056*** (0.000)</td>
<td>-24.0352*** (0.000)</td>
</tr>
<tr>
<td>PER</td>
<td>-40.2053*** (0.000)</td>
<td>-30.7914*** (0.000)</td>
</tr>
</tbody>
</table>

Note: *** \( p < 0.01 \), ** \( p < 0.05 \), * \( p < 0.1 \)
Investors allowed to trade for five-days per one week in the South Korea stock market. Thus, we include maximum 5-day lags based on stock market environment in South Korea like other studies did (Bissattini and Christodoulou, 2013; Gu et al., 2006; Karabulut, 2013). To control for idiosyncratic errors, fixed effects were included in all VAR models by adding stock and time-specific dummy variables. Fixed effects estimation allows the error term to be arbitrarily correlated with other explanatory variables, thus making the estimation results more robust (Duan et al., 2008).

See the following (B) Column in <Table 3>. Number of posts has an impact on volatility. The number of posts from t-4 to t-5 positively influence the volatility on the day at 0.05% level of significance. The results show that an increase in past Online WOM on NAVER Finance enhances volatility on the day. Thus, we confirmed that the Online WOM can predict volatility. The volatility from t-1 to t-4 has an impact on the number of posts on the day at 0.05 or 0.1% level significance. The volatility on t-1 does increase the number of posts on the day but volatility on t-2 to t-4 does decrease the number of posts. When volatility increases, investors likely to post immediately on NAVER Finance. Two days later, investors are more likely to focus on investment than posting on NAVER Finance.

See the following (A, C) Column in <Table 3>, there is no correlation among number of posts and close price, PER. The number of posts on NAVER Finance has not impact on close price, PER. The close price and PER has not impact the number of posts on NAVER Finance. Therefore, investors likely not to post about information, advice, opinion related to close price, PER on NAVER Finance.

See the following (A) Column in <Table 4>. Number of posts has impact on close price. The number of posts on t-1, t-3, t-4, t-5 has positively

\[
\Delta \ln \text{Volatility}_{i,t} = \mu_i + \tau_t + \sum_{j=1}^{n} \beta_j \Delta \ln \text{Volatility}_{i,t-j} + \sum_{j=1}^{n} \gamma_j \Delta \ln \text{Number of Posts}_{i,t-j} + \epsilon_{i,t}
\]

Volatility_{i,t} : volatility of 40 companies on the day
Number of Posts_{i,t} : number of posts on the day on NAVER Finance or PAXNET
Volatility_{i,t-j} : volatility of 40 companies during the past 5 days
Number of Posts_{i,t-j} : number of posts during the past 5 days on NAVER Finance or PAXNET
\( \mu_i \) : individual Fixed Effect
\( \tau_t \) : time Fixed Effect
\( \epsilon_{i,t} \) : error term

Equation (C) is panel VAR model to examine the correlation between the number of posts and PER. All variables taken two difference and log.

\[
\Delta \ln \text{PER}_{i,t} = \mu_i + \tau_t + \sum_{j=1}^{n} \beta_j \Delta \ln \text{PER}_{i,t-j} + \sum_{j=1}^{n} \gamma_j \Delta \ln \text{Number of Posts}_{i,t-j} + \epsilon_{i,t}
\]

PER_{i,t} : PER of 40 companies on the day
Number of Posts_{i,t} : number of posts on the day on NAVER Finance or PAXNET
PER_{i,t-j} : PER of 40 companies during the past 5 days
Number of Posts_{i,t-j} : number of posts during the past 5 days on NAVER Finance or PAXNET
\( \mu_i \) : individual Fixed Effect
\( \tau_t \) : time Fixed Effect
\( \epsilon_{i,t} \) : error term

Equation (B)
Influence close price on the day at 0.05% or 0.1% level of significance. The results show that increase in Online WOM on PAXNET are correlated with increase in close price. Thus, we confirmed that the investors likely to post related to close price on mainly PAXNET than NAVER Finance. The close price has impact on number of posts. Close price on t-2, t-3, t-4, t-5 has negatively influence close price on the day at 0.05% or 0.1% level of significance. The results show that increase in close price are correlated with decrease in Online WOM on PAXNET. When close price increases, investors are more likely to focus on investment than post their opinions in PAXNET. See the following (B) Column in <Table 4>. The number of posts has impact on volatility. The number of posts on t-3, t-5 has positively influence volatility.
The results show that online WOM on PAXNET has predictive power of volatility. The volatility on t-2, t-3, t-4 has negatively influence number of posts on the day at 0.05% or 0.1% level of significance. Two days later, investors are more likely to focus on investment than post in PAXNET. See the following (C) Column in <Table 4>. The number of posts has impact on PER. The number of posts on t-5 has positively influence PER on the day at 0.1% level of significance. The PER on t-2 has negatively influence number of posts on the day at 0.05% or 0.1% level of significance. The results have the same interpretation as the earlier results of analysis. Investors likely to post related to PER on mainly PAXNET than NAVER Finance. When PER increase, they are

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(A) Close Price</th>
<th>(B) Number of Posts</th>
<th>(C) Volatility</th>
<th>(D) Number of Posts</th>
<th>(E) PER</th>
<th>(F) Number of Posts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close Price (t-1)</td>
<td>-0.831221***</td>
<td>-0.342639</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Close Price (t-2)</td>
<td>-0.688928***</td>
<td>-0.68748*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Close Price (t-3)</td>
<td>-0.503049***</td>
<td>-0.575214*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Close Price (t-4)</td>
<td>-0.336181***</td>
<td>-0.52769*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Close Price (t-5)</td>
<td>-0.164984***</td>
<td>-0.361943*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volatility (t-1)</td>
<td>-</td>
<td>-</td>
<td>-0.773335***</td>
<td>-0.615086</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volatility (t-2)</td>
<td>-</td>
<td>-</td>
<td>-0.561531***</td>
<td>-0.6453643**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volatility (t-3)</td>
<td>-</td>
<td>-</td>
<td>-0.36272***</td>
<td>-0.526786**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volatility (t-4)</td>
<td>-</td>
<td>-</td>
<td>-0.238437***</td>
<td>-0.764713**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Volatility (t-5)</td>
<td>-</td>
<td>-</td>
<td>-0.135102***</td>
<td>-3.301228</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PER (t-1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.816097***</td>
<td>-0.84888</td>
</tr>
<tr>
<td>PER (t-2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.641008***</td>
<td>-1.929438**</td>
</tr>
<tr>
<td>PER (t-3)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.466006***</td>
<td>-0.415021</td>
</tr>
<tr>
<td>PER (t-4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.314184***</td>
<td>-0.485628</td>
</tr>
<tr>
<td>PER (t-5)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.200368***</td>
<td>0.304085</td>
</tr>
<tr>
<td>Number of Posts (t-1)</td>
<td>0.003908*</td>
<td>-0.847789**</td>
<td>9.05E-05</td>
<td>-0.84682***</td>
<td>-0.000716</td>
<td>-0.845523**</td>
</tr>
<tr>
<td>Number of Posts (t-2)</td>
<td>0.00447</td>
<td>-0.613305***</td>
<td>0.000298</td>
<td>-0.605679***</td>
<td>2.54E-05</td>
<td>-0.612615***</td>
</tr>
<tr>
<td>Number of Posts (t-3)</td>
<td>0.007775**</td>
<td>-0.37668***</td>
<td>0.000059**</td>
<td>-0.369353***</td>
<td>-0.00027</td>
<td>-0.377027***</td>
</tr>
<tr>
<td>Number of Posts (t-4)</td>
<td>0.005615*</td>
<td>-0.17735***</td>
<td>0.000403</td>
<td>-0.169258***</td>
<td>0.000299</td>
<td>-0.178591***</td>
</tr>
<tr>
<td>Number of Posts (t-5)</td>
<td>0.003869*</td>
<td>-0.069912***</td>
<td>0.000516**</td>
<td>-0.065179***</td>
<td>0.001545*</td>
<td>-0.074342**</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.461601</td>
<td>0.444626</td>
<td>0.434063</td>
<td>0.445049</td>
<td>0.494036</td>
<td>0.446211</td>
</tr>
<tr>
<td>S.E of regression</td>
<td>0.083695</td>
<td>0.824422</td>
<td>0.007658</td>
<td>0.824108</td>
<td>0.032409</td>
<td>0.823245</td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>2.083746</td>
<td>1.977856</td>
<td>2.057698</td>
<td>1.976604</td>
<td>2.082268</td>
<td>1.97457</td>
</tr>
</tbody>
</table>

Note: *** p < 0.01, ** p < 0.05, * p < 0.1
more likely to focus on investment than post their opinions in PAXNET.

According to results of VAR analysis for NAVER Finance and PAXNET, First, number of posts can predict close price, volatility, PER of stock market activities. The increase in posts on online stock message boards does increase close price, volatility, PER on the day. Thus, we believe that online stock message boards have predictive power for stock market activities, and may provide one of the possible answers for debate of efficient market hypothesis. Second, PAXNET has more predictive power of stock market activities than NAVER. In our finding, PAXNET has predictive power for close price, volatility and PER but only volatility on NAVER Finance. In addition, only NAVER Finance has online WOM related to volatility because the past volatility increased the number of posts on NAVER Finance on the day.

PAXNET is Korea’s stock trading portal site that specialized in only stock information such as stock news, success or failure story of stock investment. Especially, PAXNET provides investment strategies and live broadcasts from stock experts for improvement of stock return (Etnews, 2001). Thus, there are possibilities that a lot of information related to stock investment exists on stock message boards. On the other hand, NAVER launched information portal site with search engine, and was served with online stock message boards later than PAXNET. Because of this backgrounds, we believe that the predictive power of NAVER Finance and PAXNET are different.

IV. Conclusion

4.1. Overview of Study

The purpose of this research is examine predictive power of NAVER Finance and PAXNET, the most popular stock message boards in South Korea, on stock market activities and then compare the predictive power of the two online stock message boards. We want to provide practical implications based on the research results.

In order to achieve the research purpose, we tried to study about relationship between information on NAVER Finance, PAXNET and stock market activities. We employed the number of posts on online stock message boards because it is activity indicator of users’ online WOM (Word-of-Mouth) on virtual communities. We also employed stock close price, volatility, PER for stock market activities because they are leading indicators of the stock market trends for investors.

In this regard, we selected the 40 companies on the KOSPI in sector of IT service, auto parts, semiconductors, chemicals and foods, which is exceeded 1 trillion KRW in market capitalization over the past five years, and collected total 95,714 message posting on both NAVER Finance and PAXNET from MAY 6, 2013 to July 28, 2013 for all trading days for three months. Data on daily close price, volatility, PER of each company collected from KISVALUE (www.kisvalue.com) of online stock service in South Korea. We constructed panel data set with number of posts, stock price, volatility and PER in 40 companies during three months.

For econometric analysis, we employed methodology of panel vector auto-regression. In order to avoid a spurious estimated result, we conducted the panel unit root test of LLC, Breitung, IPS, ADF-Fisher, PP-Fisher before panel Vector auto-regression analysis. In the panel unit root test, we confirmed that some variables have non-stationary and performed two difference for all variables. We and then conducted panel vector auto-regression analysis.
The analysis results were as follows.

First, we showed that number of posts on online stock message boards predict stock market activities. In NAVER Finance, past number of posts positively influence volatility on the day. In PAXNET, past number of posts positively influence close price, volatility and PER on the day. Second, we confirmed that there are differences in predictive power for stock market activities among NAVER Finance, PAXNET. In our research results, PAXNET has more predictive power for stock market activities than NAVER Finance.

4.2. Our Research has Academic and Practical Implications

Regarding the academic implications, our research findings showed that today’s online stock message boards are associated with the theories of market efficiency hypotheses. In our research, we confirmed that information on multiple online stock message boards influences stock market activities. That is, the number of posts on NAVER Finance can predict the volatility. The number of posts on PAXNET also can predict the close price, volatility, PER. Online stock message boards are continuously evolving as a mainstream of communications related to stock investment. Thus, we suggest the need for a continuous research on market efficiency through investigating the relationship between information on online stock message boards and stock market activities.

Second, We suggest that research of the impact of information on online stock message board on stock market activities must consider multiple online stock message boards because each online stock message board has different predictive power for stock market activities. Our research findings showed that PAXNET has more predictive power for stock market activities, and has more competitive advantage for prediction of stock market activities than NAVER.

Regarding the practical implications, NAVER Finance and PAXNET have different competitive advantage for investor. Investors should be use various online stock message boards to make better investment decisions. Our research showed that the PAXNET has predictive power for close price, volatility and PER. While NAVER Finance has predictive power for only volatility. If you are sensitive to stock close price, volatility, and PER, PAXNET will provide more information value compared to NAVER Finance. Our research has also showed that there are online WOM related to volatility on NAVER Finance but not on PAXNET. If you want discuss past volatility of stock in South Korea, NAVER Finance has more information value than PAXNET. Therefore, investors need to focus on specific online stock message board, depending on their interesting of stock market activities.

Second, Korean investors are likely to use online stock message boards for the information related to close price and volatility. Our research confirmed that the past number of posts positive influence mainly close price, and volatility. In other words, we suggest that South Korean investors are sensitive to stock close price and volatility. Thus, these findings inform us about motivation of participating in online stock message boards.

Third, managers of the online stock message boards need to provide a specific service for stock price, volatility. We confirmed that users of online stock message boards are sensitive to and interest in close price and volatility. Therefore, to meet the user’ needs the manager of online stock message boards must provide the function to classify the posts about stock price, volatility easily and quickly. Online stock message boards in South Korea provide only
simple functions such as write, read, reply to posts, or recommend posts. Thus, the manager should adopt the new service or new function related to close price and volatility for user participation on online stock message boards. For example, the posts with close price and volatility should be classified automatically. If so, users would be able to access only the posts in which they are interested easily and quickly.

4.3. Research Limitations

We conducted empirical study to explore the interesting question of the influence of information on online stock message boards on stock market activities. Nevertheless, this research has several limitations. First, we selected only 40 companies on each stock message board. Thus, the research findings cannot be applied to online stock message boards of all companies. Second, we considered three stock market activities (i.e., close price, volatility, PER). Since there are various stock market activities, we will continue with the follow-up study. Third, we don’t know the exact sentiment of posts such as strong buy or strong sell. In future research, we will collect all information such as contents, comments of posts on all online stock message boards, and employ text-mining techniques to consider investors’ stock sentiment. The Future directions of our research is performance of Big Data analysis for relationship between information on online stock message boards and stock market activities.

<References>


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