The effects of limited attention on trading behavior of investors: Evidence from online ranking data

Johan Lim, Sujung Choi and Woon Youl Choi[1]

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Investors have limited ability to process all available information. We provide empirical evidence that investors' limited attention affects security prices and trading volume in the short run. Using a unique dataset hand-collected from the Internet portal in Korea, we directly measure investor attention on individual stocks based on the rank information of the top 30 most frequently discussed stocks on the online stock message board. Investor attention is associated with significant increases in abnormal trading volume on the date that a stock is ranked on the board. Interestingly, less sophisticated individual investors continue buying more attention-grabbing stocks for a week after the event day. As for the stock return performance, whether investors are attentive to a stock is statistically significant in predicting next-day stock performance. However, the effect of attention on the stock returns is short lived and disappears within two days.

[1] Johan Lim is in the Department of Statistics, Seoul National University; email: johanlim@snu.ac.kr. Sujung Choi (corresponding author) is in the School of Business Administration, Soongsil University; email: sjchoi@ssu.ac.kr. Woon Youl Choi is in the School of Business, Sogang University; email: wychoi@sogang.ac.kr. This work was supported by the Year 2014 Research Fund of the IREC (The Institute of Finance and Banking), Seoul National University..

1 Introduction

The traditional efficient market hypothesis (EMH) assumes the instant diffusion of all relevant information to the prices of financial assets as a result of fierce competition among financial market participants. Therefore, under the EMH, investors process all relevant information in a timely manner. However, in reality, investors observe too much information in the financial market, so it seems nearly impossible for investors to be attentive to all available information. Investors are often inattentive to the enormous amount of relevant information due to information overload.

Investors have limited ability to process all available information. In fact, attention is the ultimate scarce cognitive resource (Kahneman 1973; Camerer 2003). Limited attention is a well-documented cognitive bias in the psychology literature. Limited attention affects the information-processing capacity of investors, and accordingly, asset prices in the financial market are moved due to the limited attention of investors. In other words, investors, especially less sophisticated individual investors, are able to pay attention to only information that is relatively pronounced and easily accessible.

Currently, the Internet is easily accessible for investors to obtain new information. For example, Korea exhibits the highest penetration rate of high-speed wireless Internet service among OECD countries, which amounted to 100.6% among all OECD countries according to the 2011 OECD broadband statistics. In Korea, investors frequently obtain information through mobile devices and stay connected online. Therefore, a specific financial asset actively discussed online easily draws the attention of investors, and consequently, the discussion itself might affect the buying and selling decisions of individual investors.

For example, if many investors actively talk about stock A online, investors who are also reading the online discussion would likely be attentive to stock A. Then, investors are more likely to trade stock A, not because the fundamental information for stock A looks promising but because stock A is noticeable to the investors. In fact, the fundamental information is relatively less accessible to investors than the online discussion and is difficult for retail investors to interpret.

In this paper, we examine how the online discussion affects the trading behavior of investors. In particular, we indicate how differently various types of investors (e.g., individual investors; institutional investors such as mutual funds, pension funds, banks, and governments; and foreign investors) react to attention-grabbing stocks and other stocks.

In addition, we examine how investor limited attention affects security prices and trading volume in the short run. As for the stock return performance, the regression results indicate that the prices of attention-grabbing stocks are likely to increase on the following day, $t+1$. Whether investors are attentive to a stock is statistically significant in predicting the next-day stock performance. However, the effect of attention on the stock return is short-lived and disappears within two days after the event.

2 Descriptions of Data

Using a unique dataset hand-collected from Daum, the 2nd largest Internet portal in Korea, we directly measure investor attention on a group of stocks. Daum offers an online stock message board on which investors discuss a specific stock that might attract them. On a daily basis, the Daum stock message board displays a list of the top 30 most frequently discussed

stocks from the previous day online discussion.

In this paper, we assume the actively discussed stocks to be attention-grabbing stocks. Da, Engelberg, and Gao (2011) view the aggregate search frequency in Google as a direct measure of investor attention. They indicate that the weekly Search Volume Index (SVI) captures the attention of investors, especially less sophisticated investors. Following Da, Engelberg, and Gao (2011), this study also focuses on the investor attention that is revealed through the online discussion but has several advantages over the study of Da, Engelberg, and Gao (2011).

First, the Daum rank data are observed on a daily basis. Da, Engelberg, and Gao (2011) use the weekly Search Volume Index (SVI) for individual stocks because Google Trends provides weekly frequency data. Daily-observed rank data are able to capture the fluctuations in investor attention resulting from the huge flow of information and are timelier than the weekly observed SVI.

Second, the actively discussed stocks in the Daum stock message board directly capture the degree of investor attention on those stocks. The stocks searched in Google may not be exactly matched with the investing activities of investors. For example, on the Google website, people search the names of companies for various reasons to buy products, find miscellaneous information about products and so on. However, many people who are accessing the stock message board are interested in investing activities in the Korean stock market.

Finally and most importantly, Korean stock market data include all trading records by various types of investors. The Korea Stock Exchange (KSE), the only stock exchange in Korea, provides individual stock-day trading information classified by 10 different types of

investors such as mutual funds, government, pension funds, individual investors, and foreign investors. Therefore, we are able to exactly identify the trading patterns of individual investors (i.e., less sophisticated investors) from the daily orders of various types of investors.

In the U.S., due to the limitation of data, the trading behavior of individual investors has been less studied than that of institutional investors. Using a unique dataset, this paper sheds light on how individual investors move based on behavioral bias or limited attention. In addition, we find that the changes in stock prices and trading volume are associated with the frequency of online discussion, which is a proxy for the degree of investor attention on individual stocks.

The Daum rank dataset was hand-collected by authors during the 924 trading days from October 4th, 2010 to June 14th, 2014. The dataset includes the company names of the top 30 most actively discussed stocks on the stock message board on a daily basis. Therefore, our key variable of interest in this paper is the ranks of individual stocks from the online stock message board. As a proxy for the degree of investor attention, we assume that ranked stocks are more likely to attract investor attention than unranked stocks. Then, we compare the ranked stocks with the unranked stocks to analyze the characteristics of ranked or attention-grabbing stocks.

In addition, we collect the financial data for individual firms from the FnGuide. The data include stock-day trading volume by different types of investors, stock prices, stock returns, and so on. By merging two datasets, we investigate the shifts in trading volume due to the change in investor attention and how various types of investors trade the attention-grabbing stocks. As a robustness test, we also incorporate the information of earnings announcement

dates[2] by individual firms into main regressions. By doing so, we try to control for the moves caused by fundamental information since the earnings announcements would be considered one of the fundamental information that could affect next-day stock returns,

3 Summary Statistics

The Daum rank information provides the daily ranks and names of individual stocks from rank 1 to rank 30.[3] During the sample period from October 4th, 2010 to June 24th, 2014, a total of 569 stocks among publicly traded 1,945 KOSPI and KOSDAQ stocks are identified as attention-grabbing stocks. [4]

Notably, several large-sized KOSPI stocks such as Samsung Electronics, SK Hynix, Kia Motors, and LG Electronics often enter the list of the top 30 most frequently discussed stocks. As a result, those 3-5 stocks appear nearly every day in the daily lists. For example, Samsung Electronics is ranked during the whole sample period of 924 trading days. These are highly

[2] In Panel D of Table 4, the *Ann* is a binary variable with a value of 1 on the earnings announcement dates. In November 2002, the Regulation Fair Disclosure was adopted in Korea, so listed firms that would like to provide designated people such as institutional investors with material information which is not yet disclosed must immediately disclose it through the stock market so that all market participants receive the same information at the same time (http://eng.krx.co.kr/m7/m7_3/m7_3_1/m7_3_1_2/UHPENG07003_01_02_03.html). Then, earnings announcement dates are identified as the first day that the material information is released by fair or periodic disclosure. If the information is released after the market closes (i.e., 3 pm), the date is the next day after announcements. The earnings announcement dates are hand-collected from the KRX website (kind.krx.co.kr).

[3] Appendix A exhibits an example of the stock message board in Daum. From the stock message board, we collect the daily ranks and names of individual stocks. The ranks are determined by how frequently an individual stock was discussed on the board in a day.

[4] In the KSE, the daily price limit that stocks are allowed to rise or fall is $\pm$15%, so the stocks with abnormal price changes in a day more than $\pm$30% are excluded in the sample.

export-oriented companies, so the sales and market capitalization of the companies fluctuate depending on the global economic conditions. Accordingly, when news media report the economic forecasts for the Korean economy, the large-sized and export-oriented companies are also often covered by the news media.[5] Then, investors who are exposed to the news media are more likely to be attentive to these large-sized stocks than other inconspicuous and small-sized stocks that are rarely reported by the news media.

Interestingly, because the sample period overlapped with the campaign period of the 2012 presidential election in Korea, stocks that are associated with presidential candidates such as AhnLab were also often ranked in the top 30 stock list.[6] The small-sized *political* stocks generally better reflect individual investor sentiment or attention than other large-sized *non-political* stocks because many investors who actively trade the political stocks are generally individual investors. Then, the prices of small-sized *political* stocks drastically shift not because of the changes in fundamental information but because of the political rumors or the results from presidential polls.

Figure 1 indicates the number of days that stocks entered the Daum list as the top 30 most frequently discussed stocks. A total of 140 stocks (24.6%) among 569 stocks were ranked only once during the total sample period of 924 trading days. Around two-thirds of the 569 stocks are ranked less than 10 times (i.e., trading days) in the list. The majority of those stocks are small-sized stocks, which would be preferred by individual investors.

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[5] According to the World Bank, exports made up 53% of the Korean economy in 2011. (Sources: http://www.cnbc.com/id/48237596/South_Korearsquos_10_Biggest_Companies)

[6] Cheol-soo, Ahn was one of the strongest presidential candidates in Korea and finally withdrew from the candidacy for president. AhnLab, an anti-virus software startup company, was founded by Ahn in 1995.

Table 1 presents the definitions of the variables analyzed in this paper. The key variable measuring the degree of investor attention is the *Rank* of an individual stock *i* on day *t* on the Daum stock message board. If the value of the *Rank* is 1 (30), the stock is assumed to be the most (least) attention-grabbing stock among all 30 ranked stocks on day *t*. In addition, the binary variable *Indicator* represents whether investors are attentive to a stock *i*. For a stock *i* that is ranked in the Daum list on day *t*, the variable *Indicator* has a value of 1. Therefore, only 30 stocks per day are classified as attention-grabbing stocks, and we assume that investors are less attentive to other remaining KOSPI and KOSDAQ stocks than the top 30 attention-grabbing stocks. In regressions, to avoid any noise incorporated in the original *Rank* variable, we categorize the ranked stocks into quintile groups, *Quintile*, and examine whether high attention-grabbing stocks are more likely to move up on the next day than low attention-grabbing stocks within the sample of ranked stocks. The next-day market returns, *Market_Ret (MR)*, is also included in the regression models to examine the impact on market-adjusted returns of individual stocks.

Table 2 reports the summary statistics of the variables analyzed in this paper. The median values of daily stock returns are zero, and the mean values are approximately four basis points per day. Because daily stock returns have often been documented as autoregressive time series, we also include the lagged stock returns of the previous 5 trading days as control variables in the regression models. As a proxy for the liquidity of stocks, turnover ratios are measured with trading volume (i.e., the total number of traded shares) and trading amount (i.e., the total amount of traded shares in KRWs). Clearly, the two turnover ratio variables, *Turnover* and *Turnover_Amt (TurnoverA)*, are highly correlated with each other. The volatility, *VOLA*, is a

measure of total risk of stocks, but it seems not to be correlated with the measure of attention, *Indicator*.

Notably, the correlation coefficient between *Indicator* and *Size* is 0.354, implying that the attention-grabbing stocks are for the most part large-sized stocks. As for the turnover ratio, the correlation coefficient between *Indicator* and *TurnoverA* is 0.122, indicating relatively significant correlation between investor attention and trading activities by investors on day *t*. Therefore, we conclude that large-sized and liquid stocks are more likely to attract investor attention than small-sized and illiquid stocks.

4 Attention and Stock Returns

In this section, we empirically investigate how investor attention affects the stock returns. We indicate how the returns of attention-grabbing stocks fluctuate around the event date when investors pay attention to the stocks.

Figure 2 presents the changes in the mean returns from *t*-5 to *t*+5. On the event date *t*, stocks are ranked as most frequently discussed stocks in the stock message board of Daum. Relative to the returns of unranked stocks that do not shift around the event date, the returns of ranked or attention-grabbing stocks exhibit approximately 1.4% gains as the mean values on the event date. However, the gains in stock returns do not persist for a long time and disappear within the next 2 days. The returns of ranked stocks even become negative a couple of days after the event date. If we compare the KOSPI and KOSDAQ markets, clearly KOSDAQ ranked stocks (i.e., around 3% gains) present higher gains than KOSPI ones (i.e., around 0.8% gains) on the event date, *t*.

Furthermore, Figure 3 displays daily returns by quintile groups classified by the Daum ranks. On the consecutive dates, *t* and *t*+1, the higher quintile group is more likely to earn higher returns than the lower quintile group when we compare them with the returns on other dates such as *t-1, t+2, t+3, t+4,* and *t+5*. Therefore, the order of quintiles proxing for the degree of investor attention on a group of stocks seems to be related with the changes of stock returns on the event date, *t*, and the following date, *t+1*.

From the graphical evidence of the attention effect on the stock returns, as a next step, we use the OLS regressions to investigate whether investor attention on a stock is associated with the *next-day* performance of the stock. Table 3 exhibits the results of regressions. For each stock-day, we estimate the following regressions:

$$RET_{t+1} = Indicator_t(if\ ranked) + MR_{t+1} + controls_t + \sum_{k=\,t-5}^{t} RET_k + \varepsilon_t$$

, where MR_{t+1} is the KOSPI or KOSDAQ market returns on day *t+1*. In these regressions, the dependent variable is the return (i.e., RET) of stock *i* on day *t+1*. The main explanatory variable, *Indicator*, is a proxy for the investor attention to stock *i* on day *t*. We also consider three variables such as the market capitalization, *Size*, turnover amounts, *TurnoverA*, and historical volatility, *VOLA*, as there might be a relationship between the amount of investor attention and the firm size; trading activities on day *t*; and total risk.

In Panel A, the coefficients of *Indicator* are positive and statistically significant regardless of the variations of other variables. In other words, if a stock attracts investor

attention on day *t*, the stock price would increase on day *t*+1. The negative coefficients of *Size* imply that stock returns are inversely correlated with the firm sizes of the stocks. That is, small-sized firms generally seem to perform better than large-sized firms although they are less likely to attract investor attention than the large-sized stocks. The turnover ratio variable, *TurnoverA,* that relate to the trading activities of a stock on day *t* indicates negative coefficients, suggesting that more liquid stocks perform worse than less liquid stocks on day *t*+1. The historical total risk measure, *VOLA*, is also negatively associated with the next-day performance of stocks.

In Panel B, we categorize the sample into two groups (i.e., KOSPI and KOSDAQ) according to the market type. As to informational efficiency (or asymmetry), the KOSDAQ market is perceived to less efficient than the KOSPI market, in general. Consistent with our prediction, the coefficient (i.e., 0.4994) of the main variable, *Indicator*, in the KOSDAQ market is much more economically and statistically significant than that (i.e., 0.0621) in the KOSPI market in explaining the next-day performance of the attention-grabbing stocks.

Panel C also presents the regression results of subsamples according to the frequency of total ranked days. Because several large-sized stocks too often entered into the list and might critically affect the regression results, we exclude those stocks from the analyses to check the robustness of the regression results in Panel C. The regression models (i) and (ii) [(iii) and (iv)] analyze the subsamples for which the stocks were ranked in the Daum list less than 100 [200] times or trading days. The variable *Indicator* is still statistically significant regardless of the variations in the regression models in these subsample analyses.

Overall, we conclude that investor attention is important in determining the next-day performance of a stock. In other words, the attention-grabbing stocks perform well on the following day after they attract investor attention.

Table 4 presents various robustness tests documented in the attention effect in Table 3. In Panel A, we analyze a subsample including only ranked stocks in the stock message board to examine whether the rank order itself provides valuable information to predict the next-day performance of a stock. For regression analyses, we categorize the ranked stocks into quintile groups, *Quintile*, to avoid any noise incorporated in the original *Rank* variable.

$$RET_{t+1} = Quantile_t + MR_{t+1} + controls_t + \sum_{k=t-5}^{t} RET_k + \varepsilon_t$$

Even though the statistical significance varies depending on the inclusions of other control variables, the *Quintile* variable is significant at the 0.01 level in regressions (i), (ii), and (iii); and at the 0.05 level in regression (iv), implying that high attention-grabbing stocks are more likely to move up on the next day than low attention-grabbing stocks even within the sample of ranked stocks.

Panel B and C report the results with the absolute values of the next-day returns (i.e., $|RET_{t+1}|$) as a dependent variable. We expect that if the reason of investor attention is categorized into positive or negative news, the coefficients (e.g., 0.3032 and 0.1308) of the variables proxing for investor attention such as *Indicator* and *Quintile* would be more economically significant in their magnitudes with the absolute values as dependent variables than

the ones (e.g., 0.1436 and 0.0372) with the raw values in Panel A of Table 3 and Panel A of Table 4. In all types of regressions, the results are consistent with our expectation that the magnitudes of coefficients, *Indicator* and *Quintile*, are much larger than the comparative ones with raw values of the next-day returns.

Panel D incorporates one of the fundamental information which might make the next-day stock price move up into basic regressions.

$$RET_{t+1} = Indicator_t + Ann_t + Indcator_t \times Ann_t + MR_{t+1} + controls_t + \sum_{k=t-5}^{t} RET_k + \varepsilon_t$$

, where *Ann* is a binary variable with a value of 1 on the earnings announcement dates. The interaction term is also included as an explanatory variable to remove a possible interaction effect on the main variable, *Indicator*. Consistent with the results in Table 3, the coefficients of *Indicator* are economically and statistically significant at the 0.01 level in all regressions. Therefore, we conclude that the investor attention effect on the next-day performance is independent of the moves by fundamental information and would be related to the behavioral biases of naïve investors.

5 Trading Behavior by Investor Types

This section discusses the relationship between investor attention and the trading behavior of different types of investors. Da, Engelberg, and Gao (2011) argue that individual investors are more likely to find the information through a Google search than institutional

investors because institutional investors usually use more sophisticated tools such as Bloomberg to gather financial information. As indicated in the example of Appendix A, the Daum rank information is also largely determined by individual investors. Therefore, in this section, we examine the trading behavior of three different types of investors (i.e., individuals, foreigners, and institutions) to provide evidence that individual investors are more likely to trade attention-grabbing stocks than other types of investors.

First, we investigate whether abnormal trading volume *in total* is different between unranked and ranked stocks on the event day. The abnormal trading volume is defined in two ways: 1) the increase in trading volume for the *previous week* from *t*-6 to *t*; and 2) the increase in trading volume for the *previous month* from *t*-21 to *t*.

Table 5 suggests that the trading volume of *ranked* (i.e., attention-grabbing) stocks particularly jump relative to the trading volume of *unranked* stocks on the event day. The reported t-statistics from the two sample t-tests are highly statistically significant at the level of 1%. Interestingly, the magnitude of increase in the trading volume is slightly larger during the period from *t*-21 to *t* than the period from *t*-6 to *t*, implying that the trading volume of attention-grabbing stocks gradually increases approximately one week before the event and abruptly jumps close to the event date.

Table 6 reports the abnormal buying quantities of three different types of investors (i.e., individuals, foreigners, and institutions). Compared to the trading volume in the last week, *t*-6, or last month, *t*-21, the trading volume of the ranked or attention-grabbing stocks significantly increases on the event day *t*. Furthermore, individual investors buy more attention-grabbing stocks than foreign and institutional investors on the event day.

Figure 4 indicates that individual investors continue buying the attention-grabbing stocks for a week after the event day, whereas foreign and institutional investors stop buying the stocks after the event day. The results suggest that there are some individual investors who mimic the trading of other individual or foreign investors. Although investor attention can be somewhat related to the arrival of new information in the market, foreign and sophisticated individual investors immediately take advantage of the opportunities. However, less sophisticated individual investors respond slowly to the information and follow the trading of other sophisticated investors.

6 Conclusions

Currently, information overload often distracts investors from the enormous amount of relevant information. Investors can be biased in processing information for investment decisions because their ability to process all available information is limited. Less sophisticated individual investors in particular are more affected by online rumors than other sophisticated investors because online content is easy to access, so less sophisticated investors are attentive to online content.

To examine how investor limited attention affects security prices and trading volume in the short run, we assume that investors are generally attentive to the stocks that are actively discussed in the online stock message board. In this study, we directly measure investor attention on individual stocks with the rank information of the top 30 most frequently discussed stocks in the online stock message board. When a stock is ranked in the top 30 list on day *t*, we classify the stock as an attention-grabbing stock on day *t*.

We find evidence that the trading volume of attention-grabbing stocks abruptly increases on the event day when investors are highly attentive to the stocks. Therefore, we conclude that the degree of investor attention inferred from the online stock message board affects the trading behavior of investors. Specifically, individual investors continue buying the attention-grabbing stocks for a week after the event day, whereas foreign and institutional investors buy those stocks on only the event day and cease buying afterwards.

As for the stock return performance, the regression results indicate that the prices of attention-grabbing stocks are likely to increase on the following day t+1, but the effect of the attention on the stock return is short-lived and disappears within two days.

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Table 1 Variable Definitions

Variable	Definition
Indicator	A binary variable with a value that reflects being ranked in the top 30 list of Daum; if a stock is included in the list, the value is 1; otherwise, the value is 0.
Rank	The rank of an individual stock on day *t*; if the value of Rank is 1 (30), the stock is most (least) frequently discussed among the top 30 stocks on the stock message board of Daum. In this paper, *Rank* is related to the degree of investor attention on that of stocks.
Quintile	Based on the *Rank* of an individual stock on day *t*, we categorize the ranked stocks into quintile groups. Therefore, the highest (lowest) quintile group includes the most (least) frequently discussed 6 stocks among the top 30 list on the stock message board of *Daum.*
Ann	A binary variable with a value of 1 on the date when a firm discloses its financial performance following the Regulation Fair Disclosure or periodic disclosure such as annual reports.
Market_Ret (MR)	The Korea Composite Stock Price Index (i.e., KOSPI) or The Korean Securities Dealers Automated Quotations (i.e., KOSDAQ) market index returns on day *t+1*
Size	Market capitalization (1 trillion Korean won) defined as the number of shares outstanding multiplied by the closing price of a share.
$Turnover_t$	Turnover ratio (%) defined as trading volume on day *t* divided by the number of shares outstanding.
$Turnover\_Amt_t$ (TurnoverA)	Turnover amount ratio (%) defined as trading amount on day *t* divided by market capitalization.
Volatility (VOLA)	Standard deviation of daily returns over the last 20 trading days.
RET_t	Return on day *t* (%)
RET_{t-1}	Return on day *t-1* (%)
RET_{t-2}	Returns on day *t-2* (%)
RET_{t-3}	Returns on day *t-3* (%)
RET_{t-4}	Returns on day *t-4* (%)
RET_{t-5}	Raw returns on day *t-5* (%)
Diff_Turnover	$Turnover_t - Turnover_{t-6}$; or $Turnover_t - Turnover_{t-21}$
Diff_TurnoverA	$Turnover\_Amt_t - Turnover\_Amt_{t-6}$; or $Turnover\_Amt_t - Turnover\_Amt_{t-21}$

Table 2 Summary Statistics

Table 2 reports the summary statistics of the variables analyzed in this paper. The variables are observed on a daily basis during the sample period from October 4th, 2010 to June 24th 23rd, 2014. The definitions of variables are explained in Table 1.

Variables	Count	Mean	Median	Std. Dev.	Min	Max
RET_t	1,613,335	0.04	0.00	3.30	-30.00	200.24
Size	1,612,798	0.71	0.07	5.36	0.00	251.80
Turnover	1,613,335	1.59	0.42	4.90	0.00	384.27
Turnover_Amt (TurnoverA)	1,613,335	1.59	0.42	4.96	0.00	411.00
Volatility (VOLA)	1,610,079	0.04	0.01	16.70	0.00	14,981.00
Market_Ret (MR)	1,607,644	0.01	0.08	1.20	-8.28	5.83

Correlations

	Indicator	RET	RET_{t-1}	RET_{t-2}	RET_{t-3}	RET_{t-4}	RET_{t-5}	Size	TurnoverA	VOLA	MR
Indicator	1.000										
RET_t	0.048	1.000									
RET_{t-1}	0.023	0.062	1.000								
RET_{t-2}	0.013	-0.003	0.061	1.000							
RET_{t-3}	0.012	-0.006	-0.004	0.060	1.000						
RET_{t-4}	0.011	-0.017	-0.007	-0.004	0.060	1.000					
RET_{t-5}	0.011	-0.019	-0.017	-0.007	-0.005	0.059	1.000				
Size	0.354	0.001	0.001	0.001	0.001	0.001	0.001	1.000			
TurnoverA	0.122	0.066	0.123	0.093	0.084	0.075	0.066	-0.027	1.000		
VOLA	0.000	-0.005	-0.002	0.000	0.000	0.000	0.000	0.000	0.011	1.000	
MR	0.001	0.302	0.033	-0.012	-0.013	-0.033	-0.022	0.001	-0.007	0.000	1.000

Table 3 The Next-Day Performance

Table 3 presents the regression results examining whether investor attention on a stock affects the next-day performance of the stock. The dependent variable is the return of stock *i* on day *t*+1 (i.e., RET_{t+1}). In Panel A, the variable *Indicator* is a binary variable with a value if a stock *i* was ranked as a most frequently discussed stock in the top 30 stock list of Daum. Panel B and C summarize the regression results of subsamples. Panel B divides the sample into two markets such as KOSPI and KOSDAQ according to the market type. The KOSPI is a representative market index of all common stocks on the Korea Stock Exchange. The KOSDAQ is also a market index on an independent stock market for small and intermediate firms. In Panel C, regression (i) and (ii) [(iii) and (iv)] analyze the subsamples for which the stocks were ranked less than 100 [200] times or trading days. *, **, and *** represent significance at the level of 10%, 5%, and 1%, respectively.

	Panel A: All Sample							
	(i)		(ii)		(iii)		(iv)	
Variables	Est.	T-stat	Est.	T-stat	Est.	T-stat	Est.	T-stat
Intercept	0.0391***	14.96	0.0279***	11.21	0.0559***	21.31	0.0575***	21.98
Indicator	**0.0905*****	**4.52**	**0.0903*****	**4.75**	**0.2038*****	**9.92**	**0.1436*****	**6.99**
MR			0.8296***	402.11	0.8291***	402.26	0.8234***	399.54
Size					-0.0028***	-5.62	-0.0023***	-4.71
TurnoverA					-0.0173***	-33.45	-0.0188***	-35.58
VOLA					-0.0010***	-4.95	-0.0010***	-4.72
RET_t							0.0520***	68.77
RET_{t-1}							0.0004	0.57
RET_{t-2}							0.0006	0.76
RET_{t-3}							-0.0039***	-5.19
RET_{t-4}							-0.0098***	-12.96
RET_{t-5}							-0.0020***	-2.68
# of obs.	1,613,132		1,607,446		1,603,762		1,603,571	

Panel B: Market type

Variables	KOSPI (i) Est.	KOSPI (i) T-stat	KOSPI (ii) Est.	KOSPI (ii) T-stat	KOSDAQ (iii) Est.	KOSDAQ (iii) T-stat	KOSDAQ (iv) Est.	KOSDAQ (iv) T-stat
Intercept	0.0312***	9.22	0.0480***	13.67	0.0256***	7.26	0.0854***	16.78
Indicator	**0.0237**	**1.24**	**0.0621*** **	**2.94**	**0.3017*** **	**7.17**	**0.4994*** **	**10.97**
MR	0.7080***	237.43	0.7069***	237.49	0.8999***	321.28	0.8907***	318.05
Size			-0.0013***	-3.00			-0.1275***	-7.95
TurnoverA			-0.0173***	-19.07			-0.0201***	-28.79
VOLA			-0.0010***	-5.46			-0.3731**	-2.31
RET_t			0.0465***	39.61			0.0533***	53.72
RET_{t-1}			0.0016	1.32			-0.0005	-0.52
RET_{t-2}			-0.0013	-1.09			0.0016	1.60
RET_{t-3}			-0.0029**	-2.48			-0.0041***	-4.09
RET_{t-4}			-0.0086***	-7.27			-0.0101***	-10.14
RET_{t-5}			0.0004	0.37			-0.0031***	-3.11
# of obs.	675,625		674,223		931,821		929,348	

Panel C: Frequency of total ranked days

Variables	Total ranked days < 100 (i) Est.	Total ranked days < 100 (i) T-stat	Total ranked days < 100 (ii) Est.	Total ranked days < 100 (ii) T-stat	Total ranked days < 200 (iii) Est.	Total ranked days < 200 (iii) T-stat	Total ranked days < 200 (iv) Est.	Total ranked days < 200 (iv) T-stat
Intercept	0.0287***	11.42	0.0648***	23.57	0.0284***	11.34	0.0628***	23.14
Indicator	**0.3940*** **	**9.05**	**0.4808*** **	**10.70**	**0.2875*** **	**8.59**	**0.3966*** **	**11.45**
MR	0.8217***	392.30	0.8153***	389.67	0.8243***	395.19	0.8180***	392.61
Size			-0.0118***	-5.72			-0.0098***	-6.21
TurnoverA			-0.0211***	-37.89			-0.0201***	-36.93
VOLA			-0.0010***	-4.69			-0.0010***	-4.69
RET_t			0.0503***	65.17			0.0514***	67.23
RET_{t-1}			-0.0001	-0.11			0.0007	0.89
RET_{t-2}			-0.0001	-0.13			0.0005	0.63
RET_{t-3}			-0.0049***	-6.29			-0.0042***	-5.51
RET_{t-4}			-0.0102***	-13.21			-0.0101***	-13.18
RET_{t-5}			-0.0028***	-3.67			-0.0022***	-2.85
# of obs.	1,554,373		1,550,517		1,577,189		1,573,333	

Table 4 The Next-Day Performance as Robustness Test

Table 4 reports robustness tests of the attention effect presented in Table 3. In Panel A, the explanatory variable *Indicator* is replaced with *Quintile*. *Quintile* is related to the degree of investor attention on the group of stocks. The highest (lowest) quintile group includes the most (least) frequently discussed 6 stocks among the top 30 list on the stock message board of *Daum.* Panel B and C summarize the regression results employing the absolute values of the next-day returns (i.e., $|RET_{t+1}|$) as a dependent variable. In Panel D, a binary variable with a value of 1 on the earnings announcement dates and its interaction term are included as explanatory variables to control for the moves caused by fundamental information. *, **, and *** represent significance at the level of 10%, 5%, and 1%, respectively.

	Panel A: The Next-Day Performance (RET_{t+1}) by Quintile							
	(i)		(ii)		(iii)		(iv)	
Variables	Est.	T-stat	Est.	T-stat	Est.	T-stat	Est.	T-stat
Intercept	-0.0254	-0.40	-0.0405	-0.66	-0.1092*	-1.71	-0.1558***	-2.48
Quintile	**0.0516*****	**2.71**	**0.0517*****	**2.82**	**0.0537*****	**2.87**	**0.0372****	**2.02**
MR			1.0834***	47.97	1.0828***	48.16	1.0865***	49.19
Size					-0.0014*	-1.83	-0.0002	-0.26
TurnoverA					-0.0080***	-4.34	-0.0183***	-9.84
VOLA					5.8329***	5.34	3.4216***	3.17
RET_t							0.1226***	26.75
RET_{t-1}							0.0334***	6.29
RET_{t-2}							0.0331***	5.70
RET_{t-3}							0.0200***	3.35
RET_{t-4}							0.0006	0.09
RET_{t-5}							0.0101*	1.66
# of obs.	27,643		27,635		27,520		27,513	

Panel B: Dependent Variable: $|RET_{t+1}|$

	(i)		(ii)		(iii)		(iv)	
Variables	Est.	T-stat	Est.	T-stat	Est.	T-stat	Est.	T-stat
Intercept	2.0690***	1020.80	2.0682***	1025.76	1.8797***	914.32	1.8780***	913.25
Indicator	**0.7542*** **	**48.71**	**0.7573*** **	**49.25**	**0.3093*** **	**19.19**	**0.3032*** **	**18.80**
MR			-0.1934***	-115.92	-0.1928***	-119.23	-0.1936***	-119.61
Size					-0.0108***	-28.06	-0.0108***	-27.84
TurnoverA					0.1282***	315.76	0.1295***	311.43
VOLA					0.0005***	3.34	0.0005***	3.33
RET_t							0.0057***	9.65
RET_{t-1}							-0.0203***	-33.91
RET_{t-2}							0.0017***	2.80
RET_{t-3}							-0.0006	-0.99
RET_{t-4}							0.0031***	5.17
RET_{t-5}							0.0032***	5.37
# of obs.	1,613,132		1,607,446		1,603,762		1,603,571	

Panel C: Dependent Variable: $|RET_{t+1}|$

	(i)		(ii)		(iii)		(iv)	
Variables	Est.	T-stat	Est.	T-stat	Est.	T-stat	Est.	T-stat
Intercept	2.4055***	48.93	2.4063***	48.99	1.4449***	31.14	1.4270***	30.97
Quantile	**0.1392*** **	**9.39**	**0.1394*** **	**9.41**	**0.1379*** **	**10.13**	**0.1308*** **	**9.68**
MR			-0.1257***	-6.89	-0.1266***	-7.75	-0.1221***	-7.53
Size					-0.0089***	-16.25	-0.0084***	-15.44
TurnoverA					0.0595***	44.26	0.0548***	40.10
VOLA					33.3804***	42.04	32.2150***	40.68
RET_t							0.0533***	15.82
RET_{t-1}							-0.0049	-1.25
RET_{t-2}							0.0197***	4.62
RET_{t-3}							0.0119***	2.72
RET_{t-4}							0.0149***	3.33
RET_{t-5}							0.0192***	4.33
# of obs.		27,643		27,635		27,520		27,513

Panel D: Controlling for the Moves by Fundamental Information

	(i)		(ii)		(iii)		(iv)	
Dependent Variable	RET_{t+1}		$\|RET_{t+1}\|$		KOSPI (RETt+1)		KOSDAQ (RETt+1)	
Variables	Est.	T-stat	Est.	T-stat	Est.	T-stat	Est.	T-stat
Intercept	0.0598***	22.61	1.8731***	901.66	0.0494***	13.91	0.0879***	17.20
Indicator	**0.1479*** **	**7.07**	**0.3027*** **	**18.43**	**0.0715*** **	**3.32**	**0.4841*** **	**10.49**
Ann	-0.0990***	-5.98	0.2152***	16.55	-0.0565***	-2.60	-0.1249***	-5.20
Ind × Ann	-0.0664	-0.71	-0.0618	-0.84	-0.1743*	-1.92	0.4920**	2.01
MR	0.8233***	399.46	-0.1933***	-119.42	0.7068***	237.47	0.8905***	317.94
Size	-0.0023***	-4.62	-0.0108***	-28.04	-0.0013***	-2.94	-0.1265***	-7.88
TurnoverA	-0.0188***	-35.58	0.1295***	311.37	-0.0173***	-19.11	-0.0200***	-28.73
VOLA	-0.0010***	-4.72	0.0005***	3.34	-0.0010***	-5.46	-0.3713**	-2.30
RET_t	0.0520***	68.79	0.0057***	9.59	0.0465***	39.61	0.0533***	53.74
RET_{t-1}	0.0004	0.59	-0.0203***	-33.96	0.0016	1.34	-0.0005	-0.50
RET_{t-2}	0.0006	0.75	0.0017***	2.83	-0.0013	-1.09	0.0016	1.59
RET_{t-3}	-0.0040***	-5.20	-0.0006	-0.97	-0.0029**	-2.48	-0.0041***	-4.10
RET_{t-4}	-0.0098***	-12.96	0.0031***	5.18	-0.0086***	-7.28	-0.0101***	-10.15
RET_{t-5}	-0.0021***	-2.73	0.0033***	5.52	0.0004	0.35	-0.0031***	-3.16
# of obs.	1,603,571		1,603,571		674,223		929,348	

Table 5 Abnormal Trading Volume (Unranked vs. Ranked)

Table 5 reports whether abnormal trading volume is different between unranked and ranked stocks on day *t*. Abnormal trading volume of stock *i* on day *t* is defined in two ways: 1) the increase in trading volume for the *previous week* from *t*-6 to *t*; and 2) the increase in trading volume for the *previous month* from *t*-21 to *t*. To test whether two population means are equal, the *t statistics* by two sample t-tests are also reported under the assumption of unequal sample sizes and unequal variances (*** represents significance at the level of 1%).

Variable	Rank	Total #	Median	Mean
Diff_Turnover (t: t-6)	(a) 31 ~	1,586,187	-0.0063	-0.0377
	(b) 1 ~ 30	27,596	0.1056	2.1037
	Diff. in Means (b-a)			2.1414
	T stat. (unequal variance)			28.10***
	(c) 1 ~ 10	9,207	0.1397	2.2382
	Diff. in Means (c-a)			2.2759
	T stat. (unequal variance)			14.74***
Diff_TurnoverA (t: t-6)	(a) 31 ~	1,586,187	-0.0061	-0.0359
	(b) 1 ~ 30	27,596	0.1034	2.0801
	Diff. in Means (b-a)			2.1160
	T stat. (unequal variance)			27.61***
	(c) 1 ~ 10	9,207	0.1373	2.2136
	Diff. in Means (c-a)			2.2495
	T stat. (unequal variance)			14.48***

Diff_Turnover (t: t-21)	(a) 31 ~	1,583,020	-0.0078	-0.0648
	(b) 1 ~ 30	27,524	0.1444	2.9760
	Diff. in Means (b-a)			3.0409
	T stat. (unequal variance)			36.20***
	(c) 1 ~ 10	9,181	0.1990	3.2841
	Diff. in Means (c-a)			3.3490
	T stat. (unequal variance)			20.54***
Diff_TurnoverA (t: t-21)	(a) 31 ~	1,583,020	-0.0076	-0.0631
	(b) 1 ~ 30	27,524	0.1422	2.9589
	Diff. in Means (b-a)			3.0220
	T stat. (unequal variance)			35.81***
	(c) 1 ~ 10	9,181	0.1921	3.2536
	Diff. in Means (c-a)			3.3167
	T stat. (unequal variance)			20.14***

Table 6 Abnormal *Buying* by Different Types of Investors (Unranked vs. Ranked)

Table 6 reports the abnormal buying quantities of different types of investors such as individuals, foreigners, and institutions. The ranked stocks are assumed to be attention-grabbing stocks on the event day *t*. Abnormal quantity of stock *i* on day *t* is measured as the increase in the turnover ratio *Turnover* 1) for the last *one week* from *t-6* to *t*; and 2) for the last *one month* from *t-21* to *t*. To test whether two population means are equal, the *t statistics* by two sample t-tests are reported under the assumption of unequal sample sizes and unequal variances (*** represents significance at the level of 1%).

Investors	Variable	Indicator	Total #	Median	Mean
Individuals	Abnormal Buying_Qnt (t) – (t-6)	(a) Unranked	1,560,488	-0.0061	-0.0367
		(b) Ranked	27,495	0.0472	2.0232
	Diff. in Means (b-a)				2.0599
	T stat. (unequal variance)				27.36***
	Abnormal Buying_Qnt (t) – (t-21)	(a) Unranked	1,557,061	-0.0067	-0.0547
		(b) Ranked	27,423	0.0678	2.8778
	Diff. in Means (b-a)				2.9324
	T stat. (unequal variance)				35.18***
Foreigners	Abnormal Buying_Qnt (t) – (t-6)	(a) Unranked	1,426,076	0.0000	-0.0007
		(b) Ranked	27,458	0.0126	0.0339
	Diff. in Means (b-a)				0.0346
	T stat. (unequal variance)				18.96***
	Abnormal Buying_Qnt (t) – (t-21)	(a) Unranked	1,418,511	0.0000	-0.0005
		(b) Ranked	27,384	0.0161	0.0407
	Diff. in Means (b-a)				0.0412
	T stat. (unequal variance)				22.56***
Institutions	Abnormal Buying_Qnt (t) – (t-6)	(a) Unranked	1,018,710	0.0000	-0.0019
		(b) Ranked	25,417	0.0006	0.0358
	Diff. in Means (b-a)				0.0378
	T stat. (unequal variance)				18.73***
	Abnormal Buying_Qnt (t) – (t-21)	(a) Unranked	1,012,053	0.0000	-0.0024
		(b) Ranked	25,258	0.0016	0.0394
	Diff. in Means (b-a)				0.0418
	T stat. (unequal variance)				20.89***

Figure 1 Frequency Included in the Daum List

For the all ranked stocks, Figure 1 indicates the number of days included in the Daum list as the most frequently discussed 30 stocks. A total of 140 stocks (24.6%) among 569 stocks are ranked only once during the total sample period of 924 trading days. Around two-thirds of the 569 stocks are ranked less than 10 times (i.e., trading days) in the list.

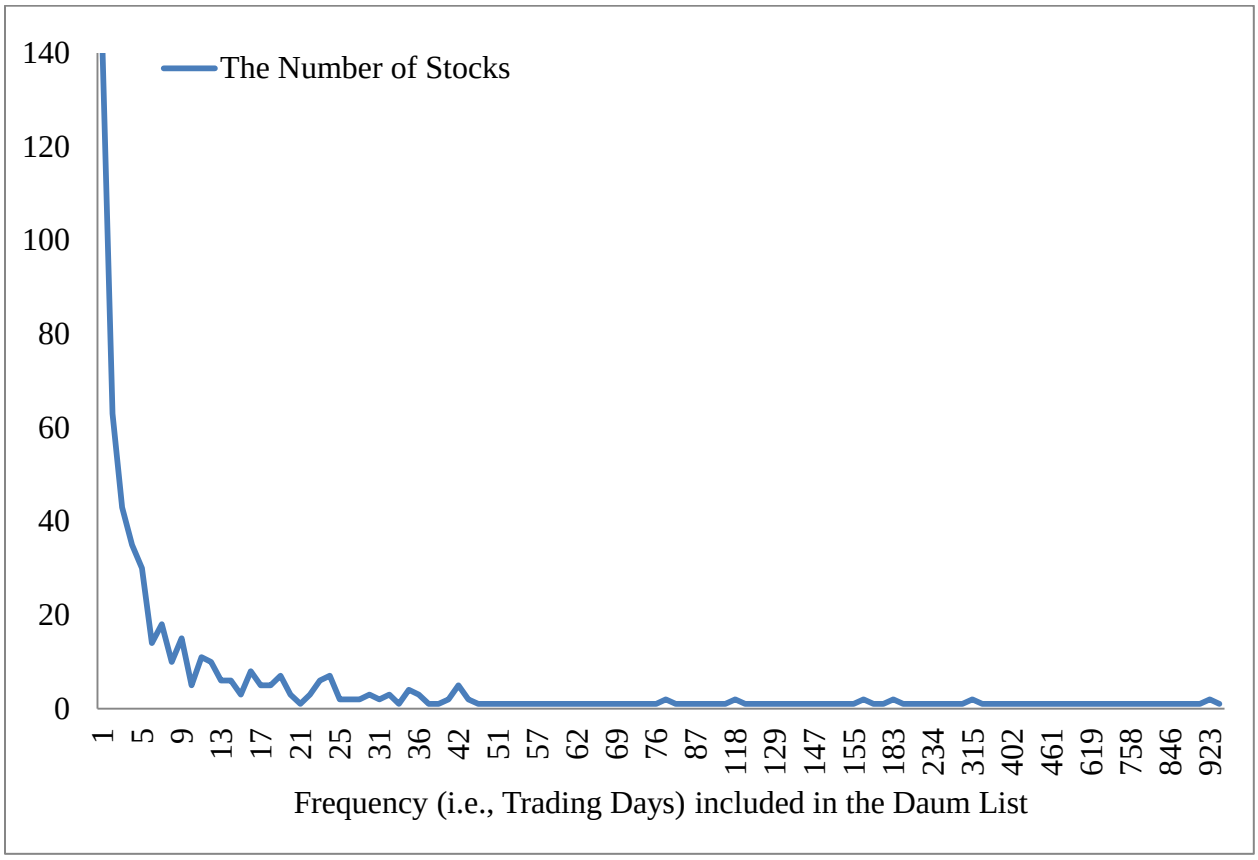
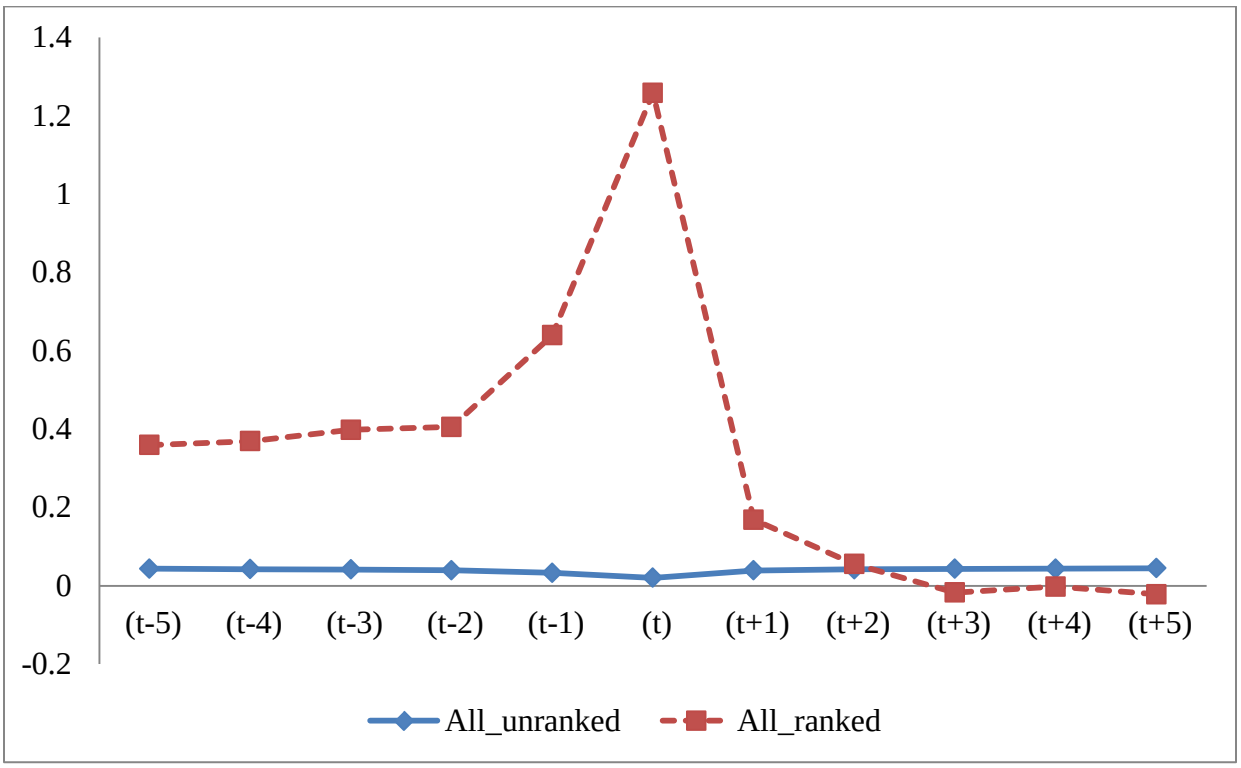
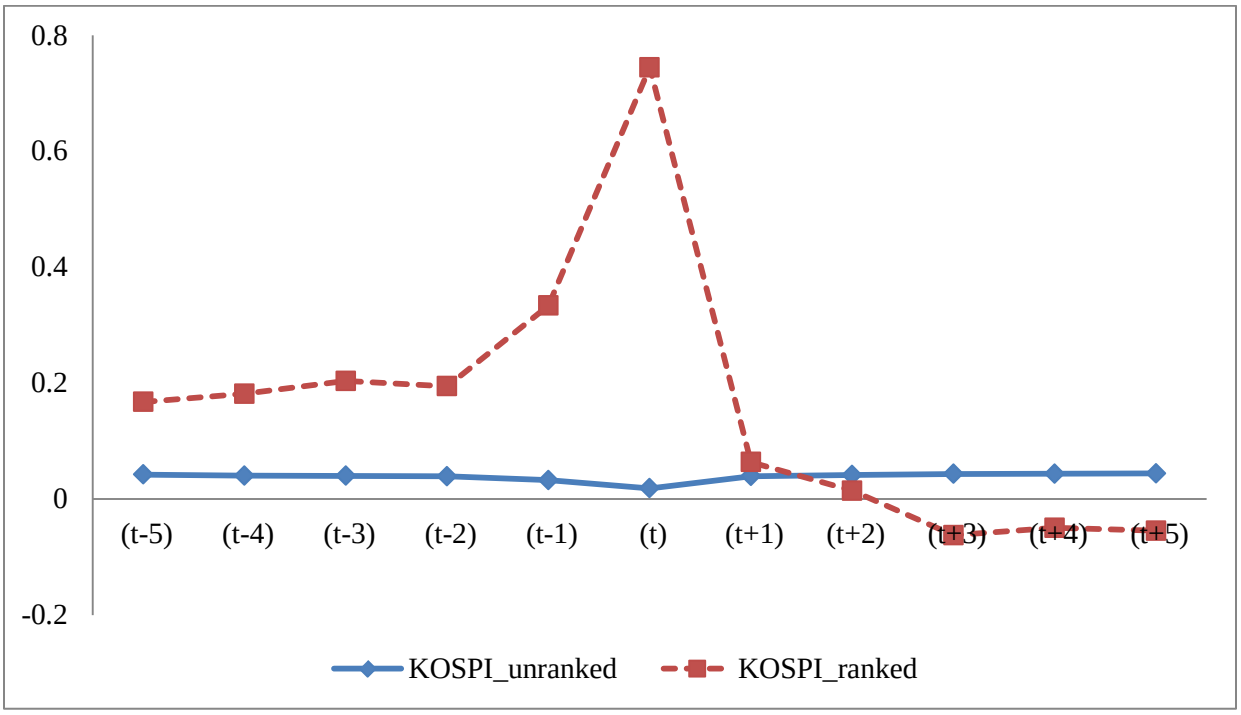


Figure 2 Changes in Returns (Unranked vs. Ranked)

Figure 2 exhibits the changes in mean returns from *t*-5 to *t*+5. On the event date *t*, stocks are ranked as the most frequently discussed stocks in the stock message board of Daum. Solid (dashed) lines are associated with unranked (ranked) stocks.

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KOSPI_unranked
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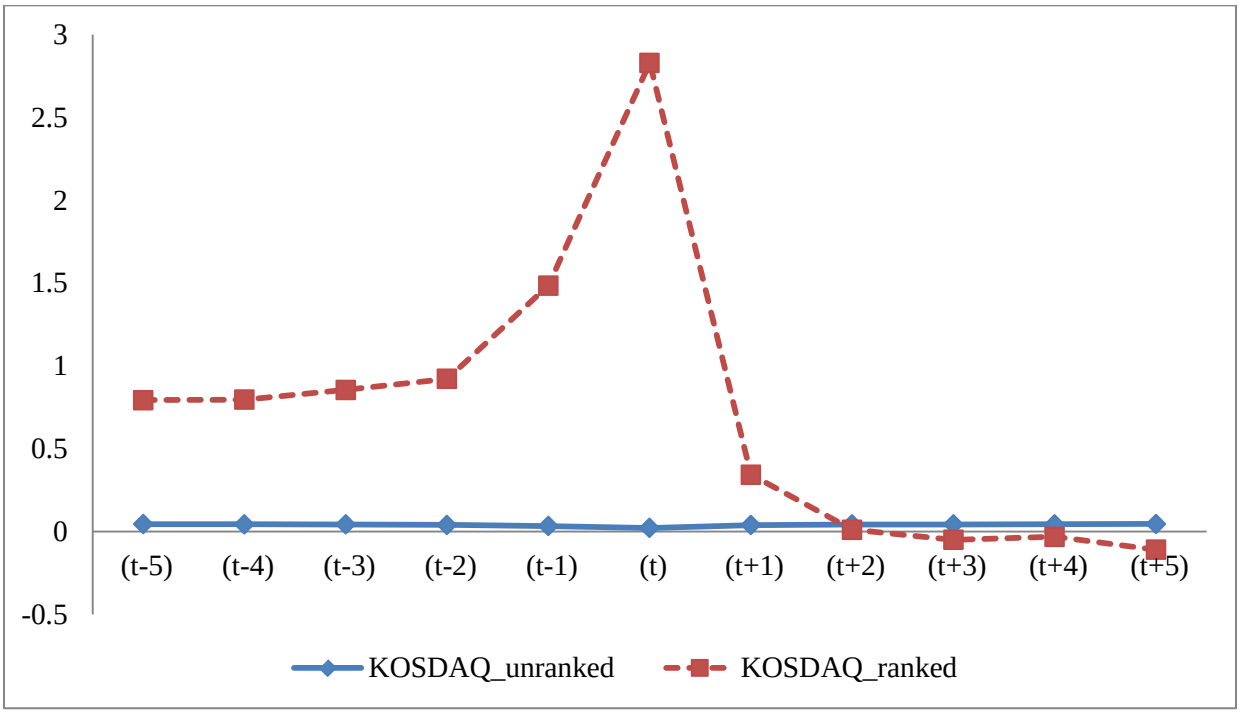
3
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KOSDAQ_unranked
KOSDAQ_ranked

Figure 3 Daily Returns by Quintiles

Figure 3 displays daily mean returns by quintile groups. The highest (lowest) quintile group includes the most (least) frequently discussed 6 stocks among the top 30 list on the stock message board of *Daum.*

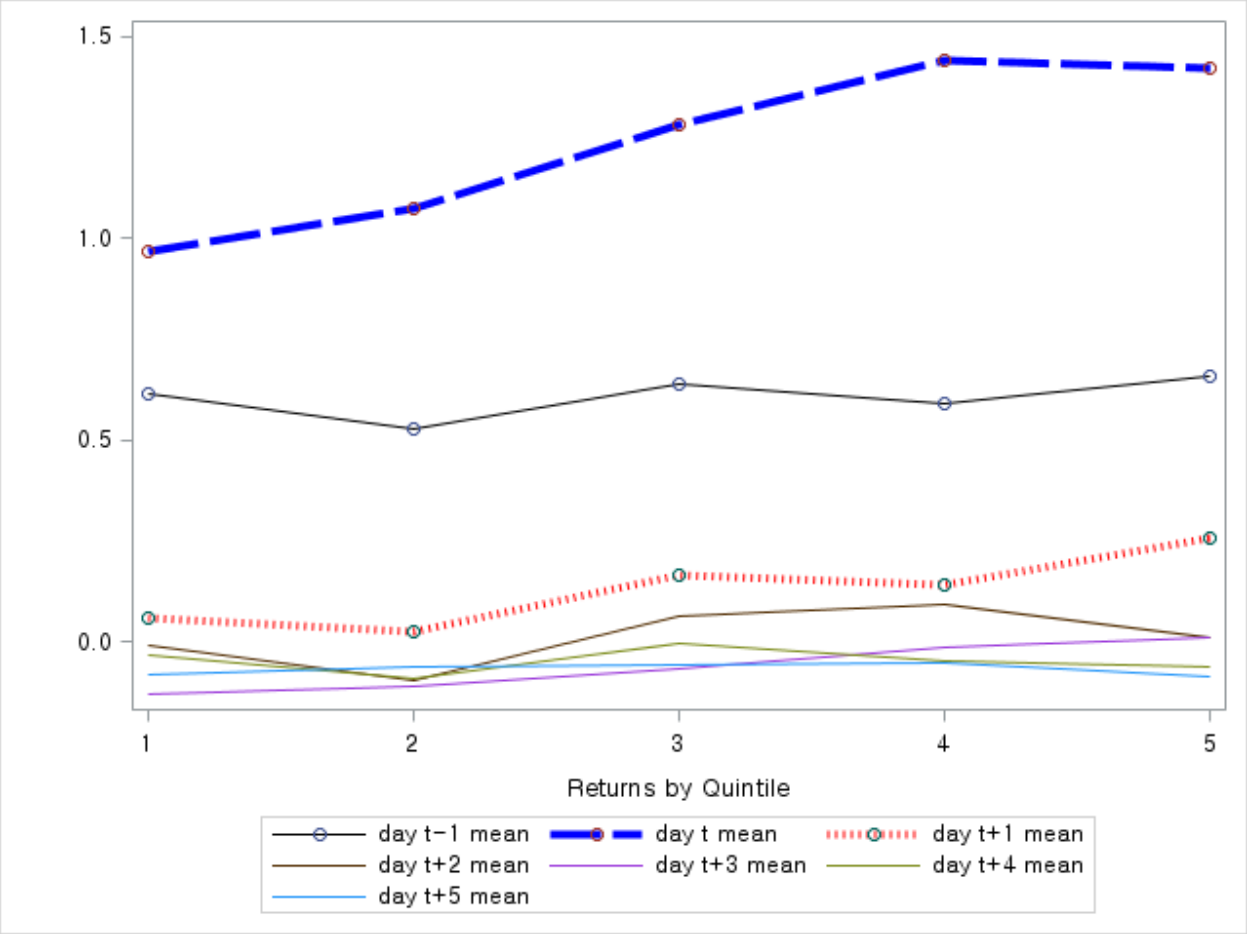
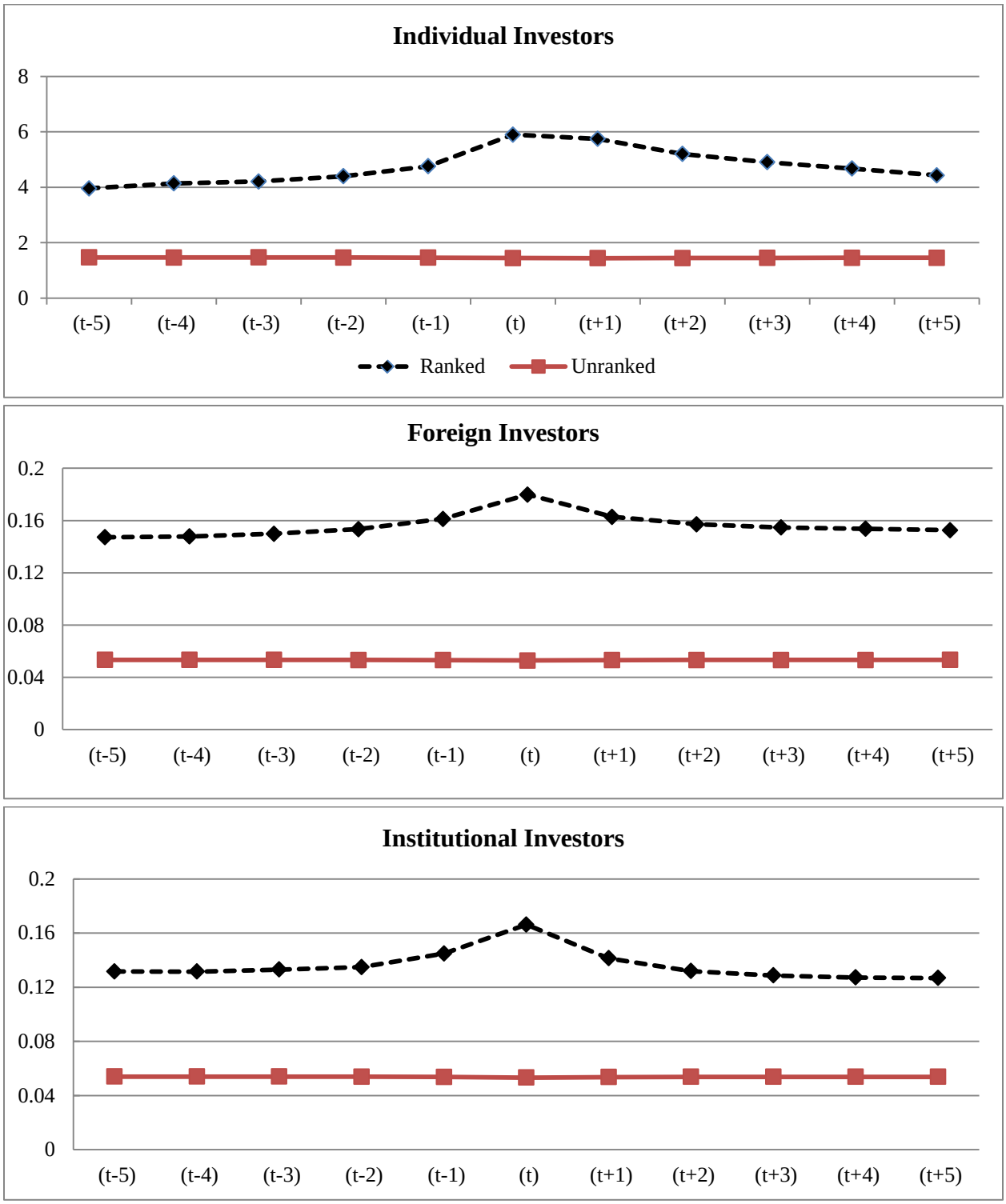


Figure 4 Buying Patterns by Different Types of Investors for Attention-Grabbing Stocks



Appendix A An Example Indicating the Ranks of Stocks in the Stock Message Board

종목 게시판

순위	변동	종목명	등락률	최신글
1	↑2	미래산업	-0.85%	여기
1	↑1	셀트리온	-0.58%	골드만삭스 곡물 투기로 4억달러 챙겨
3	↓2	메디포스트	+3.75%	메디 시작하네요...이유가 웃긴데요...
4	-	기아차	-1.48%	기회는 반드시 온다
5	-	SK하이닉스	+0.59%	헉... ㅋ
6	↑1	서희건설	+14.68%	서희 오랫만이다 너 짱먹어라
7	↓1	이노셀	-1.50%	이노셀..
8	↑1	써니전자	+14.84%	앗싸 써니 짱먹어라
9	↓1	LG전자	+2.01%	오늘 예측
10	-	한국항공우주	+1.43%	대통령직 인수위, GTX 사업 적극 검토중