

Investor Attention and Corporate Disclosure Timing: Evidence from Korea*

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This paper investigates the association between investor attention and the timing of the release of corporate information in the Korean stock market. The association provides the evidence on whether the investor demand for earnings information affects the managerial disclosure decision. Similar to a previous study that uses the *Google* Search Volume Index to measure investor attention, this paper re-measures investor attention using the Search Volume Index provided by *Naver*, which has the largest market share of all internet search portals in Korea. Using 9,526 firm-quarter observations, the paper regresses disclosure timing on investor attention. Empirical results show that managers facing greater investor attention announce quarterly earnings information on an earlier date than in the previous year, and they release earnings information during trading hours rather than non-trading hours. The findings indicate that managers consider timely disclosure to be an important factor in meeting investor interests. In addition, this paper sheds light on the role of individual/retail investors in managerial disclosure decisions, considering that the measure of investor attention primarily captures individual/retail investor interest.

Key Words: disclosure timing, earnings announcement, managerial disclosure decision, investor attention, search volume index

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1. Introduction

This paper investigates the association

between investor attention and the timing of the release of corporate information in the Korean stock market. Timeliness is one of the primary qualities of financial reporting

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and makes accounting information useful. Along with the importance of timeliness, a large stream of research has explored strategic corporate disclosure. This research shows that a manager's choice of disclosure timing is affected by litigation costs, firm performance, and the consideration of firm value (Skinner, 1994; Verrecchia, 1983; Gennotte and Trueman, 1996). More recently, Sengupta (2004) empirically examines the determinants of quarterly earnings release dates and finds that the reporting lag is shortened by investor demand for information and litigation costs, but lengthened by operational complexity. Focusing on investor demand for information, we extend the research on disclosure timing by examining whether the direct measure of investor attention affects (1) the quarterly earnings release date (days between the last year's quarterly earnings announcement date and the current year's quarterly earnings announcement date) and (2) the intraday timing of quarterly earnings announcements (before/after trading hours).

Managers have several motives for changing the timing of the release of earnings information in response to investor attention. Managers are committed to meet investor demand for financial information by providing it in a timely manner (e.g., Sengupta, 2004; Graham et al., 2005). Information asymmetry between managers and shareholders causes a rise in

the cost of capital due to information risk premium, and consequently, causes a decline in stock prices (Barry and Brown, 1985; 1986; Merton, 1987). To reduce the cost of capital, managers can use various information channels, such as voluntary disclosure, to increase the amount of information available to shareholders and/or can provide investors with the timely information that they need. Given that the quarterly report is a mandatory disclosure, the active response to investor demand for information and its disclosure in a timely manner are efficient ways for managers to reduce capital costs. DellaVigna and Pollet (2009) argue that when investor inattention exists, the extent to which investors respond to an earnings announcement is less and the timing at which earnings are reflected in stock prices is delayed (post-earnings announcement drift).¹⁾ In addition, Bhushan (1994) argues that delays in market response to earnings announcements increase trading costs, based on empirical evidence that post-earnings announcement drift and stock prices are in an inverse relationship. Taken together, since investor interest can be a market pressure for timely disclosures, we expect that managers might release their earnings information quickly and/or during trading hours when there is significant investor attention.

This study examines an empirical analysis

1) They used Friday as a proxy for investor inattention and found that earnings announcements on Friday receive a delayed response and are lower than those on any other weekday.

of investor attention in the Korean stock market using the Search Volume Index (SVI) provided by *Naver*, an internet search portal in Korea. Introduced by Da et al. (2011), the *Google* SVI is well used by related studies because it can capture the investor attention in real time and more directly and better than any other proxies such as trading volume or search-term frequency. Da et al. (2011) suggest that the investor attention measured by the *Google* SVI represents retail and/or individual investors rather than institutional or foreign investors. Compared to institutional or foreign investors, individual/retail investors have limited access to multiple sources of information. In this light, a corporate report, including financial statements, is one of the cheapest sources of information that individual investors can easily utilize in making investment decisions. Especially, the Korean stock market has feature that individual investors predominate stock trading over institutional or foreign investors. According to the Korean Exchange, over 60% of the trading volume in 2017 was owing to transactions of individual investors.²⁾ Recently, individual investors in the 20s and 30s, who are accustomed to internet, tremendously establish stock accounts, and their trading costs have been on the

rise.³⁾ Moreover, Korea's high internet penetration rate and fast internet speed make it easier for individual investors to access these reports.⁴⁾ We imply that heavy stock trading by individual investors in Korea can represent that the SVI can better capture the extent to which those investors exert efforts on getting any material corporate information. Further, the Korean stock market can provide an idealistic environment that better reflects those individual investors' behaviors.

This study uses the *Naver* SVI rather than the *Google* SVI to measure the investor attention. The SVI can serve as a proxy of the investor attention only when it satisfies the assumption that the frequency of investors' use of the internet portal, which is a basis of the SVI, is reasonably high. In Korea, the market share of *Naver* is considerably high rather than that of *Google*. Especially, stock-related online community provided by *Naver* is overwhelmingly active as compared those in other internet portals such as *Google* and *Daum* in Korea. Thus, we believe that collecting internet search volume data from *Naver* can better capture investor attention in Korea. Therefore, this study uses the *Naver* SVI followed by the methodology of Da et al. (2011).

Using the above-mentioned measure of

2) The Korean Herald 29 Jan, 2018. See <http://www.koreaherald.com/view.php?ud=20180129000620>

3) Yeonhap News 25 Mar, 2020. See <https://www.yna.co.kr/view/AKR20200325118051008?input=1195m>

4) Internet penetration rate statistics are from <https://www.statista.com/statistics/255859/internet-penetration-in-south-korea/>. Internet speed statistics are from <https://www.statista.com/statistics/204952/average-internet-connection-speed-by-country/>.

investor attention, we find the following. First, empirical results indicate that, on average, managers disclose quarterly earnings information relatively earlier than the previous year when investor attention towards a firm becomes greater. Second, we find that firms facing greater investor attention are more likely to release their earnings information during trading hours. These results support our expectation that managers provide earnings information in a timely manner as a way to provide useful information for investor decision making when investor demand for information is high. Lastly, our additional results show that the relationship between investor attention and announcing earnings earlier than in the previous year tends to be stronger for smaller firms and firms not followed by analysts. Considering that such firms have relatively poor information environment, these results imply that managers try to respond more actively to investors to improve the information environment by providing timely disclosures.

Our study contributes to the literature in the following ways. First, we extend the line of research on the disclosure timing of earnings information. Prior studies suggested that managers can strategically make decision concerning corporate disclosure in response to investor attention (Patell and Wolfson 1982; DellaVigna and Pollet 2009; deHaan et al. 2015). There are few studies focus on big data stored on the internet. The internet-based

proxies such as *Google* SVI have many advantages over existing measures in proxying investor attention. Sengupta (2004) addresses the relationship between investor attention, measured by trading volume, and the timing of disclosures and yields interesting empirical results. The trading volume as a proxy for investor attention may distort the extent of investor demand, as institutional investors often invest in a large number of stocks. Compared to trading volume, the search volume index captures the information demand more directly because it measures the effort to obtain corporate information from many investors, including retail/individual investors. The search volume data is initially stored on the internet, and is then utilized by interest users, and rankings on trending searches are shown in real time. This feature suggests a possibility that managers can be easier to obtain information on investor attention from the internet and more actively make a corporate decision to response investors. In this context, our study contributes to the existing literature on the association between investor attention and corporate disclosure.

Second, our study sheds light on the role of individual/retail investors in managerial disclosure decisions. We provide empirical evidence using a Korean setting, where the IT infrastructure is well developed and retail/individual investors' investment is active. In Korea, it is very common that gathering cor-

porate information with a simple internet search and invest in companies' stock with a smartphone. Considering this fact, it is more appropriate to use the SVI as a proxy for investor attention for Korean stock market, because Da et al. (2011) state that the SVI represents the attention of retail/individual investors rather than that of institutional investors. Thus, our evidence that investor attention affects corporate disclosure timing suggests that the role of retail/individual investors in making companies provide timelier information.

The remainder of this paper is organized as follows. In the next section, we present the previous literature and develop the hypothesis. Section 3 provides the empirical results. In Section 4, we conduct further analyses. The last section concludes the study.

II. Literature review and hypothesis development

Investor attention can be an important factor for a manager's decision-making concerning corporate disclosure timing, because it can trigger differential market reactions to corporate disclosure and reveal the extent to which investors demand for corporate information (Hirshleifer and Teoh 2003; Dellavigna and Pollet 2009; Drake et al. 2012; Brown et

al. 2012; deHaan et al. 2015).

Concerning the trigger for differential market reaction, the market reacts differently to information released because of limited investor attention. This means that investors should choose the right information - when faced with tremendous amounts of information - while limiting costs, as the selection process involves much time and effort (Kahneman 1973). The market reaction to information disclosure is relatively lower for firms with low investor attention than for firms with high investor attention (Hirshleifer and Teoh 2003). Managers have incentives to strategically alter the disclosure timing, as they are aware that limited investor attention can cause a different market reaction. More specifically, managers have incentives to disclose bad news when investor attention is dispersed and disclose good news when investor attention is high (Patell and Wolfson 1982; deHaan et al. 2015).

Furthermore, concerning information demand, investor attention can reveal the extent to which investors demand corporate information (Drake et al. 2012; Vlastakis and Markellos 2012). In this case, managers have incentives for strategic disclosure because they are responsible for responding to investor demand. Drake et al. (2012) suggested that investor attention can be seen as investor demand for information because investors can put great effort into obtaining earnings information from

interested firms prior to the date of earnings announcement through various channels. In other words, *Google* searching activities to obtain earnings information can be interpreted as investors' efforts, since putting greater effort into searching activities can increase their chances of obtaining information before it is publicly released. If investor attention can serve as a proxy for investor demand for corporate information, managers have an opportunity to build a good reputation regarding disclosure by timely disclosing corporate information (Graham et al. 2005).

In recent years, managers correspond to investors' information demands through various channels besides a traditional approach. Sengupta (2004) addresses the relationship between investor attention, measured by trading volume, and the timing of disclosures. They found a negative association between trading volume and delay of earnings announcement, suggesting that firms facing investors' greater demand for information are more likely to disclose the quarterly earnings information relatively early. Blankespoor et al. (2014) examined the impact of corporate activities releasing financial information to investors using Twitter rather than conventional disclosure on information asymmetry. According to their findings, providing investors with broad corporate information using Twitter can

not only lower bid-ask spreads, but also mitigate information asymmetry. These results imply that managers can capture investors' information demands well, meaning that they can manage various information channels to communicate with investors. In Korea, Celltrion Holdings Co. has hosted investor relations (IR) to retail and individual investors since 2019, which seem to be quite unprecedented, considering that most companies do IR to institutional investors and/or foreign investors who operate large financial capitals.⁵⁾ It is thought to be the manager's effort to satisfy demands of investors facing a lack of information sources, given that retail investors take up a large portion of entire investors of Celltrion, and it is closely connected to minority investors for a long period. Moreover, as shareholder activism recently stands out, companies subject to improper information disclosure and/or in violation of disclosure acts are under significant pressure. This case shows that managers necessarily have incentives to disclose information in a timely manner. Our main measure of investor attention is based on internet search volume index, and this measure mainly represents the extent to which minority investors are interested in investing companies because internet is a major channel of searching corporate information for minority or retail investors (Da et al.

5) ChosunBiz, 17 Sep. 2019. "Celltrion hosts an IR for retail investors".

2011; Drake et al. 2012). Moreover, internet is a place where those investors share the information and is often the starting point for shareholder activism. Accordingly, the search volume index for companies might be a good means for managers to estimate investors' information demands.

Given that the quarterly report is a mandatory disclosure which has a deadline, the most efficient way to lead greater market reaction and to fulfill investor demand can be a timelier disclosure. DellaVigna and Pollet (2009) argue that when investor inattention exists, investors respond to an earnings announcement to a lesser extent and the post-earnings announcement drift appears. Considering that delays in market response to earnings announcements increase trading costs (Bhushan 1994), managers have incentives to change the timing of the release of earnings information in response to investor attention.

Taken together, since investor attention can be a considerable factor for a manager of the firms, we expect that managers might release their earnings information quickly and/or during trading hours when there is significant investor attention. Based on this discussion, the hypothesis is as follows:

Hypothesis: Investor attention shortens corporate disclosure timing.

III. Research sample and design

3.1 Naver search volume index for investor attention

We manually collect investor search activities from *Naver Trends*. *Naver Trends* has provided data on search-term frequency since January 2007. We download the weekly Search Volume Index (SVI) for individual company stocks. To reduce noise in the data, we focus on stocks in the Korea Composite Stock Price Index (KOSPI) market, including about 780 of the largest Korean companies.⁶⁾ We collect weekly SVIs for each company's name in order to capture variations in investor attention from 2007 to 2013. The SVI measures the number of weekly searches for a particular firm and, thus, provides time-series variations for information searches on particular firms. This variable can provide a direct and timely proxy for investor attention and the information demand of a specific firm in a given week.

6) There are two stock markets in Korea. One is the Korea Composite Stock Price Index (KOSPI), and the other is the Korean Securities Dealers Automated Quotation (KOSDAQ). Generally, large/medium-sized and established firms are listed on the KOSPI market, while small, venture, and technology-related firms are listed on the KOSDAQ market. Moreover, as of June 2017, the total market capitalization of the KOSPI market amounts to USD 1.1 billion, but that of the KOSDAQ market amounts to only USD 0.2 billion. Thus, we believe that KOSPI firms represent the Korean stock market.

Following Da et al. (2011), we calculate abnormal SVI (ASVI) as

$$ASVI_t = \log(SVI)_t - \log[\text{median}(SVI_{t-1}, \dots, SVI_{t-8})] \quad (1)$$

Where $\log(SVI)_t$ is the logarithm of SVI during week t , and $\log[\text{median}(SVI_{t-1}, \dots, SVI_{t-8})]$ is the logarithm of the median value of SVI during the prior 8 weeks. We use quarterly data based on the sum of the weekly SVIs as a proxy for investor attention (*Attention*).⁷⁾

3.2 Sample selection

We construct a sample of firm-years from 2007 to 2013. Our sample period starts in 2007 because *Naver trends* has provided the service since 2007. We use the *TS2000* database for firm financial characteristics and *Fn_Dataguide* for analysts' forecast data. Search Volume Index (SVI) data and quarterly earnings disclosure data, such as announcement date and hour, is manually collected from the Data Analysis, Retrieval and Transfer

System (DART) operated by the Financial Supervisory Service.⁸⁾ We begin with *TS2000* data for Korean companies listed in the Korea Composite Stock Price Index (KOSPI) and restrict our sample by the following criteria: (1) non-financial firms, (2) December fiscal year-end, and (3) companies with complete data availability for our tests. For uniformity, we restricted our sample to firms whose fiscal year-end is December, since more than 95% of Korean firms' fiscal year-end is December. As a result, our final sample consists of 9,526 firm-quarters for analysis.

3.3 Investor attention and quarterly earnings disclosure timing

On the basis of the finding above that the SVI represents investor attention, we examine the influence of investor attention on managers' decisions to disclose quarterly earnings press releases on an earlier date than in the previous year. To test whether investor attention affects quarterly earnings disclosure timing, we estimate the following regression model:

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- 7) Korean investors use several search engines such as Daum and Google as well as Naver. Naver not only takes up the highest market share of the market, but it also provides users with sophisticated contents relating to stock investments: Google does not provide investors with discussion threads in order to share opinions while Daum has discussion threads, which is not very active compared to Naver. For example, according to the number of posts about Celltrion Holdings Co. among the three search engines during January 2020, Naver reports 7,191 posts while Daum reports only 508 posts. Further, several prior studies suggest empirical findings using Naver search volume index (Yun and Yoo 2017; Kim 2018). There is a limitation that our study does not capture investor attention based on other search engines than Naver even though prior studies provide audience with meaningful implications by using Naver Search Volume Index.
- 8) Similar to EDGAR in the U.S., all listed Korean firms are required to file a periodic report (quarterly and annual report) through the DART.

$$\begin{aligned}
\text{Delay_date}_{i,t} = & \beta_0 + \beta_1 \text{Attention}_{i,t} \\
& + \beta_2 \text{Size}_{i,t} + \beta_3 \text{Roa}_{i,t} + \beta_4 \text{Ret}_{i,t} \\
& + \beta_5 \text{Lev}_{i,t} + \beta_6 \text{Mtb}_{i,t} + \beta_7 \text{Loss}_{i,t} \\
& + \beta_8 \text{Foreign}_{i,t} + \beta_9 \text{Blockholder}_{i,t} \\
& + \beta_{10} \text{Ret_std}_{i,t} + \beta_{11} \text{Roa_std}_{i,t} \\
& + \beta_{12} \text{Analyst}_{i,t} + \beta_{13} \text{ChgGDP}_{i,t} \\
& + \text{QuarterDummy} + \text{IndustryDummy} \\
& + \varepsilon_{i,t}
\end{aligned} \quad (2)$$

The dependent variable, *Delay_date* is the number of days between the quarterly financial statement release date in the last year and that in the current year. The median value of *Delay_date* is 365, about a year. For robustness tests, we add two *Delay*-related measures based on hour (*Delay_hour*) and the logarithm of hour (*Delay_lnhour*).

Our variable of interest is *Attention*, an abnormal SVI based on Da et al. (2011), which represents investor attention and investor demand for earnings information (Drake et al. 2012). We expect β_1 to be a significant and negative value if managers disclose quarterly financial statements earlier in response to high investor attention, in order to meet investor demand.

To control the possibility that firm characteristics confound the regression results, we include various control variables. *Size* is the natural logarithm of total assets. *Roa* is operating income scaled by total assets. *Ret* is stock returns. *Lev* is debt scaled by total assets. *Mtb* is market value of assets divided

by book value of assets. *Loss* is a dummy variable equal to 1 when return on assets during the same quarter in the last year compared to the current year is lower than zero, and 0 otherwise. *Foreign* is the foreign ownership ratio of a firm, *Blockholder* is the blockholder ownership ratio of a firm, *Ret_std* is volatility of a firm's return from $t-4$ weeks to t weeks, *Roa_std* is volatility of a firm's return on asset from $t-4$ quarters to t quarters, *Analyst* is the number of analysts following, and *ChgGDP* is GDP change rate for the quarter.

From an information demand perspective, firm characteristics can be associated with a dependent variable as follows. First, the information demand can be reduced in response to information acquired through various channels even though the demand increases along with an increase in interested parties in response to bigger firms (*Size*). Firm leverage (*Lev*) increases investor demand due to an increased number of interested parties. Firm growth (*Mtb*) also increases investor demand as investors show more interest in information on the future prospects of high-growth firms. From the external stakeholders' perspective, the analyst following (*Analyst*), foreign investors (*Foreign*), and blockholders (*Blockholder*) are positively associated with information demand to facilitate monitoring. Furthermore, firm performance (*Roa*, *Ret*, and *Loss*) are included as control variables as it alters investors demand on corporate information to interpret

firm performance. A more volatile business environment (*Rest_std*, *Roa_std*) can induce information demand to mitigate the information asymmetry between the management and investors. Finally, *ChgGDP* is controlled as the market-wide factor that might affect investor demand.

To control time- and industry-specific effects, we estimate all the regressions with quarter- and industry-fixed effects and report robust *t*-statistics with clustered standard errors within the firm level.

3.4 Probability of trading hours disclosure and investor attention

We also investigate whether managers announce quarterly financial statements during stock trading hours (“daytime” announcements), when investor attention is high, rather than during non-trading hours (“overnight” announcements). To test the hypothesis above, we estimate the following logit regression model:

$$\begin{aligned} Pr(Tradinghours=1)_{i,t} = & \beta_0 + \beta_1 Attention_{i,t} \\ & + \beta_2 Size_{i,t} + \beta_3 Roa_{i,t} + \beta_4 Ret_{i,t} \\ & + \beta_5 Lev_{i,t} + \beta_6 Mtb_{i,t} + \beta_7 Loss_{i,t} \\ & + \beta_8 Foreign_{i,t} + \beta_9 Blockholder_{i,t} \\ & + \beta_{10} Ret_std_{i,t} + \beta_{11} Roa_std_{i,t} \\ & + \beta_{12} Analyst_{i,t} + \beta_{13} ChgGDP_{i,t} \\ & + QuarterDummy + IndustryDummy \\ & + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where, *Tradinghours* refers to firms disclosing quarterly financial statements within stock market trading hours. The stock market in Korea officially stops trading after 3:00 PM. *Tradinghours* is equal to 1 if a firm discloses the earnings information within trading hours, and 0 otherwise. We expect β_1 to be a significant and positive value if managers provide earnings information in a timely manner in response to high demand by investors

IV. Empirical result

4.1 Descriptive statistics

Panel A of Table 1 reports the descriptive statistics for the variables we use. The mean (median) value of *Attention*, which captures change in investor attention for a firm, is 0.245 (0.000). There is a great range from the minimum value (-3.936) to the maximum value (7.595). The mean value of *Delay_date*, the change of timing in corporate disclosure, is 366.314, the standard deviation is 5.056, and the maximum (minimum) value is 381 (350), meaning that firms tend to change the announcement date of their annual reports, compared to previous year. Given that the means of accounting earnings (*Roa*) and stock returns (*Ret*) are both positive, the companies included in our sample are generally profitable.

〈Table 1〉 Descriptive Statistics

Panel A. Statistics for variables

Variable	Mean	S.D.	Min	25%	Median	75%	Max
<i>Attention</i>	0.245	1.892	-3.936	-0.920	0.000	1.099	7.595
<i>Delay_date</i>	366.314	5.056	350.000	364.000	365.000	367.000	381.000
<i>Delay_hour</i>	8791.647	121.324	8400.000	8743.000	8762.000	8807.000	9144.000
<i>Delay_Inhour</i>	9.081	0.014	9.036	9.076	9.078	9.083	9.121
<i>Tradinghours</i>	0.469	0.499	0.000	0.000	0.000	1.000	1.000
<i>Size</i>	19.636	1.431	17.145	18.645	19.351	20.222	24.073
<i>Roa</i>	0.030	0.042	-0.085	0.006	0.023	0.049	0.176
<i>Ret</i>	0.051	0.262	-0.577	-0.103	0.028	0.188	0.936
<i>Lev</i>	0.442	0.184	0.097	0.296	0.444	0.579	0.872
<i>Mtb</i>	1.069	0.921	0.194	0.510	0.783	1.276	5.781
<i>Loss</i>	0.161	0.367	0.000	0.000	0.000	0.000	1.000
<i>Foreign</i>	0.094	0.133	0.000	0.006	0.033	0.127	0.625
<i>Blockholder</i>	0.434	0.153	0.102	0.327	0.436	0.534	0.814
<i>Ret_std</i>	0.124	0.069	0.032	0.079	0.108	0.147	0.435
<i>Roa_std</i>	0.026	0.018	0.004	0.014	0.022	0.033	0.102
<i>Analyst</i>	0.668	0.970	0.000	0.000	0.000	1.099	3.258
<i>ChgGDP</i>	0.035	0.023	-0.019	0.021	0.036	0.051	0.074

Panel B. Correlation matrix

	<i>Attention</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. <i>Delay_date</i>	0.0															
2. <i>Delay_hour</i>	0.0	0.9														
3. <i>Delay_Inhour</i>	0.0	0.9	0.9													
4. <i>Tradinghours</i>	0.0	0.0	0.0	0.0												
5. <i>Size</i>	0.0	0.0	0.0	0.0	-0.2											
6. <i>Roa</i>	0.0	0.0	0.0	0.0	0.1	0.1										
7. <i>Ret</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0									
8. <i>Lev</i>	0.0	0.0	0.0	0.0	-0.1	0.1	-0.2	0.0								
9. <i>Mtb</i>	0.1	0.0	0.0	0.0	-0.1	0.2	0.2	0.1	0.2							
10. <i>Loss</i>	0.0	0.0	0.0	0.0	0.0	-0.1	-0.5	0.0	0.1	0.0						
11. <i>Foreign</i>	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	-0.2	0.2	-0.1					
12. <i>Blockholder</i>	0.0	0.0	0.0	0.0	0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.1				
13. <i>Ret_std</i>	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0	0.2	0.1	0.1	-0.2	0.0			
14. <i>Roa_std</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	-0.1	0.3	0.1	0.1	0.0	0.1		
15. <i>Analyst</i>	0.0	-0.1	-0.1	-0.1	-0.1	0.7	0.3	0.0	0.0	0.4	-0.2	0.5	-0.2	-0.1	0.2	
16. <i>ChgGDP</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Note: Refer to Appendix 1 for the variable definitions. Panel B presents the Pearson correlations between variables for the sample. The bold number indicates the significance level at 1 percent levels (two-tailed)

Panel B of Table 2 shows Pearson correlation matrix between variables. Investor attention (*Attention*) is positively associated with stock returns (*Ret*), suggesting that investors pay more attention on firms with better market performance. In the correlation matrix, we find the positive correlation between investor attention (*Attention*) and dependent variables (*Delay* variables and *Tradinghours*) but

insignificant at 1% level.

4.2 Validation test of the measure of investor attention

Da et al. (2011) conclude that investor attention measured by *Google* SVI is associated with present and future stock prices by enhancing the methodology of measuring

〈Table 2〉 Validation Test of the Measure of Investor Attention

	(1)	(2)	(3)	(4)
	<i>Abn_Turnover</i>	<i>Abn_Net_Buy_id</i>	<i>Abn_Return (t)</i>	<i>Abn_Return (t+1)</i>
<i>Intercept</i>	-0.082*** (-3.96)	0.005** (2.17)	-0.203** (-2.35)	0.202*** (2.67)
<i>Attention</i>	0.010*** (11.59)	0.001*** (11.32)	0.011*** (13.20)	0.002*** (2.74)
<i>Ret</i>	0.005 (1.46)	-0.021*** (-13.52)		
<i>Market_Cap</i>	0.006*** (3.68)	-0.001** (-2.39)	0.015** (2.13)	-0.019*** (-2.94)
<i>Abs_Ret</i>	0.114*** (14.02)	0.011*** (7.05)		
<i>Abs_Abn_Ret</i>			0.453*** (25.22)	0.012 (0.88)
<i>Abn_Turnover</i>			0.150*** (3.96)	-0.086** (-2.52)
<i>Net_Buy_id</i>			-2.076*** (-10.91)	-0.053 (-0.49)
Firm fixed effect	Yes	Yes	Yes	Yes
Week fixed effect	Yes	Yes	Yes	Yes
Observations.	195,994	195,994	195,994	195,994
Adjusted R ² .	0.145	0.050	0.325	0.185

Note: Refer to Appendix 1 for the variable definitions. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Standard errors are corrected for heteroscedasticity using Huber-White robust standard errors clustered by firm

the investor attention from previous studies. Because our study uses a sample of Korean companies and investor attention is measured from a Korean searching engine, we test whether investor attention measured by *Naver trends* is associated with the present and future stock return and trading volume to confirm the validation of our measure of investor attention before testing our main models.

Table 2 reports the result of the test of whether investor attention is associated with trading volume and stock returns, which tests the validity of the investor attention measure. A key variable of interest is *Attention*, an abnormal SVI, indicating the difference between the logged value of SVI during the current week (t) and the logged value of median SVI during the past 8 weeks. Consistent with Da et al. (2011), the result shows that *Attention* is positively associated with all dependent variables, the trading volume (*Abnormal Turnover*), the net buy volume of investors (*Abnormal Net_Buy_Id*), and the returns of weeks t and $t+1$ (*Abnormal Return*), with significance at 1%. These results also support the attention theory introduced by Barber et al. (2008), in which individual investors are generally net buyers of attention-grabbing stocks. Taken together, our measure of investor attention (*Attention*) estimated from Korean data is valid for the empirical test, and it captures individual investor attention.

4.3 The effect of investor attention on announcement of quarterly earnings

Table 3 presents the estimation results for model (2) to test whether managers report financial statements more quickly in the current year than in the previous year's financial statement announcements, when investor attention is high. The dependent variable is *Delay_date*, and it indicates the announcement date gap between the current and previous years. To check robustness, we also use *Delay_hour* (announcement hour gap between the current and previous years) and *Delay_Inhour* (log formation of *delay_hour*) as alternative dependent variables. The main independent variable is *Attention*, capturing the investor attention. We assess statistical significance using t -statistics based on standard errors clustered by firm. We include industry- and quarter-fixed effects in the models to control for period or industry variation in *Attention*.

Column (1) of Table 3 reports the regression results using *Delay_date* as a dependent variable. We find that investor attention is negatively associated with the announcement date gap between the current and previous years. The coefficient on *Attention* is negative and statistically significant at the 1% level (t -statistics = -3.74), which is consistent with our expectation that a manager of a company that receives a lot of investor attention tends to disclose quarterly earnings earlier than in

〈Table 3〉 Investor Attention and Timing of Quarterly Earnings Disclosure

<i>Dep. Var</i>	(1) <i>Delay_date</i>	(2) <i>Delay_hour</i>	(3) <i>Delay_inhour</i>
<i>Intercept</i>	359.959*** (300.26)	8638.840*** (300.00)	9.065*** (2782.26)
<i>Attention</i>	-0.096*** (-3.74)	-2.329*** (-3.79)	-0.000*** (-3.73)
<i>Size</i>	0.401*** (6.51)	9.638*** (6.51)	0.001*** (6.33)
<i>Roa</i>	0.349 (0.21)	5.138 (0.13)	0.001 (0.20)
<i>Ret</i>	0.876*** (4.03)	21.249*** (4.07)	0.002*** (3.94)
<i>Lev</i>	-0.666* (-1.95)	-15.796* (-1.93)	-0.002* (-1.92)
<i>Mtb</i>	0.323*** (3.80)	7.696*** (3.77)	0.001*** (3.75)
<i>Loss</i>	-0.282 (-1.45)	-6.948 (-1.48)	-0.001 (-1.48)
<i>Foreign</i>	-0.911* (-1.82)	-22.107* (-1.84)	-0.002* (-1.83)
<i>Blockholder</i>	-0.662* (-1.72)	-16.071* (-1.74)	-0.002* (-1.70)
<i>Ret_std</i>	-0.019 (-0.02)	-1.646 (-0.06)	-0.000 (-0.06)
<i>Roa_std</i>	-4.777 (-1.19)	-111.316 (-1.15)	-0.012 (-1.14)
<i>Analyst</i>	-0.976*** (-9.50)	-23.402*** (-9.50)	-0.003*** (-9.47)
<i>ChgGDP</i>	-0.020 (-0.01)	1.283 (0.02)	0.001 (0.13)
Industry Fixed	Yes	Yes	Yes
Quarter Fixed	Yes	Yes	Yes
Observations.	9,526	9,526	9,526
Adjusted R ² .	0.029	0.029	0.029

Note: Refer to Appendix 1 for the variable definitions. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Standard errors are corrected for heteroscedasticity using Huber-White robust standard errors clustered by firm

the previous year. We also find a significant and negative association between investor attention and quarterly earnings announcement delay when we use alternative dependent variables such as *Delay_hour* in Column (2) and *Delay_Inhour* in Column (3). These results are consistent with the findings of Sengupta (2004) who found a negative association between trading volume and delay of earnings announcement. However, our results are based on a more direct measure of investor attention as well as a different market, where many individual investors participate and internet penetration is relatively high. This result is also robust when we use alternative variables, such as *Delay_hour* (Column (2)) and *Delay_Inhour* (Column (3)).⁹⁾ We also test the empirical model including firm-fixed effect because the firm fixed estimation refers to the estimate across within-firm variation and is identical to the estimator in the first differenced model. We find same and robust results when we include firm-fixed effect in the empirical model (untabulated). Overall our results indicate that managers respond to investor attention by releasing corporate

information more quickly.¹⁰⁾ In addition, along with Sengupta's (2004) findings, our results extend the study of investor attention and disclosure timing.¹¹⁾

Table 4 reports the result of the test of whether managers disclose quarterly earnings during trading hours rather than non-trading hours. The dependent variable, *Tradinghours*, is an indicator variable equal to 1 if firms release quarterly earnings during trading hours (before 3:00 p.m.), and 0 otherwise.

The result indicates that investor attention (*Attention*) is significantly and positively associated with the dependent variables with significance at 1%, suggesting that managers are more likely to disclose quarterly earnings during stock-trading hours than during non-trading hours when investors pay more attention to the firm. This result also means that managers provide corporate information in an efficient and timely manner, which can be used immediately in the stock market by investors.

9) Empirical results are still consistent when we use a logged variable of *delay_date*.

10) Because the filing dates of annual report and quarterly report are different and investors generally pay attention to the annual report more than quarterly report, manager may have different disclosure strategy on annual report. To test this possibility, we include the interaction term between investor attention (*Attention*) and indicator for annual report disclosure (*AnnualD*). The result show that the interaction term has the positive coefficient but insignificant (untabulated).

11) The focus of this study is the association between managers' disclosure decisions and investors' information demands. However, it is possible that alternatively, investors react to corporate disclosure. To verify a causal relationship, we additionally conduct robustness tests using firm-fixed estimation. Untabulated results are consistent with our results.

〈Table 4〉 Investor Attention and Probability of Trading Hours Disclosure

<i>Dep. Var</i>	<i>Pr(Tradinghours=1)</i>
<i>Intercept</i>	8.561*** (7.43)
<i>Attention</i>	0.028** (2.46)
<i>Size</i>	-0.465*** (-7.83)
<i>Roa</i>	5.883*** (5.90)
<i>Ret</i>	0.106 (1.21)
<i>Lev</i>	-0.069 (-0.22)
<i>Mtb</i>	-0.115** (-2.40)
<i>Loss</i>	-0.085 (-0.83)
<i>Foreign</i>	1.051** (2.06)
<i>Blockholder</i>	0.400 (1.14)
<i>Ret_std</i>	0.301 (0.55)
<i>Roa_std</i>	-2.120 (-0.84)
<i>Analyst</i>	0.092 (1.24)
<i>ChgGDP</i>	2.225** (2.51)
<i>Industry Fixed</i>	Yes
<i>Quarter Fixed</i>	Yes
<i>Observations</i>	9,526
<i>Pseudo-R²</i>	0.065

Note: Refer to Appendix 1 for the variable definitions. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Standard errors are corrected for heteroscedasticity using Huber-White robust standard errors clustered by firm

V. Additional analyses

5.1 Timing of quarterly earnings disclosure by firm information environment

In the previous section, our results show that managers announce their quarterly earnings earlier than in the previous year when investor attention increases. We interpret these results as an active response to the information needs of investors. From the view of investors demand for information, it suggests a possibility that corporate information environment can affect our results because for firms in a poor information environment, investors could voluntarily endeavor to obtain corporate information to overcome information insufficiency driven by the poor information environment, and investors efforts lead higher investor attention.

Brown et al. (2004) and Kanagaretnam et al. (2007) argue that information asymmetry is less prevalent in larger firms. Similarly, Collins et al. (1987) argues that analysts who follow larger companies have more information available. In addition, analyst reports are an important information channel because they facilitate the interpretation and dissemination of accounting information and help investors to overcome a poor information environment (Bushman and Smith 2001). In the case of large firms or firms followed by analysts, a great deal of information can be leaked earlier

than when it is officially disclosed to the market because of a good information environment. Therefore, the association between investor attention and a manager's decision making on disclosure can possibly be weakened in firms with good information environment since investors obtaining information through various channels before the information is publicly disclosed in such firms. We expect that the negative relationship between investor attention and timing of earnings announcement is more prevalent in small firms and firms without analysts following them.

Table 5 presents additional results using sub-samples. Specifically, we split the full sample into two groups based on total assets (a reference point is 2 trillion Korean won) or analyst following.¹²⁾ Panel A presents results of test whether managers report financial statements more quickly in the current year than in the previous year's financial statement announcements and Panel B shows results of test whether managers disclose quarterly earnings during trading hours rather than non-trading hours. Column (1) of both Panel A and Panel B shows results of the subsample analysis depending on firm size. We find that

investor attention (*Attention*) is negatively associated with the announcement date gap between the current and previous years (*Delay_date*) and positively associated with the likelihood of trading hour disclosure only in the subsample of small firms. In the subsample of large firms, we find a negative association between investor attention and announcement date gap and a positive association between investor attention and the probability of disclosure during trading hours, but it is insignificant. In Column (2) of both Panel A and B, we split our sample into firms with/without analysts following them. In Panel A, we find that the coefficient on investor attention (*Attention*) is significant and negative in the subsample of firms without analysts following them but the coefficient of firms with analysts following them is insignificant. In Panel B, we find the coefficient on investor attention (*Attention*) is significant and positive regardless of analyst following, suggesting that information environment proxied by analyst following does not affect the likelihood of trading hour disclosure.¹³⁾ Overall, these subsample analysis results indicate that managers facing a poor information environ-

12) In Korea, if the total assets of a firm are more than USD 1.8 billion (KRW 2 trillion), it is classified as a large company and exposed to more regulation, such as public disclosure policies and the number (and ratio) of board of directors. Thus, we use USD 1.8 billion as a criterion for dividing our sample into small and large firms.

13) We conduct additional tests based on foreign ownership in addition to analyst following as foreign investors have relatively information competitiveness over minority investors. We compare two sub-groups based on the median of the ownership of foreign investors. The result still shows a negative association between investor attention and *delay_date*, regardless of sub-groups, confirming that foreign ownership has no effect on our results (untabulated).

〈Table 5〉 Investor Attention and Timing of Quarterly Earnings Disclosure by Information Environment

Panel A: Investor Attention and Timing of Quarterly Earnings Disclosure

<i>Dep. Var = Delay_date</i>	(1)		(2)	
	<i>Small firms</i>	<i>Large firms</i>	<i>Firms with Analysts following</i>	<i>Firms without Analysts following</i>
<i>Intercept</i>	357.548*** (172.20)	359.018*** (145.12)	358.359*** (223.79)	359.590*** (134.62)
<i>Attention</i>	-0.097*** (-3.66)	-0.090 (-1.27)	-0.105*** (-3.82)	-0.041 (-0.58)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>Quarter Fixed</i>	Yes	Yes	Yes	Yes
<i>Obs.</i>	6,606	2,920	2,307	7,219
<i>Adjusted-R²</i>	0.035	0.030	0.040	0.021

Panel B: Investor Attention and Probability of Trading Hour Disclosure

<i>Dep. Var = Pr(Tradinghours=1)</i>	(1)		(2)	
	<i>Small firms</i>	<i>Large firms</i>	<i>Firms with Analysts following</i>	<i>Firms without Analysts following</i>
<i>Intercept</i>	8.592*** (5.23)	9.024*** (3.69)	7.761*** (5.69)	9.596*** (4.14)
<i>Attention</i>	0.031** (2.43)	0.030 (1.22)	0.022* (1.76)	0.064** (2.19)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>Quarter Fixed</i>	Yes	Yes	Yes	Yes
<i>Obs.</i>	6,606	2,920	2,307	7,219
<i>Pseudo-R²</i>	0.051	0.084	0.049	0.113

Note: Refer to Appendix 1 for the variable definitions. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Standard errors are corrected for heteroscedasticity using Huber-White robust standard errors clustered by firm

ment more actively respond to investor attention to resolve the demand for information and improve their information environment.

5.2 Timing of quarterly earnings disclosure by information contents

deHaan et al. (2015) find that managers report bad news after market hours and on

busy days. Their findings suggest that the content of the information – either good news or bad news – may alter our results. However, if investor attention represents information demand, the association between investor attention and the manager's decision making

on disclosure could be impervious to the content of the information. To test this possibility, we split our sample into two groups, good news and bad news firms. Good or bad news is measured as net profit (or loss) or meeting or beating (or failing to meet) earnings bench-

〈Table 6〉 Investor Attention and Timing of Quarterly Earnings Disclosure by Information contents

Panel A: Investor Attention and Timing of Quarterly Earnings Disclosure

<i>Dep. Var = Delay_date</i>	(1)		(2)	
	<i>Firms with Net Loss</i>	<i>Firms with Net Profit</i>	<i>Firms without MeetBeat</i>	<i>Firms with MeetBeat</i>
<i>Intercept</i>	362.249*** (117.11)	359.536*** (257.92)	357.632*** (180.46)	361.134*** (244.89)
<i>Attention</i>	-0.128** (-2.08)	-0.083*** (-3.04)	-0.098** (-2.23)	-0.100*** (-3.02)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>Quarter Fixed</i>	Yes	Yes	Yes	Yes
<i>Obs.</i>	1,948	7,578	3,459	6,067
<i>Adjusted-R²</i>	0.056	0.027	0.032	0.025

Panel B: Investor Attention and Probability of Trading Hour Disclosure

<i>Dep. Var = Pr(Tradinghours = 1)</i>	(1)		(2)	
	<i>Firms with Net Loss</i>	<i>Firms with Net Profit</i>	<i>Firms without MeetBeat</i>	<i>Firms with MeetBeat</i>
<i>Intercept</i>	7.072*** (3.93)	9.233*** (7.51)	8.394*** (5.89)	8.987*** (7.35)
<i>Attention</i>	0.002 (0.10)	0.034** (2.55)	0.004 (0.20)	0.043*** (2.89)
<i>Controls</i>	Yes	Yes	Yes	Yes
<i>Industry Fixed</i>	Yes	Yes	Yes	Yes
<i>Quarter Fixed</i>	Yes	Yes	Yes	Yes
<i>Obs.</i>	1,948	7,578	3,459	6,067
<i>Pseudo-R²</i>	0.080	0.068	0.061	0.071

Note: Refer to Appendix 1 for the variable definitions. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Standard errors are corrected for heteroscedasticity using Huber-White robust standard errors clustered by firm

marks measured by last quarter earnings). For each subsample, we examine again investigate whether investor attention affects the timing of quarterly earnings announcement or disclosure during trading hour.

Panel A of Table 6 presents results of test whether managers report financial statements quicker in the current year than in the previous year and Panel B shows results of test whether managers disclose quarterly earnings during trading hours rather than during non-trading hours. In Panel A, the coefficients on investor attention (*Attention*) in all columns are significant and negative consistent with our main findings. These results show the negative association between investor attention and earnings announcement delay regardless of contents of disclosure, suggesting that investor attention measured by *Naver trends* represent information demand of investors.

In Panel B, we find the positive association between investor attention and probability of disclosure during trading hour only when firms have good news, suggesting that managers reporting good news are more likely to announce quarterly earnings during trading hours rather than non-trading hours. For bad news subsamples, the coefficients on investor attention (*Attention*) is positive but insignificant. Given that deHaan et al. (2015) examine the reporting strategy during or after market hours, our results in Panel B are partially consistent with findings of deHaan et al. (2015) because our

findings suggest that managers with good news announce earnings during market hours, though we do not find that managers with bad news report earnings after market hours.

VI. Conclusion

We investigate the association between investor attention and the timing of the release of corporate information. Since investor attention captures demand for corporate information, it is important for corporate managers to fulfil this desire by investors in order to reduce information asymmetry and/or cost of capital. We focus on whether managers adjust the timing of quarterly earnings announcements depending on investor attention. Similar to Da et al. (2011), who use the *Google* Search Volume Index to measure investor attention, we re-measure investor attention using the Search Volume Index provided by *Naver*, which has the largest market share of all internet search portals in Korea.

Our empirical results show that managers announce quarterly earnings information earlier than in the previous year when investor attention is higher. In addition, we find that managers facing greater investor attention are more likely to release earnings information during trading hours rather than during non-trading hour. These results indicate that timely

disclosure can be used to meet investor demands for corporate information. In addition, the negative association between investor attention and an earlier announcement is stronger in small firms and firms not followed by analysts. These results imply that managers of firms with poor information environments respond more actively to enhance their information environments.

Our study contributes to the literature on the disclosure timing of earnings information. We find that managers advance the timing of earnings announcements, and release earnings information during trading hours, when the investor demand for corporate information is high. These results show that managers consider timely disclosure to be an important factor in meeting investor interests. In addition, our study sheds light on the role of individual/retail investors in managerial disclosure decisions. SVI-based measures reflect investor attention in a more direct and timely manner, and they capture the attention of individual/retail traders (Da et al., 2011). Thus, our study provides more direct evidence that managers adjust disclosure timing in response to individual investor attention.

This study has the following limitations. First, we use only a measure of investor attention based on the internet search volume. Until this measure was introduced, traditional measures such as trading volume and share price return have been used to measure investor

attention. However, these measures can be distorted by institutional or foreign investors who run large funds, and they are insufficient to reflect investor demand in real time because we focus on individual and retail investors. Although in the U.S., EDGAR log files can be used as an alternative measure of investor attention, DART log files are not yet available in Korea. Second, we use only *Naver's* search volume index because *Naver* has the largest market share in Korea and a site structure suitable for stock investment. As most Korean studies use the *Naver* SVI rather than the *Google* SVI to examine the investor attention in relation to the Korean stock market and disclosure of corporate information, our study chooses the *Naver* SVI as well (e.g., Koo and Kim 2015; Yun and Lee 2017; Yun and Yoo 2017; Kim 2018; Ha et al. 2019). However, investor attention can be proxied by other search engines such as Google. Unlike in the past, the market share of Google in Korea has been climbing. It has provided users with the data of search volume since 2004 as well. Future research can complement our study on empirical results and interpretation by utilizing the *Google* SVI. Finally, future research can extend the literature by utilizing the unique data such as users' gender, age, and searching device provided by *Naver* in Korean stock market since 2016.

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〈Appendix 1〉 Definition of Variables

<i>Attention</i>	Abnormal search volume index. The log of search volume index during the week minus the log of median search volume index during the previous 8 weeks;
<i>Delay_date</i>	The number of days between quarterly financial statement release date in the last year and that in current year;
<i>Delay_hour</i>	The number of hours between quarterly financial statement release date in the last year and that in current year;
<i>Delay_lnhour</i>	The natural logarithm of <i>Delay_hour</i> ;
<i>Tradinghours</i>	A dummy variable equal to 1 if a firm discloses the earnings information during trading hours, otherwise 0;
<i>Size</i>	The natural logarithm of total assets;
<i>Roa</i>	Operating income scaled by total assets;
<i>Ret</i>	Stock returns;
<i>Lev</i>	Debt scaled by total assets;
<i>Mtb</i>	Market values of assets divided by book value of assets;
<i>Loss</i>	A dummy variable equal to 1 when return on assets during the same quarter in the last year compared to in current year is lower than zero, otherwise 0;
<i>Foreign</i>	A foreign ownership ratio of a firm;
<i>Blockholder</i>	A blockholder ownership ratio of a firm;
<i>Ret_std</i>	Volatility of a firm's return from t-4 quarters to t quarters;
<i>Roa_std</i>	Volatility of a firm's <i>Roa</i> from t-4 quarters to t quarters;
<i>Analyst</i>	The number of analysts following;
<i>ChgGDP</i>	GDP change rate for the quarter;
<i>Market_Cap</i>	Market capitalization;
<i>Abs_Ret</i>	An absolute value of <i>Ret</i> ;
<i>Abs_Abn_Ret</i>	An absolute value of abnormal returns based on the market model;
<i>Abn_Turnover</i>	A market adjusted <i>Turnover</i> . <i>Turnover</i> is firms' trading volume, divided by the number of outstanding stocks;
<i>Net_Buy_id</i>	Net buying volume of individual investors of firms;
<i>Abn_Net_Buy_id</i>	Market adjusted <i>Net_Buy_id</i> .

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