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Short Seller, Firm, and Auditor Behavior

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ABSTRACT

Purpose: Although a small part of arbitrage trading, short selling has a significant impact on capital markets. This study empirically examines relationships among short selling, earnings managements, and auditor behaviors.

Design/methodology/approach: We employed short selling and abnormal short selling as independent variables. Audit hours, audit fees, and (absolute) value of discretionary accruals as dependent variables. In this study, we basically include ordinary least-squares regression analyses using panel data and interaction analyses.

Findings: This study verifies the relationship among short selling, firm earnings management, and auditor behavior, showing positive relationships between short selling and current and future audit fees, audit hours, and current audit quality. Further, higher audit risk, caused by the interaction between abnormal short selling and aggressive earnings management, is reflected in future audit fees and hours.

Research limitations/implications: Due to the financial data provided on an annual basis, the daily short selling data was aggregated on an annual basis. This study suggests that short selling is related to firm earnings management behavior, as well as to the auditor behaviors. Therefore, regulators should consider the impacts of short selling on company and auditors as well as investors.

Originality/value: This study provides evidence that the positive relationship between short selling and audit fee is not only caused by risk-premium channels, but also by audit-effort channels. Furthermore, we find that the interaction effects of short selling and earnings managements occur only in abnormal short selling. This seemed to impose penalties on short selling exceeding forecasts when auditors considered earnings managements and short selling at the same time.

Keywords: Short selling, Earnings management, Audit effort, Audit fee

I. Introduction

At the beginning of 2020, stock prices plummeted in the United States, Korea, and Japan due to the COVID-19 pandemic. Consequently, Korean financial authorities banned short selling for six months

beginning on March 16, 2020, as they believed that short selling was being abused by institutions and foreigners to manipulate stock prices. Consequently, the Korean Composite Stock Price Index was at 1714.86 on March 13, the trading day immediately before the short selling ban came into effect, and rose over 27% by June 11, 2020, to 2176.78. The Korean Securities Dealers Automated Quotations too went up more than 44% in the same period. As the Korean stock markets start recovering to pre-COVID-19

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levels, there have been ongoing calls to ban short selling altogether. Accordingly, the Financial Services Commission is reviewing various options, including system improvements, extending the ban, and phased lifting of the ban. However, the Dow Jones 30 Industrial Average and the Nikkei 255 increased by 26% and 29% at the same time, respectively, without a ban on short selling. The regulatory authorities and academia closely monitored the situation to accurately judge the effectiveness of a total ban on short selling.

Figure 1 shows stock lending and borrowing (SLB) and shorting flow included in a 2008 press release from the Financial Supervisory Service of Korea. Lenders include banks, insurance companies, and pension funds that own significant amounts of stock for long-term investment purposes, and intermediaries include securities depositories and securities firms. Borrowers are often securities firms and asset management companies, but they may also be individuals. Borrowers engage in short selling in the exchange and financial markets, and repurchases through short covering, which is the process for short selling transactions.

Certain fees are involved in borrowing stocks, and when the short is covered and repurchased, repaying the same stock of the same amount is standard. As such, when engaging in a short selling transaction, the arbitrage conditions of the short selling investor must include the price of the borrowed stock declining for more than the fee amount.

The economic function of short selling includes both positive and negative sides. On the positive

side, it expands the liquidity of the stock markets—making the price discovery function more effective—and reduces the transaction-related costs incurred by investors. Furthermore, it also has the effect of preventing stock prices from overshooting and reducing volatility. In terms of negative function, it can be misused as a tool for price manipulation, driving artificial price declines in uncertain market conditions. Misinformation may be intentionally distributed to achieve arbitrage trading through stock price declines. Furthermore, some scholars and market actors claim that short selling can lead to sharp declines in stock prices (Callen and Jeffrey 2015). In the short term, a sharp increase in short selling transactions can accelerate stock price declines and increase stock price volatility.

In the field of accounting, many studies have examined the relationship between short selling and earnings management. Short selling is primarily performed by foreign and institutional investors, but there are prior studies that potential accounting irregularities can be predicted through their actions. Karpoff and Lou (2010) showed that short interest recognizes firms engage in false financial disclosures and that short selling increased before the disclosure of such misconduct. This indicates the possibility of firms whose stocks are subject to short selling engaging in over- or understatement of their financial information. Dechow et al. (1996) found that in firms subject to audit reviews, short selling transactions increased two months before the disclosure of audit reviews. Desai et al. (2006) and Efendi et al. (2011) also argued that firms whose stocks are subject to short

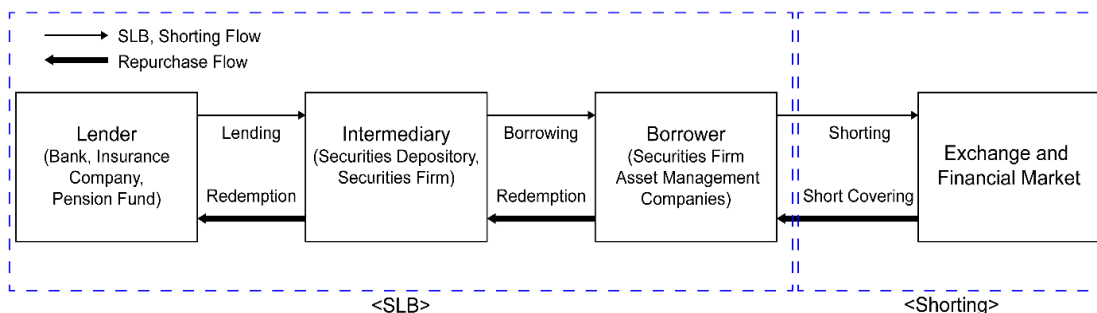


Figure 1. Short selling framework

selling are likely to have experienced a restatement of financial statements due to accounting errors. A series of prior studies also indicated that firms whose stocks are subject to short selling might be related to earnings management.

A study that directly examined the relationship between short selling and auditors reported a positive relationship between actual short selling volumes and audit fees (Cassell, Drake, and Rasmussen 2011). They argued that short selling signaled increases in audit risk. However, Hope et al. (2017) argued that short selling directly increases the audit risk of auditors. Although the two studies found a positive relationship between short selling and audit fees, they differed on the specific effects of short selling.

The difference between this study and its predecessors mentioned above is that it analyzes a series of relationships among short selling, firms, and auditors. While previous studies have confirmed the relationship between short selling and earnings management and between short selling and audit fees, this study examines the interaction effects and future audit fees to analyze the connected behavior between each economic actor. Specifically, this study analyzes whether short selling provides earnings management incentives to firms as a signal of a stock price drop, whether the audit risk of auditors rises due to earnings management, and whether auditors engage in more thorough audits in response to higher audit risk. This study verifies whether the auditor evaluates the economic condition of the firm and ensure their future audit fees and audit hours reflect the evaluation.

The remainder of this paper is organized as follows. In Section 2, we examine the relevant prior research and derive the research hypotheses. In Section 3, we present the data collection and sample selection process and describe the resulting research model. Then, we present descriptive statistics and empirical results in Section 4. Finally, we conclude the study in Section 5.

II. Literature Review

A. Short Selling

Short selling is a high-risk arbitrage method and, consequently, many countries banned short selling during the global financial crisis. Short selling has become an issue in capital markets whenever the economic crisis ensued. However, Beber and Pagano (2013) provided empirical evidence that the costs associated with banning short selling have been larger than its benefits. This indicates that the positive effects of short selling were more dominant compared with their negative effects. Many of the prior studies have highlighted the positive roles of short selling in capital markets. For example, Thornock (2013) asserted that taxation on dividend income limited the short selling that occurred before the ex-dividend date. The study asserted that the limitation to short selling benefits caused by the dividend income tax was related to a reduction in market quality.

The discussion on the role of short selling was similar to that of analyst research. In the field of accounting, previous studies have largely divided analysts' roles into information discovery, information interpretation, and monitoring roles (Hong, Lim, and Stein 2000; Ivković and Jegadeesh 2004; Chan and Hameed 2006; Barron, Byard, and Yu 2008; Yu 2008; McNinn and Collins 2011; He and Tian 2013). Short selling was also studied from a similar perspective.

Studies that have examined the relationship between short selling and earnings management have typically found that short selling has played an information delivery role for individual firms. Dechow et al. (1996) showed that short selling transactions have increased for companies two months prior to the U.S. Securities and Exchange Commission (SEC) announcing the names of the companies subject to audit reviews. This underlined the role of short selling in effectively conveying accounting fraud to the markets (Pownall and Simko 2005). Furthermore, the phenomenon of increasing short selling was understood as conveying information relating to the sustainability of profits to the markets. The results of a study conducted

by Karpoff and Lou (2010) showed that short selling recognized firms engaging in false financial disclosures in advance, leading to an increase in short selling before the disclosure of fraudulent activity. Desai et al. (2006) and Efendi et al. (2011) reported that firms with stocks subject to short selling were likely to have experienced restatements of financial statements due to accounting errors.

On monitoring short selling, Park (2017) asserted that short selling played the role of providing oversight for overall earnings quality. The study examined the relationship between short selling and real earnings management and asserted that short sellers engage in short selling based on a variety of earnings management methods and information on real earnings management.

While impacting a firm's situation directly, short selling can change its behavior. Pilot companies not subject to short selling restrictions imposed by the SEC were less likely to engage in the act of barely matching discretionary accruals and target profit levels throughout the pilot period (Fang, Huang, and Karpoff 2016). This indicates that short selling has the function of restraining firms' earnings management. Furthermore, Meng et al. (2020) asserted that short selling was related to rising capital costs for firms, using a 10-year dataset from China. Short selling was reported to have increased the financial constraints of a firm. From the firm's perspective, the occurrence of short selling may lead to an incentive to adjust earnings to avoid financial constraints.

Short selling can affect third parties (Hope, Hu, and Zhao 2017). A leading example of a third party related to short selling is an auditor. As the economic behavior of firms subject to short selling is more likely to change, the situation of the auditor, who audits such behavior, may also change. Based on this, Cassell et al. (2011) found a significant positive relationship between actual short interest and audit fees. They argued that short selling played the role of signaling an increase in audit risk. However, Hope et al. (2017) argued that short selling directly increases audit risk. The results indicated that the reason behind higher audit risk caused by short selling was not because of the increase in audit effort but because

of the reflection of the risk premium. However, unlike Cassell et al. (2011), they utilized samples from the pilot program instead of actual short interests and analyzed the effects by differentiating between firms subject to short selling restrictions and those that were not.

Many studies have also highlighted the negative effects of short selling. For example, stocks with a high short selling risk have low price efficiency and low returns (Engelberg, Reed, and Ringgenberg 2018). Therefore, the actual trends of positive and negative effects of short selling in the financial markets were mixed in the fields of financial management and accounting.

B. Earnings Management and Audit Risk

Prior studies have examined the relationship between firms' earnings management behavior and audit risk, which leads to higher audit fees. A study that measured earnings management behavior using discretionary accruals found that income-increasing earnings management had a significant positive relationship with higher litigation risk for auditors (Heninger 2001). Furthermore, higher audit risk from a firm's earnings management behavior leads to auditors raising audit hours and fees on an ex-ante basis (Bedard and Johnstone 2004). Bell et al. (2001) also reported that auditor business risk was related to higher audit hours, which had a significant relationship with higher audit fees. Thus, firms' earnings management behavior influences audit risk, which leads to higher audit fees.

Thus, studies have found that firms' earnings management behavior generally increases the audit risk of auditors. However, Abbott et al. (2006) argued that earnings management by firms and the litigation risk faced by auditors are asymmetric. They showed that a positive relationship existed between income-increasing earnings management and audit fees and a negative relationship between income-decreasing earnings management and audit fees. This indicates that the auditor evaluated the risk of income-increas-

ing and income-decreasing earnings management differently.

The reactions of auditors to earnings management by firms may vary. They may not engage with a firm with high audit risk, issue a going-concern opinion, negotiate with the firm to adjust their financial statements, impose a risk premium on audit fees, or increase audit efforts (Francis and Krishnan 1999). For example, if auditors present a going-concern opinion, a firm may face adverse effects on its cost of equity (Amin, Krishnan, and Yang 2014). Although various methods exist, the primary method that auditors consider in responding to audit risk from earnings management is raising audit fees (Krishnan et al. 2013). They presented evidence that auditors would increase audit fees to a level where the auditor can bear the audit risk and resigned if the risk level increased beyond this level. Similarly, Kim and Park (2014) found that the resignation potential of the auditor was higher when levels of real earnings management were high.

In the auditor business risk framework, which is referenced in many studies as the audit fee model framework, the expected audit fees are composed of audit efforts, normal profits, audit-related litigation risk, residual litigation risk (e.g., risk of litigation from shareholders due to share price volatility from accounting fraud, litigation potential from the financial failure of a firm), and non-litigation risk (e.g., reputation loss of auditors, future operating losses) (Houston, Peters, and Pratt 2005). As auditors cannot reduce both residual litigation and non-litigation risk, they are able to respond by asking for a fee premium or by resigning (Greiner, Kohlbeck, and Smith 2017). Therefore, if the positive relationship between short selling and audit fees comes only from the risk premium (risk-premium channel), this can be understood as being due to residual litigation risk and non-litigation risk. However, if short selling leads to higher audit-related litigation risk, under the audit fee model, auditors will increase audit effort and ask for additional fees accordingly (audit-effort channel).

There is a variety of research related to audit risk. Global firms whose shares are dual-listed on US

stock exchanges (cross-listed firms, alternative dispute resolution firms) have higher audit fees compared to the average audit fees of firms located within the United States (Bronson, Ghosh, and Hogan 2017). This was due to the higher audit risk (especially litigation risk) cross-listed global firms are facing, requiring additional audit efforts. A study that used the natural language processing technique to analyze audit risk found a significant positive relationship between disclosure of an individual firm's risk on its 10-K report and audit fees (Yang et al. 2018).

III. Hypotheses Development

This study predicts that the audit quality of firms whose stocks have been sold short will increase. If short selling can warn about accounting fraud, auditors will engage in more strict audits for firms whose stocks have been sold short. Conducting a more faithful audit engagement in response to higher audit risk will lead to higher current audit hours, fees, and quality. If a positive relationship between short selling, audit hours, and audit quality exists, this presents new evidence that the relationship between short selling and audit fees is caused by the audit-effort channel. This leads to our first and second hypotheses.

Hypothesis 1. Short selling has positive relationships with current audit fees and audit hours.

Hypothesis 2. Short selling and discretionary accruals have a negative relationship.

Furthermore, in this study, we expect short selling transactions to increase the engagement risk of individual firms, which will be reflected ex-ante on future audit fees and audit hours. As mentioned in prior studies, although short selling plays the role of sending a signal for accounting fraud externally, firms may engage in accounting fraud due to short selling. Considering that the effect of short selling on the share price is consistent in the negative direction, it is possible that short selling may lead

to firms' earnings management behavior. Therefore, the audit risk of firms whose shares are sold short will increase, and reflecting this increase, future audit fees and audit hours will increase as well. This leads to our third hypothesis.

Hypothesis 3. Short selling has positive relationships with future audit fees and audit hours.

If abnormal short selling in firms engaging in aggressive earnings management leads to a strengthened impact on future audit fees and audit hours, this indicates that the engagement risk of the firm comes from the relationship between short selling and earnings management. This allows for inference on the interaction among short sellers, firms, and auditors. In other words, evidence can be presented for a series of processes in which short selling transactions influence firm activity, and, in turn, a firm's activity then influences the auditor. This leads to our fourth hypothesis.

Hypothesis 4. As abnormal short interest occurs in firms that engage in aggressive earnings management, the positive association between future audit fees and audit hours will be strengthened.

IV. Research Design and Sample Selection

A. Actual Short Interest and Abnormal Short Interest

The short selling variable used in this study, SHO , is the natural logarithm of actual short interest as it allows for more direct observation of the relationship between the values. Abnormal short interest ($ABSI$) was estimated and used in the analysis of the interaction between short selling and discretionary accruals. Specifically, abnormal short interest is estimated as follows and the expected value of SHO is estimated using equation (2):

$$ABSI_{i,t} = SHO_{i,t} - E(SHO_{i,t}) \quad (1)$$

$$SHO_{i,t} = \beta_1 + \beta_2 SIZE_{i,t} + \beta_3 BM_{i,t} + \beta_4 TACC_{i,t} + \sum IND + \varepsilon_{i,t} \quad (2)$$

Where,

$SIZE$ The natural logarithm of total assets.

BM The book value of equity divided by the market value of equity.

$TACC$ Total accruals for the fiscal year scaled by total assets at the beginning of the fiscal year.

IND Industry fixed effect dummies.

Prior studies have shown that factors determining short selling include market capitalization, book-to-market value, and momentum (Dechow et al. 2001; Asquith, Pathak, and Ritter 2005). Griffin et al. (2003) reported that momentum is a common phenomenon in stock markets around the world. However, Chui et al. (2010) found that momentum did not exist, and cases of negative momentum also existed in some Asian countries. Therefore, as this study uses short selling data and financial data from Korea, an Asian country, the momentum variable was excluded, while the total accruals ($TACC$) variable was included in the reflection of prior studies (Karpoff and Lou 2010).

B. Current and Future Audit Fee and Audit Hour Model

The audit fee model considered the control variables found to influence audit fees in prior studies (Ghosh and Lustgarten 2006; Choi et al. 2008). The current-period model confirms whether the auditor raises both audit effort and fees to reduce the higher audit risk from short selling, and the future-period model confirms whether the auditor reflects higher audit risk from short selling on audit hours and audit fees on an ex-ante basis. Short selling occurs daily during the year, and audit costs and audit efforts are concentrated during the year-end audit. The year-end audit takes place at the beginning of the following year, so the current audit costs and audit efforts will be put in after the short sale. The current period models are

to verify that current audit costs and audit efforts increase for audit risks resulting from short selling. In addition, a new audit contract will be made shortly after the year-end audit is completed at the beginning of the next year. If the audit risk due to short selling is reflected in the audit contract for next year, the basic audit fees and audit hours will be set higher. To verify this relationship, we establish the future models. Positive values on $SHO(\beta_2)$ are consistent with our first and third hypotheses. Definitions of the variables are given in Appendix A.

$$LNFE_{i,t(or\ t+1)} = \beta_1 + \beta_2 SHO_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CURTA_{i,t} + \beta_5 INVRECR_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 EXPORTR_{i,t} + \beta_8 MTB_{i,t} + \beta_9 LEV_{i,t} + \beta_{10} ROA_{i,t} + \beta_{11} BIGA_{i,t} + \beta_{12} LOSS_{i,t} + \sum IND + \sum YEAR + \varepsilon_{i,t} \quad (3)$$

$$LNHOUR_{i,t(or\ t+1)} = \beta_1 + \beta_2 SHO_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CURTA_{i,t} + \beta_5 INVRECR_{i,t} + \beta_6 GROWTH_{i,t} + \beta_7 EXPORTR_{i,t} + \beta_8 MTB_{i,t} + \beta_9 LEV_{i,t} + \beta_{10} ROA_{i,t} + \beta_{11} BIGA_{i,t} + \beta_{12} LOSS_{i,t} + \sum IND + \sum YEAR + \varepsilon_{i,t} \quad (4)$$

C. Audit Quality Measure

Several proxies can be used for measuring audit quality. Previous studies have reported a negative relationship between a firm's discretionary accruals and audit quality (Bartov, Gul, and Tsui 2000; Bradshaw, Richardson, and Sloan 2001; Craswell et al. 2006), and many previous studies have used discretionary accruals as a proxy for audit quality (DeFond and Zhang 2014). Considering this fact, this study utilizes the performance-matched discretionary accruals ($PMDA$) model, matching ROA (Kothari, Leone, and Wasley 2005) on the Modified-Jones model (Dechow et al. 1995), to measure audit quality.

$$\frac{TACC_{i,t}}{A_{i,t-1}} = \alpha_0 + \alpha_1 \left(\frac{1}{A_{i,t-1}} \right) + \alpha_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \alpha_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t} \quad (5)$$

where $TACC_{i,t}$ represents the total accruals for firm

i in year t , derived as earnings before extraordinary items minus operating cash flow; $A_{i,t-1}$ represents total assets in year $t-1$; $\Delta REV_{i,t}$ indicates the changes in revenue from year $t-1$ to year t ; $\Delta REC_{i,t}$ is the changes in total receivables from year $t-1$ to year t ; $PPE_{i,t}$ is the property, plant, and equipment in year t .

The earnings management behavior may appear in two types: income-increasing earnings management and income-decreasing earnings management. Both are related to lower audit quality. As such, this study has simultaneously examined the absolute value of performance-matched discretionary accruals (ABS_PMDA). Negative value on $SHO(\beta_2)$ is consistent with our second hypothesis. Definitions of the variables are given in Appendix A.

$$(ABS)PMDA_{i,t} = \beta_1 + \beta_2 SHO_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 GROWTH_{i,t} + \beta_5 MTB_{i,t} + \beta_6 LEV_{i,t} + \beta_7 BIGA_{i,t} + \beta_8 LOSS_{i,t} + \beta_9 CFO_{i,t} + \beta_{10} LA_G_ (ABS)PMDA_{i,t} + \sum IND + \sum YEAR + \varepsilon_{i,t} \quad (6)$$

D. Aggressive Earnings Management and Future Audit Pricing

The following models are used to examine the influence of increasing abnormal short interest in firms with aggressive earnings management behavior on future audit hours and audit fees. This verifies whether the audit risk of the auditor originates from the interaction between short selling and earnings management. Positive values on interaction between $ABSI$ and $AGG_ABS_PMDA(\beta_3)$ are consistent with our fourth hypothesis. Definitions of the variables are given in Appendix A.

$$LNFE_{i,t+1} = \beta_1 + \beta_2 ABSI_{i,t} + \beta_3 ABSI_{i,t} * AGG_ABS_PMDA_{i,t} + \beta_4 AGG_ABS_PMDA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 CURTA_{i,t} + \beta_7 INVRECR_{i,t} + \beta_8 GROWTH_{i,t} + \beta_9 EXPORTR_{i,t} + \beta_{10} MTB_{i,t} + \beta_{11} LEV_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} BIGA_{i,t} + \beta_{14} LOSS_{i,t} + \sum IND + \sum YEAR + \varepsilon_{i,t} \quad (7)$$

Table 1. Sample selection

	No. of Obs.
Daily stock-specific short selling data was processed into yearly data. Data from KRX short selling portal (2007-2018).	11,662
Less:	
Firms that are in the financial industry and firms for whom variables required in the analysis are not provided in TS2000 and KIS-VALUE.	4,624
Samples that are failed in the process of creating variables.	545
Final Sample.	6,493

$$LNHOUR_{i,t+1} = \beta_1 + \beta_2 ABSI_{i,t} + \beta_3 ABSI_{i,t} * AGG_ABS_PMDA_{i,t} + \beta_4 AGG_ABS_PMDA_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 CURTA_{i,t} + \beta_7 INVRECR_{i,t} + \beta_8 GROWTH_{i,t} + \beta_9 EXPORTR_{i,t} + \beta_{10} MTB_{i,t} + \beta_{11} LEV_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} BIG_{i,t} + \beta_{14} LOSS_{i,t} + \sum IND + \sum YEAR + \varepsilon_{i,t} \quad (8)$$

E. Short Selling Data and Sample Selection

The analysis of this study focuses on companies in securities markets in the Korea Exchange’s (KRX) short selling portal between 2007 and 2018. Financial data were collected using TS2000, provided by the Korea Listed Companies Association, and the database from KIS-VALUE, provided by NICE Information Service. Data on short selling transactions were sourced from transactions by stock on the KRX short selling portal and included firms where short selling occurred as well as firms where it did not. As short selling data are provided daily, they were processed into firm-year data. The sample selection procedure is outlined in Table 1.

V. Descriptive Statistics and Empirical Findings

A. Descriptive Analyses

Panel A of Table 2 shows the mean quarterly short interest statistic. It compiles the daily data of individual firms in which short selling occurs on a quarterly basis and calculates a quarterly average using all sample firms in which short selling occurred.

The first and second columns show the short selling volume (number of shares) and total volume (number of stocks). In the same way, the third and fourth columns are mean values of the transaction amounts, and the last two columns are quarterly averages of the ratio of volume to price (SHO/TOTAL). On a quarterly basis, the second quarter had the highest volumes, transactions, and short selling ratio on average, whereas the first quarter had the lowest values. Based on the short selling ratios, the second, third, and fourth quarters showed slight differences from the first quarter.

Panel B in Table 2 shows the mean annual short interest statistic. It is an average annual figure calculated by compiling the daily data of individual firms in which short selling occurs on an annual basis (firm-year). The first column shows that the average short-selling volume increased significantly after the year 2011. Short-selling-related statistics (columns 1, 3, 5, and 6) show similar trends. In contrast, statistics relating to total volume showed random increases and decreases by year.

Panel C of Table 2 shows the descriptive statistics of the variables used in the empirical analysis. In 32.6% of the total sample, short-selling transactions occurred on an annual basis, and in 20.2% of the sample, firms reported net losses for the period. The mean and median of the future audit fees were similar at the levels of 18.042 and 18.005, respectively, whereas the audit fees and audit hours of the current period did not differ significantly. Furthermore, the sample population consists of firms from the securities markets, and approximately half of all sample firms were audited by Big 4 accounting firms. As PMDA

Table 2. Descriptive statistics

Panel A: Quarterly Short Interest (Mean)									
Quarter	SHO Volume	TOTAL Volume	SHO Amount	TOTAL Amount	VOLUME Percent	AMOUNT Percent			
1	313,521	24,518,514	12,070,843,447	325,590,699,622	1.2616	1.2593			
2	384,032	27,277,400	13,942,004,239	380,437,435,666	1.4095	1.4064			
3	364,723	26,203,630	13,478,979,799	364,248,602,102	1.3911	1.3917			
4	324,607	25,181,205	11,998,480,282	348,626,659,028	1.3897	1.3925			
Panel B: Annual Short Interest (Mean)									
Year	SHO Volume	TOTAL Volume	SHO Amount	TOTAL Amount	VOLUME Percent	AMOUNT Percent			
2007	127,424	24,914,934	5,858,841,851	379,255,921,040	0.3563	0.3562			
2008	207,675	23,916,704	9,053,046,155	349,144,416,178	0.4593	0.4618			
2009	88,551	32,992,773	3,658,996,209	393,081,537,499	0.2171	0.2178			
2010	188,219	25,407,750	8,370,093,622	374,238,909,178	0.5306	0.5323			
2011	156,400	23,129,840	8,123,884,928	446,924,602,124	0.4955	0.5034			
2012	220,846	31,737,255	9,478,321,882	313,290,879,904	0.8811	0.8860			
2013	275,134	21,812,174	9,977,617,600	263,383,143,291	1.2414	1.2399			
2014	399,135	18,611,927	13,172,733,104	264,834,832,960	1.8879	1.8902			
2015	624,034	31,523,234	20,425,484,013	369,705,219,625	2.4285	2.4163			
2016	604,491	25,948,401	19,506,605,117	310,085,896,014	2.7561	2.7479			
2017	585,537	22,943,467	21,468,134,967	357,104,517,801	2.5045	2.5023			
2018	716,152	26,554,962	26,312,640,436	435,012,624,214	2.7438	2.7407			
Panel C: Variables									
Variable	N	Mean	Std. Dev	Min	Q1	Median	Q3	Max	
<i>LNFEET_{t+1}</i>	6493	18.042	0.480	16.706	17.728	18.005	18.315	19.552	
<i>LNHOUR_{t+1}</i>	6493	6.798	0.546	1.609	6.465	6.773	7.124	9.101	
<i>LNFEET_t</i>	6493	17.998	0.480	14.914	17.687	17.990	18.258	19.807	
<i>LNHOUR_t</i>	6493	6.734	0.555	1.609	6.410	6.719	7.060	9.101	
<i>SHO</i>	6493	3.592	5.440	0.000	0.000	0.000	8.981	16.635	
<i>SIZE</i>	6493	25.670	0.934	22.861	25.025	25.570	26.269	28.550	
<i>CURTA</i>	6493	0.462	0.182	0.000	0.336	0.462	0.591	0.976	
<i>INVRECR</i>	6493	0.275	0.158	0.000	0.155	0.265	0.381	0.716	
<i>GROWTH</i>	6493	0.038	0.169	-0.440	-0.062	0.034	0.134	0.532	
<i>EXPORTR</i>	6493	0.057	0.118	-0.001	0.000	0.000	0.034	0.491	
<i>TACC</i>	6493	-0.019	0.076	-0.562	-0.057	-0.018	0.016	0.790	
<i>BM</i>	6493	1.208	0.654	0.294	0.688	1.069	1.601	3.227	
<i>MTB</i>	6493	1.126	0.663	0.310	0.625	0.935	1.454	3.397	
<i>LEV</i>	6493	0.373	0.191	0.001	0.218	0.370	0.514	0.937	
<i>ROA</i>	6493	0.032	0.053	-0.124	0.006	0.031	0.063	0.177	
<i>BIG4</i>	6493	0.498	0.500	0.000	0.000	0.000	1.000	1.000	
<i>LOSS</i>	6493	0.202	0.401	0.000	0.000	0.000	0.000	1.000	
<i>CFO</i>	6493	0.048	0.075	-0.501	0.007	0.046	0.089	0.453	
<i>PMDA</i>	6493	-0.001	0.073	-0.412	-0.038	-0.003	0.033	0.806	
<i>LAG_PMDA</i>	6493	-0.001	0.090	-0.975	-0.042	-0.003	0.035	1.766	
<i>ABS_PMDA</i>	6493	0.051	0.053	0.000	0.016	0.036	0.068	0.806	
<i>LAG_ABS_PMDA</i>	6493	0.057	0.069	0.000	0.017	0.039	0.074	1.766	
<i>DUM_SHO</i>	6493	0.326	0.469	0.000	0.000	0.000	1.000	1.000	
<i>AGG_ABS_PMDA</i>	6493	0.207	0.405	0.000	0.000	0.000	0.000	1.000	

Definitions of the variables are given in Appendix A

is measured using the residual regression equation, the mean was close to zero. The number of firms engaged in aggressive earnings management was approximately 20% of the sample, depending on the variable definition.

Table 3 shows the Pearson and Spearman correlations between key dependent and independent variables. The short selling variable (*SHO*) and current audit fees showed a significant positive relationship. This is consistent with the results of previous studies (Cassell, Drake, and Rasmussen 2011; Hope, Hu, and Zhao 2017). However, prior studies did not find

any significant relationship between short selling and current audit hours and audit quality, whereas the present correlation analysis indicates that short selling has significant relationships with current audit hours (positive) and the absolute value of discretionary accruals (negative). Therefore, it is necessary to examine in detail the interconnections between short selling and audit hours and quality—which were not found in previous studies—by adding various control variables. The correlations among short selling, future audit fees, and audit hours all had significant positive values.

Table 3. Pearson-Spearman correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. <i>LNFEET_{t+1}</i>	1.00 ***	0.72 ***	0.92 ***	0.68 ***	-0.05 ***	-0.06 ***	0.34 ***	0.60 ***	-0.11 ***	-0.01 ***	0.00 ***	-0.15 ***	0.06 ***	0.20 ***	-0.05 ***	-0.02 ***	-0.06 ***	-0.05 ***
2. <i>LNHOUR_{t+1}</i>	0.71 ***	1.00 ***	0.68 ***	0.88 ***	-0.05 ***	-0.09 ***	0.34 ***	0.60 ***	-0.13 ***	-0.05 ***	-0.02 ***	-0.18 ***	0.03 ***	0.15 ***	-0.05 ***	-0.02 ***	-0.06 ***	-0.08 ***
3. <i>LNFEET_t</i>	0.82 ***	0.60 ***	1.00 ***	0.70 ***	-0.06 ***	-0.07 ***	0.34 ***	0.59 ***	-0.11 ***	-0.01 ***	-0.02 ***	-0.14 ***	0.04 ***	0.20 ***	-0.05 ***	-0.01 ***	-0.05 ***	-0.05 ***
4. <i>LNHOUR_t</i>	0.66 ***	0.85 ***	0.62 ***	1.00 ***	-0.07 ***	-0.09 ***	0.34 ***	0.58 ***	-0.13 ***	-0.05 ***	-0.04 ***	-0.18 ***	0.02 ***	0.13 ***	-0.06 ***	0.00 ***	-0.06 ***	0.09 ***
5. <i>PMDA</i>	-0.04 ***	-0.05 ***	-0.05 ***	-0.06 ***	1.00 ***	-0.04 ***	0.01 ***	-0.04 ***	-0.03 **	0.12 ***	0.15 ***	0.07 ***	-0.06 ***	0.11 ***	-0.09 ***	-0.85 ***	0.16 ***	-0.02 *
6. <i>ABS_PMDA</i>	-0.05 ***	-0.09 ***	-0.05 ***	-0.09 ***	0.14 ***	1.00 ***	-0.13 ***	-0.11 ***	0.22 ***	0.11 ***	0.08 ***	0.05 ***	0.10 ***	0.10 ***	0.07 ***	0.05 ***	0.02 ***	0.22 ***
7. <i>SHO</i>	0.35 ***	0.34 ***	0.31 ***	0.33 ***	0.02 ***	-0.11 ***	1.00 ***	0.50 ***	-0.12 ***	0.05 ***	0.00 ***	-0.03 **	-0.06 ***	0.08 ***	-0.03 **	-0.04 ***	0.01 ***	-0.13 ***
8. <i>SIZE</i>	0.63 ***	0.59 ***	0.55 ***	0.56 ***	-0.03 **	-0.09 ***	0.51 ***	1.00 ***	-0.18 ***	-0.03 ***	0.05 ***	-0.10 ***	-0.18 ***	0.20 ***	0.07 ***	0.02 ***	-0.03 **	-0.10 ***
9. <i>CURTA</i>	-0.11 ***	-0.13 ***	-0.10 ***	-0.13 ***	0.01 ***	0.21 ***	-0.13 ***	-0.20 ***	1.00 ***	0.54 ***	0.06 ***	0.08 ***	0.08 ***	-0.02 ***	0.18 ***	0.05 ***	-0.01 ***	0.20 ***
10. <i>INVRECR</i>	-0.02 **	-0.06 ***	-0.02 ***	-0.05 ***	0.14 ***	0.11 ***	0.04 ***	-0.06 ***	0.55 ***	1.00 ***	0.10 ***	0.16 ***	-0.04 ***	0.32 ***	0.01 ***	-0.07 ***	0.12 ***	0.09 ***
11. <i>GROWTH</i>	0.00 *	-0.02 *	-0.01 **	-0.04 ***	0.15 ***	0.09 ***	0.00 ***	0.05 ***	0.05 ***	0.09 ***	1.00 ***	0.05 ***	0.09 ***	0.10 ***	0.26 ***	0.03 ***	0.08 ***	0.01 ***
12. <i>EXPORTR</i>	-0.09 ***	-0.10 ***	-0.09 ***	-0.09 ***	0.04 ***	0.02 **	-0.03 **	-0.04 ***	0.04 ***	0.11 ***	0.05 ***	1.00 ***	-0.05 **	0.02 **	0.04 ***	0.01 ***	0.05 ***	0.03 **
13. <i>MTB</i>	0.06 ***	0.02 *	0.04 ***	0.01 ***	-0.03 ***	0.09 ***	-0.06 ***	-0.17 ***	0.08 ***	-0.04 ***	0.09 ***	-0.03 **	1.00 ***	0.00 ***	0.14 ***	0.11 ***	-0.07 ***	0.10 ***
14. <i>LEV</i>	0.22 ***	0.14 ***	0.18 ***	0.13 ***	0.09 ***	0.11 ***	0.09 ***	0.19 ***	0.00 ***	0.32 ***	0.09 ***	0.07 ***	0.02 *	1.00 ***	-0.30 ***	-0.15 ***	0.12 ***	0.10 ***
15. <i>ROA</i>	-0.05 ***	-0.05 ***	-0.04 ***	-0.06 ***	-0.07 ***	0.05 ***	-0.03 **	0.08 ***	0.17 ***	0.00 ***	0.26 ***	0.01 ***	0.10 ***	-0.29 ***	1.00 ***	0.45 ***	-0.14 ***	0.03 **
16. <i>CFO</i>	-0.02 *	-0.02 *	-0.01 **	-0.01 ***	-0.88 ***	-0.04 ***	-0.04 ***	0.02 ***	0.02 ***	-0.10 ***	0.03 **	0.00 ***	0.07 ***	-0.13 ***	0.42 ***	1.00 ***	-0.16 ***	0.03 ***
17. <i>LAG_PMDA</i>	-0.04 ***	-0.05 ***	-0.04 ***	-0.05 ***	0.11 ***	0.02 ***	0.01 **	-0.01 *	0.02 **	0.12 ***	0.06 ***	0.02 *	-0.03 **	0.09 ***	-0.11 ***	-0.12 ***	1.00 ***	-0.05 ***
18. <i>LAG_ABS_PMDA</i>	-0.04 ***	-0.08 ***	-0.04 ***	-0.07 ***	-0.01 **	0.21 ***	-0.11 ***	-0.08 ***	0.16 ***	0.05 ***	0.00 ***	0.00 ***	0.08 ***	0.08 ***	0.00 ***	0.02 ***	0.23 ***	1.00 ***

Asterisk *, **, and *** indicate significance levels at less than 10%, 5%, and 1%, respectively, based on two-tailed t-tests. Definitions of the variables are given in Appendix A.

B. Main findings

Table 4 shows the regression analysis results of the interconnections among actual short selling (*SHO*), current audit fees, and audit hours. As the obtained data differed from prior studies, comparing the results

Table 4. Short interest and current audit fee and audit hour

Variables	<i>LN_{FEE}_t</i>	<i>LN_{HOUR}_t</i>
	Model (1)	Model (2)
Intercept	10.1096*** (37.65)	-0.7011*** (-2.64)
<i>SHO</i>	0.0039*** (3.40)	0.0034*** (2.96)
<i>SIZE</i>	0.2986*** (39.29)	0.2856*** (38.08)
<i>CURTA</i>	-0.0562 (-1.42)	-0.0896** (-2.29)
<i>INVRECR</i>	0.1997*** (4.04)	0.1631*** (3.35)
<i>GROWTH</i>	-0.1084*** (-3.28)	-0.1069*** (-3.28)
<i>EXPORTR</i>	-0.1891*** (-4.06)	-0.1323*** (-2.88)
<i>MTB</i>	0.0814*** (8.99)	0.0417*** (4.67)
<i>LEV</i>	0.1474*** (4.24)	0.0856** (2.49)
<i>ROA</i>	-0.4847*** (-3.18)	-0.6510*** (-4.32)
<i>BIG4</i>	0.1743*** (15.39)	0.2808*** (25.12)
<i>LOSS</i>	0.0241 (1.28)	0.0133 (0.72)
Industry and Year Fixed Effects	Yes	Yes
Observations	6493	6493
F-statistic	56.24	74.39
(p-value)	(<0.001)	(<0.001)
Adj. R ²	0.396	0.465

Asterisks *, **, and *** indicate significance levels at less than 10%, 5%, and 1%, respectively, based on two-tailed t-tests. Hausman tests are conducted to identify the appropriate statistical model between random and fixed effects model. The results indicate that the fixed effect (FE) approach is appropriate. Definitions of the variables are given in Appendix A.

was necessary. The results of the analysis showed that short selling and current audit fees had a significant positive relationship, consistent with prior studies (Cassell, Drake, and Rasmussen 2011; Hope, Hu, and Zhao 2017). However, the analysis of this study also shows a significant positive coefficient value in the relationship with audit hours. Prior studies were unable to find a significant relationship, which led them to infer that the positive relationship between short selling and current audit fees was due to the risk-premium channel. However, this study found a significant positive relationship between short selling and current audit hours, indicating that the results support the audit-effort channel.

The signs of the control variables are generally consistent with the prior studies. *SIZE*, *INVRECR* and *LEV* had significant positive coefficients, indicating that the larger and more complex clients are, the more audit costs and audit efforts are required. In addition, audit costs and audit efforts were higher when big4 auditor compared to non-big4 auditor (*BIG4*). However, in the case of *CURTA*, significance differed depending on the dependent variable. The explanatory power of the model is 39.6% and 46.5% respectively, similar to that of the prior studies.

Table 5 shows the regression analysis results among the actual short interest, discretionary accruals, and the absolute value of discretionary accruals. Short interest, *PMDA*, and *ABS_PMDA* had significant negative relationships, indicating that short interest was related to high audit quality. Additionally, Table 5 supports the audit-effort channel, along with the results in Table 4. Short interest and current audit fees were positively associated, along with associations with audit fees and quality.

The signs of the control variables are mostly consistent with the prior studies. The *SIZE* had significant negative coefficients, which means that larger clients had higher audit quality. However, in these models, there were no results that big4 auditor had higher audit quality than non-big4.

Irrespective of whether short selling drives earnings management or provides a signal for firms engaging in earnings management, the audit-effort channel

Table 5. Short interest and audit quality: Performance matched discretionary accruals

Variables	<i>PMDA</i>	<i>ABS_PMDA</i>
	Model (3)	Model (4)
Intercept	0.1366*** (8.03)	0.1053*** (3.32)
<i>SHO</i>	-0.0002** (-2.43)	-0.0004*** (-3.10)
<i>SIZE</i>	-0.0035*** (-7.26)	-0.0021** (-2.39)
<i>LEV</i>	-0.0026 (-1.31)	0.0243*** (6.53)
<i>LOSS</i>	-0.0400*** (-43.62)	-0.0038** (-2.22)
<i>CFO</i>	-0.9399*** (-194.98)	-0.0422*** (-4.71)
<i>GROWTH</i>	0.0522*** (24.81)	0.0199*** (5.09)
<i>MTB</i>	0.0051*** (8.90)	0.0061*** (5.71)
<i>LAG_ABS_PMDA</i>	0.0011 (0.28)	0.1106*** (11.98)
<i>BIG4</i>	0.0005 (0.67)	-0.0008 (-0.55)
Industry and Year Fixed Effects	Yes	Yes
Observations	6493	6493
F-statistic	567.6	12.65
(p-value)	(<0.001)	(<0.001)
Adj. R ²	0.867	0.119

Asterisks *, **, and *** indicate significance levels at less than 10%, 5%, and 1%, respectively, based on two-tailed t-tests. Hausman tests are conducted to identify the appropriate statistical model between random and fixed effects model. The results indicate that the fixed effect (FE) approach is appropriate. Definitions of the variables are given in Appendix A.

appears to be supported. Auditors appear to be attempting to reduce higher audit risk from short selling by inputting additional audit hours, which would then have resulted in increased audit fees and improved audit quality.

Table 6 shows the regression analysis results among actual short interest, future audit fees, and audit hours. The future audit fees showed a significant positive coefficient, and future audit hours also

Table 6. Short interest and future audit fee and audit hour

Variables	<i>LN_{FEE}_{t+1}</i>	<i>LN_{HOUR}_{t+1}</i>
	Model (1)	Model (2)
Intercept	9.5820*** (44.25)	-1.3704*** (-5.43)
<i>SHO</i>	0.0028*** (3.01)	0.0020* (1.84)
<i>SIZE</i>	0.3188*** (52.02)	0.3102*** (43.45)
<i>CURTA</i>	-0.0592* (-1.85)	-0.0795** (-2.14)
<i>INVRECR</i>	0.1882*** (4.73)	0.1686*** (3.63)
<i>GROWTH</i>	-0.0911*** (-3.42)	-0.0657** (-2.12)
<i>EXPORTR</i>	-0.1584*** (-4.22)	-0.1461*** (-3.34)
<i>MTB</i>	0.0913*** (12.51)	0.0515*** (6.05)
<i>LEV</i>	0.1844*** (6.58)	0.0827** (2.53)
<i>ROA</i>	-0.4471*** (-3.63)	-0.6265*** (-4.37)
<i>BIG4</i>	0.1556*** (17.04)	0.2682*** (25.2)
<i>LOSS</i>	0.0385** (2.55)	0.0145 (0.82)
Industry and Year Fixed Effects	Yes	Yes
Observations	6493	6493
F-statistic	93.11	84.97
(p-value)	(<0.001)	(<0.001)
Adj. R ²	0.522	0.499

Asterisks *, **, and *** indicate significance levels at less than 10%, 5%, and 1%, respectively, based on two-tailed t-tests. Hausman tests are conducted to identify the appropriate statistical model between random and fixed effects model. The results indicate that the fixed effect (FE) approach is appropriate. Definitions of the variables are given in Appendix A.

showed a significant positive coefficient at the 10% level. The results presented in Table 6 are consistent with prior research (Bedard and Johnstone 2004); it appears that auditors reflected higher audit risk from firms subject to short selling on future audit

fees and audit hours on an ex-ante basis.

The signs of the control variables are mostly consistent with the prior studies. Except for the *LOSS* variable, all control variables had significant coefficients. The explanatory power of the model is 52.2% and 49.9% respectively, slightly higher than that of current models.

Table 7 shows the relationship among abnormal short interest in firms aggressively engaging in earnings management, future audit fees, and audit hours. In this analysis, the proxy for short selling was abnormal short interest, which was estimated in the short selling decision model. The reason for using abnormal short interest is the expectation that an auditor would not impose significant penalties in the future audit fees for the short interest that occurs within a predictable range.

The signs and significance of the coefficients on control variables are similar to the results in Table 4 and Table 6, and *CURTA* and *LOSS* differed in significance depending on the dependent variables.

The analysis indicated that the positive association between future audit fees and audit hours was strengthened as abnormal short selling occurred in firms that engage in aggressive earnings management. The results were robust at a significance level of 1% when Tables 4-6 were re-analyzed using abnormal short interest (*ABS*). However, when analyzing Table 7 using actual short selling volume to examine future audit fees, the directions of the coefficients were the same, but the significance did not exist. In terms of the future audit hours, the results remained the same, with the significance level reduced to 10%. As expected, the auditor only imposed penalties on future audit fees for short interest in the unpredictable range, which was also reflected in future audit hours and provided additional effort.

C. Additional Test

A structural change during our sample period may exist because this study uses panel data with a fairly long sample period. South Korea underwent a major

Table 7. Future audit fee and hour: Abnormal short interest and *AGG_ABS_PMDA*

Variables	<i>LNFEET_{t+1}</i>	<i>LNHOUR_{t+1}</i>
	Model (1)	Model (2)
Intercept	8.9308*** (40.62)	-1.9802*** (-7.73)
<i>ABS</i>	0.0349*** (3.89)	0.0316*** (3.02)
<i>AGG_ABS_PMDA</i>	-0.0028 (-0.26)	-0.0060 (-0.47)
<i>ABS</i> * <i>AGG_ABS_PMDA</i>	0.0489*** (2.88)	0.0690*** (3.48)
<i>SIZE</i>	0.3432*** (54.68)	0.3330*** (45.54)
<i>CURTA</i>	-0.0502 (-1.57)	-0.0651* (-1.75)
<i>INVRECR</i>	0.1806*** (4.56)	0.1551*** (3.36)
<i>GROWTH</i>	-0.0903*** (-3.40)	-0.0640** (-2.07)
<i>EXPORTR</i>	-0.1576*** (-4.21)	-0.1444*** (-3.31)
<i>MTB</i>	0.0987*** (13.43)	0.0589*** (6.87)
<i>LEV</i>	0.2019*** (7.16)	0.1048*** (3.19)
<i>ROA</i>	-0.4049*** (-3.29)	-0.5687*** (-3.97)
BIG4	0.1554*** (17.06)	0.2676*** (25.21)
LOSS	0.0415*** (2.75)	0.0184 (1.04)
Industry and Year Fixed Effects	Yes	Yes
Observations	6493	6493
F-statistic	91.46	83.59
(p-value)	(<0.001)	(<0.001)
Adj. R ²	0.524	0.501

Asterisks *, **, and *** indicate significance levels at less than 10%, 5%, and 1%, respectively, based on two-tailed t-tests. Hausman tests are conducted to identify the appropriate statistical model between random and fixed effects model. The results indicate that the fixed effect (FE) approach is appropriate. Definitions of the variables are given in Appendix A.

change in its accounting regime when it introduced IFRS in 2012. Considering this circumstance, multivariate analyses are executed again by splitting samples to

pre-2012 and post-2012 period. Results (untabulated) for pre-2012 period are not qualitatively different from those presented in Table 4 and Table 6. In addition, the signs are identical compared those reported in Table 5 and Table 7, while the significance disappears. In the post-2012 period, the results (untabulated) are not qualitatively different, except for those between audit efforts and short selling. These analyses indicate that the results of this study are partly affected by structural changes and accounting regime changes.

VI. Conclusions

This study utilized data from a short selling portal provided by the KRX and financial disclosures between 2007 and 2018 to empirically analyze the relationship among short selling, firms, and auditors. The results showed a positive relationship between short selling and current audit fees using Korean short selling data, consistent with prior studies. However, positive relationships were also observed with current audit hours and audit quality. This presents new evidence that the relationship between short selling and current audit fees is caused by the audit-effort channel. Furthermore, the short selling and future audit fees and hours had a positive relationship, which indicates that the higher audit risk from short selling influences the audit fees in the upcoming fiscal year. Moreover, we found that the auditor perceived higher levels of audit risk when abnormal short interest occurred for firms that aggressively engaged in earnings management.

This study made the following contributions. First, this study presented evidence that a positive relationship between short selling and audit fees occurs not only because of the risk-premium channel but also the audit-effort channel. These results indicated that, unlike the results of Hope et al. (2017) showing only risk-premium channels, in South Korea, this relationship is caused by the audit-effort channel. Second, this

study presented evidence that higher audit risk, caused by the interaction between abnormal short selling and earnings management, is reflected in the audit fees and hours of the following fiscal year. Finally, this study connects the influences among the economic actors of short sellers, firms, and auditors.

This study has implications for regulatory authority, auditors, and investors. For the regulatory authority, it may serve as additional information for deciding the direction of short sales, which increases audit effort and cost as well as improves audit quality. For auditors, it may help prevent poor auditing by mounting a preemptive response and reasonably determining audit fees because the increase in the audit effort and the audit risk on the part of the companies engaging in short-sale transactions are duly considered as they engage to win contracts from reporting companies. Finally, investors can get help when making investment decisions by taking into account the short sale and audit when working on financial statements.

This study proposes the following future research. As the South Korean financial regulatory authority has decided to extend the short selling ban until March 15, 2021 due to the COVID-19 pandemic, the data for the year 2020 would reflect the prohibition of short sales. Accordingly, follow-up studies can verify the difference in auditor behaviors before and after a short selling ban. Reviewing the data after the prohibition of short sales in the South Korean financial market may come up with additional insights of short selling.

The study has the following limitations. It combines daily short selling data into yearly data. However, perceived risks and the associated strategies employed by firms and auditors may differ depending on the volume and the ratio of daily short interest. Firms experiencing constant short selling over a certain time and firms that experience a high concentration of short selling during a specific time may be perceived as different by firms or auditors. Nevertheless, because of the annual disclosure of audit fees, audit hours, and other financial data, short selling data were combined on annual basis (firm-year). Furthermore,

this study has relatively long sample periods and the results of this study are partly affected by structural changes in the financial market and accounting regime changes. Therefore, readers should consider these facts and these results should be interpreted with caution. In addition, there may be specific impacts that affect certain industries, which could cause a few issues in econometrics, as occurs over time. However, we could not completely and comprehensively address this issue at the industry level. Finally, measurement errors due to using estimates common in other studies may also be present in this study.

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Appendix A. Definitions of the variables

Variable	Definitions
Dependent Variables	
$LN\text{FEE}_{t(\text{or } t+1)}$	The natural logarithm of total audit fees.
$LN\text{HOUR}_{t(\text{or } t+1)}$	The natural logarithm of total audit hours.
PMDA	Performance matched discretionary accruals.
ABS_PMDA	Absolute value of PMDA.
Interest Variables	
SHO	The natural logarithm of sum of the short interest.
ABSI	Abnormal short interest.
AGG_ABS_PMDA	Equals 1 if the absolute value of PMDA is greater than the 80th percentile value.
DUM_SHO	Equals 1 if the firm is shorted, and 0 otherwise.
Control Variables	
SIZE	The natural logarithm of total assets.
CURTA	Current assets divided by total assets.
INVRECR	Receivables and inventory divided by total assets.
GROWTH	Current sales minus lagged sales divided by lagged sales.
EXPORTR	the percentage of sales that are foreign.
MTB	The market value of equity divided by the book value of equity.
LEV	Total liabilities divided by total assets.
ROA	Net income divided by total assets.
BIG4	Equals 1 if audit firm is big4, and 0 otherwise.
LOSS	Equals 1 if net income (NI) is negative, and 0 otherwise.
CFO	Cash flow from operations divided by total assets.
TACC	Total accruals for the fiscal year scaled by total assets at the beginning of the fiscal year.
BM	The book value of equity divided by the market value of equity.
LAG_PMDA	Lagged PMDA.
LAG_ABS_PMDA	Lagged absolute value of PMDA.
YEAR	Year fixed effect dummies.
IND	Industry fixed effect dummies.