“Firm-specific investor sentiment and stock price crash risk: The role of foreign investors in Korea’s stock market”

AUTHORS	Heejeong Shin Su-Young Choi

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Heejeong Shin (South Korea), **Su-Young Choi** (South Korea)

FIRM-SPECIFIC INVESTOR SENTIMENT AND STOCK PRICE CRASH RISK: THE ROLE OF FOREIGN INVESTORS IN KOREA'S STOCK MARKET

Abstract

Building on a prior study that documents that stock price crashes are positively associated with firm-specific investor sentiment (hereafter, the sentiment), this study further investigates the moderating effect of foreign investors on Korea's stock market. This study hypothesizes that foreign investors as sophisticated participants are indifferent of the significant relationship between the sentiment and the stock price crashes. For firms listed on the KSE over the period of 2011–2019, the analysis findings show that the high stock crash risk attributable to the high sentiment is attenuated for firms with high foreign ownership. However, such moderating effect of foreign ownership disappears when taking foreign investment horizon into consideration. This implies that future stock crash risk reduction under the high sentiment is due to the corporate monitoring role of foreign investors, who are targeting a long-term investment horizon. This study adds to the literature on the role of foreign investors by suggesting that foreign investors act as a rigorous monitor helpful for managing stock price, rather than a price maker who is rational under the high sentiment.

Keywords investor sentiment, stock crash, foreign investor, investor sophistication, corporate governance

JEL Classification G10, G32, M41

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Heejeong Shin, Ph.D., Assistant Professor, Business Administration Faculty, Accounting Department, Dong-eui University, South Korea. (Corresponding author)

Su-Young Choi, Ph.D., Lecturer, Inha University, South Korea.

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INTRODUCTION

Stock price crash is defined as the sudden and extreme fall of stock prices in firm-specific return dimension (Hutton et al., 2009), which is the most undesirous in the efficient stock market, but inevitable economic event in the practice field. While Jin and Myers (2006) have argued that the stock crash is attributed to the managerial problem such as incentives not to release bad news for their own benefits concerned with their compensation or reputation, many researchers have sought the causes and the stock crash predictors in the agency theory perspective.

Most studies that explain stock crashes as the agency cost incurred by the agency-principal conflicts of interest, commonly suggest information opacity in a certain context and emphasize the corporate governance mechanism in reducing the economic loss due to stock crashes (Kim et al., 2011a, 2011b; Boubaker et al., 2014; Andreou et al., 2016). Kim et al. (2011b) demonstrate that the likelihood of stock crashes increases by tax avoidance, which facilitates managerial opportunism, including the rent extraction and bad news accumulation, but is mitigated for firms with a strong monitoring system. Kim et al. (2014) document that socially responsible firms are likely to experience the crash, since managers engaged in CSR (corporate social responsibility)

commit to more transparency. Boubaker et al. (2014) report controlling shareholders, especially those who have excessive control right to cashflow right, are not willing to provide firm-specific information to hide opportunistic practices, increasing the crash risk.

The studies above show that such a particular context of firm characteristics significantly influences the crash risk, and the effects are moderated by the effective corporate governance such as external or internal monitoring mechanisms (i.e., the high institutional ownership, the larger size of board of directors, the high analyst coverage, etc.). The similar strand of research is shown in Korea as well. Mostly, the effect of foreign ownership or foreigners' investment horizon as a proxy for the governance effectiveness on future stock crashes has been investigated (Jeong, 2020; Kim & Park, 2017; Lee, 2016). They show a consensus about foreign investors' monitoring role in restraining managerial inefficient decision and enhance the information transparency, which reduces future stock price crashes.

However, given that the crashes that eventually occur in the process of asset pricing, not only internal firm characteristics (i.e., corporate governance) but also external investors' behaviors, have an impact on the crash risk. The point is that the incongruent opinions among investors (Chen et al., 2001), high investor sentiment (Yin & Tian, 2017; Fu et al., 2021), or the lower retail investor attention (Wen et al., 2019) are also associated with future stock crashes, independent of internal firm characteristics. According to these studies, the trader types, including unsophisticated noise traders or rational arbitrageurs, play a crucial role as the external investors. This shows that valuation errors attributable to stock trading by such traders lead to current or future stock price crashes. Importantly, foreign investors play a monitoring role within the company and also act as external investors who can affect stock prices.

1. LITERATURE REVIEW AND HYPOTHESIS

An indicator of investors' trading behavior that affects asset prices is the investor sentiment (Brown & Cliff, 2005; Lemmon & Portniaguina, 2006). Investor sentiment is referred to as a degree of investor' optimistic mood in financial markets (Baker & Wurgler, 2006). Ryu et al. (2018) in Korea identify the sentiment, in terms of individual firm, which has an explanatory power for the asset price movement. Furthermore, Fu et al. (2021) document that the sentiment of an individual firm is positively related to the crash risk, confirming the role of noisy traders in high sentiment in limiting the rational arbitrageurs' position. Specifically, the risk in which arbitrage is not able to take away the effects of noise forms over-valued price and consequently leads to stock price crashes.

This study investigates how foreign investors influence the future stock price crashes attributable to such investor sentiment. Foreign investors act as not only the influential share trading participants but also external controllers following share ownership. Since foreign investors are engaged in the Korean stock market with enormous financial power, the impact of their trading activities on the market's condition depends on the position in which they engage in the stock market.

As share trading participants, foreign investors are considered to be sophisticated than domestic individual/institutional ones in assessing financial information and picking potentially valuable stocks, which increases trading efficiency and firm values (Morck et al., 2000; Fan & Wong, 2002; Boehmer & Kelley, 2009; He & Shen, 2014). However, using such superiority, foreign investors used to form the market sentiment, which agitates the market widely or firm-specific investors to earn profits though arbitrage transactions in a short period of time. It is the case that the herding trading or the positive feedback strategy known as foreign investors' favorable behavior serves as a sentiment promoter in practice. But the sentiment in which foreign investors as sophisticated investors reflect their valuation opinion may not have always a positive effect on stock price crashes. Because the sentiment effect also increases for stocks exhibiting greater individual investor participations (Ryu et al., 2018) and the sentiment, which corresponds to valuation error and leads to the stock price crash, is due to group trading activity mostly by unin-

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formed or noisy traders (Barberis & Thaler, 2003; Pojarliev & Levich, 2011; Sias et al., 2016; Stein, 2009).

Meanwhile, foreign investors as the external monitors in corporate governance are regarded as the stakeholders who exert a significant influence on management by providing long-term capital. They contribute to improving corporate values indirectly by addressing agency problem in the way that controlling shareholders control the managerial decision involved in the pursuing private benefits of managers (Gillan & Starks, 2003; Mitton, 2006; Ferreira & Matos, 2008; Aggarwal et al., 2011; Garner & Kim, 2013). In this case, foreign investors' behavior as a monitor does not have a direct effect on the sentiment, but would become a kind of indicator by which external investors judge the current state of firm-specific investor sentiment as a noisy measure or as a fundamental reflection. Nevertheless, the herding behaviors among foreign investors who are devoted to their own interests or passive to firm's deteriorating values may induce stock crashes (Coffee, 1991; Manconi et al., 2012; Kim & Park, 2017).

In summary, foreign investors can play both a monitoring role and a sentiment promoter role as a price setter. In this context, taking investors' behavior as an explanatory variable of stock price crashes attributable to the sentiment may make a difference in the existing findings, which concludes in terms of corporate governance. In other words, for stock crashes, the role of foreign investors as external investors, not internal monitors may depend on the sentiment level, meaning foreign investors may promote the high sentiment and contribute to the crash risk.

When foreign investors have an effect on forming firm-specific sentiment, the positive relation between the investor sentiment and stock crashes can be moderated or incremental. If foreign investors act as noisy traders/rational arbitrageurs to promote the sentiment, the crash risk due to the sentiment increases. But if they play a monitoring role as supervisors who are indifferent of hot money by short-term trading (i.e., corporate effective monitors), the sentiment related-crash decreases. That is, although the firm-specific investor sentiment is positively related to the future stock price crash risk, the effect of foreign investors on the relationship between the sentiment and future stock price crashes is unforeseeable. Thus, the null hypothesis is formed. Hence, this study aims to investigate the role of foreign investors in stock crashes attributable to investor sentiment.

H: *Foreign investors are indifferent of the positive relationship between firm-specific investor sentiment and future stock price crash risk.*

2. METHODOLOGY

2.1. Variable measurement

Firm-specific investor sentiment measurement follows Ryu et al. (2018) who expand Yang and Zhou (2015, 2016), Ryu et al. (2017), and Yang et al. (2017) to measure daily firm-level sentiment. They suggested a firm-specific investor sentiment index created by using information such as the volume and price of individual shares so that the index can directly reflect investor's transaction sentiment and transaction type. The measures representing information used in creating the sentiment index are the daily relative strength index (RSI), psychological line index (PLI), adjusted turnover rate (ATR), the logarithm of trading volume (LTV), and individual buy-sell imbalance (IBSI) for each firm. The specific calculations for each component are presented as follows.

Relative Strength Index (RSI) is a popular market indicator that shows investor sentiment based on share trading volume (Chen et al., 2010).

$$RSI_{i,t} = 100 \cdot \frac{\sum_{i=1}^{14} \left(P_{t-i} - P_{t-i-1}\right)_+}{\sum_{i=1}^{14} \left|P_{t-i} - P_{t-i-1}\right|}, \quad (1)$$

where P_t denotes the closing price of stocks of firm i in year t. The notation, $(P_{t-i} - P_{t-i-1})_+$ in numerator of above equation corresponds to the equation of $P_{t-i} - P_{t-i-1}$ if the calculation of $P_{t-i} - P_{t-i-1}$ yields positive value, 0 otherwise. $|P_{t-i} - P_{t-i-1}|$ denotes the absolute value of the calculation of $P_{t-i} - P_{t-i-1}$. While $RSI_{i,t}$ ranges between 0 and 100, representing the overbought market at RSI above 80 and the oversold market at RSI below 20 within 14-trading days.

Psychological Line Index (PLI) is also an indicator of investor sentiment, showing the market being either oversold or overbought. Similar to RSI measures, PLI above 75 implies overbuying market and that below 25 indicates an overselling market.

$$PLI_t = 100 \cdot \sum_{i=1}^{12} \left(\frac{\max(P_{t-i} - P_{t-i-1}, 0}{P_{t-i} - P_{t-i-1}} \right) / 12. \quad (2)$$

Stock turnover rate is taken a sentiment index (Baker and Stein, 2004) while it doesn't provide a signal of market's optimism or pessimism.

Adjusted Turnover Rate (ART), as the adjusted turnover rate suggested by Yang and Zhou (2015), differentiates optimism and pessimism by taking stock returns into consideration. That is, high turnover rate with positive returns means a bullish market but that with negative returns means a bearish market. The adjusted turnover rate of stock or portfolio *i* in day *t* (*ATR*) is calculated as follows:

$$ATR_t = \frac{R_t}{|R_t|} \cdot \frac{VOL_t}{shares\ outstanding\ at\ day\ t}, \quad (3)$$

where R_t is the returns of stock or portfolio *i* at time *t*, and VOL_t is the trading volume of stock or portfolio *i* at time *t*.

LTV: The trading volume of stock or portfolio implies stock liquidity and is considered a proxy of investor sentiment (Baker & Stein, 2004; Liao et al., 2011). The Logarithm of Trading Volume (LTV) is measured as the natural log of daily trading volume of individual stock.

$$LTV_t = \ln(VOL_t). \quad (4)$$

IBSI: Investor sentiment can be represented by buy-sell trading imbalance between retail investors who is regarded as noisy investors (Kang et al., 2013; Kumar & Lee, 2006). Individual investors' trading imbalance (*IBSI*) measures trading asymmetry, implying increasing investor sentiment, which is attributable to stock demands going over (below) stock supplies (Chiang et al., 2011).

$$IBSI_t = \frac{BV_t - SV_t}{BV_t + SV_t}, \quad (5)$$

where BV_t (SV_t) denotes the individual investors' buying (selling) trading volume of firm *i* in year *t*.

The first principal analysis applies to each five components above, yielding first principal estimates (*F*). The firm-specific investor sentiment index (S_t) is measured as the linear combination of each component multiplied by its own first principal estimate as the following equation:

$$S_t = F_{RSI} \cdot RSI_t + F_{PLI} \cdot PLI_t + F_{ATR} \cdot ATR_t + \\ + F_{LTV} \cdot LTV_t + F_{IBSI} \cdot IBSI_t. \quad (6)$$

However, firm-specific investor sentiment needs to be discerned from the common sentiment component (i.e., market-wide sentiment), and is taken as the residuals (ε_t) that are unexplained by market-adjusted returns as a result of regressing the sentiment index (S_t).

$$S_t = \gamma_0 + \gamma_1 MKT_t + \varepsilon_t, \quad (7)$$

while measured on daily basis, the sentiment variable for the test needs to be modified into firm-year based one. The firm-specific investor sentiment for analysis, $SENT_t$, is calculated as the yearly mean value of standardized – daily firm-specific investor sentiment (ε_t). This sentiment indicator is alleged to exhibit more robust explanatory power than existing sentiment measures do (Ryu et al., 2018).

According to Hutton et al. (2009), stock price crash is defined as the event that a firm's weekly returns belong to less than 0.1% of their distribution. Firm-specific weekly returns are measured as the residuals from estimating the following equation:

$$r_{j,t} = \alpha_0 + \alpha_1 r_{m,t-1} + \alpha_2 r_{m,t} + \alpha_3 r_{m,t+1} + \\ + \alpha_4 r_{ind,t-1} + \alpha_5 r_{ind,t} + \alpha_6 r_{ind,t+1} + \varepsilon_{j,t}, \quad (8)$$

where $r_{j,t}$ = weekly returns for firm *j* and week *t*; $r_{m,t}$ = weekly returns for market of week *t*; $r_{ind,t}$ = weekly returns for industry to which firm *i* belongs of week *t*; where, weekly returns are calculated as market value weighted – average stock returns.

The estimation residual of the model represents the firm specific returns not explained by market and industry returns. The lagged returns are included to control for the effect of nonsynchronous trading by time periods on returns.

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Then, the residuals, or firm-specific weekly returns ($\varepsilon_{j,t}$), are transformed into linear function form ($W_{j,t}$) in equation (9).

$$W_{j,t} = \ln\left(1+\varepsilon_{j,t}\right). \quad (9)$$

By using $W_{j,t}$ in equation (9), stock price crash risk variables are measured in two ways, the negative skewness, *NCSKEW*, and the volatility, *DUVOL*. The skewness (*NCSKEW*), presented in equation (10), is the negative of the third moment of firm-specific weekly returns form each year and normalized by the standard deviation (Chen et al., 2001; Kim et al., 2014; Kim & Zhang, 2016). The higher negative skewness indicates the higher likelihood of stock price crash.

$$NCSKEW = -\frac{n(n-1)^{3/2}\sum W^3}{(n-1)(n-2)(\sum W^2)^{3/2}}. \quad (10)$$

The firm-specific weekly returns volatility (*DUVOL*) is calculated as the logarithm of the ratio of standard deviation of downward returns to that of upward returns. Where, upward/downward returns are measured as the abnormal returns adjusted by the average weekly returns for a year. Equation (11) represents the measurement of *DUVOL*, where n_u and n_d denote the frequency of upward/downward stock returns, respectively. The higher volatility indicates the higher likelihood of stock price crash.

$$DUVOL = \log\left[\frac{(n_u-1)\sum_{DOWN}W^2}{(n_d-1)\sum_{UP}W^2}\right]. \quad (11)$$

2.2. Model specification

This study investigates how foreign investors influence the future stock price crashes attributable to the investor sentiment. In line with the hypotheses on the role of foreign investors, the analysis aims to test the moderate effect of foreign investors on the future stock price crashes positively related to the sentiment. Since stock price reflects a value-weighted average consensus of all investors who estimate corporate value, this study takes foreign investor ownership as a proxy for foreign investors' trading behavior, which affects their valuation process. Foreign ownership is simply measured as the percentage of the share numbers that foreigners own out of total outstanding shares of a firm at the end of year. Then, by regression analysis, whether the higher foreign ownership enables the magnitude of stock crash risk, which responds to the sentiment, to be reduced is examined. The test models are specified as follows:

$$\begin{aligned} &CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = \\ &= Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 FOR_{t-1}^{Own} + \\ &+\beta_3 SENT_{t-1}^{Firm} \times FOR_{t-1}^{Own} + \beta_4 SENT_{t-1}^{Mkt} + \\ &+\Sigma Control Variables + \varepsilon, \end{aligned} \quad (12)$$

where $CRASH_t$ ($NCSKEW_t$ or $DUVOL_t$): Stock price crash of firm *i* in year *t*; $SENT_{t-1}^{Firm}$: Investor sentiment of firm *i* at year *t*–1; FOR_{t-1}^{Own}: Foreign ownership of firm i at year *t*–1; $SENT_{t-1}^{Mkt}$: Market-wide sentiment at year *t*–1. Control variables are illustrated as below.

Equation (12) is the regression model to test the effect of foreign investors on the stock price crash risk positively related to the firm sentiment. The interesting main variables are $SENT_{t-1}^{Firm}$ (firm-specific investor sentiment) and FOR_{t-1}^{Own} (foreign ownership). If the firm sentiment has a positive relationship with future stock crashes even in the Korean stock market, the coefficient of $SENT_{t-1}^{Firm}$, β_1, would show significantly positive sign. Further, if foreign investors as the sophisticate participants play a crucial role in mitigating such relationship, the interaction term of $SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own}$ would show the significantly negative sign. This means that foreign investors serve as the rational price maker or as a rigorous monitor not as the noisy traders who promote the investor sentiment in which valuation error is incorporated.

$SENT_{t-1}^{Mkt}$ (market-wide sentiment) is included to control the impact of the common sentiment that is pervasive but not observable in the stock market (Yin & Tian, 2017). It is measured as the yearly average of all firm-specific investor sentiments according to Guo et al. (2019) and Fu et al. (2021). Other control variables except for $SENT_{t-1}^{Mkt}$ (market-wide sentiment) in equations are illustrated as follows. Variable definitions are given in Appendix A in detail.

Several factors influencing stock price crashes are included in equation (12). Given that stock price crash is likely to occur in firms in which infor-

mation is not transferred efficiently, stock crashes may rely on firm size (*SIZE*) in which the information transmission speed or market's reaction depending on the information transparency may be different (Hutton et al., 2009). Since stock price crash risk is closely associated with firm performance and financial health (Kim & Jeong, 2017; Hutton et al., 2009; DeFond et al., 2015), return on assets (*ROA*), firm leverage (*LEV*), changes in sales (Δ*SALES*), cash flows from operation (*CFO*), and financial loss (*LOSS*) are included in the estimation. Firms with high market-to-book value is susceptible to stock crashes which are likely to arise in the over-valued in the short run.

Given that Chen et al. (2001) document that high-yielding firms are prone to facing future stock crashes, equation (12) needs to include stock returns (*RET*) measured as the yearly average based on a firm's weekly returns. Since investors' incongruence in regard with stock price forecasting may increase the future stock crash risk, the regression is implemented with both the detrended share turnover (*TURN*) and the standard deviation of firm's weekly returns (*SIGMA*) controlled. To control extremely negative skewness with time-serially consistence that affects future stock price crashes, the model includes the lagged *NCSKEW* (Bae et al., 2016). Lastly, the information quality (|DA|), measured as the accumulation of value of accruals (absolute) over prior three consecutive years, is included in the model because it is deeply related to information opacity, which is responsible for stock crashes.

All regressions consider industry and year dummies to control for the fixed effects. Also, a one-year lag between the dependent and independent variables is imposed to capture the effect of the sentiment and the prior role of foreign investor followed by stock price crash. The test statistical significance of all estimates by regression analysis is calculated based on firm-clustered standard error (Petersen, 2009).

2.3. Sample criteria

For companies listed on the Korea Stock Exchange's securities market from 2011 to 2019, the analyses are implemented. The sample meets the following requirements for analysis for the period.

1) KSE-listed firms with December-year end excluding the financial industry.

2) Firm-years without capital impairment.

3) Firm-years available for financial and stock price data from the Fn-Guide database.

The sample excludes the financial and insurance industry, which is a little different in accounts of financial statements from the other industry. By excluding firms with non-December year-end, the analysis ensures consistent test period. As main variables for the analysis, the stock crash risk and the firm sentiment are measured mainly using returns and/or trading volume of stocks on a daily basis. The data in which the continuity in stock transaction does not exist due to the trading suspension or designation as issues for administration are excluded from the samples. This procedure yields 5,308 of firm-years observations in final samples.

Table 1. Sample selection criteria

Criteria	Firm-year observations
Firms listed on KSE for the period of 2011–2019	7,083
Less: Financial and Insurance Industry	643
Less: Capital impairment	28
Less: Data unavailable for investor sentiment measurement*	1,104
Less: Data unavailable for stock price crash risk measurement*	0
Final Sample	5,308

Note: * While the measurement for the firm sentiment requires daily returns and trading volume, some of the data do not show the continuity in stock transaction due to the trading suspension or designation as issues for administration.

3. EMPIRICAL RESULTS AND DISCUSSION

3.1. Results

Table 2 provides summary statistics of test variables. As dependent variables, stock price crash measures are the negative skewness ($NCSKEW_t$) and the relative volatility ($DUVOL_t$). While the mean values are both negative, $NCSKEW_t$ has a more widespread range in distribution. Firm-specific investor sentiment ($SENT_{t-1}^{Firm}$) is stand-

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ardized, showing a range between -0.657 and 0.608. Market-wide sentiment ($SENT_{t-1}^{Mkt}$) is calculated as the average of firm-specific investor sentiments over one year, showing lower variance in distribution. The main independent variable is foreign ownership (FOR_{t-1}^{Own}). Foreign investor ownership, FOR_{t-1}^{Own}, has the mean value of 0.102, indicating about 10.2% of total shares is owned by foreign investors on average. This statistic is based on the samples that include even firms in which foreign investors do not engage. It ranges from 0% to 60.8%.

Table 2. Descriptive statistics (n = 5,308)

Variable	Mean	Std. dev	Med	Min	Max
$NCSKEW_t$	−0.306	1.035	−0.245	−3.281	2.313
$DUVOL_t$	−0.177	0.802	−0.148	−2.244	1.766
$SENT_{t-1}^{Firm}$	0.003	0.261	0.010	−0.657	0.608
$SENT_{t-1}^{Mkt}$	0.002	0.002	0.002	−0.003	0.004
FOR_{t-1}^{Own}	0.102	0.133	0.045	0.000	0.893
$SIZE_{t-1}$	20.190	1.587	19.972	17.208	24.625
LEV_{t-1}	0.472	0.199	0.476	0.090	0.934
ROA_{t-1}	0.021	0.075	0.027	−0.326	0.200
CFO_{t-1}	0.050	0.075	0.047	−0.183	0.280
MTB_{t-1}	1.237	1.198	0.854	0.182	7.225
$\Delta SALES_{t-1}$	0.066	0.243	0.038	−0.529	1.367
$LOSS_{t-1}$	0.228	0.420	0.000	0.000	1.000
$\|DA\|_{t-1}$	0.038	0.037	0.027	0.000	0.194
$SIGMA_{t-1}$	0.056	0.027	0.050	0.017	0.161
RET_{t-1}	0.002	0.008	0.001	−0.015	0.029
$TURN_{t-1}$	0.000	0.014	0.000	−0.063	0.060

Please refer to Appendix A for definitions of variables. This statistic is based on 5,214 observations that exclude firms in which foreign investors do not engage.

Table 3 presents the correlation analysis results for main variables, stock price crashes, firm-specific investor sentiment, and foreign investors measures. Interestingly, stock price crash risks (i.e., $NCSKEW_t$ and $DUVOL_t$) are positively correlated with not only firm-specific investor sentiment (i.e., $SENT_{t-1}^{Firm}$), but also foreign investor ownership (i.e., FOR_{t-1}^{Own}. Specifically, the coefficient (ρ) on correlation of $NCSKEW_t$ and $SENT_{t-1}^{Firm}$ is 0.122 and significant at the 1% level. This is in line with a prior study that documents stock price crash occurrence, which is attributable to firm-specific investor sentiment.

However, the positive coefficient of 0.128 on the correlation of $NCSKEW_t$ and FOR_{t-1}^{Own} is rather unexpected result, given prior evidence by Kim and Park (2017) who document that the foreign ownership or foreign investment period do not have an influence on stock crash risk as a single factor. These results are consistent with the other stock crash measure in this study, $DUVOL_t$.

While foreign ownership is taken as the proxy of sophisticated participants in the stock market, the coefficient of FOR_{t-1}^{Own} is 0.147 and significantly positive, implying that foreign investors may act sentiment promoters. However, simple analysis without controlling other factors that affect future stock price crashes is limited to test the hypotheses in the statistically unbiased manner. Thus, the regressions are implemented only to elaborate the analysis for the hypotheses in section 4.3.

Table 3. Correlation analysis results for the main test variables

Variables	$DUVOL_t$	$SENT_{t-1}^{Firm}$	$SENT_{t-1}^{Mkt}$	FOR_{t-1}^{Own}
$NCSKEW_t$	0.915*	0.122*	−0.028†	0.128*
$DUVOL_t$	–	0.112*	−0.020	0.109*
$SENT_{t-1}^{Firm}$	–	–	0.005	0.147*
$SENT_{t-1}^{Mkt}$	–	–	–	0.014
FOR_{t-1}^{Own}	–	–	–	–

Note: This table presents the Pearson correlation coefficients. The figures in parentheses are p-values. The notations * and † denote the statistical significance at 1% and 5% level, respectively. Please refer to Appendix A for variable definitions, and Appendix B for correlation coefficients of all test variables.

This study builds on the evidence that the future stock price crash risk is positively affected by the firm-specific investor sentiment (Fu et al., 2021). However, the evidence from the Korean stock market does not exist, it is necessary to revisit the relationship between the investor sentiment and future stock crashes prior to looking into the role foreign investors. Table 3 provides the analysis results that show the significant positive effect of firm-specific investor sentiment on future stock price crashes.

For $NCSKEW_t$, the coefficient of $SENT_{t-1}^{Firm}$ is 0.499 (t-statistics = 9.50) in the case of the simple equation without other control variables but for

market wide sentiment ($SENT_{t-1}^{Mkt}$). Such positive relationship is robust to the regressions of both the equation with other control variables and the equations in which the dependent variable is substituted by $DUVOL_t$. The coefficients of market wide sentiment ($SENT_{t-1}^{Mkt}$) are not statistically significant in any regressions, which implies market-wide sentiment does not have an incremental explanatory power exceeding firm-specific investors sentiment. Owing to results consistent with prior study, further research that investigates the role of foreign investors can proceed in sequence.

Table 5 presents the regression results on the main models, i.e. equation (12) and baseline models, which exclude other control variables but for market-wide sentiment. Equation (12) includes the interaction term of firm sentiment and foreign ownership to examine the moderate effect of foreign investors on the future stock price crashes attributable to firm-specific investor sentiment. If foreign investors who are considered as sophisticated participants play a role in reducing the future stock price crashes due to firm-specific investor sentiment, the coefficient of ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own}$) would be significantly negative, with the coefficient of $SENT_{t-1}^{Firm}$ positive.

The results show the negative coefficient of ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own}$) and the positive one of $SENT_{t-1}^{Firm}$, supporting the role of foreign investors as sophisticated participants (i.e., a rational price market or a rigorous monitor). For $NCSKEW_t$ as a dependent variable, the coefficients of $SENT_{t-1}^{Firm}$ and ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own}$) are 0.405 (t-statistics = 4.34) and –0.994 (t-statistics = –2.79), respectively. These results are similar even in the case of $DUVOL_t$ as a dependent variable and to those from the regression of Baseline equation that excludes other control variables.

Overall, the findings suggest that foreign investors moderate the future crash risk attributable to the firm sentiment. This means that foreign investors act as rational price makers or as corporate monitors not as the noisy traders who promote the investor sentiment in which valuation error is incorporated. This clearly rejects the hypothesis that foreign investors are indifferent of the positive relationship between firm-specific investor sentiment and future stock price crash risk. However, the analysis result can be weak evidence to argue for the monitoring role of foreign investors in reducing crash risk. Thus, a series of tests with a variety of proxy for foreign investors' behavior (i.e., foreign ownership change, long-term horizon investment) are further conducted in the next section.

3.2. Additional tests

Several additional tests to examine more closely whether foreign investors serve as rational price setters or strict supervisors of management are conducted in this section. When considering only foreign investor ownership as a proxy for foreign investors' trading behavior, foreign investors' ownership itself does not reflect their investment propensity, so it is explained in terms of both short-term profit pursuers and corporate monitors (Shleifer & Vishny, 1986; Maug, 1998). This means that foreign ownership, by which the sentiment is affected, cannot distinct a rational price maker from a corporate monitor. Hence, by considering the yearly growth in foreign ownership, which denotes the existence of foreign investors engaging in stock price movement in the model, the analysis tries to capture the effect of foreign investors as a price maker.

If foreign investors who acquire stocks act as rational participants not as noisy traders in the purpose of their own interests in the short run, the changes in foreign investor ownership would mitigate positive relations between the investor sentiment and the stock crash risk. However, Table 4 provides the opposite, showing the insignificant coefficient of the interaction term, ($SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own}$). The coefficients are 0.502 (t-statistics = 0.45) for $NCSKEW_t$ and 0.512 (t-statistics = 0.50) for $DUVOL_t$ as a dependent variable. This indicates that foreign investors who currently acquire stocks are indifferent of stock crashes attributable to the sentiment. In other words, foreign investor may play as a price maker who promotes sentiment. However, this interpretation is also disputable because the changes in foreign ownership do not reflect the characteristics of foreign investors regarding the investing horizon, which has an influence on the level of corporate monitoring or short-term arbitrage by foreign investor.

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Table 4. Additional test: The role of foreign investor (foreign ownership growth)

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 \Delta FOR_{t-1}^{Own} + \beta_3 SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own} + \beta_4 SENT_{t-1}^{Mkt} + \Sigma Control\,Variables + \varepsilon,$$

Variables	Dep. Var. = NCSKEW		Dep. Var. = DUVOL	
	Coef.	t-stat	Coef.	t-stat
Const	–3.360	–13.68***	–2.349	–12.31***
$SENT_{t-1}^{Firm}$	0.332	4.13***	0.268	4.46***
ΔFOR_{t-1}^{Own}	–0.326	–0.90	–0.697	–2.16**
$(SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own})$	0.502	0.45	0.512	0.50
$SENT_{t-1}^{Mkt}$	41.361	2.13**	25.453	1.40
Control Variables	Included		Included	
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Firm clustered S.E.	Yes		Yes	
Adj.R2	0.08		0.07	
N	5,308		5,308	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for the definitions of test variables.

Considering that the noisy traders in foreign investors largely correspond to those who are in short-term investment horizon, it is necessary to take investment horizon into consideration to examine the role of foreign investors (Chen et al., 2007; Callen & Fang, 2013). As previously mentioned, foreign ownership, as a proxy for foreign investors' trading behavior by which the sentiment is affected, cannot distinct a rational price maker from a corporate monitor. This is the case that foreign investors who own the large ownership may serve as a noisy trader for short-term performance, as well as a monitor (Shleifer & Vishny, 1986; Maug, 1998). Hence, the analysis uses foreign investment horizon as a proxy for foreign investors' trading behavior to capture the role of foreign investors dedicated to a monitoring role.

The investment horizon (i.e., short-term or long-term investment period) even given the same level of the ownership makes a difference in the role of foreign investors in stock valuation or corporate governance. To distinguish long-term investors from short-term ones, Kim and Jang (2012) utilize the daily turnover, which indicates the level of foreign investors' buy-sell trading amount compared to market values of their holding shares at day *t*.

$$Tradubg\ Tyrbiver_{i,d} = \frac{\left(N_{i,f,d}^{S} \cdot P_{i,f,d}^{S} + N_{i,f,d}^{B} \cdot N_{i,f,d}^{B}\right)/2}{\left(N_{i,f,d} \cdot P_{i,d} + N_{i,f,d-1} \cdot P_{i,f,d-1}\right)/2}. \quad (13)$$

The equation above represents the foreigners' share turnover; where $N_{i,f,d}^{S}$ and $N_{i,f,d}^{B}$ denote the number of shares sold and bought by foreigners, respectively. $P_{i,f,d}^{S}$ and $P_{i,f,d}^{B}$ denote the price of shares sold and bought by foreigners, respectively. $N_{i,f,d}$ denotes the number of shares that foreigners hold, and $P_{i,d}$ denotes the stock price. Thus, the denominator $(N_{i,f,d} \cdot P_{i,d} + N_{i,f,d-1} \cdot P_{i,f,d-1})/2$ indicates the daily average of market value shares that foreigners own. The numerator $(N_{i,f,d} \cdot P_{i,d} + N_{i,f,d-1} \cdot P_{i,f,d-1})/2$ indicates the average trading amount by foreigners at day t. $TURN_t$ is, as a test variable, the firm-yearly summation of such daily turnover.

$$TURN_t = \sum_{d=1}^{N} Trading\ Turnover_{i,d}. \quad (14)$$

A higher (lower) value of $TURN_t$ which means higher turnover, indicates foreigners' short-term (long-term) investing tendency. Foreigners' investment horizon (FOR_{t-1}^{Lti}) is represented as the indicator of either short-term investment or long-term investment, which are determined based on the yearly median value of $TURN_t$.

Although not tabulated, the correlation coefficients of the foreign ownership and foreign investment horizon indicator with firm-specific investor sentiment are qualitatively different from each other. The coefficient of FOR_{t-1}^{Own} is 0.147 and significantly positive, while that of FOR_{t-1}^{Lti} is not statistically significant (0.000, p-values = 0.988). This implies that foreign investment horizon may have

different implication from foreign ownership in explaining the relationship between the firm sentiment and future stock crash risk.

Equation (15) is the test model with respect to the foreign investment horizon.

$$\begin{aligned} &CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right)= \\ &= Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 FOR_{t-1}^{Lti} + \\ &+\beta_3 SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti} + \beta_4 SENT_{t-1}^{Mkt} + \\ &+\Sigma Control\,Variables + \varepsilon, \end{aligned} \quad (15)$$

where $CRASH_t$ ($NCSKEW_t$ or $DUVOL_t$); Stock price crash of firm i in year t; $SENT_{t-1}^{Firm}$ Investor sentiment of firm i in year t–1; FOR_{t-1}^{Lti}: Foreign investment tendency of firm i in year t–1; $SENT_{t-1}^{Mkt}$: Market-wide sentiment in year t–1. Control variables are identical to the equation (12).

As expected, if there exists a moderate effect of foreign investors who are dedicated to the role of a corporate monitor with long-term investment horizon, the interaction term of ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti}$) is expected to show the significantly negative sign. Other control variables except for $SENT_{t-1}^{Mkt}$ (market-wide sentiment) in the equations are illustrated as follows. Detailed variable definitions are given in Appendix A.

Table 4 provides the analysis results of equation (15), which includes the interaction term of foreign investment horizon with firm-specific investor sentiment. If foreign investors who are regarded dedicated to a corporate monitor with long-term investment horizon play a role in reducing future stock crashes due to firm-specific investor sentiment, the coefficient of ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Fti}$) would be significantly negative, with the coefficient of $SENT_{t-1}^{Firm}$ positive.

The results show the negative coefficient of ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Fti}$) and the positive one of $SENT_{t-1}^{Firm}$. For $NCSKEW_t$ as a dependent variable, the coefficients of $SENT_{t-1}^{Firm}$ and ($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Fti}$) are 0.704 (t-statistics = 8.67) and –0.412 (t-statistics = –3.83), respectively. These results are similar even in the case of $DUVOL_t$ as a dependent variable and to those from the regression of Baseline equation that excludes other control variables.

Additionally, the analysis results presented in Table 5 and Table 6 confirm the significant effect of foreign investors in a long-term investment horizon. As shown in the estimation results of the interaction terms in the tables, the moderate effect

Table 5. Additional test: The effect of foreign ownership and foreign investment horizon

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 FOR_{t-1}^{Own} + \beta_3 FOR_{t-1}^{Lti} + \beta_4 SENT_{t-1}^{Firm} \times FOR_{t-1}^{Own} + \beta_5 SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti} + \\ +\beta_6 FOR_{t-1}^{Own} \cdot FOR_{t-1}^{Lti} + \beta_7 SENT_{t-1}^{Mkt} + \sum Control\ \ Variables + \varepsilon$$

Variables	Dep. Var. = *NCSKEW*		Dep. Var. = *DUVOL*	
	Coef.	t-stat	Coef.	t-stat
Const.	–3.314	–12.69***	–2.314	–11.27***
$SENT_{t-1}^{Firm}$	0.565	5.00***	0.448	5.36***
FOR_{t-1}^{Own}	1.440	3.58***	1.060	3.46***
FOR_{t-1}^{Lti}	0.179	4.15***	0.128	3.81***
($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own}$)	–0.289	–0.78	–0.260	–0.84
($SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti}$)	–0.343	–2.73***	–0.261	–2.58**
$SENT_{t-1}^{Mkt}$	38.099	2.19**	23.192	1.36
Control Variables	Included		Included	
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Firm clustered S.E.	Yes		Yes	
Adj.R2	0.08		0.07	
N	5,214		5,214	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for the definitions of test variables.

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Table 6. Additional test: The effect of foreign ownership growth and foreign investment horizon

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 \Delta FOR_{t-1}^{Own} + \beta_3 FOR_{t-1}^{Lti} + \beta_4 SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own} + \\ + \beta_5 SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti} + \beta_6 \Delta FOR_{t-1}^{Own} \cdot FOR_{t-1}^{Lti} + \beta_7 SENT_{t-1}^{Mkt} + \sum Control\ Variables + \varepsilon$$

Variables	Dep. Var. =NCSKEW		Dep. Var. = DUVOL	
	Coef.	t–stat.	Coef.	t–stat.
Const.	–3.580	–14.32***	–2.528	–12.81***
$SENT_{t-1}^{Firm}$	0.598	5.49***	0.469	5.78***
ΔFOR_{t-1}^{Own}	–0.423	–1.16	–0.784	–2.41**
FOR_{t-1}^{Lti}	0.111	2.85***	0.075	2.45**
$(SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own})$	0.108	0.10	0.208	0.21
$(SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti})$	–0.417	–3.81***	–0.318	–3.64***
$SENT_{t-1}^{Mkt}$	39.105	2.13**	23.853	1.35
Control Variables	Included		Included	
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Firm clustered S.E.	Yes		Yes	
Adj.R2	0.08		0.07	
N	5,214		5,214	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for the definitions of test variables.

of foreign ownership disappears, showing insignificance of $(SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own})$ (–0.289, t-statistics = –0.78) and $(SENT_{t-1}^{Firm} \cdot \Delta FOR_{t-1}^{Own})$ (0.1080, t-statistics = 0.10), while the coefficients of $(SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti})$ are still significantly negative.

The results from Table 4 to Table 6 show consistently that foreign investors are effective in future stock crash reduction as a corporate monitor dedicated in the long-term investment horizon. While foreign investors have been regarded as a corporate monitor internally and as a price setter externally, this study reveals the foreign investors' dominant role as a corporate monitor under the market sentiment state. Especially, it suggests that foreign investors as sophisticated investors act as a monitor when investing in the long term, moderating stock crash risk due to the investor sentiment.

CONCLUSION

The aim of this study is to investigate whether foreign investors as sophisticated participants in the Korean stock market moderate the future stock crash risk attributable to the firm sentiment. This study hypothesizes that the foreign investors as sophisticated participants are indifferent of the significant relationship between the sentiment and stock price crashes. For firms listed on the KSE for the period of 2011–2019, the main results show that the increased future stock price crash risk, which is attributable to the high sentiment, is attenuated for firms with high foreign ownership. However, such moderate effect disappears in the estimation, which takes foreign investment horizon into consideration. This implies that the effect of foreign investors in reducing future stock crashes is due to foreign investors dedicated to a corporate monitoring with long-term investment horizon.

This study conveys some implications to the academics and practice field. This study adds to the literature on the characteristics of foreign investors by examining the role of foreign investors under a certain market condition (i.e., the sentiment state). In particular, by resolving the limitation of previous studies that confine research setting to overlooking the role of foreign investors as external pricing setters, this study helps in a broader understanding of the role of foreign investors in the capital market. However, while this study assumes foreign investors as external price makers or as controllers for sustainable cor-

porate value are significantly linked with firm-specific sentiment, there is a limitation in that the analysis does not show the direct effect of foreign investors on firm-specific investor sentiment. In this regard, more elaborate research design and profound analysis are needed in the future.

AUTHOR CONTRIBUTIONS

Conceptualization: Heejeong Shin.
Data curation: Su-Young Choi.
Formal analysis: Heejeong Shin, Su-Young Choi.
Investigation: Su-Young Choi.
Project administration: Heejeong Shin.
Resources: Su-Young Choi.
Software: Su-Young Choi.
Supervision: Heejeong Shin.
Validation: Su-Young Choi.
Writing – original draft: Heejeong Shin.
Writing – review & editing: Heejeong Shin.

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APPENDIX A

Table A1. Variable definitions

Dependent Variables	
$NCSKEW_{t}$.	Stock crash risk, measured as negative skewness in firm-specific returns distribution in year ***t***
$DUVOL_{t}$	Stock crash risk, measured as relative volatility for upward/onward returns in year ***t***
Independent variables	
$SENT_{t-1}^{Firm}$	Firm-specific investor sentiment, as the composite index that is based on five proxies for investor sentiment: the daily relative strength index (RSI), psychological line index (PLI), adjusted turnover rate (ATR), the logarithm of trading volume (LTV), and individual buy-sell imbalance (IBSI)
FOR_{t-1}^{Own}	Foreign investor ownership at the end of year ***t***-1
FOR_{t-1}^{Lti}	Foreign investing tendency, the indicator of 1 if average turnover of foreigners in year ***t***-1 is over median value, and 0 otherwise
$SENT_{t-1}^{Mkt}$	Market-wide sentiment, measured as the market-based arithmetic average of firm-specific investor sentiments ($SENT_{t-1}^{Firm}$) in year ***t***-1
$SIZE_{t-1}$	Firms size, measured as the natural log value of total assets in year ***t***-1
LEV_{t-1}	Firms leverage, measured as total liabilities to total assets ratio in year ***t***-1
ROA_{t-1}	Return on assets, measured as net income divided by average total assets in year ***t***-1
CFO_{t-1}	Cash flows from operation based on the cash flow statement in year ***t***-1
MTB_{t-1}	Firm growth, measured as market value to book value ratio in year ***t***-1
$\Delta SALES_{t-1}$	Sales growth, measured as the percentage change in sales at year ***t***-1
$LOSS_{t-1}$	Financia loss, the indicator 1 if net income at year ***t***-1 is less than 0, and 0 otherwise
$\|DA\|_{t-1}$	Accounting information opacity, measured as the accumulation of absolute value of accruals for prior three-consecutive years following Hutton et al. (2009)
$SIGMA_{t-1}$	The standard deviation of firm-specific weekly returns
RET_{t-1}	The average firm-specific weekly returns at year ***t***-1
$TURN_{t-1}$	The detrended share turnover, measured as the change of share turnover between year t and ***t***-1
$NCSKEW_{t-1}$	Negative skewness in firm-specific returns distribution at year ***t***-1

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APPENDIX B

Table B1. Pearson correlation matrix (n = 5,308)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)$NCSKEW_t$	–	0.915 (<.0001)	0.122 (<.0001)	–0.028 (0.039)	0.128 (<.0001)	0.110 (<.0001)	0.219 (<.0001)	–0.002 (0.870)	0.059 (<.0001)	0.040 (0.004)	0.062 (<.0001)	0.003 (0.809)	–0.066 (<.0001)	0.001 (0.917)	–0.064 (<.0001)	0.040 (0.003)	0.048 (0.001)	0.054 (<.0001)
(2)$DUVOL_t$	–	–	0.112 (<.0001)	–0.020 (0.152)	0.109 (<.0001)	0.090 (<.0001)	0.196 (<.0001)	–0.001 (0.916)	0.040 (0.004)	0.014 (0.314)	0.062 (<.0001)	–0.014 (0.317)	–0.048 (0.000)	0.012 (0.388)	–0.039 (0.004)	0.036 (0.009)	0.052 (0.000)	0.046 (0.001)
(3)$SENT_{t-1}^{Firm}$	–	–	–	0.005 (0.725)	0.147 (<.0001)	0.000 (0.988)	0.106 (<.0001)	–0.106 (<.0001)	0.279 (<.0001)	0.215 (<.0001)	0.124 (<.0001)	0.130 (<.0001)	–0.242 (<.0001)	–0.022 (0.106)	0.124 (<.0001)	0.679 (<.0001)	0.198 (<.0001)	–0.324 (<.0001)
(4) $SENT_{t-1}^{Mkt}$	–	–	–	–	0.014 (0.311)	–0.002 (0.859)	0.019 (0.166)	–0.017 (0.225)	–0.003 (0.817)	–0.057 (<.0001)	–0.034 (0.012)	0.029 (0.035)	0.008 (0.553)	–0.038 (0.006)	–0.188 (<.0001)	–0.132 (<.0001)	–0.062 (<.0001)	0.019 (0.156)
(5)FOR_{t-1}^{Own}	–	–	–	–	–	0.478 (<.0001)	0.488 (<.0001)	–0.126 (<.0001)	0.253 (<.0001)	0.276 (<.0001)	0.146 (<.0001)	0.014 (0.323)	–0.177 (<.0001)	–0.050 (0.000)	–0.220 (<.0001)	–0.045 (0.001)	0.000 (0.985)	0.108 (<.0001)
(6)FOR_{t-1}^{Lte}	–	–	–	–	–	–	0.344 (<.0001)	–0.209 (<.0001)	0.210 (<.0001)	0.173 (<.0001)	–0.143 (<.0001)	–0.015 (0.260)	–0.193 (<.0001)	–0.100 (<.0001)	–0.426 (<.0001)	–0.136 (<.0001)	–0.042 (0.002)	0.162 (<.0001)
(7)$SIZE_{t-1}$	–	–	–	–	–	–	–	0.248 (<.0001)	0.176 (<.0001)	0.166 (<.0001)	–0.084 (<.0001)	0.024 (0.078)	–0.146 (<.0001)	–0.114 (<.0001)	–0.270 (<.0001)	–0.139 (<.0001)	–0.009 (0.510)	0.199 (<.0001)
(8)LEV_{t-1}	–	–	–	–	–	–	–	–	–0.342 (<.0001)	–0.198 (<.0001)	0.047 (0.001)	0.009 (0.530)	0.303 (<.0001)	0.097 (<.0001)	0.212 (<.0001)	–0.053 (<.0001)	0.014 (0.299)	0.007 (0.610)
(9)ROA_{t-1}	–	–	–	–	–	–	–	–	–	0.503 (<.0001)	–0.032 (0.021)	0.185 (<.0001)	–0.690 (<.0001)	–0.073 (<.0001)	–0.305 (<.0001)	0.163 (<.0001)	–0.024 (0.074)	–0.044 (0.001)
(10)CFO_{t-1}	–	–	–	–	–	–	–	–	–	–	0.099 (<.0001)	0.102 (<.0001)	–0.365 (<.0001)	–0.089 (<.0001)	–0.195 (<.0001)	0.092 (<.0001)	–0.004 (0.750)	0.010 (0.477)
(11)MTB_{t-1}	–	–	–	–	–	–	–	–	–	–	–	0.070 (<.0001)	0.058 (<.0001)	0.166 (<.0001)	0.257 (<.0001)	0.109 (<.0001)	–0.008 (0.557)	0.002 (0.870)
(12)$\Delta SALES_{t-1}$	–	–	–	–	–	–	–	–	–	–	–	–	–0.164 (<.0001)	0.062 (<.0001)	0.022 (0.104)	0.136 (<.0001)	–0.021 (0.129)	–0.070 (<.0001)
(13)$LOSS_{t-1}$	–	–	–	–	–	–	–	–	–	–	–	–	–	0.071 (<.0001)	0.261 (<.0001)	–0.144 (<.0001)	0.004 (0.785)	0.034 (0.012)
(14)$\|DA\|_{t-1}$	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.139 (<.0001)	0.033 (0.017)	–0.023 (0.095)	–0.009 (0.525)
(15)$SIGMA_{t-1}$	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.428 (<.0001)	0.360 (<.0001)	–0.359 (<.0001)
(16)RET_{t-1}	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.373 (<.0001)	–0.595 (<.0001)
(17)$TURN_{t-1}$	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–0.206 (<.0001)

Note: This table presents the results of Pearson correlation analysis. The figures in parentheses are p-values. Please refer to Appendix A for variable definitions.

Table B2. The effect of firm-specific investor sentiment on stock price crash risk

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const + \beta_1 SENT_{t-1}^{Firm} + \beta_2 SENT_{t-1}^{Mkt} + \Sigma Control\,Variables + \varepsilon,$$

Variables	Dep. Var. = *NCSKEW*				Dep. Var. = *DUVOL*			
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Const.	–0.595	–2.57**	–3.543	–9.93***	–0.272	–1.54	–2.480	–8.93***
$SENT_{t-1}^{Firm}$	0.499	9.50***	0.309	3.74***	0.359	8.65***	0.261	4.23***
$SENT_{t-1}^{Mkt}$	68.600	1.21	48.339	0.81	29.835	0.68	29.229	0.64
$SIZE_{t-1}$	–	–	0.157	12.98***	–	–	0.114	11.9***
LEV_{t-1}	–	–	–0.364	–3.95***	–	–	–0.299	–4.50***
ROA_{t-1}	–	–	–0.420	–1.22	–	–	–0.283	–1.12
CFO_{t-1}	–	–	–0.595	–2.72***	–	–	–0.635	–3.70***
MTB_{t-1}	–	–	0.091	5.93***	–	–	0.068	5.72***
$\Delta SALES_{t-1}$	–	–	–0.058	–1.00	–	–	–0.095	–2.01**
$LOSS_{t-1}$	–	–	–0.056	–1.22	–	–	–0.036	–1.02
$\|DA\|_{t-1}$	–	–	0.618	1.60	–	–	0.665	2.24**
$SIGMA_{t-1}$	–	–	–2.579	–2.87***	–	–	–1.253	–1.88*
RET_{t-1}	–	–	6.104	1.57	–	–	2.629	0.97
$TURN_{t-1}$	–	–	4.015	2.88***	–	–	3.015	2.88***
$NCSKEW_{t-1}$	–	–	0.045	2.42**	–	–	0.029	2.17**
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
Firm clustered S.E.	Yes		Yes		Yes		Yes	
Adj.R2	0.02		0.08		0.02		0.07	
N	5,308		5,308		5,308		5,308	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for definitions of test variables.

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Table B3. The effect of firm-specific investor sentiment on stock price crash risk: The role of foreign investors

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const. + \beta_1 SENT_{t-1}^{Firm} + \beta_2 FOR_{t-1}^{Own} + \beta_3 SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own} + \beta_4 SENT_{t-1}^{Mkt} + \text{Control Variables} + \varepsilon$$

Variables	Dep. Var. = *NCSKEW*				Dep. Var. = *DUVOL*			
	Baseline		Equation (12)		Baseline		Equation (12)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Intercept	–0.762	–3.27***	–3.597	–10.13***	–0.386	–2.18**	–2.521	–9.17***
$SENT_{t-1}^{Firm}$	0.523	7.85***	0.405	4.34***	0.382	7.35***	0.332	4.77***
FOR_{t-1}^{Own}	0.976	6.83***	–0.064	–0.16	0.652	6.32***	-0.078	–0.24
$(SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own})$	–0.935	–2.54**	–0.994	–2.79***	–0.696	–2.41**	-0.742	–2.62***
$SENT_{t-1}^{Mkt}$	82.190	1.44	58.602	0.98	39.677	0.90	36.878	0.81
$SIZE_{t-1}$	–	–	0.157	13.07***	–	–	0.114	12.02***
LEV_{t-1}	–	–	–0.361	–3.93***	–	–	–0.297	–4.48***
ROA_{t-1}	–	–	–0.403	–1.17	–	–	–0.270	–1.07
CFO_{t-1}	–	–	–0.577	–2.64***	–	–	–-0.622	3.64***
MTB_{t-1}	–	–	0.094	6.11***	–	–	0.070	5.92***
	–	–	–0.061	–1.06	–	–	–0.097	–2.06**
$LOSS_{t-1}$	–	–	–0.050	–1.08	–	–	–0.031	–0.88
$\|DA\|_{t-1}$	–	–	0.638	1.65*	–	–	0.680	2.30**
$SIGMA_{t-1}$	–	–	–2.597	–2.88***	–	–	–1.266	–1.89*
RET_{t-1}	–	–	5.988	1.54	–	–	2.533	0.93
$TURN_{t-1}$	–	–	3.848	2.75***	–	–	2.893	2.74***
$NCSKEW_{t-1}$	–	–	0.044	2.36**	–	–	0.028	2.10**
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
Firm clustered S.E.	Yes		Yes		Yes		Yes	
Adj.R2	0.03		0.08		0.03		0.07	
N	5,308		5,308		5,308		5,308	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for definitions of test variables.

Table B4. Additional test: The role of foreign investors (foreign investment horizon)

$$CRASH_t\left(NCSKEW_t \text{ or } DUVOL_t\right) = Const. + \beta_1 SENT_{t-1}^{Firm} + \beta_2 FOR_{t-1}^{Own} + \beta_3 SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Own} + \beta_4 SENT_{t-1}^{Mkt} + \text{Control Variables} + \varepsilon$$

Variables	Dep. Var. = *NCSKEW*				Dep. Var. = *DUVOL*			
	Baseline		Eq. (2)		Baseline		Eq. (2)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Const.	–0.749	–3.23***	–3.649	–10.31***	–0.390	–2.20**	–2.581	–9.40***
$SENT_{t-1}^{Firm}$	0.704	8.67***	0.598	5.23***	0.517	8.34***	0.491	5.78***
FOR_{t-1}^{Lti}	0.231	7.45***	0.066	1.83*	0.148	6.30***	0.045	1.58
$(SENT_{t-1}^{Firm} \cdot FOR_{t-1}^{Lti})$	–0.412	–3.83***	–0.443	–4.08***	–0.316	–3.73***	–0.350	–4.07***
$SENT_{t-1}^{Mkt}$	77.235	1.36	71.614	1.20	39.814	0.91	51.378	1.13
Control Variables	No		Yes		No		Yes	
Year fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
Firm clustered S.E.	Yes		Yes		Yes		Yes	
Adj.R2	0.03		0.08		0.03		0.07	
N	5,214		5,214		5,214		5,214	

Note: t-statistics are calculated based on firm-clustered standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively. Please refer to Appendix A for definitions of test variables.

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