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Media Tone and Stock Price Crash Risk: Evidence from China

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Abstract: Following the 2008 financial crisis, multiple studies have contributed to the research on stock price crashes. However, most of the studies on stock price crashes are from the corporate management perspective, focusing on factors such as the board's character, the CEO's power, the brand's capital, and ESG performance. Few studies have taken external information, such as media coverage, into consideration. Meanwhile, in the era of 5G, internet media has witnessed exponential growth, heavily enhancing the speed of information transmission; this could possibly impact the future risk associated with stock price crashes. From this perspective, our study extends the coverage by investigating the relationship between internet media coverage and the potential risk of stock price crashes. Using a comprehensive dataset of the Chinese stock market from 2008 to 2021, we found that the optimistic (pessimistic) tones of internet media were positively (negatively) correlated with the future risk of crashes. These findings remained firm after accounting for winsorization, corporate governance control, firm fixed effects, and instrumental variable analysis. Further analyses showed that media tone impacts were more pronounced for firms with higher analyst coverage. Our study indicates that investors, especially retail investors, who are more easily influenced by internet media, should be more cautious about the increasingly favorable internet coverage of listed companies, which could result in a heightened future risk of stock price crashes. Moreover, regulators should inform investors when listed companies are experiencing more favorable internet coverage to minimize potential stock market fluctuations and investment losses for investors.

Keywords: risk of stock price crash; internet media tone; corporate governance; analyst coverage

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1. Introduction

Stock price crashes are a significant concern for financial markets, as they can lead to considerable shocks and losses for enterprises and investors, culminating in social and economic instability. As a result, stock price crashes have garnered widespread attention from scholars. Prior studies have argued that the risk of stock price crashes originates from the intensive release of bad news about a corporation previously concealed by its management. Specifically, managers are more willing to withhold bad news from shareholders and investors due to executive compensation and personal reputation. If bad news accumulates to a certain level, this information would flood the capital market, causing stock price crashes [1–26]. Taking this view, numerous studies have identified internal corporate characteristics that can impact stock price crashes, including firm digitalization [2,6], the board's character [1,12], the CEO's power [3], the brand's capital [4], the ESG performance [5,10], Confucianism [27], and media coverage [28]. However, an increasing number of researchers have observed that external factors, such as economic policy uncertainty [7],

investor attention [29], the impact of COVID-19 [8], and individual investor sentiment [30], also have a strong influence on the potential risk of stock price crashes.

The media, commonly viewed as a watchdog for corporate fraud, plays a vital role in diffusing information regarding corporate management (Aman [28]; Miller [31]). Specifically, studies have found that media coverage reduces information asymmetry (Bushee et al. [32]) and insider trading (Dai et al. [33]). Such evidence indicates that firms with higher media coverage would be more transparent with stakeholders, as there is a possible influence on the risk of future stock price crashes. However, only a few studies have investigated the correlation between media coverage and the risk exposure of a firm. Furthermore, with the development of 5G technology, internet media has experienced prodigious growth. The rapid development of internet media has broken the information monopoly and promoted the speed of information transmission. Considering its dominant position in the contemporary communication age and the overwhelming weight of individual investors on the Chinese stock market, our study broadens the scope of media coverage research in the realm of risk management by investigating the relationship between internet media coverage and the potential risk of stock price crashes.

In this paper, we calculated the ratios of three different tones (positive, neutral, and negative) in internet media coverage to discern whether media tones could predict the risk of future stock price crashes. We used two widely used risk indicators for stock price crashes, as introduced by Chen et al. [34] and Kim et al. [35,36], and connected them with three different tones in internet media coverage. Furthermore, to eliminate the numerical magnitude effect, we took the tone ratios—calculated as each tone's coverage relative to the total coverage—as a gauge of tone levels. We employed a regression analysis between the tone ratios and stock price crash risk and found that positive and negative media coverage were positively and negatively correlated with the stock price crash risk. No significance was detected between neutral media coverage and stock price crash risk. In addition, we performed several robustness checks, such as winsorization, firm fixed effects, additional corporate governance, control factors, and instrumental variable analysis, to confirm the credibility of our empirical findings. The results were consistent with prior findings, proving the solidness of our findings. Furthermore, to discern whether the corporate information environment can mitigate the correlation between media coverage and stock price crash risk, we performed a heterogeneity test on the analysts' coverage by dividing the entire sample into low- (high-) sub-samples and rechecked the correlations between the three media tones and the stock price crash risk, respectively. The results of the heterogeneity test indicated that media tones influenced future stock price crash risk. This effect was more pronounced for stocks with high analyst coverage, underscoring the intermediary information function that reduces information asymmetry.

Our study contributes to the literature from three perspectives. First, our study extends the growing literature regarding the determinants of stock price crash risks. Prior studies usually were performed from the perspective of internal corporate characteristics, such as management's behavior (Hu et al. [1]; Jiang et al. [2]; Al et al. [3]; Hasen et al. [4]). However, our study provides evidence that external information, such as the media's tone, would also be helpful in the discovery of the future stock price crash risk. Second, existing media-coverage studies are generally derived from the asset pricing field (Fang and Peress [37]; Guldiken et al. [38]; Huang and Zhang [39]; Shyu et al. [40]; Jang and Kang [41]; Dang et al. [42]). Few studies have investigated the real effects of media coverage on firm-specific risks. Our study fills the gap in the examination of the relationship between internet media coverage and stock price crash risk. In this paper, we employed a large sample of Chinese internet media coverage to investigate the influence of tone on the future stock price crash risk. The empirical findings showed that internet media coverage influenced the future stock price crash risk. Third, different from prior media-coverage studies that focused on traditional media (Li et al. [43]), such as newspapers, in this paper, we took a different approach by examining the impact of the predominant internet media coverage on stock price crash risk. Furthermore, in the process of media coverage diffusion and

dissemination, different media tones will have different implications. With this view, we classify internet media coverage into three different tones, which have more practical and detailed implications for both investors and regulators in the Web 3.0 era.

The rest of this paper is organized as follows. Section 2 presents the review of related literature and the hypothesis of this paper. Section 3 presents the data, variable measurements, and research design. Section 4 illustrates the empirical results and further analysis. Section 5 concludes the paper.

2. Literature Review and Hypothesis

2.1. Stock Price Crash Risk

Prior studies have identified the agency behaviors of management, which involve concealing operating losses and other unfavorable news as the primary cause of stock price crash risk (Jin and Myers [44]; Hutton et al. [45]; Kothari et al. [46]). With this view, considerable stock price crash risk studies originate from the corporate management perspective, considering factors such as corporate digital transformation and board reforms. Jiang et al. [2] investigate the impact of digital transformation at listed companies on capital markets. They find that listed companies with higher digital transformation levels will be more transparent and have better internal control quality, which will result in lower future stock price crash risk. Hu et al. [1] examine the relationship between firm board reform and the risk of future stock price crashes. They find that board reform will significantly reduce future stock price crash risk, especially for firms with severe ex-ante agency problems. They also find that board reform will generate less financial opacity and improve investment efficiency, resulting in reduced crash risk. Al et al. [3] study CEO power and stock price crash risk. They find that the more power that CEOs have, the higher the stock price crash risk, especially for CEOs whose compensations are more sensitive to fluctuations in stock prices. CEOs—faced with declining stock price pressures, have strong incentives to restate the financial statements and reduce the negative words in the reports, possibly camouflaging looming threats to the firms' future performance and precipitating stock price crashes. Hasen et al. [4] investigate the relationship between brand capital and stock price crash risk. They find that firms with substantial brand capital experience more stable stock prices, with fewer crash risks for the investors. Also, they find that the phenomenon is more pronounced when the company governance structure is weak. The authors attribute these results to the increasing exposure of firms to investor and customer scrutiny, resulting in more transparency and less managerial opportunistic behavior, reducing the stock price crash risk.

Additionally, recent studies have found that external factors, such as economic policy uncertainty and investor attention, have significant impacts on the future stock price crash risk. Luo and Zhang [7] investigate the economic policy uncertainty and stock price crash risk in China's stock market. They find that, for highly volatile, small, or young stocks, it will be easier to encounter the stock price crash risk event when the economic policy uncertainty level is high. Wen et al. [29] employ the mainstream Baidu index as the measurement for retail investor attention and connect it with the firm stock price crash risk. They find that the stock price crash risk could be reduced with increased attention from retail investors. Also, they find that a high-quality auditing company would be less impacted by the influence of retail investor attention on the future stock price crash risk. Huang and Liu [8] examine the impact of COVID-19 on stock price crash risks for energy companies. They find that, in the post-COVID-19 period, the stock price crash risks of energy firms have been significantly alleviated. The alleviation would be more prominent for firms with high corporate social responsibility and state-owned enterprises. Yang et al. [30] investigate the role of investor sentiment in stock price crashes. They construct daily panic indices through a text mining analysis of nearly one million message board posts from China's largest stock discussion forum. They find that the pandemic index is significant in predicting stock price crashes, especially for firms with lower information disclosure transparency and lower institutional investor holdings.

2.2. Media Tone

Media coverage can play a vital role in reporting company information and investigating events related to companies. First, media coverage can reduce the cost of information collection for investors and alleviate information asymmetry by facilitating the disclosure, collection, and dissemination of information (Fang and Peress [37]). Second, media coverage can supervise and constrain the behavior of company management (Miller [31]; Dyck et al. [47]; Joe et al. [48]). Based on these media coverage factors, empirical studies have examined its impact on asset pricing, such as stock return and liquidity. For example, Fang and Peress [37] examine the relationship between media coverage and cross-sectional stock returns. They find that stocks with high media coverage earn much less returns compared to non-media coverage stocks. They also find that the phenomenon is more evident in small- and low analyst-following stocks. Guldiken et al. [38] examine the effect of media coverage tone on the stock performance of an IPO firm before and after its listing. They find that coverage from a reliable media agency could significantly impact the stock IPO price. Also, the media tone fluctuation could impact the stock price in an adverse direction. Shyu et al. [40] study the influence of media coverage on stock liquidity. They find that stock liquidity significantly reduces during the earnings announcement period when earnings dispersion is disseminated by the media. They also find that individual investors show different trading patterns compared to institutional investors, by providing less liquidity for stocks with pronounced media-driven earnings dispersion. Dang et al. [42] examine the relationship between media coverage and stock price synchronicity on an international scale. They find that stocks with high media coverage demonstrate less stock price synchronicity. Also, they find that firms with worse internal governance and a less transparent information environment could more easily encounter a negative correlation between media coverage and stock price synchronicity, especially in countries with weak institutional infrastructures.

However, as an emerging economy, China's media reports are not impartial due to the immature development of its judicial system. In 2014, one of China's major business press licenses was revoked due to the extortion of money from listed companies in return for favorable news. Li et al. [43] study traditional media tone bias on firm-specific stock price crash risk. They find that favorably biased traditional media coverage could precipitate increased stock price crash risks, especially for firms with higher operating costs, such as high advertising expenditures. Aman [28] uses four prevailing Japanese newspaper reports (as a proxy for media coverage) and investigates their relationship with stock price crashes in the Japanese stock market. The author finds that a high density of media coverage of firms may trigger more stock price crash risks, with an increased frequency of crash events, showing the powerful influence of media coverage on the stock market. Meanwhile, An et al. [24] conduct a study between media coverage and stock price crash risk in the US stock market. They find that, with increased media reports, the stock price crash risk could be significantly reduced. They also find that the results are more pronounced for firms that receive less external scrutiny, for instance, those with less analyst coverage or a lower proportion of institutional investors. He et al. [11] investigate the media coverage and stock price crash risk from a message board perspective. They find that, as the number of firm posts on the message board increases, the future stock price crash risk is significantly alleviated. This effect can be attributed to the message board's role as an information intermediary and its external corporate governance function. For example, Qiao et al. [49] study the influence of CEO media exposure on crash risk. They find that CEO media exposure could significantly reduce the future stock price crash risk, confirming the external monitoring role of firm behavior in China's stock market. Based on the mentioned discussions above, we propose the following hypothesis:

Hypothesis 1 (H1). *Companies with more favorable (or adverse) news may be confronted with an increased (or reduced) risk of future firm-specific stock price crashes.*

3. Research Design

3.1. Data Description

Our sample consists of all the listed stocks on the Chinese stock market from 1 January 2008 to 31 December 2021. The media tone data, including optimistic, neutral, and pessimistic coverage numbers from more than 400 online media companies mainly used by investors, are from Chinese Research Data Services. The financial data, such as weekly stock returns, are taken from CSMAR. For sample accuracy, financial firms—especially treated firms, firms with annual trading weeks of less than 30 weeks, and firms with missing data—are excluded. The final sample contains 29,524 firm–year observations.

3.2. Measuring of Price Crash

Following the work by Kim et al. [35], we use the prevailing negative conditional return skewness (NCSKEW) and down-to-up volatility (DUVOL) as indicators of stock price crash risk.

First, for each firm and year, we calculate the firm-specific weekly return. This is done by taking one plus the natural log value of the residual from the following expanded market model regression:

$$R_{i,\tau} = \alpha_i + \beta_1 R_{m,\tau-2} + \beta_2 R_{m,\tau-1} + \beta_3 R_{m,\tau} + \beta_4 R_{m,\tau+1} + \beta_5 R_{m,\tau+2} + \varepsilon_{i,\tau} \quad (1)$$

where $R_{i,\tau}$ is the weekly stock return of firm i in week τ, $R_{m,\tau}$ is the value-weighted market weekly stock return in week τ, and $\varepsilon_{i,\tau}$ is the residual term. Then, the firm-specific weekly return $w_{i,\tau}$ for firm i in a week τ is calculated as

$$w_{i,\tau} = \ln(1 + \varepsilon_{i,\tau}) \quad (2)$$

and the crash indicator, NCSKEW, is calculated as

$$\text{NCSKEW}_{i,t} = -\left[n(n-1)^{\frac{3}{2}} \sum W_{i,\tau}^3\right] / \left[(n-1)(n-2)\left(\sum W_{i,\tau}^2\right)^{3/2}\right] \quad (3)$$

where n is the number of trading weeks of stock i in year t.

The other crash risk indicator, DUVOL, is calculated as

$$DUVOL_{i,t} = \ln\left\{\frac{\left[(n_u - 1)\sum_{\text{down}} W_{i,\tau}^2\right]}{\left[(n_d - 1)\sum_{up} W_{i,\tau}^2\right]}\right\} \quad (4)$$

where n_d (n_u) is the number of "down" ("up") trading weeks of stock i in year t. The higher values of $NCSKEW_{i,t}$ indicate more left skewness of the firm returns, suggesting higher stock crash risk. Moreover, for $DUVOL_{i,t}$, higher values also indicate higher stock crash risks.

3.3. Measuring of the Internet Media

In this paper, to obtain a quantitative measurement of the media tone level, we take the media ratio (opt,neu,pes) as the proxy; the ratio is calculated as follows:

$$\text{opt(neu,pes)ratio} = \frac{\text{the number of optimistic (neutral, pessimistic) news from the internet media}}{\text{all internet coverage}} \quad (5)$$

3.4. Model

To examine the correlation between the media tone and future stock price crash risk, we estimate two regressions:

$$\text{NCSKEW}_t = \alpha_0 + \beta_1 \text{opt(neu,pes)}_{t-1} + \sum_{q=2}^{10} \beta_q (q \text{ th ControlVariable}_{t-1}) + \varepsilon_t \quad (6)$$

$$\mathrm{DUVOL}_t = \alpha_0 + \beta_1 \mathrm{opt(neu,pes)}_{t-1} + \sum_{q=2}^{10} \beta_q (q \text{ th ControlVariable}_{t-1}) + \varepsilon_t \quad (7)$$

where $opt(neu, pes)_{t-1}$ represents the optimistic (opt_{t-1}) neutral (neu_{t-1}) or pessimistic (pes_{t-1}) media tone ratio from internet media, calculated as the tone number over the total number. For other control variables, following the work by Kim et al. [35], we adopt nine control variables, which include the average weekly specific return in year $t-1$ (RET_{t-1}), the standard deviation of the weekly specific return ($SIGMA_{t-1}$), the return on assets (ROA_{t-1}), financial leverage (LEV_{t-1}), the book-to-market ratio (BM_{t-1}), the firm size ($SIZE_{t-1}$), detrended share turnover ($DTURN_{t-1}$), the absolute value of abnormal accruals ($ABACC_{t-1}$), and NCSKEW in years $t-1$($NCSKEW_{t-1}$). In the regressions, we control the year fixed effects and industry fixed effects. Detailed variable definitions are presented in Appendix A.

4. Empirical Results

4.1. Media Tone and Stock Price Crash Risk

Table 1 presents the regressions results of the media tone on the future stock price crash risk. Coefficients on the optimistic media tone from the internet are positive and significant at the 1% level, and coefficients on the pessimistic media tone are negative and significant at the 1% level. These results indicate that the listed companies receiving more positive (or negative) internet media coverage may be more (or less) likely to experience future stock price crash risk. The results above show strong evidence in support of Hypothesis 1.

Table 1. Main results. This table presents the results of the impact of internet media tone on crash risk with panel regressions under year and industry fixed effects. The Hausman test results significantly support the implementation of fixed effects. The t-statistics are displayed in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

Dep. Var.=	**NCSKEW**			**DUVOL**		
opt	0.075 ***			0.053 ***		
	(2.58)			(2.83)		
neu		0.002			−0.011	
		(0.04)			(−0.48)	
pes			−0.087 ***			−0.053 ***
			(−2.80)			(−2.64)
RET	0.197 **	0.203 **	0.201 **	0.155 **	0.158 ***	0.158 ***
	(2.10)	(2.16)	(2.15)	(2.56)	(2.62)	(2.62)
SIGMA	2.804 ***	2.826 ***	2.850 ***	1.711 ***	1.719 ***	1.741 ***
	(4.31)	(4.34)	(4.38)	(4.08)	(4.10)	(4.15)
ROA	0.290 ***	0.317 ***	0.286 ***	0.207 ***	0.226 ***	0.207 ***
	(4.26)	(4.70)	(4.19)	(4.73)	(5.21)	(4.72)
LEV	−0.071 **	−0.071 **	−0.070 **	−0.040 **	−0.041 **	−0.040 **
	(−2.52)	(−2.53)	(−2.51)	(−2.23)	(−2.24)	(−2.23)
BM	−0.278 ***	−0.280 ***	−0.280 ***	−0.129 ***	−0.131 ***	−0.131 ***
	(−10.43)	(−10.53)	(−10.51)	(−7.54)	(−7.63)	(−7.62)
SIZE	0.019 ***	0.019 ***	0.018 ***	−0.005	−0.004	−0.005
	(3.70)	(3.81)	(3.54)	(−1.44)	(−1.28)	(−1.55)
DTURN	−0.038 ***	−0.038 ***	−0.038 ***	−0.025 ***	−0.025 ***	−0.024 ***
	(−3.89)	(−3.87)	(−3.85)	(−3.88)	(−3.86)	(−3.84)
ABACC	0.045 *	0.045 *	0.044 *	0.025	0.025	0.025
	(1.84)	(1.84)	(1.83)	(1.62)	(1.62)	(1.61)
NCSKEW	0.057 ***	0.056 ***	0.057 ***	0.033 ***	0.033 ***	0.033 ***
	(9.39)	(9.29)	(9.40)	(8.52)	(8.41)	(8.52)
Constant	−0.477 ***	−0.452 ***	−0.408 ***	0.050	0.069	0.094
	(−3.92)	(−3.73)	(−3.34)	(0.63)	(0.88)	(1.20)
Hausman chi-square	4858.490	4912.020	4897.870	3590.030	3634.790	3612.730
Year fixed effect				YES		
Industry fixed effect				YES		
N	29,524	29,524	29,524	29,524	29,524	29,524
R-square	0.057	0.057	0.057	0.064	0.064	0.064

4.2. Robustness Tests

In this section, to improve the credibility of our findings, we re-estimate the influence of three tones of internet media coverage on the future stock crash price risk with winsorizing variables, controlling for additional variables, firm fixed effects, and instrumental analysis. Tables 2–5 present regression results with four robustness checks, respectively.

Table 2. Robust regression with winsorization. This table presents the influence of media tone on crash risk in the presence of winsorization. The variables are winsorized at the 1% level. The t-statistics are displayed in parentheses. *** and ** indicate statistical significance at 1% and 5% levels.

Dep. Var.=	**NCSKEW**			**DUVOL**		
opt	0.064 **			0.045 **		
	(2.32)			(2.48)		
neu		0.005			−0.011	
		(0.15)			(−0.46)	
pes			−0.077 ***			−0.044 **
			(−2.61)			(−2.28)
Control variables				YES		
Year fixed effects				YES		
Industry fixed effects				YES		
N	29,524	29,524	29,524	29,524	29,524	29,524
R-squared	0.061	0.061	0.061	0.066	0.066	0.066

Table 3. Robust regression with corporate governance control. This table presents the influence of media tone on crash risk in the presence of corporate governance control. The variable $lnboardsize_{t-1}$ is the logarithm representing the number of directors on the board, $independence_{t-1}$ is the proportion of independent directors on the board, and $duality_{t-1}$ is a dummy variable used to measure whether the CEO holds the position of the chair of the board or not. Detailed variable definitions are presented in Appendix A. The t-statistics are displayed in parentheses. *** and ** indicate statistical significance at 1% and 5% levels.

Dep. Var.=	**NCSKEW**			**DUVOL**		
opt	0.075 ***			0.053 ***		
	(2.60)			(2.84)		
neu		0.001			−0.012	
		(0.02)			(−0.49)	
pes			−0.087 ***			−0.053 ***
			(−2.81)			(−2.64)
lnboardsize	−0.018	−0.018	−0.018	−0.015	−0.015	−0.015
	(−0.96)	(−1.00)	(−0.97)	(−1.24)	(−1.28)	(−1.26)
independence	0.011	0.011	0.011	0.007	0.006	0.007
	(0.19)	(0.16)	(0.18)	(0.18)	(0.15)	(0.17)
duality	0.034 ***	0.033 ***	0.034 ***	0.017 **	0.017 **	0.017 **
	(3.25)	(3.22)	(3.23)	(2.51)	(2.48)	(2.49)
Control variables				YES		
Year fixed effects				YES		
Industry fixed effects				YES		
N	29,522	29,522	29,522	29,522	29,522	29,522
R-squared	0.057	0.057	0.057	0.065	0.064	0.065

4.2.1. Winsorizing Some Variables

To reduce possible outlier errors, we winsorize variables at the 1% levels and repeat the regressions based on Equations (6) and (7). The results presented in Table 2 indicate that the positive (or negative) internet media coverage exhibits a significant positive (or negative) impact on the future stock price crash risk; the results are the same as the results in Table 1.

Table 4. Robust regression with firm fixed effects. This table presents the influence of media tone on crash risk, accounting for firm fixed effects. The t-statistics are displayed in parentheses. *** and ** indicate statistical significance at 1% and 5% levels.

Dep. Var.=	NCSKEW			DUVOL		
opt	0.072 **			0.053 **		
	(2.19)			(2.46)		
neu		0.039			0.013	
		(0.94)			(0.49)	
pes			−0.109 ***			−0.068 ***
			(−3.12)			(−3.02)
Control variables				YES		
Year fixed effects				YES		
Industry fixed effects				YES		
Firm fixed effects				YES		
N	29,524	29,524	29,524	29,524	29,524	29,524
R-squared	0.203	0.203	0.203	0.201	0.201	0.201

Table 5. Robust regression with instrumental variable analysis. This table presents the influence of media tone on crash risk in the presence of instrumental variable analysis. The analysis is carried out with the prevailing two-stage least square regression. *Median opt* and *Median pes*, the industry median ratio of both optimistic and pessimistic media coverage, pass the weak instrument tests (F-statistics = 1048.210, 902.588, 1145.780), and are chosen as instrumental variables. The t-statistics are displayed in parentheses. *** indicates statistical significance at 1% level.

Dep. Var.=	opt	pes	NCSKEW		DUVOL	
	1st Stage	1st Stage	2nd Stage	2nd Stage	2nd Stage	2nd Stage
Median opt	0.750 ***					
	(32.38)					
Median pes		0.746 ***				
		(33.85)				
opt			0.605 ***		0.505 ***	
			(3.85)		(4.97)	
pes				−1.048 ***		−0.809 ***
				(−6.43)		(−7.65)
Control variables				YES		
Year fixed effects				YES		
Industry fixed effects				YES		
N	29,524	29,524	29,524	29,524	29,524	29,524
R-squared	0.139	0.157	0.046	0.027	0.046	0.019

4.2.2. Controlling More Variables

To prove that the results are robust, we further add several corporate governance variables to avoid endogeneity problems caused by missing variables. Xu et al. [50] document that corporate governance indicators, such as board size, exhibit a possible influence on the future stock price crash risk. With this view, we introduce another three corporate governance indicators, $lnboardsize_{t-1}$, $independence_{t-1}$, and $duality_{t-1}$, as additional control variables, to verify whether the empirical findings are robust with the addition of new control variables. Variable $lnboardsize_{t-1}$ is the logarithm representing the number of directors on the board, $independence_{t-1}$ is the proportion of independent directors on a board, and $duality_{t-1}$ is a dummy variable used to measure whether the CEO holds the position of the chair of the board. Detailed variable definitions are presented in Appendix A. As shown in Table 3, the coefficients of $positive_{t-1}$($negative_{t-1}$) are still significantly positive (or negative) at 1% levels after controlling for corporate governance. In summary, the robustness tests suggest that the impacts of positive (or negative) internet media coverage on the future stock price crash risk are robust.

4.2.3. Controlling for Firm Fixed Effect

To control for firm characteristics, which are unobserved but could correlate with independent variables, we implement firm fixed effects within regressions (6) and (7). The

results in Table 4 show that positive and negative internet media coverage are positively and negatively correlated with future stock price crash risks. Meanwhile, for neutral internet media coverage, no significance is detected, showing no impact on the future stock price crash risk. The results in Table 4 are consistent with the findings in Table 1, demonstrating strong robustness.

4.2.4. Instrumental Variable Analysis

In order to solve the endogeneity problem, we carry out the instrumental variable analysis. To perform the analysis, we follow the work of An et al. [24]; we first calculate the industry median ratio of both optimistic and pessimistic media coverage, denoted as *Median opt* and *Median pes*, which are chosen as instrumental variables. Then, we apply the prevailing two-stage least square regression to verify whether the correlation between internet media coverage and the future stock price crash risk still holds. The results are presented in Table 5. We find that, in the first stage, the instrumental variables are strongly correlated with independent variables, *opt* and *pes*, showing the feasibility of instrumental variables. With this view, in the second stage, we regress Equations (6) and (7) with instrumental variables, *opt* and *pes*; the results are presented in columns three to six in Table 5. We find from columns three to six that the coefficients of *opt* and *pes* are positively and negatively correlated with future stock price crash risk indicators, $NCSKEW$ and $DUVOL$, demonstrating consistency with the prior findings shown in Table 1, and providing strong evidence for the robustness of our findings.

4.3. Further Analysis

To ascertain if the firms' operational environment influences stock crash risk, we separate the sample to conduct further studies. Specifically, we measure the firms' operational environment by using analyst coverage; we hypothesize that the effect of media tone on the future stock price crash risk could be more pronounced for stocks with higher analyst coverage due to the fact that forecasts released by analysts can help to mitigate information asymmetry (Green et al. [51]), and corporate bad news concealed by management boards is more easily disclosed.

For this purpose, we divide the sample into high (above median) and low analyst coverage sub-samples. The results are presented in Tables 6 and 7.

The results of the first stock price crash risk indicator, $NCSKEW_t$, are presented in Table 6. For firms with lower analyst coverage, the variable coefficients are non-significant among positive, neutral, and negative media coverage, indicating that internet media coverage does not influence future stock price crash risk when the analyst focus is low. However, for firms with higher analyst coverage, the coefficients of positive *pos* and negative *pes* coverage are significant and demonstrate positive and negative correlations with future stock price crash risks; this is consistent with the findings presented in Table 1.

The results of the second stock price crash risk indicator, $DUVOL_t$, are presented in Table 7. Similar to the results of panel A, for firms with lower analyst coverage, no significance is detected in the coefficients of positive, neutral, and negative media coverage, indicating that internet media would not influence future stock price crash risk for stocks with low analyst focus. However, in the sub-sample of higher analyst coverage, the coefficients of positive and negative media coverage are positively and negatively correlated with future stock price crash risks, with significance at the 1% levels; this is equal to the results presented in Table 6.

Table 6. Further analysis considering analyst-coverage effects (NCSKEW). This table presents the influence of media tone on crash risk, detailing the effects of analyst coverage of the first crash risk indicator, NCSKEW, with both lower and higher analyst coverage sub-samples. The t-statistics are displayed in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

NCSKEW		**Lower**			**Higher**	
opt	−0.003			0.171 ***		
	(−0.05)			(3.19)		
neu		0.014			−0.023	
		(0.23)			(−0.33)	
pes			−0.008			−0.202 ***
			(−0.14)			(−3.32)
RET	0.240	0.241	0.240	0.248	0.262 *	0.258
	(1.11)	(1.12)	(1.11)	(1.56)	(1.65)	(1.63)
SIGMA	3.266 **	3.276 **	3.273 **	3.214 ***	3.257 ***	3.314 ***
	(2.28)	(2.29)	(2.29)	(2.89)	(2.92)	(2.98)
ROA	0.284 **	0.282 **	0.281 **	−0.104	−0.049	−0.101
	(2.20)	(2.20)	(2.17)	(−0.73)	(−0.35)	(−0.71)
LEV	−0.046	−0.046	−0.046	−0.101 **	−0.093 *	−0.101 **
	(−0.95)	(−0.95)	(−0.95)	(−2.08)	(−1.92)	(−2.08)
BM	−0.087 *	−0.087 *	−0.087 *	−0.378 ***	−0.376 ***	−0.379 ***
	(−1.70)	(−1.70)	(−1.70)	(−8.95)	(−8.91)	(−8.98)
SIZE	−0.026 **	−0.026 **	−0.026 **	0.013 *	0.010	0.012
	(−2.31)	(−2.32)	(−2.31)	(1.70)	(1.26)	(1.50)
DTURN	−0.043 ***	−0.043 ***	−0.043 ***	−0.014	−0.013	−0.013
	(−2.72)	(−2.71)	(−2.72)	(−0.85)	(−0.77)	(−0.77)
ABACC	0.011	0.011	0.011	0.143 ***	0.142 ***	0.142 ***
	(0.29)	(0.29)	(0.29)	(3.75)	(3.72)	(3.73)
NCSKEW	0.061 ***	0.061 ***	0.061 ***	0.025 **	0.024 **	0.026 **
	(6.07)	(6.08)	(6.08)	(2.49)	(2.42)	(2.54)
Constant	0.443 *	0.441 *	0.445 *	−0.380 *	−0.210	−0.216
	(1.72)	(1.72)	(1.73)	(−1.86)	(−1.06)	(−1.10)
Year fixed effect				YES		
Industry fixed effect				YES		
N	10,840	10,840	10,840	10,725	10,725	10,725
R-square	0.065	0.065	0.065	0.089	0.088	0.089

Table 7. Further analysis considering analyst-coverage effects (DUVOL). This table presents the influence of media tone on crash risk, detailing the effects of analyst coverage on the second crash risk indicator, DUVOL, with both lower and higher analyst coverage sub-samples. The t-statistics are displayed in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

DUVOL		**Lower**			**Higher**	
opt	0.008			0.115 ***		
	(0.25)			(3.10)		
neu		0.004			−0.023	
		(0.10)			(−0.49)	
pes			−0.012			−0.130 ***
			(−0.36)			(−3.08)
RET	0.188	0.189	0.189	0.191 *	0.200 *	0.198 *
	(1.37)	(1.38)	(1.38)	(1.74)	(1.82)	(1.81)
SIGMA	2.033 **	2.034 **	2.042	1.996 ***	2.020 ***	2.061 ***
	(2.23)	(2.24)	(2.24)	(2.60)	(2.63)	(2.68)
ROA	0.169 **	0.171 **	0.167 **	0.001	0.038	0.005
	(2.06)	(2.09)	(2.03)	(0.01)	(0.39)	(0.05)
LEV	−0.019	−0.019	−0.019	−0.076 **	−0.071 **	−0.076 **
	(−0.63)	(−0.63)	(−0.63)	(−2.26)	(−2.11)	(−2.25)

Table 7. *Cont.*

DUVOL	**Lower**			**Higher**		
BM	−0.001	−0.001	−0.001	−0.213 ***	−0.212 ***	−0.214 ***
	(−0.03)	(−0.03)	(−0.03)	(−7.31)	(−7.27)	(−7.33)
SIZE	−0.034 ***	−0.034 ***	−0.034 ***	−0.003	−0.006	−0.005
	(−4.77)	(−4.77)	(−4.79)	(−0.65)	(−1.08)	(−0.87)
DTURN	−0.029 ***	−0.029 ***	−0.029 ***	−0.008	−0.007	−0.007
	(−2.90)	(−2.89)	(−2.90)	(−0.67)	(−0.60)	(−0.59)
ABACC	0.035	0.035	0.035	0.045 *	0.044 *	0.045 *
	(1.42)	(1.42)	(1.42)	(1.71)	(1.68)	(1.69)
NCSKEW	0.032 ***	0.032 ***	0.032 ***	0.019 ***	0.018 ***	0.019 ***
	(5.07)	(5.06)	(5.07)	(2.68)	(2.60)	(2.72)
Constant	0.605 ***	0.609 ***	0.614 ***	0.073	0.187	0.183
	(3.68)	(3.73)	(3.75)	(0.52)	(1.37)	(1.34)
Year fixed effect				YES		
Industry fixed effect				YES		
N	10,840	10,840	10,840	10,725	10,725	10,725
R-square	0.074	0.074	0.074	0.093	0.092	0.093

5. Conclusions

In this paper, we investigate whether media tone is correlated with future stock price crash risk in the Chinese market. We find a significantly positive (or negative) correlation between optimistic (or pessimistic) media tones from the internet and future crash risk. To improve the credibility of our results, we perform multiple checks. Firstly, we winsorize variables at the 1% level to avoid possible outlier errors. Secondly, we incorporate corporate governance variables into our regression models as additional control variables to minimize the possible impact from the management board. Thirdly, to control the possible impact from unobserved firm characteristics, we employ the firm fixed effect in the regression models. Fourthly, to solve the endogeneity problem, we implement the prevailing instrumental variable analysis. The results align with our primary regression findings, demonstrating the strong robustness of our results. Moreover, we find that the effects of media tone on future crash risks are more pronounced for firms with higher analyst coverage. Our findings present new insights into the implications of internet media tones and their economic consequences in emerging markets; they can help investors avoid stock price crashes while making investment decisions. Additionally, regulators can infer possible stock price crash risks based on the increasing volume of positive internet coverage, which would be meaningful for the management of stock market stability.

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Appendix A

Table A1. Variable definitions.

Variables	Definition
Crash risk measures	
$NCSKEW_t$	The negative skewness of firm-specific weekly returns in a fiscal year t. See Equations (1)–(3) for details.
$DUVOL_t$	The log of the ratio of the standard deviations of down-week to up-week firm-specific returns in fiscal year t. See Equations (1), (2), and (4) for details.
Media coverage measures	
opt_{t-1}	The proportion of optimistic coverage from internet media in fiscal year $t-1$.
neu_{t-1}	The proportion of neutral coverage from internet media in fiscal year $t-1$.
pes_{t-1}	The proportion of pessimistic coverage from internet media in fiscal year $t-1$.
Other variables	
RET_{t-1}	The mean of firm-specific weekly returns times 100 in fiscal year $t-1$. The firm-specific weekly returns are calculated based on Equations (1) and (2).
SIGMA	The standard deviation of firm-specific weekly returns in fiscal year $t-1$. The firm-specific weekly returns are calculated based on Equations (1) and (2).
ROA_{t-1}	Net profit divided by the total assets in fiscal year $t-1$.
LEV_{t-1}	Total debts divided by the total assets in fiscal year $t-1$.
BM_{t-1}	The ratio of the book value of equity to the market value of equity in fiscal year $t-1$.
$SIZE_{t-1}$	The natural logarithm of the total assets in fiscal year $t-1$
$DTURN_{t-1}$	The average monthly share turnover in fiscal year $t-1$ minus the average monthly share turnover in fiscal year $t-2$, where monthly share turnover is the monthly trading volume divided by the total number of floating shares on the market that month.
$ABACC_{t-1}$	The absolute value of discretionary accruals in fiscal year $t-1$, where discretionary accruals are estimated from the modified Jones model.
$lnboardsize_{t-1}$	The natural logarithm of the number of board directors in the board in fiscal year $t-1$.
$independence_{t-1}$	The proportion of independent directors on the board in fiscal year $t-1$.
duality_{t-1}	A dummy variable that equals 1 if the CEO and chairman are the same person in fiscal year t, and 0 otherwise.

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