Investor–firm interactions and stock price crash risk

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Abstract. With the advancement of technology, social media platforms, represented by online interactive platforms, have improved information dissemination in a faster and more dynamic manner. This study examines the relationship between the quality of interactive Q&A between investors and corporate on online platforms and stock price crash risk, using a sample of A-share listed companies from 2010 to 2023. The quality of interaction is measured by the cosine similarity of the Q&A texts. The empirical results show that high-quality interaction between investors and companies can reduce stock price crash risk. The mitigating effect of high-quality interaction on stock price crash risk is more pronounced in firms with lower information transparency.

Keywords: Investor–firm interactions; Stock price crash risk.

1. Introduction

The stock price crash denotes an abrupt and severe drop in equity prices or market indices without observable precursors, constituting an extreme financial event. Since 2015, such violent price swings have grown increasingly prevalent in global securities markets. China's A-share market has witnessed multiple instances of a thousand stocks hitting the daily limit down, indicating that stock price crashes not only disrupt the stable operation of China's securities market and hinder the healthy development of capital markets, but also pose security risks to the real economy and cause significant losses for investors. The third plenary session of the 20th Central Committee of the Communist Party of China emphasized the need to improve the coordinated functions of investment and financing in the capital market, strengthen risk prevention and supervision, and promote its healthy and stable development. A well-developed capital market can enhance efficiency, boost investor confidence, effectively coordinate individual financial risks, reduce systemic risks in the economy, and contribute to sustained economic stability. Therefore, research on stock price crash risks holds both theoretical significance and practical importance.

Research indicates that information asymmetry, particularly executives' incentive to conceal negative corporate news is a key driver of stock price crashes (Jin and Myers, 2006)[1]. When bad news accumulates beyond concealment limits, it triggers market-wide disclosure that causes stock price crashes. Information disclosure serves as a crucial mechanism to mitigate corporate information asymmetry. Studies by Hutton et al. (2009)[2] and Kim and Zhang (2014)[3] demonstrate that financial statement transparency enhances both the disclosure environment and quality, thereby reducing stock price crash risks.

The development of digital technology has expanded corporate information disclosure channels, with social media emerging as a distinctive feature in corporate information disclosure (Miller and Skinner, 2015)[4]. Current social media platforms used for corporate disclosures include private platforms like Twitter, Facebook, Yahoo, and Weibo, as well as official platforms such as interactive investor platforms. Empirical studies have demonstrated the value of social media as an effective disclosure channel (Antweiler and Frank, 2004; Blankespoor et al., 2014)[5][6]. The convenience of social media enables companies to interact with investors in real-time, facilitating timely updates on company developments and enhancing stakeholders' understanding of corporate value.

The Shenzhen Stock Exchange and Shanghai Stock Exchange launched their interactive investor platforms in 2010 and 2013, respectively. These platforms provide more efficient and convenient services for market participants, offering investors easier communication channels to understand the actual conditions of listed companies and obtain authentic information. This initiative is considered an innovative attempt to alleviate information asymmetry among minority shareholders and address

regulatory challenges in listed companies. Through these platforms, investors can ask questions about their concerns anytime and anywhere. Listed companies must respond to inquiries seriously, promptly, and thoroughly, while exchanges track all interactions to ensure information authenticity and reliability. All questions and responses from these communication processes are publicly displayed on the platforms, allowing even non-participating investors to access all interaction content. By the end of 2023, investors had raised 5.03 million questions on both platforms, with listed companies responding to 4.7 million. These online platforms have become crucial channels for corporate information disclosure. This new interactive model increases direct communication opportunities between investors and listed companies, reduces information acquisition costs for ordinary investors, enhances information transmission efficiency, and alleviates information asymmetry. This study attempts to empirically analyze the relationship between interaction quality and stock price crash risk through text analysis combined with empirical testing. The analysis examines the interaction quality between listed companies and investors using question-and-answer content from the interactive platform conducted between 2010 and 2023.

2. Theoretical Foundation

2.1. Efficient market theory

The efficient market hypothesis (EMH) forms the cornerstone of modern capital markets, asserting that markets are efficient and asset prices accurately reflect all relevant information in a timely manner (Fama, 1970)[7]. A market is considered efficient when it exhibits well-developed legal frameworks, complete market functions, high transparency, and sufficient competition. Based on the degree of efficiency, markets can be categorized into three types: (1) weak efficiency markets where prices reflect all historical information available to investors; (2) semi-strong efficiency markets where prices reflect all publicly available information; (3) strong efficiency markets where prices fully incorporate all available market information. However, recent studies indicate that investors' information acquisition and interpretation behaviors significantly influence their expectations (Drake et al., 2012; Tan et al., 2014; Drake et al., 2015)[8][9][10]. Before being reflected in prices, value-related information sequentially undergoes three stages of information processing: publicly available market information, investor-acquired information, and investor expectations (Hui et al., 2018)[11]. Investors repeatedly engage in information gathering and interpretation before making decisions, continuously refining their expectations until they align with external evidence (Pirolli, 2007)[12]. The EMH posits that enhancing capital market efficiency hinges on improving information quality through solutions for disclosure and transmission, as well as interpretation and feedback mechanisms, ensuring stock prices accurately and promptly reflect relevant information. Improving and perfecting the information disclosure system of listed companies can promote the establishment of effective capital market, and is also the starting point for the continuous improvement of the effectiveness of capital market.

2.2. Information asymmetry theory

Information asymmetry refers to the distribution of transactional information among market participants that creates an imbalance, where one party possesses more information than the other. The information-advantaged party gains a competitive edge in transactions. To maximize profits, the information-advantaged party may exploit their informational advantage to appropriate and plunder the interests of the disadvantaged party, thereby triggering moral hazard and adverse selection issues. Adverse selection occurs when prior to contract execution, the information-advantaged party uses their knowledge to gain extra benefits, distorting market prices, reducing resource allocation efficiency, and even causing market failure. This phenomenon leads to the "bad money drives out good" effect, resulting in declining product quality and market contraction. Moral hazard refers to the situation where after contract execution, the information-advantaged party (agent) exploits their information advantage to appropriate and harm the interests of the information-disadvantaged party (principal), prioritizing personal gains over collective welfare.

Information asymmetry is prevalent in market transactions. Generally speaking, it primarily stems from four factors: First, differences in information acquisition channels. Investors can obtain information either directly from its original source or through dissemination processes, though information may be lost or incomplete during transmission. Those who access information at the source gain a certain informational advantage. Second, timing variations in information acquisition. Influenced by cognitive limitations, market conditions, and professional backgrounds, investors experience time lags when obtaining relevant market data. Third, disparities in information quantity and reliability. Informed traders and uninformed ones exhibit significant differences in both the quantity and quality of information they access. Fourth, variations in interpretation capabilities. Investors differ in their methods and abilities to process information effectively.

2.3. Principal-agent theory

Jensen and Meckling (1976) developed the principal-agent theory based on the concepts of information asymmetry and incomplete contracts, offering a comprehensive explanation[13]. The principal-agent relationship arises as a result of the separation between ownership and management. Following this separation, shareholders no longer engage in daily operational activities but instead delegate managerial responsibilities to appointed executives. Managers may seek to maximize their personal utility by pursuing higher compensation and greater leisure time. When managerial interests conflict with those of shareholders, issues of moral hazard may occur. Due to information asymmetry, managers possess comprehensive operational data while shareholders remain at a disadvantage. When conflicts of interest and information gaps occur, agents may exploit their positions to harm shareholder interests through misconduct like excessive spending or embezzlement, ultimately leading to resource waste and financial losses for the company.

3. Hypothesis development

According to the efficient market hypothesis, information is effectively reflected in stock prices only when it is widely accessible and properly processed. Therefore, investors' information capabilities—including their ability to acquire and process information—significantly influence market efficiency (Coibion and Gorodnichenko, 2015)[14]. Hong and Stein (2003) highlighted that investors exhibit varying information processing capacities, with their responses to market signals being inconsistent, insufficient, or delayed. The divergence in investor expectations, which often leads to price crashes, underscores this gap[15]. Digital technologies have revolutionized how investors access and process information, significantly enhancing their information processing capabilities (Miller and Skinner, 2015). Platforms like interactive investor platforms represent innovative attempts by listed companies to empower investors with market transparency. These interactive platforms allow investors to access corporate disclosures more efficiently than traditional methods like reading financial reports(Pirolli, 2007). When investor-received information undergoes external validation, the information processing mechanism becomes optimized, enabling effective expectation testing. Furthermore, investors can analyze other investors' interactions with companies to refine their own information-gathering strategies and enhance their analytical capabilities (Hales, 2009)[16]. Therefore, when companies respond proactively to investor inquiries and engage in high-quality dialogue, it enables investors to effectively obtain fundamental value information and properly interpret the data they receive. This process helps form price expectations aligned with intrinsic value, thereby reducing the risk of stock price crashes.

Based on the theory of information asymmetry, differences in access channels, timing, quantity, reliability, and interpretation capabilities lead to varying degrees of information asymmetry among corporate executives, regulatory bodies, and investors. This asymmetry serves as a critical precursor to stock price crash risks (Jin and Myers, 2006). Online platform interactions enhance communication between listed companies and external stakeholders, effectively reducing information asymmetry (Jing et al., 2021)[17]. Compared to traditional disclosure methods, this Q&A format allows direct

investor-company dialogue, prompting companies to better address information needs and improve disclosure relevance (Elliott et al., 2020)[18]. The high participation level in online platforms increases information content and decision-making value (Matsumoto et al., 2011)[19]. Unlike general social media platforms like Weibo, Stock Bar, or Tieba that lack regulatory oversight for capital-related discussions, platforms have unique institutional safeguards. The interactive processes of listed companies are subject to securities exchange supervision, which carries statutory accountability for post-event consequences. This ensures that investors' information acquisition on platforms remains free from misinformation like rumors. Therefore, high-quality interactions on online platforms facilitate effective communication between companies and investors. Such transparency helps alleviate information asymmetry, thereby reducing the risk of stock price crash risks.

Based on principal-agent theory, managers may conceal negative company information for personal gain, leading to the accumulation of bad news within the organization. This reduces corporate transparency and resource allocation efficiency, disrupts internal governance, and ultimately causes stock price crashes. Investors leverage online platforms to monitor listed companies through reputation-based pressure mechanisms. When investors raise questions about negative company information on online platforms, the negative information preference theory suggests this may attract attention from other investors. If listed companies ignore or avoids addressing investor inquiries, it could lead to significant reputational damage for executives and prompt immediate regulatory scrutiny. To avoid such damage, management may prioritize protecting the interests of investors in their decision-making, thereby constraining adverse selection and improving the quality of investor interactions to maintain credibility(Jing et al.,2021). Consequently, high-quality online interactions can enhance investors' ability to monitor information, constrain management's adverse selection behaviors, mitigate agency problems, and reduce stock price crash risks. Based on this analysis, the following hypotheses are proposed:

H1: High quality interaction between listed companies and investors can reduce the risk of stock price crash.

Regarding information transparency and stock price crash risks, Kim and Zhang (2014) developed multi-dimensional financial reporting transparency indicators, demonstrating that enhanced transparency significantly mitigates stock price crash risks for listed companies. Jiang et al. (2021) found that improved transparency allows investors to gain a more accurate understanding of a company's actual operations and fundamental information, thereby reducing the divergence between stock prices and fundamentals to prevent false market optimism. Additionally, higher transparency increases the cost for management to conceal negative information, prompting them to disclose such information promptly and mitigate stock price crashes caused by concentrated exposure of accumulated negative information. For companies with low transparency, investors face limited access to information channels and higher integration costs. Simultaneously, lower transparency makes companies more prone to earnings management or financial manipulation, further degrading the quality of disclosed information. In such cases, investors' heightened demand for information alleviates their information dilemma, where online interactive platforms play a more significant positive role. Based on these analyses, we propose the following hypothesis:

H2: Compared to companies with high transparency, the positive effects of high-quality interactions between listed companies and investors are more pronounced in companies with low transparency.

4. Research Design

4.1. Data and sample

This study collected and analyzed 5,379,508 questions and answers between investors and listed companies on the interactive investor platforms from 2010 to 2023. The data processing involved four key steps: (1) Excluding financial industry firms, ST-listed companies, and *ST-class enterprises; (2) Filtering out samples with annual weekly returns below 30 observations when calculating stock

price crash risk metrics; (3) Removing missing primary variables; (4) Applying winsorization to major continuous variables to mitigate outlier effects. Ultimately, 35,508 firm-year observations were obtained.

4.2. Model specification

To examine the impact of interaction quality between listed companies and investors on stock price crash risk, models (1) and (2) are established. To verify Hypothesis 2 regarding the moderating effect of information transparency, models (3) and (4) are established. Specifically, NCSKEW and DUVOL represent stock price crash risk, Reply denotes interaction quality between listed companies and investors, EM stands for corporate information transparency, EM*Reply is the interaction term combining information transparency and interaction quality, Control serves as a control variable, and ε represents the residual term.

$$NCSKEW = \alpha_0 + \alpha_1 Reply + \alpha_2 Control + \varepsilon_{i,t} \quad (1)$$

$$DUVOL = \alpha_0 + \alpha_1 Reply + \alpha_2 Control + \varepsilon_{i,t} \quad (2)$$

$$NCSKEW = \alpha_0 + \alpha_1 Reply + \alpha_2 EM + \alpha_3 EM * Reply + \alpha_4 Control + \varepsilon_{i,t} \quad (3)$$

$$DUVOL = \alpha_0 + \alpha_1 Reply + \alpha_2 EM + \alpha_3 EM * Reply + \alpha_4 Control + \varepsilon_{i,t} \quad (4)$$

The explanatory variable (Reply) is the text similarity of the question and answers. This paper employs bag-of-words technology to decompose questions and answers into two vectors, resulting in a mapping from the original text to digital vectors where each element represents the count of each unique word in the original text. The similarity between investor inquiries and corporate responses can be calculated by determining the cosine distance between these two vectors.

The explained variable is the risk of stock price crash. The negative skewness coefficient of returns (NCSKEW) is calculated as the negative of the third moment of each stock's firm-specific weekly returns divided by the cube of standard deviation. The ratio of upside and downside volatility (DUVOL) is a bottom-up volatility measure of the possibility of a crash.

The moderating variable is information transparency. The residuals obtained from the annual and industry-specific estimation of the classic cross-sectional modified Jones model are used as the level of discretionary accruals. The absolute value of this residual is employed to measure the degree of earnings management through accruals of listed companies. The higher the absolute value, the greater the degree of earnings management and the lower the level of information transparency.

The selection of control variables refers to Lobo et al. (2020) and Ta1g et al. (2022)[20][21]. (1) Market volatility (Sigma) is defined as the standard deviation of firm-specific weekly returns over a year; (2) Market return (Ret) is defined as the arithmetic average of firm-specific weekly returns in a year; (3) Debt ratio (Lev) is defined as the total liabilities of the firm at the end of the period divided by the total assets; (4) Firm performance (ROA) is defined as the total asset return rate of the firm in the current year; (5) Firm size (Size) is defined as the natural logarithm of the total assets of the firm at the end of the period; (6) Market-to-book ratio (MB) is defined as the total market value of the firm at the end of the period divided by the total book value of assets; (7) Revenue growth rate (Growth) is defined as the year-on-year growth rate of the firm's revenue in the current year compared to the previous year; (8) The shareholding ratio of the largest shareholder (Fholder); (9) The proportion of independent directors (Indenp) is defined as the proportion of independent directors at the end of the year to the total number of board members; (10) The shareholding ratio of institutional investors (Institution). In addition, the model also controls for the industry (Industry) and year (Year) fixed effects of the firm during the test.

5. Empirical results

5.1. Descriptive statistics

Table 1. Descriptive statistical analysis

Variable	N	Mean	p50	SD	Min	Max
NCSKEW	35508	-0.315	-0.278	0.725	-2.459	1.700
DUVOL	35508	-0.205	-0.206	0.478	-1.373	1.026
Reply	35508	0.190	0.185	0.062	0.044	0.388
EM	35508	0.058	0.040	0.060	0.001	0.339
Ret	35508	0.003	0.001	0.009	-0.015	0.032
Sigma	35508	0.063	0.058	0.025	0.025	0.146
Lev	35508	0.413	0.402	0.206	0.053	0.922
ROA	35508	0.035	0.037	0.068	-0.295	0.200
Size	35508	22.210	22.01	1.289	19.830	26.260
MB	35508	0.619	0.616	0.251	0.114	1.200
Growth	35508	0.156	0.098	0.391	-0.577	2.376
Fholder	35508	0.337	0.313	0.148	0.084	0.740
Indenp	35508	0.377	0.364	0.054	0.333	0.571
Institution	35508	0.428	0.440	0.249	0.003	0.910

As shown in the table, the mean values of stock price crash risk (NCSKEW and DUVOL) are-0.315 and-0.205, with median values of-0.278 and-0.206, respectively. The standard deviations are 0.725 and 0.478, indicating that most companies exhibit relatively low stock price crash risks, showing significant differences among firms. The interaction quality between listed companies and investors (Reply) ranges from a minimum of 0.044 to a maximum of 0.388, with a substantial gap between the highest and lowest values, highlighting considerable variations in interaction quality across enterprises. Information transparency (EM) has a mean value of 0.058 and median of 0.040, suggesting that over half of the companies maintain high transparency levels, though some still exhibit relatively low information disclosure practices.

5.2. Regression results

Table 2. Baseline regressions

	(1) NCSKEW	(2) NCSKEW	(3) DUVOL	(4) DUVOL	(5) NCSKEW	(6) DUVOL
Reply	-0.186***	-0.168***	-0.129***	-0.131***	-0.116*	-0.093**
	(-2.855)	(-2.616)	(-3.001)	(-3.097)	(-1.762)	(-2.161)
Ret		-13.288***		-10.850***	-14.044***	-11.308***
		(-19.654)		(-24.376)	(-19.937)	(-24.271)
Sigma		-7.154***		-3.709***	-8.961***	-4.876***
		(-26.953)		(-21.945)	(-32.247)	(-27.810)
Lev		0.080***		0.062***	0.057**	0.047**
		(3.014)		(3.516)	(2.056)	(2.518)
ROA		0.007		0.057	0.027	0.064
		(0.098)		(1.176)	(0.341)	(1.223)
Size		-0.029***		-0.034***	-0.015***	-0.025***
		(-5.956)		(-9.920)	(-2.893)	(-7.200)
MB		-0.218***		-0.067***	-0.297***	-0.117***
		(-9.128)		(-4.181)	(-11.854)	(-7.045)
Growth		0.059***		0.019***	0.072***	0.029***
		(5.803)		(2.905)	(6.569)	(4.018)

Fholder		-0.055		-0.035	-0.053	-0.035
		(-1.617)		(-1.551)	(-1.534)	(-1.558)
Indenp		0.138*		0.082	0.139*	0.087*
		(1.798)		(1.615)	(1.784)	(1.692)
Institution		0.089***		0.066***	0.054**	0.045***
		(4.015)		(4.531)	(2.396)	(3.082)
EM					0.240***	0.134***
					(3.497)	(2.978)
Reply*EM					-1.997**	-1.464**
					(-1.991)	(-2.203)
_cons	-0.254***	0.835***	-0.188***	0.740***	0.638***	0.635***
	(-5.568)	(7.555)	(-6.376)	(9.991)	(5.509)	(8.238)
N	35508	35508	35508	35508	35508	35508
Adj.R2	0.0203	0.0961	0.0247	0.0973	0.1091	0.1091
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES

Columns (1) and (3) reveal that, without controlling for variables, online platform interactions show a significant negative correlation with stock price crash risk, indicating that high-quality interactions between listed companies and investors can mitigate such risks. Columns (2) and (4) confirm this relationship remains statistically significant even after controlling for variables, validating Hypothesis 1. Columns (5) to (6) demonstrate that the interaction term shows a significant negative effect, suggesting that compared to companies with higher information transparency, the positive impact of high-quality interactions between listed companies and investors is more pronounced in firms with lower transparency levels. This validates Hypothesis 2.

6. Summary

This paper examines the relationship between the quality of investor-company interactions on online interactive platforms and stock price crash risk. The OLS regression results, based on 35,508 firm-year observations, indicate that high-quality interactions between investors and companies can reduce stock price crash risk. By analyzing the moderating effect of information transparency, it is found that the positive impact of high-quality interactions is more pronounced in firms with lower information transparency compared to those with higher information transparency.

This study explores the influencing factors of stock price crash risk and the governance effects of online interactive platforms. Given the technological characteristics of these platforms, individual investors are able to play a more significant role in capital markets by leveraging them. Furthermore, online interactive platforms have reshaped corporate information disclosure practices and transformed how investors access and process market information.

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