

Dose analysts' private information acquisition impact on stock price crash risk? Based on Chinese Market

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Abstract: This paper selects A-share companies listed on China's Shanghai and Shenzhen stock exchanges from 2007 to 2021 as the research sample and empirically tests the correlation between analysts' private information acquisition ability and stock price crash risk, and finds that the improvement of analysts' private information acquisition ability will effectively reduce the expected stock price crash risk, and proves that the results are not affected by the endogeneity factors through a series of robustness tests, which are robust. Meanwhile, this paper finds that analysts' private information acquisition ability mainly weakens stock price crash risk by reducing information asymmetry through mediation mechanism analysis, and further finds that it reduces information asymmetry through the internal control efficiency path and the surplus forecasting path. Moreover, in the heterogeneity test, this paper finds that analysts' private information acquisition ability has a greater ability to influence stock price crash risk in firms with low industry concentration, large size, high audit quality or state-owned nature. The above results have important implications for capital markets and investors.

Keywords: Analysts' private information acquisition ability; stock price crash risk; information asymmetry; internal control; forecast errors.

1. Introduction

As an important component of the Chinese financial market, the volatility of the Chinese stock market has become a significant issue of national concern. In recent years, the Chinese stock market has experienced several episodes of instability and even crashes. In June-August 2015, the Chinese stock market witnessed a 56% surge followed by a 54% plunge. During the 2018 US-China trade war, concerns over global trade tensions led to a substantial decline in the Chinese stock market. The outbreak of the COVID-19 in early 2020 caused dramatic fluctuations in the Chinese stock market due to its impact on global economic activities. These events have had irreversible effects on investors and even the entire financial market. To avoid the harm caused by stock market crashes, there is a growing expectation to proactively take measures to reduce the likelihood of future crash risks (Ahsan et al., 2017). Therefore, exploring factors that influence stock market crash risk has become a hot topic in current academic discussions.

Current research primarily focuses on the impact mechanism of stock market crash risk based on agency theory, indicating that stock market crash risk is primarily caused by information asymmetry between internal corporate factors and external capital markets (Jin and Myers, 2006). Hutton et al. (2009) demonstrated that information opacity positively influences stock market crash risk. Information asymmetry is primarily influenced by managerial opportunistic behavior and the ability of external entities to acquire and interpret information. Regarding managerial behavior, Kothari et al. (2009) pointed out that managers have opportunities to hide bad news in the short term to maintain stock prices or avoid litigation in order to maximize personal benefits. Additionally, companies can increase information asymmetry and, consequently, raise stock market crash risk through tax avoidance practices (Kim et al., 2011b), earnings management (Shah et al., 2009), and inefficient investments (Habib et al., 2017). However, robust governance structures within and outside the company (Xie et al., 2003), such as internal controls (Chen, 2017), audit quality (Robin and Zhang, 2015), and analyst tracking behavior (He, 2019), supervise and constrain managerial self-interest, effectively reducing managerial misconduct and mitigating stock market crash risk. Regarding the ability of external entities to acquire and interpret information, Johansson et al. (2016) pointed out

that in the Chinese stock market, where individual investors constitute the majority, retail investors generally lack the information acquisition abilities and professional analytical capabilities of institutional investors, resulting in higher susceptibility to stock market crash risk.

Financial analysts, as one of the external entities in the capital market, play a crucial role in reducing information asymmetry between internal corporate factors and external investors. However, the current research on the economic consequences of analysts' private information acquisition ability is relatively limited. Existing studies mainly focus on how to measure and differentiate between analysts' private and public information (Fischer, 2010) and the impact of analysts' private information acquisition ability on stock price synchronicity (Jiang, 2018). This paper aims to provide more empirical evidence for the relationship between analysts' private information acquisition ability and stock market crash risk, addressing this research gap.

This paper makes contributions in both academic and practical aspects. Firstly, in terms of academia, this paper fills the research gap regarding the link between analysts' private information acquisition ability and stock market crash risk, enriching the empirical research on factors influencing stock market crash risk. The current studies on the impact of analysts on stock market crash risk mainly focus on analyst tracking and earnings forecasts (Crawford et al., 2012; Xu et al., 2013). In contrast, this paper represents analysts' activities through their private information acquisition ability and establishes the connection between analysts' private information acquisition ability and stock market crash risk. Secondly, this paper complements the literature on the role of financial analysts in the Chinese market as an external governance mechanism. The existing research on the economic consequences of private information acquisition ability is limited to its impact on stock price synchronicity (Jiang, 2018). This paper explores the weakening effect of analysts' private information acquisition ability on stock market crash risk, expanding the research on the economic consequences of analysts' private information.

In terms of practical implications, this paper focuses on the unique context of the Chinese market. In China, public disclosure is relatively imperfect compared to developed countries, and voluntary disclosure is lacking, leading to more pronounced information asymmetry (Jiang, 2018). In such circumstances, the acquisition of private information is more advantageous in providing constructive recommendations for investors to mitigate stock market crash risk.

2. Literature review and Hypothesis Development

The primary cause of stock market crashes is the information asymmetry between internal corporate factors and external market participants (Jin and Myers, 2006; Hutton et al., 2009). Analysts, as intermediaries between investors and the capital market, play a crucial role in addressing this information asymmetry. Firstly, analysts effectively enhance the ability of external market participants to acquire and interpret internal corporate information by acting as information intermediaries. He (2018) noted that analysts disseminate various value-relevant information to market participants in a form understandable to the public, reducing information asymmetry between market participants and internal corporate factors. Existing researchers have provided evidence in support of this: analyst coverage is positively associated with improved stock price informativeness (Barth and Hutton, 2004), lower financing costs (Bowen et al., 2008), and a reduction in firm-specific stock market crash risk (Kothari et al., 2009; He, 2018).

Secondly, analysts contribute to enhancing internal corporate governance efficiency by playing an external governance role, thereby reducing information asymmetry and mitigating managerial misconduct, such as reducing earnings management (Yu, 2008), decreasing inefficient investments (Irani and Oesch, 2013), and improving firm performance (Jung et al., 2012).

Analyst private information acquisition refers to the ability of analysts to obtain non-public information during their research and analysis, such as undisclosed financial data, unreleased product information, insider information about executives, and industry trends. For analysts covering a higher number of companies, having access to more private information can provide them with a greater

advantage in making investment decisions. In this study, we use analyst private information acquisition as a proxy for analyst activity, which is considered more objective and comprehensive (Barron et al., 1998). This is because the Chinese capital market provides a specific environment for studying private information.

Firstly, in terms of market characteristics, the Chinese capital market is dominated by individual investors rather than institutional investors. As a result, most investors lack professional information acquisition and processing capabilities, as well as the ability to supervise companies (Feng et al., 2006). Most investors rely on analysts' professional opinions, and the Chinese society's emphasis on personal relationships facilitates the acquisition of private information by analysts (Wang and Ahammad, 2012).

Secondly, in terms of the characteristics of Chinese financial analysts, Wang (2011) pointed out that the primary service provided by Chinese financial analysts is offering investment advice to investors. As the analyst industry matures, financial analysts are required to acquire more private information to improve the accuracy of their forecasts and recommendations, thus enhancing their competitiveness (Wang et al., 2011). The improvement in analyst private information acquisition can disclose more company-specific information and narrow the information gap between internal corporate factors and market participants (Jiang, 2018). Therefore, we hypothesize that the improvement in analyst private information acquisition can reduce stock market crash risk by reducing information asymmetry. Hence, the following hypothesis is proposed:

H1: The improvement in analyst private information acquisition can reduce stock market crash risk.

H2: The improvement in analyst private information acquisition reduces stock market crash risk by reducing information asymmetry.

To further research the impact mechanism of analyst private information on stock price crashes, we expect that analyst private information acquisition ability will reduce stock price crash risk by addressing information asymmetry in the following aspects. First, analyst private information can effectively enhance the accuracy of forecasted information and improve investors' access to firm-specific information. Analysts often obtain non-public sensitive information through field visits and social relationships with management, which allows them to validate the accuracy of public information and acquire additional private information about the company's internal operations, such as management capabilities, business strategies, and even government connections, enabling them to provide more accurate forecasts and investment recommendations (Wachtel et al., 2014; Chong et al., 2017). Hu (2008) demonstrated that analysts who conducted on-site visits had higher accuracy in earnings forecasts compared to those who did not, as the former had more opportunities to acquire private information. Han et al. (2018) revealed that local analysts outperformed non-local analysts in terms of private information acquisition ability and the accuracy of earnings forecasts. Therefore, we hypothesize that the improvement in analyst private information acquisition ability will reduce forecast errors and enhance the information interpretation capability of external investors, thereby lowering stock price crash risk. Hence, the following hypotheses are proposed:

H3: Analysts' increased ability to acquire private information reduces the risk of stock price crashes by lowering earnings forecast errors.

Mike and Yu (2015) argue that analysts' cash flow forecasts can constrain management from manipulating earnings quality and reducing accounting accruals, thereby enhancing the efficiency of internal controls related to financial reporting and preventing analysts from conveying negative information to the capital market. Similarly, greater access to private information strengthens analysts' monitoring role, as management tends to delay the release of bad news rather than good news (Kothari et al., 2009). Therefore, analysts with higher abilities to acquire private information are more likely to disclose negative information about a company, thereby exerting stronger constraints on management's misconduct. Consequently, we hypothesize that the improvement in analysts' ability to acquire private information enhances internal control efficiency, which in turn

supervises management behavior, leading to a reduction in the risk of stock price crash. Hence, we propose the following hypothesis:

H4: The improvement in analysts' ability to acquire private information reduces the risk of stock price crash by enhancing internal control efficiency.

3. Sample and data

3.1 Data source

This study selects the A-share listed companies on the Shanghai and Shenzhen Stock Exchanges in China from 2007 to 2021 as the research sample. During the data merging process, the following treatments were applied: 1) Exclusion of companies in the financial industry; 2) Exclusion of ST (Special Treatment) and PT (Protection Treatment) companies; 3) Exclusion of samples with missing fundamental financial data; 4) Exclusion of samples with analyst coverage equal to 1 (cannot to calculate sample variance). Finally, a total of 33,451 sample observations were obtained. The internal control index score used in this study is sourced from the "DIB (Dibo) Internal Control and Risk Management Database," while data on stock price crash risk, analyst earnings forecast, financial data, and corporate governance are sourced from the Guotai An CSMAR database. Following past research, this study conducted winsorization on continuous variables at the 1% and 99% levels to mitigate the influence of extreme observations.

3.2 Measurement of variables

3.2.1 Stock price crash risk (*NCSKEW*, *DUVOL*, *CRASH*)

This study uses three methods to measure the stock price crash risk, following Chen et al. (2001), Hutton et al. (2009).

The first measure of crash risk initially proposed by Chen et al. (2001), which calculates the negative skewness of the week return $w_{i,t}$ (Kim et al., 2011a) for stock i in the given fiscal period t . As the value increases, the crash risk is amplified.

$$NCSKEW_{i,t} = - \left[n(n-1)^{\frac{3}{2}} \sum w_{i,t}^3 \right] / \left[(n-1)(n-2) (\sum w_{i,t}^2)^{\frac{3}{2}} \right]$$

where n denotes the annual number of trading weeks for stock i .

The second measure captures the violability ratio of the week returns $w_{i,t}$ (Kim et al., 2011a) for stock i in the given fiscal period t . similarly, the higher value reflect higher crash risk.

$$DUVOL_{i,t} = \log \left\{ [(n_u - 1) \sum_{DOWN} w_{i,t}^2] / [(n_d - 1) \sum_{UP} w_{i,t}^2] \right\}$$

Where n_u and n_d denote the number of weeks where the week return $w_{i,t}$ is greater or less than annual average weak return $w_{i,t}$, respectively.

The third measure is originate from Hutton et al. (2009), which is a binary variable, coded one if the firm-specific week return $w_{i,t}$ falling at least 3.2 standard deviations below its mean value in a given fiscal year, meaning highly possible stock price crash, and zero otherwise.

3.2.2 Analysts private information acquisition

As Barron et al. (1998)'s model, this study measures the analyst private information acquisition by capturing the proportion of firm-specific private information (*private*) utilized by analyst forecasts. This model estimates the private information using the characteristics of analyst forecasts:

$$private_{i,t} = \frac{D_{i,t}}{\left[\left(1 - \frac{1}{N_{i,t}} \right) D_{i,t} + SE_{i,t} \right]^2}$$

Where $N_{i,t}$ denotes the number of analyst forecasts for firm i during given fiscal year t , $D_{i,t}$ denotes the sample deviations of analyst forecasts for firm i during given fiscal year t , $SE_{i,t}$ is the square of analyst forecast errors, calculated by the square of difference between actual earnings per share and the average analyst forecasts. Barron (1998) states that this model has effective function to measure the quality of analyst's private information, which is popularly used in research related to analyst forecasts (Kothari et al., 2009; Jiang, 2018; Chen and Zhou, 2015).

3.2.3 Control variables

Following the studies of Hutton (2009)、Kim (2016)、Chen(2016), this paper introduce the financial factors like firm size (*size*), return on assets (*roa*); corporate governance factors like internal control index (*ic_index*), board size (*bro_size*), percentage of independent directors in board (*bro_ind*); and other factors which have potential effect on crash risk like information opacity (*opacity*), shareholding of institutional investors (*insti*), comparability of accounting information (*compact*), and property nature (*equ_nature*). The detailed information of variables is in the Table 1.

Table 1. Definition of variables

Type of variable	variable	Measurement
explained variable	<i>crashrisk</i>	1 if a firm experiences one or more firm-specific weekly returns falling 3.2 standard deviations below the mean firm-specific weekly return over the fiscal year, and 0 otherwise
	<i>ncskew</i>	The negative skewness of firm-specific weekly returns over the fiscal year period
	<i>duvol</i>	The down-to-up volatility of firm-specific weekly returns over the fiscal year period
explanatory variable	<i>private</i>	Measured follow the model of Barron(1998)
controls variable	<i>size</i>	The natural logarithm of a firm's book value of total assets at the end of a fiscal year
	<i>btm</i>	Ratio of book value of equity to market value at the end of a financial year
	<i>roa</i>	The company's return on assets at the end of the financial year
	<i>opacity</i>	Absolute value of discretionary accruals measured by the modified Jones model
	<i>compact</i>	As the DeFranco et al. (2011), the level of comparability of the company's annual accounting information relative to other companies in the same industry.
	<i>%bro_ind</i>	The percentage of number of independent directors in the total number of board members
	<i>bro_size</i>	Number of members of the Company's Board of Directors at the end of the financial year
	<i>ic_index</i>	Internal control indicators reported by Dibo
	<i>insti</i>	Shareholding of institutional investors at the end of the financial year
	<i>big4</i>	1 if a company's financial statements are audited by a Big 4 accounting firm; 0 if not.
	<i>equ_nature</i>	1 if a company is state-owned; 0 if not.

3.3 Design of model

To test the hypothesis, this study establishes a multiple regression model and incorporates fixed effects for year and industry, aiming to analyze the impact of analysts' private information acquisition ability on stock price crash risk.

$$NCSKEW_{i,t}(DUVOL_{i,t}, CRASH_{i,t}) = \beta_0 + \beta_1 private_{i,t} + \beta_2 Controls_{i,t} + \delta_t + \mu_i + \varepsilon_{i,t}$$

Where i and t denote the specific firms and specific year respectively; $NCSKEW_{i,t}(DUVOL_{i,t}, CRASH_{i,t})$ represent the risk of stock price crash as the explained variable; $private_{i,t}$ is the ability of analyst to acquire the private information as the explanatory variable. $Controls_{i,t}$ denotes all the controls variables, as detailed in Table 1. δ_t and μ_i is the dummy variable for years and industry fixed effect, respectively. And $\varepsilon_{i,t}$ is the residual errors.

4. Results and analysis

4.1 Descriptive Statistics

The descriptive statistics for the variables in the study are provided in Table 2. As observed from Table 2, the minimum value of '*private_raw*' measured by Barron (1998) is 0, and the maximum value is 1286, indicating significant variability in analysts' private information acquisition abilities. The variable '*NCSKEW*' ranges from a minimum of -2.457 to a maximum of 1.635, highlighting some level of volatility in stock price crash risk as well.

Table 2 Descriptive statistics

Variable	N	Mean	Median	SD	Min	Max
<i>NCSKEW</i>	30216	-	-0.244	0.716	-	1.635
<i>DUVOL</i>	30216	-	-0.207	0.482	-	1.009
<i>CRASH</i>	30216	0.094	0	0.292	0	1
Private[The raw value (<i>private_raw</i>) of the measure of analysts' private information using Barron's (1998) model is highly skewed, with a range of values of 1286. Thus, drawing on Jiang's (2018) treatment, I take the natural logarithm of <i>private_raw</i> and then performs a maximum-minimum normalisation to obtain private as an explanatory variable.]						
	20346	0.92	0.919	0.039	0	1
<i>private_raw</i>	27656	36.52	1.276	149.8	0	1286
<i>size</i>	33451	22	21.8	1.288	19.68	26.14
<i>roa</i>	29595	0.055	0.054	0.066	-	0.243
<i>opacity</i>	33336	0.073	0.05	0.074	0.002	0.424
<i>ic_index</i>	29589	639.8	665.2	131.8	0	886.6
<i>bro_size</i>	33387	10.73	10	2.569	6	19
<i>bro_ind</i>	33387	0.347	0.333	0.072	0.063	0.545
<i>insti</i>	33297	43.68	45.26	25.04	0.343	92.53
<i>big4</i>	15218	0.055	0	0.227	0	1
<i>compacct</i>	33451	-	-0.008	0.008	-	-
<i>equ_nature</i>	33387	0.259	0	0.438	0	1

In addition, this study also conducted a correlation analysis among the variables. The results indicate that the correlation coefficients among the control variables are all below 0.5, suggesting the absence of severe multicollinearity issues.

4.2 Regression results analysis

Table 3 presents the fundamental regression results for the relationship between analysts' private information acquisition ability and stock price crash risk. The results reveal that, when measuring stock price crash risk using negative skewness (*NCSKEW*) and weekly return volatility (*DUVOL*) respectively, the regression coefficient for analysts' private information (*private*) is significantly negative at the 5% significance level. Similarly, when considering the binary variable '*CRASH*', the regression coefficient is significantly negative at the 1% significance level. This initial analysis confirms the hypothesis, providing evidence that analysts' private information acquisition ability effectively mitigates stock price crash risk.

Table 3. Baseline Regression

	(1) <i>NCSKEW</i>	(2) <i>DUVOL</i>	(3) <i>CRASH</i>
<i>private</i>	-0.590** (-2.40)	-0.352** (-2.07)	-2.674*** (-3.00)
<i>size</i>	0.003 -0.36	0.007 -1.34	0.005 -0.11
<i>roa</i>	0.506*** -4.21	0.118 -1.38	-0.83 (-1.27)
<i>opacity</i>	0.119 -1.23	0.095 -1.46	-0.208 (-0.37)
<i>ic_index</i>	-0.000*** (-3.18)	-0.000*** (-3.41)	-0.001*** (-3.65)
<i>bro_size</i>	-0.005 (-1.95)	-0.002 (-1.13)	-0.016 (-1.00)
<i>bro_ind</i>	0.00957 -0.11	0.0226 -0.38	-0.519 (-0.97)
<i>insti</i>	0.000 -1.02	0.001*** -3.02	-0.00496** (-1.98)
<i>big4</i>	0.004 -0.17	-0.010 (-0.57)	0.128 -0.87
<i>compacct</i>	3.155*** -2.79	2.608*** -3.36	11.27 -1.78
<i>equ_nature</i>	-0.036 (-2.25)	-0.001 (-0.11)	-0.054 (-0.62)
N	10555	10555	10480
R ²	0.0640	0.0631	
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes

t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (same below)

4.3 Robustness check

To address potential endogeneity concerns, the study conducted robustness tests on the research findings. Robustness was examined using Propensity Score Matching (PSM), where analysts' private information acquisition ability was grouped around the median, and control variables were matched accordingly. The regression results remained significant. Moreover, this study undertook the following additional robustness tests: (1) Lead-lag regression; (2) Including extra controls variables: corporate tax avoidance (measured by effective tax rate (*ert*)); stock liquidity (*ILLIQ_Y*), and digital economy level (*digi_level*), referring the prior studies (C Zhang, 2016; Q Li, 2022; Shun Nie, 2022); (3) Sample reduction: Samples from 2008 and 2020-2021 were excluded to mitigate the impact of the financial crisis and the COVID-19 pandemic, respectively. In all cases, the results remained significant; however, due to space limitations, detailed results are not provided here.

Lastly, the study employed instrumental variables to address and mitigate potential endogeneity issues associated with the explanatory variable. The robustness of the results was tested using a two-stage least squares (2SLS) approach (Table 4). Following the approach of Kim (2019), the study employed the squared average earnings forecast error of other firms, excluding the focal firm, as an instrument (denoted as 'iv'). The instrument 'iv' was calculated as the cross-sectional average of squared earnings forecast errors for each year and industry, except for the focal firm. It is known that 'iv' is significantly correlated with 'private' but not significantly correlated with 'NCSKEW' (as

indicated in results (1) and (2)). In result (3), the filtered 'private' variable, after accounting for the instrumental variable, still exhibits a significant correlation with 'NCSKEW', which indicates the robustness of the findings.

Table4. Instrument variable and 2SLS

	(1) <i>private</i>	(2) <i>NCSKEW</i>	(3) <i>NCSKEW</i>
<i>iv</i>	-0.004*** (-8.13)	-0.001 (-0.07)	4.583*** (-4.67)
N	20404	20429	17398
R ²	0.0574	0.0485	-0.0633
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes

5. Further analysis

5.1 Intermediary mechanism test

5.1.1 Model design

Certainly, the study employed the Sobel mediation test method, inspired by Baron and Kenny (1986), to establish a three-step regression model for verifying the mediating variable. Taking the example of the mediating variable '*Info_asy*', the model is constructed as follows:

$$NCSKEW_{i,t} = \beta_0 + \beta_1 private_{i,t} + \beta_2 Controls_{i,t} + \delta_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$Info_asy_{i,t} = \alpha_0 + \alpha_1 private_{i,t} + \alpha_2 Controls_{i,t} + \beta_2 Controls_{i,t} + \delta_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$NCSKEW_{i,t} = \beta'_0 + \beta'_1 private_{i,t} + \beta_2 Info_asy_{i,t} + \beta_3 Controls_{i,t} + \delta_{i,t} + \mu_{i,t} + \varepsilon_{i,t} \quad (3)$$

According to Baron and Kenny (1986), testing whether a mediating variable exerts a significant mediating effect involves three steps. First, without introducing the mediating variable '*Info_asy*', construct the regression model (1) between the explanatory variable 'private', representing analysts' private information acquisition ability, and the dependent variable 'NCSKEW', representing stock price crash risk. Obtain the coefficient of 'private' denoted as β_1 . In the second step, test the influence of the explanatory variable 'private' on the mediating variable '*Info_asy*'. Observe the coefficient α_1 of 'private' in model (2). In the third step, introduce the mediating variable '*Info_asy*' into the relationship between the explanatory variable 'private' and the dependent variable 'NCSKEW'. Observe the coefficient β'_1 of 'private' and the coefficient β_2 of '*Info_asy*' in model (3). When the coefficients β_1 in model (1), α_1 in model (2), and β'_1 in model (3) are all significant, it indicates the presence of a mediating effect of '*Info_asy*'. If, under this premise, the coefficient β_2 in model (3) is significant, it suggests a partial mediating effect of '*Info_asy*'. Conversely, if it is not significant, it indicates a complete mediating effect of '*Info_asy*'. Finally, after confirming the mediating effect of '*Info_asy*' through these three steps, its significance is tested using the Sobel Z-test.

5.1.2 Results analysis

Tables 5-7 present the results of mediation tests for the mediating variables: Information Asymmetry ('*Info_asy*'), Internal Control ('*ic_index*'), and Earnings Forecast Error ('*SE*'). Each table corresponds to the mediation test for one of the three mediating variables.

As shown in Table 5, in result (1), the regression of the explanatory variable 'private' on the dependent variable 'NCSKEW' indicates a significant negative coefficient for 'private'. In result (2), the regression of 'private' on the mediating variable '*Info_asy*' also shows a significant negative coefficient for 'private'. Result (3) incorporates the mediating variable '*Info_asy*' and demonstrates

that the coefficient of 'private' remains significantly negative, confirming that the improvement in analysts' private information acquisition ability can reduce stock price crash risk by mitigating information asymmetry. Additionally, the significant coefficient for 'Info_asy' in result (3) indicates partial mediation. The Sobel Z-value [The significance of the mediating effect is determined by calculating the Sobel statistic Z and the p-value, if the statistic Z is significantly not equal to 0 and the p-value is less than the present level of significance, the mediating effect can be considered significant.] of -1.839 at a 10% significance level confirms the significance of the mediating effect.

Similarly, Tables 6 and 7 respectively display the mediation effects of Internal Control ('ic_index') and Earnings Forecast Error ('SE'). The results indicate that enhancing analysts' private information acquisition ability ('private') can reduce stock price crash risk by promoting better internal control practices and minimizing analysts' earnings forecast errors. The Sobel Z-values are significant at the 10% and 1% levels, respectively.

Table5. Intermediary of Information Asymmetry

	(1) NCSKEW	(2) Info_asy	(3) NCSKEW
<i>private</i>	-0.603** (-2.47)	-0.111*** (-4.31)	-0.561** (-2.23)
<i>Info_asy</i>			0.211** (-2.01)
N	10641	10211	10211
R ²	0.0630	0.1270	0.0630
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes
Sobel Z		-1.839	
p ≥ Z		0.066	

Table 6. Intermediary of internal control effectiveness

	(1) NCSKEW	(2) SE	(3) NCSKEW
<i>private</i>	-0.579** (-2.36)	-16.52*** (-7.80)	-0.301** (-1.07)
<i>SE</i>			0.0168** (-2.24)
N	10433	10433	10433
R ²	0.0632	0.3800	0.0638
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes
Sobel Z		-3.102	
p ≥ Z		0.002	

Table 7. Intermediatory of earning forecast errors

	(1) <i>NCSKEW</i>	(2) <i>ic_index</i>	(3) <i>NCSKEW</i>
<i>private</i>	-0.627** (-2.52)	181.4*** -3.87	-0.579** (-2.36)
<i>ic_index</i>			-0.000*** (-3.21)
N	10443	10433	10433
R ²	0.0621	0.2460	0.0632
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes
Sobel Z		-1.73	
$p \geq Z $		0.084	

5.2 Moderating effect

This study examines the heterogeneity of the weakening effect of analysts' private information acquisition ability on stock price crash risk from both macro and micro perspectives. The results of this exploration are presented in Table 8. Specifically, result (1) displays the original main effect regression without introducing any moderating variables. This serves as a baseline for comparison to assess the effects of different moderating variables.

From a micro-level perspective, this study examines the heterogeneity of the main effect across different company sizes, as shown in result (2) of Table 6. The interaction coefficient between 'private' and 'size' is significantly negative and consistent with the main effect coefficient. This suggests that in larger companies, the impact of analysts' private information acquisition ability on reducing stock price crash risk is stronger. Larger companies often have more complex business structures and financial disclosure practices, which may create opportunities for information hoarding of bad news. Additionally, these companies tend to attract more investor attention. Therefore, the ability of analysts to acquire private information becomes more significant in evaluating risk for investors, enhancing their supervisory role. This, in turn, is more likely to mitigate the holdback motive and weaken stock price crash risk. Furthermore, this study examines the moderating effects of ownership nature and audit quality. Result (3) indicates that in state-owned enterprises, the ability of analysts' private information acquisition to mitigate stock price crash risk is more pronounced. Result (4) reveals that in companies audited by the Big Four, analysts' private information acquisition has a stronger supervisory and informational role in reducing stock price crash risk. From a macro-level perspective, the study finds that the main effect is significantly weakened in industries with higher concentration, as demonstrated in result (5) of Table 8. When measuring industry concentration using the ratio of the top 8 main business revenues to the total industry main business revenues, the interaction coefficient is significantly positive at the 5% level. This indicates that higher industry concentration weakens the main effect. As noted by Waris Ali (2022), companies in highly concentrated industries are more susceptible to external non-microeconomic factors that could elevate stock price crash risk, such as macroeconomic downturns and industry transformations. Analysts' company-specific proprietary information, however, cannot cover the influence of macro factors, meaning analysts cannot disclose unpredictable macro factors to the public. This implies that the role of analysts' private information acquisition ability may weaken or even fail to operate in monopolistic or oligopolistic industries.

Table 8. Test of Moderating effect

	(1)	(2)	(3)	(4)	(5)
	<i>NCSKEW</i>	<i>NCSKEW</i>	<i>NCSKEW</i>	<i>NCSKEW</i>	<i>NCSKEW</i>
<i>private</i>	-0.437*** (-3.51)	5.120** -2.29	-0.356*** (-2.85)	-0.379*** (-2.94)	-1.526*** (-3.00)
<i>private*size</i>		-0.250** (-2.50)			
<i>equ_nature*private</i>			-0.079*** (-6.92) (.)		
<i>big4*private</i>				-0.675 (-1.34)	
<i>private*CR_8A</i>					1.691** (-2.3)
N	22703	22703	22702	22662	21084
R ²	0.0005	0.0056	0.0026	0.0012	0.0014
Controls	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes	Yes

6. Conclusion

This study focuses on Chinese A-share listed companies from 2007 to 2021 to investigate the relationship between analysts' private information acquisition ability and stock price crash risk. The findings indicate that enhancing analysts' private information acquisition ability effectively reduces stock price crash risk by mitigating information asymmetry. Furthermore, the study demonstrates that analysts' private information acquisition ability reduces stock price crash risk through two pathways: by decreasing earnings forecast errors and improving internal control efficiency. Additionally, the study highlights that the effectiveness of analysts' private information acquisition ability may be compromised in industries with strong concentration, smaller non-state-owned enterprises, or lower audit quality.

This research not only contributes to the academic literature on financial analysts but also provides crucial insights for capital markets and investors in practice. It suggests that analysts' private information acquisition ability plays a more significant role in markets with lower levels of public information disclosure and more severe information asymmetry. Given China's lower levels of public and voluntary disclosure, analysts' private information is particularly influential in its capital market. The study demonstrates that improving analysts' private information acquisition ability can effectively mitigate the occurrence of stock price crashes in the Chinese market. This implies that investors should consider analysts' private information acquisition ability when evaluating and adopting analysts' investment recommendations, making informed investment decisions, and mitigating the impact of stock price crashes.

Moreover, these findings offer regulators a new perspective for assessing the role of insider private information. In emerging markets with poor information environments, private information may play a more significant and positive role in alleviating information asymmetry. Ultimately, this study opens new avenues for future research on the economic consequences of analyst activities by focusing on the acquisition of private information, shedding light on the different economic outcomes generated by various types of analyst information (private and public) and their implications.

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