Research on Relations Between ESG Performance and Stock Price Crash Risks

Xin Wang[1,2]([✉]), Yueyang Wang[1], and Qiang Meng[1]

[1] School of Business, Fuyang Normal University, Fuyang, Anhui, China
787165673@qq.com
[2] Graduate School of Business, Segi University, Kuala Lumpur, Malaysia

Abstract. Environmental, social and corporate governance (ESG) of businesses is becoming an important concern for investors in making investment decisions. This paper surveys a sample of A-share stocks listed on the Shanghai and Shenzhen Stock Exchanges between 2009 and 2020, examining the impacts of the ESG performance on stock price crash risks. It shows that sound ESG performance can significantly mitigate the stock price crash risks. The extended analysis suggests that from the perspective of shareholding structure, ESG performance has a stronger inhibitory effect on stock price crash risks for non-state-owned enterprises and enterprises with low equity concentration. A probe into the impact mechanism suggests that corporate accounting information quality has some mediating effects, i.e., better ESG performance improves accounting information quality, thus containing stock price crash risks. The results of this study form a scientific basis for listed corporations to facilitate their ESG performance and reduce the stock price crash risks.

Keywords: ESG Performance · Stock Price Crash Risks · Shareholding Structure

1 Introduction

As green development becomes the common pursuit of modern society, environmental issues remain a major global concern. To develop sustainably, corporations must go beyond the traditional concepts that pursue nothing but profits. Instead, they should focus on the demands of employees, customers, creditors, suppliers and other stakeholders, as well as the corporate social responsibility and environmental issues, striving to achieve social goals. ESG is a non-financial analysis framework that comprehensively evaluates corporations' sustainability in environmental (E), social (S) and corporate governance (G).

For listed companies with many stakeholders, the company's market value and volatility risks are the greatest concerns for investors. Disclosing the ESG information elevates the quantity and quality of overall information disclosure. In theory, an increase in non-financial information disclosure minimizes the fluctuations of market value, curbing the risks of stock price crashes. But in reality, can sound ESG performance

leads to a lower risk of a stock price crash and help investors make better decisions? This is the question that this paper aims to answer. With this basis, this paper examines how corporate ESG disclosure affects stock price crash risks. Besides, it also surveys the impact mechanism behind and the heterogeneity factors influencing this relationship.

The contributions of this paper are as follows: First, the paper surveys the ESG performance's impacts on stock price crash risks, enriching the theoretical research on the economic consequences of ESG evaluation and the factors influencing stock price crash risk. Second, it explores how the impacts of ESG performance on the stock price crash risks fluctuate due to different property rights and equity concentrations. The study provides scientific evidence and empirical insights to listed corporations to facilitate their ESG evaluation and reduce the stock price crash risks.

2 Literature Review

2.1 Research on ESG Performance

Research on ESG performance broadly covers two areas: first, factors that influence ESG performance; second, economic consequences of different ESG performances. Thus far, few academic studies have covered the first area, namely the influencing factors, while multiple scholars have surveyed the economic consequences of ESG performance, which can generally be divided into two categories:

(1) Economic consequences on corporations: A. Impacts on business performance. Velte (2017) [20] examined 412 German listed companies and found that ESG exerted positive impacts on their return on assets (ROA), and compared with the indicators of environmental and social governance, corporate governance indicators have the largest impacts on financial performance. Likewise, Cui et al. (2021) [16] studied the listed companies in China and discovered the same positive correlation between ESG performance and business performance. By organizing 2,200 relative research papers, Friede et al. (2015) [9] observed that around 90% of the studies displayed a positive correlation between ESG and financial performance. However, it should be noticed that different opinions were presented. For example, Duque-Grisales and Aguilera-Caracuel (2019) [7] analyzed the data of 104 multinationals in Brazil and spotted an obvious negative correlation between ESG evaluation and their financial performance. B. Impacts on financing costs. Atan et al. (2018) [2] surveyed a sample of 54 listed companies in Malaysia and noticed that companies with higher comprehensive ESG evaluations had higher financial costs. While Qiu and Yin (2019) [19], based on the data of China's capital market, tested the impacts of ESG performance on financing costs and capability and found that companies with better environmental and corporate governance enjoyed significantly lower financing costs.

(2) Economic consequences on external stakeholders. Investors are positive about ESG performance [17]. Compared with non-independent and short-term trading institutional investors, long-term and stable institutional investors obviously prefer companies with better ESG [23].

2.1.1 Research on Stock Price Crash Risk

Stock price crash risk is a classic topic of academic interest. The current research on the subject generally covers two aspects:

(1) Internal factors: Callen and Fang (2011) [4], An and Zhang (2013) [11] investigated shareholders' impacts on stock price crash risk from the perspective of institutional investors. Wang (2015) [21] surveyed the impacts of the substantial shareholders' shareholding percentage on stock price crash risk and found that as the largest shareholders had a higher percentage of shares, the stock price would be less likely to crash in the future. Some scholars studied how stock price crash risks are influenced by the characteristics of the management, including their age [1], over-confidence [14], and religions [5]. Others examined from the perspective of the efficiency of the governance, and found that the management may use accounting techniques to level out fluctuations in net income to cover the low-revenue programs. In this way, the boards failed to take immediate measures or settle the distressed investment, leading to the stock price crash [13].

(2) External factors: From the perspective of investors, as foreign institutional investors held more shares, the stock liquidity went up, leading to higher stock price crash risks [18]. From the perspective of analysts, their attention will raised stock price crash risks in the future [10]. From the perspective of external regulators, Dang et al. (2021) [6] found that looser bank regulations were negatively correlated to stock price crash risks.

In summary, scholars have explored some influencing factors and economic consequences of ESG performance, observing that ESG performance influences financial performance, financing costs, investment efficiency, investors' behaviors, etc. So, whether and how does the ESG performance affect stock price crash risk? Few scholars investigated the economic consequences of ESG performance from the perspective of stock price crash risk. Therefore, this paper will explore the relations between ESG performance and stock price crash risk as well as their impact mechanism, with an aim to enrich the research on the economic consequences of ESG performance and the influencing factors of stock price crash risk.

3 Theoretical Foundation and Hypothesis Development

ESG performance may affect stock price crash risk in two ways:

First, based on the theory of information asymmetry, investors who lack the needed information are at a disadvantage compared with the business management with sufficient information. This asymmetry harms the information transparency in the stock market, making it easier for the management to hide bad news. When accumulated to a certain level, all the bad news will be released for some reason, leading to a stock price crash [12, 15]. Enterprises are not isolated in society. Instead, their development is influenced by various social forces, not only internal management, employees and governance structure, but also external suppliers, customers, government and other social and environmental factors. The ESG rating contains environmental, social, and corporate

governance information, which helps increase investors' comprehensive understanding of the company compared with traditional financial information. Theoretically, it can reduce information asymmetry between investors and the company, and prevent the management from hiding bad news, thus mitigating the stock price crash risks.

Second, based on signaling theory, the disclosure of ESG rating is an important process that conveys signals based on which investors will make investment decisions. In this way, conflicts arising from commissioning agents will be reduced. At the same time, firms with poor ESG ratings will attach importance to public ESG reports to improve investors' negative impression caused by the prior poor ESG performance [8], thus preventing the stock price crash risks.

Based on the above theoretical analyses, this paper proposes its hypothesis:

H1: The better the ESG performance is, the more it can mitigate the stock price crash risks.

4   Research Design

4.1   Sample Selection and Data Sources

This paper selects Chinese A-share listed companies on the Shanghai or Shenzhen Stock Exchanges from 2009 to 2020 as the research sample. The final sample size is 27,416 after excluding samples from the financial industry, samples with asset ratios higher than 1 or lower than 0, and incomplete samples. The ESG rating data of the sample companies are from Hua Zheng index information service Co., Ltd, while the data of financial statements and corporate governance are from China Stock Market and Accounting Research Database (CSMAR). The top and bottom 1% of the continuous variables are winsorized to mitigate the effects of extreme values.

4.2   Model and Variables

To test the impact of ESG performance on stock price crash risk, this paper draws on the research of Benlemlih and Bitar (2018) [3], using stock price crash risk as the dependent variable and ESG performance as the independent variable to build the model (1):

$$NCS_{i,t}/DUV_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \sum \alpha_j Controls_{i,t} + Year + Ind + \varepsilon_{i,t} \quad (1)$$

To measure the dependent variable stock price crash risk, the Negative Coefficient of Skewness (NCS) and Down-to-Up Volatility (DUV), two indicators drawn from existing studies, are used. The data are built as follows:

First, the weekly specific returns on individual share are estimated by model (2),

$$R_{i,t} = \beta_0 + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{i,t} \quad (2)$$

$R_{i,t}$ is the returns on individual share i in week t. $R_{m,t}$ is the weighted average returns on the weekly circulating market value in week t. Based on the residual $\varepsilon_{i,t}$ estimated in the model (2), the weekly returns on individual share i can be calculated. Based on the

existing studies, the weekly returns on individual share i, W, can be defined as $W_{i,t} = \ln(1 + \varepsilon_{i,t})$.

Second, the NCS (equal-weighted average of submarkets), the indicators of stock price crash risk, are calculated based on $W_{i,t}$:

$$NCS_{i,t} = -\left[n(n-1)^{3/2}\sum W_{i,t}^3\right]\Big/\left[(n-1)(n-2)\left(\sum W_{i,t}^2\right)^{3/2}\right] \qquad (3)$$

The DUV (equal-weighted average of submarket) is calculated as:

$$DUV_{i,t} = log\left\{\left[(n_{up}-1)\sum\nolimits_{Down} W_{i,t}^2\right]\Big/\left[(n_{down}-1)\sum\nolimits_{Up} W_{i,t}^2\right]\right\} \qquad (4)$$

Where $W_{i,t}$ denotes the specific weekly return on individual share i. n is the number of trading weeks per year for individual share i. n_{up} represents the number of weeks when the weekly return $W_{i,t}$ is above the mean annual return, and n_{down} denotes the number of weeks when the weekly return $W_{i,t}$ is below the mean annual return. Larger $NCS_{i,t}$ and $DUV_{i,t}$ values indicate a higher risk of stock price crash.

To measure the independent variable, ESG performance, we use the Hua Zheng Index Information Service ESG rating, a database that covers the largest number of companies and updates most frequently in China. The rating evaluates the performance on a scale from one to nine. And the nine levels are assigned as numbers 1 to 9 from low to high in this paper.

Controls in the model denote control variables. Based on existing studies, other factors that may affect stock price crash risk should be considered and designed as control variables. The factors are as follows: in terms of internal corporate finance, there are firm size (Size), leverage (Lev), net cash flow per share (CF), liquidity ratio (Liqt), return on assets (Roa), revenue growth rate (Growth), and earnings management (DisAcc); in terms of corporate governance, there is the combination of position CEO and chairman of the board (CC); externally, we choose whether to change the audit firm (Firmchg) and the level of marketization in the place where the company registers (Market) as the factors to be considered. In addition, industry and year are also listed as control variables. The specific descriptions of variables are shown in Table 1.

Table 1. Variables

Types of Variables	Variables' Names	Symbols	Descriptions
Dependent Variables	Negative Coefficient of Skewness	NCS	Calculated by Eq. (3)
	Down-to-Up Volatility	DUV	Calculated by Eq. (4)
Independent Variables	ESG Performance	ESG	The nine levels of ESG performance, from poor to good, were assigned the values 1 to 9

Table 1. (*continued*)

Types of Variables	Variables' Names	Symbols	Descriptions
Control Variables	Firm Size	Size	Natural logarithm of total assets at the end of the year
	Leverage	Lev	Total debt/Total assets
	Cash Flow	CF	Net cash flow per share
	Liquidity Ratio	Liqt	Liquid asset/Liquid debt
	Return on Assets	Roa	Net income/Total assets
	Growth	Growth	Revenue growth rate
	Earnings Management	DisAcc	The absolute value of the disposable earnings is calculated by the modified Jones model
	CEO and Chief Manager	CC	The value 1 stands for the combination of the position CEO and chief manager, and 0 otherwise
	Audit Firm Change	Firmchg	Firm changes take the value 1, otherwise 0
	Marketization	Market	Wang X.L. et al. "China Provincial Marketization Index Report" (2019)
	Year	*Year*	Yearly dummy variable
	Industry	*Ind*	Industry dummy variable

5   Research Results

5.1   Descriptive Statistical Analysis

Two indicators, NCS and DUV, are used in the paper to measure stock price crash risks. As shown in Table 2, the mean of NCS is -0.422, the standard deviation 0.745, the minimum -2.630, and the maximum 1.715; the mean of DUV is -0.299, the standard deviation 0.485, the minimum -1.476, and the maximum 0.973. The above numbers demonstrate that the data distribution of the two indicators is basically normal. The mean of ESG performance is 6.472, the standard deviation 1.127, the minimum 1, and the maximum 9, which indicates that the sample ESG ratings are various and recognizable. The mean of CC is 0.257, which shows that two positions of CEO and chairman in the sample are 25.7% likely to be merged. The mean of firm change (Firmchg) is 0.099, signaling that 9.9% of the firms in the sample change their audit institutions. The data distribution of other control variables is also normal. The descriptive statistics are generally consistent with related studies.

Table 2. Descriptive statistics of variables

VarName	Obs	Mean	SD	P25	Median	P75	Min	Max
ESG	27416	6.472	1.127	6	6	7	1	9
NCS	27416	−0.422	0.745	−0.824	−0.382	0.019	−2.630	1.715
DUV	27416	−0.299	0.485	−0.621	−0.302	0.013	−1.476	0.973
Size	27416	21.820	1.200	20.956	21.682	22.502	19.420	25.480
Lev	27416	0.369	0.214	0.194	0.353	0.524	0.005	0.874
CF	27416	−0.057	0.402	−0.172	−0.013	0.111	−1.817	1.139
Liqt	27416	2.617	3.017	1.116	1.647	2.779	0.307	19.832
Roa	27416	0.008	0.013	0.001	0.007	0.014	−0.026	0.057
CC	27416	0.257	0.437	0	0	1	0	1
Growth	27416	−0.181	0.365	−0.404	−0.184	−0.007	−0.900	1.428
Firmchg	27416	0.099	0.299	0	0	0	0	1
DisAcc	27416	0.015	0.100	−0.034	0.014	0.063	−0.319	0.356
Market	27416	8.867	7.515	3	6	13	1	29

Table 3. Analysis of correlations

VarName	ESG	NCS	DUV
ESG	1	−0.018***	−0.019***
NCS	−0.031***	1	0.879***
DUV	−0.028***	0.875***	1

5.2 Analysis of Correlations

Spearman's ρ and Pearson correlation coefficient were used to test the correlations of the main variables. The results are shown in Table 3: both indicators of stock price crash risk, NCS and DUV, are significantly and negatively correlated with ESG ratings. The correlation coefficients between the other variables not shown in the table are small, indicating that there is no extreme multicollinearity.

Spearman's ρ and Pearson correlation coefficient are respectively shown in the upper and lower half corners.

5.3 Univariate Analysis and Multiple Regression Test

Table 4 presents the test results on how ESG performance affects stock price crash risks. First, column (1) of Table 4 shows the regression results without control variables. The results are divided into two columns based on NCS and DUV, two different measures of stock price crash risk. Both measures register significantly negative ESG regression

Table 4. Univariate analysis and multiple regression

VarName	Univariate test (1)		Multiple regression test (2)	
	NCS	DUV	NCS	DUV
ESG	−0.0200***	−0.018***	−0.026***	−0.014***
	(−5.050)	(−4.560)	(−5.759)	(−4.922)
Size			0.010**	0.005*
			(2.221)	(1.690)
Lev			−0.0002	0.004
			(−0.007)	(0.223)
CF			0.006	0.004
			(0.567)	(0.591)
Liqt			0.001	0.002**
			(0.747)	(2.023)
Roa			3.201***	1.835***
			(8.613)	(7.455)
CC			0.042***	0.026***
			(4.017)	(3.874)
Growth			−0.016	−0.012
			(−1.202)	(−1.408)
Firmchg			0.018	0.010
			(1.204)	(1.040)
DisAcc			−0.032	−0.040
			(−0.665)	(−1.287)
Market			−0.00005	0.00002
			(−0.079)	(0.043)
_cons	−0.283***	−0.216***	−0.591***	−0.440***
	(−10.940)	(−12.880)	(−6.002)	(−6.839)
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.001	0.001	0.038	0.043
N	27416	27416	27416	27416

Note: T-values are in parentheses. ***, **, * respectively indicate significance at the 1%, 5%, and 10% levels

coefficients at a 1% level. Second, in column (2) of Table 4, the multiple regression analysis with control variables still delivers negative ESG regression coefficients. The above regression results verify hypothesis 1. The reason may be that ESG performance brings more transparent accounting information by disclosing information related to environmental, social, and corporate governance. This allows investors a more realistic and comprehensive understanding of the companies, which, on the one hand, sends positive signals to investors and, on the other hand, reduces information asymmetry to

prevent the management from hiding bad news, thus mitigating the stock price crash risks.

6   Extended Analysis Based on Shareholding Structure

6.1   Heterogeneity of Property Rights

Chinese capital market is special and different from Western capital markets as it includes a large number of state-owned enterprises, which account for nearly half of the listed companies. The information about whether the enterprise is a state-owned enterprise (SOE) comes from CSMAR. Value 1 is assigned to the state-owned enterprises and 0 to the non-state-owned enterprises. Interaction term ESG*SOE is added. As shown in column (1) of Table 5, the effects of ESG performance on stock price crash risk are suppressed in SOEs. It may derive from the fact that private firms are more concerned about ESG performance since they cannot enjoy as much government resource allocation and national capital support as SOEs. Moreover, the better the ESG performance of private firms is, the more attention investors will pay to interpret the ESG signals. Consequently, the mitigating effects on stock price crash risk will be more conspicuous.

6.2   Heterogeneity of Equity Concentration

"The domination of substantial shareholders" is prevalent in Chinese firms. This paper tries to examine whether the effect of ESG performance on stock price crash risk is affected by equity concentration. Equity concentration (Cr), measured by the shareholding percentage of the largest shareholder in one firm, are from CSMAR. The median of the largest stockholder's shareholding percentage is used as the boundary, with those above assigned a value 1 and those below a value 0. Interaction term ESG*Cr is added. As shown in column (2) of Table 5, the role of ESG performance on stock price crash risk is inhibited in the sample with high equity concentration, probably because a concentrated smaller number of shareholders leads to fewer followers of the ESG information.

Table 5. Heterogeneity test

	Property Rights (1)		Equity Concentration (2)	
	NCS	DUV	NCS	DUV
ESG	−0.027***	−0.015***	−0.033***	−0.021***
	(−4.811)	(−4.005)	(−5.489)	(−5.419)
SOE	−0.173***	−0.110***		
	(−3.045)	(−2.986)		
ESG*SOE	0.015*	0.009*		
	(1.814)	(1.685)		

(continued)

Table 5. (*continued*)

	Property Rights (1)		Equity Concentration (2)	
	NCS	DUV	NCS	DUV
Cr			−0.117**	−0.103***
			(−2.206)	(−3.004)
ESG*Cr			0.016*	0.014***
			(1.938)	(2.738)
Size	0.015***	0.009***	0.011**	0.005*
	(3.272)	(2.825)	(2.305)	(1.742)
Lev	0.004	0.007	−0.001	0.004
	(0.140)	(0.375)	(−0.028)	(0.209)
CF	0.004	0.003	0.007	0.005
	(0.341)	(0.356)	(0.582)	(0.609)
Liqt	0.001	0.002	0.001	0.002**
	(0.302)	(1.552)	(0.815)	(2.113)
Roa	2.967***	1.674***	3.278***	1.894***
	(7.949)	(6.770)	(8.770)	(7.661)
CC	0.028**	0.016**	0.043***	0.027***
	(2.561)	(2.344)	(4.062)	(3.935)
Growth	−0.013	−0.010	−0.017	−0.013
	(−0.975)	(−1.172)	(−1.243)	(−1.464)
Firmchg	0.022	0.013	0.018	0.010
	(1.447)	(1.304)	(1.174)	(0.994)
DisAcc	−0.033	−0.041	−0.029	−0.038
	(−0.686)	(−1.313)	(−0.608)	(−1.221)
Market	0.001	0.000	−0.000	0.000
	(0.948)	(1.102)	(−0.090)	(0.049)
_cons	−0.644***	−0.481***	−0.547***	−0.397***
	(−6.135)	(−7.027)	(−5.308)	(−5.908)
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.039	0.045	0.038	0.043
N	27416	27416	27416	27416

7 Robustness Tests

7.1 Substitution of Key Variables: Stock Price Crash Risk

To test the model's robustness, different indicators are used to replace the previous measures of stock price crash risk, namely the NCS and DUV. NCS and DUV are calculated through the equal-weighted average of submarkets, while the alternative measures are

NCS1 and DUV1 calculated by the equal-weighted average of the integrated market. After measuring the predicted variable, stock price crash risk, with different indicators, the regression results in column (1) of Table 6 show that the regression coefficient of ESG on stock price crash risk is still significantly negative at the 1% level. Therefore, it demonstrates that the original hypothesis still holds true even with different measuring indicators.

Table 6. Substitution of key variables

	(1)		(2)	
	NCS1	DUV1	NCS	DUV
ESG	−0.026***	−0.015***		
	(−5.604)	(−5.191)		
ESG_new			−0.040***	−0.023***
			(−4.209)	(−3.759)
Size	0.011**	0.005	0.007	0.003
	(2.261)	(1.588)	(1.539)	(1.155)
Lev	−0.003	0.002	0.004	0.006
	(−0.119)	(0.095)	(0.143)	(0.342)
CF	0.005	0.003	0.008	0.005
	(0.420)	(0.417)	(0.671)	(0.673)
Liqt	0.004**	0.004***	0.001	0.002**
	(2.171)	(3.137)	(0.734)	(2.015)
Roa	3.093***	1.750***	3.119***	1.794***
	(7.969)	(6.954)	(8.394)	(7.292)
CC	0.043***	0.026***	0.043***	0.027***
	(3.905)	(3.776)	(4.105)	(3.942)
Growth	−0.012	−0.013	−0.015	−0.012
	(−0.874)	(−1.413)	(−1.088)	(−1.319)
Firmchg	0.025	0.012	0.020	0.011
	(1.553)	(1.151)	(1.314)	(1.132)
DisAcc	−0.023	−0.030	−0.036	−0.042
	(−0.454)	(−0.920)	(−0.741)	(−1.349)
Market	−0.000	−0.000	−0.000	0.000
	(−0.035)	(−0.278)	(−0.021)	(0.090)
_cons	−0.611***	−0.440***	−0.591***	−0.441***
	(−5.931)	(−6.640)	(−6.004)	(−6.848)
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.038	0.045	0.037	0.042
N	27416	27416	27416	27416

7.2   Substitution of Key Variables: ESG Performance

In the previous section, the nine levels of ESG performance, from poor to good, were assigned the values 1 to 9. With a new measure comes a new variable called ESG_new, which assigns the value 1 to all the samples with ESG scores of 1–3, value 2 to those with scores 4–6, value 3 to those with scores 7–9. The regression results in column (2) of Table 6 remain significantly negative at the 1% level after changing the ESG measure, consistent with the previous findings.

7.3   Endogeneity Test

7.3.1   Heckman Two-Step Method

To mitigate the endogeneity problem caused by potential reciprocal causality, the Heckman two-step method was adopted to test the endogeneity of the previous findings. The first step is to set a dummy variable ESG_dum for ESG performance, and assign value 1 to ESG performance above the median (experimental group), value 0 to ESG performance below the median (control group). Then, with the dummy variable ESG_dum being the predicted variable, Probit regression that includes all variables in the main regression is conducted to calculate the Inverse Mills Ratios (IMR). The second step is to include the Inverse Mills Ratios (IMR) into the original regression model. As seen in column (1) of Table 7, the same conclusions are drawn after containing the endogeneity problem arising from potential reciprocal causality.

7.3.2   Propensity Score Matching (PSM)

To alleviate the endogeneity problem caused by potential reciprocal causality, we used the Propensity Score Matching (PSM) technique to match each experimental group sample with the control group one based on all the control variables in the main regression model. The experimental group and the control group were set in the same way as in 6.3.1. We matched the variables 1:1 with their nearest neighbors, and ran the regression based on the matched samples. As shown in Table 8, the regression results were still significant at the 1% level.

7.3.3   Adding Control Variables

To mitigate the endogeneity problems caused by omitted variables, control variables such as the market-to-book ratio (MB), return on equity (Return), and accounting robustness (Gscore) are added to the previous variables, and the data are from CSMA. The regression results shown in column (2) of Table 7 again prove consistent with the original hypothesis.

Table 7. Endogeneity test: Heckman's method and added control variables

	(1) Heckman		(2) Added control variables	
	NCS	DUV	NCS	DUV
ESG	−0.024***	−0.013***	−0.016***	−0.008***
	(−5.407)	(−4.524)	(−3.468)	(−2.687)
IMR	0.476***	0.359***		
	(5.466)	(6.320)		
Size	0.039***	0.027***	0.018***	0.009***
	(5.767)	(5.976)	(3.572)	(2.950)
Lev	−0.074**	−0.052***	0.012	0.014
	(−2.457)	(−2.649)	(0.424)	(0.769)
CF	−0.007	−0.006	0.004	0.005
	(−0.640)	(−0.778)	(0.374)	(0.689)
Liqt	0.003*	0.004***	0.003	0.004***
	(1.734)	(3.162)	(1.430)	(2.942)
Roa	5.047***	3.228***	3.435***	1.994***
	(10.380)	(9.937)	(8.755)	(7.734)
CC	0.030***	0.017**	0.044***	0.027***
	(2.847)	(2.504)	(3.998)	(3.809)
Growth	−0.042***	−0.032***	−0.013	−0.009
	(−2.982)	(−3.430)	(−0.906)	(−1.031)
Firmchg	−0.010	−0.011	0.011	0.007
	(−0.621)	(−1.074)	(0.695)	(0.685)
DisAcc	0.038	0.013	−0.020	−0.022
	(0.779)	(0.417)	(−0.396)	(−0.661)
Market	−0.000	0.000	−0.000	0.000
	(−0.074)	(0.050)	(−0.083)	(0.024)
MB			0.011***	0.006***
			(3.864)	(5.315)
Return			−0.148***	−0.109***
			(−12.327)	(−13.809)
Gscore			0.000	0.000
			(0.146)	(0.574)
_cons	−1.261***	−0.945***	−0.774***	−0.537***
	(−8.372)	(−9.440)	(−6.998)	(−7.833)
Year	YES	YES	YES	YES
Ind	YES	YES	YES	YES
R^2	0.039	0.044	0.044	0.052
N	27416	27416	24455	24455

Table 8. Endogeneity problem: PSM

	(1) NCS	(2) DUV
_ESG_dum	−0.088***	−0.058***
	(−6.413)	(−6.518)
_cons	−0.345***	−0.248***
	(−26.790)	(−29.543)
Year	YES	YES
Ind	YES	YES
R^2	0.001	0.002
N	27416	27416

8   Impact Mechanism Test

To test how ESG performance affects the stock price crash risk, we consider a possible mechanism that exerts influence, that is, accounting information quality (Accinfor). The quality of accounting information is measured by the disclosure assessment of listed companies. The data are from CSMAR, with the assessment results taking the value 1 for fail, 2 for pass, 3 for good, and 4 for excellent. The sample size of the regression in Table 9 is smaller due to missing accounting information data.

According to the three-step method of mediating effects [22], first, regressions are done on ESG using stock price crash risk, and the results in column (2) of Table 4 show that better ESG performance leads to lower stock price crash risks.

Second, regressions are done on ESG using accounting information (Accinfor), and the results in column (1) of Table 9 find that the ESG coefficient is significantly positive, indicating that better ESG performance greatly improves accounting information quality.

Last, regressions are done on accounting information quality and ESG using stock price crash risk. The results in column (2) of Table 9 register that both accounting information quality and ESG coefficients are significant, demonstrating that accounting information quality has some mediating effects on the relation between ESG and stock price crash risk. By improving accounting information quality, stock price crash risk can be reduced.

Table 9. Test of accounting information's mediating effects

	(1) Accinfor	(2) NCS
ESG	0.157***	−0.031***
	(30.352)	(−5.266)
Accinfor		−0.036***
		(−3.515)
Size	0.065***	0.042***
	(12.028)	(6.094)
Lev	−0.261***	−0.050
	(−8.700)	(−1.333)
CF	−0.006	−0.007
	(−0.487)	(−0.436)
Liqt	0.003**	0.001
	(2.173)	(0.642)
Roa	8.871***	3.267***
	(21.387)	(6.658)
CC	−0.037***	0.026**
	(−3.740)	(1.989)
Growth	−0.101***	−0.015
	(−6.710)	(−0.834)
Firmchg	−0.112***	0.023
	(−6.957)	(1.200)
DisAcc	0.528***	−0.047
	(10.019)	(−0.749)
Market	−0.005***	−0.002*
	(−7.194)	(−1.874)
_cons	0.463***	−1.046***
	(4.060)	(−7.329)
Year	YES	YES
Ind	YES	YES
R^2	0.193	0.036
N	16367	16367

9 Conclusion and Insights

9.1 Conclusion

ESG rating is a new topic of academic interest. This paper surveyed a sample of Chinese A-share companies listed on the Shanghai or Shenzhen Stock Exchanges between 2009 and 2020, exploring the impacts of ESG performance on the stock price crash risks. The research found that the better the ESG performance, the lower the individual stock price

crash risks. The extended analysis suggested that from the perspective of property rights, the effects of ESG performance on stock price crash risk were suppressed in state-owned enterprises (SOEs), while in non-state-owned enterprises, better ESG performance could significantly reduce stock price crash risk; from the perspective of equity concentration, ESG performance had fewer impacts on stock price crash risk in firms with high equity concentration, while the effects were more obvious in firms with low equity concentration. The impact mechanism test showed that corporate accounting information quality in part played a mediating role by improving which ESG performance inhibited stock price crash risk.

9.2 Insights

The findings of this paper provide some insights. First, firms should attach importance to environmental protection, social responsibility and corporate governance, laying a foundation for sustainable development. Second, to deal with stock price crashes, enterprises should actively disclose ESG information. Improved ESG performance can reduce stock price crash risks, especially for non-state-owned enterprises and enterprises with low equity concentration. Last, governments should perfect the ESG information disclosure system, encouraging companies to actively disclose ESG information while punishing those disclosing insufficiently or inaccurately. As a result, we can contain the stock price crash risks and maintain the stability of the capital market.

References

1. Andreou, P. C., Louca, C., & Petrou, A. P. (2017). CEO age and stock price crash risk. J. Review of Finance. 21(3), 1287–1325.
2. Atan, R., et al. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. J. Management of Environmental Quality. 29(2), 182–194.
3. Benlemlih M, Bitar M (2018). Corporate social responsibility and investment efficiency. J. Journal of Business Ethics.148(3), 647–671.
4. Callen, Jeffrey & Fang, Xiaohua (2011). Institutional Investor Stability and Crash Risk: Monitoring versus Short-Termism? J. Journal of Banking & Finance. 37, 3047–3063.
5. Callen, Jeffrey & Fang, Xiaohua. (2012). Religion and Stock Price Crash Risk. J. Journal of Financial and Quantitative Analysis. 50, 1–2.
6. Dang, V & Lee, E& Liu, Y.K & Z, C. (2021). Bank deregulation and stock price crash risk. J. Journal of Corporate Finance. 72(7), 102–148.
7. Duque-Grisales, E. and J. Aguilera-Caracuel (2021). Environmental, Social and Governance (ESG) Scores and Financial Performance of Multilatinas: Moderating Effects of Geographic International Diversification and Financial Slack. J. Journal of Business Ethics. 168(2), 315–334.

8. Fatemi, A., Glaum M., and Kaiser S (2018). ESG performance and firm value: The moderating role of disclosure. J. Global Finance Journal. 38, 45–64.

9. Friede, G., T. Busch and A. Bassen (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. J. Journal of Sustainable Finance & Investment.5(4), 210–233.

10. Han Yanjin, Feng Xiaoqing, Song Jianbo (2021). Analyst Coverage and Stock Price Crash Risk Based on Information Generation Process. J. Chinese Journal of Management. 18(02), 279–286.

11. Heng An, Ting Zhang (2013). Stock Price Synchronicity, Crash Risk and Institutional Investors. J. Journal of Corporate Finance. 21, 1–15.

12. Hutton, A. P., A. J. Marcus. H. Tehranian (2009) . Opaque Financial Reports, R2, and Crash Risk. J. Journal of Financial Economics. 94 (1), 67–86.

13. Khurana I K, Pereira R, Zhang E X, et al (2018). Is real earnings smoothing harmful? Evidence from firm-specific stock price crash risk.J. Contemporary Accounting Research. 35(1), 558–587

14. Kim J., Wang Z., Zhang L. D (2016). CEO Overconfidence and Stock Price Crash Risk. J. Contemporary Accounting Research. 33(4), 1720–1749.

15. Kim, J. B., L. Zhang (2014). Financial Reporting Opacity and Expected Crash Risk: Evidence from Implied Volatility Smirks. J. Contemporary Accounting Research. 31 (3), 851–875.

16. Li Jinglin, Yang Zhen, Chen Jin, Cui Wenqing (2021). Study on the Mechanism of ESG Promoting Corporate Performance: Based on the Perspective of Corporate Innovation. J. Science of Science and Management of S. & T. 42(9), 71–89.

17. Mehdi Nekhili, Amal Boukadhaba, Haithem Nagati & Tawhid Chtioui (2021). ESG performance and market value: the moderating role of employee board representation. J. The International Journal of Human Resource Management. 32(14), 3061–3087.

18. O. Sezgin Alp, B. Canbaloglu and G. Gurgun (2021). Stock liquidity, stock price crash risk, and foreign ownership. J. Borsa Istanbul Review.

19. Qiu Muyuan, Yin Hong (2019). An Analysis of Enterprises' Financing Cost with ESG Performance under the Background of Ecological Civilization Construction. J. The Journal of Quantitative & Technical Economics. 3, 108–123.

20. Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. J. Journal of Global Responsibility. 8(2), 169–178.

21. Wang Huacheng, Cao Feng and Ye Kangtao (2015). Monitoring or Tunneling?: The Proportion of the Proportion Held by the Big Shareholders and the Risk of the Crash of the Stock Price. J. Management World. 2, 45–57+187.

22. Wen Zhonglin, Ye Baojuan (2014). Analyses of Mediating Effects: The Development of Methods and Models. J. Advances in Psychological Science. 22(5), 731–745.

23. Zhou Fang-zhao, Pan Wan-ying, Fu Hui (2020). ESG Responsibility Performance of Listed Companies and Institutional Investors' Shareholding Preference. J. Scientific Decision Making. 11, 15–41.