ESG Performance, Institutional Investors and Corporate Risk-taking: Empirical Evidence from China

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Abstract. Corporate ESG practices have attracted much attention as an important starting point to achieve China's dual carbon goal, and how the ESG performance by Chinese listed firms affects their risk-taking is a question worth exploring. Basing our analysis on the data of China's A-share listed companies from 2009 to 2021, we find that good ESG performance by listed companies significantly reduces their risk-taking, with institutional investors' shareholding as the mediating mechanism. Further research indicates that long-term institutional investors' shareholding strengthens the risk inhibitory effect of good ESG performance, while short-term institutional investors' shareholding weakens this effect. Good ESG performance only significantly reduces the risk-taking of firms at high risk levels and significantly inhibits excessive rather than insufficient risk-taking. When economic policy is unstable, ESG has a stronger inhibitory effect on risk-taking. This paper illustrates the importance of ESG engagement for long-term stable corporate development, which is of significant practical implications for regulatory policy making and listed companies' strategic decisions in developing countries.

Keywords: ESG Performance; Corporate Risk-taking; Institutional Investor; Heterogeneity.

1. Introduction

The Chinese government has recently pledged to peak CO2 emissions by 2030 and strive to achieve carbon neutrality by 2060. In the field of sustainable development, much attention has been paid to the ESG concept as an important starting point to achieve the dual carbon goal. ESG is an evaluation criterion for corporate sustainability based on three factors: environmental, social, and governance. China's ESG investment and corporate ESG engagement have been driven by regulatory policies to show accelerated development. With increasingly stringent regulation, the negative environmental, social, and corporate governance events of listed companies have been repeatedly exposed, placing companies at severe reputational and litigation risk.

In the context of global capital market volatility, there is an urgent need for theoretical research based on the actual situation in China on whether ESG practices can enhance the ability of firms to cope with changes in the macroeconomic environment and achieve sustainable development. The previous literature notes that good ESG performance can alleviate information asymmetry and financing constraints, improve corporate innovation and investment efficiency, and ultimately enhance corporate financial performance and value (Alareeni & Hamdan, 2020; Fatemi et al., 2018; Ellili, 2022; Bai et al., 2022; Zhang et al., 2020). However, risk-taking, which plays a significant role in investment decision-making for firms, may be influenced by their ESG strategies. As a result, this article empirically investigates the impact of ESG performance on corporate risk-taking and its potential underlying mechanisms using data of Chinese A-share listed companies from 2009 to 2021.

The paper mainly makes the following contributions: First, by combining a company's ESG strategy with its behavioural choices, our study fills the gap between ESG performance and corporate risk-taking correlation analysis, offering useful insights for emerging economies like China. Second, by examining the effects of different types of institutional investors on corporate risk-taking and further providing evidence for the positive effect of participation in corporate governance by long-term institutional investors. Third, while low levels of risk-taking may be a symptom of agency problems, high levels of risk-taking also have a negative impact on the long-term health of the firm.

Therefore, we distinguish two aspects of abnormal corporate risk-taking and provide evidence that ESG helps reduce firms' excessive rather than insufficient risk-taking.

The paper proceeds as follows: Section 2 reviews earlier writings. Theoretical analysis and research hypotheses are presented in Section 3. The data source, variable definition, and model setting are presented in Section 4. The model regression analysis and robustness test are conducted in Section 5 along with a discussion of descriptive statistics and correlation. Additional analysis is conducted in Section 6. Conclusions and implications are presented in Section 7.

2. Literature Review

2.1 Corporate Risk-taking

As an important part of investment decision-making, corporate risk-taking reflects the tendency of enterprises to pursue high profits and pay for them (Lumpkin & Gregory, 1996). In terms of the economic consequences of corporate risk-taking, the previous literature suggests that moderate risk-taking helps to improve the efficiency of capital allocation and innovation capacity of firms, which in turn enhances corporate performance and shareholder wealth (John et al., 2008; Yu et al., 2013; Liu & Yang, 2018). However, there is not a simple linear relationship between risk-taking and corporate performance. Dong (2014) argues that risk-taking has an inverted U-shaped relationship with corporate performance. According to Fishburn et al. (1977), firms tend to be more risk-averse when they are profitable, while they tend to be risk-chasing when their performance is below target, and the degree of risk-chasing is much higher than the degree of risk-aversion. Based on a firm life cycle perspective, Habib and Hasan (2017) state that excessive risk-taking reduces firm performance during growth and decline periods. Excessive risk-taking is also detrimental to the company's growth and does not promote long-term development. (Li, 2017).

In terms of factors influencing corporate risk-taking, prior studies show that corporate risk-taking is affected by external factors such as government policies (Bargeron et al., 2010; Mao & Xu, 2016), bank competition and credit policies (Yan et al., 2019; Wang et al., 2022), and informal institutions(Li et al., 2019; Díez-Esteban et al., 2019), while some scholars, from the perspective of internal factors of firms, suggest that corporate risk-taking is influenced by managers' personal traits (Yu et al., 2013; Zhang et al., 2022), management incentives (Coles et al., 2004; Gormley et al., 2013), and board characteristics (Wang, 2012; Mohsni et al., 2021). Prior research on the impact of CSR on risk-taking has different perspectives: one view is that CSR can alleviate agency problems and thus increase corporate risk-taking (Liu et al., 2016; Xue, 2021), while another view is that CSR is negatively related to corporate risk-taking. Research by Zhou et al. (2020) suggests that CSR activity is negatively related to corporate risk-taking. Feng et al. (2016) also show that the moral and reputational capital formed by CSR can provide insurance-like protection to protect firms from the negative impact of crisis events, thus effectively reducing their risk-taking. Harjoto and Laksmana (2018) argue that CSR is an effective mechanism to reduce deviation from the optimal risk-taking level. In terms of the impact of institutional investors, Zhu and Ni (2014) state that both independent and non-independent institutional investors' shareholdings reduce firm risk-taking. Zhang et al. (2019) provide evidence that the more stable the holdings of institutional investors, the more effective they are at monitoring the firm and reducing corporate risk-taking.

2.2 Economic Consequences of Enhancing ESG Performance of Firms

Prior research suggests that good ESG performance by firms has a positive impact on their financial performance (Alareeni & Hamdan, 2020; Friede et al., 2015) and firm value (Fatemi et al., 2018; Wang et al., 2022). Good ESG scores can alleviate corporate financing constraints and attract institutional investors to hold shares (Bai et al., 2022; Beiting et al., 2014). ESG also improves the efficiency of corporate investment by mitigating information asymmetry (Ellili, 2022), and all three dimensions, E, S, and G, promote corporate innovation (Zhang et al., 2020).

From the previous literature, it can be seen that moderate risk-taking is more conducive to corporate development, and the optimal level of corporate risk-taking should be dynamically adjusted in light of the particular circumstances of the organization. Prior research on the internal factors influencing corporate risk-taking has mostly focused on corporate governance mechanisms such as personal characteristics of managers, management incentives, and board characteristics, while studies on the economic consequences of ESG mainly focus on its value and financial performance enhancement, but the impact of ESG on corporate risk-taking is not yet clear. Therefore, this paper seeks to fill this gap and further explore the mediating effect of institutional investors.

3. Theoretical Analysis and Research Hypothesis

3.1 ESG Performance and Corporate Risk-taking

According to stakeholder theory, the survival and development of a company depend on its effective response to the interests of its stakeholders (Donaldson & Presto, 1995). Firms with good ESG performance tend to have good stakeholder responsibility and are more likely to include the maintenance of community relations, the protection of the natural environment, and scientific internal governance as corporate development and management objectives. In order to coordinate the interests of all stakeholders, managers tend to have more stable behavior patterns and make responsible investment decisions not only with the goal of maximizing profits but also taking the expectations of stakeholders into account (Heal & Garret, 2005). The resulting good stakeholder relationships create a good internal cohesion and stable external environment for sustainable development and enhance the risk management capability of the company (Porter & Kramer, 2006).

According to corporate reputation theory, corporate reputation is the evaluation of a company by many stakeholders based on how well their demands and expectations are met (Wartick, 1992). Corporate ESG performance, as important non-financial information about firms, conveys a positive image of firms to the outside world and helps to build a good corporate reputation (Maaloul et al., 2021). Corporate reputation is cumulative and fragile, requires long-term building and management, and is difficult to rebuild once damaged. Therefore, corporations typically develop more effective internal controls and make better decisions on high-risk investment projects in order to minimize reputation degradation and meet stakeholders' expectations.

In summary, the active implementation of ESG responsibilities by companies not only helps to improve the enterprise risk management process and reduce short-sightedness in corporate decision making, but also helps to build a good reputation for the company, subjecting it to more scrutiny and discipline from stakeholders and ultimately motivating it to make more responsible decisions to maintain and improve its reputation.Therefore, the following hypothesis H1 is proposed:

Hypotheses 1 (H1). Good ESG performance by listed companies can reduce their risk-taking.

3.2 ESG Performance, Institutional Investors' Shareholding and Corporate Risk-taking

The concept of ESG responsible investment has been becoming increasingly accepted across the globe with the establishment of UN PRI (the UN Principles for Responsible Investment) in 2006. The ESG investment sector in China is growing quickly, particularly in light of the "carbon peaking and carbon neutrality" objective. The China Sustainable Investment Review 2021 (https://en. chinasif. org/ products/csir2021) states that in 2012, less than 10 institutional investors in China joined the UN PRI, but by 2021, that number had increased to more than 80. As a result, the ESG performance of listed firms has increasingly grown in priority to professional institutional investors in the Chinese capital market. Institutional investors, as professional financial institutions with strong capital, can gain information advantages through channels such as participation in corporate management, field research, communication with management, and shareholding in other firms in the industry, playing an important role in improving the governance of listed companies (Li & Li, 2008; Tan & Lin, 2016). According to the signaling theory, it is difficult for investors to accurately evaluate the status of a firm due to asymmetric information in the capital market, and successful firms will take proactive

measures to give out positive signals in order to attract more investors. By doing this, they will set themselves apart from other firms and assist investors in making investment decisions (Ross, 1977). Good ESG performance, as important non-financial information, is a positive signal sent by firms in response to the information asymmetry in the capital market, which not only conveys firms' willingness to pursue stable operations and long-term sustainable development but also attracts institutional investors who are concerned with asset safety. The increase in the shareholding of institutional investors gives them a stronger voice in the firms and more power to "vote with their hands" and influence management decisions. Therefore, they can use their professional abilities to improve corporate governance and strengthen the supervision and restraint of high-risk activities by firms. Accordingly, the second hypothesis H2 of this paper is proposed.

Hypotheses 2 (H2). Companies with good ESG performance attracts more institutional investment, which in turn reduces corporate risk-taking.

4. Research Design

4.1 Sample Selection and Data Sources

The ESG ratings of Sino-Securities Index Information Service (Shanghai) Co. Ltd. can be traced back to 2009 at the earliest, so this paper selects A-share listed companies from 2009-2021 as the research sample. The data related to abnormal risk-taking and institutional investor heterogeneity are obtained from the Csmar database, while the rest of the data are obtained from the Wind database. The original information is screened as follows: (1) the samples of financial listed companies are excluded; (2) the samples of delisted, ST and *ST firms are excluded; (3) the samples with missing relevant data are excluded. The final sample involves 33449 observations. In order to avoid the interference of outliers to the results of empirical analysis, all continuous variables are Winsorized at the upper and lower 1% quantile in this paper. The data analysis software used in this paper is Stata 17.0.

4.2 Variable Settings

The explanatory variable in this paper is corporate risk-taking (Risk). The commonly used measures in previous studies are mainly the volatility of earnings (John et al., 2008; Yu et al., 2013) and the volatility of stock returns (Coles et al., 2004). Considering the high volatility of the Chinese stock market, the reliability of measuring risk-taking by the volatility of stock returns is affected by the efficiency of the capital market. Therefore, this paper uses the degree of volatility of ROA (EBITDA/total assets at the end of the period) of the firm over the 3-year observation period to measure corporate risk-taking. The specific calculation method is shown in equations (1) and (2): first, the industry average is used to adjust the ROA to obtain Adj_ROA; second, the extreme deviation of Adj_ROA is calculated by selecting year t to t+2 as a rolling observation period. In the robustness test, the three-period rolling standard deviation of Adj_ROA is used as an alternative indicator for corporate risk-taking to ensure the robustness of the empirical findings, which is calculated as shown in Equation (3).

$$Adj_ROA_{i,t} = \frac{EBIT_{i,t}}{ASSET_{i,t}} - \frac{1}{X}\sum_{k=1}^{X}\frac{EBIT_{i,t}}{ASSET_{i,t}} \tag{1}$$

$$\mathrm{Risk}_{i,t} = Max(Adj_ROA) - Min(Adj_ROA) \tag{2}$$

$$Risk_rb_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(Adj_ROA_{i,t} - \frac{1}{T}\sum_{t=1}^{T}Adj_ROA_{i,t})^{2}} \,\Big|T = 3 \tag{3}$$

In Equation (1)-(3), i denotes a firm, t denotes the observation year, T denotes the observation interval, X denotes the number of listed companies in the same industry, and k denotes the kth firm in the industry.

ESG performance (ESG) is the explanatory factor in this study. The ESG rating of Sino-Securities covers all A-share listed companies and is known for its suitability to the Chinese market. In this study, the ESG performance of companies is measured using Sino-Securities' ESG rating. The ESG rating of Sino-Securities includes 9 grades, from the highest to the lowest, AAA, AA, A, BBB, BB, B, CCC, CC, C. This paper constructs numerical variables to assign 9, 8, 7, 6, 5, 4, 3, 2, 1 to each of the 9 grades from the highest to the lowest, with higher values representing better ESG performance.

Shareholding of institutional investors (Inst) is the mediating variable in this paper, which is the proportion of institutional investors' holdings to all of the company's shares. The higher the value, the larger the proportion of shares held by institutional investors.

Drawing on existing studies, the following indicators are selected as control variables in this paper: leverage (Lev), growth (Growth), operating cash flow ratio (Cash), capital expenditure ratio (Capital), firm size (Size), firm age (Age), and firm ownership (Soe). The basic meanings and metrics of the main variables are shown in Table 1.

Table 1. Variable definition

Variable Types	Variables	Measurements
Explained Variables	Risk	Corporate risk-taking, the extreme difference in corporate earnings
	Risk_rb	Corporate risk-taking, corporate surplus volatility
	abrisk	Abnormal risk taking
	over_risk	Excessive risk-taking
	under_risk	Insufficient risk-taking
Explanatory Variables	ESG	ESG rating scores (1 to 9)
Mediating Variables	Inst	Shareholding of institutional investors
	GLTST	If long-term institutional ownership is dominant, it takes a value of 1; otherwise, 0
	GSTLT	If short-term institutional ownership is dominant, it takes a value of 1; otherwise, 0
Control Variables	Lev	Leverage, total liabilities/total assets
	Growth	The growth of enterprises, operating income growth rate
	Cash	Operating cash flow ratio, cash flow from operating activities/total assets
	Capital	Capital expenditure ratio, capital expenditure/total assets
	Size	The natural logarithm of total assets
	Age	The natural logarithm of years from the establishment year to the research year
	Soe	Firm ownership, if state owned and controlled, it takes a value of 1; otherwise, 0
	Year	Control
	Industry	Control

4.3 Empirical Model Construction

Following Baron and Kenny (1986), we use the causal-steps approach to determine whether there is a mediation effect of institutional investors' shareholding between corporate ESG performance and risk-taking. Model (4) is used to test the main effect of corporate ESG performance and risk-taking, and if the coefficient of ESG performance (ESG) is significant, it indicates the existence of the main effect. Models (5) and (6) are used to verify the mediation effect. If the coefficient α_1 of corporate ESG performance (ESG) in model (5) and the coefficients χ_1 and χ_2 of corporate ESG performance (ESG) and shareholding of institutional investors (Inst) in model (6) are significant, it indicates that corporate ESG performance can influence institutional investors' shareholding and play a mediating role in the relationship between corporate ESG performance and risk-taking.

$$Risk_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta \sum Controls_{i,t} + Year_FE + Ind_FE + \varepsilon \quad (4)$$

$$Inst_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha \sum Controls_{i,t} + Year_FE + Ind_FE + \varepsilon \quad (5)$$

$$Risk_{i,t} = \chi_0 + \chi_1 ESG_{i,t} + \chi_2 Inst_{i,t} + \chi \sum Controls_{i,t} + Year_FE + Ind_FE + \varepsilon \quad (6)$$

5. Empirical Analysis

5.1 Descriptive Analysis

Table 2 presents descriptive statistics for the full sample. The minimum value of risk-taking level (Risk) is 0.004, the maximum value is 0.402, and the median value is 0.044, which shows that there is a large variation in the risk-taking level of the sample firms. The minimum value of corporate ESG performance (ESG) is 1, the maximum value is 6, and the mean value is 4.10, which shows that corporate ESG performance is generally at a low to medium level, with some companies actively engaging in ESG, while others have a far lower than average ESG performance. Therefore, it is important from a practical standpoint to investigate how corporate ESG performance affects risk-taking. The mean, maximum, and minimum values of Lev, Growth, Cash, and Captital associated with the financial condition of listed firms differ significantly, suggesting significant variation in the operating conditions of the sample companies, which provides a useful basis for the regression.

Table 2. Descriptive analysis

Variables	Observation	Mean	Std	Min	Medium	Max
Risk	33449	0.067	0.069	0.004	0.044	0.402
Risk_rb	33449	0.035	0.037	0.002	0.023	0.215
ESG	33449	4.105	1.09	1	4	6
Inst	33449	37.83	23.85	0.067	38.33	87.89
Lev	33449	41.86	20.84	5.489	41.01	95.45
Growth	33449	15.59	33.48	-54.37	11.07	197.5
cash	33449	0.048	0.072	-0.199	0.047	0.335
capital	33449	0.051	0.049	0	0.037	0.266
Size	33449	22.14	1.333	17.47	21.94	28.64
age	33449	2.033	0.924	0	2.197	3.296
Soe	33449	0.357	0.479	0	0	1

Source: calculated from the data from Wind database.

5.2 Correlation Analysis

Table 3. Pearson correlation coefficient

	Risk	ESG	Inst	Lev	Growth	Cash	Capital	Size	Age	Soe
Risk	1									
ESG	-0.206***	1								
Inst	-0.151***	0.071***	1							
Lev	-0.038***	-0.094***	0.232***	1						
Growth	-0.012**	0.029***	-0.011*	0.001	1					
Cash	-0.030***	0.088***	0.125***	-0.147***	0.023***	1				
Capital	-0.017***	0.088***	-0.030***	-0.064***	0.085***	0.148***	1			
Size	-0.179***	0.193***	0.451***	0.485***	0.004	0.083***	-0.040***	1		
Age	-0.028***	-0.136***	0.399***	0.397***	-0.115***	0.005	-0.241***	0.393***	1	
Soe	-0.112***	0.051***	0.387***	0.309***	-0.104***	0.003	-0.094***	0.343***	0.432***	1

The results of the correlation analysis are shown in Table 3. It is not surprising that both ESG performance (ESG) and shareholding of institutional investors (Inst) are negatively correlated with risk-taking (Risk), and ESG performance (ESG) is positively correlated with shareholding of institutional investors (Inst). In order to check for multicollinearity, we calculated variance inflation factors (VIF) taking into account the correlation of some of the variables. The results show that the maximum value is 2.1 and the mean value is 1.55, indicating that multicollinearity should not affect our results.

5.3 Analysis of Regression Results

The regression results of the mediating effects model are presented in Table 4. The regression analysis on the relationship between ESG performance and corporate risk-taking is shown in Column (1), and the coefficients of the variable ESG are significantly positive at the 1% level, indicating that listed companies with good ESG performance can significantly reduce their risk-taking. H1 is validated.

In Column (2), the regression results on the relationship between ESG performance and institutional investors' shareholding ratio are displayed. The coefficient of ESG is statistically significant positive at the 5% level, indicating that good ESG performance by listed companies can raise institutional investors' shareholding ratio. The coefficients of ESG and Inst in model (3) are both significantly negative at the 1% level, indicating a partial mediating effect of institutional investors' shareholding ratio, i.e., that corporate risk-taking can be reduced by both enhanced ESG performance and increases in institutional investors' shareholding. H2 is validated.

Table 4. Full-sample regression results

Variable	Model (1)	Model (2)	Model (3)
	Risk	Inst	Risk
ESG	-0.0104***	0.398**	-0.0104***
	-0.000589	-0.19	-0.000586
Inst			-0.000228***
			-2.68E-05
Lev	0.000209***	-0.0601***	0.000195***
	-4.16E-05	-1.33E-02	-4.17E-05
Growth	-4.15e-05**	0.0245***	-3.59e-05**
	-1.71E-05	-3.64E-03	-1.71E-05
Cash	-0.00722	25.47***	-0.00142
	-0.00837	-2.443	-0.00843
Capital	-0.0262**	14.85***	-0.0228**
	-0.0109	-3.855	-0.0109
Size	-0.00837***	5.643***	-0.00708***
	-0.000681	-0.238	-0.000706
Age	0.00129*	5.677***	0.00258***
	-0.000778	-0.273	-0.000803
Soe	-0.0103***	9.086***	-0.00821***
	-0.00153	-0.634	-0.00154
Constant	0.292***	-102.0***	0.269***
	-0.0166	-5.989	-0.0168
industries and years	Control	Control	Control
N	33,449	33,449	33,449
R^2	0.136	0.332	0.14

Note: *, **,*** denote the significance at the 10%, 5% and 1% level, respectively.
Source: calculated from the data from Wind database.

5.4 Robustness test

5.4.1 Change Variables

To prevent the findings of this paper from being biased by the selection of variables, we use two alternative indicators to change the explained and explanatory variables, respectively. First, we change the explained variable. A different method is used to calculate the level of corporate risk-taking, that is, the standard deviation of ROA adjusted by the industry mean (Risk_rb), as shown in the previous equation (3). Second, we change the explanatory variable. Bloomberg ESG rating (ESG_rb) is used to reflect corporate ESG performance. Table 5 reports the regression results of the three models, all of which are consistent with Table 4 and support the conclusions of this paper.

Table 5. Change variables

Test Method	**Change Explained Variable**			**Change Explanatory Variable**		
Variables	①	②	③	④	⑤	⑥
	Risk_rb	Inst	Risk_rb	Risk	Inst	Risk
ESG	-0.00558***	0.398**	-0.00553***			
	-0.000315	-0.19	-0.000314			
Inst			-0.000121***			-0.000158***
			-1.43E-05			-2.62E-05
ESG_rb				-0.000223***	0.185***	-0.000194**
				-7.60E-05	-0.0673	-7.63E-05
Constant	0.155***	-102.0***	0.143***	0.127***	-73.20***	0.116***
	-0.00879	-5.989	-0.00889	-0.014	-11.42	-0.0135
Control variables, industries and years	Control	Control	Control	Control	Control	Control
N	33449	33449	33449	9601	9,601	9601
R^2	0.134	0.332	0.139	0.136	0.303	0.144

Note: *, **, *** denote the significance at the 10%, 5% and 1% level, respectively.
Source: calculated from the data from Wind database.

5.4.2 Instrumental Variable (IV) Estimation

Considering the complexity of factors influencing corporate risk-taking, it is still possible that important variables beyond the control variables are omitted. Therefore, this paper alleviates the possible endogeneity problem in the model with an instrumental variables approach. Following Wang et al. (2022), the mean ESG score of the city where the firm is incorporated (ESG_mean) and the firm's earliest period ESG score (ESG_initial) are used as instrumental variables. The selected instrumental variables are closely related to the ESG performance of individual firms and do not directly affect the ESG performance of individual firms, satisfying the requirements of correlation and exogeneity of IVs. In addition, this paper conducts an unidentifiable test, a weak instrumental variable test, and an over-identification test for the selected instrumental variables, respectively. The test results all indicate that using ESG_mean and ESG_initial as instrumental variables is appropriate. In this paper, the two-stage least squares (2SLS) method is used for the instrumental variables regression, and the regression results of the first and second stages of the two-stage least squares (2SLS) method are reported in columns ① and ② of Table 6, respectively, and the ESG coefficient remains significantly negative. Therefore, the conclusions of this paper remain robust after after the endogeneity problem is solved.

5.4.3 Propensity Score Matching

To mitigate the interference of sample selection bias on the study findings, we split the sample companies into high and poor groups based on the upper third of ESG performance and conduct nearest neighbor 1:1 matching according to all control variables in model (2), and there is no significant difference in these control variables between the control group and the processing group after matching, which meets the requirement of equilibrium. As shown in columns ③ to ⑤ of Table 6, the regression results of the matched samples are all consistent with Table 4, and the conclusions of this paper based on the full-sample analysis are robust.

Table 6. Tool variables and propensity score matching

Test Method	**Instrumental Variable (IV) Estimation**		**Propensity Score Matching**		
Variables	①	②	③	④	⑤
	ESG	Risk	Risk	Inst	Risk
ESG		-0.008***	-0.00704***	0.646**	-0.00689***
		(-9.06)	-0.00101	-0.325	-0.000997
Inst					-0.000281***
					-4.50E-05
ESG_mean	0.761***				
	-44.32				
ESG_initial	0.376***				
	-56.05				
Constant	-4.724***	0.248***	0.228***	-114.1***	0.197***
	(-40.07)	-31.9	-0.031	-12.9	-0.0299
Control variables, industries and years	Control	Control	Control	Control	Control
N	33,449	33,449	5022	5022	5022
R^2		0.072	0.162	0.465	0.171

Note: *, **, *** denote the significance at the 10%, 5% and 1% level, respectively.
Source: calculated from the data from Wind database.

6. Further Analysis

6.1 Heterogeneous Risk Taking

To further examine the inhibitory effect of ESG performance on corporate risk-taking, this paper groups firms according to their risk-taking level and deviation from the optimal risk-taking.

First, following Yu et al. (2013), we divide the sample firms into two groups of high risk-taking and low risk-taking according to the industry annual median of risk-taking for empirical testing respectively.

Second, the optimal risk-taking model (Harjoto & Laksmana, 2018) is used to further test the inhibitory effect of enhancing ESG performance on abnormal risk-taking.

$$\begin{aligned} Risk_{i,t} &= \gamma_0 + \gamma_1 Roa_{i,t-1} + \gamma_2 MB_{i,t-1} + \gamma_3 Lev_{i,t-1} + \gamma_4 GDPgrowth_{i,t} \\ &\quad + \gamma_5 compreturn_{i,t} + Year_FE + Ind_FE + \varepsilon \end{aligned} \tag{7}$$

Model (7) was used to calculate the abnormal risk level of firms: where i denotes the firm, t denotes the observation year, t-1 denotes the variable lag by one period, and T denotes the observation interval, ROA is the return on total assets, MB is the market-to-book ratio (market capitalization / book value), compreturn is the composite annual market return, and GDPgrowth is the GDP growth rate. The absolute value of the regression residuals in the model, i.e., the difference from the optimal risk-taking level, is used to measure abnormal risk-taking (abrisk), and then the samples are grouped

by the positive or negative residuals. The samples with negative residuals are taken as the under-risk group, and those with positive residuals are taken as the over-risk group.

Table 7 displays the results of the regression. While the coefficient of ESG in column ① is not significant, the coefficient of ESG in column ② is considerably negative at the 1% level, showing that high risk-taking enterprises are the ones who are most affected by good ESG performance rather than all firms. The coefficient of ESG in column ⑤ is not significant, indicating that improving ESG performance has no effect on firms' insufficient risk-taking. However, the coefficients of ESG in columns ③ and ④ are both significantly negative at the 1% level, indicating that enhancing ESG performance can inhibit abnormal and excessive risk-taking by firms. In summary, good ESG engagement helps to inhibit the extreme risk-taking behavior of the firm without exacerbating insufficient risk-taking, which is conductive to the stable growth of the company.

Table 7. Heterogeneous risk taking

	①	②	③	④	⑤
	Low Risk Level Group	**High Risk Level Group**	**Abnormal Risk-taking**	**Excessive Risk-taking**	**Insufficient Risk-taking**
Variables	Risk	Risk	abRisk	over_risk	under_risk
ESG	-0.000152	-0.0116***	-0.00260***	-0.00478***	-9.68E-05
	-9.77E-05	-0.000792	-0.000236	-0.000522	-8.81E-05
Inst	-5.84E-06	-0.000272***	-5.03e-05***	-0.000121***	1.91e-05***
	-4.99E-06	-3.84E-05	-1.03E-05	-2.53E-05	-4.59E-06
Constant	0.0362***	0.306***	0.0709***	0.0867***	0.0561***
	-0.00324	-0.0218	-0.00548	-0.0132	-0.00335
Control variables, industries and years	Control	Control	Control	Control	Control
N	16724	16725	26,882	9,191	17,691
R^2	0.06	0.146	0.098	0.135	0.193
Note: *, **, *** denote the significance at the 10%, 5% and 1% level, respectively. Source: calculated from the data from Wind database and Csmar database.					

6.2 Heterogeneous Institutional Investors

Varied institutional investors have quite varied reasons for and methods of participating in corporate governance. Therefore, in further examining the mediating effect of different types of institutional investors between ESG performance and corporate risk-taking, it is necessary to distinguish the types of institutional investors. Following Gasper et al. (2005), this paper divide institutional investors into long-term and short-term investors according to their portfolio turnover. Long-term institutional investors keep stocks of listed firms for a long period and engage in infrequent stock trading, while short-term institutional investors focus on short-term gains and trade often in equities.

$$\mathrm{CR_buy}_{k,t} = \sum_{i=1}^{M_k} \left| \left(N_{k,i,t} - N_{k,i,t-1} \right) P_{i,t} \right| 1_{\left| N_{k,i,t} > N_{k,i,t-1} \right|} \tag{8}$$

$$\mathrm{CR_sell}_{k,t} = \sum_{i=1}^{M_k} \left| \left(N_{k,i,t} - N_{k,i,t-1} \right) P_{i,t} \right| 1_{\left| N_{k,i,t} \le N_{k,i,t-1} \right|} \tag{9}$$

First, the total market value of stocks bought and sold by institutional investors k cumulatively in period t is calculated by formula (8) and (9): where $P_{i,t}$ and $P_{i,t=1}$ denote the price of stock i in periods

t and t-1, respectively, and $N_{k,i,t}$ and $N_{k,i,t-1}$ denote the number of institutional investors k invested in stock i in periods t and t-1, respectively. $N_{k,i,t}>N_{k,i,t-1}$ indicates that institutional investor k has increased its holdings in stock i in period t, and $N_{k,i,t}\leq N_{k,i,t-1}$ indicates that institutional investor k has reduced its holdings in stock i in period t.

Second, the turnover rate of institutional investors k in period t is defined with the following formula.

$$CR_{k,t} = \frac{2\min(CR_buy_{k,t}, CR_sell_{k,t})}{\sum_{i=1}^{N_k} N_{k,i,t}P_{i,t} + N_{k,i,t-1}P_{i,t-1}} \tag{10}$$

Therefore, the average turnover rate for the past two years (four semi-annuals in total) is defined as

$$AVG_CR_{k,t} = \frac{1}{4}\sum_{j=0}^{3} CR_{k,t-j} \tag{11}$$

The institutional investors were sorted into three groups based on the average turnover rate, and the group with high average turnover rate was defined as long-term institutional investors and the group with low average turnover rate was defined as short-term institutional investors. Accordingly, the shareholding ratio of both long-term institutional investors and short-term institutional investors are calculated for each firm separately.

Finally, the long- and short-term institutional investors' dominance indexes are constructed, and if the long-term institutional shareholding ratio is larger than the short-term institutional shareholding ratio, the long-term institutional dominance (DLTST) is determined; otherwise, the short-term institutional dominance (DSTLT). The interaction of the independent variable (ESG) and the moderating variables (DLTST and DSTLT) are added to the main regression model to test the different effects of ESG performance on corporate risk-taking under heterogeneous institutional investors' shareholdings.

The regression results are displayed in Table 8's columns ① and ②. Long-term institutional investors' shareholding strengthens the risk-inhibiting effect of good ESG performance, as shown by the coefficient of ESG*DLTST, which is notably positive at the 1% level. The coefficient of ESG*DSTLT, on the other hand, is notably negative at the 1% level, demonstrating that institutional short-term investors' shareholdings reduce the risk-inhibiting impact of good ESG performance. This might be because short-term institutional investors own shares for the sole purpose of making short-term speculative trades and are more focused on making quick money than on the company's ability to grow sustainably. They have less motivation to oversee and manage the company and are more likely to protect their own interests by "voting with their feet". Long-term institutional investors are more interested in the future development potential of firms than short-term institutional investors are, and they anticipate earning profit from those companies' long-term expansion. In order to ensure that their own interests are not compromised, long-term institutional investors are more driven to participate in corporate governance activities by "voting with their hands" to strengthen the constraints on the firm's high-risk activities and thus effectively reduce corporate risk-taking.

6.3 Economic Policy Uncertainty

Influenced by the characteristics of China's gradual and decentralized economic system transformation, the business environment of Chinese firms, especially the institutional environment, is relatively more dynamic and uncertain. In the context of global capital market volatility, macroeconomic policies play an important regulatory role in maintaining economic stability for the Chinese government. Considering that economic policy uncertainty obscures the future business environment of firms, we further examine the regulatory role of economic policy uncertainty. To measure the moderating variable (EPU), we use the monthly Chinese economic policy uncertainty indices (http://www.policyuncertainty.com/index.html) developed by Baker et al. (2016) and divide their yearly average by 100. The interaction of the independent variable (ESG) and the moderating

variable (EPU) is added to the main regression model. As shown in column ③ of Table 8, the coefficient of ESG*EPU is significantly negative at the 1% level, indicating that economic policy uncertainty strengthens the risk inhibitory effect of good ESG performance. The possible reason is that when faced with high uncertainty, companies with greater ESG performance are more likely to sustain positive relationships with stakeholders, particularly long-term institutional investors, due to their strong reputation and corporate governance, and these stakeholders are more likely to play their role as "stabilizers" to enable companies to cope with shocks from changes in the macroeconomic environment.

Table 8. Heterogeneous institutional investors and economic policy uncertainty

	①	②	③
	Long-term Institutional Investors	**Short-term Institutional Investors**	**Economic Policy Uncertainty**
Variables	Risk	Risk	Risk
ESG	-0.00739***	-0.0117***	-0.00357***
	-0.000906	-0.000695	-0.00102
ESG*DLTST	-0.00435***		
	-0.00107		
DLTST	0.0165***		
	-0.00495		
ESG*DSTLT		0.00438***	
		-0.00107	
DSTLT		-0.0168***	
		-0.00495	
ESG*EPU			-0.00152***
			-0.00023
EPU			0.00993***
			-0.00329
Constant	0.281***	0.297***	0.238***
	-0.0168	-0.0166	-0.0196
Control variables, industries and years	Control	Control	Control
N	33449	33,449	33449
R^2	0.137	0.137	0.143

Note: *,**,*** denote the significance at the 10%, 5% and 1% level, respectively.
Source: calculated from the data from Wind database.

7. Conclusion and Implication

This paper empirically investigates the effect of enhancing ESG performance on corporate risk-taking using data of Chinese A-share listed companies from 2009-2021. We find that good ESG performance of listed companies helps to reduces their risk-taking and the mechanism test finds that good ESG performance reduces corporate risk-taking behavior by attracting more institutional investors to hold shares. The above findings still hold after changing the measures of corporate risk-taking and ESG performance, instrumental variables tests and propensity score matching tests. Further, we find that good ESG performance only significantly reduces the risk-taking of firms at high risk levels and reduces excessive risk-taking rather than insufficient risk-taking, which indicates that ESG engagement helps to inhibit extreme risk-taking behavior of the firm and has positive effects on the healthy growth of the company. Long-term institutional investors' shareholding strengthens the risk inhibitory effect of good ESG performance, while short-term institutional investors'

shareholding weakens this effect. Compared with short-term institutional investors who hold shares for short-term speculative trading purposes, long-term institutional investors are more motivated to participate in the governance and management of firms, affecting their major business decisions and restraining their high-risk behavior. When economic policy is unstable, good ESG performance has a more prominent inhibitory effect on risk-taking, allowing firms to better withstand the negative effects of changes in the macroeconomic environment.

This study examines the relationship between Chinese listed companies' ESG performance and risk-taking behavior from 2009 to 2021. We find that good ESG performance of public corporations significantly reduces their risk-taking and institutional investor ownership ratios have a minor moderating effect on this , with better ESG performance encouraging more institutional investors to increase their holdings. According to the analysis of heterogeneity, successful ESG performance only considerably lowers excessive risk-taking rather than insufficient risk-taking among enterprises with high risk levels.

7.1 Suggestions for Government Departments

First, the government and regulatory authorities should accelerate the promulgation of a unified ESG report disclosure system and operational guidelines to promote the shift of ESG disclosure from voluntary to mandatory. At the same time, construct oversight requirements for information disclosure to prevent listed businesses from overpackaging themselves with ESG concepts and misleading market participants. Second, institutional investors should be encouraged to continuously make long-term investments so that they attract more funds to be invested in top-notch enterprises and support the stable development of the capital market.

7.2 Suggestions for Enterprises

First, it is crucial for companies to actively seek investment opportunities, identify feasible investment projects, and pursue appropriate risk-taking on the premise of a rational assessment of their own risk-taking capacity. The normative ethical component of ESG responsibility and the balance of interests of stakeholders may make companies abandon some investment projects with high returns but may jeopardize the social public interest, which not only reduces the risk-taking level of companies, but also benefits their long-term stable development. Second, it is necessary for corporate decision-makers to integrate environmental, social, and governance factors with corporate strategies in the increasingly competitive market. At the same time, they should promptly disclose the good outcomes and best practices of ESG engagement. This will help companies gain the support of various stakeholders and achieve long-term sustainable development.

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