



# Corporate Board Diversity and ESG Performance in the Context of Big Data Management

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**Abstract.** Cloud computing, the Internet of Things, and other information technologies have become increasingly vital in the development of an intelligent society with the arrival of the big data era. In order to accomplish the transformation of business value, organizations should take advantage of cloud computing technology for huge data mining and employ IoT for governance intelligence construction. ESG is a crucial management component that businesses must urgently improve, so how to fully enhance corporate ESG performance while simultaneously constructing information has emerged as a pressing problem. In contrast to most literature, which treats ESG as a whole or as a factor in theoretical research, this paper uses A-share listed companies in China from 2015 to 2017 as its research subject and empirically examines the effects of corporate board diversity on each of the three ESG dimensions: environmental, social, and governance. The study's findings demonstrate the enormous benefits that a diverse board of directors can bring to a company's environmental, social, and governance (ESG) performance. In the framework of big data management, this advances knowledge on how to enhance China's information construction, smart economy, and society.

**Keywords:** Big Data Management · Cloud Computing · Internet of Things (IoT) · Board Diversity · ESG performance

## 1 Introduction

With the onset of the big data era and the expanding significance of businesses in the economy and society, more and more practitioners and academics are using ESG as a key criterion for a thorough evaluation of businesses. They have also extensively researched how corporate ESG performance affects investor preferences, corporate reputation and performance, and other factors. ESG is a corporate evaluation standard and investment concept that focuses on the integrated performance of enterprises in environmental, social, and governance aspects. It was first introduced by the United Nations Environment Programme in 2004. The importance of the ESG evaluation system and data mining with cloud computing and governance intelligence with IoT technology have emerged as the primary themes of the new development stage. The effective data management capabilities of enterprises can improve the ESG ecosystem, thereby helping

China's intelligent economy and society and create a more positive global governance environment.

This study examines the effect of board diversity on enterprises' ESG performance in the context of big data management using A-share listed companies in China as the research subject. The majority of academics today have examined how ESG performs as an influencing factor on a particular aspect of economic society or enterprises, while less pertinent research has been done on how to assist enterprises in creating an ESG system that is more effective. To some extent, the study of this topic can make up for the dearth of theoretical research on how to enhance corporate ESG performance and offer richer data support for enhancing corporate ESG performance and the ESG ecosystem in the context of big data management. The impact of corporate board diversity on the three ESG dimensions of environmental, social, and governance is separately examined in this paper, in contrast to most of the literature, which treats ESG as a whole for theoretical research.

## 2 Literature Review

Board diversity arises from the heterogeneity of board members, and a large body of literature has examined the age and gender diversity of board members as proxy variables for board diversity. Based on principal-agent theory, board diversity is mainly reflected in the independence and non-independence of directors; based on resource dependence theory, scholars such as Pfeffer and Salancik view the board of directors as "resource providers" within the firm; Isaac Boadi and Daniel Osarfo measure board diversity in terms of differences in educational qualifications of board members, after excluding unobservable characteristics (experience in terms of knowledge and ability, etc.). Furthermore, an increasing number of researchers studying board diversity have concentrated on the diversity disparities displayed by board members at a mix of demographic and cognitive levels. For instance, Nicholas Walt and Coral Ingley examine board nominations with various professional backgrounds, levels of independence, age, gender, and ethnicity in order to understand the significance of board diversity and its influence on decision-making. We will also employ an integrated demographic and cognitive measuring technique to examine board diversity from the viewpoints of age, gender, and background in the future research of this paper in order to more fully and reliably assess board diversity in businesses.

Environmental, social, and governance (ESG) are the foundation of the ESG concept, which has been interpreted differently by many academics. ESG is a behavioral expression of increased corporate autonomy. Caoqun and Xu Qian (2019) make the case that the three most important components of gauging sustainability and ethical effect in a firm or business investment are covered by the financial ESG framework. The Industrial and Commercial Bank of China's Green Finance Group (2017) developed a novel three-tier ESG framework system, the second and third tiers of which screened to discover 17 dimensions and 32 critical indicators. The first tier adopted an internationally recognized conceptual framework. The concern and demand for ESG among different market actors have grown fast with the advancement of economic globalization, however due to China's defective ESG ecosystem, how to assist businesses in enhancing their ESG

performance has emerged as a key study area. In contrast to the study by Manita et al. (2018), which finds that board gender disparities have no discernible impact on ESG disclosure, the study by Cucari et al. (2018) makes the case that board gender differences are negatively associated to ESG disclosure.

In summary, this paper adopts a more comprehensive demographic and cognitive dimension in the evaluation of board diversity to provide a comprehensive measure of corporate board diversity. In contrast to some of the existing studies, we focus on the impact of a diverse board of directors on the ESG performance of companies and whether the impact differs across dimensions. In this paper, we conduct an empirical analysis based on these questions.

### 3 Research Hypothesis

#### 3.1 Diversity on Boards and Environmental Performance

Enterprises have an indispensable role in the stable and sustainable development of the economy and the vitality of the market, given their significance to the economy and society. As the enterprise's central component, diverse board is the most effective way to integrate resources and assist corporations in resolving many of their own issues. By bringing high quality human capabilities, rich knowledge resources, and unique thinking perspectives into the company, the independence of board members can be enhanced and the supervisory role of the board can be expanded, leading the company to establish a greener development concept so that strategic decisions and activities in line with the modern green economy concept can be developed and the company can be encouraged to develop sustainably within its industry. In light of the preceding study, the following hypotheses are proposed in this study:

*Hypothesis 1: Diversity on a company's board can improve its environmental performance.*

#### 3.2 Diversity on Boards and Social Responsibility Performance

In addition to environmental considerations, social responsibility is a significant component of ESG. Several studies have demonstrated that female directors place a greater emphasis on social benefits in strategic decision-making and the development of company activities; consequently, gender diversity in the board can contribute to the social responsibility performance of businesses. Wang Xin and Yang Zhen (2019) discovered that board gender diversity had a large beneficial influence on CSR performance and a significant negative effect on the level of corporate risk-taking. Additionally, with older board members being more mature, experienced, and risk-aware, and younger board members being better at capturing the essence of the times and innovating to break the waves. By integrating the group's resources, members with diverse backgrounds can provide a more unique perspective on the development of the company, i.e. focusing not only on the realization of value, but also on the social responsibility performance of the company. Companies with a diverse board of directors are able to send quality signals to a variety of stakeholders, assisting family-owned businesses in enhancing their professional management operations and establishing a positive corporate image, thereby

demonstrating a higher level of social responsibility performance in the face of volatile market conditions. In light of the preceding study, the following hypotheses are proposed in this study:

*Hypothesis 2: Diversity on a company's board can improve its social responsibility performance.*

### **3.3 Diversity on Boards and Corporate Governance Performance**

As the company's brain, the board of directors has an evident and vital role in corporate governance. Two perspectives on the impact of a diverse board of directors on corporate governance can be considered: resource provision and independence. Initially, by including board members of various backgrounds and ages, we can create a broader resource supply system for the company and build a more efficient corporate governance structure; furthermore, given the prevalence of corporate principal-agent problems, a pluralistic board can increase the proportion of independent directors by enriching the composition of the board, thereby enhancing the independence of the board and reducing governance conflicts within the company. It is evident from these research that a diverse board of directors can improve corporate governance by offering a higher quality resource provision system and greater autonomy. Based on the preceding analysis, the following assumptions are presented in this study:

*Hypothesis 3: Diversity on a company's board can improve its corporate governance performance.*

Given that environmental performance, social responsibility, and governance levels collectively comprise business ESG performance, the following hypotheses are given:

*Hypothesis 4: Diversity on a company's board can improve its ESG performance.*

## **4 Method**

### **4.1 Sample**

The research in this paper selects the data of A-share listed companies in China during 2015–2017 as the initial sample, and in order to ensure the stability and reliability of the research results, this study removes the sample of companies that have been delisted within the observation period, and finally obtains a valid sample of 7682. The data of China's A-share listed companies in this study were obtained from the CSMAR database. The indicators of age, gender, education, and financial background in the board diversity index were obtained from the CSMAR database of personal characteristics of directors and supervisors of listed companies, and the environmental, social, and governance indicators in the corporate ESG performance were obtained from the Carbon Neutral Research Database, the Corporate Common Wealth Research Database, and the Governance Structure of Listed Companies Database, respectively. In addition, to avoid the influence of extreme values, a 1% tailoring process is applied to all data.

## 4.2 Measures

### Dependent variables

The explanatory variable is the ESG performance of enterprises, and at present, the ESG performance of enterprises in academia consists primarily of three forms: one is to take the ESG evaluation data developed by SynTao Green Finance company and RKS, etc. in conjunction with the actual situation of the Chinese A-share market, and the ESG ratings of enterprises are categorized on a scale from excellent to poor. Using the Wind ESG database of A-share listed companies developed by SynTao Green Finance company, Zhang Lin and Zhao Haitao (2019) analyzed the impact of corporate environmental, social, and corporate governance (ESG) performance on corporate value using a two-way fixed effects model, and further investigated the moderating effect of corporate heterogeneity on the relationship between ESG and corporate value. Secondly, a number of academics developed a comprehensive corporate ESG score evaluation system based on the characteristics of their own research topics by selecting specific indicators in conjunction with industry characteristics and varying the focus and depth of the three dimensions of environment, society, and governance. For instance, Sun Dong and Yang Shuo et al. (2019) assessed the features of the electricity industry and selected the thorough evaluation approach employed by Changhong Zhao et al. in their study to calculate the ESG score. This method incorporates the P-S-R model, which divides measurement indicators into three levels, with environmental (E), social (S), and corporate governance (G) as the three first-level indicators, and the remaining specific indicators distributed in the second and third levels, with the number of indicators in the third level being as high as 38. These extensive ESG score evaluation systems, which are built by academics based on the peculiarities of their particular study areas, typically have an excessive number of indications, a tendency toward redundancy, and a limited field of application. Thirdly, beginning with each of the three dimensions of ESG, utilize principal component analysis to pick the principle components of different dimensions and analyze the function performed by each of these three dimensions in connection with the research material of the relevant studies. For example, Qiu Muyuan and Yin Hong (2019), in their study of corporate ESG performance and financing costs in the context of Ecological Civilization Construction, conducted Principal Component Analysis on two dimensions of corporate governance and social responsibility, and selected the first principal component as a proxy variable for corporate governance capability and social responsibility. Considering the suitability of the data and the convenience of the study, when measuring the environmental performance of the company, this paper considers both internal and external perspectives, firstly, whether the company has a relevant environmental management system in place, and assigns a value of 1 if it is disclosed, and 2 otherwise. Next, consider whether the company is involved in social welfare activities such as environmental protection, and assign a value of 1 if disclosed, otherwise 2. These data are normalized and allocated equal weights in order to produce an exhaustive index of corporate environmental performance.

Due to the fact that both CSR performance and governance performance contain more relevant aspects, this article refers to Qiu Muyuan and Hong Yin's (2019) method for building proxy variables and measures them using Principal Component Analysis from these two dimensions separately. In the dimension of CSR, this paper considers

each stakeholder inside and outside the enterprise, and selects several variables for principal component analysis, including whether the enterprise pays taxes according to the law, social donation, whether it discloses the protection of creditors' rights and interests, whether it discloses the protection of employees' rights and interests, whether it discloses the protection of shareholders' rights and interests, and whether it discloses the protection of customers' and consumers' rights and interests, and selects the first principal component as the proxy variable Sperformance for CSR performance, and then standardizes the data to make it comparable. In the corporate governance dimension this paper considers the board structure and information disclosure quality of enterprises, and conducts principal component analysis on the variables of chairman and general manager concurrently, the percentage of independent directors and information disclosure quality, and selects the first principal component as the proxy variable Gperformance of corporate governance. Finally, the data are standardized to make them comparable.

### **Independent variables**

Board diversity is the explanatory variable, and current research on assessing board diversity often focuses on both demographic and cognitive factors. Cao Peiqi (2020) employed eight characteristics to develop comprehensive diversity indicators. Li Xiongfei (2022) utilized seven board member qualities to construct diversity indicators. Considering the topic of our own research, we chose age and gender of board members as demographic variables and education, financial background, and international background as cognitive criteria. Among them are: Age is assessed by the standard deviation of board members' ages, Gender is measured by the proportion of female board members in office at the conclusion of each observation year, and the remaining indicators are measured by the Herfindahl index, which is calculated as  $H = 1 - \sum P_i^2$ ,  $P_i$  denotes the ratio of the number of people from background  $i$  to the total number of board members. Education definition 1 is secondary school and below, 2 is college, 3 is bachelor's degree, 4 is master's degree, 5 is doctoral degree, 6 is other (including MBA/EMBA, etc.). Financial background is defined 1 as having a financial background and 2 as not having a financial background. Overseas background is positioned 1 as having an overseas posting background, 2 as having an overseas study background, and 3 as having no overseas background. The data of these indicators are standardized and given equal weight assignments, so as to construct a comprehensive indicator of board diversity.

### **Control variables**

Considering the impact of business size and earnings status on ESG performance, this study introduces firm size, board size, firm growth, return on net assets, current ratio, and gearing ratio as control variables to improve the accuracy of the research results. The size of a firm is determined by the natural logarithm of its total assets at the end of the year. Larger organizations have greater overall assets to allocate to ESG operations, hence company size can have some effect on ESG performance. Using the natural logarithm of a company's total board of directors, board size is determined. Companies with larger boards of directors also tend to have greater board diversity. The growth of a company is determined by the difference between the total assets at the end of the year and the total assets at the beginning of the year. The foundation for high-quality economic development, sustainable social development, and inclusive development is a company's ability to consistently add value, which is proportional to its

growth rate. Return on net assets is the ratio of net profit to average shareholders' equity, which measures the efficiency with which a corporation uses shareholders' capital. If the return on net assets is excessively low for an extended period of time, it shows that the company is less profitable and lacks adequate capital usage and protection. In general, the higher the current ratio, the greater the liquidity and short-term solvency of the company's assets, as well as the greater protection for creditors and suppliers. The gearing ratio, which is the ratio of total assets to total liabilities, can reflect the degree of safety of creditors in granting loans and to some extent has an impact on the ESG performance of a company.

In summary, the specific descriptions of the research variables in this paper are shown in Table 1.

### 4.3 Models

To explore the relationship between corporate board diversity and ESG performance, the following panel data regression model was constructed.

$$Eperformance_{it} = \alpha_0 + \alpha_1 diversity_{it} + \alpha_2 Bsize_{it} + \alpha_3 growth_{it} + \alpha_4 roe_{it} + \alpha_5 liquidratio_{it} + \alpha_6 DARatio_{it} + \sum industry + \sum year + \varepsilon_{it} \quad (1)$$

where  $i$  denotes individual firm,  $t$  denotes year, and  $Eperformance$  denotes firm's environmental performance. Model (1) In order to explore the relationship between board diversity and firm's environmental performance, and  $\varepsilon$  is a random error term.

$$Sperformance_{it} = \beta_0 + \beta_1 diversity_{it} + \beta_2 Csize_{it} + \beta_3 Bsize_{it} + \beta_4 growth_{it} + \beta_5 roe_{it} + \beta_6 liquidratio_{it} + \beta_7 DARatio_{it} + \sum industry + \sum year + \varepsilon_{it} \quad (2)$$

where  $Sperformance$  denotes corporate social responsibility performance, and model (2) in order to explore the relationship between board diversity and corporate social responsibility performance.

$$Gperformance_{it} = \eta_0 + \eta_1 diversity_{it} + \eta_2 Csize_{it} + \eta_3 Bsize_{it} + \eta_4 roe_{it} + \eta_5 liquidratio_{it} + \eta_6 DARatio_{it} + \sum industry + \sum year + \varepsilon_{it} \quad (3)$$

where  $Gperformance$  denotes the governance performance of the firm, model (3) in order to explore the relationship between board diversity and corporate governance performance.

## 5 Empirical Results and Analysis

### 5.1 Descriptive Analysis

Based on the variables and models identified above, descriptive statistical analysis of the data was performed using stata17.0, and the results are shown in Table 2. As can be seen from the data in the table, the standard deviation of environmental performance

**Table 1.** Definition of research variables

<b>type</b>	<b>name</b>	<b>lable</b>	<b>definition</b>
Dependent variables	Corporate Environment Performance	Eperformance	Whether to develop relevant environmental management system, whether to participate in environmental protection and other social welfare activities.
	Corporate Social Responsibility Performance	Sperformance	First principal component: whether to pay taxes according to the law, social donations, whether to disclose the protection of creditors' rights and interests, whether to disclose the protection of employees' rights and interests, whether to disclose the protection of shareholders' rights and interests, whether to disclose the protection of customers' and consumers' rights and interests.
	Corporate Governance Performance	Gperformance	First principal component: concurrent chairman and general manager, percentage of independent directors, quality of information disclosure.
Independent variables	Board Diversity	diversity	Comprehensive indicators based on demographic characteristics (age, gender) and cognitive characteristics (education, financial background, overseas background)
Control variables	Company Size	Csize	Natural logarithm of the company's total assets at the end of the year.
	Board Size	Bsize	Natural logarithm of the total number of the company's board of directors.
	Company Growth	growth	$(\text{Total assets at the end of the year} - \text{Total assets at the beginning of the year}) / \text{Total assets at the beginning of the year} \times 100$
	Return on Net Assets	roe	$\text{Net income} / \text{Average shareholders' equity} \times 100$
	Current Ratio	liquidratio	$\text{Current assets} / \text{Current liabilities}$
	Gearing ratio	DAratio	$\text{Total liabilities} / \text{Total assets} \times 100$

is 0.088, which is the least volatile within the three dimensions of ESG; and the mean value of -0.002 is the only negative value within all variables, indicating that the vast majority of companies do not perform well in environmental aspects. The mean value of



**Table 2.** Descriptive statistical analysis

variables	observations	mean	median	sd	min	max
Eperformance	7682	-0.002	0.05	0.088	-0.24	0.05
Sperformance	7682	2.221	2.029	0.486	1.469	3.732
Gperformance	7682	1.116	1.546	0.875	-0.035	3.761
diversity	7682	0.043	0.029	0.129	-0.23	0.411
Csize	7682	22.286	22.148	1.304	18.675	27.147
Bsize	7682	2.123	2.197	0.199	1.609	2.708
growth	7682	0.209	0.097	0.414	-0.306	2.709
roe	7682	0.058	0.063	0.112	-0.541	0.34
liquidity	7682	2.305	1.648	2.187	0.27	15.067
DAratio	7682	0.426	0.415	0.206	0.057	0.936

social responsibility performance is 2.221, and the median value is 2.029, indicating that the performance of enterprises in social responsibility is not good enough, and many enterprises may not realize the importance of taking some social responsibility. Due to the different nature of enterprises and managers, the greatest volatility in corporate governance performance is observed with a standard deviation of 0.875; in addition, the minimum value is -0.035, the maximum value is 3.761, and the mean value is 1.116, indicating that enterprises show significant variability in governance and the overall governance level is average. Secondly, the mean value of board diversity index is 0.043, the median value is 0.029, and the standard deviation is 0.129, which indicates that the level of board diversity in China is generally low, and many companies may not pay proper attention to the importance of board diversity.

In addition, further study of the board diversity indicator revealed that the age of corporate board members is very variable. To measure the gender indicator, the proportion of female directors in office at the conclusion of each observation year was chosen, and it was discovered that Chinese corporations pay little attention to female directors and lack a balance between male and female directors on the board. The education of board members, whether they have an international history, and their financial background are measured using the Herfindahl index, and the data for these indicators are normalized to eliminate the impact of any outliers and make them comparable. With the advancement of social development, the expansion of China's reform and opening up, and the improvement of the education level, the overall educational level of corporate executives has increased, and an increasing number of corporate board members are equipped with overseas study or employment and specialized training, which provides a broader resource system for the development of modern enterprises in China.

## 5.2 Correlation Analysis

In order to initially determine the correlation and significance of each variable, and to exclude the interference of multiple co-linearities on the regression results, a person

correlation analysis was conducted on all variables, and the results are shown in Table 3, which shows that board diversity is positively correlated with corporate environmental performance, social responsibility performance, and governance performance at the 1% significance level, which initially confirms our conjecture that the higher the degree of corporate board diversity, the better the corporate ESG performance.

Furthermore, combined with the variance inflation factor test shown in Table 4, it can be seen that the variance inflation factor (VIF) of the regression model is much less than 5, and the possibility of multicollinearity in the variables selected in this paper is low. The combined person correlation analysis and variance inflation factor test indicate that the variables and models selected in this paper have reasonable economic significance, and the subsequent regression results have good reliability and stability.

### 5.3 Regression Analysis

The results of the OLS multiple regression for model (1) in this paper are shown in Table 5. According to the data in the table, the coefficient of board diversity is 0.195 and is significant at the 5% level, indicating that more diverse firms can positively contribute to their environmental performance, which verifies hypothesis (1). In addition, the size of the board of directors and the gearing of the firm are negatively correlated at the 1% level of significance, which may be due to the fact that as the size of the board of directors and the gearing of the firm increase, the effectiveness of the firm's management and its ability to repay debts decreases, leading to a decrease in its overall growth capacity and environmental performance level. Company growth shows a significant positive correlation with the environmental performance of the company at the 1% level, indicating that as the company continues to grow, the emphasis on environmental performance and related investments are also increasing. Return on net assets and current ratio do not have significant effects on the environmental performance of companies.

Following the F-test of model (2), it was determined that the P-value was less than 0.01 in this study, suggesting the existence of individual fixed effects. The Hausman test was then conducted to obtain the rejection of the original hypothesis at the 1% significance level, indicating that the coefficients of the fixed-effects model and the random-effects model are significantly different; consequently, the fixed-effects model was selected for the analysis, and the regression results are presented in Table 6. The coefficient of board diversity is 0.160, which is statistically significant at the 5% level, indicating that a more diverse board of directors can greatly boost the enhancement of CSR performance, thus confirming hypothesis 2. In addition, the correlation coefficients of business size, board size, and company growth are all negative, which may be because the larger a firm is, the more effective its oversight and management are. After the constraint, it is difficult to give adequate attention to CSR performance while concentrating on elements such as corporate performance and quick growth, leading in a lack of corporate investment in social responsibility performance and poor social responsibility performance. Lastly, the table data reveals that the coefficient of return on net assets is positive and statistically significant at the 5% level, indicating that shareholders, as important stakeholders of the enterprise, can significantly improve the social responsibility performance of the enterprise and aid in the establishment of a positive social

**Table 3.** Correlation analysis

	Eperformance	Spperformance	Gperformance	diversity	Csize	Bsize	growth	roe	Liquid ratio	DAratio
Eperformance	1									
Spperformance	0.050***	1								
Gperformance	0.160***	-0.036***	1							
diversity	0.061***	0.035***	0.049***	1						
Csize	-0.126***	-0.100***	-0.237***	-0.308***	1					
Bsize	-0.056***	-0.037***	-0.120***	-0.371***	0.255***	1				
growth	0.060***	0.026**	0.147***	0.031***	0.025**	-0.070***	1			
roe	0.019*	0.007	0.022*	0.004	0.100***	0.017	0.154***	1		
Liquidratio	0.061***	0.041***	0.121***	0.150***	-0.344***	-0.134***	0.017	0.086***	1	
DAratio	-0.067***	-0.030***	-0.185***	-0.184***	0.501***	0.143***	-0.035***	-0.159***	-0.625***	1

Notes:\*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

**Table 4.** VIF test

Variable	VIF	1/VIF
diversity	1.24	0.809372
DAratio	2.03	0.492082
liquidratio	1.65	0.606249
Csize	1.59	0.63045
Bsize	1.2	0.831456
roe	1.1	0.910968
growth	1.06	0.947065
Mean VIF	1.33	

**Table 5.** Corporate board diversity and environmental performance

Dependent variables	Eperformance		
	Independent variables	Coefficient	SD
diversity	0.195**	0.095	0.039 (2.06)
Bsize	-0.307***	0.061	0.000 (-5.00)
growth	0.079***	0.028	0.004 (2.85)
roe	-0.124	0.103	0.228 (-1.21)
liquidratio	0.007	0.007	0.264 (1.12)
DAratio	-0.335***	0.071	0.000 (-4.73)
_cons	1.408	0.995	0.157 (1.42)
Industry	Control		
year	Control		
N	7682		

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

responsibility image if the enterprise pays close attention to and satisfies shareholder interests.

After performing the F-test on model (3), the p-value was less than 0.01, indicating the existence of individual fixed effects. The Hausman test was conducted to obtain

**Table 6.** Corporate board diversity and social responsibility performance

Dependent variables	Sperformance		
	Independent variables	Coefficient	SD
diversity	0.160**	0.081	0.048 (1.98)
Csize	-0.012	0.021	0.562 (-0.58)
Bsize	-0.100	0.067	0.138 (-1.48)
growth	-0.016	0.015	0.302 (-1.03)
roe	0.119**	0.057	0.038 (2.08)
liquidratio	0.001	0.006	0.795 (0.26)
DAratio	0.000	0.083	0.999 (0.00)
_cons	3.231***	0.658	0.000 (4.91)
Industry	Control		
year	Control		
N	7682		

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

the rejection of the original hypothesis at the 1% significance level, so the fixed effect model was selected for analysis, and the specific regression results are shown in Table 7. From the data in the table, we can get that the coefficient of board diversity is positive and significant at the 5% level, indicating a significant positive relationship between board diversity and governance performance of enterprises, thus verifying hypothesis 3, which shows that a diverse composition of directors can provide enterprises with a more reasonable and rich resource supply system and a unique perspective to help enterprises make better decisions. In addition, corporate gearing and return on net assets have a non-significant positive relationship with governance performance, and the effects of board size, corporate size and current ratio are not significant.

The preceding analysis demonstrates that the current degree of board diversity in Chinese businesses is low. Board diversity is significantly and favorably connected with environmental performance, social responsibility, and governance performance, demonstrating that board diversity can have a considerable positive impact on the ESG performance of organizations as a whole (4). The analysis demonstrates that board diversity can increase sensitivity and focus on social responsibility by attracting more specialized and multidimensional board talent, enriching the internal and external composition of

**Table 7.** Corporate board diversity and governance performance

Dependent variables	Gperformance		
	Independent variables	Coefficient	SD
diversity	0.165**	0.083	0.047 (1.99)
Csize	-0.005	0.027	0.864 (-0.17)
Bsize	-0.024	0.092	0.797 (-0.26)
roe	0.063	0.078	0.42 (0.81)
liquidratio	-0.001	0.008	0.902 (-0.12)
DAratio	0.021	0.122	0.864 (0.17)
_cons	1.842**	0.765	0.016 (2.41)
Industry	Control		
year	Control		
N	7682		

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

top personnel, and enhancing the board's ability to make effective decisions and solve problems.

#### 5.4 Robustness Tests

This paper adopts the ESG score system developed by RKS with the actual situation of the Chinese A-share market as a proxy variable for corporate environmental performance, social responsibility performance, and governance performance in order to further validate the reliability of the research results. Different tiers correspond to different scores, with the CCC tier corresponding to 0.0–1.4, B tier corresponding to 1.4–2.9, BB tier corresponding to 2.9–4.3, BBB tier corresponding to 4.3–5.7, A tier corresponding to 5.7–7.1, AA tier corresponding to 7.1–8.6, and AAA tier corresponding to 8.6–10.0. The greater the score and rating, the better the company's performance on the metric, and vice versa. Table 8 displays the specific results of the robustness tests, and the data in the table indicate that the coefficients of corporate board diversity in the environmental dimension, social responsibility dimension, and governance dimension are 0.537, 0.548, and 0.631, respectively, and significant at the 10%, 10%, and 1% levels, respectively, after controlling for industry and year, which is consistent with the previously analyzed data. This is consistent with the findings of the prior analysis, demonstrating that a diverse

**Table 8.** Robustness tests

	<b>escoring</b>	<b>sscoring</b>	<b>gscoring</b>
<b>diversity</b>	0.573*	0.548*	0.631***
	(1.75)	(1.92)	(3.36)
<b>Csize</b>	0.0158	0.0477	−0.00175
	(0.44)	(1.51)	(−0.09)
<b>Bsize</b>	0.0968	0.327*	0.0845
	(0.48)	(1.85)	(0.74)
<b>growth</b>	0.210**	0.0453	0.0696
	(2.40)	(0.59)	(1.42)
<b>roe</b>	0.203	−0.0475	0.0527
	(0.66)	(−0.18)	(0.31)
<b>liquidratio</b>	−0.0249	0.000578	−0.0296*
	(−1.01)	(0.03)	(−2.09)
<b>DAratio</b>	−0.453*	−0.225	−0.564***
	(−1.93)	(−1.10)	(−4.27)
<b>_cons</b>	1.277	0.476	3.001***
	(1.48)	(0.63)	(6.22)
<b>Industry</b>	Control		
<b>year</b>	Control		
<b>N</b>	2298	2298	2055

Note: \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

board of directors can contribute significantly to the ESG performance of a company, and the regression results are quite reliable.

## 6 Conclusion

This study empirically investigates the relationship between corporate board diversity and environmental performance, social responsibility performance, and governance performance from three dimensions of ESG in the context of big data era, utilizing A-share listed businesses in China as the research object from 2015 to 2017. The study finds that a diverse board of directors has a significant positive relationship with the environmental, social responsibility, and governance performance of enterprises, indicating that a more diverse board of directors can provide enterprises with the necessary expertise and help them make more appropriate and high-quality strategic decisions, thereby improving the ESG performance of enterprises in the modern market system and assisting them in better implementing ESG practices. This aids enterprises to better practice

the new development concept of information-based economy and achieve healthy and sustainable development in the unpredictable economy and society.

Based on the aforementioned research findings, the following policy recommendations are presented.

Firstly, the government, as the economic market regulator, should acknowledge the inadequacy of China's ESG environment. Before broadly requiring individual enterprises to disclose their ESG performance, relevant regulatory authorities should formulate basic ESG disclosure rules and have good industry adaptability in rule making, for example, industries with high environmental pollution and playing a significant role in social development can be given appropriate mandatory disclosure requirements; other enterprises that are environmentally friendly and promote social development can be given voluntary disclosure requirements. While the government has intensified its focus on environmental preservation, the social responsibility and governance performance of businesses cannot be disregarded. On the one hand, as a significant part of society, a good social responsibility performance can maintain the relationship between all stakeholders and even promote the advancement of society as a whole; therefore, the government should also pay sufficient attention to whether or not businesses fulfill their social responsibility. China's market vigor must be restored owing to the influence of the new crown pandemic and the twists and turns of the global economic process. Companies can only maximize their market dynamics in a sustainable and long-term manner if they have a high level of intelligent governance. To promote China's continued development in the new era, the government should evaluate all areas of the ESG ecosystem and actively play the role of corporate market participants and government macro-regulation.

Secondly, as an important participant in social development, enterprises should set up a good new economic development concept with cloud computing, Internet of Things and other information technology as the core. While pursuing excellence in performance, companies cannot neglect corresponding investment in the three areas of environment, social responsibility and governance. Data mining through tools such as cloud computing to build a diverse board of directors, helping companies gain richer knowledge skills and a long-term perspective, so that they can be equipped with forward-looking ESG concepts and better cope with various internal and external environmental risks, thus achieving comprehensive and sustainable corporate development. In addition, companies should be proactive enough to improve their ESG performance, not just for the sake of "face-saving", but also to effectively use IoT technology to create intelligent governance structures and realize the important role that companies play as social actors, especially with the full-scale development of our society into a new stage of information economy, how to achieve long-term and healthy development is a key concern for companies at this stage. The issue of "face" should be realized that enterprises play an important role as a social participant.

Thirdly, stakeholders must play a role in monitoring and urging. Stakeholders must acknowledge the significance of healthy and sustainable business development and utilize ESG as a more comprehensive company evaluation indicator to provide a comprehensive long-term perspective to assist them in making sound decisions. Stakeholders



should therefore take the initiative to monitor corporate ESG performance and encourage businesses to proactively enhance their environmental, social responsibility, and governance performance in order to create and perpetuate your value in the era of big data.

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