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Article

A Study on the Impact of Board Characteristics on the Environmental, Social, and Governance (ESG) Responsibilities of Listed Companies—Evidence from Chinese Listings

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Abstract: Company boards play a critical role in ESG leadership by shaping strategy, ensuring accountability, and driving sustainability practices. However, ineffective board structures can hinder ESG goals, making the identification of board attributes that enhance ESG outcomes essential. Using data from 1931 A-share listed companies between 2009 and 2022, this study investigates how board characteristics, such as independence, independent directors' overseas experience, board size, and gender diversity, affect environmental, social, and governance (ESG) performance. The analysis reveals that the combined influence of board characteristics positively impacts ESG outcomes. Among individual attributes, board independence and independent directors with overseas education backgrounds significantly enhance ESG ratings, emphasizing the value of independent oversight and global perspectives. In contrast, board size and gender diversity show no significant impact, suggesting that simply increasing board size or representation does not necessarily improve ESG performance. Unlike prior studies focusing on isolated board characteristics, this research comprehensively analyzes how various attributes influence ESG outcomes. This study fills a critical gap in the ESG literature by addressing these complex dynamics. It offers actionable insights for policymakers and corporate governance reformers to improve business practices' accountability, transparency, and sustainability.

Keywords: ESG performance; board size; board diversity; board independence; independent director overseas study background; Chinese listed company



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1. Introduction

ESG is a sustainability framework based on the principles of sustainability and legitimacy, which aims to balance the interests of stakeholders and enhance the company's long-term value by focusing on environmental, social, and governance benchmarks [1]. With the advancement of the “dual carbon” policy and the maturity of the green financial system, ESG is playing an increasingly important role in promoting industrial upgrading, economic restructuring, and guiding companies to achieve sustainable low-carbon growth. The “dual carbon” policy refers to China's pledge to achieve peak carbon emissions by 2030 and carbon neutrality by 2060. This initiative drives industries toward sustainable practices by reducing carbon emissions and fostering green, low-carbon development. These goals are closely tied to corporate ESG performance, prompting companies to prioritize ESG ratings and align their operations with long-term sustainability objectives [2]. Despite the growing attention, ESG development in China is still in its early stages. Many listed companies still face low ESG disclosure rates, incomplete reporting, and poor performance [3,4]. Environmental violations, product safety issues, and plummeting stock prices associated

with ineffective board oversight still occur frequently. Moving from corporate social responsibility to ESG-advocated long-term value creation is critical in promoting sustainable business practices and supporting healthy economic growth [5]. Board characteristics typically refer to the specific attributes of a company's board of directors, including its size, independence, diversity, and members' educational backgrounds, which can influence governance practices and strategic decision-making [6,7]. These characteristics significantly impact company outcomes by ensuring accountability, fostering diverse perspectives, and leveraging expertise to improve decision-making. In terms of ESG performance, the board of directors plays a key role in incorporating sustainability goals into corporate governance. As the central corporate governance body, the board of directors is pivotal in business decisions. It plays a significant role in ensuring that companies fulfill their sustainability commitments and ESG practices [8]. Improving the actual fulfillment of ESG responsibilities requires measures from the top of the company, the most important of which is the board of directors recognizing the importance of ESG [9]. This study is guided by resource-dependent theory, which emphasizes how organizations rely on external resources to survive and develop. From a resource-dependence perspective, the board of directors can influence ESG performance by providing the resources needed to implement ESG. These resources may include the director's experience, skills, reputation, and connections to critical external entities [10,11]. A board of directors with abundant resources can provide necessary guidance on ESG issues and support the implementation of ESG strategies [12]. The existing research suggests that board characteristics have a significant impact on ESG performance. For example, external directors can provide external perspectives and independent oversight, thereby driving improvements in corporate environmental and social responsibility [13,14]. A diverse board of directors can better understand and respond to complex ESG issues, improving corporate ESG performance [15,16]. However, some studies hold the opposite view, that external directors may lack in-depth knowledge of the company's internal operations, making it challenging to promote ESG improvements in practice [17,18]. In addition, factors such as the board's size and the directors' educational background are also considered to have an essential impact on ESG performance [19]. The board's size and the directors' educational background have a positive impact on the implementation of the company's ESG strategy through active participation in resource allocation, the introduction of professional knowledge, and cultural shaping [20,21].

Previous research on the impact of board characteristics on ESG has deepened the understanding of how companies can actively implement ESG strategies. However, some research gaps still exist. First, most previous studies focused on the impact of board characteristics on individual indicators of ESG performance, ignoring the impact of the combined effect of board characteristics on ESG performance. This paper aims to fill this gap by studying the board characteristics combined and the individual impact on ESG performance. Our findings provide practical insights for Chinese companies pursuing sustainable development and long-term profitability, as well as policy recommendations to support the sustainable growth of the Chinese economy.

Against this backdrop, this study examines listed companies on the Shanghai and Shenzhen stock exchanges from 2009 to 2022 to investigate the impact of board characteristics on ESG performance. Guided by resource-dependence theory, this study identifies the key board characteristics that influence ESG outcomes, including board size, independence, gender diversity, and the international education background of independent directors. We explore these characteristics combined and individual effects on companies' ESG performances, providing a comprehensive analysis of each factor's unique contribution. The contributions of this study are mainly reflected in the following three aspects: (1) This study extends the existing theoretical framework of ESG research by exploring the impact of board characteristics on ESG through both aggregate and individual effects, providing a more comprehensive perspective on understanding how to improve a company's ESG strategy. (2) This study fills a gap in the existing literature by analyzing how resource-dependent theory can be applied to ESG performance under different board characteristics. It high-

lights how optimizing board structure can improve the operability of ESG management, providing actionable insights for companies responding to complex market environments. (3) This study provides data-driven evidence for policymakers, emphasizing the importance of board independence and international expertise in improving ESG performance. These insights can guide the optimization of regulatory frameworks and corporate governance practices to promote strategic and sustainable ESG management.

The rest of this paper is organized as follows. Section 2 introduces the theoretical background and the hypotheses. Section 3 presents the methodological part of the study. Section 4 presents the results of the study's empirical analysis. Section 5 presents the conclusions and suggestions for future research.

2. Research Hypotheses

2.1. Board Size and ESG Performance

The size of the board of directors generally refers to the number of board members. As the company's executive and core management body, it performs essential functions, such as supervising the management and safeguarding the rights and interests of shareholders. The existing research explains how the size of the board of directors affects corporate performance by providing critical resources based on the resource dependence theory [22]. Previous studies have found that the size of the board of directors significantly impacts ESG [23]. Treepongkaruna et al. (2024) argued that board size positively affects mitigating ESG controversies [12]. Specifically, companies need to implement ESG strategies through the board of directors' recommendations. As the company's board size becomes more extensive, ESG controversies will decrease accordingly, and ESG strategies will be more actively implemented. Research by De Villiers and others has confirmed a positive correlation between board size and environmental performance, i.e., the more significant the board, the higher the company's environmental performance [24]. On the other hand, existing research also shows that the size of the board of directors positively impacts a company's environmental information disclosure. The larger the board of directors, the more active the company's investment in environmental information disclosure [25]. In addition, there is a significant positive correlation between the size of the board of directors and the disclosure of corporate social responsibility (CSR) activities. The larger the board of directors, the more attention the company pays to related CSR activities [26,27]. Pucheta-Martínez and Gallego-Álvarez further supported this conclusion in a study on the relationship between board attributes and CSR disclosure that companies with larger boards are more likely to disclose CSR matters and that board size positively impacts CSR disclosure [26]. Therefore, this study proposes Hypothesis 1:

Hypothesis 1: *The larger the board, the more positive the ESG performance.*

2.2. Board Independence and ESG Performance

Independent directors are generally independent of the company's shareholders and management, so they can consider the needs of the company's management, shareholders, and other stakeholders, such as the public, and make recommendations and decisions more objectively and impartially. Board members provide companies with access to critical resources such as advice, knowledge, relationships, and legitimacy, which help companies cope with environmental uncertainty [11,28]. Brinette et al. (2023) argued that board independence can enhance ESG by mitigating disputes and reducing negative impacts on the company, thereby enhancing the company's value [29]. The more external directors there are, the more beneficial it is for the company's corporate environmental social responsibility (ECSR) [30]. Cuadrado-Ballesteros and others found that establishing independent directors helps improve the quality of corporate environmental information disclosure. The higher the proportion of independent directors in a company, the higher the corporate social responsibility information disclosure level [31]. When the proportion of independent directors on a company's board of directors increases, the company is

more likely to form a sustainability-themed alliance. Such alliances have a positive effect on improving a company's environmental performance [32]. Independent directors of a company have expertise and connections from outside the company. This external perspective can significantly improve the company's strategic flexibility and adaptability in terms of resources compared to internal perspectives, thereby maintaining a competitive advantage in a complex and ever-changing market environment [22,33]. However, the results of existing empirical studies are inconsistent. Theoretical and empirical studies have also pointed out that the relationship between independent directors and ESG is insignificant. Although independent directors provide independence and oversight mechanisms in corporate governance, they may be insufficient in promoting positive environmental performance initiatives [34]. Another study found that the more independent directors there are, the better the sustainability performance [35]. In addition, Pucheta-Martínez and Gallego-Álvarez believe that board independence is negatively correlated with corporate CSR, that is, board independence does not encourage the disclosure of CSR reports. The more independent directors a company has, the lower its CSR [26]. Therefore, it is necessary to study the relationship between board independence and ESG from an academic perspective in light of the different views of different scholars. Based on this, this paper proposes Hypothesis 2:

Hypothesis 2: *The higher the proportion of independent directors on the board, the more positive the ESG performance.*

2.3. Board Diversity and ESG Performance

Previous research has shown that gender diversity on corporate boards is conducive to greater environmental awareness and social responsibility [36]. Lu and Herremans found that gender diversity on the board positively correlates with environmental performance. The higher the gender diversity on the board, the higher the company's environmental performance [37,38]. Gender-diverse companies can implement environmental strategies more effectively than related companies, and increasing the proportion of female directors on the board can improve the company's environmental, social, and governance performance [39]. Post et al. (2021) further confirmed that companies with three or more female directors are more likely to prioritize long-term ESG-related development strategies [30]. In a study by Terjesen, Sealy, and Singh on how gender diversity on corporate boards affects corporate governance outcomes, gender diversity was shown to improve corporate governance outcomes by introducing more diverse perspectives and experiences into corporate decision-making processes, leading to more comprehensive decision-making processes [40]. McGuinness et al. further found in their study on the relationship between the gender of board members and CSR performance of Chinese listed companies that gender diversity on the board was conducive to improving corporate social responsibility performance, and the higher the gender diversity on the board, the higher the corporate social responsibility performance [41]. Companies with many women on their boards tend to have a higher social performance score. The higher the gender equality on the board, the higher the company's social performance [42]. Carter et al. pointed out that the presence of female directors has a positive impact on companies in most cases. However, the effect may vary depending on the industry, cultural background, and company-specific governance structure [43,44]. Therefore, this paper proposes Hypothesis 3, based on the above research:

Hypothesis 3: *The higher the proportion of female directors, the better the ESG performance.*

2.4. Independent Director's Overseas Study Background and ESG Performance

Based on higher-order theory and imprinting theory, the decision-making of senior management's risk appetite is influenced by their personal characteristics, educational background, and life experience, especially the background of studying abroad, which plays an important role in the strategic positioning of the enterprise, the fulfillment of social

responsibilities, and globalization and sustainable development [45,46]. Zhang et al. (2018) found that directors' overseas experience significantly impacts corporate social responsibility. This overseas educational experience is built on a long-term basis [47]. Business decision-makers with overseas education have gained knowledge and experience in corporate sustainability in different cultural contexts, which helps them better understand the importance of fulfilling corporate social responsibility and the methods of achieving this strategy [48]. When companies have directors with an international educational background, their ideas are often more advanced and open than those with a local educational background. These directors can use knowledge and experience from other countries to enhance the company's sustainable development goals and incorporate them into its strategy [49]. Thus, the board of directors is provided with advice and expertise, and the overall strategy for promoting sustainable development is supported.

There is a clear gap between developing and developed economies in terms of ESG awareness and practice, with developed countries generally showing higher engagement [50]. However, senior management with an overseas education background is more familiar with the early adoption of ESG principles in developed countries. Learning from knowledge and experience from different cultural backgrounds can enhance the importance of understanding ESG strategies [51]. The board of directors with an international education background provides the company with ESG-related expertise, makes decisions to implement the ESG strategy, provides effective planning and guidance for ESG practices, and ultimately promotes the company's ESG strategy [52]. Therefore, Hypothesis 4 is proposed in this study:

Hypothesis 4: *The higher the proportion of independent directors with overseas education backgrounds, the better the ESG performance.*

3. Research Methods and Data

3.1. Sample Selection and Data Sources

This study examines 1931 A-share listed companies from 2009 to 2022, encompassing 18,932 annual observations, to investigate the relationship between board characteristics and ESG performance. In order to improve the scientific nature of the experimental results, this paper makes the following recommended treatments for the initial research sample: (1) remove samples from the financial industry. Data from the financial industry is generally highly heterogeneous, and accounting treatments differ from those in other industries. Financial data may be affected by macroeconomic factors, such as interest rate changes, monetary policies, and market fluctuations. These factors may cause financial industry data to generate outliers or disturbance terms in the model, affecting the overall analysis results. In the past, such initial data has been removed from the industry, and this paper also removes it. (2) Remove samples in the ST and *ST categories. These samples usually represent companies that have been suspended from listing or are about to be delisted. Data quality issues or bias may be introduced, and significant differences in financial data from non-ST and *ST stocks may also be present, affecting the overall data analysis results. (3) Remove companies with a large number of missing values. (4) To reduce the impact of extreme values, the continuous variables in this article were winsorized at the upper and lower 1% quantiles. All company data in this article are from the CSMAR database, and data processing and regression analysis were completed using Stata16.0.

3.2. Variable Setting

- (1) Explanatory variables (independent variables): Composite score of board characteristics (Board Composite)

This variable reflects the overall characteristics of the board by combining four key indicators, board size, board independence, board diversity, and the overseas background of directors, using Principal Component Analysis (PCA). This approach synthesizes multiple dimensions of board composition into a single, comprehensive score, minimizing potential

biases that may arise from relying on individual indicators. This composite measure provides a robust basis for examining their collective impact on ESG performance by capturing a more holistic view of board characteristics.

(2) Explanatory variables (independent variables): Board size (Board Size)

Board size is measured by the number of board members representing the board's decision-making and oversight capacity.

(3) Explanatory variables (independent variables): Board independence (Board Independence)

This variable is the proportion of independent directors on the board, calculated as the percentage of independent directors among the total number of board members. This indicator reflects the impartiality of internal monitoring by the board of directors.

(4) Explanatory variables (independent variables): Board gender diversity (Board Multi)

Measured by the percentage of female directors, this variable indicates the level of gender diversity, which can influence ESG practices and inclusivity in decision-making.

(5) Explanatory variables (independent variables): Independent director's overseas study background (Board Background)

This variable represents the proportion of independent directors with overseas educational experience, capturing the board's exposure to global perspectives and practices.

(6) Explained variable (dependent variable): ESG performance (ESG score)

To evaluate the ESG performance of Chinese A-share listed companies, this study utilizes the Shanghai Huazheng ESG Rating, a third-party evaluation system. Building on previous research methods, this rating system is tailored to the Chinese market, offering stability through extensive data collection and analysis [53,54].

(7) Control variables

The control variables selected in this paper are as follows: enterprise size (Size), financial leverage (LEV), cash flow level (Cashflow), enterprise growth (Growth), enterprise profitability (Roe), equity concentration (Top10), and book-to-market ratio (Mb). The specific relevant variables are shown in Table 1.

Table 1. Research Model.

| Variable | Symbol | Definition |
|----------------------|---|---|
| Explained variable | Board composite | Principal component analysis (PCA) is used to synthesize the four indicators of board size, board independence, board diversity, and board overseas background to reflect the overall characteristics of the board of directors, avoiding the bias that a single indicator may bring. |
| | Board size (Board Size) | Measured by the total number of members of the board of directors in the company. |
| | Board independence (Board Independence) | The number of independent directors on the board of directors as a percentage of the total number of board members. |
| | Board gender diversity (Board Multi) | The percentage of female directors on the board of directors. |
| | Independent director's overseas study background (Board Background) | The ratio of the total number of independent directors with overseas education backgrounds in the listed company to the total number of independent directors on the company's board of directors in that year is measured. |
| Explanatory variable | ESG performance (ESG score) | Huazheng ESG score |

Table 1. Cont.

| Variable | Symbol | Definition |
|------------------|--------------------------------|--|
| Control variable | Enterprise size (Size) | The natural logarithm of the company's total assets. |
| | Financial leverage (LEV) | The total liabilities/total assets of the company |
| | Cash flow level (Cashflow) | Net cash flow from operating activities/total assets |
| | Enterprise growth (Growth) | The growth rate of total assets of the company |
| | Enterprise profitability (Roe) | The net profit/net assets of the company |
| | Equity concentration (Top10) | The sum of the shareholdings of the company's top ten shareholders |
| | Book-to-market ratio (Mb) | The book value/market value of the company |

3.3. Research Model

In order to more intuitively analyze the impact of board characteristics on corporate ESG performance, we have constructed a two-way fixed-effect model that controls for industry and individual factors based on the existing literature. The specific model is as follows (1)–(5).

To test the comprehensive impact of board characteristics on ESG performance, we built Model (1):

$$ESGscore_{it} = \alpha_0 + \alpha_1 Board_{it} + \alpha_3 control_{it} + \gamma_i + \theta_t + \varepsilon_{it} \quad (1)$$

To examine the individual effects of board characteristics on ESG performance, we constructed Models (2)–(5):

$$ESGscore_{it} = \alpha_0 + \alpha_1 BoardSize_{it} + \alpha_3 control_{it} + \gamma_i + \theta_t + \varepsilon_{it} \quad (2)$$

$$ESGscore_{it} = \alpha_0 + \alpha_1 BoardIndependence_{it} + \alpha_3 control_{it} + \gamma_i + \theta_t + \varepsilon_{it} \quad (3)$$

$$ESGscore_{it} = \alpha_0 + \alpha_1 BoardMulti_{it} + \alpha_3 control_{it} + \gamma_i + \theta_t + \varepsilon_{it} \quad (4)$$

$$ESGscore_{it} = \alpha_0 + \alpha_1 BoardBackground_{it} + \alpha_3 control_{it} + \gamma_i + \theta_t + \varepsilon_{it} \quad (5)$$

In this study, i represents the individual, t represents the year, and the Huazheng ESG score serves as the dependent variable. Board characteristics are the independent variables, specifically board size (BoardSize), independence (BoardIndependence), diversity (BoardMulti), and overseas background (BoardBackground). Principal component analysis is applied to derive a composite score of board characteristics (BoardComposite). The model controls for individual and time effects to enhance its accuracy.

4. Results

4.1. Descriptive Statistics

This study first conducted a descriptive statistical analysis to show the basic characteristics of the selected data, and the results are shown in Table 2. The mean value of the ESG score is 73.07, the median is 73.27, and the standard deviation is 5.313. Most companies have an ESG rating between 70 and 77, reflecting a relatively high ESG performance level among Chinese A-share listed firms. This range suggests that these firms are generally engaged in ESG practices. Regarding the characteristics of the board of directors, most boards have 8–9 members, indicating a balanced distribution of board sizes. Larger boards may provide diverse expertise and resources, but they may also encounter coordination challenges. Independent directors account for approximately one-third of the board, with only a few companies having more than half of their directors independent. This distribution aligns with governance norms in China, where independent directors play a significant role in oversight but are not the majority on boards.

Table 2. Descriptive statistics of major variables.

| Variable | N | Mean | SD | Min | Max |
|------------------|--------|----------|--------|--------|-------|
| ESG score | 18,932 | 73.07 | 5.313 | 36.62 | 92.93 |
| Board Compo~e | 18,932 | −0.00200 | 1.211 | −3.578 | 4.821 |
| Board Size | 18,932 | 8.859 | 1.823 | 5 | 15 |
| Board Indep~e | 18,932 | 37.35 | 5.415 | 30.77 | 57.14 |
| Board Multi | 18,932 | 17.34 | 11.04 | 0 | 50 |
| Board Backg~d | 18,932 | 0.511 | 0.500 | 0 | 1 |
| Size | 18,932 | 7.993 | 1.348 | 4.205 | 11.70 |
| Roe | 18,932 | 0.0570 | 0.143 | −0.837 | 0.327 |
| Lev | 18,932 | 0.471 | 0.199 | 0.0730 | 0.941 |
| Growth | 18,932 | 0.128 | 0.222 | −0.281 | 1.166 |
| Top10 | 18,932 | 57.72 | 16.50 | 21.93 | 92.84 |
| Cashflow | 18,932 | 0.0520 | 0.0700 | −0.186 | 0.253 |
| Mb | 18,932 | 0.657 | 0.261 | 0.110 | 1.219 |

4.2. Correlation Analysis

According to Table 3, the correlation analysis shows that the absolute values of the correlation coefficients for all variables are below 0.7, indicating strong independence among variables and minimizing potential negative impacts on the subsequent regression analysis. This confirms the general reliability of the data used in this study, helping to mitigate collinearity issues in the regression model and supporting the viability of further analysis.

4.3. Comprehensive Model of Board Characteristics

First, the impact of the board's overall score on the ESG score is studied and analyzed. As can be seen from Table 4, when no control variables are included, the impact of board characteristics on the ESG score is not significant. After all the control variables are included, the board's overall score is positive at the 1% significance level, indicating that the overall score selected in this paper significantly improves the company's ESG performance. As for what specific sub-indicators play a facilitating role, it still needs to be verified in the following text.

Table 3. Correlation analysis.

| | ESG Score | BoardC~e | BoardS~e | BoardI~e | BoardM~i | BoardB~d | Size | Roe | Lev | Growth | Top10 | Cashflow | Mb |
|--------------|------------|------------|------------|-----------|------------|-----------|-----------|------------|------------|------------|-----------|------------|----|
| ESG score | 1 | | | | | | | | | | | | |
| BoardCompo~e | 0.0120 | 1 | | | | | | | | | | | |
| BoardSize | 0.040 *** | −0.846 *** | 1 | | | | | | | | | | |
| BoardIndep~e | 0.093 *** | 0.772 *** | −0.414 *** | 1 | | | | | | | | | |
| BoardMulti | −0.030 *** | 0.372 *** | −0.176 *** | 0.031 *** | 1 | | | | | | | | |
| BoardBackg~d | 0.072 *** | −0.126 *** | 0.079 *** | 0.013 * | −0.00700 | 1 | | | | | | | |
| Size | 0.257 *** | −0.206 *** | 0.255 *** | 0.037 *** | −0.262 *** | 0.141 *** | 1 | | | | | | |
| Roe | 0.214 *** | −0.028 *** | 0.023 *** | −0.016 ** | −0.0110 | 0.043 *** | 0.110 *** | 1 | | | | | |
| Lev | −0.088 *** | −0.116 *** | 0.145 *** | 0.00800 | −0.145 *** | −0.00600 | 0.324 *** | −0.229 *** | 1 | | | | |
| Growth | 0.122 *** | 0.028 *** | −0.033 *** | 0.0110 | 0.022 *** | 0.028 *** | −0.015 ** | 0.293 *** | −0.047 *** | 1 | | | |
| Top10 | 0.178 *** | −0.027 *** | 0.051 *** | 0.040 *** | −0.036 *** | 0.115 *** | 0.218 *** | 0.186 *** | −0.078 *** | 0.157 *** | 1 | | |
| Cashflow | 0.115 *** | −0.036 *** | 0.046 *** | −0.0110 | −0.00200 | 0.035 *** | 0.151 *** | 0.326 *** | −0.166 *** | 0.00800 | 0.173 *** | 1 | |
| Mb | 0.128 *** | −0.110 *** | 0.147 *** | 0.013 * | −0.117 *** | 0.026 *** | 0.407 *** | −0.047 *** | 0.307 *** | −0.054 *** | 0.181 *** | −0.062 *** | 1 |

t-statistics in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4. Regression results of comprehensive board characteristics and ESG.

| | (1) | (2) |
|-----------------|--------------------------|-------------------------|
| Variables | ESG Score | ESG Score |
| Board Composite | −0.0094 (−0.29) | 0.2011 *** (6.56) |
| Size | | 1.2473 *** (36.43) |
| Roe | | 3.7226 *** (13.20) |
| Lev | | −4.8461 *** (−22.30) |
| Growth | | 1.9025 *** (11.33) |
| Top10 | | 0.0216 *** (9.08) |
| Cashflow | | 0.9420 * (1.69) |
| Mb | | 1.1406 *** (6.30) |
| Constant | 73.0727 *** (1953.23) | 62.8879 *** (252.82) |
| Observations | 18,932 | 18,932 |
| R-squared | 0.066 | 0.209 |
| Industry FE | YES | YES |
| Year FE | YES | YES |

t-statistics in parentheses *** $p < 0.01$, * $p < 0.1$.

4.4. Individual Board Characteristics Model

The regression on the impact of the secondary indicator board size on the ESG score is shown in Table 5. It can be seen that when the control variables are not included, the indicator is significantly positive at the 1% level. In contrast, the indicator is not significant after the control variables are included. This is likely because the number of board members usually increases with the company's size. Therefore, the company's size weakens this indicator's contribution to ESG. Hypothesis 1 is not supported.

Table 5. Regression results of board size and ESG.

| | (1) | (2) |
|--------------------|-------------------------|-------------------------|
| Variables | ESG Score | ESG Score |
| Board Independence | 0.0896 *** (12.74) | 0.0784 *** (12.08) |
| Size | | 1.2037 *** (35.54) |
| Roe | | 3.7523 *** (13.34) |
| Lev | | −4.8703 *** (−22.48) |
| Growth | | 1.9087 *** (11.40) |
| Top10 | | 0.0209 *** (8.82) |
| Cashflow | | 1.0089 * (1.81) |
| Mb | | 1.1319 *** (6.27) |
| Constant | 69.7251 *** (262.76) | 60.3563 *** (179.14) |
| Observations | 18,932 | 18,932 |
| R-squared | 0.074 | 0.213 |
| Industry FE | YES | YES |
| Year FE | YES | YES |

t-statistics in parentheses *** $p < 0.01$, * $p < 0.1$.

The regression results on the impact of the secondary indicator board independence on the ESG score are shown in Table 6. Whether or not the control variables are included, the proportion of independent directors is positive at the 1% significance level, indicating that independent directors do promote improvements in environmental protection, social responsibility, and corporate governance. As an external monitoring mechanism, independent directors are not affected by other characteristics of the enterprise and significantly improve the ESG performance of the enterprise. Hypothesis 2 is established.

This paper uses the proportion of women on the board of directors to measure the diversity of the board of directors. Table 7 shows that this indicator is insignificant after adding the control variables. Increasing the proportion of women on the board of directors does not promote the improvement of corporate ESG. Assumption 3 is not supported.

Finally, we verify the effect of the proportion of directors with overseas backgrounds on improving an enterprise's ESG performance. As seen from Table 8, whether or not the control variables are included, the board background indicator is significantly positive at the 1% or 5% level, indicating that the overseas experience of the board of directors can improve an enterprise's ESG performance. Hypothesis 4 is established.

Table 6. Regression results of board independence and ESG.

| | (1) | (2) |
|--------------|-------------------------|-------------------------|
| Variables | ESG Score | ESG Score |
| Board Multi | −0.0308 *** (−8.13) | −0.0029 (−0.81) |
| Size | | 1.2128 *** (35.11) |
| Roe | | 3.6827 *** (13.04) |
| Lev | | −4.8948 *** (−22.50) |
| Growth | | 1.9266 *** (11.46) |
| Top10 | | 0.0217 *** (9.12) |
| Cashflow | | 0.9762 * (1.75) |
| Mb | | 1.1150 *** (6.15) |
| Constant | 73.6062 *** (975.24) | 63.2439 *** (233.85) |
| Observations | 18,932 | 18,932 |
| R-squared | 0.069 | 0.207 |
| Industry FE | YES | YES |
| Year FE | YES | YES |

t-statistics in parentheses *** $p < 0.01$, * $p < 0.1$.

Table 7. Regression results of board diversity and ESG.

| | (1) | (2) |
|-------------|------------------------|-----------------------|
| Variables | ESG Score | ESG Score |
| Board Multi | −0.0308 *** (−8.13) | −0.0029 (−0.81) |
| Size | | 1.2128 *** (35.11) |
| Roe | | 3.6827 *** (13.04) |

Table 7. Cont.

| | (1) | (2) |
|--------------|-------------------------|-------------------------|
| Variables | ESG Score | ESG Score |
| Lev | | −4.8948 *** (−22.50) |
| Growth | | 1.9266 *** (11.46) |
| Top10 | | 0.0217 *** (9.12) |
| Cashflow | | 0.9762 * (1.75) |
| Mb | | 1.1150 *** (6.15) |
| Constant | 73.6062 *** (975.24) | 63.2439 *** (233.85) |
| Observations | 18,932 | 18,932 |
| R-squared | 0.069 | 0.207 |
| Industry FE | YES | YES |
| Year FE | YES | YES |

t-statistics in parentheses *** $p < 0.01$, * $p < 0.1$.

Table 8. The regression results of the independent directors' overseas study backgrounds and ESG.

| | (1) | (2) |
|------------------|--------------------------|-------------------------|
| Variables | ESG Score | ESG Score |
| Board Background | 0.7239 *** (9.46) | 0.1661 ** (2.32) |
| Size | | 1.2093 *** (35.38) |
| Roe | | 3.6812 *** (13.04) |
| Lev | | −4.8859 *** (−22.47) |
| Growth | | 1.9216 *** (11.43) |
| Top10 | | 0.0212 *** (8.90) |
| Cashflow | | 0.9581 * (1.71) |
| Mb | | 1.1211 *** (6.18) |
| Constant | 72.7025 *** (1344.12) | 63.1571 *** (257.05) |
| Observations | 18,932 | 18,932 |
| R-squared | 0.070 | 0.207 |
| Industry FE | YES | YES |
| Year FE | YES | YES |

t-statistics in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.5. Heterogeneity Analysis

Finally, this article will conduct a heterogeneity analysis of the above five indicators, as shown in Table 9. Columns (1) to (5) are the state-owned enterprise group, and columns (6) to (10) are the non-state-owned enterprise group. For both state-owned enterprises and non-enterprises, the comprehensive score of the board of directors and the independence of the board of directors have a significant positive effect on improving corporate ESG. In the group of state-owned enterprises, the overseas background of the board of directors has a more significant effect on improving corporate ESG. This may be because state-owned enterprises themselves have fewer overseas directors' experience, and introducing

independent directors with overseas backgrounds can have a more significant marginal optimization effect on corporate management. In non-state-owned enterprises, the size of the board of directors has a suppressive effect on corporate ESG. This may be because the more cumbersome board of directors in non-state-owned enterprises makes corporate management more constrained, thus reducing its ESG performance.

Table 9. Heterogeneity analysis.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|--------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score | ESG Score |
| Board Composite | 0.2081 *** (5.28) | | | | | 0.2304 *** (4.61) | | | | |
| Board Size | | 0.0183 (0.73) | | | | | −0.1003 *** (−2.69) | | | |
| Board Independence | | | 0.0867 *** (10.68) | | | | | 0.0654 *** (5.97) | | |
| Board Multi | | | | 0.0053 (1.00) | | | | | −0.0024 (−0.46) | |
| Board Background | | | | | 0.5714 *** (6.11) | | | | | −0.1808 (−1.60) |
| Size | 1.1496 *** (24.72) | 1.1269 *** (24.04) | 1.0904 *** (23.53) | 1.1374 *** (24.30) | 1.0936 *** (23.38) | 1.2100 *** (21.61) | 1.1943 *** (21.30) | 1.1815 *** (21.36) | 1.1661 *** (20.74) | 1.1779 *** (21.19) |
| Roe | 3.0097 *** (8.12) | 2.9650 *** (7.99) | 3.0167 *** (8.17) | 2.9738 *** (8.01) | 2.9430 *** (7.94) | 4.6877 *** (10.59) | 4.6699 *** (10.54) | 4.7194 *** (10.67) | 4.6594 *** (10.51) | 4.6526 *** (10.50) |
| Lev | −4.2958 *** (−14.98) | −4.3265 *** (−15.06) | −4.3198 *** (−15.13) | −4.3236 *** (−15.06) | −4.2781 *** (−14.92) | −5.6302 *** (−16.40) | −5.6438 *** (−16.43) | −5.6517 *** (−16.48) | −5.6706 *** (−16.50) | −5.6557 *** (−16.46) |
| Growth | 1.4769 *** (5.44) | 1.4530 *** (5.34) | 1.4713 *** (5.44) | 1.4564 *** (5.36) | 1.4442 *** (5.32) | 2.4108 *** (10.65) | 2.4158 *** (10.66) | 2.4012 *** (10.61) | 2.4204 *** (10.68) | 2.4161 *** (10.66) |
| Top10 | 0.0162 *** (4.94) | 0.0156 *** (4.75) | 0.0150 *** (4.60) | 0.0158 *** (4.82) | 0.0138 *** (4.21) | 0.0280 *** (7.39) | 0.0282 *** (7.45) | 0.0283 *** (7.49) | 0.0289 *** (7.63) | 0.0292 *** (7.69) |
| Cashflow | 1.7792 ** (2.39) | 1.7983 ** (2.41) | 1.8200 ** (2.45) | 1.7869 ** (2.40) | 1.8065 ** (2.43) | 0.4398 (0.52) | 0.4579 (0.54) | 0.4767 (0.56) | 0.4599 (0.54) | 0.4556 (0.54) |
| Mb | 1.3753 *** (5.61) | 1.3667 *** (5.56) | 1.3735 *** (5.62) | 1.3724 *** (5.58) | 1.3094 *** (5.34) | 0.7193 *** (2.58) | 0.7175 ** (2.57) | 0.7175 *** (2.58) | 0.6765 ** (2.42) | 0.6534 ** (2.34) |
| Constant | 63.8959 *** (193.06) | 63.9257 *** (172.85) | 61.1934 *** (144.54) | 63.9108 *** (178.90) | 64.2206 *** (194.15) | 62.8468 *** (149.09) | 63.8649 *** (132.98) | 60.6680 *** (102.19) | 63.2903 *** (141.37) | 63.2453 *** (152.39) |
| Observations | 10,531 | 10,531 | 10,531 | 10,531 | 10,531 | 8098 | 8098 | 8098 | 8098 | 8098 |
| R-squared | 0.221 | 0.219 | 0.227 | 0.219 | 0.222 | 0.238 | 0.237 | 0.240 | 0.236 | 0.236 |
| Industry FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Year FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

t-statistics in parentheses *** $p < 0.01$, ** $p < 0.05$.

5. Conclusions

5.1. Summary and Inspiration

This study investigates how board characteristics influence ESG performance, using a sample of 1931 listed companies from 2009 to 2022 and drawing on resource dependence theory. The analysis demonstrates that the collective composition of board characteristics positively impacts ESG outcomes, underscoring the strategic role of boards in fostering corporate sustainability. Among individual board attributes, independent directors' independence and international educational background emerge as particularly influential factors, significantly enhancing ESG performance. Independent directors with global perspectives are better attuned to sustainable business practices and provide valuable guidance for ESG-related strategies. In contrast, attributes such as board size and gender diversity did not significantly impact ESG performance within this sample. This finding suggests that increasing board size or gender representation may not automatically lead to stronger ESG outcomes without complementary structural or strategic adjustments. The heterogeneity analysis reveals notable differences in the influence of board characteristics between state-owned and non-state enterprises. In state-owned enterprises, the positive impact of independent directors with international backgrounds is more pronounced, likely due to the scarcity of such directors in these organizations. Conversely, larger board sizes in non-state-owned enterprises are associated with lower ESG performance, potentially because oversized boards in these firms hinder management efficiency and responsive-

ness. These findings highlight the critical importance of strategically composing boards to prioritize independent oversight and diverse experiences, particularly those with international exposure, to effectively address the complexities of ESG challenges. To enhance ESG performance, companies should focus on recruiting independent directors with global expertise, optimizing board size to balance diversity and efficiency, and ensuring that gender diversity is strategically empowered rather than represented. This study contributes to the literature by offering novel insights into the role of board characteristics in driving sustainability performance. It provides practical implications for corporate governance reforms, emphasizing the need to structure boards strategically to enhance accountability, improve ESG outcomes, and support sustainable business practices in an increasingly complex global environment.

5.2. Limitations and Future Research

While this study offers valuable insights into the impact of board characteristics on ESG performance, certain limitations suggest directions for future research. As it focuses on Chinese-listed companies, the findings may primarily apply to regions with similar governance structures and cultural contexts. Expanding the sample to include companies from diverse countries could yield broader insights. Additionally, while this study examines board size, independence, gender diversity, and international educational background, other attributes, such as age diversity, tenure, and industry expertise, may influence ESG outcomes. Future research could explore these factors to better understand how board composition affects ESG performance globally.

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