sustainability

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Does a Company's Position within the Interlocking Director Network Influence Its ESG Performance?—Empirical Evidence from Chinese Listed Companies

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Abstract: In an era focused on deepening green sustainable development, improving corporate ESG performance has become a theoretical focal point. Starting from the positional attributes of the interlocking director network, this study investigates the influence of a company's position within this network on its ESG performance among China's A-share-listed companies from 2009 to 2022. It utilizes Huazheng ESG ratings from the Wind database and employs regression models, analyses, endogeneity, and propensity score matching tests via Stata15.0 to probe the internal mechanisms at play. Research findings indicate that corporations at the core of the interlocking director network exhibit significantly better ESG performance compared to those in peripheral positions. The interlocking director network enhances corporate ESG performance by improving internal control levels. Media attention positively influences the effect of the interlocking director network on corporate ESG performance. Further analysis reveals that the beneficial impact of the interlocking director network on ESG performance is more pronounced in highly marketized corporations, those outside of heavy pollution industries, and those with a higher proportion of female directors. Economically, the positive effect of the interlocking director network on ESG performance enhances both earnings per share and total factor productivity. This study offers a novel pathway for enhancing corporate sustainability in emerging economies through the lens of the interlocking director network, drawing on China's experience. It aims to guide emerging markets in fostering ESG practices among corporations, thus offering theoretical insights for enhancing ESG performance.

Keywords: interlocking director network; ESG performance; internal control; media attention; sustainable development

Citation: Feng, H.; Zhang, Z.; Wang, Q.; Yang, L. Does a Company's Position within the Interlocking Director Network Influence Its ESG Performance?—Empirical Evidence from Chinese Listed Companies. *Sustainability* **2024**, *16*, 4190. https://doi.org/10.3390/su16104190

Received: 13 April 2024
Revised: 10 May 2024
Accepted: 14 May 2024
Published: 16 May 2024

1. Introduction

Since humanity entered the era of rapid industrialization, the contradiction between economic development and environmental protection has become increasingly prominent. Environmental pollution, infringement of employees' rights, financial fraud, and other corporate responsibility deficiencies have emerged one after another, posing severe challenges to the international community. To achieve a dynamic balance between economic growth and environmental protection, countries and social organizations worldwide have started urging companies to actively assume responsibilities in environmental governance and community maintenance, alongside profit pursuit, to foster a conducive market environment for sustainable development. As the world's second-largest economy, China's sustainable economic development plays a crucial role in global green economic progress. In 2016, the Chinese government signed the Paris Agreement, focusing on global climate change and elevating the green economy and social equity to national strategic priorities. The agreement proposed that China aims to reach a carbon peak by 2030 and achieve carbon neutrality by 2060, underscoring China's commitment to environmental protection as a major country. As the largest developing country, China's adherence to the "dual carbon" goals and its comprehensive promotion of economic green transformation are garnering attention from both theoretical and academic circles. ESG, integrating environmental, social, and corporate governance dimensions, aligns with China's new development concepts and can guide the enhancement of sustainable development and development quality at the micro-level. Guided by the government's planning and market forces, Chinese enterprises are increasingly adopting the ESG concept and improving ESG performance as key strategies for enhancing development quality and achieving sustainability.

Good ESG performance can enhance a company's market competitiveness [1], risk resistance [2,3], and sustainable development capabilities [4]. Consequently, numerous scholars have conducted extensive research on the factors influencing corporate ESG performance, focusing primarily on macro-level policy factors and micro-level corporate factors. At the macro level, studies have identified positive influences from green policies [5], carbon control policy risks [6], government regulations [7], capital market openness [8], and environmental oversight policies [9] on enhancing corporate ESG performance. On the micro level, research has shown a positive correlation between corporate ESG performance and factors such as company size [10], ownership equity structure [11,12], executive equity incentives [13], digital transformation [14], and the education level of management [15].The interlocking director network is defined as the phenomenon where members of a company's board of directors hold positions across multiple companies' boards through concurrent appointments, thus creating a network of interconnected companies [16]. Existing research on interlocking director networks primarily examines their impact on aspects such as corporate value [17], performance [18,19], behavior [20], governance [21], risk-taking [22], investment efficiency [23], and earnings sustainability [24], among other economic outcomes.

Although extensive research has been conducted on interlocking director networks and corporate ESG performance separately, scant research exists on the impact of informal institutions on corporate ESG performance. With the diminishing influence of formal institutions on corporate green transformation and sustainable development [25], the role of informal institutions as a complement to formal ones becomes significantly important in studying their impact on corporate ESG performance. The interlocking director network, as a crucial informal institution, has been scarcely examined in the literature for its impact on corporate ESG performance. To address this research gap, this study investigates the impact of interlocking director networks on corporate ESG performance, focusing on the mechanism of action from the network's positional perspective. This study aims to answer three key questions: (1) Does the interlocking director network's position influence corporate ESG performance? (2) What mechanisms underlie this influence? (3) How does this impact vary across different industries and degree of marketisation?

This study examines Chinese A-share listed companies from 2009 to 2022, analyzing the impact of interlocking director network positions on corporate ESG performance. The study reveals a positive correlation between interlocking director network centrality and corporate ESG performance. Specifically, companies with higher centrality in the interlocking director network exhibit significantly better ESG performance compared to those with lower centrality. Internal control mediates the relationship between interlocking director networks and corporate ESG performance, while media attention positively influences this effect. This study employs propensity score matching and instrumental variable methods to address its endogeneity issue. Robustness tests were performed by altering the measurement of interlocking director networks and ESG performance, lagging the network variable by one period, and excluding independent director samples. Furthermore, heterogeneity analysis shows the interlocking director network's positive impact on ESG performance is stronger in highly marketized companies, non-heavy pollution industries, and those with a higher proportion of female directors. Finally, the positive influence of the interlocking director network on ESG performance leads to higher earnings per share and improved total factor productivity.

The selection of Chinese listed companies as the research sample is primarily based on two reasons. Firstly, China operates within a "relationship"-oriented societal framework [26]. Establishing and maintaining inter-company relationships is crucial for business operations in China. Furthermore, the interlocking director network represents a significant aspect of the enterprise "relationship" network. As the largest emerging market, the proportion of A-share listed companies with interlocking directors averaged over 95% from 2012 to 2020 [27], offering a rich pool of research samples. Secondly, in the emerging market context, Chinese enterprises face significant challenges due to inadequate formal institutions and government intervention, impacting sustainable development [28]. Consequently, the critical role of informal institutions in corporate decision-making [23] offers an ideal context for assessing the interlocking director network's effectiveness.

This study aims to contribute to the existing literature by integrating the interlocking director network with corporate ESG performance within a unified analytical framework. It examines the influence of interlocking director network positions on corporate ESG performance, thereby enriching the ESG performance literature. Prior research has predominantly examined the effects of formal systems, including the Guidelines for Establishing a Green Financial System [5], carbon control policy [6], political and labor systems [7], Shanghai-Hong Kong Stock Connect trading system [8], and government environmental regulation policies [9], on corporate ESG performance. Research on the impact of informal systems on corporate ESG performance is scarce. Addressing the crucial question of enhancing corporate ESG performance, this study delves into the effects of interlocking director networks from an informal systems perspective. It broadens the scope of ESG performance research and offers new insights for businesses aiming to boost their ESG metrics. Furthermore, this study uncovers the non-economic impacts of interlocking director networks, thus expanding the discourse on their economic outcomes. Previous research on interlocking director networks has concentrated on economic outcomes like risk-taking [22], corporate governance quality [21], earnings sustainability [24], corporate value [17] and performance [18,19], often overlooking their influence on corporate sustainability capacities. This study investigates how interlocking director networks affect corporate ESG performance, enriching the body of knowledge with insights into their non-economic effects. Lastly, this study explores the influence of corporate social networks—an informal system—on ESG performance, elucidating the mechanisms through which interlocking director networks impact ESG outcomes. It offers empirical evidence for firms to develop interlocking director networks, elevate governance standards, and boost ESG performance.

The remainder of this study is structured as follows: Section 2 covers the theoretical analysis and research hypotheses. Section 3 introduces the data sources, research methods, variable measurements, and model settings. Section 4 presents the analysis of empirical results. Section 5 delves into the heterogeneity of the research questions and discusses their potential economic implications. Section 6 elucidates the study's conclusions and limitations.

2. Theoretical Analysis and Hypotheses

2.1. Interlocking Director Network and ESG Performance

Social network theory suggests that society, as a network of various entities (individuals, groups, or organizations), enhances the efficiency of exchanging information and resources among these entities [29]. The interlocking director network, formed through directors' cross-company appointments, significantly enhances information and resource exchange efficiency for enterprises. Network centrality, a key measure of a director's position within the interlocking director network, indicates their proximity to the center or edge of the social network. A more central position in the interlocking director network equates to a director's increased ability to access information and resources. Hence, this study employs network centrality to gauge the enterprise's position within the interlocking director network. This study posits that leveraging the information and peer effects of the interlocking director network can enhance an enterprise's ESG performance.

On the one hand, the interlocking director network can facilitate the provision of timely external information for corporate ESG practices through its information effects. Practicing the ESG concept requires enterprises to focus not only on their economic benefits but also on the social and environmental benefits of interest to stakeholders, thereby enhancing their sustainable development capabilities. Enterprises must adapt their strategies and business models to the evolving external competitive environment, technological standards, and consumer demands. This adaptation necessitates a sharp perception for seizing the latest external information promptly. In the interlocking director network, each enterprise has unique heterogeneous information resources, such as investment and financing, strategy, and corporate governance information [30]. Through connecting enterprises, interlocking directors serve as a conduit for accessing information and resources from the external environment [31]. They offer diversified and distinct information, enriching the decision-making process of the board with a wealth of knowledge, information, and resources. This, in turn, enables a more comprehensive and profound understanding of corporate ESG development [32], aiding in the enhancement of ESG performance.

On the other hand, the interlocking director network can help companies enhance their ESG performance by leveraging its peer effects. In economics, peer effects are defined as the mutual imitation behavior among organizations [33], a phenomenon present within the interlocking director network [34]. ESG practices open new paths for value creation for companies [35] while carrying higher market risks. The ambiguity in decision-making contexts heightens the risks and costs for companies, which can be mitigated through information exchange and mutual imitation within the interlocking director network. When ESG practices are capable of creating value and peer companies exhibit superior ESG performance, target companies will increase their focus on ESG development to avoid falling behind. The resources and decision-making basis provided by leading companies in the interlocking director network enable target companies to enhance their ESG performance with lower costs and reduced risks, realizing ESG's value-added benefits. Based on the above analysis, this study proposes Hypothesis H1.

H1. *Assuming other conditions are constant, interlocking director network centrality positively influences corporate ESG performance levels.*

2.2. Mediating Role of Internal Controls

Drawing from the resource dependency theory, resources constitute the key elements for a company's survival and development, crucial for building competitive advantages and boosting sustainable development capabilities. The interlocking director network serves as an important channel for companies to gain access to external information resources, aiding in the improvement in internal control quality, the improvement in corporate governance [36], and the advancement of ESG initiatives within companies.

Initially, the interlocking director network aids in enhancing the quality of internal control within companies. Companies at the center of the interlocking director network, valuing their reputation and aiming to sustain their competitive edge and central network position [37], are more inclined towards bolstering corporate governance and internal control quality. Furthermore, core-positioned companies within the network can utilize their strategic advantages to access vital information for enhancing internal control quality. Directors, key figures in internal control, bring extensive knowledge and experience in its design, execution, oversight, and enhancement. Interlocking directors, overseeing internal control across various companies, are apt to amass significant insights and expertise in this area. The network serves as an efficient conduit for information flow between companies, enabling the sharing of pertinent knowledge and expertise, thereby bolstering corporate internal control levels [24].

Following that, enhancing internal control quality within enterprises can foster corporate ESG development through organizational optimization and increased information transparency. Firstly, superior internal control quality streamlines organizational structure, delineates responsibilities between the board and managers, and balances equity among shareholders [38], thus rationalizing corporate ESG decision-making [39]. On the one hand, an effective internal control system enhances board oversight over management, deterring managers from neglecting shareholder-aligned ESG projects for personal gain or risk aversion; on the other hand, internal control's risk assessment and monitoring can reduce decision-making errors from principal-agent issues, thus improving the scientific integrity of corporate ESG decisions [40]. Secondly, high-quality internal control boosts information transparency, reduces information asymmetry with investors, allows for the accurate assessment of ESG project benefits, stimulates investment, and mitigates ESG underinvestment due to high financing costs, thereby improving ESG performance [41]. Based on the analysis above, we propose Hypothesis H2.

H2. *Holding other factors constant, corporate internal control mediates the effect of interlocking director network centrality on corporate ESG performance.*

2.3. Moderating Role of Media Attention

In line with stakeholder theory, enterprises typically develop ESG strategies to align with the interests of stakeholders, including the government, media, and the public. Within the stakeholder group, the media frequently oversees corporate behavior via its external governance effect [42,43]. This means that the pressure from media attention encourages enterprises to boost their ESG awareness, which in turn enhances their ESG performance [44].

On the one hand, media attention heightens both enterprises' and interlocking directors' focus on their reputation. Facing negative events, enterprises leverage the interlocking director network to gather information and adopt "defensive" and "adaptive" strategies, such as standardizing operations and enhancing ESG performance, to manage crises and bolster their reputation [45]. Under pressure, directors will intensify their oversight and governance to boost corporate ESG performance [46]. On the other hand, the economic and liberalization reforms in China's media business model, alongside government control, significantly enhance the timeliness, accuracy, and credibility of media reports [47]. This makes media information more likely to attract attention and trust from the enterprise's external investors. Consequently, with high media attention, enterprises are more inclined to elevate their ESG performance to cultivate a positive corporate image [48]. This analysis leads to the following hypothesis:

H3. *Media attention positively moderates the impact of interlocking director networks on corporate ESG performance, other conditions being constant.*

3. Data and Research Method

3.1. Data and Sample Selection

This study focuses on Chinese A-share listed companies between 2009 and 2022. We utilize the ESG rating data from the Wind database, known as Huazheng ESG ratings, to assess the ESG performance of companies. The Huazheng ESG ratings, first published in 2009, offer extensive coverage tailored to the Chinese market, thus providing a more accurate assessment of companies' ESG performance. The Huazheng ESG rating data have been extensively applied in corporate ESG research [49,50]. Data on interlocking director network centrality and media attention are sourced from the CNRDS database, while the internal control index is derived from the DIBO database, with remaining data obtained from the CSMAR database.

Preliminary data processing involved (1) excluding financial and insurance firms; (2) removing companies labeled as ST or *ST; (3) omitting firms with missing data within the sample period; and (4) applying a 1% Winsorization to all continuous variables. Following these procedures, the study compiled a non-balanced panel dataset comprising 3610 companies and 20,089 observations, processed primarily using Stata 15.0.

3.2. Variable Measurement

3.2.1. Dependent Variable

Given that Huazheng ESG ratings effectively evaluate a company's ESG performance, this study adopts the methodology of Wang et al. (2023), utilizing Huazheng ESG ratings for assessment [50]. The dependent variable in this study was corporate ESG performance. Third-party institutions' ESG rating scores are the primary method for assessing corporate ESG performance. The Huazheng ESG ratings evaluation framework comprises four tiers of indicators: over 300 foundational data indicators, 44 tertiary issue indicators, 16 secondary theme indicators, and 3 primary indicators. Indicators are scored based on their impact scope and intensity, with varying weights, culminating in a descending rating scale of AAA to C, across three levels and nine grades. In this study, corporate ESG ratings were assigned values from 1 to 9, ascending from low to high, where a higher value signifies superior ESG performance.

3.2.2. Independent Variable

The explanatory variable in this study was the position within the interlocking director network. To more effectively investigate the impact of positions within the interlocking director network on corporate ESG performance, this study adopted the methodology of Xie and Chen (2012), utilizing widely recognized social network indicators, specifically network centrality, to gauge a company's position within the interlocking director network [51].

Network centrality emphasizes the centrality of interlocking directors within the network. Drawing upon the existing social network literature [31,52], this study employs the methodology of Cheng et.al. (2019), which considers three centrality indicators—degree, betweenness, and closeness centrality [53]—to fully assess a company's centrality within the interlocking director network. In the measurement process, this study follows the methodology of Larcker et al. (2013), utilizing the median of degree, betweenness, and closeness centrality at the company level as indicators of a company's position in the interlocking director network. These indicators were sorted by year, divided into ten groups with values assigned from 0 to 9, and then the averaged value of the three indicators was used as the comprehensive network centrality of interlocking directors [54].

3.2.3. Mediating Variable

The mediating variable in this study was the internal control of enterprises. Following the methodologies of Li et al. (2021) and Wang et al. (2018), this study adopted the Dibo internal control index from the DIBO database, adjusted by dividing by 100, to assess corporate internal control levels [55,56]. The Dibo internal control index served as a crucial measure of annual enterprise internal control efficiency. This indicator assessed a range of factors, including company and industry risks, corporate internal audits, internal control defects, violations, related transactions, and legal litigation. The internal control index score, ranging from 1 to 1000, was determined by evaluating five key elements: the corporate internal environment, risk assessment, control activities, internal supervision, and information communication. A higher internal control index indicated a better quality of a company's internal control.

3.2.4. Moderating Variable

The moderating variable in this study was media attention. This study examined the comprehensive impact of media attention on listed companies, particularly its role in external supervision, without delving into the effects of varying reporting tendencies. Given that CNRDS's media attention data encompass both traditional and online media, they offers a comprehensive and objective measure of media focus on listed companies. Adopting the methodology of Wang et al. (2022) [57], this study utilized CNRDS media attention data, measuring them as the natural logarithm of the annual media report count plus one, to assess the extent of media attention received by listed companies. A higher value indicated greater media attention towards the listed company.

3.2.5. Control Variables

In light of existing studies [50,58–62], this study controls for variables including company size (SIZE), equity concentration (CONCEN1), corporate growth (GROWTH), capital structure (LEV), profitability (ROA), total asset turnover (TURNTA), proportion of independent directors (OUT), shareholder relatedness (Relate), years listed (AGE), asset tangibility (PPE), resource slackness (Slack), and operating cash flow (CF). Furthermore, the study incorporates year and industry dummy variables to mitigate the effects of macroeconomic shifts and sectoral variances. Detailed definitions of these variables are provided in Table 1.

Table 1. Definition of variables.

Variable Categories	Variable Names	Variable Symbols	Measurement
Dependent variable	ESG performance	ESG	Huazheng ESG ratings
Independent Variable	network centrality	CEN_median	median network centrality at the firm level
Mediating variable	internal control	IC	Dibo internal control index/100
Moderating Variable	media attention	web	the natural logarithm of the annual media report count plus one
Control Variables	company size	SIZE	natural logarithm of total enterprise assets
	equity concentration	CONCEN1	shareholding ratio of the largest shareholder
	corporate growth	GROWTH	(closing operating income—opening operating income)/opening operating income
	capital structure	LEV	total liabilities/total assets
	profitability	ROA	net profit/total assets
	total asset turnover	TURNTA	sales revenue/total assets
	proportion of independent directors	OUT	number of independent directors/total number of board members
	shareholder relatedness	Relate	dummy variable, top ten shareholders are 1 if they are related, 0 otherwise
	years listed	AGE	the natural logarithm of the number of years the enterprise has been listed plus one.
	asset tangibility	PPE	sum of inventories and fixed assets divided by total assets
	resource slackness	Slack	free cash flow divided by total assets
	operating cash flow	CF	net cash flow from operations divided by total assets

3.3. *Model Setting*

3.3.1. Basic Regression Model

In order to test the effect of interlocking director networks on firms' ESG performance, this study constructed the basic Model 1 for testing hypothesis 1:

$$ESG_{i,t} = \beta_0 + \beta_1 CEN\_median_{i,t} + \beta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

In this model, $ESG_{i,t}$ denotes the corporate ESG performance rating score, $CEN\_median_{i,t}$ refers to the centrality in the corporate interlocking director network, β_0 is the constant term, $Control_{i,t}$ includes a set of control variables, and $\varepsilon_{i,t}$ is the regression residual. The study integrated fixed effects for both industry and year into the model. The coefficient β_1, if significantly positive, suggests that centrality in the interlocking director network positively influences corporate ESG performance, thereby supporting research Hypothesis 1.

3.3.2. Modelling the Mediating Effects of Internal Controls

To verify whether the interlocking director network affects corporate ESG performance through strengthening internal control, this study adopted the stepwise regression method proposed by Baron and Kenny (1986) [63] to establish Models 2 and 3 to test Hypothesis H2.

$$IC_{i,t} = \gamma_0 + \gamma_1 CEN\_median_{i,t} + \gamma_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \tag{2}$$

$$ESG_{i,t} = \delta_0 + \delta_1 CEN\_median_{i,t} + \delta_2 IC_{i,t} + \delta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \tag{3}$$

In models (2) and (3), "*IC*" denotes internal control, with the remaining variables being consistent with those previously mentioned. Should γ_1, δ_1, and δ_2 be significantly positive, it would indicate that interlocking director network centrality can enhance internal controls, thus elevating the corporate ESG performance level, thereby supporting hypothesis H2.

3.3.3. Modelling the Moderating Effects of Media Attention

This study referred to the approach of Dong et al. [64] and established Model 4 to examine the moderating effect of media attention on the primary effect, thereby testing Hypothesis H3.

$$ESG_{i,t} = \gamma_0 + \gamma_1 CEN\_median_{i,t} + \gamma_2 web_{i,t} + \gamma_3 CEN\_median_{i,t} \times web_{i,t} + \gamma_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \tag{4}$$

In Model 4, "*web*" denotes media attention, with all other variables remaining as previously described. The coefficient γ_3 represents the interaction between the interlocking director network centrality and media attention. A significantly positive γ_3 suggests that media attention acts as a positive moderator in the relationship between interlocking director network centrality and corporate ESG performance, thereby lending support to Hypothesis H3.

4. Empirical Analysis

4.1. Descriptive Statistics

The descriptive statistical results of the sample data are presented in Table 2. The average ESG performance score for corporations was 4.142, with a median of 4, suggesting that both the mean and median levels were relatively low. This may reflect the late adoption of ESG practices by Chinese listed companies and the absence of unified ESG disclosure and evaluation standards by rating agencies. The standard deviation was 1.006, with values ranging from a minimum of 1.25 to a maximum of 6.25, highlighting a significant disparity in ESG performance among Chinese listed companies and suggesting considerable room for improvement.

The average network centrality (*CEN_median*) was 3.54, with a median of 3.333, indicating a lower level of centrality among Chinese listed companies. With a maximum of 8.667, a minimum of 0.333, and a standard deviation of 1.693, there was a significant variance in the interlocking director network centrality across companies.

The internal control index (*IC*) averaged at 6.438 with a median of 6.642, suggesting a generally optimistic quality of internal control among Chinese listed companies. A standard deviation of 1.179 indicates significant variability in internal control among Chinese listed companies, offering valuable evidence for research due to the uneven levels of control.

The average media attention (*web*) score was 4.975, with a median of 4.875, indicating that over half of the companies receive less media attention than the average. The range of media attention spanned from a minimum of 2.833 to a maximum of 8.031, with a standard deviation of 1, highlighting the significant variability in media coverage among Chinese listed companies, possibly influenced by media preferences for high-profile companies.

Table 2. Descriptive statistics.

Variable	*N*	Mean	Median	Std. Dev	Min	Max
ESG	20,289	4.142	4	1.006	1.250	6.250
CEN_median	20,289	3.574	3.333	1.693	0.333	8.667
STR_median	20,289	0.837	0.844	0.115	0.081	1.125
IC	20,289	6.438	6.642	1.179	0	8.598
web	20,289	4.975	4.875	1	2.833	8.031
SIZE	20,289	22.32	22.12	1.284	19.93	26.28
CONCEN1	20,289	0.322	0.300	0.142	0.083	0.729
GROWTH	20,289	0.166	0.112	0.370	−0.569	2.086
LEV	20,289	0.431	0.426	0.200	0.0550	0.886
ROA	20,289	0.034	0.0350	0.066	−0.274	0.200
TURNTA	20,289	0.588	0.505	0.391	0.057	2.339
OUT	20,289	0.376	0.364	0.053	0.333	0.571
Relate	20,289	0.891	1	0.312	0	1
AGE	20,289	2.222	2.303	0.668	1.099	3.367
PPE	20,289	0.351	0.339	0.172	0.017	0.778
Slack	20,289	0.002	0.015	0.098	−0.371	0.245
CF	20,289	0.047	0.045	0.068	−0.159	0.247

4.2. Regression Analysis

4.2.1. Basiline Regression Results and Analysis

Table 3 displays the baseline regression results of Model 1. From column (1), it can be seen that the regression coefficient between interlocking director network centrality (*CEN_median*) and corporate ESG performance (*ESG*) was 0.033, and it was significantly positive at the 1% level, indicating that interlocking director network centrality positively influences corporate ESG performance. Hypothesis H1 has been verified.

The results confirm that the interlocking director network serves as a bridge between the company's internal and external environments. Interlocking directors leverage their network positions to exert informational and communicative effects. Informational effects aid in acquiring technological and managerial resources, while communicative effects represent indirect social capital, complementing information resources. Additionally, interlocking directors can also generate reputation and peer effects through their network positions. Reputation effects encourage companies to enhance ESG performance by adopting advanced practices from others in the network, to uphold their reputation.

The empirical results indicate that a central position within the interlocking director network positively correlates with enhanced ESG performance in enterprises. Prior studies have explored the interlocking director network's influence on factors such as corporate behavior [20], corporate risk-taking [22], corporate governance [21], investment efficiency [23], and corporate value [17–19]. This study's contributions enrich the body of knowledge on the interlocking director network.

Table 3. Regression results of interlocking director networks on firms' ESG performance.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
CEN_median	0.033 ***	0.030 ***	0.029 ***	0.032 ***
	(8.02)	(5.92)	(4.92)	(7.89)
IC			0.119 ***	
			(14.61)	
Web				−0.006
				(−0.68)
CEN_median × web				0.007 *
				(1.96)
SIZE	0.295 ***	0.297 ***	0.275 ***	0.296 ***
	(41.40)	(41.78)	(20.83)	(36.79)
CONCEN1	0.137 ***	0.142 ***	0.105	0.136 ***
	(2.86)	(2.94)	(1.16)	(2.83)
GROWTH	−0.129 ***	−0.130 ***	−0.161 ***	−0.128 ***
	(−6.81)	(−6.86)	(−8.26)	(−6.73)
LEV	−0.869 ***	−0.870 ***	−0.832 ***	−0.869 ***
	(−18.08)	(−18.09)	(−10.29)	(−18.07)
ROA	2.736 ***	2.747 ***	1.965 ***	2.740 ***
	(19.53)	(19.56)	(10.92)	(19.54)
TURNTA	0.093 ***	0.096 ***	0.061 *	0.092 ***
	(4.57)	(4.72)	(1.69)	(4.55)
OUT	1.439 ***	1.485 ***	1.423 ***	1.439 ***
	(12.10)	(12.37)	(7.10)	(12.07)
Relate	0.044 *	0.044 *	0.047	0.045 *
	(1.78)	(1.78)	(1.31)	(1.80)
AGE	−0.222 ***	−0.221 ***	−0.211 ***	−0.223 ***
	(−19.00)	(−18.85)	(−10.03)	(−18.92)
PPE	0.367 ***	0.365 ***	0.348 ***	0.366 ***
	(7.86)	(7.81)	(4.42)	(7.83)
Slack	−0.043	−0.042	−0.002	−0.046
	(−0.64)	(−0.62)	(−0.02)	(−0.68)
CF	−0.092	−0.090	−0.053	−0.088
	(−0.85)	(−0.83)	(−0.41)	(−0.81)
IND	yes			
YEAR	yes			
CONSTANT	−3.096 ***	−3.354 ***	−3.452 ***	−2.921 ***
	(−12.12)	(−13.17)	(−9.17)	(−19.91)
N	20,289	20,289	20,289	20,289
R^2	0.243	0.242	0.257	0.243

Note: *** and * indicate significance at the 1% and 10% levels, respectively.

4.2.2. Mediating Effect Test Results of Internal Controls

This study examined the effect of the interlocking director network on corporate ESG performance through enhanced internal control, utilizing models 2 and 3 for stepwise regression analysis as detailed in Table 3. Table 3 reveals hypothesis H2's test results. Column (1) shows baseline regression, while column (2) demonstrates a significant positive correlation (coefficient = 0.030) at the 1% level between interlocking director network centrality (*CEN_median*) and the internal control (*IC*), suggesting enhanced internal control. Column (3) shows significant positive impacts: a coefficient of 0.029 for the interlocking director network on ESG performance and 0.119 for internal control on ESG performance, both at the 1% level. This indicates internal control's partial mediation in the network's positive effect on ESG performance, preliminarily supporting Hypothesis H2. To bolster the findings, Bootstrap and Sobel tests were performed, further confirming the partial mediating effect of internal control on the positive relationship between the interlocking director network and corporate ESG performance. Hypothesis H2 is thus confirmed.

The results verify that internal control mediates the positive effect of the interlocking director network on ESG performance. Faced with reputation pressures, companies leverage their network positions to access external information, adopt advanced management practices, improve internal controls, optimize organizational structures, enhance transparency, and boost ESG performance. The empirical results are consistent with the existing research on internal control, suggesting that the interlocking director network helps to improve enterprises' internal control levels, and these improvements contribute to enhancing their ESG performance [24,38,40].

4.2.3. Moderating Effect Test Results of Media Attention

Table 3 presents the moderating effect of media attention (*web*) on the relationship between interlocking director network centrality and corporate ESG performance. The interaction term ($CEN\_median \times web$) was significantly positive (coefficient = 0.007) at the 10% level, suggesting that media attention enhances the network's positive influence on ESG performance, supporting hypothesis H3. Empirical findings indicate that companies in the interlocking director network improve their ESG performance by adhering to regulations and fulfilling social responsibilities, driven by the external pressure of media attention, to uphold a good reputation. Similar to findings in existing research [42,43], this study's empirical results further validate the significant role of media attention as a crucial external oversight mechanism in enhancing corporate governance. Enterprises within the interlocking director network may, under the external pressure of media attention, strive to uphold a positive reputation through legal compliance and social responsibility fulfillment, thus improving their ESG performance.

4.3. Endogeneity Test

4.3.1. Instrumental Variable Method

To address the endogeneity issue, we employed the Hausman test to assess OLS and IV regression outcomes, revealing a p-value of 0.001 and confirming the presence of endogeneity in the explanatory variables. Consequently, we constructed an instrumental variable based on the annual regional average of interlocking director network centrality for the 2SLS analysis. The annual regional average of interlocking director network centrality is strongly correlated with explanatory variables, yet it remains unassociated with other perturbations, qualifying it as a suitable instrumental variable. Table 4 displays the regression outcomes, with the first stage revealing a significantly positive coefficient for *CEN_median_Province*, negating any weak instrumental variable concerns. The second stage of 2SLS regression, as shown in column (2), confirms that the interlocking director network centrality's effect on corporate ESG performance aligns with baseline findings, underscoring the study's robust conclusions.

Table 4. Instrumental variable method: two-stage regression results.

Variables	(1) First-Stage CEN_Median	(2) Second-Stage ESG
CEN_median_Province	0.792 ***	
	(15.57)	
CEN_median		0.226 ***
		(5.60)
SIZE	0.274 ***	0.240 ***
	(23.66)	(17.79)
CONCEN1	−0.039	0.145 ***
	(−0.49)	(2.90)
GROWTH	−0.007	−0.126 ***
	(−0.24)	(−6.66)
LEV	0.020	−0.864 ***
	(0.26)	(−17.99)
ROA	−0.499 **	2.827 ***
	(−2.41)	(21.48)
TURNTA	0.169 ***	0.053 **
	(5.01)	(2.35)
OUT	−2.442 ***	1.922 ***
	(−12.42)	(12.06)
Relate	0.049	0.034
	(1.06)	(1.16)
AGE	0.240 ***	−0.268 ***
	(12.39)	(−17.34)
PPE	−0.136 *	0.393 ***
	(−1.75)	(8.03)
Slack	0.109	−0.061
	(0.98)	(−0.88)
CF	0.423 **	−0.169
	(2.40)	(−1.52)
IND	yes	
YEAR	yes	
CONSTANT	−7.257 ***	−2.210 ***
	(−15.65)	(−6.74)
N	20,289	20,289
R^2	0.275	0.178

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

4.3.2. Propensity Score Matching Test

To tackle the endogeneity issue stemming from sample selection bias, this study employs the Propensity Score Matching (*PSM*) approach. This study creates a dummy variable, using the median centrality of corporate director networks as a threshold. Samples above this median were classified as the experimental group (1) and those below as the control group (0). Given that factors such as equity nature (*SOE*), the independent director ratio (*OUT*), total asset turnover (*TURNTA*), female director ratio (*Female*), listing duration (*AGE*), capital structure (*LEV*), shareholder connectedness (*Relate*), asset tangibility (*PPE*), and cross-listing in Hong Kong (*CrossList*) can influence the position within the interlocking director network, this study incorporated these variables as covariates. Employing the Logit model, this research conducted 1:1 with-replacement nearest neighbor matching, 0.05 radius matching, and kernel matching for propensity score analysis. It then calculated the *ATT* and empirically tested the matched samples to assess the study's robustness, as depicted in Table 5.

Table 5. Regression results after sample matching.

	1:1 Nearest Neighbor Matching	**0.05 Radius Matching**	**Kernel Matching**
Variables	**ESG**	**ESG**	**ESG**
CEN_median	0.019 ***	0.025 ***	0.025 ***
	(2.82)	(5.6)	(5.6)
Control	yes	yes	yes
IND	yes	yes	yes
YEAR	yes	yes	yes
ATT	4.17 ***	4.18 ***	4.18 ***
CONSTANT	−3.279 ***	−2.738 ***	−2.729 ***
	(−8.25)	(−9.34)	(−9.31)
N	10,195	19,965	19,955
R^2	0.266	0.256	0.256

Note: *** indicate significance at the 1% levels.

Initially, a balance test was conducted on both *variable* groups, revealing no significant differences in their characteristics post-matching. Subsequently, the study calculated the Average Treatment Effect of Treatment group (*ATT*). The *ATT* values derived from the three methods were significantly different at the 1% level, highlighting disparities in ESG performance between the experimental and control groups, as shown in Table 5. The positive and significant regression coefficients at the 1% level from all three methods confirm that a central position within the interlocking director network enhanced corporate ESG performance, further supporting Hypothesis H1 and underscoring the robustness of these findings.

4.3.3. Excluding the Influence of Management's Self-Interest Behavior

Considering the potential of improved corporate ESG performance as a means for management to seek personal reputation [65,66], this study acknowledges that such self-interested behaviors could influence our conclusions. Given the individual nature of management's pursuit of personal reputation, it is challenging to entirely exclude this from our analysis. Consequently, this study employed a stratified analysis approach. Drawing on agency theory, this study posits that management's self-interested behaviors originate from the more severe principal-agent problem between shareholders and management. Holding shares by management is considered one of the most effective solutions to this principal-agent dilemma [67]. Based on the management shareholding proportions in the sampled companies, we divided the samples into two groups. Companies were categorized into high- and low-management shareholding ratio groups, based on whether they met or exceeded the median shareholding proportion. We posit that in the high-management shareholding ratio group, the severity of the principal-agent problem is reduced, diminishing the incentive for management's self-interested behaviors, which makes it unlikely for management to enhance corporate ESG performance solely for personal reputation gains. Thus, the findings from this group more accurately depict the influence of the interlocking director network on corporate ESG performance. Conversely, in the low-management shareholding ratio group, the principal-agent problem's severity is heightened, increasing the likelihood of management enhancing ESG performance to pursue personal reputation. Empirical tests were conducted on both groups, with regression results presented in Table 6.

Table 6. Regression results grouped by management shareholding ratio.

Variables	**(1)**	**(2)**
	High Management Shareholding Ratio Group	**Low Management Shareholding Ratio Group**
	ESG	**ESG**
CEN_median	0.027 ***	0.042 ***
	(4.38)	(6.79)
Coefficient of difference test between groups	0.015 *	
Control	yes	
IND	yes	
YEAR	yes	
CONSTANT	−0.781 ***	−2.665 ***
	(−3.11)	(−14.53)
N	9789	9351
R^2	0.111	0.199

Note: *** and * indicate significance at the 1% and 10% levels, respectively.

This study initially employed the Fisher's Permutation Test, sampling 1000 times to assess inter-group differences. The results revealed a coefficient of 0.015 for the inter-group difference, significant at the 10% level, suggesting substantial differences between groups. According to Table 6, the regression coefficient for interlocking director network positions on corporate ESG performance was 0.027 in column (1), aligning with basic regression results and significant at the 1% level. This indicates that with minor principal-agent problem, management's pursuit of personal reputation scarcely influences corporate ESG performance improvements; significantly, the interlocking director network enhances corporate ESG performance, further supporting Hypothesis H1. In column (2), the regression coefficient for the interlocking director network's impact on corporate ESG performance was 0.042, significantly at the 1% level. This coefficient notably surpasses both the basic regression results and those of the high management shareholding ratio group. This suggests that in cases of severe principal-agent problem, both the interlocking director network and management's self-interest actions collaboratively enhance corporate ESG performance, demonstrating a stronger combined effect. Overall, the robustness of our regression results is confirmed, even after accounting for the potential of interlocking directors, particularly core network directors, to pursue personal reputation through ESG.

4.4. Robustness Tests

4.4.1. Alternative Measurement for Interlocking Director Network

(1) Replacing the measurement indicator for the interlocking director network

The interlocking director network's structure hole index signifies the informational gap occurring when two indirectly linked companies connect through a mutual company, serving as a crucial network position metric. Situated in structure holes, companies act as "bridges" linking non-directly connected firms, thus gaining informational and control benefits [68]. Interlocking directors' close connections afford structure hole companies timely insights into complex stakeholder relationships, enabling strategic stakeholder management, mapping, pressure mitigation, and crucial ESG performance enhancement for competitive advantage [69]. This study adopts the interlocking directors' structure hole index median (*STR_median*) as an alternate metric for the interlocking director network's robustness analysis. Following Chen (2015) [70], this study utilizes CNRDS database's interlocking director structure hole data, applying the network centrality measurement method by using the company-level directors' median as the structure hole metric, where a higher index indicates greater informational advantage.

Table 7, column (1) presents the regression results of the interlocking director network's impact on ESG performance, with the interlocking director network structure hole (*STR_median*) coefficient at 0.382, significant at the 1% level. This suggests that a denser structure hole network correlates with enhanced ESG performance among sampled companies. Companies with abundant structure holes act as bridges within the interlocking director network, using their informational and control advantages to access more resources and improve ESG performance, aligning with our baseline regression findings.

Table 7, columns (1) to (3), detail the mediation effect of internal control. Column (2) reveals a significant positive coefficient of 0.255 for the interlocking director network structure hole index (*STR_median*) on corporate internal control quality (*IC*) at the 1% level, signifying a notable enhancement in internal control levels. Column (3) shows regression results for *STR_median* and *IC* on corporate ESG, with coefficients of 0.352 and 0.120, respectively, both significant at the 1% level. This indicates that a denser interlocking director network structure hole and superior internal control quality correlate with improved ESG performance, preliminarily confirming the mediating role of internal control. Bootstrap and Sobel tests were conducted to further affirm the mediating effect's robustness.

Table 7, column (4), illustrates the moderating effect of media attention, where the interaction between the interlocking director network structure hole index and media attention (*STR_median* × *web*) positively correlates with ESG performance (γ_3 = 0.388, $p < 0.01$). This indicates that increased media attention amplifies the positive impact of a dense interlocking director network on ESG performance, reinforcing the moderating effect's solidity.

(2) Replacing the measurement approach for interlocking director network centrality

To enhance the robustness of our study, we adopted the maximum value of interlocking director network centrality (*CEN_max*), as proposed by Xie et al. (2012), to replace the conventional measurement method of the interlocking director network in our baseline regression [51]. Table 8 displays the regression outcomes following the adjustment in the measurement approach for interlocking director network centrality. Column (1) indicates that interlocking director network centrality has a significantly positive impact on corporate ESG performance, with significance at the 1% level. The test results for the mediating effect of internal control, presented in columns (1) to (3), show that the regression coefficient between interlocking director network centrality (*CEN_max*) and internal control (*IC*) is 0.020, significant at the 1% level. Moreover, the regression coefficient of internal control on ESG performance is 0.131, also significant at the 1% level, confirming the continued mediating role of corporate internal control in the relationship between interlocking director network centrality and ESG performance after adjusting the measurement approach. As demonstrated in column (4), the moderating effect of media attention is evident, with a significant positive correlation between interlocking director network centrality and corporate ESG performance at the 1% level. Furthermore, the positive and significant regression coefficient of the interaction term (*CEN_max* × *web*) with corporate ESG performance at the 1% level suggests that media attention amplifies the positive influence of the interlocking director network on corporate ESG performance. This further corroborates the robustness of our research findings.

Table 7. Regression Results of the Structure Hole Index on Corporate ESG Performance.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
STR_median	0.382 ***	0.255 ***	0.352 ***	0.388 ***
	(6.55)	(3.41)	(4.35)	(6.64)
IC			0.120 ***	
			(14.70)	
Web				−0.007
				(−0.81)
STR_median × web				0.156 ***
				(3.24)
SIZE	0.297 ***	0.171 ***	0.277 ***	0.299 ***
	(41.78)	(12.94)	(20.96)	(37.11)
CONCEN1	0.142 ***	0.277 ***	0.108	0.140 ***
	(2.94)	(3.87)	(1.20)	(2.92)
GROWTH	−0.130 ***	0.267 ***	−0.162 ***	−0.128 ***
	(−6.86)	(11.67)	(−8.33)	(−6.77)
LEV	−0.870 ***	−0.317 ***	−0.832 ***	−0.869 ***
	(−18.09)	(−3.95)	(−10.30)	(−18.07)
ROA	2.747 ***	6.501 ***	1.969 ***	2.752 ***
	(19.56)	(23.20)	(10.93)	(19.59)
TURNTA	0.096 ***	0.272 ***	0.063 *	0.096 ***
	(4.72)	(7.44)	(1.76)	(4.73)
OUT	1.485 ***	0.147	1.468 ***	1.484 ***
	(12.37)	(0.85)	(7.27)	(12.33)
Relate	0.044 *	−0.028	0.048	0.044 *
	(1.78)	(−0.93)	(1.32)	(1.79)
AGE	−0.221 ***	−0.092 ***	−0.210 ***	−0.221 ***
	(−18.85)	(−4.95)	(−9.95)	(−18.79)
PPE	0.365 ***	0.160 **	0.346 ***	0.362 ***
	(7.81)	(2.07)	(4.39)	(7.75)
Slack	−0.042	−0.350 ***	−0.000	−0.045
	(−0.62)	(−3.79)	(−0.00)	(−0.67)
CF	−0.090	−0.320 **	−0.051	−0.086
	(−0.83)	(−2.17)	(−0.39)	(−0.79)
IND		yes		
YEAR		yes		
CONSTANT	−3.354 ***	2.796 ***	−3.688 ***	−3.111 ***
	(−13.17)	(8.96)	(−9.89)	(−21.33)
N	20,289	20,289	20,289	20,289
R^2	0.242	0.260	0.257	0.261

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 8. Regression Results after Replacing Measurement Approach of Interlocking Director Network Centrality.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
CEN_max	0.022 ***	0.020 ***	0.019 ***	0.022 ***
	(7.40)	(6.30)	(6.56)	(7.39)
IC			0.131 ***	
			(18.47)	
web				0.007
				(0.80)
CEN_max × web				0.004 *
				(1.68)
Control	yes			
IND	yes			
YEAR	yes			
CONSTANT	−2.091 ***	3.150 ***	−2.502 ***	−2.046 ***
	(−14.85)	(18.45)	(−17.73)	(−13.81)
N	20,289	20,289	20,289	20,289
R^2	0.162	0.247	0.180	0.162

Note: *** and * indicate significance at the 1% and 10% levels, respectively.

4.4.2. Alternative Measurement for ESG

This study further explores substituting the explained variable's measurement method by employing Bloomberg ESG ratings in place of Huazheng ESG ratings to assess ESG performance, aiming to verify the robustness of our findings. Table 9 presents the regression outcomes of interlocking director network centrality on Bloomberg ESG scores. The column (1) results indicate a significant positive impact of interlocking director network centrality on corporate ESG performance at the 1% level. Columns (2) and (3) show that the regression coefficients for interlocking director network centrality with internal control (0.031) and internal control on ESG performance (0.421) are significant at the 1% level. Additionally, the regression coefficient of interlocking director network centrality on corporate ESG performance (0.130) is also significant at the 1% level. This suggests that, even after changing the ESG performance measurement method, internal control's mediating role between interlocking director network centrality and ESG performance persists, with internal control continuing to exert a partial mediating effect. The results in column (4) reveal that the interaction term coefficient between interlocking director network centrality and media attention (0.149) is significant at the 1% level, affirming media attention's positive moderating role in the relationship between interlocking director network centrality and corporate ESG performance. This aligns with prior findings, underscoring the robustness of our conclusions.

Table 9. Regression results of interlocking director network centrality on Bloomberg ESG scores.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
CEN_median	0.143 ***	0.031 ***	0.130 **	0.042
	(2.81)	(4.24)	(2.56)	(0.78)
IC			0.421 ***	
			(6.07)	
web				0.513 ***
				(5.36)
CEN_median × web				0.149 ***
				(3.17)
Control	yes			
IND	yes			
YEAR	yes			
CONSTANT	−35.949 ***	1.138 ***	−36.428 ***	−31.944 ***
	(−17.81)	(3.86)	(−18.06)	(−15.63)
N	6139	6139	6139	6139
R^2	0.540	0.296	0.542	0.544

***, ** indicate significance at the 1%, 5% levels, respectively.

4.4.3. Explanatory Variables Lagged by One Period

To mitigate potential reverse causality and account for the lag effect of the interlocking director network on ESG performance, this study lags the explanatory variable by one period. Table 10 presents the regression outcomes for the interlocking director network centrality with a one-period lag, indicating a significant positive impact on corporate ESG performance at the 1% level. The regression analysis in column (2) reveals a significant relationship between the lagged interlocking director network centrality and internal control (*coefficient* = 0.027, significant at the 1% level). Column (3) shows internal control's significant impact on ESG performance (coefficient = 0.135, significant at the 1% level), and a significant effect of lagged interlocking director network centrality on ESG performance (*coefficient* = 0.040, significant at the 1% level). This suggests the persistent mediating role of internal control between interlocking director network centrality and ESG performance, even after a one-period lag. Column (4) demonstrates the positive moderating role of media attention on the link between lagged interlocking director network centrality and ESG performance, with an interaction coefficient of 0.015, significant at the 1% level. This finding underscores the robustness of our results.

Table 10. Regression results of interlocking director network centrality lagged by one period.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
CEN_median	0.044 ***	0.027 ***	0.040 ***	0.041 ***
	(9.21)	(5.84)	(8.53)	(8.72)
IC			***	
			(15.13)	
web				0.030 ***
				(3.10)
CEN_median × web				0.015 ***
				(3.84)
Control	yes			
IND	yes			
YEAR	yes			
CONSTANT	−1.699 ***	2.474 ***	−2.034 ***	−31.944 ***
	(−10.64)	(14.12)	(−12.72)	(−15.63)
N	15546	15546	15546	6139
R^2	0.130	0.184	0.146	0.544

*** indicate significance at the 1% levels.

4.4.4. Sample of Independent Directors Excluded

This study aimed to further validate its findings by narrowing the sample size. Given China's "guanxi" society (relationship-based society), the nomination and subsequent election of independent directors by the board and shareholders' meeting, respectively, challenges their independence. Unlike internal directors, independent directors lack familiarity with the company's operations, hindering effective oversight of corporate decisions. This study excludes independent director samples due to their independence and externality, focusing on the non-independent interlocking director network's impact on corporate ESG performance. Table 11 presents the regression outcomes for the narrowed sample.

Column (1) reveals a significant link between interlocking director network centrality and corporate ESG performance at the 1% level after sample reduction. After narrowing the sample, Column (2) indicates a significant association (*coefficient* = 0.026) between interlocking director network centrality and internal control at the 1% level. Column (3) further shows significant effects of internal control on ESG performance (*coefficient* = 0.120) and maintains the centrality's impact on ESG performance (*coefficient* = 0.026), underscoring internal control's mediating role. Column (4) demonstrates, post-sample reduction, that media attention positively moderates the relationship between interlocking director network centrality and corporate ESG performance (*interaction coefficient* = 0.011, significant at 1%), affirming the study's robustness.

Table 11. Post-sample reduction regression results of interlocking director networks on firms' ESG performance.

	(1)	(2)	(3)	(4)
	ESG	**IC**	**ESG**	**ESG**
CEN_median	0.029 ***	0.026 ***	0.026 ***	0.028 ***
	(5.59)	(4.36)	(5.02)	(5.53)
IC			0.120 ***	
			(16.85)	
web				−0.007
				(−0.78)
CEN_median × web				0.011 ***
				(2.71)
Control	yes			
IND	yes			
YEAR	yes			
CONSTANT	−3.213 ***	2.897 ***	−3.560 ***	−3.242 ***
	(−12.60)	(11.37)	(−14.02)	(−12.47)
N	20,289	20,289	20,289	20,289
R^2	0.242	0.260	0.256	0.242

*** indicate significance at the 1% levels.

5. Further Analysis

5.1. Heterogeneity Analysis

5.1.1. Heterogeneity Analysis Based on Degree of Marketisation

China exhibits significant regional disparities in regulatory policies, labor markets, openness, and infrastructure, leading to variations in marketization levels. Marketization levels influence government incentives for businesses, as well as the frequency and quality of ESG training, ultimately impacting corporate ESG performance. Utilizing the marketization degree index, this study categorized enterprises into high- and low-marketization groups based on their location in median or above regions for heterogeneity analysis and conducts separate tests on each group. Grouped regression findings are detailed in Table 12.

Initially, a Fisher's permutation test with 1000 samples revealed a significant intergroup difference (*coefficient* = −0.019, significant at the 5% level), underscoring the need for group-based analysis. Subsequent analysis shows that enterprises in regions with higher marketization have larger regression coefficients, suggesting that interlocking director networks play a more significant role in enhancing ESG performance in these areas. This effect likely stems from the fact that enterprises in highly marketized areas benefit from government ESG incentives, possess a deeper comprehension and application of ESG principles, and have more efficient interlocking director networks, enhancing ESG performance.

Table 12. Regression results based on heterogeneity in degree of marketisation.

Variables	(1) High-Marketisation Group ESG	(2) Low-Marketisation Group ESG
CEN_median	0.043 ***	0.024 ***
	(7.32)	(3.98)
Coefficient of difference test between groups	−0.019 **	
Control	yes	
IND	yes	
YEAR	yes	
CONSTANT	−2.562 ***	−1.841 ***
	(−11.43)	(−9.83)
N	10,062	10,227
R^2	0.174	0.155

***, ** indicate significance at the 1%, 5% levels, respectively.

5.1.2. Heterogeneity Analysis Based on Firm Characteristics

Enterprises in heavily polluted industries face significant environmental pollution and resource consumption, drawing considerable attention and constraints from stakeholders. ESG performance emerges as a crucial indicator for stakeholders to assess whether companies prioritize environmental benefits. Given that listed companies in heavily polluted sectors are targeted for environmental inspections, they encounter substantial environmental regulatory pressures. This could distract them from focusing on ESG performance, potentially affecting their ESG scores. Accordingly, this study categorizes the sample firms into listed companies within heavily polluted industries and those in non-heavily polluted sectors for grouped regression analysis, as illustrated in Table 13.

Table 13. Regression results based on heterogeneity of firm characteristics.

Variables	(1) Heavily Polluted Industries Group ESG	(2) Non-Heavily Polluted Industries Group ESG
CEN_median	0.023 ***	0.041 ***
	(2.88)	(8.18)
Coefficient of difference test between groups	0.017 **	
Control	yes	
IND	yes	
YEAR	yes	
CONSTANT	−1.735 ***	−2.255 ***
	(−6.57)	(−13.32)
N	5628	14661
R^2	0.143	0.173

***, ** indicate significance at the 1%, 5% level, respectively.

Initially, the study employed Fisher's Permutation test, conducting 1000 samples for inter-group variance analysis. The findings revealed a coefficient of 0.017 for the inter-component variance test, significant at a 5% level, indicating notable differences between the groups. Further analysis of the regression coefficients between the two groups demonstrates significant variance in the impact of interlocking director networks on ESG performance across non-heavily and heavily polluted sectors. However, the enhancement effect of interlocking director networks on ESG performance is more pronounced in non-heavily polluted industries. This discrepancy may stem from the intense environmental regulatory pressures faced by heavily polluted firms, compelling them to concentrate more on environmental governance at the expense of ESG's holistic development, thereby leading to lower overall ESG performance ratings.

5.1.3. Heterogeneity Analysis Based on Director Characteristics

The increasing proportion of female directors on boards highlights their unique decision-making style. According to social role theory, women in organizations tend to focus on social orientation over performance [71]. Rossi (2017) noted that female directors are likely to disrupt traditional business models and mitigate risks [72]. This study explores how female directors' interpersonal skills and emotional decision-making may influence their ability to access resources and information in the interlocking director network, affecting ESG performance. Thus, this study conducted a heterogeneity analysis based on the proportion of female directors. Companies were divided into high and low female director proportion groups based on the median value, with empirical tests conducted on each, as shown in Table 14.

Table 14. Regression results based on heterogeneity of director characteristics.

Variables	(1)	(2)
	High Proportion of Female Directors	**Low Percentage of Female Directors**
	ESG	**ESG**
CEN_median	0.042 ***	0.030 ***
	(7.20)	(4.83)
Coefficient of difference test between groups	−0.012 *	
Control	yes	
IND	yes	
YEAR	yes	
CONSTANT	−2.295 ***	−1.877 ***
	(−10.78)	(−9.91)
N	10638	9651
R^2	0.172	0.156

***, * indicate significance at the 1%, 10% levels, respectively.

Initially, using Fisher's permutation test with 1000 samples revealed a significant difference coefficient of −0.012 between the groups at the 10% level, underscoring the need for group testing. Comparison of regression coefficients shows the interlocking director network positively impacts ESG performance in both groups, with a stronger effect in the high female director proportion group. The denser information network of female directors facilitates more effective information and resource exchange, enhancing ESG performance.

5.2. Economic Consequences Analysis

The preceding sections confirmed the positive impact of the interlocking director network on corporate ESG performance. Can the interlocking director network thus enhance corporate ESG performance, encouraging a focus on core business activities, boosting earnings per share, and increasing total factor productivity? This section aims to examine the economic outcomes of the interlocking director network's positive effects on corporate ESG performance, analyzing corporate earnings per share and total factor productivity as examples.

5.2.1. Earnings Per Share (*EPS*)

Green initiatives serve as a hallmark for new era Chinese listed companies, aiding in building and maintaining a competitive market advantage, and boosting corporate earnings. The ESG performance of a company positively impacts its earnings per share [73]. As corporate decision-makers, company directors can leverage information resources within the interlocking director network to enhance the company's ESG performance and capitalize on the capital market. Therefore, this article explores the impact of the interlocking director network in enhancing ESG performance on the company's financial performance. Given that earnings per share (*EPS*) is a crucial indicator of corporate financial performance, this study used *EPS* as *the* economic outcome variable for empirical analysis. Building on the benchmark regression model (1), this study established the following model to assess the impact on earnings per share:

$$EPS_{i,t} = \beta_0 + \beta_1 CEN\_median_{i,t} + \beta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (5)$$

$$EPS_{i,t} = \beta_0 + \beta_1 CEN\_median_{i,t} + \beta_2 ESG_{i,t} + \beta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (6)$$

The empirical results regarding the economic consequences measured by earnings per share are presented in Table 15. Column (1) presents the regression results of Model 5, column (2) those of Model 1, and column (3) those of Model 6. Column (1) shows that the interlocking director network's coefficient was significantly positive concerning the company's earnings per share, suggesting that an interlocking director network enhances the company's earnings per share. Column (3) reveals that both the interlocking director network and ESG performance coefficients were significantly positive, indicating that the interlocking director network positively impacted the company's ESG performance and earnings per share. This implies that by leveraging the interlocking director network, companies can bolster their reputation, garner stakeholder support, boost earnings per share, and elevate their sustainability.

Table 15. Regression results for economic consequences (EPS).

	(1)	(2)	(3)
	EPS	**ESG**	**EPS**
CEN_median	0.012 ***	0.033 ***	0.011 ***
	(3.66)	(8.02)	(3.55)
ESG	—	—	0.010 *
	—	—	(1.79)
Control		yes	
IND		yes	
YEAR		yes	
CONSTANT	−3.180 ***	−3.096 ***	−3.150 ***
	(−15.38)	(−12.12)	(−15.20)
N	20,239	20,289	20,239
R^2	0.493	0.243	0.493

***, * indicate significance at the 1%, 10% levels, respectively.

5.2.2. Total Factor Productivity (*TFP*)

China's economic development is transitioning from factor-driven to technology-driven, making total factor productivity a crucial measure of an enterprise's sustainable development capacity. The interlocking director network offers an efficient way for enterprises to access external information resources, thereby supporting the enhancement of ESG performance. Moreover, strong ESG performance can mitigate information asymmetry [74], encouraging enterprises to optimize resource allocation and enhance total factor productivity. Consequently, this study investigated how ESG performance changes, facilitated by the interlocking director network, affect total factor productivity. This study adopted the LP method, based on Lu et al. (2012) [75], to measure the total factor productivity of sampled enterprises, as detailed in model (7):

$$lnY_{i,t} = \delta_0 + \delta_1 lnK_{i,t} + \delta_2 lnL_{i,t} + \delta_3 lnM_{i,t} + \varepsilon_{i,t} \quad (7)$$

where $Y_{i,t}$ denotes total output (operating income), $K_{i,t}$ denotes capital input (net fixed assets), $L_{i,t}$ denotes labor input (number of employees), $M_{i,t}$ denotes intermediate input (net amount of goods and services purchased), and the residual term $\varepsilon_{i,t}$ signifies total factor productivity.

Building on Model (1), this study developed Models (8) and (9) to examine the influence of the interlocking director network on total factor productivity via ESG performance:

$$TFP_{i,t} = \beta_0 + \beta_1 CEN\_median_{i,t} + \beta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (8)$$

$$TFP_{i,t} = \beta_0 + \beta_1 CEN\_median_{i,t} + \beta_2 ESG_{i,t} + \beta_k \sum Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (9)$$

The empirical results regarding the economic implications of total factor productivity are presented in Table 16, with column (1) showing the regression outcomes for Model 8, column (2) for Model 1, and column (3) for Model 9. According to column (1), the positive and significant coefficient between the interlocking director network and corporate total factor productivity suggests that the interlocking director network enhances corporate total factor productivity. Column (3) reveals that both the interlocking director network and ESG performance had significantly positive coefficients, implying that the interlocking director network boosts corporate ESG performance, which in turn enhances corporate total factor productivity. The empirical findings affirm that the interlocking director network elevates corporate total factor productivity by enhancing ESG performance levels, thereby improving the quality of corporate development.

Table 16. Regression results for economic consequences (TFP).

	(1)	(2)	(3)
	TFP	**ESG**	**TFP**
CEN_median	0.004 ***	0.032 ***	0.003 ***
	(3.14)	(7.72)	(2.75)
ESG			0.015 ***
			(7.41)
Control		yes	
IND		yes	
YEAR		yes	
CONSTANT	−9.416 ***	−3.021 ***	−9.369 ***
	(−149.73)	(−11.78)	(−147.92)
N	19,804	19,804	19,804
R^2	0.965	0.239	0.965

*** indicate significance at the 1% level.

6. Discussion and Conclusions

6.1. Conclusions

This study examined the impact of the interlocking director network's positional attributes on corporate ESG performance, focusing on China's A-share listed companies from 2009 to 2022. The conclusions of this study are given as the following.

Firstly, the study revealed that a central position within the interlocking director network significantly boosts corporate ESG performance. The interlocking director network facilitated corporate ESG performance improvement through its information effects and peer effects. While existing studies have concentrated on the economic effects of interlocking director networks [19,21,23,76], this study highlighted their non-economic impact on corporate ESG performance, enriching the discourse on their economic and non-economic consequences. Moreover, this study addressed the gap in the existing ESG performance literature by focusing on the overlooked factor of informal institutions, specifically the role of interlocking director networks, thereby broadening the understanding of influences on corporate ESG performance.

Secondly, we identified the interlocking director network's potential impact mechanisms on corporate ESG performance, including the mediating role of internal control and the moderating role of media attention. Companies at the central position of an interlocking director network leverage their location to access external information, optimize their structure, improve internal controls, boost transparency, and enhance ESG performance. This finding corroborates prior studies on the interlocking director networks and internal control nexus [24,37], offering new evidence linking internal control to corporate ESG performance [38–41]. Furthermore, our analysis revealed that media attention significantly positively moderates how interlocking director networks enhance corporate ESG performance. Gaining media attention prompts companies to boost ESG investments, driven by concerns for reputation and image, thereby improving ESG performance. This research confirms media attention's external governance effect [42,43] and expands on how it influences corporate ESG performance through the lens of director networks [46].

Thirdly, heterogeneity analysis reveals that the influence of an interlocking director network's position on corporate ESG performance is notably stronger in companies characterized by a higher marketization level, those in non-heavy pollution industries, and those with a higher proportion of female directors. This finding corroborates existing studies on how marketization levels [77], environmental regulations [78,79], and board characteristics [80] influence corporate ESG performance.

Lastly, this study investigated the economic outcomes of promoting corporate ESG performance through the interlocking director network, focusing on corporate financial performance and development quality. It revealed that such networks positively influence both earnings per share and total factor productivity. Although existing studies have examined the link between interlocking director networks and corporate value and performance, there remains no consensus [17–19]. This issue is significant as it directly influences corporate ESG decision-making. Our findings indicate that interlocking director networks can positively affect corporate value and performance by optimizing ESG practices. From this perspective, this research contributes to the theoretical understanding of how interlocking director networks and ESG performance influence corporate value.

6.2. Social and Practical Implications

For enterprises, it is crucial to optimize the interlocking director network structure to boost their centrality within this network. Central companies in the interlocking director network gain access to diverse resources, which facilitates knowledge enhancement, supervisory efficiency, and problem-solving in ESG practices, and ultimately boosts ESG performance. Therefore, companies must timely adjust their interlocking director count and optimize the network structure to enhance their network centrality, aligning with internal and external dynamics and strategic goals. Secondly, focusing on the comprehensive strength of partner enterprises is essential to elevate the quality of network connections.

Typically, enterprises with robust comprehensive strength possess superior corporate governance and ESG performance. Networking with strong enterprises can cut trial-and-error costs and elevate ESG practices. Third, by enhancing directors' comprehensive capabilities and professional competence, enterprises can increase cross-company appointments and deepen integration into the interlocking director network. Moreover, hiring leading directors from the interlocking director network can deepen social network integration and boost the network's impact on ESG performance. Fourth, the interlocking director network notably enhances ESG performance in highly marketized, non-heavy pollution industries with a significant female director presence. Enterprises should, therefore, strategically leverage this network to maximize its positive impact on ESG performance.

For government departments, it is essential to promote the establishment of rational interlocking director networks among companies. They should also develop comprehensive policies for director systems, clarifying responsibilities and operational methods to ensure effective oversight of director actions. This approach aims to optimize resource allocation through the interlocking director network, enhance corporate governance, improve internal controls, reduce information asymmetry, and boost ESG performance. Furthermore, existing research indicates that environmental regulations and similar policies can guide companies towards enhanced sustainability [5–9]. Thus, it is crucial for government departments to refine the environmental policy framework, foster a business ecosystem committed to green development, and encourage companies to integrate non-economic development impacts, thereby strengthening their capacity for sustainable growth.

6.3. Research Limitations and Prospects

This study still has some limitations. Initially, our analysis, focusing on the static aspect of interlocking director network positions' impact on ESG performance, overlooked the dynamic nature of these positions over time. This opens avenues for future research to explore how dynamic shifts in these positions influence ESG performance, aiming for a deeper understanding of the interlocking director network's dynamic effects. Secondly, while focusing on the interlocking director network as a proxy for corporate social networks, this study did not account for other forms such as executive, strategic alliance, and shareholder networks. Researchers are encouraged to extend this framework to other corporate social networks, like the interlocking executive networks, to compare their effects on ESG performance and assess the applicability of our findings across different network types.

Author Contributions: Conceptualization, Z.Z.; Methodology, H.F. and Z.Z.; Validation, H.F.; Formal analysis, L.Y.; Writing—original draft, Q.W.; Writing—review & editing, H.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by "Planning Fund Project of the Ministry of Education of China" grant number [22YJA630118]; (*funder*: Zhihong Zhang). This research was also funded by "Shandong Expressway Group Project" grant number [SDGS-YJYKJ-2021-11]; (*funder*: Zhihong Zhang).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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