An Empirical Study of Independent Director Network and ESG Performance

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***Abstract*—Based on the data of Chinese listed companies from 2009 to 2022, this study empirically tests the impact of independent director network centrality on corporate Environmental, Social, and Governance (ESG) performance, and explores the moderating effects of the nature of property rights and media attention. our results suggest that: (1) The higher the network centrality of independent directors, the better the ESG performance of the company. (2) The independent director network can promote the environmental, social, and governance dimensions separately. (3) The impact of independent director network centrality on corporate ESG performance is more obvious in state-owned enterprises and companies with higher media attention. This study not only expands the influencing factors of ESG performance but also enriches the research on the non-economic consequences of the independent director network. The research provides a useful reference for enterprises to achieve sustainable development.**

***Keywords*—independent director network centrality, Environmental Social and Governance (ESG), nature of property rights, media attention**

I. Introduction

In 2004, the United Nations Global Compact organization formally introduced the concept of ESG, to measure the performance of enterprises across the three dimensions of environment, society, and governance. In recent years, the world has faced unprecedented challenges due to events such as climate warming and the COVID-19 epidemic. Countries are also actively adopting new public policies to encourage companies to actively fulfill their social responsibilities, thereby enhancing their capabilities for sustainable development (Gillan *et al.*, 2021). In 2020, China set forth the “Double carbon” goals, aiming to peak carbon emissions before 2030 and achieve carbon neutrality by 2060. Against this backdrop, Chinese enterprises are increasingly focusing on their ESG performance. While ESG receives policy attention, related academic research are also growing. Existing scholars demonstrate that strong ESG performance can improve a company’s operational performance and market valuation (Wong *et al.*, 2021), contributing to enhanced competitiveness. Regarding the influencing factors of ESG, current research is still in its early stages, mainly focusing on the external environment (Baldini *et al.*, 2018), board structure (Heubeck, 2023), and CEO characteristics’ impact (Bax and Paterlini, 2022) on corporate ESG performance. There is relatively limited research on the influence of director networks on corporate ESG performance.

The board of directors plays a guiding role in enterprise development. Academically, it is believed that internal directors perform advisory functions, while independent directors, due to their independence, are better positioned to fulfill supervisory roles (Coles *et al.*, 2008). Since the China Securities Regulatory Commission (CSRC) introduced requirements for the number of independent directors in listed companies, there has been a gradual increase in instances of independent directors holding concurrent positions. Through serving on the boards of different companies, independent directors form director networks, thereby influencing corporate governance. A director network is a type of social network that refers to the collection of individual directors within a company’s board and the direct and indirect connections established among directors by concurrently serving on at least one board. Existing research indicates that the centrality of director networks positively influences various aspects of corporate performance, such as financial performance (Larcker *et al.*, 2013), mergers and acquisitions (Renneboog and Zhao, 2014), and financing constraints (Feng *et al.*, 2019). However, as evident from the literature review, there is limited research considering the impact of independent director networks on corporate ESG or CSR performance (Nandy *et al.*, 2020).

Therefore, it is of great importance to analyze the influence of independent directors on corporate ESG performance from a network perspective. Specifically, does the centrality of independent director networks affect corporate ESG performance? And does this influence depend on the nature of property rights and media attention?

II. Research Hypothesis

A. *Independent Director Network and ESG Performance*

Firstly, stakeholder theory emphasizes the importance of the interaction between businesses and various stakeholders for corporates. In corporate decision-making, independent directors play a crucial role. They not only represent shareholder interests but also need to consider the rights of other stakeholders. Independent directors with higher network centrality can bring information advantages to the company (Nahapiet and Ghoshal, 1998; Woolcock and Narayan, 2000), including the latest regulations, social trends, and customer expectations (Macaulay *et al.*, 2018). This enables them to better understand the needs of stakeholders, facilitating the establishment of closer connections between the company and various stakeholder groups(Shahgholian and Theodoulidis, 2015). Therefore, companies with higher centrality of independent director networks have a greater ability to enhance their ESG performance.

Secondly, the reputation incentive mechanism is a key mechanism to promote the diligence of independent directors (Fama and Jensen, 1983). Independent directors who are at the center of the network usually have high reputations and visibility. Therefore, for companies with higher independent director network centrality, their independent directors pay more attention to the recognition of internal and external stakeholders (Renneboog and Zhao, 2014), and therefore work harder to participate in corporate governance. In addition, independent directors with higher network centrality tend to receive greater attention, which motivates them to perform their monitoring responsibilities more actively to reduce the risk of possible reductions in future position attainment. All in all, the higher the network centrality of independent directors, the more motivated companies are to improve their ESG performance. Based on this, we propose hypothesis H1.

Hypothesis H1: The higher the network centrality of independent directors, the better the ESG performance of the enterprise.

B. Mediating Effect of Property Right Nature

On one hand, from the perspective of corporate property rights in China, state-owned enterprises are subject to stricter government regulations and inherently shoulder the responsibility and mission of fulfilling social obligations (Bai *et al.*, 2000). Therefore, stakeholders have higher expectations and concerns for state-owned enterprises. In this context, companies with higher centrality of independent director networks are more attentive to their reputation and more willing to improve their ESG performance. In contrast, non-state-owned enterprises face relatively less pressure from social scrutiny and media attention. Consequently, their independent directors have greater flexibility in fulfilling social responsibilities.

On the other hand, state-owned enterprises have closer ties with the government, allowing them to secure financial support from government and state-owned banks (Ovtchinnikov, 2020). In contrast, non-state-owned enterprises find it challenging to obtain policy support, and their financing costs are higher. Compared to non-state-owned enterprises, state-owned enterprises with higher centrality of independent director networks have more abundant funds and resources to meet the needs of internal and external stakeholders. This, in turn, contributes to improving their ESG performance. Consequently, we propose hypothesis H2.

Hypothesis H2: Compared to non-state-owned enterprises, state-owned enterprises with higher centrality of independent director networks have a stronger facilitating effect on corporate ESG performance.

C. Mediating Effect of Media Attention

Without the attention of stakeholders, ESG will not produce any economic benefits (Hawn and Ioannou, 2016). Media attention, as an external governance mechanism, primarily influences corporate ESG behavior through public opinion guidance and information dissemination. In the context of the “dual-carbon” initiative, the media exposes both positive and negative aspects of a company’s behavior, thereby affecting its ESG performance. Media attention leads to more comprehensive information disclosure by companies, enabling stakeholders to better supervise them. Meanwhile, independent directors with higher centrality, to uphold corporate reputation, pay closer attention to the demands of external stakeholders, thereby enhancing corporate ESG performance.

Additionally, from the legitimacy perspective of institutional theory, companies, Positive media coverage improves a company’s reputation (Deephouse, 2000). Media attention plays a crucial role in a company’s legitimacy attainment, as higher media attention correlates with greater social exposure for the company. When a company faces issues such as pollution incidents, media coverage can impact the company’s development. Therefore, for companies with higher media attention, those with higher centrality in their independent director networks are expected to pay more attention to their image and actively implement sustainable development practices. Based on this, we propose hypothesis H3.

Hypothesis H3: The higher the media attention, the stronger the facilitating effect of independent director network centrality on corporate ESG performance.

III. Research Design

A. Sample Selection and Data Collection

Since the earliest available Huazheng ESG score data is from 2009, this article selected all Chinese listed companies from 2009 to 2022 as the research sample. Basic data sources include the CSMAR database and CNRDS database. On this basis, this article eliminates the financial industry, ST companies, and companies with missing relevant data. For the main continuous variables, this article carries out winnowing processing at the upper and lower 1% level. Ultimately, the research data covered 4,519 companies, with a total of 37,275 observations. Stata17 performed data analysis.

B. Variable Definition

Dependent variable. ESG performance (ESG). Due to differences in China’s socialist system, economic structure, and the development level of financial markets compared to international evaluation indicators, international rating agencies face challenges in providing assessments that align with the actual conditions in China. Huazheng ESG rating incorporates international mainstream ESG rating systems, adjusted to fit the characteristics of the Chinese market. It covers all A-share listed companies and has a high update frequency. Therefore, we use Huazheng ESG rating data to measure the ESG performance of listed companies. Following common practice (Lins *et al.*, 2017), we assign ESG ratings to listed companies from 1 to 8, with higher values indicating better ESG performance.

We employ the network centrality indicators introduced by Renneboog (Renneboog and Zhao, 2011) and Larcker to measure the different positions of independent directors in the board networks of listed companies. Network centrality comprises degree centrality, betweenness centrality, and closeness centrality, evaluating the centrality characteristics of directors from multiple perspectives. Specifically, we first collect personal information for all directors of A-share listed companies, calculate the network centrality for each director, and retain only the centrality data for independent directors. On a company basis, we select the maximum centrality value among independent directors as the company’s centrality indicator, concurrently conducting robustness tests using the mean and median. To comprehensively assess centrality, and eliminate dimensional differences and the influence of outliers for each centrality indicator, we rank the three network centrality indicators annually and divide them into ten groups, assigning values from 1 to 10. Subsequently, we sum these three rankings and divide by 30, ultimately obtaining the annual centrality indicator, Centrality, for each company.

Adjust variables. Nature of property rights (Soe). The nature of property rights refers to the nature of the ultimate controller of a listed company. Following general research practice, this variable is set as a dummy variable. When the nature of the ultimate controller of a listed company is state-owned, the value is 1; when the nature of the ultimate controller of a listed company is non-state-owned, the value is 0. Media attention (Media). Media attention refers to the degree of media focus on a company, which can be measured by the total number of news related to the company in media reports. We draw on the relevant research by scholars such as Jia *et al.*, (2016), primarily using internet news search engines to retrieve information on relevant companies and obtain the frequency of their news coverage.

Control Variables: Drawing from existing research, the following control variables are selected. Size: Represents the company's size, expressed as the natural logarithm of the total number of employees. Age: Indicates the company's age, expressed as the natural logarithm of the company's years since listing + 1. Lev: Represents the asset-liability ratio, calculated as the total liabilities divided by total assets. Roe: This signifies the return on assets, calculated as the net profit divided by total assets. Board: Represents the board size, expressed as the natural logarithm of the total number of board members. Indep: Indicates the proportion of independent directors, calculated as the number of independent directors divided by the total number of board members. Dual: Represents the combination of CEO and Chairman roles, taking the value 1 when the CEO concurrently holds the position of Chairman, and 0 otherwise. Own: Represents the ownership percentage of the largest shareholder, expressed as the ownership percentage of the company's largest shareholder.

C. *Research Model*

To test the impact of the independent director network on corporate ESG performance, this paper constructs the following fixed effects model.

$$ESG_{i,t} = \alpha_0 + \alpha_1 Centrality_{i,t} + \sum Controls_{i,t} + Industry + Year + \varepsilon_{i\,t} \quad (1)$$

In Eq. (1), $ESG_{i,t}$ is the dependent variable, which represents the ESG performance of the enterprise. The subscripts i and t respectively represent the i-th company and the t-year. $Centrality_{i,t}$ is the independent variable, representing the network centrality of the company's independent directors, α_1 represents the intercept term, and β_1 is the core variable coefficient of the model Eq. (1), which represents the impact of the network centrality of multiple independent directors on the ESG performance of the company. Sector represents the industry effect of enterprise, Year represents the year effect, Controls represent all control variables and $\varepsilon_{i,t}$ is the random disturbance term.

Furthermore, Eq. (2) and Eq. (3) were constructed to test the moderating effect of the nature of property rights (Soe) and media attention (Media) on the main effects.

$$ESG_{i,t} = \beta_0 + \beta_1 Centrality_{i,t} + \beta_2 Centrality_{i,t} \times Soe_{i,t} + \beta_3 Soe_{i,t} + \sum Controls_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (2)$$

$$ESG_{i,t} = \beta_4 + \beta_5 Centrality_{i,t} + \beta_6 Centrality_{i,t} \times Media_{i,t} + \beta_7 Media_{i,t} + \sum Controls_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (3)$$

In Eq. (2) and Eq. (3), $ESG_{i,t}$ represents the ESG performance of the enterprise, and $Centrality_{i,t}$ represents the network centrality of independent directors. $Soe_{i,t}$ and $Media_{i,t}$ represent the nature of property rights and media attention. Other variables are the same as in Eq. (1).

IV. Empirical Test

A. *Descriptive Statistics*

The specific analysis results are shown in Table 1. The mean value of corporate ESG performance is 4.12, the variance is 1.06, the minimum value is 1, and the maximum value is 8. This shows that the ESG performance of the sample companies is on average at a medium level, and there is a large ESG performance gap between companies. The mean value of independent director centrality is 0.55, while the values of other control variables fall within reasonable intervals, consistent with the results of the existing literature.

Table 1. Descriptive statistics (N=37275)

Variable	Average	SD	Max	Min
ESG	4.12	1.0 7	8	1
Centrality	0.55	0.27	1	0.1
Soe	0.36	0.48	1	0
Media	0.03	0.09	6.63	0
Size	7.62	1.26	11.09	4.56
Age	2.04	0.92	3.33	0
Lev	0.42	0.21	0.9	0.05
Roe	0.06	0.14	0.34	0.83
Board	2.24	0.18	2.77	1.79
Indep	0.38	0.05	0.57	0.33
Dual	0.29	0.45	1	0
Own	0.35	0.15	0.9	0.02

B. *The Main Effect*

Table 2 lists the baseline regression results of the impact of corporate independent director network centrality on corporate ESG performance. From the results in column (1) of Table 2, we see that the coefficient of Centrality is 0.1197, which is significant at the 1 % confidence level. This result shows that companies with higher independent director network centrality have better ESG performance. Columns (2) to (4) of Table 3 report the regression results of the independent director network centrality on the three subdivisions of environment, society, and governance. It is found that the coefficients of Centrality are all positively significant at the 1 % confidence level. It shows that the network centrality of independent directors has a promoting effect on the three specific dimensions of corporate ESG. Therefore, assume H1 holds.

Table 2. The main effect

Variable	(1) ESG	(2) E	(3) S	(4) G
Centrality	0.1197 ***	0.1432 ***	0.1246 ***	0.0723 ***
	(6.26)	(6.78)	(6.12)	(3.05)
Controls	Yes	Yes	Yes	Yes
Constant term	1.46 ***	0.1320 ***	1.5698 ***	2.5988 ***
	(13.25)	(1.08)	(13.35)	(18.95)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	37275	37275	37275	37275
Adj.R^2	0.1932	0.1360	0.2174	0.2530

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

C. The Moderating Effects

We further test the moderating effect of the nature of property rights and media attention on the main effect. The regression results are shown in Table 3. First, from column (1) in Table 3, we can see that the regression coefficient of corporate director network centrality is significantly positive at the 5% level, and the coefficient of the interaction term (Centrality × Soe) is significantly positive at the 1 % level, indicating that in state-owned enterprises, the network centrality of independent directors of enterprises has a stronger promoting effect on the ESG performance of enterprises, so hypothesis H2 is established. The possible reason is that state-owned enterprises are naturally subject to stronger government regulations and have greater pressure to fulfill their social responsibilities.

Secondly, from column (2) in Table 3, the regression coefficient of corporate director network centrality is significantly positive at the 5 % level, and the coefficient of the interaction term (Centrality × Media) is significantly positive at the 1 % level, indicating that Media attention positively moderates the main effect. That is, the more media attention a company receives, the stronger the promoting effect of the independent director network on corporate ESG performance. Therefore, Hypothesis 3 is established. The possible reason is that independent directors assume a supervisory and advisory role. When media attention is greater, independent directors with stronger centrality are more concerned about the reputation and social image of the company. Therefore, companies with higher independent director network centrality are more motivated to improve corporate ESG performance.

Table 3. The moderating effect

Variable	(1) ESG	(2) ESG
Centrality	0.0589**	0.0953***
	(2.51)	(4.80)
Centrality × Soe	0.1523	
	(3.93)	
Centrality×Media		0.9214
		(4.74)
Controls	Yes	Yes
Constant term	1.8647***	1.5811***
	(16.59)	(14.19)
Year	Yes	Yes
Industry	Yes	Yes
N	37275	37275
Adj.R^2	0.2003	0.1947

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

D. Robustness Test

First, we use the mean and median centrality of the independent director network as alternative explanatory variables for robustness testing. Secondly, we test the original model with a one-stage lag. The results are still significant, and due to space constraints, the relevant results are not presented in the paper.

V. Conclusion

We select listed companies on the China A-share market from 2009 to 2022 as the research sample and empirically analyze the impact of the centrality of independent director networks on corporate ESG performance. The research results confirm the positive role of the centrality of independent director networks in promoting corporate ESG performance and ensure the robustness of this conclusion through a series of robustness tests. From a detailed perspective, the centrality of independent director networks has a promoting effect on the environmental, social, and governance dimensions of enterprises. In addition, from the perspective of corporate nature, compared to private enterprises, the promoting effect of the centrality of independent director networks on corporate ESG performance is more significant in state-owned enterprises. Secondly, from the perspective of the external environment, when companies face significant media pressure, the promoting effect of the centrality of independent director networks on corporate ESG performance becomes more pronounced.

This study holds both theoretical and practical significance. Against the backdrop of the “dual carbon” initiative, the ESG performance of Chinese enterprises has become increasingly important. This paper enriches the understanding of the impact of independent directors on corporate non-financial performance and expands on the factors influencing corporate ESG performance. The conclusion offers a new perspective for companies to enhance their ESG performance. Since independent directors with higher centrality are more likely to play a supervisory role and promote corporate ESG performance, companies with lower centrality in their independent director networks should establish robust supervisory mechanisms and increase their attention to ESG issues. The government should take proactive measures to support the ESG performance of private enterprises. In the short term, the government can encourage companies to strengthen ESG management by implementing relevant policies such as providing tax incentives and financial support. In the long term, the government needs to establish a fair and transparent market environment, establish a just competition mechanism, and strengthen the market’s guiding role in ESG aspects. Media, when exercising its supervisory function, should operate rationally and moderately increase its focus on corporate ESG performance through relevant reporting. This can guide companies to improve their ESG performance levels.

Conflict of Interest

The author declares no conflict of interest.

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