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Study on the impact of ESG performance on the Financial Performance of the Chinese Energy Industry

LIN Mengyuan[1], Takehiko Murayama[1], Shigeo Nishikizawa[1], Kultip Suwanteep[1]

1. School of Environment and Society, Tokyo Institute of Technology, Japan, G5-9 4259 Nagatsuda, Midoriku, Yokohama, Kanagawa 226-8502, Japan.

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Abstract: ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) AIM TO HELP INVESTORS INCREASE INVESTMENT VALUE AND CREATE LONG-TERM RETURNS, ULTIMATELY ACHIEVING SUSTAINABLE DEVELOPMENT FOR SOCIETY AS A WHOLE. THIS STUDY EXAMINES THE IMPACT OF ESG PERFORMANCE ON THE FINANCIAL PERFORMANCE OF CHINESE ENERGY COMPANIES, CONSIDERING THE DIMENSIONS OF ENVIRONMENTAL, SOCIAL, AND GOVERNANCE FACTORS. THE OBJECTIVE IS TO UNDERSTAND HOW ESG PERFORMANCE CAN CONTRIBUTE TO SUSTAINABLE DEVELOPMENT AND ENHANCE INVESTMENT VALUE IN LINE WITH THE PRINCIPLES OF SUSTAINABLE AND HIGH-QUALITY DEVELOPMENT IN CHINA. TO ACHIEVE THIS, A SAMPLE OF A-SHARE LISTED ENERGY COMPANIES IN CHINA WAS USED. THE RESEARCH METHODOLOGY INVOLVED CONSTRUCTING A FIXED-EFFECTS MODEL THROUGH CROSS-SECTIONAL DATA ANALYSIS AND PANEL DATA ANALYSIS FOR REGRESSION. BY EMPIRICALLY ANALYZING THE DATA, THIS STUDY AIMS TO INVESTIGATE THE DIRECT AND DIFFERENTIAL EFFECTS OF ESG PERFORMANCE ON THE FINANCIAL PERFORMANCE OF CHINESE ENERGY COMPANIES, CONSIDERING THE HETEROGENEITY BETWEEN TRADITIONAL AND RENEWABLE ENERGY COMPANIES. THE FINDINGS INDICATE THAT THE ESG PERFORMANCE OF CHINESE ENERGY COMPANIES DIRECTLY AND POSITIVELY INFLUENCES THEIR FINANCIAL PERFORMANCE. FURTHERMORE, THE IMPACT OF ESG PERFORMANCE ON FINANCIAL PERFORMANCE DIFFERS BETWEEN TRADITIONAL AND RENEWABLE- ENERGY COMPANIES. ADDITIONALLY, THIS STUDY EXAMINES WHETHER GREEN TRANSFORMATION ACTS AS A MEDIATING FACTOR IN THE RELATIONSHIP BETWEEN ESG PERFORMANCE AND THE FINANCIAL PERFORMANCE OF RENEWABLE ENERGY COMPANIES. ROBUSTNESS TESTS WERE CONDUCTED TO ENSURE THE RELIABILITY OF THE RESULTS. THESE TESTS AIMED TO VALIDATE THE ROBUSTNESS AND CREDIBILITY OF THE FINDINGS, THEREBY ENHANCING THE OVERALL VALIDITY OF THE RESEARCH OUTCOMES.

Keywords: ESG Performance, Financial Performance, Return on assets (ROA), Energy Industry

1. Introduction

In 2004, the United Nations Environment Programme (UNEP FI) introduced the concepts of Environmental, Social, and Governance (ESG) to assist investors in comprehending the impact of ESG factors on investment value. It also aims to support signatories in integrating these elements into their investment strategies, decisions, and active ownership, with the goal of reducing risk, increasing investment value, and achieving sustainable development for society as a whole (UN PRI, 2015). Notably, in late September 2020, China announced its specific goals of " peaking carbon emissions and carbon neutrality," aligning closely with the theme of promoting high-quality development (19th Central Committee of the CPC, 2020). This convergence highlights the correspondence between the ESG concept and current emphasis on sustainable and high-quality development in China. Recently, ESG evaluations have gradually gained international acceptance as measures of corporate sustainability. Environmental, social, and governance factors have become crucial pillars in the development of sustainable CSR strategies for corporate social responsibility, affecting companies' financial performance (Barrena et al., 2016; Madorran and Garcia, 2016). Consequently, there is mounting concern about the influence of corporate ESG on economic and financial performance (Velte, 2017). Stakeholders, including investors and managers, can assess corporate performance based on the ratings and assessments provided in ESG reports (Auer and Schuhmacher, 2016; Limkriangkrai et al., 2017).

Currently, research on ESG ratings in China is still in its early stages, with the most relevant evaluation systems adapted from foreign ESG rating frameworks. Moreover, the value-creation effect of ESG ratings depends on industry characteristics (Yoon et al., 2018). The energy industry is particularly environmentally sensitive; with higher environmental risks and more stringent monitoring and evaluation systems, ESG evaluation exerts a deeper impact on this sector. However, there is a dearth of research in China focusing on environmentally sensitive industries, particularly the energy industry. Consequently, investigating the ESG performance of energy companies holds significant reference value and can further advance the green, low-carbon development, and ESG standards of energy companies.

This study examines the influence of energy companies' ESG performance on their financial performance, and compares the ESG performance of traditional fossil energy companies with that of renewable energy companies, contributing to a more comprehensive and in-depth exploration of ESG theory in China. Additionally, this study explores the role of green transformation in the relationship between ESG performance and the financial performance of renewable energy companies, thereby providing optimization suggestions for the environmentally sustainable development of energy companies.

2. Literature review and hypotheses

Company ESG performance and financial performance

Environmental (E), Social Responsibility (S), and Corporate Governance (G) factors are increasingly recognized as integrated, serving as important criteria for assessing a corporation's ability to achieve sustainable development goals (Yan, 2022). Early ESG research by foreign scholars yielded valuable insights. Nau and Breuer (2014) examine the technology industry in the US and find a positive association between overall ESG performance and corporate financial performance (CFP). Ortas et al. (2015) investigated companies' ESG and the financial implications of their commitment to the United Nations Global Compact (UNGC) using data from Spain, France, and Japan, and concluded that ESG performance significantly affects CFP for firms adopting UNGC principles. Sassen et al. (2016) analyzed a large European panel dataset and discovered that higher ESG performance leads to reduced total and idiosyncratic risk. Garcia et al. (2017) conducted an empirical analysis using data from Brazil, Russia, India, China, and South Africa, and found that ESG performance has a positive effect on CFP.

In the context of China, Ma et al. (2016) compared and summarized the ESG information disclosure systems in China and foreign countries, offering insights for improving China's own ESG information disclosure system. Yan (2022) examines 285 A-share listed companies from 2015 to 2020 and identifies a positive correlation between ESG performance and firm value. Further analysis reveals that corporate reputation plays a mediating role in this relationship. Gu (2022) studied sample stocks of the China CSI 300 Index from 2015 to 2020 and concluded that while environmental performance does not significantly impact firm value, social responsibility and corporate governance have clear positive effects. Zhao et al. (2018) investigated the relationship between ESG performance and financial indicators in China's energy power market and found that good ESG performance can improve CFP.

Conclusions regarding the relationship between ESG and CFP remain unclear. However, a comprehensive review of more than 2,200 studies on the relationship between ESG and financial performance indicated that over 90% supported a positive correlation between ESG and financial performance (Gunnar et al., 2015). By implementing ESG strategies and actively disclosing ESG information, companies can send positive signals to society and investors, thereby enhancing their reputation and competitive advantage, which, in turn, improves financial performance (Chen, 2022). Although ESG investments may impose short-term cost burdens on companies, an excellent ESG performance enables sustainable development and enhances market competitiveness in the long run. Therefore, the first

hypothesis of this study is as follows:

Hypothesis 1. The ESG performance of energy companies in China will have a positive impact on corporate financial performance.

ESG in the energy industry

China's energy industry faces numerous difficulties and challenges owing to its heavy reliance on traditional fossil fuel energy sources, making it impractical to eliminate these sources abruptly from economic production (Geng, 2021). Advancements in science and technology are gradually reshaping the market structure by introducing alternative energy sources and creating new consumption sectors. Despite these changes, the oil and gas industry still dominates the global energy and fuel balance, accounting for approximately 60% of global energy consumption (Carayannis et al., 2017; Cherepovitsyn et al., 2018).

Traditional energy companies, such as coal and petroleum, have a significant environmental impact, rendering them largely "environmentally unfriendly" entities. In a report released by the International Energy Agency (IEA) in May 2020, it was recommended that further funding for new coal, petroleum, and gas projects be stopped to achieve net-zero carbon emissions by 2050 (IEA, 2021). International oil companies have embraced ESG principles and integrated them into their strategies to facilitate energy transitions. European companies such as Shell and British Petroleum (BP) have taken more assertive measures towards energy transformation, setting net-zero emission targets (Xiong et al., 2022). In the United States, oil companies such as ExxonMobil have adopted a relatively conservative approach to energy transition, established carbon emission reduction targets, and incorporated climate risk and other factors into their strategies (ExxonMobil, 2023). Furthermore, influential institutional investors such as BlackRock have advocated incorporating ESG considerations into the strategic management of oil companies by calling for votes at shareholder meetings (BlackRock, 2023).

Traditional fossil energy companies are not aligned with development goals; thus, their ESG performance is often unsatisfactory, making it challenging to translate their ESG efforts into tangible economic benefits (Filimonova et al., 2020; Cha et al., 2017; Eva et al., 2018). Based on these studies, the second hypothesis is as follows:

Hypothesis 2. ESG performance of renewable energy companies has a more significant impact on their financial performance than that of traditional fossil energy companies.

The mediating role of renewable energy company green transformation

The concept of green transformation has emerged as a response to the constraints imposed by natural capital. Both the theory and practice of this transformation are currently in an exploratory stage (Che et al., 2016). The renowned "Porter hypothesis," introduced by Porter and Vander (1995) posits that appropriate environmental regulations and protective policies can stimulate companies to engage in technological innovation. This innovation enhances productivity, offsets costs associated with environmental protection, and ultimately improves marketplace profitability. Li (2016) conducted research that strongly supports the significant role of green product design and green supply chain processes in enhancing a company's financial performance. Tang et al. (2018) find that both green process innovation and green product innovation significantly and positively predict company performance. Chen et al. (2008) argued that all companies should embrace green transformation and develop clean production technologies to enhance their competitiveness. Peng and Li (2015) discovered that the green transformation of heavily polluting industrial sectors in China positively impacted import trade. Zhao and Qiao (2015) conclude from their data analysis that the green transformation of Chinese companies contributed to the promotion of corporate financial performance.

The achievement of the green transformation goals requires substantial financial resources that cannot be fully covered by government funding alone. This significant funding gap necessitates targeted interventions using social funds. An essential feature and advantage of the ESG system is its ability to provide a comprehensive evaluation framework for green investments that align with sustainable development goals. Therefore, the ESG system is anticipated to serve as a crucial catalyst for green transformation (Wu and Chen, 2022). Strong ESG performance has a significant positive effect on companies' green transformation.

Based on the aforementioned literature analysis, it is apparent that although green transformation may temporarily increase product costs, corporations fulfill their social responsibility by improving their reputations. This proactive social responsibility behavior can lead to long-term improvements in a company's financial performance (Geng, 2021). Therefore, the third hypothesis is as follows.

Hypothesis 3. Green transformation mediates the impact of renewable energy companies' ESG performance on financial performance.

3. Methodology

Variables selection

Currently, two primary categories of indicators are used to evaluate a company's financial performance: the first category is accounting indicators, such as Return on Assets (ROA) and Return on Equity (ROE), and market indicators, such as the M/B ratio and Tobin's Q value (Gentry et al., 2010). Divergence arises in the conclusions derived from the various indicators as the degree of company diversification increases. This divergence can be attributed to accounting indicators responding to the operational outcomes of the company, whereas market indicators respond to investor expectations (Lei and Du, 2003). Because China's capital market, especially the stock market, is affected by various irrational factors and fluctuates greatly at the current stage, stock prices cannot effectively reflect the real value of companies (Song, 2021). Consequently, this study excludes market indicators and employs more objective accounting indicators. Among these indicators, ROA was chosen as the financial performance index because of its capacity to measure the net profit generated per unit of assets. ROA is considered a comprehensive indicator of the strong correlation between social responsibility and corporate financial performance (Orlitzky et al., 2008). Thus, ROA was selected to represent a company's financial performance. The formula employed to calculate ROA is as follows:

$$\text{Return on Assets (ROA)} = \text{Net Profit after Tax} / \text{Total Assets} \times 100\%$$

For the independent variable, to better measure the overall ESG performance of companies, this study uses WIND’s ESG rating score published by Wind Financial Terminal, which covers the three dimensions of environmental, social, and governance, and is further subdivided into 27 issues encompassing over 300 specific indicators. A more comprehensive, realistic, and authoritative representation of ESG performance in the Chinese market can be attained using Wind’s ESG score.

Among the green transformation investment indicators, the investment ratio of environmental protection projects was set to measure green transformation investment. Because this research concentrates on the energy industry, only renewable energy companies develop renewable projects, utilizing the operating cost ratio of renewable energy projects as an indicator of green transformation.

As corporate financial performance can be influenced by factors such as corporate peripatetic characteristics and financial operating conditions (Luo, 2019), some researchers have suggested selecting the Debt Asset ratio (Lev), Total Assets Turnover (Ato), and Company Age (age) as control variables to ensure that any relationship between ESG and financial performance is not the outcome of any missing

variables. The Debt Asset ratio refers to leverage, which represents company risk that may affect financial performance (Prior et al., 2008). Total asset turnover serves as an indicator of a company's efficiency in utilizing its assets to generate revenue and may also affect financial performance (Adam, 2022). Older companies typically possess more stable cash flows and abundant resources, attracting a greater number of consumers and investors, and ultimately enhancing financial performance; thus, Company Age was included as a control variable in this study (Zhang et al., 2017). Table 1 presents the measurement definitions of each variable.

Table 1 The measurement definition of variables

Categories	*Variables*	*Symbol*	*Description*
Dependent variable	Corporate Financial Performance	ROA	Net Profit after Tax / Total Assets *100%
Independent variable	ESG Performance	ESG	ESG rating score evaluated by Wind Financial Terminal
Mediator variable	Energy Company's Green Transformation	GX	Renewable Energy Project Operating Costs / Total Operating Costs *100%
Moderator variable	Energy Company's Type	TYP	Renewable energy companies are defined as 1, traditional fossil energy companies are defined as 0
Control variables	Debt Asset ratio	Lev	Total Debt / Total Assets * 100%
	Total Assets Turnover	Ato	Net Sales / Average Total Assets *100%
	Company Age	Age	The difference between the current year and the year in which the company was established

Model construction

In this study, three multiple linear regression models were formulated to investigate the impact of energy companies' ESG performance on their financial performance. Moreover, the study aims to explore the mediating role of green transformation in the relationship between ESG performance and financial performance, while analyzing the moderating effect of company type. The following regression models were constructed in this study:

$$ROA_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Lev_{i.t} + \beta_3 Asset\_tur_{i,t} + \beta_4 Age_{i,t} + \varepsilon \quad (a)$$

$$GX_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Lev_{i.t} + \beta_3 Asset\_tur_{i,t} + \beta_4 Age_{i,t} + \varepsilon \quad (b)$$

$$ROA_{i,t} = \beta_0 + \beta_1 GX_{i,t} + \beta_2 ESG_{i,t} + \beta_3 Lev_{i.t} + \beta_4 Asset\_tur_{i,t} + \beta_5 Age_{i,t} + \varepsilon \quad (c)$$

Where: i = company; t = period; β_0 = constant term; β_i (i=1 to 5) = the coefficient of each variable; ε = error term.

Model (a) examines Hypothesis 1 and Hypothesis 2, which investigate the impact of ESG performance on financial performance; Models (b) and (c) examine Hypothesis 3; Model (b) investigates the relationship between energy companies' ESG performance and green transformation; and Model (c) investigates the mediating role of green transformation.

To comprehensively investigate the influence of green transformation on the relationship between the ESG performance and financial performance of renewable energy companies, this study uses the causal step approach proposed by Baron and Kenny (1986). The mediation analysis seeks to establish a deeper understanding of the underlying impact mechanism of green transformation on the financial performance of renewable energy companies during the ESG performance process. To achieve this, specific regression equations were used to describe the relationships between the relevant variables involved in the mediating analysis.

$$Y \ cX \ |e_1 \quad (1)$$

$$M \ aX \ |e_2 \quad (2)$$

$$Y \ c'X \ bM \ |e_3 \quad (3)$$

where: c is the effect of the independent variable X on the dependent variable Y, a is the effect of the independent variable X on the mediating variable M, b is the effect of the mediating variable M on the dependent variable Y after controlling for the mediating variable M, c' is the effect of the independent variable X on the dependent variable Y after controlling for the mediating variable M, e_i(i=1 to 3) is the regression residuals.

Owing to its temporal dimensions, this study necessitates the utilization of panel data analysis. Typically, panel data analysis encompasses two predominant methodologies: fixed-effects and random-effects. In this study, by conducting the F-test, Lagrange multiplier (LM-test) test, and Hausman test, a fixed-effects model was selected to conduct a regression analysis to test the correlation between corporate ESG performance and financial performance.

Data sources

This study selects financial performance and ESG score data from the WIND financial database of China. The specific project cost data for each company were collected from their respective annual reports. The data used in the model estimation span from 2018 to 2021. The selection of 2018 as the starting year is based

on the statistical commencement year of the WIND ESG rating database, the choice of 2021 as the ending year is due to the incomplete publication of ESG data for the year 2022 on the Wind Financial Database at the time this study was conducted. To enhance sample standardization and ensure the validity and efficacy of the research findings, this study extracted data based on the following principles:

(1) According to the industry classification of the China Securities Regulatory Commission (CSRC), companies related to the energy industry, such as electricity, heat, and gas production and supply companies, were selected as the sample base.

(2) Eliminate ST and *ST samples with abnormal data were excluded[1].

(3) Eliminating samples with missing or abnormal ESG rating data.

Following the elimination of abnormal data, 356 observations were made, including 69 renewable and 43 traditional energy companies. The research period spanned from 2018 to 2021. The initial processing of raw data to form the panel data was conducted using Microsoft Excel, whereas the final regression analysis and empirical tests were primarily performed using Stata16 software.

4. Result and discussion

Descriptive statistical analysis

Table 2 shows the descriptive statistics of the variables, which can be used to analyze their characteristics and trends. The mean ROA was 3.067. Notably, there was a substantial disparity between the maximum and minimum values, with a difference of 11.57. This observation suggests significant variation among the sample companies, signifying an imbalance in their development. For the ESG variable, the mean value was 5.941, with a minimum value of 3.520 and a maximum value of 9.320. This wide dispersion in ESG performance indicates notable diversity among the companies assessed. The mean value of green transformation was 33.7% with a median value of 14.7%, suggesting that more than half of the companies in the sample attained a relatively high degree of green transformation in their operations.

Concerning the type of energy company, the mean value is 0.604, indicating that the number of renewable energy companies is greater than that of traditional energy companies.

Among the control variables, the mean value of Lev (Debt Asset ratio) is approximately 54.77%, which is smaller than the median value, indicating that a significant proportion of the companies in the sample

[1]ST -- The company has been operating at a loss for two consecutive years, special treatment.
*ST --Three consecutive years of operating losses for the company, delisting warning.

maintain relatively low levels of debt. The mean value of Total Asset Turnover (Ato) is 0.364, which is larger than the median value, meaning that most companies have relatively high asset management efficiency. Age also differs among companies. Overall, the sample data were well differentiated.

Table 2 The descriptive statistical of the variables

Variable	*N*	*Mean*	*P50*	*Sd*	*Min*	*Max*
ROA	356	3.067	2.879	2.255	-2.926	8.646
ESG	356	5.941	5.840	0.889	3.520	9.320
GX	215	0.337	0.147	0.373	0.000	1.000
TYP	356	0.604	1.000	0.490	0.000	1.000
Lev	356	54.77	57.42	16.08	1.306	88.21
Ato	356	0.364	0.283	0.246	0.024	1.508
Age	356	15.48	20.00	10.81	1.792	39.00

Correlation Analysis and Multicollinearity Analysis

To prove that each variable selected for this study was scientific and reasonable, a Pearson's correlation test was conducted, and the results are shown in Table 3. Specifically, ESG is positively correlated with ROA and significant at the 1% level, which is consistent with Hypothesis 1. Conversely, Lev is negatively correlated with ROA, indicating that a higher debt-to-asset ratio adversely impacts financial performance. This negative association suggests that companies operating at higher debt levels experience diminished financial performance. Conversely, Ato is positively correlated with ROA, revealing that more efficient operations positively influence financial performance, which is conducive to enhancing financial performance. Age also shows significant negative correlations with financial performance, indicating that older companies negatively influence financial performance. Additionally, it is worth noting from Table 3 that the correlation coefficients between all independent variables were modest, thereby affirming the appropriateness of the variable selection in this research.

Table 3 The Pearson correlation test results

	ROA	*ESG*	*Lev*	*Ato*	*Age*
ROA	1				
ESG	0.181***	1			
Lev	-0.381***	0.043	1		
Ato	0.180***	0.008	-0.118**	1	
Age	-0.169***	0.151***	0.100*	-0.069	1

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

The results of the multicollinearity analysis among the variables in this study are shown in Table 4. Variance Inflation Factor (VIF) values were used to assess whether multicollinearity existed among the explanatory variables. A VIF value within the range of 0–10 indicates the absence of multicollinearity issues among the explanatory variables. As observed in Table 4, all VIF values for each variable were below 10, affirming that there was no multicollinearity problem among the variables included in the model.

Table 4 The Multicollinearity Analysis

Variable	*VIF*	*1/VIF*
ESG	1.02	0.976
Lev	1.02	0.977
Ato	1.02	0.982
Age	1.04	0.965
Mean VIF	1.02	

The impact of ESG performance on financial performance

Table 5 shows the regression coefficient between ESG and ROA, which is significant at the 1% level. This implies that a company's ESG performance has a substantial positive influence on its financial performance. In other words, companies with better ESG performance tend to exhibit higher financial performance than those with lower ESG performance. This suggests that energy companies demonstrating commendable ESG performance can transmit positive signals to the market by actively reducing their natural resource utilization and energy consumption. Consequently, these companies have attracted investors' attention, leading to enhanced financial performance. Moreover, an improvement in ESG performance allows a company to gain more social resources and cultivate a favorable reputation, thereby enhancing its social image and contributing to sustained financial performance in the long run. However,

Lev and Age have significantly negative impacts on financial performance. This finding suggests that companies with higher debt ratios tend to exhibit poorer financial performance. Additionally, younger companies may possess greater development potential and consequently attract more investment, positively influencing their financial performance. Finally, Ato exhibits a significantly positive impact, indicating that companies with robust profitability tend to demonstrate superior financial performance.

Table 5 Regression results of the impact of ESG performance on financial performance

	ROA
ESG	0.474***
	(0.123)
Lev	-0.053***
	(0.007)
Age	-0.983**
	(0.416)
Ato	1.363***
	(0.441)
ydum	control
_cons	5.721***
	(1.624)
N	356.000
r2	0.216
r2_a	0.200

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

The impact of company ESG performance, type, and financial performance

In this study, the sample of energy companies was categorized into two groups based on company type: renewable and traditional. This study aimed to examine the potential differences between these two categories. As shown in Table 6, the regression coefficient between ESG performance and the financial performance of renewable energy companies exhibits a positive and statistically significant relationship at the 1% level. This finding indicates that renewable energy companies with better ESG performance tend to achieve better financial performance. Additionally, the regression coefficient between ESG performance and the financial performance of traditional energy companies is positive, but the statistical significance is at the 5% level. This suggests that the significant relationship between ESG performance and the financial performance of renewable energy companies is stronger than that of traditional energy companies.

These results indicate that ESG performance has a more substantial impact on the financial performance of renewable energy companies than on traditional energy companies. This finding is consistent with Hypothesis 2, which posits that there are variations in the relationship between ESG and financial performance based on company type.

Table 6 Empirical analysis of company ESG performance, type, and financial performance

Variables	*Company type*	
	Renewable energy company	*Traditional energy company*
	ROA	*ROA*
ESG	0.551***	0.494**
	(0.158)	(0.211)
Lev	-0.044***	-0.068***
	(0.008)	(0.014)
Age	-0.865	-0.438
	(0.585)	(0.643)
Ato	0.940	1.272*
	(0.600)	(0.698)
_cons	4.306*	5.032*
	(2.268)	(2.657)
N	215	141
r2	0.174	0.259
r2_a	0.146	0.220

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

The mediating role of renewable energy company green transformation

The regression results are presented in Table 7. The examination of the mediating effects, following the methodology proposed by Wen et al. (2014), was performed using models (a), (b), and (c). In these models, the effects of c, a, b, and c' were found to be statistically significant ($p< 0.05$), it is necessary to further examine the symbol direction of the indirect effects ab and c'. Upon closer examination of Model (c), the indirect effect ab of green transformation exhibited a negative correlation, which contrasts with the regression coefficient c' for ROA. Moreover, the absolute value of the total effect c (0.551) of ESG on ROA is slightly smaller than that of the direct effect c' (0.612). Following the determination method proposed by Mac Kinnon et al. (2000), the indirect effect of green transformation on both ESG performance and financial performance is not characterized as a "mediating effect," but rather as a “suppressing effect.”

This study categorizes renewable energy companies into two groups based on their renewable energy

project operating costs: (1) completely renewable energy companies, where renewable energy project costs account for more than 50% of their total operating costs, and (2) incompletely renewable energy companies, where renewable energy project costs account for less than 50%. These categories correspond to green transformation levels exceeding 50%. Fig. 1 illustrates the impact of ESG performance on the financial performance of two types of renewable energy companies. Notably, the slope for completely renewable energy companies is more pronounced than that of incompletely renewable energy companies. This disparity indicates that as ESG performance improves, completely renewable energy companies experience a significantly faster rate of financial performance enhancement than do incompletely renewable energy companies, suggesting that the green transformation variable of these two types of companies increases the difference in the impact of their ESG performance on financial performance.

These findings highlight the need to account for the green transformation variable to avoid suppressing the observed differences in the impact of ESG performance on the financial performance of different renewable energy companies. By including the green transformation variable as a control, the divergence between these distinct renewable energy companies became more evident. Hence, the results of our tests demonstrate that the green transformation variable acts as a mechanism of suppression in the relationship between ESG and the financial performance of renewable energy companies.

Table 7 Empirical results on ESG performance, green transformation, and financial performance

Variables	*Model (a)*	*Model (b)*	*Model (c)*
	ROA	*GX*	*ROA*
GX	——	——	1.027**
	——	——	(0.415)
ESG	0.551***	-0.059**	0.612***
	(0.158)	(0.026)	(0.158)
Lev	-0.044***	-0.002	-0.042***
	(0.008)	(0.001)	(0.008)
Age	-0.865	-0.079	-0.784
	(0.585)	(0.097)	(0.578)
Ato	0.940	-0.593***	1.549**
	(0.600)	(0.099)	(0.642)
_cons	4.306*	1.260***	3.013
	(2.268)	(0.376)	(2.300)
N	215.000	215.000	215.000
r2	0.174	0.197	0.198
r2_a	0.146	0.169	0.167

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

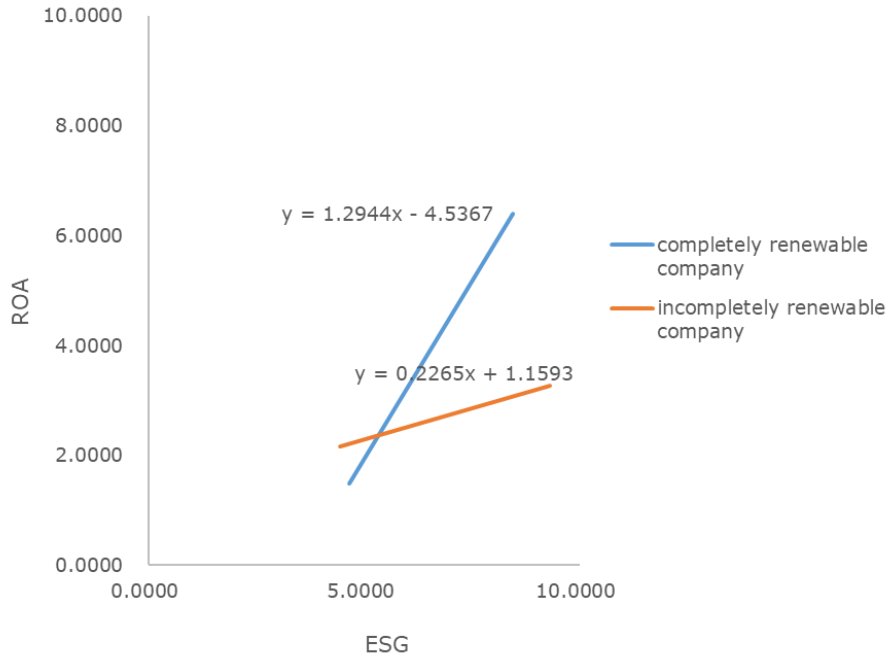

Fig. 1 ESG performance on financial performance between two types of renewable companies

Robustness check

To enhance the robustness and reliability of the findings, a robustness check was conducted by substituting the dependent variable Return on Assets (ROA) with Return on Equity (ROE). The utilization of ROE in this analysis aims to examine the consistency and validity of the results from an alternative perspective. The ROE was calculated using the following formula:

$$\text{Return on Equity (ROE)} = \text{Net Income} / \text{Average Shareholders' Equity} \times 100\%$$

Tables 8, 9, and 10 show the results of the robustness check analysis in which ROE was adopted as the substituted dependent variable for the entire sample. The results of the robustness check are consistent with those of previous research, demonstrating a high degree of consistency and stability in the conclusions drawn from this study.

Table 8 Impact of ESG performance on financial performance

	ROE
ESG	1.214***
	(0.281)
Lev	-0.017
	(0.015)
Age	-2.855***
	(0.950)
Ato	2.926***
	(1.006)
_cons	8.245**
	(3.708)
N	356.000
r2	0.102
r2_a	0.084

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

Table 9 Empirical analysis of company ESG performance, type, and financial performance

	Company type	
Variables	*Renewable energy company*	*Traditional energy company*
	ROE	*ROE*
ESG	1.184***	0.009**
	(0.395)	(0.004)
Lev	-0.007	-0.058**
	(0.020)	(0.028)
Age	-3.495**	-0.055
	(1.458)	(0.070)
Ato	3.007**	2.155
	(1.497)	(1.418)
_cons	9.671*	9.873***
	(5.655)	(2.202)
N	215.000	141.000
r2	0.088	0.102
r2_a	0.057	0.055

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

Table 10 Empirical results on ESG performance, green transformation, and financial performance

Variables	*Model (a)*	*Model (b)*	*Model (c)*
	ROE	*GX*	*ROE*
GX	——	——	2.570**
	——	——	(1.034)
ESG	1.184***	-0.059**	1.336***
	(0.395)	(0.026)	(0.395)
Lev	-0.007	-0.002	-0.002
	(0.020)	(0.001)	(0.020)
Age	-3.495**	-0.079	-3.292**
	(1.458)	(0.097)	(1.442)
Ato	3.007**	-0.593***	4.530***
	(1.497)	(0.099)	(1.601)
_cons	9.671*	1.260***	6.434
	(5.655)	(0.376)	(5.736)
N	215.000	215.000	215.000
r2	0.088	0.197	0.115
r2_a	0.057	0.169	0.080

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

5. Conclusions

This study uses ESG rating data from the WIND financial database to measure companies' ESG performance. Return on Assets (ROA) is utilized to measure the financial performance of these companies. A fixed-effects model is established to empirically examine the impact of energy companies' ESG performance on their financial performance. Subsequently, the moderating effect of different types of energy companies was explored. Finally, whether green transformation plays a mediating role in the impact process was examined. The primary research sample included 112 energy companies, consisting of 69 renewable and 43 traditional energy companies. The research period spans from 2018 to 2021.

These findings demonstrate a positive relationship between ESG performance and the financial performance of energy companies. Specifically, higher ESG performance is associated with better financial performance. By actively implementing effective environmental strategies and fulfilling social responsibilities, energy corporations have attracted stakeholders' attention and gained increased access to social resources. During the investment selection process, investors tend to select companies with exemplary ESG performances. Furthermore, energy companies that exhibit proactive approaches to social

responsibility garner robust support from government bodies and the public. As a result, the proper implementation of ESG responsibilities not only facilitates the sustainable development of energy companies but also significantly enhances their social image and confers a competitive advantage. Consequently, the company's financial performance has improved correspondingly.

Among energy companies, the ESG performance of renewable energy companies which contain renewable energy projects has a more significant positive impact on financial performance than traditional energy companies without any renewable energy projects. In recent years, as the concept of green and sustainable development has become mainstream social development in China, constraints on the energy industry have become stricter, and the country has vigorously promoted the transition from conventional fossil fuels to renewable and clean energy sources. In this context, investors and the public show concern for and appreciation for the efforts undertaken by renewable energy companies to enhance their environmental conditions. Consequently, renewable energy companies enjoy a more favorable social image and possess increased opportunities to convey positive development signals to the market. Consequently, the positive influence of ESG performance on renewable energy companies' financial performance significantly surpasses that of traditional energy companies.

Furthermore, the green transformation of renewable energy companies suppresses the impact of ESG performance on financial performance. Without controlling for the green transformation variable, the difference in the impact of ESG performance on the financial performance of different renewable energy companies will be suppressed, which will significantly enlarge the difference between completely renewable energy companies and incompletely renewable energy companies in the impact of ESG performance on financial performance. These findings suggest that renewable energy companies should allocate further investment toward green transformation processes. As the degree of green transformation increases, incomplete renewable energy companies transition to completely renewable energy companies; consequently, the positive impact of ESG performance on financial performance increases, resulting in greater financial benefits.

The empirical results and insights derived from this study highlight the beneficial outcomes of energy companies' initiatives for enhancing their ESG performance. The concept of ESG aligns with the development strategies of energy companies. Accelerating green transformation, vigorously developing renewable clean energy projects, and enhancing resource utilization will increase the trust of investors and the general public, and can further enhance the positive image of energy companies. Thus, the energy industry could achieve sustainable, long-term development.

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Data availability

The ESG and financial data of companies provided by the Wind Financial Database are not publicly available. The data sets used in this study are available from the corresponding author upon request.

Conflict of interest

On behalf of all authors, the corresponding author states that there are no conflicts of interest.

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