Study on the Impact of ESG Performance on Financial Performance of Chinese Energy Industry

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CHAPTER 1. INTRODUCTION

Introduction - ESG concept

Concept of ESG:

- In 2004, **Environmental, Social and Governance (ESG)** was first introduced by United Nations Environment Programme (UNEP FI), which aims to achieve sustainable development for the whole society.

Figure 1. The concept of ESG

Policies proposed in China:

- ***The 14th Five-Year Plan*** and ***The Vision 2035***
- The goal of ***Carbon Peaking and Carbon Neutrality***
- Boost the green development of China's economy
- Closely focused on the theme of promoting high-quality development

ESG coincides with the concept of sustainable and high-quality development currently advocated in China.

[1] "Outline of the 14th Five-Year Plan of the National Economic and Social Development of the People's Republic of China and the Vision 2035", 2021. http://www.gov.cn/xinwen/2021-03/13/content_5592681.html

Introduction - Energy transformation

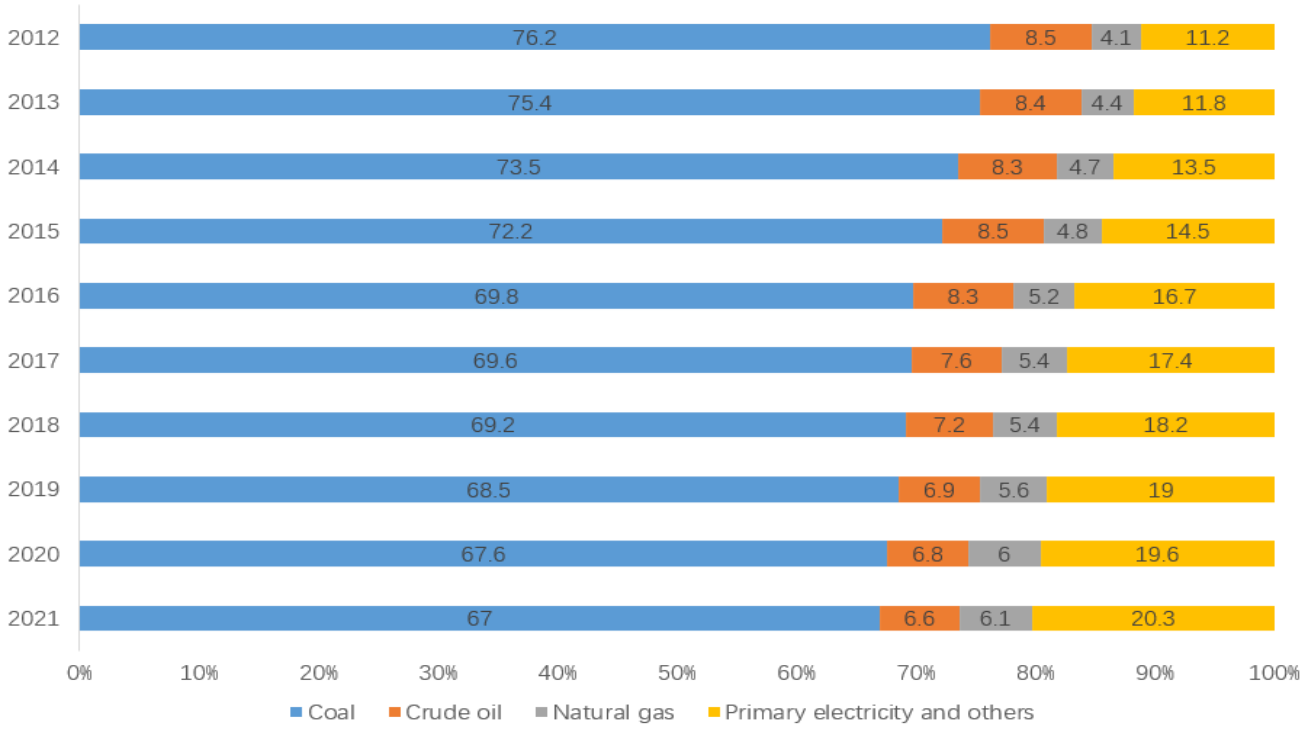


Figure 2. China's Energy Production Structure 2012-2021

Source: National Bureau of Statistics

Inevitable path to achieve the goal:

- **Energy industry** is an environmentally sensitive industry, has higher environmental risks and a more stringent monitoring evaluation system, and **ESG evaluation** has a deeper impact on the energy industry.

- The full implementation of the **energy strategy** and **the ESG concept** are two important tools to realize sustainable development.

ESG of energy industry has certain significance for today's green and low-carbon transition process.

CHAPTER 2. RESEARCH OBJECTIVES

Objectives

- Analyzing the impact of energy corporates' ESG performance on financial performance.
- Exploring whether there has heterogeneity in the impact of ESG performance on financial performance of energy corporates.
- Introducing the mediating variable of green transformation to explore its impact in the process of influencing ESG performance on financial performance of energy corporates.

CHAPTER 3. LITERATURE REVIEW AND FRAMEWORK

Literature Review - ESG performance and financial performance

Table 1. Literature on the relationship between ESG and financial performance

Authors (Year)	ESG Measure	Performance Measure	Sample Period	Country	Findings
Breuer (2014)	Thomson Reuters ESG data	Return on assets and Tobin's q	2009-2012	USA	Positive
Ortas et al. (2015)	Thomson Reuters ESG indexes	Return on assets and Tobin's q	2008-2013	Multiple countries	Positive
Garcia et al. (2017)	Thomson Reuters ESG data	Systematic risk, free cash flow, market capitalization, and return on assets	2010-2012	Multiple countries	Positive
Yan (2022)	Wind ESG score	Tobin's q	2015-2020	China	Positive
Yu and Wang (2021)	E: IPE, S: Social contribution value, G: CGI	Tobin's q	2015-2018	China	Negative
Lee et al. (2009)	Dow Jones Sustainability Indexes	Return on assets and return on equity	1998-2002	Multiple countries	Negative
Atan et al. (2018)	Bloomberg ESG data	Return on assets, return on equity and Tobin's q	2010-2013	Malaysia	No relationship
Gu (2022)	E: CNRDS and IPE S: Social contribution value G: CGI	Tobin's q	2015-2020	China	No relationship

Hypothesis 1. *The environmental, social and corporate governance of energy corporates in China will have a positive impact on corporate financial performance.*

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

Literature Review – Green transformation

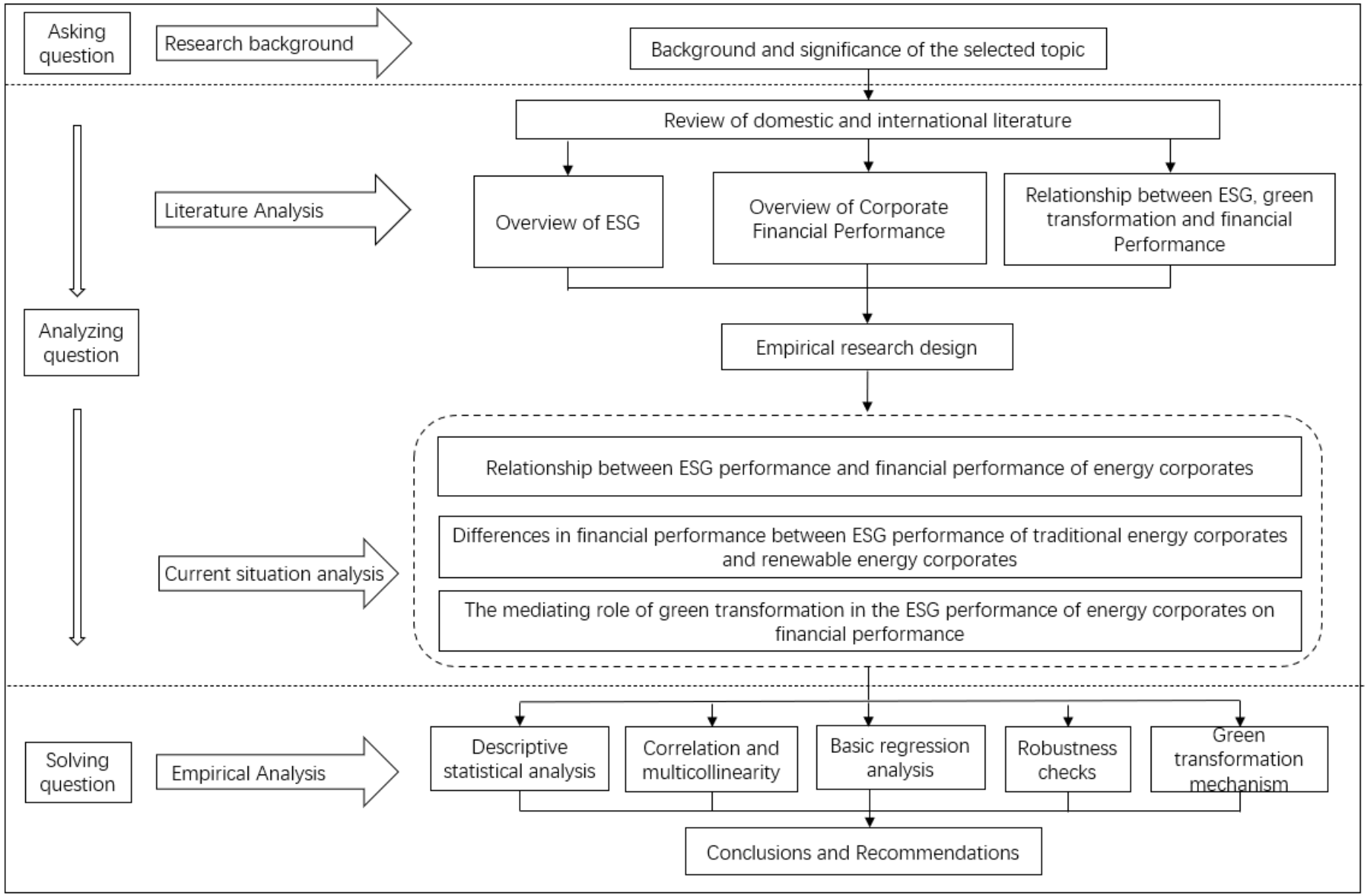
The theory and practice of green transformation are still in the exploratory stage.

- "Porter hypothesis" suggests that appropriate environmental regulation and protection policy can stimulate the enterprise to conduct technology innovation, and the technology innovation can promote the enterprise's productivity (Porter and Vander, 1995).
- Green process innovation and green product innovation both significantly positively predict firm performance (Li, 2016;Tang et al., 2018; Zhao, 2015).
- All companies should implement green transformation and develop clean production technologies in order to improve their competitiveness (Chen et al., 2008).

Hypothesis 3. *The green transformation has a mediating effect in the impact process of corporate ESG performance on financial performance.*

[2] Porter, M. E., and Claas van der Linde. "Green and Competitive: Ending the Stalemate." Harvard Business Review 73, no. 5 (September–October 1995).
[3] Shaorui Li, Vaidyanathan Jayaraman, Antony Paulraj & Kuo-chung Shang (2016) Proactive environmental strategies and performance: role of green supply chain processes and green product design in the Chinese high-tech industry, International Journal of Production Research, 54:7, 2136-2151, DOI: 10.1080/00207543.2015.1111532
[4] Tang, Mingfeng & Walsh, Grace & Lerner, Daniel & Fitza, Markus & Li, Qiaohua. (2018). Green Innovation, Managerial Concern and Firm Performance: An Empirical Study. Business Strategy and the Environment. 27. 39-51. 10.1002/bse.1981.
[5] Zhao Cunli, Qiao Guitao. Research on the integration and development of state-owned enterprises and private enterprises--based on the perspective of corporate social responsibility [J]. Research on finance and economics,2015,(06):122-129.
[6] Chen Shunyou, Ding Zurong, Li Juan. Game analysis between enterprises and government in cleaner production[J]. Environmental Science and Technology,2008,(01):142-144.

Research Framework



CHAPTER 4. RESEARCH METHODS

Methodology

Data collection

Number: 384 observation data of 114 energy corporates, including 71 renewable energy corporates and 43 traditional energy corporates.

Period: 2018-2021.

Source: WIND Financial Database and Annual Reports of each corporate.

Figure 4. Example of Wind ESG Rating Score

Source: Wind Financial Database

Methodology

Variable selection

Table 2. The definition of the variables

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

[7] Xueting Luo. A study on the nonlinear relationship between executive compensation incentives, equity incentives and capital structure--empirical data from Chinese manufacturing listed companies[J]. Explorations in Financial Theory,2019,No.186(04):43-52.DOI:10.16620/j.cnki.jrjy.2019.04.005.

Methodology

Model construction

Using the fixed-effects model to conduct multiple linear regression analysis. The regression models are as follows:

$$(1)ROA_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i.t} + \beta_4 Asset\_tur_{i,t} + \beta_5 Age_{i,t} + \varepsilon \quad \text{(a)}$$

→ H1, H2

$$(1)GX_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i.t} + \beta_4 Asset\_tur_{i,t} + \beta_5 Age_{i,t} + \varepsilon \quad \text{(b)}$$

→ H3

$$(1)ROA_{i,t} = \beta_0 + \beta_1 GX_{i,t} + \beta_2 ESG_{i,t} + \beta_3 Size_{i,t} + \beta_4 Lev_{i.t} + \beta_5 Asset\_tur_{i,t} + \beta_6 Age_{i,t} + \varepsilon \quad \text{(c)}$$

Where: i = corporate; t = period; β_0 = constant term; $\beta_i (i$=1 to 6) = the coefficient of each variable; ε = error term.

CHAPTER 5. ANALYSIS OF RESULTS AND DISCUSSION

Research results – Descriptive statistical analysis

Table 3. The descriptive statistic of the variables

Variable	N	Mean	P50	Sd	Min	Max
ROA	384	3.060	2.879	2.220	-2.926	8.646
ESG	384	5.919	5.805	0.889	3.520	9.320
GX	215	0.337	0.147	0.373	0	1
TYP	384	0.633	1	0.483	0	1
Size	384	5.058	4.959	1.455	0.335	8.412
Lev	384	55.04	57.25	15.84	1.306	88.21
Ato	384	0.359	0.282	0.241	0.0240	1.508
Age	384	22.95	24	5.224	6	39

- ROA: there are significant differences among the sample corporates and the development is not balanced.
- ESG: ESG performance varies relatively widely among the sample corporates.
- GX: that more than half of the corporates have a relatively high degree of green transformation.
- TYP: the proportion of renewable energy corporates has reached to 63.3%, shows that the number of the renewable energy corporates are more than traditional fossil energy corporates.
- Control variables: have some differences among different corporates.

Overall, the sample data are well differentiated.

Research results – Correlation analysis and multicollinearity analysis

Table 4. The Pearson correlation test

	ROA	ESG	Size	Lev	Asset_tur	Age
ROA	1					
ESG	0.202***	1				
Size	-0.0490	0.405***	1			
Lev	-0.389***	0.0330	0.371***	1		
Ato	0.173***	-0.00700	-0.212***	-0.127**	1	
Age	-0.0780	-0.0710	0.00500	-0.099*	0.132***	1

Notes: *, **, *** Significant at 10, 5 and 1 per cent levels, respectively

Table 5. The multicollinearity analysis

Variable	VIF	1/VIF
Size	1.560	0.642
ESG	1.250	0.802
Lev	1.210	0.825
Ato	1.090	0.918
Age	1.060	0.941
Mean VIF	1.220	

0<VIF<10

- **The correlation coefficients between all independent variables are small, which can make the conclusion that the selection of variables in this research is scientifically appropriate.**
- **The VIF values of each variable are less than 10, which indicates that there is no multicollinearity problem among all the variables involved in the model of this study.**

Research results – Regression analysis

Impact of corporate ESG performance on financial performance

Table 6. Regression results of ESG on financial performance

	ROA
ESG	0.561***
	(0.137)
Lev	-0.955***
	(0.235)
Age	-0.895**
	(0.415)
Ato	1.632***
	(0.463)
size	-0.055
	(0.088)
ydum	control
_cons	5.967***
	(1.835)
N	384.000
r2	0.129
r2_a	0.111

Notes: *, **, *** Significant at 10, 5 and 1 per cent levels, respectively

- The regression coefficient between corporate ESG and ROA is positive, which is significant at the 1% level, indicating that corporate ESG performance has a significant positive impact on financial performance, which means corporates with better ESG performance have higher financial performance than corporates with poor ESG performance.
- Among control variables, Debt Asset ratio (Lev) and Age has a significantly negative impact; Total Assets Turnover (Ato) has a significantly positive impact.

Therefore, Hypothesis 1 can be verified.

Research results – Regression analysis

The moderating effect of corporate heterogeneity

Table 7. Regression results of ESG, type and financial performance

Variables	Corporate type	
	Renewable energy corporate ROA	Traditional energy corporate ROA
ESG	0.510***	-0.141
	(0.158)	(0.286)
Lev	-0.053***	0.003
	(0.009)	(0.039)
Age	-1.079**	-10.759
	(0.523)	(8.035)
Ato	1.167*	4.736***
	(0.594)	(1.765)
size	0.160	0.969
	(0.116)	(1.327)
_cons	4.843**	30.369
	(1.993)	(23.694)
N	243	141
r2	0.203	0.144
r2_a	0.175	-0.331

- Divided the sample energy corporates into renewable energy corporates and traditional energy corporates.
- The coefficient of renewable energy corporate is positive and significant at 1% level.
- The regression coefficient of traditional energy corporate is negative and not significant.
- This means ESG performance of renewable energy corporates has a more significant impact on financial performance than that of traditional fossil energy corporates.

Therefore, Hypothesis 2 can be verified.

Research results – Regression analysis

The mediating role of energy corporate green transformation

Using the causal steps approach proposed by Baron and Kenny (1986) and conducts fixed-effect regression analysis on regression equation (1), (2) and (3) respectively to test the mediating effect.

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

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

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

c: total effect of the independent variable X on the dependent variable Y;
a: the total effect of independent variable X on the mediating variable M;
b: the effect of the mediating variable M on the dependent variable Y after controlling the independent variable X;
c': the direct effect of the independent variable X on the dependent variable Y after controlling the mediating variable M;
e_1, e_2 and e_3: the regression residuals.

[8] Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.

Research results – Regression analysis

The mediating role of energy corporate green transformation

Table 8. Regression results of ESG, green performance and financial performance

Variables	Model (a) ROA	Model (b) GX	Model (c) ROA
GX	——	——	1.310*** b
	——	——	(0.419)
ESG	0.363** c	-0.045** a	0.369** c'
	(0.182)	(0.023)	(0.179)
Lev	-0.055***	0.004*	-0.057***
	(0.010)	(0.003)	(0.010)
Age	-0.063**	-0.009	-0.066**
	(0.029)	(0.010)	(0.029)
Ato	1.448**	-0.052	2.426***
	(0.643)	(0.113)	(0.703)
size	0.261**	-0.084	0.361***
	(0.132)	(0.054)	(0.133)
_cons	3.304**	1.064***	2.104
	(1.371)	(0.226)	(1.397)
N	215.000	215.000	215.000
r2	0.192	0.095	0.229
r2_a	0.161	-0.374	0.195

- Following the procedure for testing mediating effect suggested by Wen et al. (2014).
- The effects of c, a, b and c' are all significant ($p< 0.05$), ab of green transformation is negative, which is opposite to the regression coefficient c'.
- The absolute value of the total effect c (0.363) is smaller than the absolute value the c' (0.369).
- According to the determination method proposed by Mac Kinnon et al. (2000), the effect of green transformation on ESG performance and financial performance is not "mediating effect", but "suppressing effect".

How to understand this "suppressing effect"?

[9]Wen Zhonglin,Ye Baojuan. Mediating effects analysis: Methods and model development[J]. Advances in Psychological Science,2014,22(05):731-745.
[10]MacKinnon, D.P., Krull, J.L. & Lockwood, C.M. Equivalence of the Mediation, Confounding and Suppression Effect. Prev Sci 1, 173–181 (2000). https://doi.org/10.1023/A:1026595011371

Research results – Regression analysis

The mediating role of energy corporate green transformation

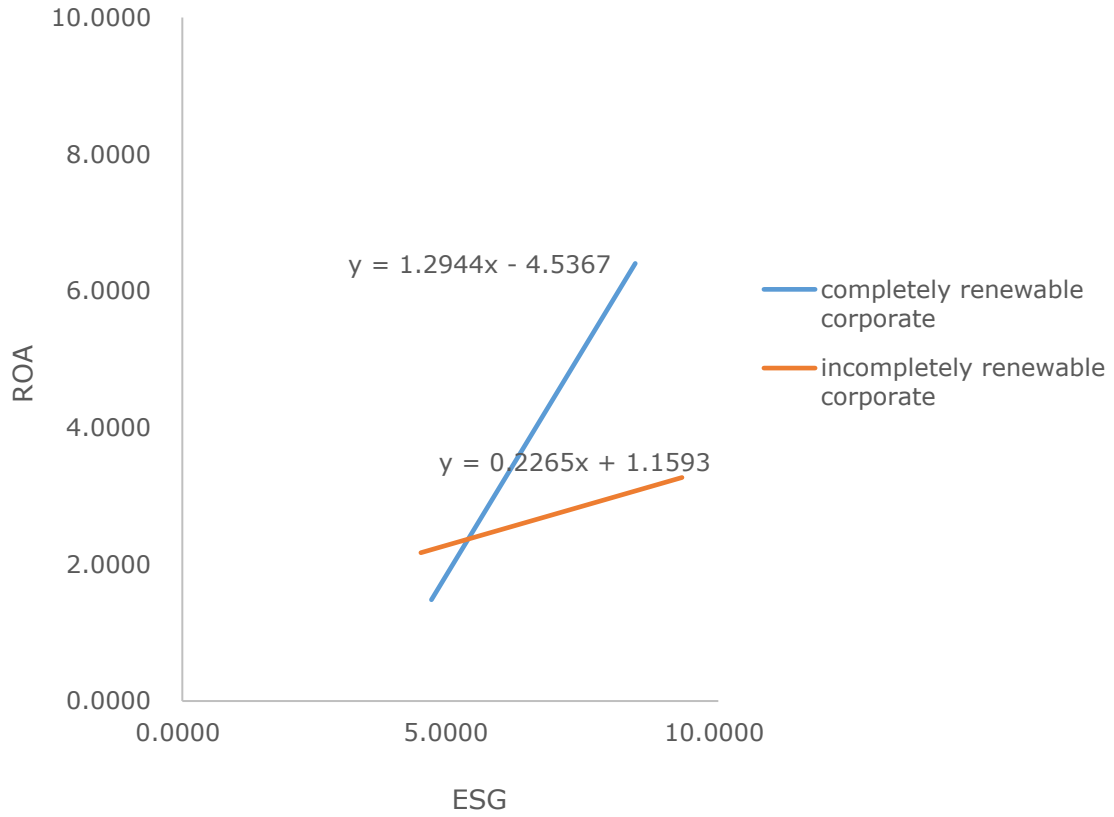


Figure 5. ESG performance on ROA between two types of renewable corporates

- Completely renewable energy corporates: renewable energy projects operating costs accounting for more than 50%. Incompletely renewable energy corporates: renewable energy projects operating costs less than 50%.
- The slope of completely renewable energy corporates is larger than that of incompletely renewable energy corporates.
- The green transformation variable of these two types of corporates enlarge the difference in the impact of their ESG performance on financial performance.

The mediating effect of Hypothesis 3 is not valid, the mechanism of the green transformation variable is the suppressing effect.

Research results – Robustness check

Table 9. Impact of ESG performance on financial performance

	ROE
ESG	1.154***
	(0.297)
Lev	-0.026*
	(0.016)
Age	-0.152***
	(0.046)
Ato	2.974***
	(0.996)
size	0.285
	(0.194)
_cons	2.360
	(2.187)
N	384.000
r2	0.113
r2_a	0.095

Table 10. Regression results of ESG, type and financial performance

Variables	Corporate type	
	Renewable energy corporate ROE	Traditional energy corporate ROE
ESG	1.184***	1.149**
	(0.398)	(0.456)
Lev	-0.023	-0.045*
	(0.022)	(0.027)
Age	-0.191***	-0.066
	(0.067)	(0.066)
Ato	3.132**	2.416*
	(1.487)	(1.391)
size	0.330	0.350
	(0.293)	(0.279)
_cons	2.415	1.694
	(3.046)	(3.482)
N	243.000	141.000
r2	0.105	0.152
r2_a	0.075	0.101

Table 11. Regression results of ESG, green performance and financial performance

Variables	Model (a)	Model (b)	Model (c)
	ROE	GX	ROE
GX	——	——	0.284**
	——	——	(0.112)
ESG	0.126**	-0.045**	0.127***
	(0.048)	(0.023)	(0.048)
Lev	-0.004	0.004*	-0.005*
	(0.003)	(0.003)	(0.003)
Age	-0.026***	-0.009	-0.026***
	(0.008)	(0.010)	(0.008)
Ato	0.374**	-0.052	0.586***
	(0.171)	(0.113)	(0.188)
size	0.037	-0.084	0.059*
	(0.035)	(0.054)	(0.036)
_cons	2.262***	1.064***	2.002***
	(0.364)	(0.226)	(0.374)
N	215.000	215.000	215.000
r2	0.127	0.095	0.154
r2_a	0.093	-0.374	0.116

The previous research results are stable.

CHAPTER 6. SUMMARY

Summary

For objective 1

- There is a positive relationship between ESG performance and financial performance of energy corporates, the better the ESG performance of the corporate, the higher the financial performance of the corporate.

For objective 2

- The ESG performance of renewable energy corporates has a more significant positive impact to financial performance than that of traditional energy corporates.

For objective 3

- The green transformation of renewable energy corporates has a suppressing effect in the impact process of ESG performance on financial performance.

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Thanks for your listening!

Let’s continue the conversation!

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