

An Empirical Study of ESG Performance and Corporate Investment Efficiency -- *Moderating Effect of External Pressure*

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Abstract: This paper develops a multiple linear regression model to empirically test the effect of corporate ESG performance on investment efficiency and using the nature of equity and media attention as the entry point to deeply explore the moderating effect of external pressure on ESG performance and investment efficiency, selecting Shanghai and Shenzhen A-share main board listed companies from 2012 to 2020 as the research object. The findings indicate that ESG performance significantly suppresses inefficient investment, i.e., better ESG performance is correlated with higher investment efficiency; however, external pressures on companies, such as the nature of equity and media attention, mitigate the effect of ESG performance on investment efficiency. The empirical results of this paper further highlight the existence of specificities in the Chinese capital market, while providing important theoretical insights for the further implementation of ESG practices in China.

Keywords: ESG performance; nature of equity; media attention; investment efficiency; multivariable linear regression model.

1 INTRODUCTION

The abbreviation ESG stands for environment, social, and governance, and it refers to an investment idea and comprehensive evaluation criteria that focuses on environmental pollution management, social duty fulfilment, and corporate governance performance. The 18th national Congress of CCPC established construction of ecological civilisation as a strategic aim for the first time. at a result of this potential, the green economy and sustainability concept have grown into an unavoidable trend now and for a longer period, the ESG concept with sustainable development as its core has gradually been noticed and accepted.

In recent years, several theoretical and practical investigations on ESG have been conducted in academia. Better ESG performance, according to well-researched studies on ESG behavior at the business level, may considerably cut the cost of company financing (Qiu and Yin 2019)^[3], raise the book value and market value of corporations (Wang and Yang 2022)^[8], and promote corporate innovation (Zhang et al. 2020)^[13]. In addition, companies with superior ESG performance have greater excess returns (Zhou et al. 2020)^[14], and tend to exhibit better performance levels (Yuan and Xiong 2021)^[12]. Furthermore, the impact of external pressure on corporate development should not be overlooked. The government can exercise control over

companies through legal penalties and policy restrictions, the media may exert pressure on companies to commence ESG behavior through news coverage, and third-party stakeholders can influence corporate investment decisions (Song et al. 2019)^[6].

In summary, domestic scholars have rarely focused on this area, and there is almost no discussion on the mechanism of external pressure in related literature, leaving greater space for discussion. Thus, this paper selects Shanghai and Shenzhen A-share main board listed companies as the research object, develops a multiple linear regression model, discusses the effect of corporate ESG performance on investment efficiency, investigates the difference between the two relationships as external pressure changes, and provides the theoretical foundation for the subsequent development of ESG practice in corporations.

2 RESEARCH HYPOTHESIS

2.1 ESG performance and Investment Efficiency

According to the perspective of stakeholder theory and resource dependence theory, good ESG performance can partially satisfy the demands of various stakeholders, increase their chances of gaining stakeholder support, which makes it more likely to obtain relevant external resources, and ultimately improve the effectiveness of their investment decisions (Anwar and Malik 2020)^[1]. As a result, hypothesis 1 is offered.

H1: Corporate investment efficiency can be increased with strong ESG performance.

2.2 Moderating Effect of External Pressure

According to the viewpoint of organizational legitimacy, it is crucial for a company's survival and growth that its behavior conforms to the expectations of its stakeholders. Researcher have found that public opinion monitoring and government regulation can significantly improve firms' environmental information disclosure (Shen and Feng 2012)^[5]. Therefore, this paper proposes hypotheses in turn.

Government departments and other regulators have passed a series of laws, regulations, and policy documents to encourage listed corporations to incorporate ESG practices into their development strategies, improve corporate ESG information disclosure, enhance their ESG performance, and guide investors to practice ESG investment concepts, thus resulting in external pressure that can influence corporations' investment decisions to some extent. Furthermore, because of the nature of the equity of the corporation, this form of external pressure will be far more binding on SOEs than non-SOEs. As a result, SOEs may emphasize investing in environmental and social responsibility, leading to investment inefficiencies. As a result, hypothesis 2 is offered.

H2: The relationship between ESG performance and investment efficiency is moderated by the nature of equity.

As information technology advances, the media may play an important external monitoring role in the stock market (Walter et al. 2008)^[7]. Firstly, media coverage can improve stakeholders' comprehension of corporate ESG performance, minimize information asymmetry, lower investment risk, and increase its investment efficiency; then, for those companies with

insufficient ESG performance, the media may focus on reporting their negative information, and under such public pressure, companies may over-invest in environmental and social responsibility activities. Such passive ESG practices may consume their resources, and media attention may play a reverse moderating role. As a result, hypothesis 3 is offered.

H3: The relationship between ESG performance and investment efficiency is moderated by media attention.

3 RESEARCH DESIGN

3.1 Sample Selection and Data Sources

This paper selects listed businesses on the main board of Shanghai and Shenzhen A-shares from 2012 to 2020 as an initial sample and screen the initial sample using the criteria listed below: (1) exclude the sample of the financial industry; (2) exclude the sample of ST, *ST and PT; (3) exclude the sample of assets and liabilities ratio over 1; (4) exclude the sample listed after 2020; (5) exclude the variable samples with more missing values. Finally, we obtained 1076 valid samples to construct a balanced panel database with 9684 observations. The data are obtained from the Wind database (Wind), the China Listed Companies Financial News Database (CFND), and the CSMAR database (CSMAR). During the study, this paper's data processing and statistical analysis were carried out using Excel 2013 and Stata 17.

3.2 Variable Description

3.2.1 Explained Variable

Corporate investment efficiency (Inv). Corporate investment efficiency reflects whether firms can fully use investment opportunities for value creation. Referring to Richardson (2006)^[4] and Xu (2014)^[10], the absolute value of the residuals generated from OLS regressions of the model (1) by industry and year is used to measure corporate investment efficiency in this paper.

$$Inv_{i,t} = \alpha_0 + \alpha_1 Growth_{i,t-1} + \alpha_2 Lev_{i,t-1} + \alpha_3 Cash_{i,t-1} + \alpha_4 Age_{i,t-1} + \alpha_5 Size_{i,t-1} + \alpha_6 Ret_{i,t-1} + \alpha_7 Inv_{i,t-1} + \sum Industry + \sum Year + \varepsilon \quad (1)$$

3.2.2 Explanatory Variable

ESG performance (ESG). ESG Ratings establish nine levels according to the ESG level of the corporation, and this paper uses the nine-point system to rate the ESG performance of the company: 9 points for AAA, 8 points for AA, 7 points for A, 6 points for BBB, 5 points for BB, 4 points for B, 3 points for CCC, 2 points for CC, and 1 point for C. The higher the score, the better the ESG performance.

3.2.3 Adjustment Variables

Nature of equity (Soe). In this study, we use dummy variables 0-1 to measure the nature of equity. If the corporation's true controller is the State-owned Assets Supervision, Administration Commission or government department at all levels, it has been determined to be a state-owned corporation and takes the value of 1. Other non-state-owned corporations take a value of 0.

Media attention (Media). This paper adopts newspaper financial news from CFND as the data source for media attention and utilizes the "1 + number of media coverage " natural logarithm to judge the degree of media attention of corporations.

3.2.4 Control Variables

In this study, which references earlier pertinent studies (Yao et al. 2020^[11]; Wang et al. 2021^[9]), the following control variables are selected: age of firm listing (Age), firm size (Size), firm growth (Growth), total net asset margin (Roa), gearing ratio (Lev), management remuneration (Sala), equity concentration (Hold), and the percentage of independent directors (Dboard), Meantime, year and industry dummy variables are introduced to adjust for time and industry impacts.

3.3 Multiple Linear Regression Models

In this study, we set models (2) to (4) for testing hypotheses H1 to H3, with the following model settings:

$$Inv_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \sum \beta_j C_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (2)$$

$$Inv_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 State_{i,t} + \beta_3 ESG_{i,t} \times State_{i,t} + \sum \beta_j C_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (3)$$

$$Inv_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 Media_{i,t} + \beta_3 ESG_{i,t} \times Media_{i,t} + \sum \beta_j C_{i,t} + Industry + Year + \varepsilon_{i,t} \quad (4)$$

Model (2) investigates the direct impact of ESG and Inv. Model (3) tests the role of equity nature in modulating ESG performance and investment efficiency. Model (4) tests the role of media attention in modulating ESG performance and investment efficiency.

4 EMPIRICAL RESULTS AND ANALYSIS

4.1 Descriptive Statistics and Correlation Analysis

In Table 1, the sample corporations generally have inefficiency in investment with significant differences. The mean value of ESG is 4.250, showing that the sample corporate average ESG grades vary from CCC to B, indicating that ESG performance still needs to be improved.

Table 1: Descriptive statistics of major variables.

Variable	Mean	SD	Min	Max
Inv	0.038	0.068	0	2.885
ESG	4.250	1.096	1	8
Age	2.624	0.495	1.099	3.332
Size	22.75	1.325	20.21	26.65
Growth	0.092	0.252	-0.522	1.170
Roa	0.037	0.045	-0.112	0.187

Lev	0.461	0.196	0.069	0.866
Sala	15.56	0.721	13.95	17.55
Hold	0.357	0.151	0.090	0.750
Dboard	0.372	0.0540	0.333	0.571

Table 2 shows the results of a bivariate inter-variate Pearson analysis performed on the variables listed above. The correlation coefficients show that ESG and Inv are highly negatively associated, with a correlation coefficient of -0.078, implying that ESG performance has a favorable influence on corporate investment efficiency. Furthermore, the mean value of VIF across variables is 1.40 and its maximum value is 2.25, which is substantially lower than the reference standard value of 5.

Table 2: Correlation Analysis of major variables.

	Inv	ESG	Age	Size	Growth	Roa	Lev	Sala	Hold	Dboard
Inv	1									
ESG	-0.078 ***	1								
Age	-0.076 ***	0.018 *	1							
Size	-0.089 ***	0.286 ***	0.219 ***	1						
Growth	0.092 ***	0.033 ***	-0.098 ***	0.053 ***	1					
Roa	0.044 ***	0.147 ***	-0.092 ***	-0.024 **	0.213 ***	1				
Lev	-0.063 ***	0.027 ***	0.204 ***	0.526 ***	0.043 ***	-0.386 ***	1			
Sala	-0.028 ***	0.248 ***	0.131 ***	0.532 ***	0.093 ***	0.192 ***	0.179 ***	1		
Hold	-0.026 **	0.074 ***	-0.038 ***	0.243 ***	-0.040 ***	0.090 ***	0.106 ***	-0.052 ***	1	
Dboard	-0.006	0.126 ***	-0.005	0.113 ***	0.005	-0.026 **	0.035 ***	0.043 ***	0.041 ***	1

4.2 Baseline Regression Analysis

In order to better address the issue of omitted variables, improve the estimation accuracy of the model, and represent more information on the form of individual dynamics, this paper uses balanced panel data for a total of nine years from 2012 to 2020. The Hausman test was first performed before the regression analysis, and the result showed a p-value of 0. Therefore, it was decided that the panel regression of the data in this study would adopt a fixed effects model. In

addition, the regressions were clustered at the firm level for standard errors to prevent the impact of aggregation effects on standard errors at the firm level.

Table 3 displays the results of the empirical model's multiple linear regressions. After controlling for industry and year fixed effects, column (1) can be seen that ESG is negatively correlated with Inv, implying that there is a boosting effect of ESG on Inv. Further, column (2) presents the results after adjusting for all control variables, and the ESG regression coefficient is -0.003, implying that corporate ESG performance successfully suppresses its inefficient investment and positively enhances its investment efficiency. As a result, the empirical data support hypothesis H1 of this research.

Table 3: Result of Baseline regression analysis.

	(1)	(2)
ESG	-0.004***	-0.003***
	(0.001)	(0.001)
Constant	0.043***	0.080***
	(0.005)	(0.029)
Controls	NO	Yes
Industry	Yes	Yes
Year	Yes	Yes
N	9684	9684
R ²	0.054	0.067
Adj.R ²	0.047	0.059

The figures in parenthesis represent standard deviations

* p < 0.1, ** p < 0.05, *** p < 0.01

The following are the same

4.3 Endogeneity Test

The baseline regression verifies the boosting effect of ESG on Inv, but this result may be due to the reverse causality brought about by the ability and willingness of the more efficient investment firms to improve their ESG performance. Considering that lagged-period ESG is not susceptible to the reverse effects of current period Inv, this paper re-runs the regression test using ESG with one, two, and three lags (L.ESG, L2.ESG, L3.ESG) as explanatory variables respectively to mitigate the reverse causality. According to the test findings of Table 4, Inv and ESG are considerably negative at the 1% level for each lag, i.e., corporate ESG performance has a longer-term and sustained impact on enhancing corporate investment efficiency. After considering the endogeneity problem, the results of this research remain valid.

Table 4: Result of Endogeneity Test.

	(1)	(2)	(3)
L.ESG	-0.003***		
	(0.001)		
L2.ESG		-0.004***	
		(0.001)	
L3.ESG			-0.003***
			(0.001)

Constant	0.085*** (0.031)	0.092*** (0.035)	0.116*** (0.040)
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	8608	7532	6456
R ²	0.095	0.099	0.100
Adj.R ²	0.086	0.089	0.089

4.4 Robustness Test

This paper refers to the method of Gao et al. (2021)^[2] to reconstruct the explanatory variable ESG2, with ESG2=1 when the ratings are C~CCC, ESG2=2 when the ratings are B~BBB and ESG2=3 when the ratings are A~AAA. After replacing the explanatory variables, columns (1) and (2) of Table 5 shows the results, the significant levels of ESG2 and Inv remain at 1%, which is the same with previous findings, and the test results of hypothesis H1 can be considered robust.

Second, because the 2020 epidemic may have an unanticipated effect on corporate ESG performance, this article omits the sample data from 2020 and re-estimates the link between ESG and Inv using the sample data from 2012 to 2019. Columns (3) and (4) of Table 5 display the regression results, where ESG and Inv remain at the 1% level and the regression results do not change substantially.

Table 5: Result of Robustness Test.

	(1)	(2)	(3)	(4)
ESG2	-0.009*** (0.003)	-0.007*** (0.002)		
ESG			-0.004*** (0.001)	-0.004*** (0.001)
Constant	0.043*** (0.006)	0.088*** (0.028)	0.047*** (0.006)	0.082*** (0.031)
Controls	NO	Yes	NO	Yes
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	9684	9684	8608	8608
R ²	0.054	0.092	0.055	0.093
Adj.R ²	0.047	0.084	0.046	0.084

5 MODERATING EFFECT TEST

5.1 Moderating Effect of Soe

The results of column (1) of Table 6 show that the $ESG \times Soe$ passes the significance test at the 5% level. The moderating impact of Soe on the effect of ESG on Inv is convincingly proven, and hypothesis H2 is tested. Further analysis reveals that the extent to which ESG performance enhances investment efficiency decreases in a state-owned enterprise. The reason for this is that

state-owned corporations bear more responsibilities than non-state-owned corporations for economic development, environmental protection, and promoting social harmony, they may make responsible investments that are not very helpful to the long-term development, while they can achieve higher ESG ratings, it is challenging to increase the enterprise's investment efficiency.

5.2 Moderating Effect of Media

The results in column (2) of Table 6 show that the ESG×Media passes the significance test at the 10% level. It is sufficient to show that Media has a negative moderating effect, and hypothesis H3 is verified. Further research demonstrates that for corporations with high media attention, it has negative effects on the contrary. The reason for this is that the media may focus on negative information about ESG underperforming firms, passive ESG practices may disrupt firms' original investment plans, resulting in more inefficient investments.

Table 6: Moderating Effect Test of external pressure.

	(1)	(2)
ESG	-0.004*** (0.001)	-0.006*** (0.002)
Soe	-0.021*** (0.006)	
ESG×Soe	0.003** (0.001)	
Media		-0.005** (0.002)
ESG×Media		0.001* (0.000)
Constant	0.087*** (0.023)	0.079*** (0.026)
Controls	Yes	Yes
Industry	Yes	Yes
Year	Yes	Yes
N	9684.000	9684.000
R ²	0.070	0.068
Adj.R ²	0.061	0.059

6 CONCLUSION AND RECOMMENDATION

This paper constructs a multiple linear regression model to test the linear relationship of corporate ESG performance and corporate investment efficiency while examining the moderating effect of external pressure that exists between the two. The empirical findings demonstrate that ESG performance significantly improves the effectiveness of corporate investment. The moderating mechanism reveals that external pressure has a significant moderating effect between ESG and Inv, indicating that ESG practices driven by external pressure reduce corporate investment efficiency due to the specificity of the Chinese capital market, resulting in counterproductive effects.

The following suggestions are made in light of the aforesaid results: Firstly, corporations should pay attention to the role of ESG performance in improving investment efficiency, and promote the in-depth application of ESG investment concepts in enterprise investment decisions; Secondly, the government should formulate pertinent policies and regulations to guide corporations in optimizing their investment structures, and should provide them specific incentives or appropriate penalties in terms of tax policies, loan projects, and government bidding projects according to their ESG performance; Thirdly, state-owned corporations should fully consider the degree of emphasis of different indicators in ESG ratings and take multiple measures to improve their investment efficiency. Fourthly, the media should maintain benign and close attention to corporations with insufficient ESG performance, properly play the role of public opinion supervision, maintain the independence of the news industry, and at the same time actively report positive information on the ESG performance.

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