



# The Correlation Between Corporate Profitability and ESG Ratings: Samples from Forestry and Paper Industry

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**Abstract.** Recently, the sustainability and social responsibility of business operation have become more and more important in the criteria to evaluate the value of a company, which cause the environmental, social, and governance (ESG) scores to be valued. This study examined the impact of the ESG score and profitability of the year before on the profitability of Chinese forestry companies, which is weighed by EBIT and ROA, with regression to determine that does ESG score will affect the profitability of forestry corporations or not. The findings suggest that the scores have a significant correlation with the EBIT while all of the scores do not show a significant effect on the ROA. At the same time, the findings also show that the ROA is affected by the ROA in the year before extremely significant, while the influence of the EBIT in the year before to the EBIT in one year later is not as obvious as the effect of the previous ROA generated to the later one.

**Keywords:** ESG, Forestry and Paper Industry, Corporate Profitability.

## 1 Introduction

ESG grading is a method to measure whether firms have social responsibility or not and how responsible they are, which is an important focus for the stockholders [1]. An interview done by Accountingtoday.com with corporate executives and audit partners referred to that ESG may assist corporations to have better performances and earnings [2]. However, there is an observation about carbon emission and of companies and environmental governance pointed out that the opportunities for environmental benefits can be analyzed by social and technological changes but the consideration from firms of it is only a method to present their business leadership [3]. Becchetti et al. (2022) proposed that the S of ESG can affect the welfare of employees and local sustainable development positively [4]. Meanwhile, the Latin Trade Journal (2023) mentioned that a McKinsey report stressed that governance is vital as it enables companies to decide reasonably and govern effectively [5]. In this regard, the basis can be found in the study of D'Amato, D'Ecclesia, and Levantesi (2023) that there does exist a positive impact of ESG on the profitability of firms while it tends to be only firms with relatively high

ESG score can be affected positively [6]. There are also many other researchers investigating whether ESG can help companies to perform better or not. While the former researchers are more focused on corporate profitability with companies in some countries instead of focusing on a specific industry. To find out if ESG indeed contributes to the profitability of companies in some specific fields such as Chinese forestry and paper industry that is not determinate, this study may offer more information on it. This study used EBIT and ROA to measure the profitability and search whether EBIT and ROA in the year before and ESG scores have influences on the EBIT and ROA in the year after or not.

## **2 Method**

### **2.1 Sample**

The samples are Chinese forestry and paper corporations in the accounting period from 2012 to 2022. Their data are selected in the Wind database by searching for whether the companies have ESG ratings and whether their financial indexes are enough and able to be obtained or not. After removing the companies and indexes that cannot be acquired, the number of valid sample companies is 24 and the number of total samples is 264.

### **2.2 Variables**

#### **ESG.**

The ESG rating and its section ratings are evaluated by Huazheng Index Information Service, which is screened from Wind Financial Terminal. These data are the ESG rating and its section ratings from 2012 to 2022, which contain 264 scores in each separate item.

#### **Profitability of corporations.**

The research methodology is adopted by D'Amato, D'Ecclesia, and Levantesi (2023) and Xu and Liu (2023), which used Earnings before Interest and Tax (EBIT) and Return on Assets (ROA) to measure the profitability of companies respectively, and both of them [6] [7]. The former one is to present the earnings of companies directly eliminating the effect of liabilities and taxation of government. At the same time, the latter is to estimate the profits generated by assets of companies, which is more focused on the point of view of how profitable companies can be than Return on Equity (ROE), which tends to consider profitability from the perspective of investors. As the study measures if the ESG score, the EBIT, and ROA a year before having an influence on the EBIT and ROA in the year after, accounting data are selected from 2011 to 2022 and regressed. Table 1 below presents the definition of variables.

**Table 1.** Variable definition.

Type of Variables	Variables	Notations	Variable Definitions
Dependent variable	Corporate profitability	EBIT <sub>i,t</sub>	EBIT = Revenue – Cost of Goods Sold – Operating Expenses
		ROA <sub>i,t</sub>	Earnings / (the average of Total Assets) × 100%
Independent variable	Environment, social, and governance	ESG	Includes more than a hundred indicators with four levels
Independent variable	Environment	E	Includes 5 main criteria
Independent variable	Social	S	Includes 4 main criteria
Independent variable	Governance	G	Includes 5 main criteria
Independent variable	Corporate profitability	EBIT <sub>i,t-1</sub>	EBIT in a year before EBIT <sub>i,t</sub>
		ROA <sub>i,t-1</sub>	ROA in a year before ROA <sub>i,t</sub>

### 2.3 Method design

The following eight formula is the hypothetical relationship between the profitability of corporations and ESG ratings. This study assumes that the profitability in a year can be affected by its sustainability, social responsibility, governance, and profitability in the previous year as the past finance may limits its development in the future.

$$EBIT_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 EBIT_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 EBIT_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 S_{i,t} + \beta_2 EBIT_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 G_{i,t} + \beta_2 EBIT_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_2 ROA_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 ROA_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 S_{i,t} + \beta_2 ROA_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

$$EBIT_{i,t} = \beta_0 + \beta_1 G_{i,t} + \beta_2 ROA_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

The *i* is for different companies, the *t* is for different periods, and the residual  $\varepsilon_{i,t}$  is used to ensure the critical in this model as there probably are some other exogenous variables that are not presented such as overall market performance or the financial accounting standard. ROA and EBIT used to weigh the profitability of companies are

both the explanatory variables and the explained variables decided by the period. This study did a regression of all the data and do another two regressions about the correlation of EBIT and ROA by separating the companies into two parts. The separation method is based on the average ESG score of the companies and divides the two types of companies into two groups.

**2.4 Hypothesis**

Based on the previous research, the result of D’Amato, D’Ecclesia, and Levantesi (2023) that ESG score correlates to EBIT positively in most cases and the finding which done by Xu and Liu (2023) proved that ROA has a significant positive correlation with ESG [6][7]. Although the samples from that research are from the Euro-Stoxx 600 and the Chinese A-share with cultural distance data, their outcome may still have some research basis for the Chinese forestry and paper industry [6][7]. Hence, the following hypothesis are proposed:

H1: ESG has a positive influence on corporate profitability.

H2: The impact from the group of companies with high average ESG scores will have a more significant consequence.

**3 Result**

**3.1 Descriptive statistics**

Table 2 presents some basic statistics of the research variables.

**Table 2.** descriptive statistics.

Variable	Mean	St. Dev	Min	Max	P25	P50	P75
ESG	73.22	5.75	47.8	89.08	69.55	73.8	76.87
E	67.62	8.66	46.8	91.66	61.22	66.98	72.58
S	71.85	9.46	51.43	97.65	64.25	72.34	77.91
G	77.77	7.93	23.87	93.73	74.91	79.31	83.06
EBIT <sub>i,t-1</sub>	10.99	44.84	-250.85	360.61	5.19	7.96	12.3
EBIT <sub>i,t</sub>	11.34	41.99	-184.89	360.61	4.79	7.75	11.6
ROA <sub>i,t-1</sub>	4.51	18.62	-160.11	144.87	2.29	4.39	7.21
ROA <sub>i,t</sub>	4.57	18.18	-160.11	144.87	2.25	4.26	7.04

*the P25, P50, and P75 are the quartiles*

From Table 2, the data shows that the average ESG level in the Chinese forestry and paper companies is medium with a moderate standard deviation that can result from the similar operating methods as they are in the same industry which limited their operation modes and deviate from prevailing patterns. The range of governance levels in these companies is relatively large compared with the environmental and social levels while the standard deviation is the lowest one in the three rating sections, which indicates that though the governance levels of these observed objects have some deviations, most of

the governance levels of the firms tend to be close to each other. For the profitability indexes, data shows that both ROA and EBIT exist that extreme numbers are significantly different from the median and average values, which may imply that the disparity of the profitability of Chinese firms in the forestry and paper industry is large.

### 3.2 The influence of ESG on corporate profitability

#### The influence of ESG on corporate profitability with full data.

As mentioned before, the profitability of a company in the former year may impact profitability in the latter year, which is the reason why this study set former EBIT as the explanatory variable to alleviate its impact on the results that is an attempt to explore whether there is an impact or not ESG may cause to profitability. Meanwhile, the statistical consequences of the coefficient of EBIT in the former year are like each other and most of them impact the EBIT in the later year at a 5% level. The ESG has a strong negative impact on EBIT as presented by the regression result table that every unit increased by ESG score will decrease 1.212 units in EBIT for the companies used to observation. Expect the ESG score, the most significant influence factor is social rating, which also influences EBIT negatively at the 1% level. The negative influence may be because the ESG level of companies in the forestry and paper industry already attained a relatively higher level, which leads to the impact of ESG on firms changing from positive to negative [8].

The following Table 3 and Table 4 are the full statistical consequence of corporate profitability.

**Table 3.** Full regression results of EBIT.

	(1)	(2)	(3)	(4)
	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$
<i>ESG</i>	-1.212*** (-2.74)			
<i>E</i>		-0.618* (-2.08)		
<i>S</i>			-0.747** (-2.77)	
<i>G</i>				-0.371 (-1.14)
$EBIT_{i,t-1}$	0.121* (2.13)	0.112 (1.95)	0.113* (1.99)	0.133* (2.31)
<i>cons</i>	98.75** (3.04)	51.86* (2.54)	63.75** (3.25)	38.77 (1.53)
<i>N</i>	264	264	264	264
$R^2$	0.0391	0.0274	0.0396	0.0163

*t* statistics in parentheses; \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$  and the same follow

**Table 4.** Full regression results of ROA.

	(5)	(6)	(7)	(8)
	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$
<i>ESG</i>	0.168 (0.93)			
<i>E</i>		0.140 (1.17)		
<i>S</i>			0.0320 (0.29)	
<i>G</i>				0.0338 (0.26)
$ROA_{i,t-1}$	-0.377*** (-6.74)	-0.374*** (-6.71)	-0.373*** (-6.68)	-0.374*** (-6.66)
<i>cons</i>	-6.017 (-0.45)	-3.220 (-0.39)	3.956 (0.50)	3.625 (0.35)
<i>N</i>	264	264	264	264
$R^2$	0.142	0.144	0.139	0.139

Independent of the statistical consequence of EBIT, none of the regression results of ROA about ESG ratings shows any statistically significant impact on the ROA of companies. All of the coefficients of ESG ratings to ROA do not fall in the 95% confidence interval which is considered as cannot rely on the explanatory variables and explained variables have significant correlation. Another difference from the consequence of EBIT is that the ROA in the former year has an impact on the ROA in the latter year at 0.1% level which can be assumed that there is a strong correlation between the ROAs. Another difference in the regression of the ROA is in Table 4. When using the ROA to measure corporate profitability, the ESG ratings have a positive correlation to profitability instead of a negative correlation to EBIT in Table 3.

**The influence of ESG on corporate profitability with separated data.**

The following Table 5, Table 6, Table 7, and Table 8 are the separate statistical consequences of corporate profitability.

**Table 5.** The regression results of EBIT for the group with higher average ESG score.

	(9)	(10)	(11)	(12)
	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$
<i>ESG</i>	-0.395 (-0.61)			
<i>E</i>		-0.479 (-1.08)		
<i>S</i>			-0.265 (-0.69)	
<i>G</i>				-0.000276 (-0.00)

$EBIT_{i,t-1}$	0.284** (3.36)	0.269** (3.15)	0.278** (3.27)	0.283** (3.28)
<i>cons</i>	35.50 (0.73)	39.38 (1.27)	25.68 (0.89)	5.910 (0.14)
<i>N</i>	132	132	132	132
$R^2$	0.0677	0.0735	0.0685	0.065

**Table 6.** The regression results of EBIT for the group with lower average ESG score.

	(13)	(14)	(15)	(16)
	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$	$EBIT_{i,t}$
<i>ESG</i>	-2.208*** (-3.38)			
<i>E</i>		-0.632 (-1.50)		
<i>S</i>			-1.246** (-3.10)	
<i>G</i>				-0.649 (-1.55)
$EBIT_{i,t-1}$	-0.0279 (-0.38)	-0.0139 (-0.18)	-0.0222 (-0.30)	-0.00167 (-0.02)
<i>cons</i>	172.2*** (3.68)	55.81* (2.00)	100.8*** (3.58)	63.92* (1.98)
<i>N</i>	132	132	132	132
$R^2$	0.0672	0.00188	0.0550	0.00311

**Table 7.** The regression results of ROA for the group with higher average ESG score.

	(17)	(18)	(19)	(20)
	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$
<i>ESG</i>	0.512* (2.20)			
<i>E</i>		0.0373 (0.24)		
<i>S</i>			0.173 (1.26)	
<i>G</i>				0.362 (1.96)
$ROA_{i,t-1}$	-0.445*** (-5.98)	-0.422*** (-5.63)	-0.427*** (-5.73)	-0.440*** (-5.91)
<i>cons</i>	-33.35 (-1.91)	2.424 (0.22)	-7.823 (-0.76)	-23.56 (-1.61)
<i>N</i>	132	132	132	132
$R^2$	0.214	0.185	0.194	0.208

**Table 8.** The regression results of ROA for the group with lower average ESG score.

	(21)	(22)	(23)	(24)
	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$	$ROA_{i,t}$
<i>ESG</i>	0.0456 (0.15)			
<i>E</i>		0.333 (1.77)		
<i>S</i>			-0.0247 (-0.13)	
<i>G</i>				-0.126 (-0.66)
$ROA_{i,t-1}$	-0.345*** (-4.16)	-0.349*** (-4.28)	-0.343*** (-4.16)	-0.339*** (-4.10)
<i>cons</i>	4.225 (0.19)	-14.29 (-1.15)	9.183 (0.71)	17.07 (1.17)
<i>N</i>	132	132	132	132
$R^2$	0.105	0.126	0.105	0.108

In the statistical consequence of the separated two groups, only the ESG score and S score in Table 6 and ESG score in Table 7 presented significant outcomes at 0.1% level, 1% level, and 5% level respectively, which are from in the group that has lower average ESG score with EBIT to be the index to estimate corporate profitability and the group that has higher average ESG score with ROA to be the index to measure corporate profitability. While the other correlations are not statistically significant.

## 4 Discussion

The consequences of the regression are not fully consistent with the hypothesis this research assumed previously. For the first hypothesis, the outcome is that ESG ratings do not impact corporate profitability positively but have some significant negative correlation with EBIT and a non-significant positive correlation to ROA, which conflicts with much research mentioned before. This finding also is different from the conclusion Liu et al (2023) made, which mentioned that the ESG has a significant positive influence on the profitability of listed companies [9]. The difference can be explained by different chosen accounting indexes and different sample selections. To explain why there is a negative correlation between EBIT and ESG, there may should separate correlation into three aspects. Firstly, as this study chose the forestry and paper industry, consuming environmental sources and energy seems cannot be avoided, which will lead to a lower ESG score with higher earnings. Simultaneously, within a certain range, the larger social welfare consumption, such as lower charity investment and employee benefits, can lead to lower costs and higher profits. Eventually, in some cases, the governance will cause some negative effects on corporate profitability [10]. Additionally, the ROA can be impacted by ESG positively, which is consistent with Xu and Liu (2023),



but not significantly due to though higher ESG can partly represent better sustainability, it is not that obvious in the short term [7].

For the second hypothesis, when using ROA to measure the profitability of companies, the group with a higher average ESG score does have a slightly larger significance, while the consequences with EBIT indexes on the opposite. The difference between it and the research of D'Amato, D'Ecclesia, and Levantesi (2023) tends to be the grouping standard of that research is the ESG score larger than 75 or not [6]. Yet in this study, the grouping standard is the average ESG score of companies, which merely considered the different operation and financial conditions between different companies without containing the unique ESG and financial conditions in separate years in a company and their underlying correlations.

Despite these explanations, the industry of samples may be an influencing factor as well. As mentioned before, the former researchers are more focused on the other industries instead of paying attention to the forestry and paper industry. The different industries may have different operating functions, which probably affects the ESG score and its correlations to corporate profitability as well.

## 5 Conclusion

This study found that the correlation between EBIT and ESG ratings is significantly negative while the correlation between ROA and ESG ratings is positive but not as significant as the former one, which is different from the research mentioned in this article and partly different from the first hypothesis as well. This difference may result in effects on sustainability that cannot be observed in the short term. Moreover, this study also found that after dividing the observation objects into two groups based on the average ESG score of the companies and searching for their separate correlations with EBIT and ROA, the general correlations about positive or not are like the former outcome. However, the level of significance is different from the second hypothesis that the regression used ROA to estimate the profitability does present the group with a higher average ESG score is observed a more significant correlation with ROA while the groups regressed with EBIT showed an opposite result. The difference from the previous research that were completed by others can be explained by different grouping standards. At the same time, the difference between the regression consequences and the hypotheses can be attributed to the difference in industries where samples belong. This study focused on an industry that relatively few researchers focused on, which may offer some new information in the fields relevant to ESG. In future research, the failure without considering the underlying correlations and effects between ESG and financial conditions in different years for different companies should be avoided.

## References

1. Zhao, X., Fang, L. and Zhang, K. (2023) Online search attention, firms' ESG and operating performance. *International Review of Economics and Finance*, 223–236.
2. Cohn, M. (2021) How useful is ESG reporting? <https://search.ebscohost.com/login.aspx?direct=true&db=bsu&AN=153044945&site=eds-live&scope=site>.
3. Trahan, R.T. and Jantz, B. (2023). What is ESG? Rethinking the “E” pillar. *Business Strategy and the Environment*, 32: 4382-4391. doi:10.1002/bse.3371.
4. Becchetti, L., Bobbio, E., Prizia, F. and Semplici, L. (2022) Going Deeper into the S of ESG: A Relational Approach to the Definition of Social Responsibility. *Sustainability (Switzerland)*, 14. doi:10.3390/su14159668.
5. THE POWER OF G: Understanding governance - the G part of ESG - is an unavoidable assignment for CEOs and Boards. (2023) *Latin Trade (English)*, 31: 24–27.
6. D'Amato, V., D'Ecclesia, R. and Levantesi, S. (2023). Firms' profitability and ESG score: A machine learning approach. *Applied Stochastic Models in Business and Industry*, doi:10.1002/asmb.2758.
7. Xu, X. and Z. Liu. (2023) ESG, Cultural Distance and Corporate Profitability: Evidence from Chinese Multinationals. *Sustainability (Switzerland)*, 15. doi:10.3390/su15086771.
8. Zhou, R., Hou, J. and Ding, F. (2023) Understanding the nexus between environmental, social, and governance (ESG) and financial performance: evidence from Chinese-listed companies. *Environmental Science and Pollution Research*, 30: 73231-73253.
9. Liu, Q., Yang, S., Lin, C. and Liu, W. (2023). Research on the impact of ESG performance on the profitability of listed forestry companies. *China Forestry Economy*, 1: 137–143.
10. Mensah, L. and Bein, M.A. (2023) Sound Corporate Governance and Financial Performance: Is There a Link? Evidence from Manufacturing Companies in South Africa, Nigeria, and Ghana. *Sustainability (Switzerland)*, 15. doi:10.3390/su15129263.

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