

Analysis of the Impact of ESG on Financial Performance

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Abstract. With the development of the economy and society, the relationship between enterprises and the environment has received widespread attention. In the context of the deeply rooted concept of sustainable development, the relationship between ESG and corporate financial performance has become a focus of current financial research. Therefore, this article collected relevant data on the S&P 500 index and ESG for in-depth research. Specifically, financial data includes stock returns, P/E ratios, and earnings per share, while ESG data includes ESG risk ratings and ESG controversies. The empirical results indicate that, firstly, there is no significant correlation between ESG performance and returns; Secondly, there is a significant negative correlation between ESG and PE and EPS. The relevant results of this study have played a certain auxiliary role in deepening the understanding of the relationship between ESG and corporate financial performance.

Keywords: ESG; financial performance; PE; EPS.

1. Introduction

“ESG,” which stands for Environment, Social, and Governance, has been the center of discussion in the 21st century as human activities continuously caused damage to the planet Earth, especially after the Industrial Revolution. The formalized integration of ESG factors into investment and corporate decision-making began to gain traction in the early 2000s [1]. A company’s financial performance is crucial for financial statements analysis and long-term planning, on which a company is obligated to monitor and focus [2]. While the financial performance is influenced by many factors, such as the management system and the marketing strategy, ESG, a relatively new concept that people recently added to the analysis on firms, plays an important but controversial role on a firm’s performance [3-5]. This study analyzes the correlation between companies’ ESG risks as well as controversies and the financial indicators in the stock market to testify whether ESG contributes to the financial performance of companies.

2. Data

The sample is acquired from the S&P 500 Index. The stock information are extracted from Google Finance; and the ESG data-ESG risk score and ESG controversy score, are provided by Sustainalytics [6]. The ESG risk score represents the ESG factors that is harmful to a company’s performance and the ESG controversy score represents the current debate over a company’s ESG performance; a high ESG risk score or controversy means a weaker ESG performance. The ESG risk score and ESG controversy score are measurements of the ESG performance of a company, and the return, price-to-earnings ratio, and earnings per share are aimed at evaluating financial performance. The ESG data has a time frame of December 30, 2022, to Jan 31, 2023, and the stock price returns are six months after the ESG data to evaluate the predictability of the correlation [6]. The original dataset contains 503 unique sets of values corresponding to all the companies in the S & P 500 Index. Upon checking the reliability of the data, 70 companies that are not assigned an ESG rating and 35 companies that are not assigned a price-to-earnings ratio have been removed from the dataset. Within the 398 companies left in the sample, four of them, Booking Holdings Inc., Chipotle Mexican Grill Inc, Nvr Inc., Broadcom Inc., and Mettler Toledo International have extremely high or low (Mettler Toledo) return (>0.5 or <0.25), and Wynn Resorts Ltd and Molson Coors Beverage Co B have extremely high price to earnings ratio (>300), which would potentially influence the accuracy of the models. After

removing the seven companies with extreme values, 391 sets of unique data are left in the dataset. The attributes of the data are listed in Table 1.

Table 1. Summary of data.

	Total ESG risk rating	ESG controversy score	Normalized return	Environmental risk score	Social risk score	Governance risk score	PE	EPS (normalized)
Mean	21.49	1.87	0.021	5.69	9.06	6.72	26.29	0.053
Std.dev	(7.27)	(0.94)	(0.065)	(5.38)	(3.84)	(2.24)	(23.69)	(0.037)

3. Method

The study uses linear regression to examine the correlation between total ESG risk rating, three branches of ESG risk rating-environmental risk score, social risk score and governance risk score, ESG controversy score, and stock prices, price-to-earnings ratios, and earnings per share. The return is normalized regarding the S&P 500 and the EPS is normalized regarding the stock price.

$$\text{Normalized Return} = \frac{\text{Stock Price at time 2} - \text{Stock Price at time 1}}{\text{S\&P at time 2} - \text{S\&P at time 1}}, \quad (1)$$

$$\text{Normalized EPS} = \frac{\text{EPS at time 2} - \text{EPS at time 1}}{\text{Stock Price at time 2} - \text{Stock Price at time 1}} \quad (2)$$

The study mainly adopts linear models $f(x) = kx + b$ and the regressions are drawn in graphs with the dot plots. In the traditional view, a lower ESG risk rating and a lower ESG controversy score would both contribute to better company performance, which means a higher return, a higher price-to-earnings ratio, and higher earnings per share.

4. Result

The correlation and the dot plot between the ESG risk rating and the normalized return are shown in Table 2 and Fig. 1. Even though the regression suggests a negative correlation, the slope coefficient is not statistically significant ($p=0.39$). Therefore, the ESG risk is not significantly correlated with the financial performance based on this sample.

Table 2. Regression of normalized return on ESG risk rating.

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG total risk)	21.5926	0.3861	<2e^-16
Return	-4.9314	5.6922	0.387
Residual standard error: 7.275 on 389 degrees of freedom			
Multiple R-squared: 0.001926		Adjusted R-squared: -0.00064	
F-statistic: 0.7505 on 1 and 389 DF, p-value: 0.3868			

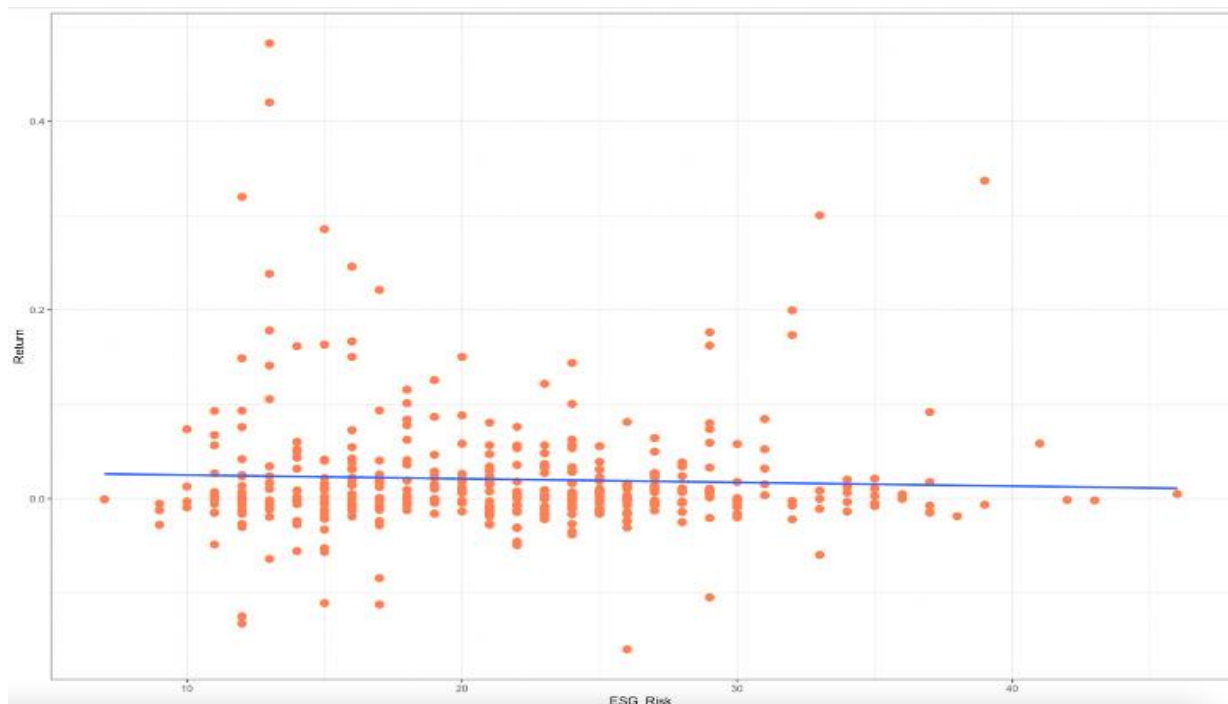


Fig 1. Dot plot of normalized return on ESG risk rating.

In order to verify the credibility of using the normalized return instead of numerical growth, the regression of ESG risk rating on the non-normalized return is added to the comparison (Table 3). Although the regression on the normalized data is not significant to prove the hypothesis, the new regression is even more inaccurate if the returns are not normalized ($P=0.82 > 0.39$). The R-squared and F scores are also even smaller, which means less data are interpreted ($R\text{-squared}=0.0001 < 0.002$, $F=0.048 < 0.75$). Hence, it is more advised to use normalized returns regardless of the inaccuracy in both situations.

Table 3. Regression of non-normalized return on ESG risk rating.

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG total risk)	21.4669	0.3844	<2e^-16
return	0.4409	2.0112	0.827
Residual standard error: 7.282 on 389 degrees of freedom			
Multiple R-squared: 0.0001235		Adjusted R-squared: 0.8266	
F-statistic: 0.04806 on 1 and 389 DF, p-value: 0.8266			

Table 4 and Fig. 2 displays the linear regressions of the ESG controversy on the normalized return. Similar to the result for ESG risk rating, there is a negative correlation, but which is not statistically significant ($p=0.23$).

Table 4. Regression of normalized return on ESG controversy.

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG controversy)	1.88515	0.04975	<2e^-16
Return	-0.88132	0.73344	0.23
Residual standard error: 0.9374 on 389 degrees of freedom			
Multiple R-squared: 0.003698		Adjusted R-squared: 0.001137	
F-statistic: 1.444 on 1 and 389 DF, p-value: 0.2302			

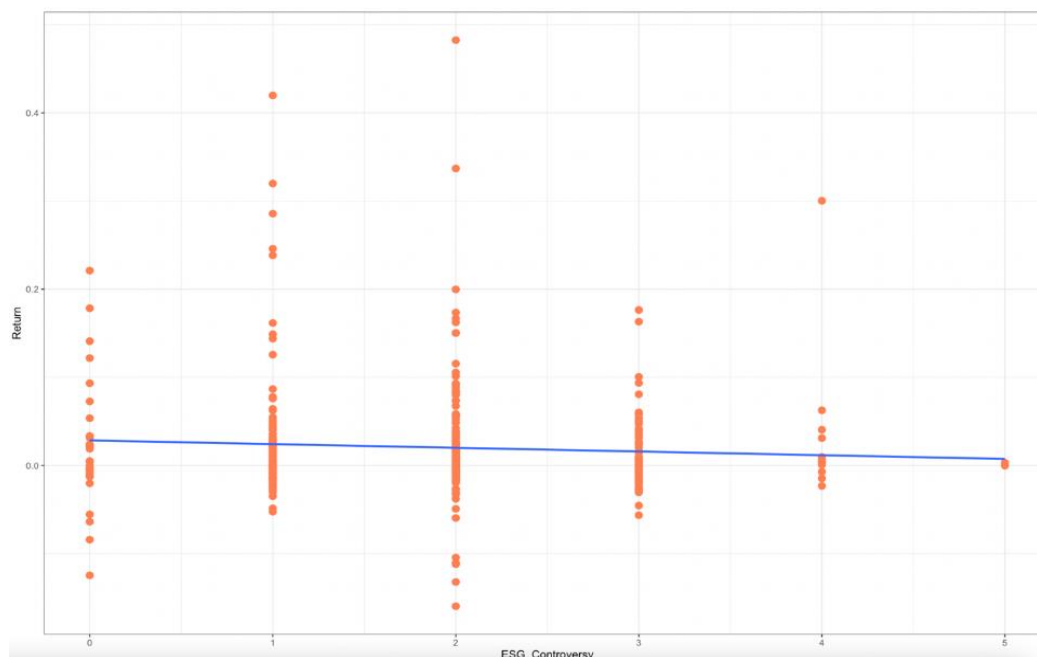


Fig 2. Dot plot of normalized return on ESG controversy.

On the contrary, the correlation between ESG risk rating, ESG controversy, PE, and EPS is significant, which is shown in Table 5-8. As the hypothesis states, both the ESG risk rating and the ESG controversy have significant negative correlations with the price-to-earnings ratio ($p < 0.05$). However, both ESG data have positive correlations with earnings per share ($p < 0.05$). As all four R-squared are smaller than 0.1, it is possible to have faulty results for the weak correlations.

Table 5. Regression of PE on ESG risk rating.

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG total risk)	23.33497	0.53597	<2e^-16
PE	-0.07013	0.01515	5.03e^-6
Residual standard error: 7.089 on 389 degrees of freedom			
Multiple R-squared: 0.05219		Adjusted R-squared: 0.04976	
F-statistic: 21.42 on 1 and 389 DF, p-value: 5.03e^-6			

Table 6. Regression of PE on ESG controversy

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG controversy)	2.073038	0.069595	<2e^-16
PE	-0.007836	0.001968	8.13e^-05
Residual standard error: 0.9205 on 389 degrees of freedom			
Multiple R-squared: 0.03918		Adjusted R-squared: 0.03671	
F-statistic: 15.86 on 1 and 389 DF, p-value: 8.133e^-5			

Table 7. Regression of EPS on ESG risk rating

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG total risk)	18.2308	0.6167	<2e^-16
EPS	61.0395	9.5033	3.9e^-10
Residual standard error: 6.924 on 389 degrees of freedom			
Multiple R-squared: 0.09588		Adjusted R-squared: 0.09356	
F-statistic: 41.25 on 1 and 389 DF, p-value: 3.904e^-10			

Table 8. Regression of EPS on ESG controversy.

Coefficients:			
	Estimate	Std. Error	Pr(> t)
(ESG controversy)	1.59062	0.08189	<2e^-16
EPS	5.17465	1.26197	5.02e^-5
Residual standard error: 0.9195 on 389 degrees of freedom			
Multiple R-squared: 0.04143		Adjusted R-squared: 0.03897	
F-statistic: 16.81 on 1 and 389 DF, p-value: 5.023e^-5			

Due to the insignificance of the regressions, Table 9 displays the segmented coefficients to test whether one or more of the three sub-components of the total ESG risk-environmental risk, social risk and governance risk-influence each financial indicator significantly. Furthermore, each segment is divided into two parts by the mean to test if the risk level serves as a factor that influence the precision of the regression. The p-values are shown in the parenthesis.

Table 9. Segmented Coefficients.

		Return	PE	EPS
ESG Risk Total	All	-4.93(0.39)	-0.070(<0.01)	61.04(<0.01)
	High	12.54(0.07)	-0.018(0.45)	18.33 (0.02)
	Low	-1.41(0.65)	-0.018(0.03)	20.86(0.02)
Environmental	All	-4.33(0.30)	-0.042(<0.01)	6.67(<0.01)
	High	-10.46(0.16)	-0.085(<0.01)	30.50(<0.01)
	Low	1.19(0.4)	0.004(0.23)	-8.50(0.01)
Social	All	1.39(0.65)	-0.019 (0.02)	12.87(0.01)
	High	10.98(<0.01)	0.007(0.55)	-4.42(0.38)
	Low	0.52(0.79)	-0.012(0.02)	13.60(<0.01)
Governance	All	-1.58(0.38)	-0.009(0.07)	12.49(<0.01)
	High	2.20(0.4)	-0.014 (0.09)	6.64(0.049)
	Low	0.80(0.34)	0.001 (0.55)	-0.17(0.93)
Controversy	All	-0.88(0.23)	-0.008(<0.01)	5.17(<0.01)
	High	0.83 (0.41)	0.002 (0.44)	1.25 (0.3)
	Low	-0.62 (0.26)	-0.006 (<0.01)	4.72(<0.01)

5. Discussion

One major problem in this study is the insignificant regression between ESG data and the return. Except for biases, another potential explanation is the random walk theory, which states that the stock price of a company totally represents its intrinsic value and is independent of the previous price in an efficient market and no additional analysis is useful unless new information is given [7]. Therefore, the correlation between ESG and the stock return could be random and invalid. However, the PE ratio and EPS are significant for evaluation regarding all dependent variables.

The price-to-earnings ratio is one of the major data to estimate the cost of equity capital and can reflect the market's expectation of future growth and firm risk [8]. The negative correlations between ESG risk rating, ESG controversy, and PE ratio favor the ESG supporters as companies save from costs and investors gain trust. Evaluating by segment, companies with lower ESG risks and controversies have relatively higher significance on the conclusion ($p < 0.01$).

Earnings per share represents the company's earnings (net of taxes and dividends on preferred stocks) for each share of stock, which represents the share value [9]. The positive correlations indicate that a company with higher ESG risk and controversy makes more profits. One potential reason is that ESG imposes more limitations on company operations [10]. Nevertheless, PE and EPS should follow the same pattern since they are both indexes for the intrinsic value of the company. On one

hand, there is an inherent limitation for EPS, which might fail to represent the real value of shares [11]. On the other hand, the low R-squared for all regressions could cause the result to be vague.

6. Conclusion

In conclusion, the insignificance of return, the inconsistency of the PE ratio and EPS as well and the low R-squared make it nearly impossible to generate a clear conclusion. However, the uncertainty confirms the chaotic conclusions of previous researchers, including the uncertain direction of the influence of ESG controversy, and the lack of correlation between economic impact and ESG ratings. Such phenomenon also rationalized the debate over ESG investing. While sustainability is a long-term concept, it is hard to judge the correctness of either ESG regulations in the government perspective or the ESG investing strategies in the financial perspective. Hence, it is important for investors to be alarmed and cautious as they make investment decisions by ESG performance.

There are also limitations to this study. Firstly, this study lacks external validity and cannot be generalized. The sample in this study only focuses on the S&P companies, which are large companies only in the United States. The datasets exclude medium and small companies which might have different traits, international companies which might have different government policies and financial environments, etc. Additionally, the lack of an official and uniformed ESG rating system might lead to arbitrary bias before ratings by all organizations are compared. Besides, the segmentation of high and low based on the mean might be invalid as not all the data are spread evenly. A more systematic segmentation method should be adopted. At least the above-mentioned limitations deserve future investigations.

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