



AN ANALYSIS OF THE RELATIONSHIP BETWEEN ESG SCORES AND STOCK RETURNS

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ABSTRACT

This study explores the link between ESG scores and stock returns for US companies using data from Bloomberg. Linear regression models reveal positive correlations between ESG scores and market capitalization and profit margins. However, higher ESG scores are associated with lower stock returns. Environmental and social scores are more significant predictors of returns than governance scores. These findings underscore the importance of considering ESG factors in investment decisions and offer insights for investors, companies, and policymakers.

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Introduction

In the contemporary business landscape, the concept of **Environmental, Social, and Governance (ESG)** has gained significant traction. This is primarily due to the increasing recognition of the role businesses play in societal development and environmental conservation. The ESG scores of a company are a comprehensive measure of a company's performance in these three critical areas.

The importance of ESG scores to stock returns is rooted in the idea that companies with high ESG scores are more likely to be sustainable in the long run (Mario La Torre, 2020)¹. These companies are often seen as better equipped to manage environmental risks, maintain good relationships with their stakeholders, and adhere to the highest standards of corporate governance. All these factors can contribute to a company's financial performance and, consequently, its stock returns.

The prominence of ESG investing has been on the rise, with more investors now considering ESG factors in their investment decisions. This trend is driven by the growing awareness of the potential risks and opportunities associated with ESG issues. Investors are increasingly recognizing that companies with strong ESG practices may offer better long-term returns and lower risk profiles.

The interest in this research problem stems from the desire to understand the relationship between ESG scores and stock returns better. Given the increasing importance of ESG factors in investment decisions, understanding this relationship can provide valuable insights for investors. Moreover, this research could also contribute to the ongoing discourse on the role of businesses in addressing environmental and social challenges.

This research will focus on US companies, given the country's significant role in the global economy and its diverse and dynamic corporate sector. The findings of this research could have important implications for investors, companies, and policymakers in the US and beyond.

In conclusion, this research aims to shed light on the impact of ESG scores on stock returns, a topic of increasing relevance in today's business world. It is hoped that the findings will contribute to a deeper understanding of the role of ESG factors in financial performance and inform investment strategies that align financial returns with environmental, social, and governance objectives.

Data

For this analysis, we have used data from the Bloomberg terminal.

The main concern when it comes to data collection for our research is with respect to the ESG scores themselves. Various prominent organizations such as MSCI, Bloomberg, S&P Global, all calculate ESG metrics for US companies. Naturally, variance arises in these scores because of the subjectivity of the problem at hand. For this research, we have sought the Bloomberg BESG scores because they employ a rigorous analytical approach to measuring the scores.²

These ESG scores are further divided into the three namesake categories: Environmental score, Social score and Governance score. All scores range from 0 to 10, with unimodal distributions. (Fig. 1).

¹ (Mario La Torre, 2020)

² Refer to Bloomberg's white paper on how the BESG scores are calculated

<https://hr.bloomberglia.com/data/files/Pitanja%20i%20odgovori%20o%20Bloomberg%20ESG%20Scoreu.pdf>

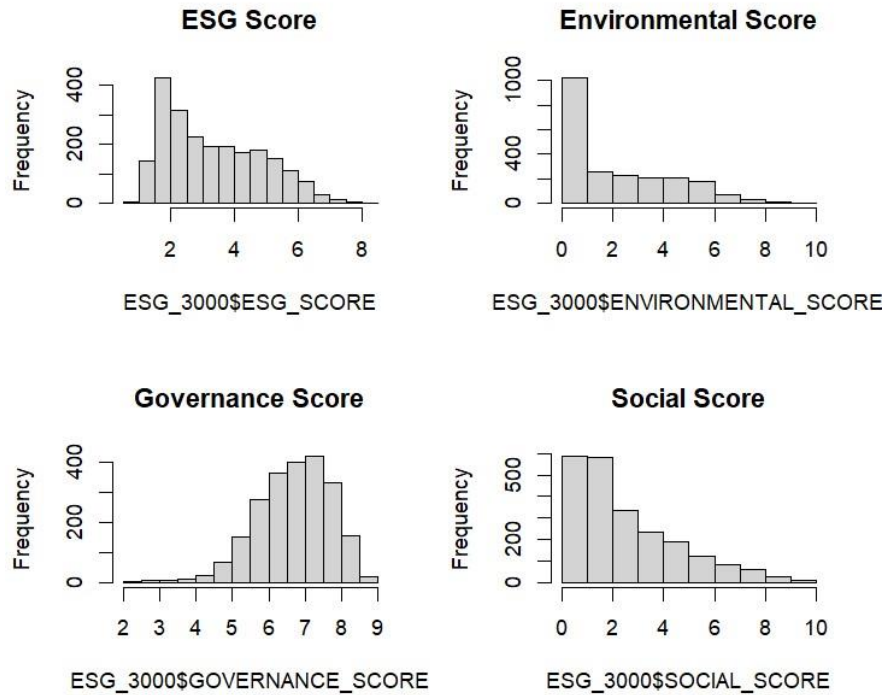


Fig. 1: Frequency distributions of ESG scores

Now, in order to make a linear regression model for stock returns, we also considered fundamental financial data for companies, including market cap, sales, D/E ratio, P/E ratio, and profit margins.

So, our final variables include:

- r* : Total annual stock returns for 1 year
- env* : Bloomberg Environmental Score
- soc* : Bloomberg Social Score
- gov* : Bloomberg Governance Score
- mcap* : Current market capitalisation
- pm* : Profit margin
- pe* : Price-to-equity ratio
- de* : Debt-to-equity ratio

Exploratory data analysis

The exploratory data analysis began with the examination of the number of observations where the environmental and social scores were zero, which could potentially indicate missing or incomplete data. The summary statistics for the current market capitalization of the companies were also calculated, revealing a wide range from 34 million to 3.15 trillion.

To better understand the relationship between ESG scores and other variables, scatter plots were created. These plots showed a somewhat positive linear pattern between ESG scores and the natural logarithm of the market capitalization. This suggests that larger companies tend to have higher ESG scores. (De Pasquale & Cella, 2023)³

³ (De Pasquale & Cella, 2023)

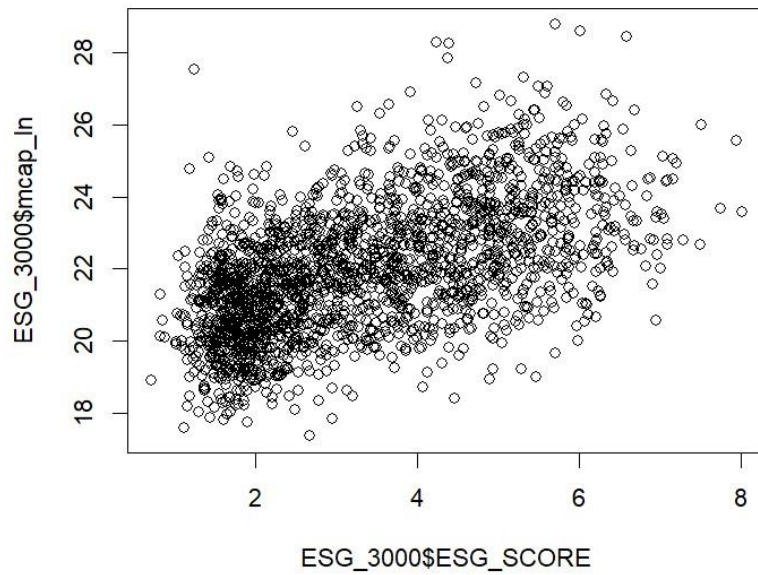


Fig. 2: Scatterplot between ESG score and Market cap

The analysis also explored the relationship between ESG scores and profit margin. An outlier in the profit margin data was identified and addressed using a winsorization technique. The correlation between ESG scores and profit margin was found to be slightly positive⁴. (Wu, 2022)

Finally, the analysis involved the transformation of the price-to-earnings (PE) ratio and debt-to-equity (DE) ratio using a custom logarithmic function. This was done to manage the skewness in these variables and make their distributions more symmetrical for further analysis.

In conclusion, the exploratory data analysis provided valuable insights into the data and set the stage for the subsequent stages of the research. It highlighted the importance of data cleaning and transformation, and the potential relationships between ESG scores and key financial indicators.

Multicollinearity

One of the necessary conditions for running OLS on a regression model is that the independent variables be uncorrelated with respect to each other. In order to check this, we create a correlation matrix and use a maximum Variance Inflation Factor⁵ of 2.5.

⁴ (Wu, 2022)

⁵ $VIF = 1/(1 - \text{Correlation Coefficient})$

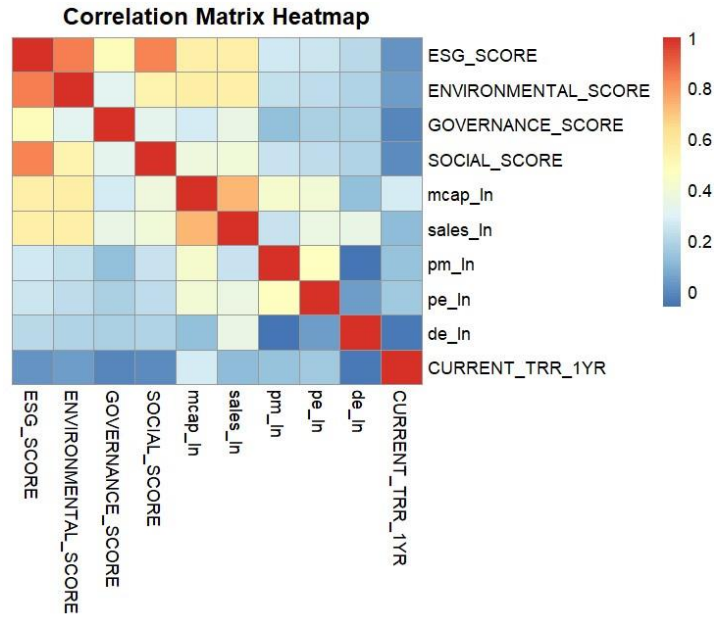


Fig. 3 : Correlation matrix

As can be seen in Fig. 2, the following pairs of variables are highly correlated with each other:

1. Market cap and sales
2. Overall ESG score with all individual E, S and G scores

So, for our further analysis, we remove sales as an independent variable since much of that information is conveyed by the market cap as well.

Moreover, we decide to use the three individual scores rather than the overall ESG score.

Model development

Our initial model is a simple linear regression model as follows:

$$r_i = \alpha + \beta_{env} env_i + \beta_{soc} soc_i + \beta_{gov} gov_i + \beta_{pm} pm_i + \beta_{mcap} \ln mcap_i + \beta_{pe} \ln pe_i + \beta_{de} \ln de_i + \varepsilon_i$$

$$\varepsilon_i \sim N(0, \sigma^2)$$

Model 1

<i>Adjusted R-squared</i>	11%
<i>Residual standard error</i>	53.25
<i>p-Value for F-test</i>	2.2E-16

	<i>Estimate</i>	<i>Std. error</i>	<i>p-Value</i>
<i>(Intercept)</i>	-228.08	20.76	0.00
<i>ENVIRONMENTAL_SCORE</i>	-2.29	0.71	0.00
<i>GOVERNANCE_SCORE</i>	-2.27	1.26	0.07
<i>SOCIAL_SCORE</i>	-1.64	0.70	0.02
<i>mcap_ln</i>	13.46	1.08	0.00
<i>sales_ln</i>	-3.98	0.99	0.00
<i>pm_ln</i>	-0.68	1.07	0.53
<i>pe_ln</i>	3.27	0.89	0.00
<i>de_ln</i>	-0.83	0.76	0.28

Fig. 4: OLS regression results for Model 1

Since GOVERNANCE_SCORE, pm_ln and de_ln, all are found to be insignificant at a 95% confidence level, in explaining stock returns, it is best to exclude them from the model and then respecify it. This will help in reducing the complexity of the model and getting more reliable inferences for the rest of the variables.

In order to check whether the innovations for the model are heteroskedastic, we use the Breusch-Pagan test with

H_0 : Innovations are homoscedastic

H_A : Innovations are heteroskedastic

The p-value for this test is 0.0007, meaning we can strongly reject the null. Therefore, we can infer that the innovations for our model are heteroskedastic. These affect the standard errors of our coefficient estimates. So, it is better to calculate robust standard errors for our model to make inferences.

Results

$$r_i = \alpha + \beta_{env} env_i + \beta_{soc} soc_i + \beta_{mcap} \ln mcap_i + \beta_{pe} \ln pe_i + \varepsilon_i$$

$$\varepsilon_i \sim N(0, \sigma^2)$$

Model 2

<i>Adjusted R-squared</i>	11%
<i>Residual standard error</i>	53.24
<i>p-Value for F-test</i>	2.2E-16

	<i>Estimate</i>	<i>Std. error</i>	<i>p-Value</i>
<i>(Intercept)</i>	-243.44	18.28	0.00
<i>ENVIRONMENTAL_SCORE</i>	-2.40	0.71	0.00
<i>SOCIAL_SCORE</i>	-1.97	0.69	0.00
<i>mcap_ln</i>	13.53	1.01	0.00
<i>sales_ln</i>	-4.51	0.91	0.00
<i>pe_ln</i>	3.04	0.83	0.00

Fig. 5: OLS regression results for Model 2

To robustly confirm whether the ES scores are actually significant, we run a joint F-test using the `linearHypothesis` function in R.

With the

$$H_0: \beta_{env} = 0 \text{ \& } \beta_{soc} = 0$$

$$H_A: \text{At least one of } \beta_{env} \text{ and } \beta_{soc} \text{ is not zero}$$

A p-value of 9.642e-07 is returned, confirming that the Environmental score and Social score are of significance when it comes to explaining stock returns.

We also run an F-test for our 3rd ESG variable, the Governance score with the following hypotheses:

$$H_0: \beta_{gov} = 0$$

$$H_A: \beta_{gov} \neq 0$$

A p-value of 0.085 is returned. So, with 95% confidence level we can't reject the null that governance scores are insignificant in this model.

Conclusion

The primary conclusion of our research is that ESG scores do matter when explaining stock returns. However, it is important to note that ESG scores have a negative coefficient when it comes to stock returns, indicating an inverse relationship. This suggests that as ESG scores increase, stock returns decrease, and vice versa.

The research also led to several other conclusions:

- Environmental and social scores tend to be more significant than Governance scores in predicting stock returns. This implies that the environmental and social aspects of a company's operations may have a more substantial impact on its financial performance than its governance practices.

The research confirms existing literature on the topic, indicating that firms with higher market capitalizations tend to have higher ESG scores. This relationship was found to have a correlation of 55%.

The relationship between ESG scores and profit margins is also slightly positive, with a correlation of 28%. This suggests that companies with higher ESG scores may also have higher profit margins.

In conclusion, this research provides valuable insights into the role of ESG scores in predicting stock returns. It underscores the importance of considering ESG factors in investment decisions and highlights the potential financial implications of a company's ESG practices. As the prominence of ESG investing continues to grow, these findings could have significant implications for investors, companies, and policymakers alike.

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