



Sustainability and Shareholder Value: Exploring ESG-Stock Return Dynamics in the S&P500 and STOXX 600

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Title: Sustainability and Shareholder Value: Exploring ESG-Stock Return Dynamics in the S&P500 and STOXX 600

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Abstract

The interaction between Environmental, Social, and Governance (ESG) performance and stock returns has increasingly garnered attention amid evolving regulatory frameworks and market expectations. This thesis investigates the bidirectional relationship between ESG scores and stock returns in the S&P500 and STOXX600 indices, focusing on regional and temporal variations. The findings reveal that higher ESG scores are associated with a short-term trade-off in stock returns, reflecting regulatory and societal pressures. Conversely, stock returns have a significant negative effect on ESG performance, indicating that firms prioritizing higher financial returns may reduce their focus on sustainability initiatives. Firm-specific characteristics, such as size and leverage, play critical roles in shaping ESG outcomes but exhibit nuanced regional dynamics. This research underscores the complexities and trade-offs in aligning financial performance with sustainability initiatives. It provides valuable insights into corporate strategy and investment behavior within the evolving ESG landscape.

Key-words: Environmental, Social, and Governance (ESG), Sustainability Metrics, ESG Ratings, Sustainability Trade-offs, STOXX600, S&P500

Título: Sustentabilidade e valor para os acionistas: Explorando a dinâmica do retorno das ações ESG no S&P500 e no STOXX600

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Resumo

A interação entre o desempenho ambiental, social e de governança (ESG) e os retornos das ações tem ganhado cada vez mais atenção em meio à evolução dos marcos regulatórios e das expectativas do mercado. Esta tese investiga a relação bidirecional entre as pontuações ESG e os retornos das ações nos índices S&P500 e STOXX600, com foco nas variações regionais e temporais. Os resultados revelam que pontuações ESG mais altas estão associadas a um trade-off de curto prazo nos retornos das ações, refletindo pressões regulatórias e sociais. Por outro lado, os retornos das ações têm um efeito negativo significativo sobre o desempenho ESG, indicando que empresas que priorizam retornos financeiros mais elevados podem reduzir seu foco em iniciativas de sustentabilidade. Características específicas das empresas, como tamanho e alavancagem, desempenham papéis cruciais na formação dos resultados ESG, mas apresentam dinâmicas regionais diferenciadas. Esta pesquisa destaca as complexidades e os trade-offs envolvidos em alinhar o desempenho financeiro com iniciativas de sustentabilidade. Ela oferece insights valiosos sobre a estratégia corporativa e o comportamento de investimento no cenário em constante evolução do ESG.

Palavras-chave: Environmental, Social, and Governance (ESG), Métricas de Sustentabilidade, Classificações ESG, Trade-offs de Sustentabilidade, STOXX600, S&P500

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Table of Contents

Abstract.....	i
Resumo	ii
Acknowledgments.....	iii
1. Introduction.....	1
2. Literature Review.....	3
3. Data and Methodology.....	5
3.1 Data Sources and Description	5
3.1.1 ESG Scores.....	5
3.1.2 Stock Return Data	5
3.1.3 Variables Used in the Analysis	6
3.2 Methodology	7
3.2.1 Research Design.....	7
3.2.2 Regression Models	7
3.2.3 Data Transformation and Preprocessing	8
3.2.4 Statistical Tests and Validation	8
3.2.4.1 Fixed-Effects Versus Random-Effects Model Selection	9
3.2.4.2 Heteroscedasticity Testing	9
3.2.4.3 Granger Causality Tests	10
4. Results.....	12
4.1 Descriptive Statistics	12
4.2 Correlation Matrix.....	15
4.3 Influence of Stock Return on ESG-Score	19
4.3.1 Results within the S&P500 Constituents	19
4.3.2 Results within the STOXX600 Constituents.....	22
4.3.3 Comparison between S&P500 and STOXX600	25
4.4 Influence of ESG-Score on Stock Return	25
4.4.1 Results within the S&P500 Constituents	25
4.4.2 Results within the STOXX600 Constituents.....	28
4.4.3 Comparison between the European and American Markets	31
5. Conclusion	32
Bibliography	34

List of Tables

Table 1 - Pooled Granger Causality Results in the S&P500 Sample	11
Table 2 - Pooled Granger Causality Results in the STOXX600 sample	12
Table 3 - Descriptive Statistics S&P500.....	13
Table 4 - Descriptive Statistics STOXX600.....	14
Table 5 - Correlation Matrix S&P500	16
Table 6 - Correlation Matrix STOXX600.....	18
Table 7 - Impact of Financial Variables on ESG Scores in S&P500 Firms	20
Table 8 - Impact of Lagged Financial Variables on ESG Scores in S&P500 Firms	21
Table 9 - Impact of Financial Variables on ESG Scores in STOXX600 Firms	23
Table 10 - Impact of Lagged Financial Variables on ESG Scores in STOXX600 Firms	24
Table 11 - Impact of Financial Variables on Stock Return in S&P500 Firms	26
Table 12 - Impact of Lagged Financial Variables on Stock Return in S&P500 Firms	28
Table 13 - Impact of Financial Variables on Stock Return in STOXX600 Firms.....	30
Table 14 - Impact of Lagged Financial Variables on Stock Return in STOXX600 Firms.....	31

List of Appendices

Appendix A - Table of Variables	iv
Appendix B - Graph of unique Companies with ESG Scores each Year in the S&P500.....	v
Appendix C - Graph of avg. ESG scores and Stock Returns over time in the S&P500	v
Appendix D - Graph of unique Companies with ESG Scores each Year in the STOXX600....	vi
Appendix E - Graph of avg. ESG scores and Stock Returns over time in the STOXX600	vi

Introduction

The global ESG landscape has developed and evolved dramatically over the last few years. In its research Bloomberg Intelligence found that ESG assets under management (AUM) around the globe reached \$30 trillion in 2022 and are expected to grow to over \$40 trillion by 2030, thus, making up for more than 25% of the global AUM. Despite geopolitical risks and the expectations of the lower growth rate, the ESG industry is growing up. Europe remains at the forefront as the biggest giver with ESG assets predicted to reach more than \$18 trillion by 2030 while the U. S. market is expected to grow at a slower rate due to political rivalry and supported market by dominance. Notably, 85% of surveyed investors believe ESG integration leads to better returns and more resilient portfolios, underscoring its value in modern financial strategies (Bloomberg, 2024).

The rising focus on sustainability is evident in the increased ESG reporting across both the United States and Europe. Despite political resistance, U.S. companies have significantly improved their ESG disclosures. By September 1, 2024, 82.6% of S&P500 firms had published workforce diversity data, a sharp rise from just 5.3% in 2019. Similarly, greenhouse gas emissions disclosures increased from 54% in 2019 to 85% by the end of 2023 (Reuters, 2024). In Europe, the STOXX 600 companies are subject to the European Union's Corporate Sustainability Reporting Directive (CSRD), which mandates comprehensive ESG reporting for large firms and listed SMEs starting in 2024. This regulatory framework aims to enhance transparency and comparability of ESG data, further strengthening Europe's position as a leader in sustainability (European Commission, 2024). These developments signal a broader shift towards transparency and accountability, driven by investor demands, regulatory changes, and evolving stakeholder expectations.

ESG considerations are now a foundation of modern investment strategies, highlighting their crucial role in achieving sustainability and driving long-term value. Investors, policymakers, and firms increasingly prioritize ESG performance, not only to address pressing global challenges like climate change and social inequality but also to align with stakeholder expectations and regulatory pressures (Bassen et al., 2015).

Motivated by these developments, this thesis investigates the bidirectional relationship between ESG scores and stock returns for companies listed on the S&P 500 and STOXX 600 indices. Specifically, it seeks to answer two critical research questions:

1. Does a company's ESG performance impact its subsequent stock returns?

2. Do stock returns influence changes in a company's ESG performance?

While existing literature has mainly examined the influence of ESG performance on stock returns, this study also researches the reverse relationship, emphasizing how stock returns may drive ESG initiatives. The analysis incorporates lagged specifications to capture potential causal relationships and delayed effects, addressing a significant gap in the field. This approach also acknowledges the roles of ESG visibility and reverse causality highlighted in prior research. Furthermore, the comparative analysis of the S&P500 and STOXX600 allows for a deeper understanding of regional differences in the ESG-financial performance dynamic. Particularly in light of variations in regulatory frameworks, societal expectations, and market structures.

This research uses data from 2002 to 2023, sourced from the London Stock Exchange Group's (LSEG) Datastream. It applies econometric methods such as panel data regressions, Granger causality tests, and lagged variable specifications to explore both immediate and delayed effects. The study incorporates firm-specific control variables, such as total assets, total debt, profitability metrics, and liquidity ratios, to account for heterogeneity across firms and ensure robust findings. By examining companies from varying regions, the study highlights how sustainability and financial performance interact in different contexts.

The findings reveal distinct relationships between ESG scores and stock returns. In both the S&P500 and STOXX600 indices, ESG scores are generally associated with a slight negative impact on stock returns, particularly in European firms, where regulatory and societal pressures may drive stronger trade-offs. Conversely, stock returns have a weak to insignificant impact on ESG scores, suggesting that financial performance alone is not a primary driver of sustainability initiatives. Additional factors, such as firm size and financial leverage, on the other hand, play significant roles in shaping ESG performance.

This thesis contributes to the ongoing discourse by emphasizing the bidirectional nature of ESG and financial performance relationships, a dimension that has received limited attention in the literature. By comparing U.S. and European markets, the study sheds light on regional variations.

This thesis continues with Section 2, which reviews the relevant literature on ESG performance and financial returns. Section 3 describes the data and methodology, followed by empirical results and discussion in Section 4. Finally, Section 5 concludes with key insights, limitations, and suggestions for future research.

1. Literature Review

The increasing focus on sustainability in financial markets is reshaping the dynamics of corporate valuation. Investors are now integrating Environmental, Social, and Governance (ESG) factors into their decision-making processes, driven by regulatory frameworks such as the EU's Green Deal and growing societal demand for corporate responsibility (J.P. Morgan, 2024). This literature review explores the bidirectional relationship between ESG performance and stock returns in existing research, focusing on regional and sectoral differences, the role of ESG visibility, and the impact of crises on this relationship.

Research examining ESG as a driver of stock returns has yielded mixed results. Shackleton et al. (2022) found that better Environmental and Social (ES) performance does not lead to improved stock returns, suggesting that the financial benefits of ESG may depend on firm-specific factors or broader market conditions. Similarly, Durand et al. (2019) extended Hawn et al.'s (2018) work, finding a limited impact of sustainability index events (e.g., inclusion in the Dow Jones Sustainability Index) on stock returns. However, these events increased long-term investor ownership and analyst coverage, highlighting the importance of ESG visibility for market participants. Dimson et al. (2015) support this view by showing that ESG-focused shareholder activism leads to significant positive abnormal returns, demonstrating how successful engagements on ESG issues can enhance stock performance.

In contrast, Koundouri et al. (2022) reported a positive correlation between ESG performance and profitability metrics like ROA and ROE, especially in high-performance sectors like healthcare and construction. This contradicts the findings by Shackleton et al. (2022), who emphasize the lack of direct financial benefits from ESG improvements, pointing to a possible disconnect between profitability and market valuation outcomes. Flammer (2015) complements these findings by showing that narrowly approved CSR proposals result in higher shareholder value, driven by improved employee productivity and sales growth. This causal evidence underscores the tangible benefits of ESG initiatives.

The relationship between ESG and financial performance varies across sectors and regions. Shackleton et al. (2022) emphasize that high customer awareness enhances the effectiveness of ESG activities, particularly in consumer-focused industries. In contrast, Durand et al. (2019) found that ESG-driven investor attention is more pronounced in CSR-intensive regions, such as Europe, compared to the U.S. These findings align with Ioannou and Serafeim (2015), who documented a shift in analyst perceptions, with European firms gaining greater recognition for consistent CSR practices.

Additionally, studies such as Cheung and Roca (2012) noted that less mature ESG markets, like Asia, experience negative price impacts following sustainability index inclusions. This "sustainability redundancy hypothesis" highlights how ESG selection criteria can add constraints to portfolio optimization, reducing returns in certain contexts. Hong and Kacperczyk (2009) contribute to this discussion with the "sin stock" phenomenon, where socially controversial industries yield higher expected returns due to lower institutional ownership driven by social norms. This contrast underscores the nuanced role of societal values in shaping market responses to ESG.

Crises often highlight the importance of ESG factors in mitigating risk and enhancing resilience. For instance, Lins et al. (2017) demonstrated that firms with strong CSR performance outperformed their peers during the Global Financial Crisis. This finding underscores the strategic role of ESG initiatives in fostering stability and maintaining investor confidence during periods of economic turbulence.

Research also highlights reverse causality in the ESG-performance relationship. Shackleton et al. (2022) showed that poor stock performance often precedes ESG improvements, as firms attempt to rebuild trust with stakeholders. This aligns with Waddock and Graves (1997), who identified a "virtuous circle" where financial success enables firms to allocate resources toward sustainability initiatives, creating long-term value. Cai et al. (2020) add to this by demonstrating how strong CSR performance enhances social reputation, which in turn improves external opportunities for CEOs and strengthens corporate leadership. This suggests reputational benefits as a key driver of ESG engagement, particularly post-crisis.

Margolis et al. (2009) support this view, showing that financial slack enables proactive CSR investments. Their meta-analysis, however, also emphasizes that ESG's financial impact is often context-dependent, with event studies yielding larger effects than long-term analyses.

Durand et al. (2019) emphasized that ESG visibility, rather than ESG performance itself, influences investor behavior. Additions to sustainability indices such as the DJSI lead to increased analyst coverage and long-term investor ownership, even without significant short-term stock price impacts. This aligns with the findings of Xu et al. (2022), who argue that CSR initiatives often yield reputational benefits rather than substantive financial gains.

This review highlights the critical need to understand the bidirectional relationship between ESG performance and stock returns. While prior research reveals diverse outcomes and regional nuances, gaps remain in explaining how ESG initiatives translate into financial

performance across different markets. By focusing on the S&P500 and STOXX 600, this study seeks to provide clarity on whether ESG efforts drive shareholder value or reflect reactive corporate strategies, contributing to the evolving discourse on sustainable investing.

2. Data and Methodology

This chapter outlines the data sources, variables, and methodologies used to examine the bidirectional relationship between Environmental, Social, and Governance (ESG) scores and stock returns for companies listed on the S&P500 and STOXX 600 indices. The considered period spans from 2002 to 2023, with data obtained from the London Stock Exchange Group's (LSEG) Datastream. The analyses explore the impact of ESG performance on stock returns and vice versa using panel data regressions, Granger causality tests, and lagged specifications of key variables to capture potential causal relationships and delayed effects. This chapter provides a description of the data used, the methods applied, and the statistical tests performed to ensure robust and meaningful results.

2.1 Data Sources and Description

2.1.1 ESG Scores

The primary dataset for ESG scores was sourced from LSEG's Datastream, a comprehensive data platform known for its robust and transparent ESG scoring methodology. ESG scores measure a company's performance, commitment, and effectiveness in addressing environmental, social, and governance issues, drawing from over 800 publicly available data points. The scores are aggregated into 10 main themes, such as emissions, human rights, and shareholder interests, which are then rolled up into three pillar scores: Environmental, Social, and Governance. These pillar scores are weighted according to industry-specific materiality and company size considerations, with the governance pillar being consistently weighted across all industries. For this analysis, the overall ESG score, and individual pillar scores were used to explore their relationship with financial performance metrics.

2.1.2 Stock Return Data

Stock return data for companies in the S&P500 and STOXX 600 indices was retrieved from LSEG's Datastream, covering the period from 2002 to 2023. The data represents yearly stock

returns, providing a broad view of performance over time. This focus on annual returns enables the analysis to capture long-term trends and performance dynamics, rather than short-term market fluctuations.

2.1.3 Variables Used in the Analysis

The primary variables in this study include:

- **Dependent Variables:** Depending on the direction of the analysis, either ESG scores or stock returns were treated as dependent variables. The stock returns were log-transformed for consistency and to address potential non-linearity in the relationships.
- **Independent Variables:** ESG scores and stock returns were used as independent variables in different models to explore their respective impacts.
- **Control Variables:** To isolate the effect of ESG scores and stock returns, several firm-specific control variables were incorporated:
 - **Log-Transformed Total Assets:** Used as an alternative for firm size, capturing potential scale effects.
 - **Log-Transformed Total Debt:** Reflects the firm's leverage and financial structure.
 - **Price-to-Earnings (P/E) Ratio:** A measure of firm valuation and market expectations.
 - **Debt-to-Capital Ratio:** Captures the firm's financial structure and reliance on debt financing.
 - **Operating Profit Margin:** Represents the firm's profitability.
 - **Current Ratio:** Measures short-term liquidity and the ability to cover current liabilities.

2.2 Methodology

2.2.1 Research Design

The study employs a panel data approach to explore the relationship between ESG scores and stock returns for companies in the S&P500 and STOXX 600 indices. Two primary research questions are addressed:

1. Does a company's ESG performance impact its subsequent stock returns?
2. Do stock returns influence changes in a company's ESG performance?

To address these questions, a series of panel data regressions were conducted using log-transformed variables to account for potential non-linear relationships and to standardize variable scales. The analysis incorporates lagged independent and control variables to capture delayed effects and potential causality. Panel data models were chosen for their ability to control for unobserved heterogeneity across firms and over time.

2.2.2 Regression Models

The bidirectional relationship between ESG scores and stock returns is explored using four regression specifications. These models aim to capture both contemporary and lagged effects, providing a comprehensive analysis of how ESG performance impacts stock returns and vice versa. The regression equations are structured as follows:

The first two equations investigate the effect of ESG scores on stock returns. The first specification (1) examines the contemporary relationship, where ESG scores ($ESG_{i,t}$) and control variables ($Controls_{i,t}$) are measured at the same time period as the dependent variable ($Stock\ Return_{i,t}$).

$$Stock\ Return_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \sum \beta_k Controls_{i,t} + \mu_i + \varepsilon_{i,t} \quad (1)$$

The second specification (2) introduces lagged ESG scores ($ESG_{i,t-1}$) and lagged control variables ($Controls_{i,t-1}$) to capture any delayed effects on stock returns. Firm-specific fixed effects (μ_i) are included to account for unobserved, time-invariant heterogeneity, and $\varepsilon_{i,t}$ represents the idiosyncratic error term.

$$Stock\ Return_{i,t} = \beta_0 + \beta_1 ESG_{i,t-1} + \sum \beta_k Controls_{i,t-1} + \mu_i + \varepsilon_{i,t} \quad (2)$$

The third and fourth equations reverse the direction of the analysis, assessing whether stock returns influence ESG scores. Similarly, the third specification (3) evaluates contemporary effects, with stock returns ($Stock\ Return_{i,t}$) and controls ($Controls_{i,t}$) measured in the same period as the dependent variable ($ESG_{i,t}$).

$$ESG_{i,t} = \alpha_0 + \alpha_1 Stock\ Return_{i,t} + \sum \alpha_k Controls_{i,t} + v_i + \eta_{i,t} \quad (3)$$

The fourth specification incorporates lagged stock returns ($Stock\ Return_{i,t-1}$) and lagged control variables ($Controls_{i,t-1}$) to explore delayed effects on ESG performance. Firm-specific fixed effects (v_i) control for unobserved heterogeneity, and $\eta_{i,t}$ captures the residual errors.

$$ESG_{i,t} = \alpha_0 + \alpha_1 Stock\ Return_{i,t-1} + \sum \alpha_k Controls_{i,t-1} + v_i + \eta_{i,t} \quad (4)$$

2.2.3 Data Transformation and Preprocessing

To ensure data consistency and robustness, several preprocessing steps were applied:

- **Log-Transformation:** Key variables, including stock returns, total assets, and total debt, were log-transformed to normalize distributions and address non-linearities.
- **Winsorization:** Outliers were addressed by winsorizing variables at the 3rd and 97th percentiles, reducing their influence on regression estimates without excluding observations.
- **Lagged Variables:** The analysis incorporated lagged values of dependent and independent variables to capture potential delayed effects.

2.2.4 Statistical Tests and Validation

To ensure the robustness and reliability of the findings, a series of statistical tests and validation techniques were applied. These included fixed-effects versus random-effects model selection using the Hausman test, tests for heteroscedasticity, and Granger causality tests to explore the

causal relationships between ESG scores and stock returns. The results of each of these tests are discussed below.

2.2.4.1 Fixed-Effects Versus Random-Effects Model Selection

The Hausman test was employed to determine whether fixed-effects or random-effects models were more appropriate for the analysis. The null hypothesis of the Hausman test posits that the differences between the coefficients of the fixed-effects and random-effects models are not systematic, indicating that the random-effects model is consistent and efficient. The test results for the different specifications are summarized as follows:

- **ESG as the Dependent Variable (S&P500):** The test statistic yielded a chi-square value of 189.79 with a p-value of 0.0000, indicating a rejection of the null hypothesis. Therefore, the fixed-effects model was chosen, as it provides consistent estimates by accounting for firm-level heterogeneity.
- **ESG as the Dependent Variable (STOXX 600):** The Hausman test produced a chi-square value of 144.47 with a p-value of 0.0000, similarly suggesting that the fixed-effects model is preferable.
- **Stock Return as the Dependent Variable (S&P500):** For this specification, the chi-square value was 12.77 with a p-value of 0.0780, suggesting no systematic difference between the models at conventional significance levels. Thus, the random-effects model may be considered appropriate.
- **Stock Return as the Dependent Variable (STOXX 600):** The test yielded a chi-square value of 23.51 with a p-value of 0.0014, indicating the fixed-effects model as the preferred specification.

2.2.4.2 Heteroscedasticity Testing

Heteroscedasticity can affect the efficiency of standard errors and lead to unreliable inference. The Breusch-Pagan/Cook-Weisberg test was conducted to assess whether heteroscedasticity was present in the residuals of the regression models.

- **ESG as the Dependent Variable (S&P500):** The test statistic showed a chi-square value of 0.48 with a p-value of 0.4891, suggesting no evidence of heteroscedasticity.

- **ESG as the Dependent Variable (STOXX 600):** The test yielded a chi-square value of 10.17 with a p-value of 0.0014, indicating the presence of heteroscedasticity. Robust standard errors were used to correct for this issue.
- **Stock Return as the Dependent Variable (S&P500):** The chi-square value was 55.78 with a p-value of 0.0000, revealing significant heteroscedasticity. Robust standard errors were employed to ensure reliable coefficient estimates.
- **Stock Return as the Dependent Variable (STOXX 600):** The test did not show evidence of heteroscedasticity, with a chi-square value of 0.00 and a p-value of 0.9665.

2.2.4.3 Granger Causality Tests

Granger causality tests were used to explore the direction of the causal relationship between ESG scores and stock returns. By incorporating lagged values of the independent variables, the tests aimed to determine whether changes in ESG scores Granger-cause changes in stock returns and vice versa.

S&P500 Results:

- **Lagged Stock Returns as Predictors of ESG Scores:** Lag1 showed a significant positive coefficient (0.787, $p < 0.05$), indicating that past stock returns Granger-cause changes in ESG scores. However, Lag2 was negative and highly significant (-3.728, $p < 0.001$).
- **Lagged ESG Scores as Predictors of Stock Returns:** Both lagged ESG scores were significant predictors. Lag1 had a negative and significant coefficient (-0.00172, $p < 0.001$), while Lag2 showed a positive but smaller magnitude (0.000688, $p < 0.05$).

Table 1 - Pooled Granger Causality Results in the S&P500 sample

*This table reports the pooled Granger causality results in the S&P500 sample. The dependent variables are Stock Return and ESG Score, and the table presents the results for two separate specifications. The key independent variables include lagged Stock Returns and lagged ESG Scores. Significance levels are denoted by *** (1%), ** (5%), and * (10%). T-statistics are reported in parentheses. Observations for each specification are included to summarize the model scope and performance.*

	(1) Stock Return	(2) ESG Score
lag1Stock Return	0.0237* (2.36)	0.787* (2.17)
lag2Stock Return	-0.00408 (-0.40)	-3.728*** (-10.15)
lag1ESG Score	-0.00172*** (-5.75)	0.836*** (77.21)
lag2ESG Score	0.000688* (2.30)	0.0515*** (4.75)
Constant	0.148*** (20.93)	6.848*** (26.62)
Observations	9940	9940

STOXX 600 Results:

- **Lagged Stock Returns as Predictors of ESG Scores:** Lag1 was significant and positive (0.0748, $p < 0.001$), while Lag2 also showed significance (0.0536, $p < 0.001$).
- **Lagged ESG Scores as Predictors of Stock Returns:** Lag1 had a significant and positive coefficient (0.837, $p < 0.001$), indicating that past ESG scores Granger-cause stock returns. Lag2 also demonstrated significance (0.0765, $p < 0.001$).

Table 2 - Pooled Granger Causality Results in the STOXX600 sample

*This table reports the pooled Granger causality results in the STOXX600 sample. The dependent variables are Stock Return and ESG Score, with the table presenting results for two separate specifications. The key independent variables include lagged Stock Returns and lagged ESG Scores. Significance levels are denoted by *** (1%), ** (5%), and * (10%). T-statistics are reported in parentheses. Observations for each specification are included to summarize the model scope and performance.*

	(1) Stock Return	(2) ESG Score
lag1Stock Return	0.0748*** (8.13)	-0.128 (-0.47)
lag2Stock Return	0.0536*** (5.73)	-0.200 (-0.71)
lag1ESG Score	-0.00254*** (-7.98)	0.837*** (88.02)
lag2ESG Score	0.00130*** (4.09)	0.0765*** (8.06)
Constant	0.130*** (16.47)	5.816*** (24.56)
Observations	11820	11820

3. Results

3.1 Descriptive Statistics

Table 3 provides descriptive statistics for the selected variables in the S&P500 sample. The mean ESG score is 52.33, with a standard deviation of 20.323, highlighting a broad range in ESG performance among firms. The range of ESG scores (0.6 to 95.16) indicates the presence of both industry leaders and firms lagging in sustainability efforts. The mean Stock Return is 0.088, suggesting modest average returns, but the wide range (-3.055 to 2.193) reflects considerable volatility in stock performance.

Firm size, represented by Total Assets, has a mean of 16.293 and ranges from 6.405 to 22.078, suggesting that the dataset primarily includes large firms but with some smaller companies at the lower end. Total Debt shows a similar pattern, with a mean of 14.831 and a standard deviation of 2.094. The price-to-earnings ratio (mean = 28.57, range = 7.8 to 122.9) demonstrates wide variation, potentially reflecting differences in growth expectations and profitability across firms.

The debt-to-capital ratio has a mean of 43.747 and a range from 1.81 to 104.46, indicating varying financial structures among firms, while the current ratio with a mean of 1.808 suggests that most firms maintain strong liquidity positions, with values ranging from 0.53 to 5.4.

Table 3 - Descriptive Statistics S&P500

This table presents the descriptive statistics for key variables in the S&P500 sample. The table includes the number of observations (Obs.), mean values, standard deviations (Std. Dev.), minimum (Min.), and maximum (Max.) values for each variable. The variables include ESG Score, Stock Return, Total Assets, Total Debt, Price-to-Earnings, Debt-to-Capital, Operating Profit Margin, and Current Ratio, providing a summary of their distribution and range across the dataset.

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
ESG Score	8511	52.33	20.323	0.6	95.16
Stock Return	10489	0.088	0.316	-3.055	2.193
Total Assets	11497	16.293	1.743	6.405	22.078
Total Debt	10796	14.831	2.094	1.609	20.513
Price-to-Earnings	9914	28.57	23.906	7.8	122.9
Debt-to-Capital	10779	43.747	24.161	1.81	104.46
Op. Profit Margin	11530	16.334	11.124	-7.79	42.87
Current Ratio	9570	1.808	1.125	0.53	5.4

Table 4 summarizes the same variables for firms in the STOXX 600 index. The mean ESG score is slightly higher than in the S&P500, at 58.89, with a range of 2.57 to 95.74. This suggests that European firms generally perform better in sustainability metrics. The mean log stock return (0.053) is slightly lower than the S&P500, with a comparable range (-3.662 to 2.307), reflecting similar levels of volatility.

Log total assets (mean = 16.265) show a broader range (8.119 to 23.887) compared to the S&P500, indicating greater diversity in firm size within the STOXX 600. Log total debt (mean = 14.581) exhibits slightly less variation than in the S&P500, with a standard deviation of 2.505. The price-to-earnings ratio (mean = 20.963, range = 5.3 to 76) is lower on average than in the S&P500, reflecting potentially lower growth expectations or regional market dynamics.

The debt-to-capital ratio with a mean of 41.583 is slightly lower than in the S&P500, with a narrower range (1.84 to 89.51), suggesting more conservative leverage among European firms.

Also, the liquidity appears tighter, as indicated by the current ratio (mean = 1.541), which is lower than the S&P500.

Table 4 - Descriptive Statistics STOXX600

This table presents the descriptive statistics for key variables in the STOXX600 sample. The table includes the number of observations (Obs.), mean values, standard deviations (Std. Dev.), minimum (Min.), and maximum (Max.) values for each variable. The variables include ESG Score, Stock Return, Total Assets, Total Debt, Price-to-Earnings, Debt-to-Capital, Operating Profit Margin, and Current Ratio, providing a summary of their distribution and range across the dataset.

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
ESG Score	9507	58.89	20.25	2.57	95.74
Stock Return	11974	.053	.338	-3.662	2.307
Total Assets	13294	16.265	2.111	8.119	23.887
Total Debt	12977	14.581	2.505	.693	22.146
Price-to-Earnings	11447	20.963	15.031	5.3	76
Debt-to-Capital	12966	41.583	23.24	1.84	89.51
Op. Profit Margin	13255	14.412	12.971	-5.94	53.36
Current Ratio	10428	1.541	.799	.55	4.07

Comparing the results of the descriptive statistics of the S&P500 and STOXX600 data, clear differences can be perceived. The higher average ESG scores observed in the STOXX 600 compared to the S&P500 could potentially be influenced by regional differences in regulatory, societal, and systemic factors. European firms may face stricter regulatory requirements, as frameworks like those introduced by the European Banking Authority emphasize mandatory ESG disclosures, which encourage integrating sustainability into corporate strategies. Additionally, societal and market expectations in Europe might place greater emphasis on transparency and sustainability, which could influence firms to prioritize ESG practices. The perception of ESG as a means to reduce systemic risks, such as those related to environmental degradation or financial instability, might also contribute to the observed differences. These potential factors suggest that European firms could be embedding ESG considerations more deeply into their strategies, while U.S. firms might place relatively greater weight on financial metrics like profitability and liquidity (Bax et. al 2023).

3.2 Correlation Matrix

The correlation matrix for the S&P500, as seen in Table 5, shows several noteworthy relationships among the variables. One of the most significant observations is the positive and statistically significant correlation between ESG scores and firm size, measured through total assets ($r = 0.224$). This relationship is significant at the 1% level, suggesting that larger firms in the S&P500 tend to have higher ESG scores. This could be attributed to their greater resources and ability to invest in sustainability initiatives. Similarly, market capitalization is positively correlated with ESG scores ($r = 0.221$), also significant at the 1% level, reinforcing the idea that larger, more valuable firms are often leaders in ESG practices.

On the other hand, there is a negative correlation between ESG scores and liquidity metrics, such as the current ratio ($r = -0.106$), which is significant at the 1% level, and the quick ratio ($r = -0.0599$), significant at the 5% level. This indicates that firms with stronger ESG scores may prioritize long-term investments in sustainability over maintaining higher levels of short-term liquidity. Additionally, the correlation between ESG scores and profitability metrics like ROA ($r = 0.0549$) is positive but relatively weak. This relationship is statistically significant at the 1% level, suggesting that while profitability may have some influence on ESG scores, it is not the primary driver for ESG initiatives.

Overall, the S&P500 results highlight the role of firm size and market value as key contributors to ESG performance, while liquidity and profitability exhibit more nuanced relationships.

Table 5 - Correlation Matrix S&P500

*This table presents the correlation matrix for the S&P500 sample, showing pairwise correlations among the key variables. The variables include ESG Score, Stock Price, Market Capitalization, Total Assets, Debt-to-Capital, Total Return Index, Operating Profit Margin, Return on Assets, Return on Equity, Current Ratio, Quick Ratio, Market-to-Book Ratio, and Stock Price. The prefix “l” indicates that the variables are lagged by 1 period. Significance levels are denoted by *** (1%), ** (5%), and * (10%). This table highlights the relationships and potential multicollinearity among the variables.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) l ESG Score	1.00													
(2) l Stock Price	0.0106	1.00												
(3) l Market Cap	0.221***	0.0657***	1.00											
(4) l Total Assets	0.224***	0.00222	0.608***	1.00										
(5) l Debt to Capital	0.130***	0.0140	-0.0481***	0.00689	1.00									
(6) l Total Return ind	0.0148	0.0152	0.103***	0.0319*	-0.0692***	1.00								
(7) l Op. Profit Margin	0.0294*	0.00550	0.00801	0.00822	-0.00490	0.00424	1.00							
(8) l ROA	0.0549***	0.175***	0.146***	-0.0634***	-0.167***	0.120***	0.0430**	1.00						
(9) l ROE	0.0259	0.0225	0.0142	-0.000658	0.0817***	0.0445**	0.00200	0.0824***	1.00					
(10) l Current Ratio	-0.106***	0.0446**	-0.00452	-0.129***	-0.307***	0.0616***	-0.0110	0.150***	-0.0195	1.00				
(11) l Quick Ratio	-0.0599***	0.0403**	0.0437**	-0.0771***	-0.268***	0.0588***	-0.0184	0.115***	-0.0185	0.905***	1.00			
(12) l Market to Book	0.0399**	0.0608***	0.0295*	-0.0159	0.0613***	0.00638	0.00191	0.0703***	0.0838***	-0.00547	0.00118	1.00		
(13) ESG Score	0.209***	0.0903***	0.103***	0.0615***	0.0193	0.0561***	0.0160	0.0113	0.0108	0.00605	-0.0214	-0.0110	1.00	
(14) Stock Price	0.128***	0.0444**	0.132***	0.0113	-0.0169	0.0480***	0.00673	0.101***	0.0119	0.100***	0.103***	0.0593***	0.0107	1.00

Table 6 shows the STOXX 600 correlation matrix, which also demonstrates significant relationships, with some similarities and differences compared to the S&P500. The positive correlation between ESG scores and firm size, measured through log total assets ($r = 0.253$), is even stronger than in the S&P500, with a significance level of 1%. This suggests that larger firms in Europe may face greater societal or regulatory pressures to adopt ESG practices. Additionally, the correlation between ESG scores and market capitalization ($r = 0.180$) is significant at the 1% level, supporting the idea that more valuable firms tend to have higher ESG ratings.

Interestingly, the correlation between ESG scores and liquidity metrics, such as the current ratio ($r = -0.158$), is more strongly negative in the STOXX 600 than in the S&P500. This relationship is significant at the 1% level and might indicate that European firms with better ESG performance allocate more resources toward long-term sustainability efforts, potentially at the expense of immediate liquidity. The weak and negative correlation between ESG scores and profitability metrics, such as ROA ($r = -0.101$), is also significant at the 1% level. This suggests that ESG efforts in Europe may be more closely aligned with compliance and stakeholder expectations rather than financial returns.

The STOXX 600 results emphasize the importance of firm size and market value in driving ESG performance, with stronger negative relationships between ESG scores and liquidity and profitability metrics compared to the S&P500.

Table 6 - Correlation Matrix STOXX600

*This table presents the correlation matrix for the STOXX600 sample, showing pairwise correlations among the key variables. The variables include ESG Score, Stock Price, Market Capitalization, Total Assets, Debt-to-Capital, Total Return Index, Operating Profit Margin, Return on Assets, Return on Equity, Current Ratio, Quick Ratio, Market-to-Book Ratio, and Stock Price. The prefix “1” indicates that the variables are lagged by 1 period. Significance levels are denoted by *** (1%), ** (5%), and * (10%). This table highlights the relationships and potential multicollinearity among the variables.*

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) 1 ESG Score	1.00													
(2) 1 Stock Price	0.0175	1.00												
(3) 1 Market Cap	0.180***	0.0517***	1.00											
(4) 1 Total Assets	0.253***	0.0543***	0.561***	1.00										
(5) 1 Debt to Capital	0.187***	-0.0282*	-0.0666***	0.0974***	1.00									
(6) 1 Total Return ind	0.000498	0.222***	0.186***	-0.000149	-0.0233	1.00								
(7) 1 Op. Profit Margin	0.00508	0.0505***	0.0726***	0.0239	0.0183	0.0383**	1.00							
(8) 1 ROA	-0.101***	0.119***	0.145***	-0.0773***	-0.249***	0.0838***	0.331***	1.00						
(9) 1 ROE	-0.0474***	0.0833***	0.0733***	-0.0387**	0.0392**	0.0585***	0.187***	0.619***	1.00					
(10) 1 Current Ratio	-0.158***	0.0521***	-0.0307*	-0.122***	-0.419***	0.0243	-0.0852***	0.184***	-0.00261	1.00				
(11) 1 Quick Ratio	-0.0986***	0.0246	-0.00123	-0.0694***	-0.252***	-0.00214	-0.113***	0.167***	0.0198	0.811***	1.00			
(12) 1 Market to Book	-0.0109	0.00958	0.0127	-0.000933	-0.0521***	0.00566	0.00117	0.0258	-0.0764***	0.0159	0.0132	1.00		
(13) ESG Score	0.227***	-0.0102	0.0750***	0.100***	0.0182	0.00546	-0.0162	-0.0520***	-0.0564***	0.0302*	0.0376**	-0.00275	1.00	
(14) Stock Price	-0.0190	-0.000366	-0.0278*	-0.0515***	0.0149	-0.00497	0.00588	0.0134	0.00662	0.0640***	0.0425**	-0.0216	0.0135	1.00

3.3 Influence of Stock Return on ESG-Score

3.3.1 Results within the S&P500 Constituents

The regression results presented in Table 7 provide insights into the key determinants of ESG scores among S&P500 firms. Derived from fixed-effects models selected based on the Hausman test, these results show a consistent and significant negative relationship between log stock returns and ESG scores across all specifications. This suggests that firms prioritizing higher financial returns may allocate fewer resources toward ESG initiatives, as reflected in the negative correlation observed in the correlation matrix (Table 5).

On the other hand, log total assets display a consistently positive and highly significant relationship with ESG scores, indicating that larger firms, with greater visibility to regulators and stakeholders, tend to adopt stronger ESG practices. This finding aligns with the descriptive statistics (Table 3), which show that larger firms have higher mean ESG scores, reflecting their ability to allocate resources toward sustainability.

Log total debt also exhibits a positive and significant relationship with ESG scores in several models. This may indicate that leveraged firms seek to enhance their ESG performance to appeal to debt markets and mitigate perceived risks, consistent with prior research on sustainability and debt-market preferences. Conversely, the weak but negative relationship between the price-to-earnings ratio and ESG scores implies that firms with higher market valuations may focus more on growth or profitability over sustainability efforts.

The R^2 values, ranging from 0.169 to 0.209, suggest that while financial metrics provide moderate explanatory power, other factors—such as regulatory environments, societal expectations, or industry-specific pressures—also play a significant role. These results provide initial evidence of trade-offs between financial performance and ESG priorities, a theme further explored in the STOXX 600 sample and the bidirectional analysis of ESG impacts on stock returns.

Table 7 - Impact of Financial Variables on ESG Scores in S&P500 Firms

*This table reports the regression results for the impact of financial variables on ESG scores in S&P500 firms. The dependent variable is the ESG score, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is stock return. The regressions are estimated with fixed effects to account for unobserved heterogeneity. All continuous variables are winsorized at the 3% level. Standard errors are reported in parentheses, and the significance levels are denoted by *** (1%), ** (5%), and * (10%). Observations, R-squared values, and the number of years in the dataset are included to summarize the model performance and scope.*

Variables	(1) ESG Score	(2) ESG Score	(3) ESG Score	(4) ESG Score	(5) ESG Score	(6) ESG Score
Stock Return	-3.828*** (0.806)	-3.739*** (0.837)	-4.120*** (0.914)	-4.089*** (0.914)	-3.760*** (0.917)	-3.929*** (0.994)
Total Assets	5.321*** (0.128)	3.995*** (0.225)	3.498*** (0.235)	3.151*** (0.300)	3.300*** (0.301)	6.509*** (0.392)
Total Debt		1.291*** (0.191)	1.526*** (0.197)	1.935*** (0.296)	1.815*** (0.297)	-0.179 (0.344)
Price-to-Earnings			-0.0329*** (0.00836)	-0.0331*** (0.00835)	-0.0355*** (0.00836)	-0.0445*** (0.00932)
Debt-to-Capital				-0.0229* (0.0124)	-0.0182 (0.0124)	0.0262* (0.0144)
Op. Profit Margin					-0.0790*** (0.0186)	-0.0247 (0.0213)
Current Ratio						-0.0433 (0.236)
Constant	-35.71*** (2.154)	-32.97*** (2.286)	-26.95*** (2.465)	-26.38*** (2.481)	-25.77*** (2.484)	-50.03*** (3.377)
Observations	8,377	8,003	7,339	7,336	7,330	6,061
R-squared	0.182	0.171	0.169	0.169	0.171	0.209
Number of years	22	22	22	22	22	22

The regression results in Table 8 assess the lagged impact of financial and operational characteristics on ESG scores among S&P500 firms, following the methodology's approach of incorporating lagged variables to explore delayed effects. Lagged log stock returns do not show a significant relationship with ESG scores, suggesting that past stock performance does not influence firms' sustainability efforts. This contrasts with the contemporary analysis, where stock returns had a significant negative impact on ESG scores, emphasizing the immediacy of financial performance in shaping ESG initiatives.

Among the control variables, lagged operating profit margin (-0.0851, $p < 0.01$) and lagged current ratio exhibit negative effects on ESG scores, implying that firms prioritizing short-term profitability or liquidity may allocate fewer resources to sustainability. Similarly, the lagged

debt-to-capital ratio shows a weak negative relationship, reflecting the constraints of financial leverage on ESG investments.

The low R² values (0.000–0.005) indicate that lagged variables explain only a small portion of the variance in ESG scores. This finding supports the methodological focus on contemporary analysis as the primary framework, underscoring that ESG strategies in S&P500 firms are more responsive to current conditions than influenced by past financial metrics.

Table 8 - Impact of Lagged Financial Variables on ESG Scores in S&P500 Firms

*This table reports the regression results for the impact of lagged financial variables on ESG scores in S&P 500 firms. The dependent variable is the ESG score, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is lagged stock return. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with fixed effects to account for unobserved heterogeneity. Standard errors are reported, and the significance levels are denoted by *** (1%), ** (5%), and * (10%). Observations, R-squared values, and the number of years in the dataset are included to summarize the model performance and scope.*

Variables	(1) ESG Score	(2) ESG Score	(3) ESG Score	(4) ESG Score	(5) ESG Score	(6) ESG Score
Stock Return	-0.919 (0.923)	-1.354 (0.962)	-1.345 (1.064)	-1.267 (1.065)	-0.977 (1.068)	-0.941 (1.168)
Total Assets	-0.157 (0.140)	-0.152 (0.259)	0.208 (0.272)	-0.335 (0.355)	-0.358 (0.356)	-0.489 (0.465)
Total Debt		-0.0933 (0.224)	-0.399* (0.232)	0.236 (0.353)	0.291 (0.354)	0.453 (0.415)
Price-to-Earnings			0.00191 (0.00971)	0.00128 (0.00972)	-0.00167 (0.00974)	0.000704 (0.0109)
Debt-to-Capital				-0.0332** (0.0145)	-0.0316** (0.0145)	-0.0453*** (0.0168)
Op. Profit Margin					-0.0712*** (0.0219)	-0.0851*** (0.0255)
Current Ratio						-0.259 (0.273)
Constant	56.01*** (2.333)	57.62*** (2.503)	56.31*** (2.733)	57.21*** (2.762)	58.00*** (2.767)	58.98*** (3.809)
Observations	7,641	7,253	6,576	6,571	6,565	5,447
R-squared	0.000	0.001	0.001	0.002	0.003	0.005
Number of years	22	22	22	22	22	22

3.3.2 Results within the STOXX600 Constituents

The regression results in Table 9 analyze the determinants of ESG scores for STOXX 600 firms, focusing on contemporary relationships as outlined in the Methodology. Stock return consistently shows a negative and statistically significant relationship with ESG scores, indicating that firms achieving higher stock returns may deprioritize ESG initiatives in favor of short-term financial goals. This finding highlights the tension between shareholder returns and sustainability efforts, even within the STOXX 600's stricter regulatory environment (Bax et. al 2023).

Firm size, measured by Total Assets, positively influences ESG scores, aligning with the descriptive statistics that show that larger firms achieve higher ESG performance due to greater resources and scrutiny. Total Debt also exhibits a positive relationship, suggesting that leveraged firms may enhance ESG practices to mitigate perceived risks. Conversely, the debt-to-capital ratio negatively affects ESG scores, reflecting potential constraints on sustainability investments for highly leveraged firms.

Operating profit margin shows a significant negative effect, implying that firms prioritizing profitability may allocate fewer resources to ESG initiatives. The price-to-earnings ratio does not show significant effects, suggesting market valuations are less tied to ESG performance in this sample.

The R^2 values (0.169–0.239) indicate that financial metrics explain some variability in ESG scores, but external factors like regulatory frameworks and industry dynamics likely play a significant role. These results underscore the complex trade-offs between financial performance and long-term ESG priorities in the STOXX 600.

Table 9 - Impact of Financial Variables on ESG Scores in STOXX600 Firms

*This table reports the regression results for the impact of financial variables on ESG scores in STOXX600 firms. The dependent variable is the ESG score, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is stock return. The regressions are estimated with fixed effects to account for unobserved heterogeneity. Robust standard errors are reported in parentheses. Observations, R-squared values, and the number of years in the dataset are included to summarize the model performance and scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) ESG Score	(2) ESG Score	(3) ESG Score	(4) ESG Score	(5) ESG Score	(6) ESG Score
Stock Return	-3.554*** (1.186)	-2.858** (1.167)	-3.554** (1.294)	-3.906*** (1.261)	-3.070** (1.236)	-4.434*** (1.093)
Total Assets	3.926*** (0.193)	1.721*** (0.332)	1.810*** (0.331)	0.431 (0.263)	0.344 (0.248)	3.598*** (0.442)
Total Debt		2.075*** (0.190)	2.045*** (0.186)	4.054*** (0.225)	4.050*** (0.228)	1.414*** (0.289)
Price-to-Earnings			0.0180 (0.0162)	0.0140 (0.0164)	0.00142 (0.0147)	-0.0156 (0.0154)
Debt-to-Capital				-0.140*** (0.0139)	-0.138*** (0.0138)	-0.0278* (0.0156)
Op. Profit Margin					-0.136*** (0.0171)	0.0268 (0.0258)
Current Ratio						-1.468*** (0.415)
Constant	-5.927* (3.235)	-0.146 (3.330)	-1.331 (3.568)	-2.492 (3.629)	1.284 (3.650)	-15.40*** (4.427)
Observations	9,309	9,152	8,367	8,366	8,353	6,505
R-squared	0.169	0.173	0.175	0.188	0.197	0.239
Number of years	22	22	22	22	22	22

The regression results in Table 10 examine the determinants of ESG scores in STOXX 600 firms using lagged independent and control variables, as outlined in the Methodology section. Lagged Stock Return does not show a significant relationship with ESG scores, indicating that past stock performance does not strongly influence sustainability outcomes. This contrasts with contemporary results (Table 9), where stock returns negatively impacted ESG scores, highlighting the dominance of immediate factors.

Lagged Total Debt shows a consistently positive relationship with ESG scores, suggesting that leveraged firms may improve ESG practices to mitigate financial risks. Conversely, lagged Price-to-Earnings and Debt-to-Capital ratios have negative effects, indicating that higher valuations and debt reliance might constrain sustainability investments. Lagged Operating

Profit Margin exhibits a positive relationship in some models, implying that profitability supports ESG initiatives.

Despite these findings, low R² values (0.002–0.014) indicate limited explanatory power for lagged variables, emphasizing the stronger influence of contemporary factors (Table 9) on ESG performance in STOXX 600 firms.

Table 10 - Impact of Lagged Financial Variables on ESG Scores in STOXX600 Firms

*This table reports the regression results for the impact of lagged financial variables on ESG scores in STOXX600 firms. The dependent variable is the ESG score, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is lagged stock return. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with fixed effects to account for unobserved heterogeneity. Robust standard errors are reported in parentheses. Observations, R-squared values, and the number of years in the dataset are included to summarize the model performance and scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) ESG Score	(2) ESG Score	(3) ESG Score	(4) ESG Score	(5) ESG Score	(6) ESG Score
Stock Return	0.173 (0.845)	0.298 (0.818)	0.296 (0.734)	0.140 (0.768)	-0.0779 (0.805)	0.0648 (1.028)
Total Assets	0.376*** (0.0724)	-0.691*** (0.193)	-0.865*** (0.214)	-1.372*** (0.214)	-1.326*** (0.208)	0.916** (0.343)
Total Debt		0.962*** (0.126)	1.030*** (0.150)	1.766*** (0.177)	1.758*** (0.177)	0.119 (0.341)
Price-to-Earnings			-0.0570*** (0.0115)	-0.0588*** (0.0115)	-0.0558*** (0.0111)	-0.0770*** (0.0157)
Debt-to-Capital				-0.0527*** (0.00992)	-0.0541*** (0.00985)	0.000529 (0.0207)
Op. Profit Margin					0.0342*** (0.0119)	0.0233* (0.0122)
Current Ratio						0.425 (0.301)
Constant	53.67*** (1.204)	57.08*** (1.599)	60.28*** (1.791)	59.93*** (1.796)	58.76*** (1.731)	44.45*** (2.236)
Observations	8,271	8,110	7,402	7,401	7,391	5,806
R-squared	0.002	0.004	0.006	0.008	0.009	0.014
Number of years	22	22	22	22	22	22

3.3.3 Comparison between S&P500 and STOXX600

Across the S&P500 and STOXX 600, stock returns consistently show a negative relationship with ESG scores, with the effect being more pronounced in the S&P500. This suggests that U.S. firms face stronger short-term financial trade-offs, reflecting differences in market dynamics and shareholder expectations. Firm size positively influences ESG scores in both indices, with a slightly stronger effect in the S&P500, likely due to varying regulatory and market contexts.

Debt-related variables exhibit nuanced differences. Total Debt positively correlates with ESG scores in both indices, likely reflecting the role of ESG-conscious debt markets. However, the Debt-to-Capital ratio has a more negative effect on the STOXX 600, indicating greater leverage constraints on sustainability investments in European firms. Profitability negatively impacts ESG scores in the S&P500, but its effect in the STOXX 600 is less consistent, potentially reflecting differing priorities and pressures.

These findings highlight regional variations, with European firms appearing more aligned with sustainability goals, likely driven by stronger societal and regulatory pressures compared to their U.S. counterparts.

3.4 Influence of ESG-Score on Stock Return

3.4.1 Results within the S&P500 Constituents

The regression results in Table 11 analyze the impact of ESG scores and financial variables on stock returns for S&P500 firms, as outlined in the Methodology. ESG scores consistently show a statistically significant negative relationship with stock returns across all models. Although the coefficients are small, they highlight a potential trade-off where firms prioritizing sustainability may experience reduced immediate financial performance.

Control variables reveal several key relationships. Total assets exhibit a weak negative relationship with stock returns, suggesting that firm size alone does not strongly influence return potential in S&P500 firms. Larger firms may still achieve consistent performance due to their market stability and established positions. Total debt also negatively impacts stock returns, likely due to increased risk perceptions, consistent with the negative correlations observed in Table 5. Conversely, the price-to-earnings ratio and operating profit margin show

positive and significant relationships, underscoring profitability and market valuation as critical drivers of financial performance.

Other variables, such as the debt-to-capital ratio and current ratio, lack consistent significance, suggesting their effects are context-dependent. The R² values indicate that while financial metrics, including ESG scores, explain a meaningful portion of the variance in stock returns, external factors like market conditions likely contribute further.

In summary, the findings highlight a trade-off between ESG commitments and short-term returns, but profitability and market valuation remain central to driving stock performance.

Table 11 - Impact of Financial Variables on Stock Return in S&P500 Firms

*This table reports the regression results for the impact of financial variables on stock returns in S&P 500 firms. The dependent variable is stock return, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is the ESG score. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with random effects to account for variability across firms while maintaining consistency across the dataset. Robust standard errors are reported in parentheses. Observations and the number of years in the dataset are included to summarize the model scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) Stock Return	(2) Stock Return	(3) Stock Return	(4) Stock Return	(5) Stock Return	(6) Stock Return
ESG Score	-0.000701*** (0.000189)	-0.000664*** (0.000199)	-0.000669*** (0.000189)	-0.000663*** (0.000188)	-0.000608*** (0.000194)	-0.000653*** (0.000225)
Total Assets	-0.0212*** (0.00582)	-0.0106* (0.00559)	-0.00672 (0.00546)	-0.00322 (0.00636)	-0.00512 (0.00639)	-0.0105 (0.00761)
Total Debt		-0.0115*** (0.00424)	-0.00973** (0.00407)	-0.0139** (0.00593)	-0.0127** (0.00586)	-0.00891 (0.00674)
Price-to-Earnings			0.00101*** (0.000199)	0.00102*** (0.000199)	0.00106*** (0.000206)	0.00118*** (0.000212)
Debt-to-Capital				0.000230 (0.000219)	0.000157 (0.000214)	5.74e-05 (0.000216)
Op. Profit Margin					0.00171*** (0.000459)	0.00195*** (0.000540)
Current Ratio						-0.00352 (0.00496)
Constant	0.477*** (0.0914)	0.473*** (0.0854)	0.360*** (0.0697)	0.354*** (0.0690)	0.337*** (0.0696)	0.377*** (0.0813)
Observations	8,377	8,003	7,339	7,336	7,330	6,061
Number of years	22	22	22	22	22	22

The regression results in Table 12 analyze the relationship between ESG scores and stock returns in S&P500 firms, focusing on lagged independent and control variables to assess delayed effects, as outlined in the Methodology section. ESG scores do not exhibit a statistically significant relationship with stock returns in any model, indicating that ESG performance does not have a delayed or direct influence on stock performance in subsequent periods. This contrasts with expectations that higher ESG performance might enhance stock returns through improved investor confidence or reputational gains, as suggested in the Literature Review (Dimson et al., 2015). This may be because ESG performance also serves as a tool for risk mitigation rather than a driver of financial gains. Another explanation could be that its impact on stock returns might depend on visibility and recognition of ESG initiatives (Durand et al., 2019).

Among the control variables, total assets consistently show a significant positive relationship with stock returns, suggesting that larger firms tend to experience higher returns in this sample, potentially due to their stability or market positioning. Total debt, however, demonstrates a significant negative relationship with stock returns across multiple models, aligning with the idea that higher leverage increases financial risk, thereby dampening stock returns (Drudi & Giordano, 2000). These findings are consistent with the descriptive statistics (Table 3), which highlight notable differences in firm size and leverage across the sample.

Operating profit margin shows a weak but significant positive effect on stock returns in Model (6), indicating that profitability may contribute to improved stock performance in some cases. By contrast, variables such as price-to-earnings ratio, debt-to-capital ratio, and current ratio fail to display consistent significance, suggesting their limited influence in this context.

Overall, the results highlight the significant roles of firm size and leverage in influencing stock returns, while ESG scores do not appear to have a delayed or direct impact. This aligns with the earlier findings in Table 11, which indicated a negative contemporary relationship, suggesting that the influence of ESG scores may be immediate rather than long-lasting.

Table 12 - Impact of Lagged Financial Variables on Stock Return in S&P500 Firms

*This table reports the regression results for the impact of lagged financial variables on stock returns in S&P 500 firms. The dependent variable is stock return, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is the lagged ESG score. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with random effects to account for variability across firms while maintaining consistency across the dataset. Robust standard errors are reported in parentheses. Observations and the number of years in the dataset are included to summarize the model scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) Stock Return	(2) Stock Return	(3) Stock Return	(4) Stock Return	(5) Stock Return	(6) Stock Return
ESG Score	-0.000140 (0.000184)	-9.93e-05 (0.000184)	-3.60e-05 (0.000182)	-3.93e-05 (0.000182)	-2.30e-05 (0.000186)	6.10e-06 (0.000229)
Total Assets	0.00242 (0.00198)	0.00876*** (0.00260)	0.00733*** (0.00260)	0.00855* (0.00444)	0.00787* (0.00464)	0.00912 (0.00583)
Total Debt		-0.00640*** (0.00225)	-0.00647*** (0.00221)	-0.00788* (0.00450)	-0.00743 (0.00458)	-0.00855* (0.00474)
Price-to-Earnings			7.34e-06 (0.000138)	9.76e-06 (0.000138)	1.99e-05 (0.000139)	1.13e-05 (0.000139)
Debt-to-Capital				7.87e-05 (0.000214)	5.35e-05 (0.000223)	7.53e-05 (0.000198)
Op. Profit Margin					0.000480 (0.000298)	0.000602** (0.000299)
Current Ratio						-0.00199 (0.00336)
Constant	0.0624 (0.0436)	0.0515 (0.0437)	0.0748 (0.0467)	0.0724 (0.0476)	0.0682 (0.0462)	0.0647 (0.0672)
Observations	7,627	7,297	6,637	6,634	6,628	5,451
Number of years	22	22	22	22	22	22

3.4.2 Results within the STOXX600 Constituents

The regression results in Table 13 examine the relationship between ESG scores and stock returns for STOXX 600 firms, as detailed in the Methodology section. ESG scores consistently exhibit a statistically significant negative relationship with stock returns at the 1% level across all models. This finding suggests that higher ESG performance is associated with slightly lower stock returns, potentially reflecting a trade-off where investments in sustainability initiatives reduce resources available for maximizing short-term shareholder returns. The robustness of this negative relationship across all specifications underscores its consistency in the STOXX 600 context.

Among the significant control variables, Total debt demonstrates a significant negative relationship with stock returns in two models, which suggest that firms with higher leverage

face increased financial risks that dampen market performance. Similarly, the debt-to-capital ratio consistently exhibits a significant negative relationship, reinforcing the idea that higher leverage structures constrain stock performance.

Conversely, the price-to-earnings ratio demonstrates a positive and significant relationship across four models, suggesting that firms with higher market valuations are more likely to achieve stronger stock performance. Operating profit margin shows a strong positive relationship in Models (5) and (6), highlighting profitability as a key driver of financial performance. Interestingly, the current ratio in Model (6) has a significant negative effect, implying that firms with higher liquidity levels may prioritize maintaining cash reserves over immediate returns to shareholders.

The R^2 values range from 0.023 to 0.065, indicating that the models explain a modest portion of the variation in stock returns. This suggests that while financial metrics, including ESG scores, play a role, other factors likely influence stock performance. These findings are similar to the results for S&P500 firms (Table 11), where the negative relationship between ESG scores and stock returns was also evident, but the impact of control variables show regional variations.

Table 13 - Impact of Financial Variables on Stock Return in STOXX600 Firms

*This table reports the regression results for the impact of financial variables on stock returns in STOXX600 firms. The dependent variable is stock return, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is the ESG score. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with fixed effects to account for unobserved heterogeneity. Observations, R-squared values, and the number of years in the dataset are included to summarize the model scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) Stock Return	(2) Stock Return	(3) Stock Return	(4) Stock Return	(5) Stock Return	(6) Stock Return
ESG Score	-0.000725*** (0.000148)	-0.000589*** (0.000150)	-0.000652*** (0.000148)	-0.000726*** (0.000149)	-0.000571*** (0.000149)	-0.000927*** (0.000179)
Total Assets	-0.0154*** (0.00145)	-0.000851 (0.00282)	0.00201 (0.00277)	-0.00474 (0.00322)	-0.00303 (0.00321)	-0.00797 (0.00529)
Total Debt		-0.0145*** (0.00242)	-0.0116*** (0.00236)	-0.00145 (0.00341)	-0.00244 (0.00341)	0.00337 (0.00482)
Price-to-Earnings			0.00259*** (0.000171)	0.00256*** (0.000171)	0.00268*** (0.000171)	0.00280*** (0.000191)
Debt-to-Capital				-0.000685*** (0.000169)	-0.000695*** (0.000168)	-0.00110*** (0.000240)
Op. Profit Margin					0.00191*** (0.000193)	0.00247*** (0.000266)
Current Ratio						-0.0131*** (0.00437)
Constant	0.355*** (0.0222)	0.320*** (0.0233)	0.188*** (0.0244)	0.182*** (0.0244)	0.127*** (0.0249)	0.173*** (0.0382)
Observations	9,309	9,152	8,367	8,366	8,353	6,505
R-squared	0.023	0.025	0.050	0.051	0.062	0.065
Number of years	22	22	22	22	22	22

The regression results in Table 14 assess the impact of lagged financial variables on stock returns for STOXX 600 firms, as detailed in the Methodology section. ESG scores do not exhibit a statistically significant relationship with stock returns in any model, suggesting that past ESG performance does not influence future stock returns in the European market. This finding reinforces earlier results (Table 12), where contemporary factors played a more dominant role in determining stock performance, and aligns with broader themes suggesting that sustainability metrics impact stock returns immediately, rather than over time.

Among the control variables, none show consistent significance across models. Total assets display weak significance in Model (1), with a negative relationship implying that larger firms might generate slightly lower stock returns. However, this result does not persist in subsequent models, highlighting the limited robustness of this finding. The R² values remain low (0.001

across all specifications), indicating that lagged variables explain only a minimal fraction of the variation in stock returns. This underscores the limited predictive power of historical financial characteristics in explaining future market performance for STOXX600 firms.

Overall, the results suggest that stock performance in European markets is influenced more by contemporary market dynamics than by past financial or ESG metrics.

Table 14 - Impact of Lagged Financial Variables on Stock Return in STOXX600 Firms

*This table reports the regression results for the impact of lagged financial variables on stock returns in STOXX600 firms. The dependent variable is stock return, and the table includes multiple specifications with different combinations of explanatory variables. The independent variable of interest is the lagged ESG score. All continuous variables are winsorized at the 3% level to mitigate the impact of outliers. The regressions are estimated with fixed effects to account for unobserved heterogeneity. Observations, R-squared values, and the number of years in the dataset are included to summarize the model scope. Significance levels are denoted by *** (1%), ** (5%), and * (10%).*

Variables	(1) Stock Return	(2) Stock Return	(3) Stock Return	(4) Stock Return	(5) Stock Return	(6) Stock Return
ESG Score	-3.96e-05 (0.000163)	-3.52e-05 (0.000166)	-1.36e-05 (0.000175)	-1.73e-05 (0.000177)	1.21e-05 (0.000178)	6.85e-06 (0.000207)
Total Assets	-0.00350** (0.00160)	-0.00339 (0.00314)	-0.00357 (0.00330)	-0.00389 (0.00382)	-0.00435 (0.00383)	-0.00252 (0.00610)
Total Debt		0.000307 (0.00269)	0.000982 (0.00281)	0.00149 (0.00401)	0.00197 (0.00402)	-0.000769 (0.00557)
Price-to-Earnings			0.000235 (0.000196)	0.000239 (0.000196)	0.000262 (0.000197)	0.000170 (0.000214)
Debt-to-Capital				-4.08e-05 (0.000198)	-5.11e-05 (0.000198)	8.63e-05 (0.000276)
Op. Profit Margin					0.000318 (0.000226)	0.000297 (0.000301)
Current Ratio						0.00542 (0.00504)
Constant	0.121*** (0.0246)	0.113*** (0.0259)	0.100*** (0.0289)	0.0996*** (0.0289)	0.0931*** (0.0296)	0.0960** (0.0441)
Observations	8,304	8,159	7,385	7,384	7,378	5,796
R-squared	0.001	0.001	0.001	0.001	0.001	0.001
Number of years	22	22	22	22	22	22

3.4.3 Comparison between the European and American Markets

In both the S&P500 and STOXX 600, ESG scores show a negative relationship with stock returns, but the effect is more pronounced and consistent in the STOXX 600. This suggests that European firms experience stronger trade-offs between sustainability investments and

shareholder returns. Total debt negatively impacts stock returns in both indices, reflecting the financial risks associated with leverage. However, profitability, measured by operating profit margin, consistently drives stock returns across both markets, emphasizing its role as a key determinant of financial performance. Differences in the significance of other variables highlight regional variations, with European firms likely being more influenced by regulatory and societal sustainability pressures, while U.S. firms appear more focused on short-term financial outcomes.

4. Conclusion

This thesis explores the bidirectional relationship between Environmental, Social, and Governance (ESG) scores and stock returns within the S&P500 and STOXX600 indices. It provides valuable insights into the interplay between financial performance and sustainability initiatives across two major markets.

The immediate (non-lagged) impact of stock returns on ESG scores reveals a consistent and significant negative relationship across both markets. Firms prioritizing higher financial returns may allocate fewer resources to sustainability initiatives, as evidenced by the regression results. This dynamic is slightly stronger in the S&P500, where short-term financial priorities appear to play a more dominant role. Larger firms, indicated by total assets, consistently display higher ESG scores, reflecting their capacity to invest in sustainability and respond to regulatory and stakeholder pressures. Debt-related variables, such as total debt, exhibit a positive influence on ESG scores, suggesting that leveraged firms may engage in ESG practices to mitigate financial risks.

The lagged results indicate that past stock returns do not significantly influence ESG performance in either market. Instead, ESG strategies are more responsive to immediate financial and market conditions. While lagged total debt positively correlates with ESG scores, other lagged variables, such as operating profit margin and debt-to-capital ratio, show limited explanatory power. These findings emphasize the predominance of current market dynamics in shaping ESG initiatives.

The analysis of ESG scores' impact on stock returns reveals a statistically significant negative relationship across both markets in the short term. This relationship is more consistent in the STOXX600, where sustainability investments appear to entail stronger trade-offs with shareholder returns. Profitability metrics, particularly operating profit margin, emerge as critical drivers of financial performance in both markets, underscoring the importance of

balancing ESG commitments with profit generation. Additionally, total debt negatively impacts stock returns, reflecting the financial risks associated with leverage.

Lagged ESG scores, however, do not exhibit a significant influence on subsequent stock returns in both markets, again showing the immediacy of ESG's financial implications. Furthermore, the negative relationship between total debt and stock returns underscores the challenges posed by financial leverage, which negatively affects their market performance. Similarly, larger firms, do not consistently translate their size advantage into higher stock returns in lagged contexts.

Future studies could build on these findings by incorporating a broader range of markets, including emerging economies, to capture global variations in ESG-financial relationships. A sector-specific analysis would also yield valuable insights, particularly for industries where ESG metrics play a pivotal role, such as energy, technology, or healthcare. Additionally, exploring the influence of ESG visibility, such as media coverage or investor sentiment, could provide a more nuanced understanding of how sustainability perceptions shape financial outcomes.

However, there are noteworthy limitations that should be acknowledged. Data availability constrained the analysis, particularly for earlier periods where ESG metrics were less standardized, hence the rather short time frame studied in the analysis. Further, the reliance on annual data limits the ability to capture short-term market dynamics and reactions to ESG-related announcements. The analysis does not incorporate direct measures of investor behavior, such as fund flows or sentiment analysis, which could provide additional context for understanding the observed relationships between ESG performance and financial metrics. Additionally, sectoral differences were not controlled for, which may influence the results regarding distinct ESG priorities or financial structures. The geographical focus on the S&P500 and STOXX600 indices limits the generalizability of the results to other regions, leaving room for further research.

In summary, this thesis provides an extensive exploration of the complex relationship between ESG performance and stock returns. The findings highlight significant regional differences, immediate financial trade-offs, and the importance of firm size and profitability in driving ESG outcomes. As ESG considerations continue to shape corporate strategies and investor decisions, further research will be essential to understanding their long-term implications for financial markets.

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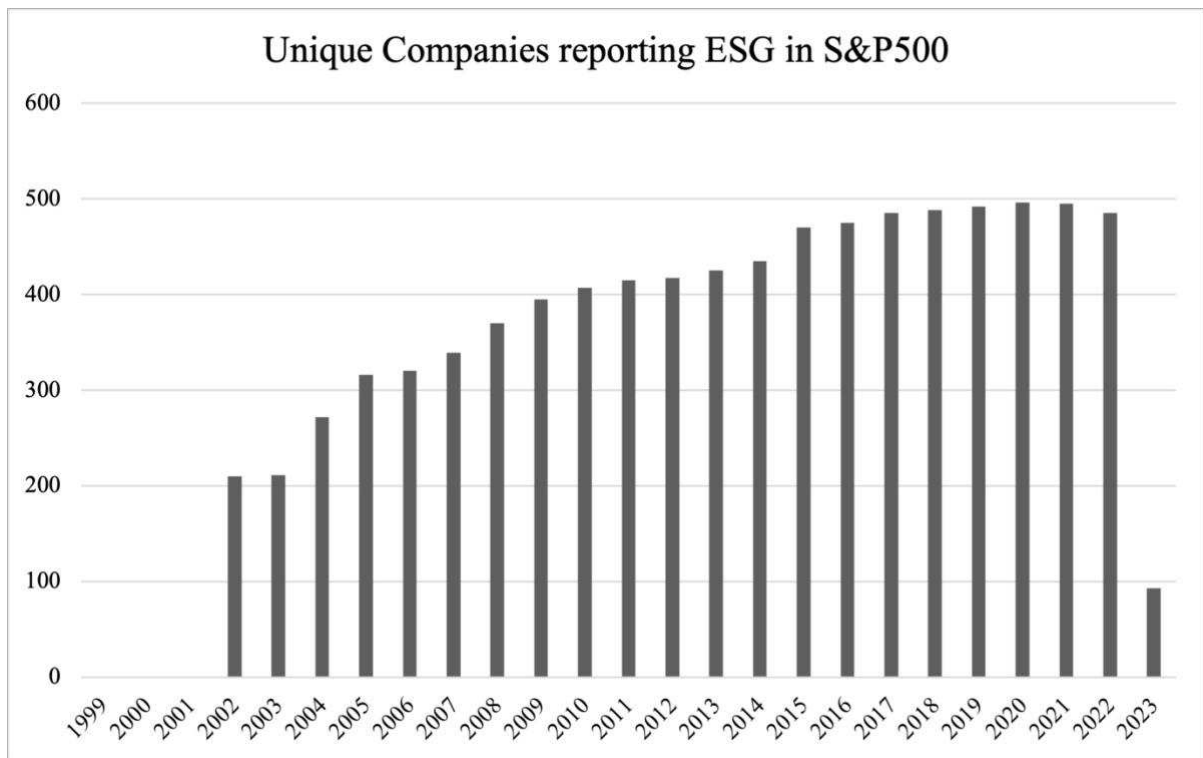
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Appendix A - Table of Variables

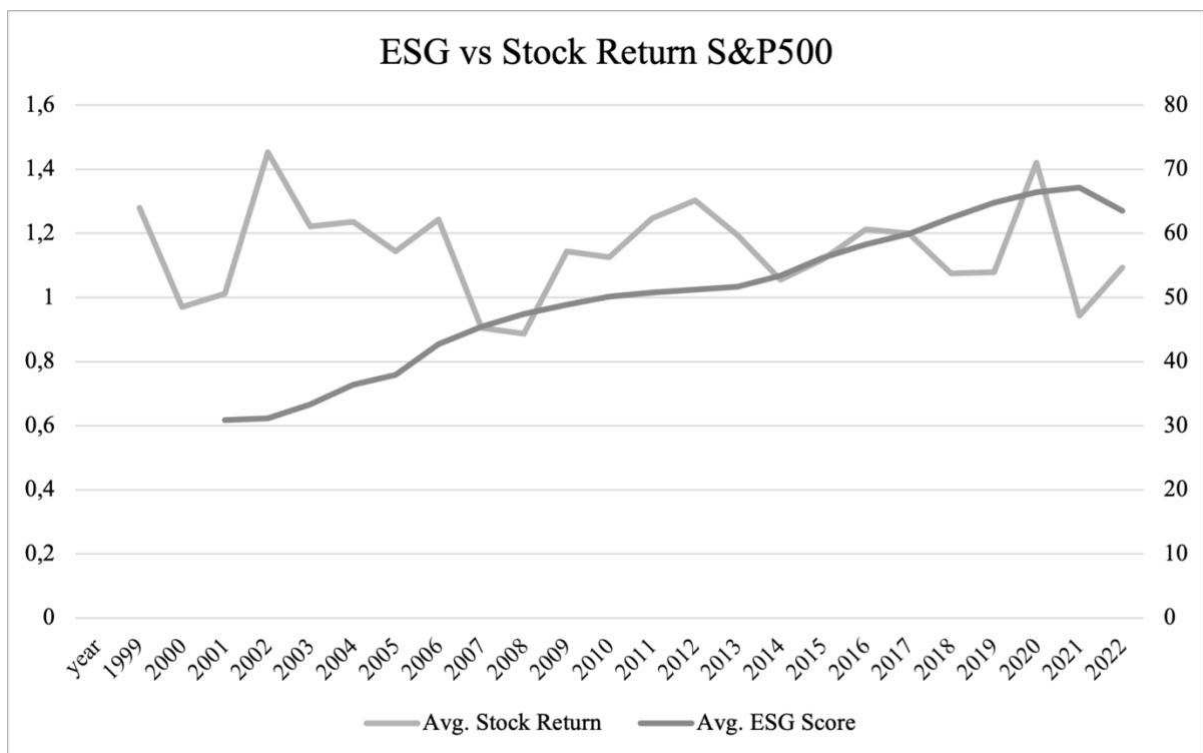
All variables shown in this table were sourced from LSEG Eikon Datastream.

Variable	Definition	Use	Reference
ESG-Score	Environmental, social, and governance score	Evaluates a company's sustainability practices, risk mitigation, and ethical impact	Deng et al. (2013)
Stock Price	Price at which a stock is traded	Reflects market valuation, investor sentiment, and overall performance	Fama & French, (1993)
Total Assets	Sum of all company assets	Proxy for company size and operational capacity	Berger & Ofek (1995)
Total Debt	Sum of short and long-term liabilities	Reflects leverage, financial risk, and capital structure	Shackleton et al. (2022)
Price to Earnings	Ratio of stock price to earnings	Indicates valuation, expected growth, and profitability potential	Phan et al. (2015)
Debt to Capital	Ratio of debt to total capital	Measures leverage and the risk related to capital structure	Iqbal & Usman, (2018)
Operating profit margin	Ratio of operating income to revenue	Assesses operational efficiency and profitability	Mahruzal & Khaddafi (2020)
Current Ratio	Ratio of current assets to current liabilities	Evaluates short-term liquidity and financial health	Delen et al. (2013)

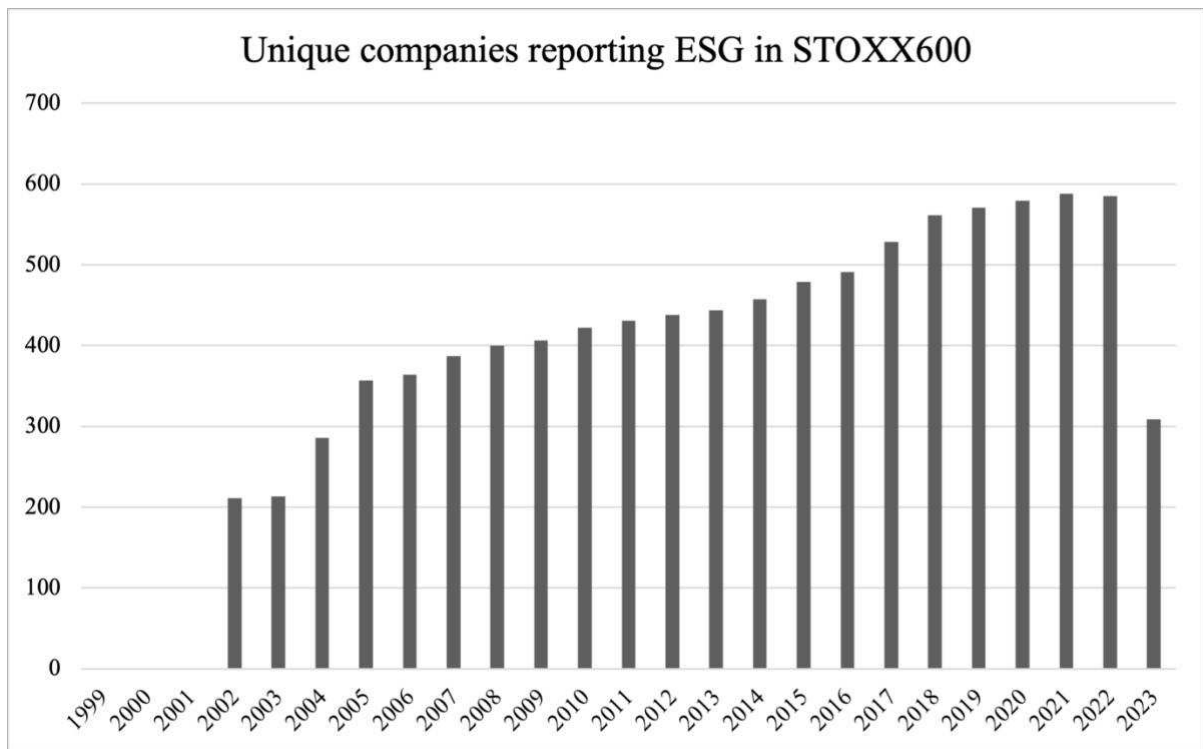
Appendix B - Graph of unique Companies with ESG Scores each Year in the S&P500



Appendix C - Graph of avg. ESG scores and Stock Returns over time in the S&P500



Appendix D - Graph of unique Companies with ESG Scores each Year in the STOXX600



Appendix E - Graph of avg. ESG scores and Stock Returns over time in the STOXX600

