

Master Thesis

The effects of ESG scores on stock performance of US S&P 500 listed firms

Carlo Lech (152421144)

Dissertation written under the supervision of Eva Schliephake

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Abstract

This thesis investigates the linear relationship between ESG ratings and stock performance of companies of the S&P 500 index between 2010 and 2022.

As database for the overall ESG score and the individual environmental, social and governance pillars the independent leading financial data provider Thomson Reuters is used. I use a long-short zero investment strategy, by going long on the 20% highest rated and short on the 20% lowest rated companies, to investigate a potential relationship.

No abnormal excess returns are observed when examining the regression results for portfolios constructed based on overall ESG scores, indicating a neutral relationship within our time and data sample. However, when analyzing the individual pillars of environmental, social, and governance, slightly negative abnormal returns are statistically significant. These findings indicate a negative linear correlation between the performance of these specific pillars and the financial performance of S&P 500 companies.

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Keywords: ESG, financial performance, S&P500, socially responsible investing, Thomson Reuters, abnormal excess returns

Resumo

Esta tese investiga a relação linear entre as classificações ESG e o desempenho das ações das empresas do índice S&P 500 entre 2010 e 2022.

Como base de dados para a pontuação global ESG e para os pilares ambientais, sociais e de governação individuais, é utilizado o principal fornecedor independente de dados financeiros Thomson Reuters. Utilizo uma estratégia de investimento longo-curto nula, que consiste em investir a longo prazo nos 20% das empresas com a classificação mais elevada e a curto prazo nos 20% das empresas com a classificação mais baixa, para investigar uma potencial relação.

Não se observam retornos excessivos anormais quando se examinam os resultados da regressão para carteiras construídas com base em pontuações globais de ESG, o que indica uma relação neutra na nossa amostra temporal e de dados. No entanto, quando se analisam os pilares individuais ambientais, sociais e de governação, os retornos anormais ligeiramente negativos são estatisticamente significativos. Estas conclusões indicam uma correlação linear negativa entre o desempenho destes pilares específicos e o desempenho financeiro das empresas do S&P 500.

Título: Os efeitos das pontuações ESG no desempenho das ações das empresas listadas no índice S&P500 dos EUA

Autor: Carlo Lech

Palavras-chave: ESG, desempenho financeiro, S&P500, investimento socialmente responsável, Thomson Reuters, retorno anormal em excesso

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1 Introduction

A recent report by Stanton (2022) published by PwC indicates significant growth in ESG-oriented assets under management (AUM) across multiple regions, since the last ten years have been marked by a significant increase in demand for sustainable investments. It is anticipated that these assets will more than double to reach \$10.5 trillion in the United States and in Europe ESG oriented assets will grow by 53%, amounting to \$19.6 trillion. By 2026, ESG assets under management in the Asia-Pacific region will have more than tripled to \$3.3 trillion, experiencing a remarkable increase and demand. In addition, Africa, the Middle East, and Latin America are investing heavily in ESG products. Mark Carney (2019), Governor of Bank of England, he mentioned the upcoming and growing importance in socially responsible investing for investors by stating:

“In the future, climate and ESG considerations will likely be at the heart of mainstream investing. Investors will tailor their investments and fulfil their fiduciary duties through better quality and more widely available data on sustainability and performance, and more informed judgements of strategic resilience.” (Carney, 2019)

Lima (2017) and several other scholars, including Edmans (2011), Derwall et al. (2005), Kempf and Osthoff (2007), and Eccles et al. (2012), have conducted extensive research exploring the relationship between a company's environmental, social, and governance (ESG) performance and its stock performance. The prevailing consensus in these studies suggests a positive correlation, indicating that companies with strong ESG scores, commonly referred to as "good" ESG performers, are expected to surpass companies with lower rated ESG performance in terms of their anticipated returns. These findings provide evidence that ESG performance can have a favorable impact on stock performance.

However, recent research, including the works of Halbritter and Dorfleitner (2015) and Statman and Glushkov (2009), contradicting results, suggesting a neutral effect of ESG performance on stock performance. Additionally, studies conducted by Hong and Kacperczyk (2009) have found a negative effect. These studies have introduced a novel perspective by indicating a statistically significant negative linear relationship between ESG performance and stock performance. The rationale behind this contrasting finding lies in the perception that companies with lower-rated ESG performance are considered to carry higher levels of risk. Accordingly,

this outcome aligns with the trade-off theory, which posits that stocks associated with greater risk tend to exhibit higher returns.

These studies have introduced a novel perspective by indicating a statistically significant negative linear relationship between ESG performance and stock performance. The rationale behind this contrasting finding lies in the perception that companies with lower rated ESG performance are considered to carry higher levels of risk. Accordingly, this outcome aligns with the trade-off theory, which posits that stocks associated with greater risk tend to exhibit higher returns.

This thesis intends to investigate the existence of a linear relationship between ESG performance and stock performance among companies listed in the S&P 500 index from 2010 to 2021, using a sample of 500 companies per year. ESG scores from Thomson Reuters Refinitiv represent ESG performance. Refinitiv's ESG performance evaluation assesses a company's performance across the environmental, social, and governance pillars. The evaluation is based on publicly available information, ensuring an objective analysis that incorporates a comprehensive range of ESG data. By relying solely on publicly available information, Refinitiv aims to provide investors with a reliable and unbiased assessment of a company's ESG performance. This approach enables investors to make informed decisions by leveraging the complete spectrum of available ESG information.

The study ranks companies based on their ESG performance and constructs portfolios using a long-short strategy, a net-zero investment approach involving the purchase of the top 20% of ranked companies and the sale of the bottom 20%. ESG performance is measured by a company's overall ESG and accordingly to each pillar, which will be described later more in detail. The portfolios are rebalanced annually, with a lag of one year following the release of new ESG scores. The lag guarantees information symmetry for all market participants, thereby mitigating any potential for a look-ahead bias. In addition, by delaying the study by one year, information asymmetry concerns are addressed, allowing an investigation into the linear relationship between ESG ratings and financial performance after the market and investors have incorporated this public information.

This study employs the following three well-known models to investigate the existence of a positive or negative relationship between ESG performance and its returns: the Fama-French three-factor model, the Carhart four-factor model, and the Fama-French five-factor model (excluding momentum). The regression results indicate no statistically significant relationship

between the stock performance of companies with high and low ESG performance when considering the overall ESG scores. The study reveals, however, that the long-short portfolio generates statistically significant slightly negative abnormal returns when the individual scores for environmental, social, and governance dimensions are analyzed. This suggests that companies with lower scores in these ESG dimensions are more likely to overperform and high rated ESG companies to underperform. The results from my empirical analysis are in line with the latest finding of ESG experts.

This study adds value to the existing empirical literature by analyzing a different time frame, a different company sample and by using different data sources as the previous published papers, theses, and studies on this topic. In addition, it investigates the interplay between the three ESG dimensions, examining how performance in one dimension may be related to performance in the other dimensions.

2 Theoretical framework

The empirical evidence in this study aims to explore the linear relationship between ESG ratings and stock returns for companies listed in the S&P 500. Specifically, the objective is to investigate the existence of a linear relationship between high ESG ratings and abnormal returns. Through this analysis, the study seeks to contribute to the understanding of the impact of ESG ratings on companies' financial performance. I am going to look through the previously published relevant empirical studies in the following part, which are building the theoretical foundation for my thesis.

Gompers, Ishii and Metrick's (2003) published their study on investigating the relationship between corporate governance and equity prices for 1500 large US firms during the early 1990s. The research and influence of the ESG rating on stock returns gained in importance and more research relating to socially responsible investing was conducted. The authors assessed by constructing their own "Governance Index", incorporating 24 governance rules, and by implementing an investment strategy of buying the top 10% and shorting the bottom 10% companies ordered accordingly to the index. by following this investment strategy, investors would have earned in the sample period an excess return of 8.5%. This study emphasized the significance of good corporate governance in enhancing financial performance and shareholder value.

The importance of ESG grew in the early 2000s and more and more research on this topic has been conducted. Derwall et al. (2005) refuted the belief that socially responsible investing (SRI) resulted in financial underperformance rather than portfolio overperformance. They constructed two equity portfolios differing in eco-efficiency characteristics, ranking stocks based on environmental performance rather than traditional ESG pillars. Their results state that during the period from 1995 to 2003, the top portfolio exhibited superior performance compared to the bottom portfolio. This was achieved by constructing a portfolio that took a long position in the top 30% of ranked stocks and a short position in the bottom 30% of ranked stocks. This study addresses a variety of concerns and concludes that adopting an SRI approach can result in significant benefits for investors, even after transaction costs are considered.

Two years later Kempf and Osthoff (2007) examined in their article "*The Effect on Socially Responsible Investing on Portfolio Performance*" the impact of socially responsible investing (SRI) on portfolio performance. They constructed portfolios based on social responsibility criteria's from KLD Research & Analytics, using stocks data of companies traded in the S&P 500 and the DS 400 index from 1992 to 2004. Kempf and Osthoff used a best-in-class investment strategy by constructing a portfolio by going long on the top 10% socially responsible stocks and short selling the bottom 10%, generating an abnormal return of 8.7% for the analyzed period. Even after incorporating transaction costs, the best-in-class strategy generated an alpha that was statically significant.

However, Hong and Kacperczk (2009) challenged the belief that socially responsible investing portfolios would outperform so called "sin stocks", companies in the tobacco, alcohol, and gambling industry. They discovered that these sin stocks outperformed SRI portfolios in the US between 1962 and 2006. They investigated that sin stocks outperformed ESG portfolios by 21 basis points a month or 2.5% per year. The authors suggest that investors biases and preferences may drive the performance of sin stocks, possible due to higher appetite or perceives undervaluation. This study called into question the validity of previous research that it is worth investing in socially responsible equities. This study called into question the validity of previous research suggesting that incorporating SRI investments would generate excess returns.

The primary focus of Edmans's (2011) research was on the social pillar of ESG, specifically the relationship between employee satisfaction and long-term stock returns. The study compiled a value-weighted portfolio of the "100 best companies to work for in the United States" from 1984 to 2009. Using the four-factor model developed by Carhart (1997), which incorporates

market risk, size, value, and momentum, the study aimed to determine whether a linear relationship exists between ESG-conscious companies and their financial performance. During the period between 1984 and 2009, the portfolio comprised of companies with high employee satisfaction exhibited an abnormal return of 3.5%. In terms of returns, this portfolio outperformed industry benchmarks by 2.1%. These findings shed light on the potential positive impact of prioritizing employee satisfaction within an organization and suggest a link between strong social performance and superior financial performance. Edmans stated with its paper that companies prioritizing their employee well-being and a positive work environment may enhance its financial performance, since the well-being of its employees will be reflected by their work ethic.

The effect of corporate sustainability on organizational processes and performance has been investigated by Eccles, Ioannou and Serafeim (2013). They discovered in a sample of 180 US companies, retrieved from Thomas Reuters ASSET4 database, that those who voluntarily (high sustainability companies) adopted sustainability policies of since 1993, significantly outperformed their counterparts over the long-term run-in terms of financial performance on the stock market as well as accounting performance. By comparing a portfolio of the best ESG scoring companies with a portfolio including the worst scoring companies, generated abnormal returns of 4.8% annually.

Clark, Feiner and Viehs (2014) conducted a comprehensive meta study categorizing over 200 different sources finding a remarkable positive correlation between strong sustainability practices and economic performance. 88% of reviewed sources supported the notion that prudent sustainability practices have a significant positive influence on investment performance. This study highlights the complementary correlation between profitability and socially responsible investing, emphasizing the importance of incorporating sustainability into business strategies.

The empirical analysis conducted in this thesis primarily builds upon the research conducted by Halbritter and Dorfleitner (2015), which investigates the impact of ESG ratings on stock returns using data from multiple platforms. The sample encompasses ESG data from ASSET4, Bloomberg, and KLD, focusing on the U.S. market between 2002 and 2012. The authors construct portfolios based on each dataset provider, taking long positions in the top 20% ESG-rated companies and short positions in the bottom 20% rated companies. They also adopt a best-in-class investment strategy, as suggested by Kempf and Osthoff (2007). The analytical

framework of this study employs an ESG portfolio approach and utilizes the Carhart (1997) four-factor model, along with cross-sectional Fama and McBeth (1971) regressions, to predict excess stock returns using monthly data. To enhance robustness, the dataset is divided into two distinct time periods: 2002-2006 and 2007-2012. Contrary to previous research, Halbritter and Dorfleitner find no significant relationship between ESG ratings and financial performance. In certain instances, the effects of corporate governance exhibit negative associations. Additionally, the subcomponents of ESG do not demonstrate any significant effects. However, for the overall ESG score, a limited, albeit statistically insignificant, effect is observed. The authors emphasize that the existence of a relationship between ESG ratings and financial performance heavily relies on the underlying data sample and, more notably, on the specific data provider of the ESG ratings.

In an influential paper Auer and Schuhmacher (2016) examined the performance of high ESG portfolios versus low ESG portfolios across the following three regions: United States, Europe, and Asia-Pacific. After employing various portfolio screens based on industry-level and geographic regions, this study did not discover any definitive evidence supporting the superior performance of high ESG portfolios across the analyzed regions. However, investors who prioritized ethical considerations in portfolio selection could achieve comparable performance to the market return in the Asia-Pacific and the United States. However, depending on the industry focus investors would pay tend to pay a premium for investing in socially responsible equities.

The article by Kumar et al. (2016) questions the conventional finance belief that lower risk equals lower returns. Their mathematical analysis reveals that companies considering environmental, social, and governance (ESG) factors have lower stock volatility than their industry peers, with ESG factors having a different impact on each industry. Furthermore, firms with high ESG ratings outperform firms with lower ratings in terms of risk-adjusted returns. The study focused on equities included in the 157 Dow Jones Sustainability Index and 809 non-listed companies. According to the findings, incorporating ESG factors into investment decisions can result in superior risk-adjusted returns, which benefits low-risk investment strategies such as pension funds.

In one of the most recent published studies by Petitjean (2019) addressing the impact of environmentally friendly policies on companies' financial performance during crises and post crisis. This study collected data from the Bloomberg ESG Database on environmental, social

and governance measures for large US companies in the S&P 500 index from 2005 to 2017. In addition to accounting and market-based financial performance, the study controlled financial soundness, social and governance performance, and seven indicator proxies to measure environmental performance. Petitjean noted that there is no apparent correlation between financial performance and emission reduction or climate change policies in major US corporations. No obvious changes were noticed, not even when the 2008–2009 financial crisis was taken into consideration.

Drempetic et al. (2019) investigate the impact of firm size, available resources for ESG data, and data availability on sustainability performance using Thomson Reuters ASSET4 ESG ratings. The study discovers a significant positive correlation between these variables, indicating an ESG rating size bias. The ESG rating system favors larger companies with more resources. This calls into question whether ESG scores accurately measure corporate sustainability and provide sufficient information for SR investors to align their ethical beliefs.

Regarding the relationship between ESG ratings and financial performance, the previously mentioned literature offers contradictory results. While some studies suggest a positive relationship, suggesting that investing in companies with high ESG ratings can result in abnormal stock returns, other studies cast doubt on this correlation. Given the complexity of this relationship, it is essential to carefully consider the limitations of each study and the larger body of research in this field. Examining the effect of each ESG pillar on stock returns, this thesis aims to contribute to the existing body of knowledge. To accomplish this, I will employ methodologies derived from prior research. I will analyze the performance of portfolios comprised of companies with the highest and lowest ESG scores. To collect pertinent information, I will concentrate on S&P 500-listed companies from 2010 to 2021. This exhaustive analysis aims to shed light on the connection between ESG performance and stock returns over the specified time.

3 Hypothesis

This thesis investigates the existence of a statistically significant linear relationship between socially responsible investing, companies with high ESG ratings, and their stock performance. Based on the previous research mentioned in Section 2, the following hypothesis is presented.

3.1 Tested hypothesis

“Companies with high ESG ratings generate abnormal returns, compared to companies with low ESG ratings”.

The existing literature contains contradictory findings concerning the relationship between ESG ratings and financial performance. Some studies indicate a positive relationship implying that investing in companies with high ESG ratings can result in superior financial performance. However, other scientific studies and papers contradict and call this relationship into question. Given the complexities involved, it is critical to carefully consider each study's limitations as well as the broader research in this field.

To shed light on this, our analysis considers overall ESG metrics and investigates the specific dimensions of environmental, social, and governance factors. This allows us to compare our findings to those of previous studies and investigate how each factor influences financial performance. Understanding the complex relationship between ESG and financial outcomes necessitates a careful examination of study limitations and broader research in this field.

4 Data

4.1 Data overview

Firstly, I will describe the database, the data, and the period utilized in this thesis. This dissertation retrieves data from Thomson Reuters Refinitiv Eikon Datastream and the data library of Kenneth R. French. Thomson Reuters Refinitiv Eikon Datastream was used to collect annual ESG data, the daily return indexes, and annual market capitalization values for the companies included in the study. The Fama French and Carhart factors, necessary for the regressions, for U.S. companies are retrieved from the data library of Kenneth R. French (2021).

This thesis focuses on portfolio investors looking to implement an ESG-based screening strategy. Based on prior research, ethical portfolio's are constructed by comparing companies with the highest and lowest ESG scores (Statman & Glushkov, 2009; Halbritter & Dorfleitner, 2015). The stocks return with the highest and lowest ESG scores were chosen from a large data sample, enabling performance comparisons and the examination of a potential linear relationship between ESG ratings and a company's financial performance.

By analyzing the influence of ESG scores on stock returns, I began by looking at individual stocks listed in the US market to determine the scope of my thesis. The data collection spans the years 2010 to 2021 and consists of companies included in the S&P 500 index. The decision to concentrate on the U.S. market, specifically on the S&P 500 index, was justified by the fact that it represents a large market comprising numerous sectors and industries, guarantees stock liquidity, investor accessibility, and consistent reporting along our time span. Furthermore, previous literature showed that the S&P index is a good proxy for this analysis. Moreover, the time horizon was carefully selected to mitigate the effects of the 2008 financial crisis and its aftermath on the financial performance of corporations.

The data library of Kenneth French was accessed to retrieve the daily variables for the Fama French three-factor-, the Carhart four-factor- and the Fama French five-factor models for the US needed to perform the OLS regressions.

4.2 ESG data

Refinitiv Eikon's ESG scores, which are built from publicly reported data across three pillars (environmental, social, and governance) and ten ESG topics, are used to measure a company's ESG performance (Refinitiv, 2022). These ESG scores are intended to objectively and transparently measure the relative ESG performance of a company. Refinitiv Eikon's database covers 80% of the global companies and consists of over 630 ESG metrics, incorporating historical ESG ratings dating back to 2002 (Refinitiv, 2022). Refinitiv is the world's leading provider of financial data.

Eikon's ESG scores are driven by collected company specific data and incorporate the most important industry metrics but are hampered by company size and transparency-related biases. Environmental, social, and governance (ESG) factors in the company's industry (for environmental and social issues) and country of incorporation (for governance issues) determine the ratings (Refinitiv, 2022). Human rights, community, workforce, innovation, environmental resource use, environmental emissions, environmental products, product responsibility, shareholders, management, and CSR strategy are all considered when determining a company's relative ESG performance (Refinitiv, 2022). The percentile scores for these ESG ratings range from 0 to 100. Environmental, social, and governance (ESG) scores are calculated with a rigorous methodology by Refinitiv. The initial consideration of over 500 data points per company is followed by the selection of 186 relevant and comparable data

points. Each of the ten categories' ratings are determined by Refinitiv using percentile rank scoring. The scores for each pillar are the sum of the weighted category scores for that pillar. Each category is subdivided into six to ten subcategories, with each subcategory being evaluated using an assortment of numeric and Boolean data points. The assigned scores for the environmental, social, and governance pillars serve as indicators of the company's performance within each specific pillar. By determining the scores for each pillar, the ESG score is determined by multiplying each pillar's weight by its score. Notably, while the weight of the governance pillar varies slightly across sectors, the weights of the environmental and social pillars remain constant. The respective weighting is described as follows:

Environmental	Social	Governance
a) resource use (11%)	a) Employees (16%)	a) Management (19%)
b) Emission (12%)	b) Human dignity (4.5%)	b) Shareholders (7%)
c) Innovation (11%)	c) Regionality (8%)	c) CSR strategy (4.5)
	d)Product responsibility (7%)	

Table 1: Subcategories and weightings for each ESG pillar

Since the necessary data for Eikon Refinitiv to define ESG ratings is typically contained in a company's balance sheet and other relevant documents, which are typically made public at the end of its fiscal year, Eikon Refinitiv issues ESG ratings annually. Since every company defines the end of its fiscal year differently, and to be consistent throughout the thesis, I've decided to rebalance the portfolios annually on January 1st, taking each company's t-1 ESG rating in December into consideration.

4.3 Key ESG data descriptives

We retrieved the ESG data for the companies listed in the S&P 500 index from 2010 to 2021 on a yearly. As already mentioned, I only included companies in the portfolio construction process if they reported all 4 ESG rating proxies; ESG, environmental-, social- and governance pillar, for the specific year. If one of the 4 variables is missing, I excluded the company to ensure consistency in the portfolios and to compare the same companies the different ESG variables.

The S&P 500 index, which serves as a benchmark for the market and measures the performance of 500 large publicly traded companies, is a widely used stock market index in the US. that for the 4 variables not only the number of companies reporting their ratings

increases, but also the ratings, from 0 to 100, increased continuously over the years. Over the years, there has been an increase in both the number of companies reporting their ratings and the ratings themselves, which range from 0 to 100. In 2010, only 479 out of the 500 companies published ratings, while by 2021, all 500 companies had reported their ratings. Additionally, the average rankings in each ESG category have shown a consistent upward trend. For instance, the average ESG rating was 43.4 in 2011 and increased to 58.1 in 2021. Notably, even the lowest performers in ESG have shown improvement over time. In 2010, the lowest social rating was 4.6, whereas in 2021, it increased to 17.2. This trend is reflected in all 4 categories.

In recent years, ESG (Environmental, Social, and Governance) has gained significant global attention due to various factors, including the occurrence of natural disasters and widespread protests such as Fridays for Future. This increased awareness has led to a shift in investor preferences, as an expanding number of individuals are no longer solely motivated by profits but also seek investments aligned with their social and ethical values. Consequently, there is a growing demand for companies to disclose their ESG ratings and make continuous efforts to enhance them over time. It has become crucial for leading global companies to recognize the significance of ESG, as it directly impacts their reputation, stakeholder trust, and ability to attract investment from socially conscious individuals and institutions. By embracing ESG principles, companies can demonstrate their commitment to sustainability, responsible business practices, and long-term value creation.

Year	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Companies	479	478	480	479	485	473
ESG average	43.4	45.3	45.7	47.4	47.0	47.8
ESG max.	86.2	88.9	92.5	91.3	88.2	89.3
ESG min.	3.9	2.8	3.0	1.9	2.5	2.5
Year	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Companies	476	469	489	492	499	500
ESG average	52.4	53.4	56.4	57.4	58.2	58.1
ESG max.	88.1	82.7	90.9	92.7	90.1	90.2
ESG min.	5.8	10.9	10.4	14.7	20.6	16.1

Table 2: Descriptive statistics of the ESG score 2010 - 2021

Year	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Companies	479	478	480	479	485	473
ESG average	47.1	48.5	49.4	50.3	50.2	51.0
ESG max.	93.9	97.7	98.0	98.5	98.5	98.6
ESG min.	1.4	0.1	0.7	1.0	0.3	0.9
Year	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Companies	476	469	489	492	499	500
ESG average	51.0	53.4	54.2	56.1	58.7	61.6
ESG max.	98.7	97.3	97.1	97.2	98.1	97.5
ESG min.	1.0	0.5	0.9	0.7	0.6	0.1

Table 3: Descriptive statistics of the environmental-pillar score 2010 - 2021

Year	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Companies	479	478	480	479	485	473
ESG average	50.3	51.8	53.2	52.5	53.4	54.2
ESG max.	97.6	96.5	95.9	95.4	95.7	95.8
ESG min.	4.6	1.2	1.6	0.3	3.5	3.4
Year	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Companies	476	469	489	492	499	500
ESG average	57.1	58.9	63.9	63.4	65.6	69.1
ESG max.	95.9	97.7	98.9	97.7	97.9	97.6
ESG min.	12.1	11.9	26.8	15.3	13.0	17.2

Table 4: Descriptive statistics of the social-pillar score 2010 - 2021

Year	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Companies	479	478	480	479	485	473
ESG average	53.1	53.3	55.4	55.0	55.1	55.4
ESG max.	98.5	97.7	97.3	97.8	96.5	95.1
ESG min.	1.9	1.6	1.6	0.8	1.5	1.7
Year	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Companies	476	469	489	492	499	500
ESG average	59.5	61.3	62.8	62.9	62.8	64.6
ESG max.	98.5	96.0	98.6	98.6	97.2	99.5
ESG min.	5.3	5.1	7.6	10.1	6.3	10.6

Table 5: Descriptive statistics of the governance-pillar score 2010 - 2021

4.4 Stock sample selection

We required continuous ESG scores and financial data for the historical constituents of the S&P 500 index from 01.01.2010 to 31.12.2021. For the sake of simplicity, we exclude companies that were not included in the index for the entirety of the year or lacked ESG data, daily return indexes, or market capitalization. From Thomson Reuters Eikon Refinitiv Datastream the historical lists of S&P 500 components for each sample year were retrieved. Since I am rebalancing the portfolios annually, I had to ensure that only active S&P 500 members for each year were included, as some companies were not included throughout the entire sample period. Some businesses were omitted because they declared bankruptcy or were no longer among the 500 largest businesses in the US, and replacements were made. In addition, we retrieved for the selected companies the daily return indexes and market capitalizations for the portfolio weights for each year. Lack of reporting from a portion of the included companies hampered the ESG data. Even after selecting the 500 largest companies in the United States, some companies did not provide ESG reporting. These stocks were eliminated from the data sample for the given year. Eikon Refinitiv publishes ESG ratings annually, as this information is typically disclosed in a balance sheet or other relevant documents of a company at the end of its fiscal year, which can vary from company to company. To alleviate this limitation, I've resolved to rebalance the portfolio's annually on January, the 1st to incorporate each company's actual ESG score. The statistics demonstrate that ESG ratings are gaining importance. Initially, in 2010, only a few businesses reported their ratings. However, as the popularity of socially responsible investing grew and people became more environmentally conscious, a growing number of companies began to report ESG scores. Today, ESG ratings are considered as crucial and practically every company publishes them, as a high rating leads to a favorable reputation.

The limitations of our data in this study must be acknowledged. The exclusion of businesses that do not publish ESG ratings results in one limitation. Businesses that choose not to disclose their ESG performance might go unnoticed because of the potential selection bias this exclusion introduces. Therefore, using ESG scores as the only metric for measuring ESG performance may not accurately reflect the full ESG landscape. Additionally, Eikon Refinitiv's ESG performance evaluation, which is based on publicly available data, may penalize non-disclosing companies with poor ESG performance and result in lower ESG scores. This strategy aims to make sure that businesses trying to hide information receive the proper punishment rather than being disqualified from the ranking. Despite this intention, it is crucial to consider any biases

that this evaluation methodology may introduce. Because of this, it is important to acknowledge the limitations brought on by the exclusion of non-disclosing companies as well as any potential biases related to the ESG scoring methodology, even though we contend that our sample is not subject to selection bias. Finally, we emphasize that transaction costs are not factored into the calculation of portfolio returns in our analysis. This omission may affect the portfolio's overall performance and should be considered when interpreting the results.

4.5 Portfolio methodology

To evaluate the financial performance of companies based on their ESG a portfolio construction approach was employed the following four socially responsible rating proxys: ESG (ESG), environmental (E), social (S), and governance (G) scores. Following the empirical methodology of Kempf and Osthoff (2007), Auer and Schuhmacher (2016), Halbritter and Dorfleitner (2015) a best-in-class, "Top-Bottom", portfolio strategy was implemented to construct zero-investment portfolios for each ESG variable (ESG, E, S, and G) for our investigated data sample of the companies listed in the S&P 500 index from 2010 to 2021.

To capture potential ESG premiums or discounts, the long-short "Top-Bottom" portfolio strategy was adopted. This involved purchasing the "Top" portfolio containing the top 20% ranked equities accordingly to their ESG scores while short selling the bottom 20%, the lowest ESG rated companies. The resulting ESG portfolio aimed to analyze the differential abnormal returns between companies with high and low ESG ratings. Each portfolio was formed on the first trading day of January in year t and held until the end of the year t , the portfolios are rebalanced on a yearly basis. At the end of year t , we rank the updated ESG ratings form the updated S&P 500 constituents list from $t+1$ and construct the portfolios to are held in $t+1$. The ESG ratings used were obtained from the Thomson Reuters Eikon Refinitiv. The ESG data for the year t constituents' companies of the S&P 500 are retrieved for year $t-1$, because we want to investigate the relationship of ESG Data and financial performance. By lagging the ESG data I am ensuring that the information is priced in the stock returns. It should be noted that the composition of the S&P 500 index changed from year to year.

Two portfolios, an equal-weighted and one value-weighted portfolio, were created in order to test the results' sensitivity to different weighting methods. In total, 96 portfolios were formed for each year, encompassing the four ESG ratings (ESG, E, S, and G), two portfolio weights (equal-weighted and value-weighted), and a 11-year observation period from 2010 to 2021. To

determine the equal-weighted return, we averaged the "Top" portfolios' returns minus the "Bottom" portfolio's returns. However, the market capitalization of the stocks in each portfolio was taken into account when calculating the value-weighted return.

The dependent variable in the subsequent regression analysis was the return of the "Top-Bottom", the "Top" and "Bottom" portfolio. Both the equal-weighted and value-weighted returns of the long-short portfolios were utilized to capture potential ESG premiums or discounts. The study encompassed daily return index to calculate the daily returns, yearly market capitalization figures, and yearly ESG ratings for the S&P 500 companies, ensuring a comprehensive analysis over the 11-year period from 2010 to 2021. Refinitiv (2022), defines the daily return index as the incorporation the daily price change and any relevant dividends for the same day.

$$RI_t = RI_{t-1} \frac{P_t}{P_{t-1}} * (1 + \frac{DY_t}{100 * N})$$

Equation 1: Thomson Reuters return index

Where:

RI_t and RI_{t-1} = the return index in period t and $t - 1$ respectively

PI_t and PI_{t-1} = the price index in period t and $t - 1$ respectively

DY_t = dividend yield in period t

N = number of working days each year

The daily returns for every stock are calculated as follows:

$$r_t = \frac{RI_t}{RI_{t-1}} - 1$$

Equation 2: The daily return formula

Where:

RI_t and RI_{t-1} = the return index in period t and $t - 1$ respectively

The equal-weighted return was calculated by averaging the "Top" portfolio returns minus the "Bottom" portfolio returns. The value-weighted return, on the other hand, took into account the market capitalization of individual equities within the portfolios. The market capitalization of each stock in the value-weighted portfolios is divided by the sum of all the stocks' market capitalizations to determine the weights.

$$w_{it} = \frac{\text{Market capitalization}_{it}}{\sum_{n=1}^N \text{Market capitalization}_{it}}$$

Equation 3: Formula for the weights of the value weighted portfolio

Where:

w_{it} = weight of stock i in the value weighted portfolio

$$w_{it} = \frac{1}{\sum_{n=1}^N (\text{number of companied in the Top-bottom portfolio})}$$

Equation 4: Calculation for the weights of the equally weighted portfolio

Where:

w_{it} = weight of stock i in the value weighted portfolio

The portfolio returns are finally calculated as follows:

$$r_{pt} = \sum_{i=1}^N (w_{it} - r_{ti})$$

Equation 5: The portfolio return formula

Where:

r_{pt} = the portfolio return at time t

w_{it} = the stock i 's weight in the portfolio at time t

r_{ti} = the stocks daily return i at time t

5 Methodology

According to prior research, the construction of ESG portfolios has become a popular method for examining the potential relationship between a company's financial performance and its corporate social responsibility (CSR) performance (Halbritter & Dorfleitner, 2015; Auer et al., 2016). This study employs the ESG ratings methodology, which permits the consolidation of numerous large datasets into a single time series. In addition, it facilitates the use of asset pricing models and provides investors with a straightforward trading strategy (Halbritter & Dorfleitner, 2015). Typically, the ESG portfolio method requires the creation of two portfolios: a high-ESG-rated portfolio representing an ESG outperformance and a low-ESG-rated portfolio representing an ESG underperformance. In addition, a long-short strategy portfolio is created by purchasing the portfolio with a high ESG score and selling the portfolio with a low ESG

score (Halbritter & Dorfleitner, 2015). Prior research has shown that these portfolios produce returns that conventional asset pricing models cannot fully explain, indicating the existence of empirical anomalies (Hjalmarsson, 2009).

In accordance with previously cited literature on the impact of non-financial criteria on financial performance, the following methodology was used to investigate the linear relationship between financial performance and ESG ratings and to address the thesis question of whether ESG investing produces abnormal returns. We used a long-short zero investment strategy to compare the financial performance of the "Top" minus "Bottom" ESG equally weighted and value-weighted portfolios with the Carhart four-factor-model, the Fama French five-factor-model, and the Fama French three-factor-model.

The factor models attempt to explain stock return variation by incorporating factors that explain excess returns (Womack and Zhang, 2003). These models are better suited to run regression for estimating portfolio returns than the CAPM (Bartholdy and Pearce, 2005). Due to the lack of empirical significance in most CAPM-based applications, I decided to exclude the capital asset pricing model from my methodology. The objective of the models is to explain all stock price fluctuations using risk factors. I use the ordinary least squares regression analyses the factor coefficients, the intercept is estimated, and the corresponding t-statistics and p value are determined to interpret the results. Estimated differences between long and short portfolios are interpreted. As a result, we interpret the intercept and alpha values in the same way as previous studies: when alpha is not statistically significant, there are no abnormal returns. As a result, the portfolio is a representation of the market. If an estimate is not statistically significant, there is no difference between the top and bottom portfolios' exposure to a particular risk factor. As the linear model estimates the coefficients of differences in addition to long portfolios, the estimates and R-squared may be less significant.

5.1 Fama and French three-factor model

The Fama and French (1993) three-factor model extends the capital asset pricing model's foundational framework, providing a more comprehensive understanding of asset returns. This model adds two new risk factors, "Small minus Big" (SMB) and "High minus Low" (HML), with the goal of capturing additional sources of systematic risk.

The SMB factor represents the excess return of a portfolio constructed by holding long positions in small-cap stocks and short positions in large-cap stocks. Empirical evidence suggests that

this strategy has historically produced positive risk-adjusted returns, implying that small-cap stocks outperformed large-cap stocks. The SMB factor incorporates the additional risk premium associated with investing in smaller companies, recognizing the size effect in asset pricing.

Similarly, the HML factor accounts for the excess return of a portfolio that is heavy on value stocks and light on growth stocks. This factor captures the market value premium, where undervalued stocks outperform overvalued stocks. The model accommodates the portfolio's exposure to the performance differences between high and low book-to-market value companies by incorporating the HML factor.

This inclusion allows the model to consider the impact of value factors on expected returns. The three-factor model developed by Fama and French (1993) has been widely used in empirical research to assess investment portfolio performance and the impact of size and value factors on expected returns. It provides an important framework for understanding the multifaceted nature of asset pricing and has aided in the development of subsequent multi-factor models

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i} * (R_{Mt} - R_{Ft}) + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \varepsilon_{it}$$

Equation 6: The Fama French three-factor model

R_{it} = total return of a stock or portfolio i at time t

R_{Ft} = risk free rate of return at time t

R_{Mt} = total market portfolio returns at time t

α_i = the abnormal return of portfolio i

$R_{it} - R_{Ft}$ = expected excess return of portfolio i

$R_{Mt} - R_{Ft}$ = excess return on the market portfolio (index)

SMB_t = the size factor at time t

HML_t = the value factor, calculated as the difference in returns between high book-to-market value stocks and low book-to-market value stocks (high minus low)

$\beta_{1,2,3}$ = factor coefficients

ε_t = the error term at time t

5.1 Carhart four-factor model

The Four-Factor Model of Mark Carhart extends the Fama-French three-factor model by including a momentum factor. In 1992, Jegadeesh and Titman (1992) observed that the momentum factor captures the persistence of stock return performance by constructing a portfolio that is long on “winner” stocks and short on “loser” stocks that underperformed.

According to Carhart (1997) stocks with high past returns tend to continue performing well, while stocks with low past returns continue to perform poorly. This strategy assumes that recent winners will continue to outperform, while recent losers will continue to underperform, generating a momentum premium.

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i} * (R_{MT} - R_{Ft}) + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * MOM_t + \varepsilon_{it}$$

Equation 7: The Carhart four-factor model

MOM_t = the momentum factor at time t

$\beta_{1,2,3,4}$ = factor coefficients

5.2 Fama and French five-factor model

Fama and French added two new factors to the original three-factor model: Robust minus Weak (RMW) and Conservative minus Aggressive (CMA) forming the five-factor model. By comparing the returns of portfolios comprised of high-profitability companies and low-profitability companies, the RMW factor captures the profitability premium. This factor quantifies the difference in returns between these portfolios, indicating that companies with higher profits generate higher returns.

The CMA factor, on the other hand, considers the investment premium by comparing the returns of portfolios with high and low levels of investment. This factor provides an alternative explanation for the investment premium by measuring the return differential between portfolios of companies with low and high investment levels.

According to Fama and French's empirical evidence, firms with a high level of investment, indicating higher expected growth in book equity, have lower expected returns. The extended Fama and French model provides a more comprehensive framework for understanding asset returns by including the RMW and CMA factors. These factors shed light on the relationship between these factors and expected returns by providing additional insights into the profitability and investment characteristics of companies.

$$R_{it} - R_{Ft} = \alpha_i + \beta_{1i} * (R_{MT} - R_{Ft}) + \beta_{2i} * SMB_t + \beta_{3i} * HML_t + \beta_{4i} * RMW_t + \beta_{5i} * CMA_t + \varepsilon_{it}$$

Equation 8: The Fama French five-factor model without momentum

CMA_t = the investment factor at time

RMW_t = the profitability factor at time t

$\beta_{1,2,3,4,5}$ = factor coefficient

6 Empirical analysis

We use the zero-investment strategy in our framework to run ordinary least squares (OLS) regression for the Fama French 3-factor, Carhart, and Fama French 5-factor models for both equally- and value-weighted portfolios to analyse the existence of a positive or negative linear relationship of ESG ratings on stock returns. We analyzed four ESG scores: the overall ESG score, the environmental-, social-, and governance pillars.

6.1 ESG score

Table 6: ESG score portfolio regression output

The linear relationship between the overall ESG score and the stock performance of S&P 500 companies can be investigated by analyzing the regression results of my thesis. There is insufficient evidence to support a correlation between high ESG scores and abnormal returns, according to the findings (alpha). The values of alpha are close to zero, indicating that companies with high ESG ratings do not outperform the market. This result of my analysis is

	Dependent variable:					
	Portfolio returns					
	FF3		Carhart		FF5	
	EW	VW	EW	VW	EW	VW
α	0.000 (0.903)	0.000 (-0.131)	0.000 (0.899)	0.000 (0.895)	0.000 (0.788)	0.000 (-0.212)
MRK-RF	0.003 (0.614)	0.014 (0.815)	0.004*** (0.734)	0.014 (0.396)	0.007 (1.244)	0.021 (1.215)
SMB	-0.027*** (-2.672)	-0.037 (-1.211)	-0.028 (-2.751)	-0.038 (0.217)	-0.021** (-2.094)	-0.024 (-0.763)
HML	0.005 (0.650)	-0.012 (-0.488)	-0.001 (-0.071)	-0.018 (0.541)	-0.007 (-0.644)	-0.031 (-1.034)
RMW					0.024 (1.596)	0.066 (1.423)
CMA					0.032 (1.505)	0.040 (0.616)
MOM			-0.009 (-1.173)	-0.009 (0.710)		
Observations	3020	3020	3020	3020	3020	3020
R^2	0.04	0.04	0.02	0.03	0.03	0.02
Adjusted R^2	0.03	0.03	0.02	0.01	0.02	0.01

Significance levels

*p<0.1; **p<0.05;***p<0.01

Note: This table reports the ordinary least square regression results of equation (1), (2), and (3) respectively. T-statistics are reported in parentheses. *,** and *** denote significance at the 10%, 5% and 1% levels respectively.

consistent across all regression models and weighting techniques used in the thesis. Thus, the results of my framework contradict the hypothesis and prior research suggesting that high ESG firms exhibit superior stock performance relative to low ESG firms, indicating that the stock market incorporates and evaluates ESG information accurately. Concerning the systematic risk factor (MRK-RF), the regression results indicate that the equally weighted portfolio

demonstrates statistical significance at various levels (10%, 5%, and 1%) in the Carhart model. Positive beta coefficients suggest that high-rated ESG firms are more volatile than low-rated ESG firms, implying that high-rated ESG firms have a higher beta. The coefficient of 0.004 (0.4%) and t-statistic of 0.734 indicate that a one-unit increase in the systematic factor is associated with a modest increase in the zero-investment portfolios. The significant difference corroborates previous research suggesting that ESG performance is a risk factor that influences the expected return of a portfolio. According to the scientific literature, companies with poor ESG performance are more likely to face increased regulatory and legal risks, reputational risks, stakeholder concerns, and operational challenges, all of which contribute to an increase in systematic risk. Changing market dynamics and investor preferences, as well as the perception of ESG performance as an indicator of long-term sustainability, provide additional support for the positive association between ESG performance and systematic risk. Positive beta coefficients observed in the regression analysis suggest that high-rated ESG firms, which are characterized by lower systematic risk, tend to be more volatile and have higher betas than low-rated ESG firms. These results demonstrate the influence of ESG factors on the expected return and risk profile of investment portfolios. All portfolios display a negative exposure to the SMB factor, indicating a preference for larger firms. In both the Fama-French 3-factor model and the Fama-French 5-factor model, portfolio exposure at the 5% and 1% levels is statistically significant. The negative SMB coefficients suggest that companies with higher ESG ratings have larger market capitalizations than those with lower ESG ratings. This is consistent with the findings of Dremptec et al. (2019), which explain the size bias and indicate that larger firms have higher ESG ratings. As expected, given the inclusion of large-cap companies in the analysis, the representation of high- and low-rated portfolio's is consistent with this observation. The negative exposure to the SMB factor in portfolios with high ESG ratings and larger market capitalizations is due to the financial resources and capabilities of larger companies, which allow them to invest in ESG initiatives and achieve higher ESG ratings. In addition, their access to capital markets and transparency and disclosure practices contribute to improved ESG performance. Larger companies are further motivated to prioritize ESG practices, in line with investor expectations, by their long-term outlook and established stakeholder relationships. Except for the equally weighted portfolio in the Fama-French 3-factor model, the HML coefficients are predominantly negative for all regressions and portfolios. The negative HML values suggest that the portfolios behave more like growth stock portfolios than value stock portfolios. However, there is no statistical significance in this regard. In addition, the Carhart and Fama-French 5-factor models include the MOM, RMW, and CMA

factors, none of which are statistically significant in any of the regressions. The lack of statistical significance for the MOM (Momentum), RMW (Profitability), and CMA (Investment) factors across all regressions in the Carhart and Fama-French 5-factor models can be interpreted through various lenses of prior academic research. The overlapping effects of ESG ratings, which include sustainability, social responsibility, and corporate governance, may diminish the explanatory power of the additional variables. In addition, it is possible that market efficiency has already incorporated the information embedded in momentum, profitability, and investment factors into stock prices, thereby diminishing their importance in elucidating the returns of ESG-focused portfolios. Further research should investigate alternative model specifications and data sources to elucidate the intricate dynamics between ESG performance and these factors, thereby advancing knowledge of their interrelationships. My result contradicts those of Kempf and Osthoff (2007), despite using the same methodology. The authors employed a best-in-class investment strategy by purchasing the top 10% of socially responsible stocks and selling short the bottom 10%, resulting in an abnormal return of 8.7%. In conclusion, the thesis's regression analysis reveals no significant relationship between ESG scores and S&P 500 index stock returns. Nonetheless, there is a significant correlation between ESG scores and systematic risk, as well as exposure to larger companies. The results contradict previous research and hypotheses regarding the superior stock performance of companies with high ESG performance, suggesting that the stock market accurately values ESG performance. Notably, the R-squared values ranging from 0.01 to 0.04 indicate that the variables included in the regression analysis explain only a small portion of the variance in the influence of ESG ratings on companies' financial performance. Therefore, it is prudent to interpret with caution the impact of Refinitiv's ESG rating on the financial performance of S&P 500 companies between 2010 and 2021. Additional research is necessary to gain a deeper understanding of the causal relationship between ESG ratings and financial performance, considering additional potential factors and utilizing more exhaustive methodologies.

6.2 Environmental pillar score

	Dependent variable:					
	Portfolio returns					
	FF3		Carhart		FF5	
	EW	VW	EW	VW	EW	VW
α	-0.002*** (-2.957)	0.001 (0.002)	-0.002*** (-2.955)	0.001 (0.002)	-0.002*** (-2.915)	0.025 (0.041)
MRK-RF	-0.018 (-0.263)	-0.017*** (-2.992)	-0.021*** (-0.309)	-0.017 (-2.986)	-0.034 (-0.469)	-0.018*** (-3.113)
SMB	0.043 (0.339)	0.029*** (2.755)	0.047*** (0.372)	0.030 (2.755)	0.024 (0.180)	0.028** (2.534)
HML	-0.049 (-0.480)	0.020 (0.023)	-0.020 (-0.163)	0.024 (0.079)	0.003 (0.021)	0.006 (0.584)
RMW					-0.091 (-0.477)	-0.005 (-0.328)
CMA					-0.146 (-0.555)	-0.020 (-0.893)
MOM			0.043 (0.458)	0.009 (0.111)		
Observations	3020	3020	3020	3020	3020	3020
R^2	0.01	0.04	0.02	0.03	0.02	0.04
Adjusted R^2	0.01	0.03	0.02	0.02	0.01	0.03

Significance levels

*p<0.1; **p<0.05;***p<0.01

Note: This table reports the ordinary least square regression results of equation (1), (2), and (3) respectively. T-statistics are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

Table 7: Environmental-pillar score portfolio regression output

After controlling for the environmental pillar, the results show statistical significance for all alpha coefficients of -0.002 (-0.2%) in relation to abnormal returns for equal-weighted portfolios. Notably, a statistically significant negative relationship exists between abnormal returns and highly rated environmental companies across all models, as observed in the equally weighted portfolios at the 10%, 5%, and 1% significance levels. This indicates that investors whose investment decisions are based solely on environmental considerations may incur abnormal returns. Companies with lower environmental ratings have outperformed companies with higher environmental ratings, indicating the need for caution when pursuing socially responsible investing based solely on the environmental dimension.

The Fama-French 3-factor model for the value-weighted portfolio, the Carhart model for the equally weighted portfolio, and the Fama-French 5-factor model for the value-weighted portfolio all show statistically significant evidence of a negative relationship with regard to the impact of systematic risk exposure at the 10%, 5%, and 1% significance levels, respectively. The systematic risk exposure coefficient for the Fama-French 3-factor model is -0.017, whereas the exposure coefficient for the Carhart model is -0.021. These negative coefficients imply that low-rated environmental companies are more prone to systematic risk than high-rated ones because they are more volatile. This suggests that the perceived risk associated with these investments is influenced by the environmental performance of the portfolio.

Additionally, the Fama-French 3-factor model for the value-weighted portfolio, the Carhart model for the equally weighted portfolio, and the Fama-French 5-factor model for the value-weighted portfolio all show a positive and statistically significant relationship between the size factor and the value-weighted portfolio at the 10%, 5%, and 1% significance levels.

Between 0.028 and 0.047, the significant SMB coefficients range. The SMB factor indicates that high-rated environmental portfolios are more exposed to small market capitalization companies than low-rated portfolios. Contrary to the results obtained from the combined ESG score, the positive coefficients indicate that a greater proportion of small-cap firms are included among the highly rated firms. This finding demonstrates the complexity of the relationship between environmental performance and size and calls for additional research into the underlying factors that influence these dynamics.

There are no significant differences between the portfolios in terms of exposure to value, momentum, profitability, and investment factors. This indicates that, after controlling for the other variables in the models, these specific factors have no significant impact on the portfolios' abnormal returns.

In conclusion, the results suggest that environmental performance plays an important role in determining abnormal returns, with a negative relationship observed for highly rated environmental companies in equally weighted portfolios. In addition, the results indicate that systematic risk exposure and company size also contribute to the observed performance differences, with low-rated environmental companies exhibiting greater volatility and a greater exposure to small-cap stocks. These results highlight the need for investors to carefully consider environmental performance and associated risks when making investment decisions. However,

additional research is required to investigate the intricate interplay between various ESG dimensions and market contexts and to improve the explanatory power of the model.

According to the analysis, the model's R-squared coefficients range between 0.01 and 0.03. These numbers show that the model's components only explain a small percentage of the variance in portfolio performance. The low R-squared values imply that there are extra influential elements that are not accounted for in the model and have a greater impact on portfolio performance.

To enhance the model's explanatory power and gain a deeper understanding of the factors influencing portfolio returns, it is crucial to consider additional variables and conduct additional research.

6.3 Social pillar score

	Dependent variable: Portfolio returns					
	FF3		Carhart		FF5	
	EW	VW	EW	VW	EW	VW
α	-0.001* (-1.929)	0.000 (-0.695)	-0.001** (-1.925)	0.000 (-0.691)	-0.000** (-2.004)	-0.001 (-0.696)
MRK-RF	-0.082** (-2.220)	-0.032 (-0.782)	-0.086** (-2.301)	-0.036 (-0.870)	-0.025* (-1.740)	-0.067 (-0.593)
SMB	0.026 (0.375)	-0.076 (-1.011)	0.030 (0.442)	-0.071 (-0.944)	-0.094 (0.803)	0.057 (-1.207)
HML	-0.045 (-0.800)	0.091* (1.498)	-0.012 (-0.187)	0.125* (1.735)	0.028 (-1.060)	-0.073 (0.370)
RMW					-0.124* (1.627)	0.167 (-1.105)
CMA					0.302 (0.131)	0.019* (1.932)
MOM			0.047 (0.925)	0.049 (0.877)		
Observations	3020	3020	3020	3020	3020	3020
R^2	0.02	0.02	0.03	0.03	0.02	0.03
Adjusted R^2	0.01	0.01	0.02	0.02	0.02	0.01

Significance levels

*p<0.1; **p<0.05; ***p<0.01

Note: This table reports the ordinary least square regression results of equation (1), (2), and (3) respectively. T-statistics are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

Table 8: Social-pillar score portfolio regression output

At the 10%, 5%, and 1% significance levels, the findings regarding the social pillar reveal statistically significant negative abnormal returns. This is consistent with the results obtained for the environmental pillar, indicating that investors in socially responsible companies must forego excess returns or incur costs. Specifically, businesses with lower social scores perform better than those with higher scores. In addition, the regression analysis reveals significant alphas ranging from -0.001 across all models, confirming the existence of abnormal returns. The negative alpha coefficients support our earlier findings and provide additional evidence that investing in socially responsible companies does not result in superior returns for investors.

Regarding the systematic risk factor, the beta coefficients exhibit statistical significance at the 5% and 1% levels, depending on the specific model and weighting strategy employed. Notably, the equally weighted portfolio exhibits a significant beta of -0.082 in the Fama-French 3-factor model and a significant beta of -0.086 in the Carhart model. In addition, the Fama-French 5-factor model reveals a beta of -0.025 that is statistically significant. These negative coefficients indicate that low-rated social companies are more volatile and exposed to higher levels of systemic risk than companies with higher ratings. In none of the examined models or portfolios do the size factor coefficients for the social pillar exhibit statistical significance, indicating that company size does not significantly impact the correlation between social scores and financial performance. In both the Fama-French 3-factor model and the Carhart model, the coefficients for the HML (Value/Growth) factor demonstrate weak statistical significance at the 10% level for value-weighted portfolios. The Fama-French 3-factor model with an equally weighted portfolio exhibits a statistically significant beta of 0.091, whereas the Carhart model with a value-weighted portfolio exhibits a significant beta of 0.125. These positive coefficients indicate that companies with higher social pillar ratings tend to have higher book-to-market ratios than companies with lower ratings. In addition, the RMW (Profitability) factor is significant at the 10% level for the portfolio with equal weighting. This indicates that companies with a high social rating adopt a more conservative investment strategy, whereas companies with a low social rating are typically more aggressive. Intriguingly, our results contradict the findings of Edmans (2011), whose study focused on the social pillar and demonstrated that incorporating employee satisfaction led to abnormal returns of 3.5% between 1984 and 2009 for highly rated social companies. These disparities demonstrate the need for additional research and analysis to better comprehend the intricate relationship between ESG ratings and financial performance. Overall, the R-squared values for the regression models range between 0.01 and 0.02, indicating that the included variables only account for a small proportion of the variance in the relationship between ESG ratings and financial performance. Considering the limited explanatory power of the models, it is essential to interpret these coefficients and their implications with caution. Future research should investigate additional variables and employ more exhaustive methodologies to gain a deeper comprehension of the causal relationship between ESG ratings and financial performance.

6.4 Governance pillar score

	Dependent variable:					
	Portfolio returns					
	FF3		Carhart		FF5	
	EW	VW	EW	VW	EW	VW
α	-0.004 (-1.450)	-0.001* (-1.450)	-0.004* (-1.450)	-0.001* (-1.450)	-0.004 (-1.349)	-0.001* (-1.349)
MRK-RF	0.146 (0.499)	0.069 (0.499)	0.145 (0.495)	0.075 (0.495)	-0.011 (-0.035)	0.072 (-0.035)
SMB	0.421 (0.783)	0.130 (0.783)	0.422 (0.782)	0.123 (0.782)	0.129 (0.232)	0.119 (0.232)
HML	-0.064 (-0.146)	0.031 (-0.146)	-0.061 (-0.118)	-0.016 (-0.118)	0.297 (0.549)	0.001 (0.549)
RMW					-1.524 (-1.882)	-0.075* (-1.882)
CMA					-0.552 (-0.493)	0.153 (-0.493)
MOM			0.004 (0.011)	-0.069 (0.011)		
Observations	3020	3020	3020	3020	3020	3020
R^2	0.02	0.01	0.02	0.01	0.02	0.01
Adjusted R^2	0.01	0.00	0.01	0.00	0.01	0.01

Significance levels

*p<0.1; **p<0.05;***p<0.01

Note: This table reports the ordinary least square regression results of equation (1), (2), and (3) respectively. T-statistics are reported in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

Table 9: Governance pillar score portfolios regression output

The governance results are identical to those of the environmental and social pillars, with negative alphas indicating negative abnormal returns. This consistency is observed across all models and portfolio weightings, though not all are statistically significant. Significant alphas range from -0.004 to -0.001, indicating that investors in companies with high governance ratings must forego abnormal returns. In contrast, investing in companies with poor governance can generate statistically significant excess returns. The non-significance of the equally weighted portfolios in the Fama-French 3-factor model and Fama-French 5-factor model suggests that the relationship between governance ratings and financial performance may vary when different portfolio weightings are considered. Our findings again contradict the published

findings of Gompers et al. (2003) regarding the relationship between corporate governance and stock prices. In contrast to our findings, their research indicates that investors would have earned an additional 8.5% by investing in firms with high governance scores. These discrepancies demonstrate the need for additional research and investigation into the factors that influence the relationship between governance ratings and financial performance. Concerning the systematic risk factor and the SMB (Size) factor, none of the models's coefficients demonstrate statistical significance. The positive coefficients for the SMB factor provide some evidence that smaller firms place a greater emphasis on governance factors than larger firms. Conversely, the positive coefficients for the systematic risk factor indicate that companies with higher governance ratings are more exposed to systematic risk than companies with lower ratings. In addition to the negative alphas, the RMW (Profitability) factor demonstrates significance at the 10% level in the Fama-French 5-factor model for the value-weighted portfolio. This factor's beta coefficient is -0.075, highlighting the correlation between governance ratings and financial performance. The R-squared value of 0.01 indicates that the regression models do not adequately explain the investigated variable, highlighting the models' limited explanatory power. Future research should consider additional factors and employ more exhaustive methodologies to better comprehend the intricate relationship between governance ratings and financial performance.

7 Limitations of the thesis

It is important to recognize the limitations of the framework and methodology of the empirical part of this thesis.

First off, the analysis was restricted to a particular time frame, which may limit the applicability of the findings to other researched timeframes. Future research could look at the relationship between ESG ratings and stock performance over several time periods, considering various market conditions, economic cycles, and regulatory environments, to strengthen the reliability of the findings. This would give a more thorough understanding of the relationship's dynamics and variability.

Secondly, while the study used time lags and dynamics in its analysis, the dynamics and time lags that were selected might not have adequately captured the nuanced interactions between ESG ratings and stock performance. Alternative time lags could be investigated, and more

complex econometric models could be used to capture any potential nonlinearities, threshold effects, or other time-dependent patterns.

Insights could also be gained by examining the ways in which ESG ratings affect stock performance, such as via the mediation of financial performance or investor sentiment. Furthermore, the study ignored potential explaining factors that could affect and add more descriptive value to the relationship between ESG ratings and stock performance, since the R-squared values for our regressions are very low and our results do not have too much descriptive power. The impact of variables like industry characteristics, firm size, or return on assets on the relationship between ESG ratings and financial performance may be explored in further research. This would help us understand the underlying mechanisms and contextual variables more fully.

Finally, it is important to consider that the results of this study only apply to a particular sample or set of stocks, for companies listed in the S&P 500 between 2010 and 2022, so care should be taken when extrapolating the findings to other stocks or markets. Similar analyses using diverse samples, such as firms from various industries, different sizes, or geographical areas, would enable a more thorough analysis of the correlation between ESG ratings and financial performance. The limitations of this thesis must be considered, even though it offers insightful information about the connection between ESG ratings and stock performance over a specific time frame. The complex relationship between ESG ratings and the financial performance of stocks would be better understood with additional research that considers multiple time periods, investigates alternative time lags and dynamics, investigates mediating or moderating variables, and increases the sample size.

8 Conclusion

This thesis focused on the linear relationship between a company's stock performance within the S&P 500 index between 2010 and 2021 and its ESG performance, as determined by its ESG score. Based on Refinitiv's overall ESG score, the study found no statistically significant evidence of abnormal returns. This suggests that the relationship between ESG performance and stock performance is neutral, the stock market accurately takes into account ESG performance, and there is no information asymmetry because investors cannot profit from ESG ratings. Therefore, it does not support the hypothesis that these variables have a positive relationship. However, significant evidence of a negative relationship between companies with

high environmental, social, and governance scores and their financial performance was discovered. To engage in socially responsible investing, investors may have to forego abnormal returns, as companies with higher ESG pillar (environmental, social and governance) scores tend to underperform financially.

Furthermore, the study found that firms with strong ESG performance are less vulnerable to systematic risk, implying that investors must pay a higher risk premium when investing in firms with poor ESG performance. When the ESG score and the environmental and social pillar scores were examined separately, the relationship between stock market performance and ESG performance was found to be negative.

In addition, the results revealed a significant size exposure difference between the portfolios based on ESG scores. The portfolio comprising high rated ESG companies primarily consists of large companies with substantial market capitalization. Conversely, the portfolio comprising low rated ESG companies predominantly includes smaller companies.

This study did not find a correlation between ESG performance, as measured by Refinitiv's ESG scores, and the long-short performance of the S&P 500 index. To account for variations in rating methodologies, it is recommended that future research incorporate data from multiple ESG rating providers. This method could aid in identifying potential differences between rating providers and gaining additional insight into the topic.

9 References

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