AALBORG UNIVERSITY

Beyond the Rating: Investigating the Impact of ESG Ratings on Stock Market Performance

Education:

Masters in finance

Author:

Andreas Østergaard

Advisor:

Cesario Mateus

Due date:

3rd June 2024

Number of pages:

69

Abstract

This thesis examines the relationship between ESG ratings and stock returns across diverse sectors and geographical regions. Using a balanced dataset of 107 companies from the USA and Europe within three sectors, Energy, Technology and Industrial, over 56 weeks. The study employs a panel regression analysis incorporating the Fama-French three-factor model along with macroeconomic variables such as interest rates and GDP. Besides the panel regression, the study applies different portfolios to measure the impact of high-ESG portfolios against low-ESG portfolios. This research addresses the methodological issues often related to ESG literature, particularly the many frameworks and the measurement. The study aims to mitigate these concerns by applying rigorous statistical methods to assess the impact of ESG ratings on stock returns. The findings from the analysis indicate that higher ESG-rated portfolios do not statistically significantly outperform low-rated ESG portfolios. Thus, it seems like there can be a correlation with high-ESG vs low-ESG. The study contributes to the ongoing debate around the financial effect of ESG integration offering new insights into how sustainable investment strategies might impact stock performance in the short term.

Chapter 1 Introduction

The growing focus on Environmental, Social and Governance (ESG) within the investment community is underpinned by a proposition that investors can achieve positive social and sustainable outcomes and be competitive with financial returns. This goal is often framed as the ability for companies to do well while doing good and recently there has been a lot of support for this. A meta-study by Friede, Busch and Basen summarizes over 2.000 empirical studies that focus on business cases for ESG investing affirming its foundation on solid empirical grounds. Other studies that motivate the integration of ESG are studies by Amel-Zadeh and Serafeim (2018), Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019) that understates the importance of ESG integration to get better financial returns.

Despite this optimism around ESG integration and financial performance. Investors must be cautious about their optimism about the topic. Critics within ESG have focused on the methodological limitations of existing studies in recent years and shown evidence that these limitations can create challenges for investors. For instance, a significant size of these research studies relies on a single provider which means that they do not focus on the fact that several agencies offer ESG ratings, and since they only focus on a single provider, the result of their research may be misleading or may contain bias as is highlighted by Berg, Koelbel, and Rigobon (2022). Another focus of ESG is the short-term sample periods which raises concern within the research of ESG. Pastor, Stambaugh, and Taylor (2021) suggest that these durations may capture temporary investor demand rather than the underlying values or results. Furthermore, there has been more focus on U.S. stocks even though Europe is one of the leaders when it comes to regulations within sustainability and taking care of the world (Global Sustainable Investment Alliance, 2022). There have been papers that show positive significant results between ESG ratings and financial performance like Friede, Busch and Basen (2015). Other studies like Hong, H., & Kacperczyk, M. (2009), Chava (2014) and Bolton and Kacperczyk (2020) present evidence that contradicts the positive findings of ESG to generate financial performance. The findings in these studies focus on the fact that if companies want to be sustainable, then in certain circumstances it may end up affecting their financial performance. Given this mixed evidence and methodological challenges the community with ESG stays divided. We have a government that pushes companies to implement ESG in their strategy and forces the company

to integrate ESG (European Financial Reporting Advisory Group. 2022). Which has affected the literature within the ESG landscape for years.

Alex Edmans, one of the leading critics and researchers in the ESG field has been highly active in recent years when it comes to ESG. He published the article 'Rational Sustainability' which offers a reinterpretation of what he thinks ESG is and the concept behind ESG. He focuses on companies implementing initiatives that can create long-term value instead of implementing strategies that do no good for the companies. He believes that companies should act rationally and with a long-term perspective rather than trying to achieve a higher rating by implementing a strategy that does not create long-term value. As stated above, ESG is a complex area that is still trying to find its perfect framework and implementation around the world. This thesis aims to contribute to this ongoing debate by examining the relationship between ESG ratings and stock returns. By using a more nuanced way of ESG ratings to clarify if there is a significant relationship between higher ESG ratings and stock performance. This has laid the ground for the following research questions.

1.1 Research Questions

Does ESG ratings (Short-term) explain stock return?

Do high-ESG portfolios outperform low-ESG portfolios?

What are the methodological challenges in measuring the real impact of ESG ratings on stock performance?

Trying to navigate around these complex ESG frameworks and empirical evidence can be a difficult challenge for investors and corporations in pursuing sustainable value. This thesis aims to get a better understanding of the impact of ESG ratings on stock performance and at the same time aims to get a nuanced picture of literature within the ESG field. Even though studies like Berg, Koelbel, and Rigobon (2022) criticize the method of only using one source to obtain ESG data, this paper due to limitations focuses on a single provider which could end up affecting the results or lead to bias. I am aware that it would have been better to implement more agencies but due to limited access to data, it was only possible to get data from one provider. The thesis focuses on 107 companies from the USA and Europe across three different sectors,

Energy, Technology and Industrial over 56 weeks. The choice of companies and period was affected by the availability of ESG data. By using weekly data points the analysis captures the nuanced fluctuations in stock performance and changes in ESG ratings. Which offers a solid view of how investors might react to ESG rating adjustments. While there has only been one source for gathering ESG data this allowed for a focused examination of how uniform ESG evaluation impacts stock performance within the specified sectors. The thesis adopts a panel regression analysis to explore the relationship between ESG ratings and stock performance while factoring in Fama and French three-factor models as control variables to see if there could be a pattern within these factors. Additionally, the consideration of macroeconomic variables such as interest rate and GDP will be implemented as control variables in the macro model. Lastly, portfolios will be implemented to see if high-ESG portfolios perform better than low-ESG portfolios.

1.2 ESG

Environmental, Social and Governance are called ESG. ESG is a set of criteria emphasizing the Environment, social and governance. Within these categories, companies are evaluated based on different risk measures and metrics. Investors can use these evaluations to assess how well or effectively a company manages the risk associated with these criteria. Giving the investors a framework to evaluate the companies for their performance within ESG. The interest in ESG investing has significantly increased in recent years as more investors and funds focus on sustainability in their investments. According to Morningstar, global ESG fund assets have increased to approximately $2.5 trillion by the end of year 2022 from $2.24 trillion at the end of Q3. This is nearly a 12% increase in assets, which was nearly double the growth rate of the broader fund market. (Bankrate, 2023) This growth has been driven by Europe, which held 83% of ESG fund assets at the end of 2022. The region saw positive inflows of $40 billion during the fourth quarter. In contrast, the U.S., which holds 11% of ESG fund assets, experienced outflows of $6.2 billion in the same period. This decline in the U.S. marks a shift following a prolonged period of growth for ESG funds. (Bankrate, 2023)

1.2.1 Environmental Criteria

The ‘E’ in ESG focuses on how a company's operations affect the environment. This could include factors like a company’s carbon footprint or waste management. It could be how their operation is affecting the water and nature. The “E” often weighs more when it comes to rating agencies as they see the environment as a key focus point for the future of the globe. (Investopedia, 2023)

1.2.2 Social Criteria

The ‘S’ examines how a company manages relationships with its employees, suppliers, and customers. Key components in “S” are labor practices, Fair Pay, Workplace safety, and equal rights among employees. Social criteria reflect the company’s ability to generate trust and loyalty through its treatment of people and its contribution to society. (Investopedia, 2023)

1.2.3 Governance Criteria

The ‘G’ in ESG refers to a set of standards for running a company. This could be the company’s leadership, Risk management, and rules of transparency. It revolves around ensuring accountability of company management and transparency in a company, preventing conflicts, and ensuring the company is run in the shareholder’s interest. (Investopedia, 2023)

Table 1 *shows the E, S and G and the metrics that are measured when working with ESG ratings - Source: TechTarget, 2023*

Chapter 2 Literature Review

ESG ratings have become crucial in evaluating the sustainability and ethical impact of investments in companies. These ratings cover a wide range of Environmental, Social, and Governance issues. While Socially Responsible Investing mainly focuses on choosing whether to invest or not, ESG provides a more comprehensive look at how well a company performs across these areas compared to others in its sector or industry. This thorough approach can possibly help mitigate risks and potentially lead to financial returns over the long run. Additionally, ESG has evolved into an essential benchmark for assessing corporate behavior and operational strategies (Corporate Finance Institute, 2023).

However, trying to navigate the landscape of ESG and the evolution of methodologies can be difficult for investors. Major rating agencies such as MSCI, Bloomberg, Morningstar, and RepRisk, employ different methodologies and weighting systems to rate companies based on their ESG performance (*Table 2)*. Berg, F., Kölbel, J. F., & Rigobon, R. (2022) focus on analyzing and dissecting the divergences in ESG ratings among different agencies where some of the key findings were that the measurement divergence differences in how ESG factors are quantitatively assessed, is the principal reason for the different ratings amongst the agencies. These findings have significant implications for researchers and investors, and they highlight the need for ESG rating agencies to be more transparent about their rating methodologies including how they define and measure ESG performance. (Berg, F., Kölbel, J. F., & Rigobon, R., 2022)

2.1 Evolution of ESG

The concept of ESG investing traces its roots back to the social movements of the 1960s and 1970s particularly around civil rights, which highlighted the need for corporate accountability beyond financial metrics. This era introduced the first Socially Responsible Investment (SRI). In 1971 the launch of the first fund dedicated to SRI began screening companies involved in controversial activities, such as tobacco and weapons manufacturing. Then in the 1980s, Corporate Social Responsibility (CSR) saw companies beginning to do other things than trying to generate profit but instead focusing on their employees' communities and the environment. Through the following centuries, funds increased focus on sustainability and ethical policy. Various frameworks were developed to try to standardize and enhance the comparability of sustainability reporting. In 2004 the report “Who Cares Wins” created the term ESG and linked

sustainable investing to financial performance and in 2006 the Principles for Responsible Investment (PRI) outlined a set of principles encouraging ESG factors in financial analysis. In the following years, other frameworks were created by different agencies to try to standardize how ESG reporting should be done. This created frameworks such as GRI, GDP, SASB, TCFD, WDI, CDSB and SGD which all are frameworks within ESG that are trying to standardize the procedure of ESG reporting and ESG performance (*Table 2)*. In response to these frameworks, the U.S. Securities and Exchange Commission took the initiative to create a comprehensive ESG disclosure frame that should exemplify regulatory efforts to standardize ESG reporting (Atkins, B., 2020). This importance is highlighted by Berg, F., Kölbel, J. F., & Rigobon, R. (2022) which addresses the importance of standardization and transparency. It is not only the U.S government which has participated in the debate for standardized ESG measurements and transparency, The EU Corporate Sustainability Reporting Directive (CSRD) and The European Securities and Markets Authority have impacted the way ESG has to be reported in the future and 2024 is the year where we see a significant impact on what EU companies need to report. In January 2023, the CSRD stood for a significant milestone in EU's way towards sustainable economic development. This initiative is going to affect all large companies with over 250 employees, €50 million in turnover or €25 million in assets which is around 50,000 companies. The following list is what these companies need to include for 2024 - The list below is gathered from Bernoville, T. (2024, March 14) article "*All 2024 ESG and non-financial reporting regulations in the EU.*"

- *Environmental impact: The companies must report on their environmental performance, which includes energy use, biodiversity impact and resource consumption.* (Bernoville, T. 2024)
- *Social responsibility: The directive calls for disclosures of labor practices, respect for human rights, and community engagement.* (Bernoville, T. 2024)
- *Governance: Firms must provide insights into their governance structures, particularly how they integrate sustainability into their decision-making processes.* (Bernoville, T. 2024)
- *Risk management: There is an emphasis on showing how businesses identify and address sustainability-related risks and opportunities.* (Bernoville, T. 2024)

All these factors should help the standardization of ESG reporting and transparency in how these ESG criteria are measured. While sustainability is undoubtedly beneficial, the question

arises whether the laws and regulations enforced by the EU are genuinely effective or if it simply pressures companies to comply accordingly to avoid penalties. This brings us to critical consideration. Is it better for the EU to heavily regulate in this area, or should companies be allowed to pursue sustainability at their own pace and based on their own initiatives?

Frameworks	Rating Agencies
GRI	MSCI
CDP	Sustainalytics
SASB	RepRisk
TCFD	ISS Environmental and Social QualityScore
WDI	Dow Jones Sustainable Indices (DJSI)
Climate Disclosure Standards Board (CDSB)	Bloomberg Professional Services
UN Principles for Responsible Investment (PRI)	FTSE Russell
UN Sustainable Development Goals (SDG)	Vigeo Eiris

Table 2 *Presents the different frameworks and methodologies that are in the ESG landscape - Source Atkins, B. 2020*

2.2 Exploring the Financial Impacts of ESG and CSR

As described in the previous chapter *1.2 ESG*, ESG principles have gained significant attention in recent years, sparking an increase in the research related to ESG. This next chapter delves into a variety of studies that focus on examining the connection between ESG and CSR. It will explore how these factors influence key financial outcomes such as stock performance and financial resilience during economic downturns. The reason for investigating CSR is due to the interconnection between ESG and CSR practices.

2.2.1 ESG and Corporate Financial Performance

ESG has become a highly popular subject, resulting in numerous meta-studies that compile the results of various empirical studies related to ESG. A comprehensive study by Whelan et al. (2021) reviews over 1000 research papers between the period of 2015 and 2020 finding a positive relationship between ESG practices and financial performance, 58% of corporate-focused studies found a positive relationship while only 33% found a positive relationship in the investor-focused studies. While the remaining percentages were divided between neutral, mixed, and negative as can be observed in *Table 3* below. The investor-focused studies tend to look at

a direct relationship between ESG and performance based on benchmarks and portfolios-level while the corporate-focused study includes factors such as innovation, operational efficiency, or risk management (Whelan, T., Atz, U., Van Holt, T., & Clark, C., 2021).

Another meta-study by Friede, Busch, & Bassen (2015) synthesizes data from over 2000 empirical studies, uncovering a positive correlation between ESG ratings and financial performance. Spanning from the early 1970s to 2014, their findings consistently show similar results.

Figure 1. Positive and/or neutral results for investing in sustainability dominate. Very few studies found a negative correlation between ESG and financial performance (based on 245 studies published between 2016 and 2020) .

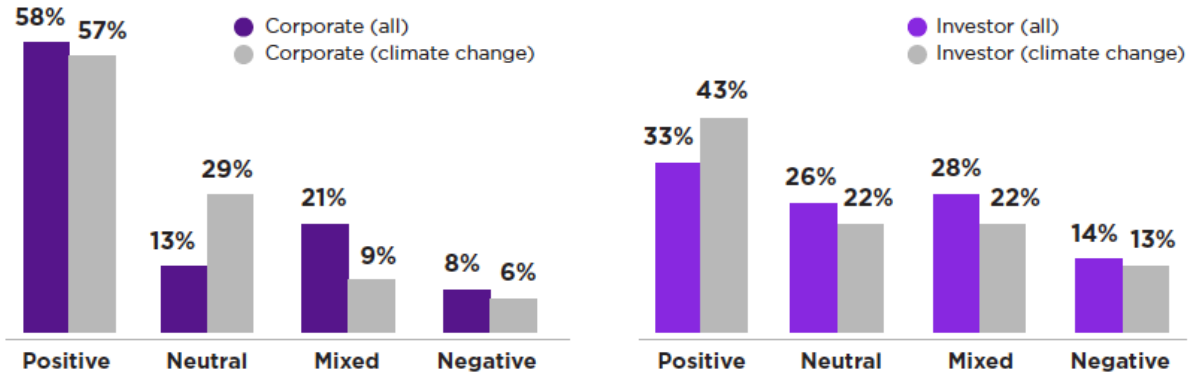


Table 3 *Positive and/or neutral results for investing in sustainability dominate - Source - Whelan, T., Atz, U., Van Holt, T., & Clark, C., 2021*

The COVID-19 pandemic was an interesting period to test and see if it would be possible to see stocks with robust ESG ratings outperform the stocks with lower ESG ratings. Albuquerque et al. (2019) provide evidence that stocks with higher ESG standards demonstrated significant resilience during the Covid-19 crisis and outperformed the broader market suggesting that during crisis times companies with higher ESG focus are possibly viewed as a lower risk companies compared to companies with lower ESG focus. This makes sense when looking into ESG because ESG can be used as a metric for measuring how well companies do with risk management.

While most of the older studies suggest that there is a positive relationship between ESG and financial performance a relatively new study by Gantchev, Giannetti, and Li (2024) examines the repercussions of Morningstar's sustainability ratings on mutual fund behaviors and the findings were interesting. They discovered mutual funds increased their investments in ESG stocks to attract more investors. However, these trades typically underperformed compared to non-ESG trades, which suggests there would be a tradeoff between sustainability and financial performance. This illustrates how fund managers align their strategies with investor demand for sustainability, underscoring the challenges they face in juggling ethical investment practices

with their performance goals. Another interesting topic to review is the CSR's impact on stock performance. Bolton & Kacperczyk (2020) explore CSR impact from its association with stock returns and carbon emissions. Their study proves that effective CSR practices are not only beneficial for stock performance, but they are important when it comes to mitigating financial penalties like the ones provided by EU. A study by Aswani, Raghunandan, & Rajgopal (2023) finds a positive relationship between carbon emissions and stock returns. However, they find these associations weaken when using different emission estimates which they find more suitable.

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014) use hand-collected carbon emission data from the year 2006 to 2008 and examine the effects of the firm value of carbon emission and they find that there is a positive relationship between firm value and companies that disclose their carbon emission. Their findings indicate that companies disclosing their carbon emissions have a median firm value of $2.3 billion higher than those of non-disclosing firms. This aligns with other studies such as Bolton & Kacperczyk (2020) that show companies neglecting their carbon emissions are penalized. While carbon emission looks to have a positive relationship with positive stock performance.

Luo's (2022) "ESG, liquidity, and stock returns" explores the rawer ESG ratings impact on liquidity and stock returns. One of the key findings is that companies with higher ESG ratings tend to have better stock liquidity suggesting sustainable companies attract more trading activity due to investors' preference for sustainable companies. The study examines the relationship between ESG ratings and stock returns, finding companies with lower ESG ratings earn higher returns compared to those with higher ESG ratings. Luo finds investors pay a premium for companies with high E and S ratings while G is insignificant. Their findings match the studies on stock performance and ESG where most studies confirm investors are willing to pay a premium to invest in more sustainable companies, but it ends up affecting the returns (Gantchev, Giannetti, and Li, 2024). On the other hand, investors experience enhanced risk mitigation when they invest in stocks with higher ESG ratings. This suggests that high ESG investments can provide a safer, more stable choice even if they might offer lower returns initially, especially during market shocks (Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C., 2019).

2.3 Market and Behavioral Dynamics in ESG

After exploring how Environmental, Social, and Governance factors and Corporate Social Responsibility impact financial performance, the attention is now turned to why investors might want to implement ESG or CSR. This section of the literature review explores how institutional investors influence ESG initiatives.

We have seen that there are both advantages and disadvantages to the financial performance of integrating ESG. Investors might not yield as high profits as those who do not focus on ESG, but in the long run, they might not be as exposed to market shocks. Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019) investigate whether institutional investors are catalysts for corporate social responsibility. The study finds a positive relationship between institutional ownership and environment and social performance globally, which shows investors play a significant role in the enhancement of E&S practices. Which pushes companies towards more sustainable practices that might be forgotten otherwise.

Edmans (2021) "*Grow the Pie: How Great Companies Deliver Both Purpose and Profit"* supports this in his book and argues that companies which tend to integrate CSR into their business strategies tend to create more value not only for themself but for the shareholders as well. Edmans is suggesting the traditional view between social responsibility and financial performance is flawed, and he means by implementing CRS a company can gain a competitive advantage. Other research papers which confirm investors tend to focus on sustainable companies are Heinkel, R., Kraus, A., & Zechner, J. (2001), Krueger, Sautner, & Starks (2020) and Pastor, Stambaugh, & Taylor (2021) which all focus on how inventors' preferences are toward green or sustainable companies. Heinkel, R., Kraus, A., & Zechner, J. (2001) focuses on the effect of green investment on corporate behavior, and they find that a significant proportion of investors opt for green funds which suggest companies which are non-green need to improve their environmental performance to gain interest amongst investors. Krueger, Sautner, & Starks (2020) highlight a growing recognition of climate risk as a critical factor in portfolio management. Lastly, Pastor, Stambaugh, & Taylor (2021) explores the equilibrium dynamics of sustainable investing and finds as more investors opt for sustainable stocks, the returns from these stocks adjust to reflect their underlying risk and popularity which can lead to a new equilibrium where sustainable investing does not necessarily offer a premium over conventional investments. This is supported by Hartzmark, S. M., & Shue, K. (2023) which sees a positive performance for the future for sustainable investments, though they do not find evidence that sustainable funds

outperform non-sustainable funds. Studies like Hong, H., & Kacperczyk, M. (2009) investigate how the market reacts to companies engaged in activities considered socially irresponsible. Hong, H., & Kacperczyk, M. (2009) find such companies often incur a 'sin discount', where their stock prices are systematically lower than their peers. This discount reflects the broader societal impact of social norms on market valuations, suggesting unethical behavior can detrimentally affect a company's financial standing. This is supported by Luo, L., & Balvers, R. (2017) who researched the financial consequences of social boycotts and the risk associated with not meeting the expectations. They find evidence that negative public beliefs can lead to significant financial repercussions for companies.

The findings across all these studies underscore the significant role of ESG criteria in shaping corporate behavior and investment strategies. Investors are pivotal influencers when it comes to promoting the environment and social performance globally. It confirms the need for companies to adjust to these criteria in the future if they want to be relevant for investors and funds.

2.4 Methodological and Theoretical Insights on ESG Investing

In the earlier chapters, I explored the evolution of ESG, examining empirical studies on financial performance as well as market and investor behavior. Now, this chapter will delve into the critiques concerning the methodological and theoretical aspects of ESG investing.

Evidence has proved that a high ESG rating generally adds value for investors, who often show a preference for holding and investing in sustainable stocks even if the returns may not be as high as those from stocks with lower sustainability ratings. These investments typically offer lower risk during downturns and potentially rewarding long-term returns, especially as the focus on ESG continues to grow. As discussed in *2.1 Evolution of ESG*, various methodologies are used by agencies to incorporate ESG ratings and measure company performance, sparking a debate on how to measure these ESG criteria and reporting to enhance transparency for investors. Edmans work ‘Rational Sustainability' introduces a unique perspective on ESG, which he terms 'Rational Sustainability.' Edmans critiques the current approaches to ESG as often irrational. He advocates for a rational approach, rooted in logical and informed decisions, emphasizing both investors and companies should strive for the best returns. By redefining ESG in this way, Edmans argues sustainability efforts should be guided by rationality, ensuring they

are not only ethical but economically sensible and aligned with long-term value creation. Moreover, another insightful paper worth mentioning is 'Aggregate Confusion: The Divergence of ESG Ratings' by Berg, Kölbel, and Rigobon. This study uncovers significant discrepancies in ESG ratings across different providers. The authors attribute these differences to three primary components: measurement (56%), scope (38%), and weight (6%). Measurement divergence, being the largest contributor, shows rating agencies use varied indicators to assess the same ESG attributes. Scope divergence arises from differences in the attributes that agencies include in their evaluations. Finally, weight divergence reflects the differing importance that agencies assign to various ESG attributes. The authors advocate for greater standardization in the ESG rating methodologies, and they suggest that harmonizing the measurement, scope and weighting criteria could improve the utility of ESG ratings for stakeholders.

In summary, while ESG investing has proven its potential to add value and attract investor interest, challenges remain, particularly concerning the standardization and transparency of ESG ratings.

2.5 Discussion of Literature

This review revisits the landscape of ESG investing, exploring its impact on financial performance and its influence on corporate behavior across various market conditions. The evidence presented shows a complex understanding of ESG rating and financial performance where there are both benefits and challenges to incorporating ESG criteria.

Firstly, empirical studies proved ESG ratings often are correlated with investor value, which primarily stems from the lower risk during economic downturns and the potential long-term gains (Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C., 2019). This trend reflects a growing recognition among investors and highlights the importance of sustainability measures in mitigating future uncertainties. However, the studies proved that the short-term or immediate financial returns on stocks with high ESG ratings may not always exceed those with lower-rated scores, underscoring a potential trade-off between ethical commitment and short-term performance (Whelan, T., Atz, U., Van Holt, T., & Clark, C., 2021).

Moreover, studies reviewed the critical role institutional investors play in promoting ESG practices and their way of steering companies towards sustainability which can lead to enhanced reputations and better overall performance. However, this influence does not come without its complications since the variability in these methodologies for accessing ESG performance

across different agencies raises significant concerns about their consistency and transparency among ESG ratings. This inconsistency and missing transparency can hinder investors' ability to make fully informed decisions, which potentially could impact the broader adaptation of ESG criteria. These inconsistencies were challenged by Alex Edmans, with his consent "Rational Sustainability" and "Aggregate Confusion: The Divergence of ESG Ratings" by Berg, Kölbel, and Rigobon.

In summary, while ESG investing supports broader societal benefits and aligns with long-term financial performance, the path forward requires a nuanced understanding of its economic impacts and methodological improvements. For ESG investing to evolve from a niche strategy to a fundamental business practice, it must not only promote sustainability but adapt to the dynamic financial landscapes and diverse investor needs. Moreover, it will be critical for stakeholders to collaborate on standardizing ESG metrics and enhancing the transparency of reporting. Such efforts will make sure ESG will continue to grow in a healthy way with transparency and standardization. (Berg, Kölbel, and Rigobon, 2022)

Chapter 3 Methodology

3.1 Data Sample

Choosing the right ESG agency is crucial, and in this paper, True Value Insights ratings are used due to accessibility through FactSet. Unlike other agencies that require subscriptions, True Value Insights takes an outside-in perspective, gathering views from analysts, advocacy groups, and regulators via independent media sources. This broad approach means they cover both positive ESG behaviors and controversies (FactSet, 2023). They analyze articles to score ESG factors named by the Sustainability Accounting Standards Board (SASB) as impacting company value. SASB emphasizes industry-specific standards and an investor-centric view, recognizing the intangible value and risk factors from ESG data. Companies can combine SASB categories to create unique composite scores (FactSet, 2023). True Value differs from traditional ESG datasets by monitoring ESG behavior in real time. Their Insight Score assesses long-term ESG, while the Pulse Score shows near-term performance changes. The Momentum Score tracks ESG behavior trends over time, and the Volume Score measures information flow about a company over 12 months (FactSet, 2023). Additionally, they offer an Adjusted Insight score for firms with low or zero article coverage, blending company scores with industry medians. Industry Percentiles provide context on company-adjusted Insight scores compared to peers, while ESG Ranks categorize companies as Laggard, Below Average, Average, Above Average, or Leader, based on Industry Percentiles (FactSet, 2023). Due to limitations, data collection was constrained to 56 weeks. Consequently, the Pulse Score appeared as the preferred ESG rating metric, providing a robust sign of ESG performance in the short term. While ESG considerations typically aim to generate long-term value, the study's focus was to examine whether these ratings influence company returns in the short term. This decision was driven by the desire to explore the immediate effects of ESG performance on financial outcomes within the specified period. (FactSet, 2023)

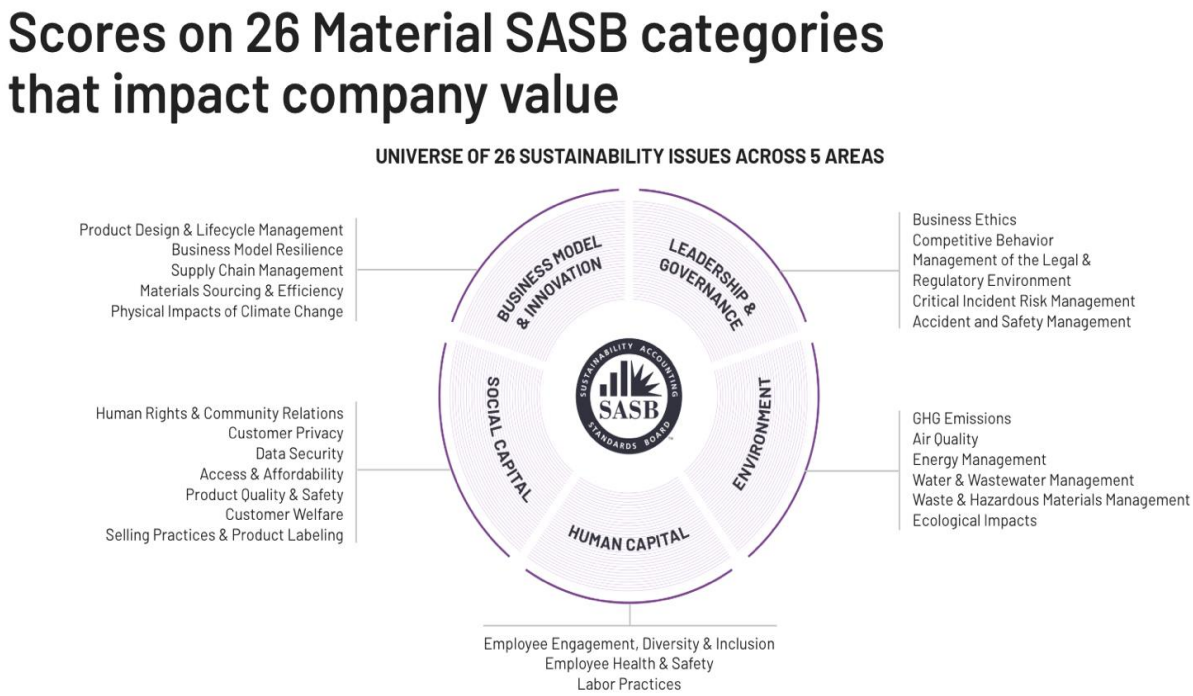


Table 4 *shows the 26 different categories that impact the company value in the SASB methodology. Source - FactSet 2023*

When investigating the relationship between Environmental, Social, and Governance factors and corporate performance, selecting the right sectors and geographical areas is crucial due to the varying importance and implementation of ESG principles. In this focused study, I chose to analyze 107 companies from the United States and Europe, available through FactSet. These regions were selected based on their advanced ESG frameworks and significant emphasis on sustainable practices, particularly in the wake of the EU agreement which mandates ESG strategies for companies by 2024 *"2.1 Evolution of ESG"*.

3.1.1 Sectoral Focus

The sectors chosen for this analysis, Energy, Technology, and Industrial are particularly pertinent to ESG considerations. These sectors face significant environmental challenges and opportunities, from carbon footprint and energy efficiency in the Energy sector to waste management and ethical issues in Technology and Industrial practices. Therefore, these industries provide a rich ground for assessing the impact of ESG metrics on financial and operational performance.

3.1.2 Geographical Considerations

The choice of the United States and Europe as the primary regions for this study is informed by their leadership in ESG regulation and practice. European countries have been frontrunners in integrating ESG into corporate governance, largely driven by regulatory frameworks and a strong cultural push towards sustainability. The European Union's active role in promoting ESG standards, especially highlighted by the recent enhancements under the EU agreement, makes it a critical area for studying ESG's impact (European Commission, 2023). The US was selected for this study because it is one of the largest and most influential players in the global financial market.

The thesis uses 56 weeks of data, spanning from January 6, 2023, to January 29, 2024. The data has been gathered from the FactSet database. This dataset includes metrics such as Return, ESG ratings, RM-RF, HML, SMB, Interest rates, and GDP. These data points are consistent across various tests and methods applied in the study, serving as a foundation for examining the relationships between stock returns, ESG ratings, and other economic indicators.

3.2 Fama and French Factors

The Fama-French three-factor model significantly enhances the analytical framework provided by the Capital Asset Pricing Model by incorporating two additional factors, Small Minus Big (SMB) and High Minus Low (HML) taking account of the empirical fact that small-cap stocks outperform large-cap stocks, and value stocks outperform growth stocks over longer periods. SMB of a portfolio of small-cap stocks over large-cap stocks captures the size effect in returns. ESG can be relevant to the size effect in stock returns, as firms' size affects how they act on and disclose ESG activity, which in turn may influence their stock price. (Fama and French, 1993).

HML, on the other hand, is the return of stocks with high book-to-market ratios relative to stocks with low book-to-market ratios, in effect capturing the value premium. A key comparison is that value stocks are generally less risky and more stable than growth stocks. These stocks are often connected to real economic activity and are associated with less sensitive or speculative demand and therefore are less volatile. Value stocks are often considered more 'low beta' than growth stocks. Including this factor allows for consideration of the specificity of how value orientation interacts with ESG factors and has implications for stock returns. (Fama and French, 1993) Besides those, the market risk factor RM-RF makes the model adjust for

overall market volatility and systematic risk since it captures the sensitivity to all broad market movements. The Fama-French model explains the price behaviors of different assets thanks to the consideration of these three different risk factors. When building the model, Fama and French made the model more accurate and convincing.

This modelling ability means it is now possible to use the model to decompose the effects of these factors to understand specifically what is driving the returns of stocks that are characterized by specific ESG criteria. This, in turn, tells us whether firms perform well specifically because they have a favorable ESG profile, or whether these returns compensate for other fundamentally existing risk factors. (Fama & French 1993)

Additionally, the fact that the Fama-French model has been empirically validated and widely adopted in the research and practice of academic and professional finance contributes to the confidence put into any findings that utilize it. The Fama-French model thus serves as a vital instrument for the financial analyst exploring these complex issues. (Fama & French, 1993)

- SMB = ⅓ (Small Value + Small Natural + Small Growth) - ⅓ (Big Value + Big Natural + Big Growth) (Fama & French, 1993)
- HML = ½ (Small Value + Big Value) - ½ (Small Growth + Big Growth) (Fama & French, 1993)
- RM-RF is the excess market return, calculated as the value-weighted return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ, minus the 1-month Treasury bill rate. (Fama & French, 1993)

3.3 Interest and GDP

The Federal Funds interest rate and the U.S. GDP growth rate are included as control variables to maintain consistency, as most of the selected stocks are traded on the U.S. market (Federal Reserve Bank of St. Louis, 2023). Additionally, this inclusion allows for the examination of how different sectors respond to macroeconomic factors, recognizing that sectors may react differently to these influences.

3.4 Return Calculation

In this financial analysis within the thesis, both log returns and simple returns are used as dependent variables across different regression models, specifically the Fama and French model

and the Macroeconomic model. Additionally, the simple standard deviation is used to assess the variability of returns. This methodological approach uses distinct statistical advantages of each method to ensure robustness and depth in the findings. Simple Returns, ideal for the Fama and French model, simple returns measure the percentage change in value from one period to the next. They directly reflect the impact of market factors without the complications of logarithmic transformations, providing immediate and interpretable outcomes that are essential for capturing short-term market effects. Log Returns, employed due to their statistical properties in the Macroeconomic model, log returns normalize return distributions, crucial for econometric techniques. They offer time additivity essential for longitudinal studies and moderate the impact of extreme values, thus ensuring more stable and reliable statistical analyses. In conjunction with the use of two types of returns, the simple standard deviation is chosen over covariance-based measures for its clarity and simplicity in quantifying risk. This choice is particularly pertinent under the following considerations:

The simple standard deviation provides a straightforward measure of risk and is easy to calculate and interpret. When portfolios are not heavily diversified, or when the focus is more on individual asset performance within portfolios, the simple standard deviation effectively captures the inherent risk without introducing the complexity of inter-asset correlations. The use of simple standard deviation assumes the returns of different assets are independent. This assumption is a common simplification that helps in isolating the impact of individual investments on the portfolio's overall risk profile, although it may overlook potential diversification benefits that arise from non-correlated assets.

The methodological choice to use both types of returns and simple standard deviation in panel regression allows for comprehensive control over unobserved heterogeneity, which could affect the results based on the return calculation method. By examining both simple and log returns, the analysis gains in thoroughness, offering a cross-validation mechanism that ensures robust conclusions. The simple standard deviation supports this approach by providing a consistent measure of volatility across different models and setups, despite its limitations in not capturing diversification effects in portfolios composed of interrelated assets. In *Appendix 1* it is possible to see the different calculations used to calculate return and standard deviation.

3.5 Panel regression

Working with panel regression to analyze the impact of ESG ratings on stock returns, one must choose among three primary model types, Pooled OLS, Fixed Effects, and Random Effects. Each model serves a unique purpose and is suited for several types of data characteristics and analysis goals. Pooled OLS treats the data as one large dataset ignoring individual differences, Fixed Effects control for all time-invariant differences between the entities, thus focusing on within-entity variation, and the Random Effects model assumes that the entity-specific effects are random and uncorrelated with the regressors across all periods. (Wooldridge, J. M. 2010)

For the analysis of ESG ratings' impact on stock returns, I used a balanced panel dataset making up weekly observations of 107 companies over 56 weeks, totaling 5,992 observations. Additionally, when working with simple returns, the analysis is based on only 55 weeks of data giving a total of 5,885 observations. This dataset allows for an exploration of not only the direct impact of ESG ratings on stock returns but also how these effects might evolve or persist over time across different firms. A key advantage of panel regression is its ability to control unobserved heterogeneity, such as a firm's culture or ethical standards, which might affect stock performance but are not directly observable from outside the firm. (Wooldridge, J. M, 2010)

To conduct the analysis, I used the R software program and the plm package, which is specifically designed for estimating panel data models. This package provides functions for fitting Pooled OLS, Fixed Effects, and Random Effects models, and for conducting necessary diagnostic tests.

To find the most suitable panel model to account for these unobserved effects while utilizing the full power of the panel data, I initially conducted a Hausman test. This test is crucial for choosing between a Fixed Effects model and a Random Effects model. The Hausman test evaluates whether the unique errors in the Random Effects model are correlated with the regressors. If they are correlated, the Fixed Effects model is preferred because it provides consistent estimates even when the regressors are correlated with the effects. In my study, the results of the Hausman test did not show significant differences between the Random and Fixed Effects models, suggesting the Random Effect model over Fixed Effects. (Wooldridge, J. M, 2010)

But more advanced tests involving the Breusch-Pagan Lagrange Multiplier test for Random Effects gave a non-significant finding (chisq = 0.47186, df = 1, p-value = 0.4921), implying that there was no significant heterogeneity across entities, and hence did not need to control for this part. As such, the Breusch-Pagan test showed that there was no significant reason to adopt

a Random Effects model (Breusch, A, Pagan, G 1979). A further exploration of the data led to the analysis that the random part of the Random Effects Model was indeed zero, meaning the Random Effects model was simply equivalent to the Pooled OLS model. (Wooldridge, J M 2010)

Given these findings, I opted to continue with the Pooled OLS model. This decision was based on the simplicity of the Pooled OLS model and its ability to efficiently handle the dataset without the need for complex adjustments for unobserved heterogeneity that the tests showed were unnecessary. This approach simplifies the analysis without sacrificing explanatory power, ensuring robustness in the estimation of the impact of ESG ratings on stock returns.

As stated above, this exploits both the temporal and cross-sectional dimensions of the original data, greatly improving statistical power and degrees of freedom from separate cross-sectional studies (Hsiao, 2003). It is possible to estimate the influence of the ESG factor simultaneously with other important determinants of stock returns such as the Fama-French three-factor model and macroeconomic influences (such as interest rates and GDP growth), providing a firm theoretical basis for the analysis. The panel regression specification is shown below:

Fama French model specification:

$$Returnit = \beta 0 + \beta 1 ESGit + \beta 2 RM.RFit + \beta 3 SMBit + \beta 4 HMLit + \varepsilon it$$

- Return*it* is the stock return of company *i* at time *t*.
- ESG*it* is the ESG rating of company *i* at time *t*.
- RM.RF*it* is the market risk premium (excess return on the market portfolio over the risk-free rate) for company *i* at time *t*.
- SMB*it* is the "Small Minus Big" size premium factor for company *i* at time *t*.
- HML*it* is the "High Minus Low" value premium factor for company *i* at time *t*.
- β0 is the intercept term.
- β1, β2, β3, β4 are the coefficients for ESG, RM.RF, SMB, and HML, respectively.
- ϵit is the error term for company *i* at time *t*.

Macroeconomic model specification:

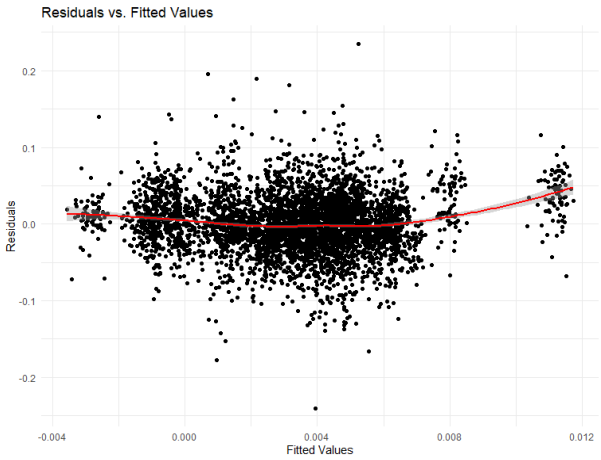
$$Returnit = \beta 0 + \beta 1 ESGit + \beta 2 Interestit + \beta 3 GDPit + \epsilon it$$

- Return*it* is the stock return of company *i* at time *t.*
- ESGit is the ESG rating of company *i* at time *t.*
- Interest*it* is the interest rate relevant to company *i* at time *t.*
- GDP*it* is the GDP growth rate relevant at time *t.*
- β0 is the intercept term, representing the average effect on stock returns when all independent variables are zero.
- β1, β2, β3 are the coefficients for ESG, Interest, and GDP, respectively, each showing the expected change in stock returns for a one-unit change in the respective independent variable, holding all other variables constant.
- ϵit is the error term for company *i* at time *t*, capturing all other factors affecting returns that are not included in the model.

3.5.1 Assumptions and Diagnostics for Pooled OLS Panel Regression

In financial analysis, employing Pooled OLS Panel Regression requires careful consideration of key assumptions. This section explores these fundamental assumptions and the diagnostic tests necessary to confirm them, ensuring the robustness and reliability of my regression model. I focus on how these principles apply to the study of ESG ratings' impact on stock returns.

The linearity assumption claims a linear relationship between the dependent variable, in this case, stock returns, and independent variables such as ESG, RM.RF, HML, SMB, Interest and GDP. To verify this assumption, I conducted a visual inspection of plots of residuals against fitted values. Although the relationship does not appear entirely linear, for this analysis, the Pooled OLS model is still suitable. This decision is supported by the practical considerations of modelling financial data where perfect linearity is uncommon. (Wooldridge, J. M. 2010)



Scatterplot 1 *Illustrates the relationship between the residuals and fitted values for the full model with all independent variables.*

Multicollinearity occurs when there are high correlations among independent variables, which can distort the estimation of regression coefficients. To assess multicollinearity, I used the Variance Inflation Factor (VIF) scores computed in R. Additionally, I analyzed a correlation matrix as an extra diagnostic layer. The results show no perfect multicollinearity among the independent variables. Notably, Interest and GDP showed higher correlations. However, after extensive testing, I concluded that including both variables did not significantly alter the results, justifying their retention in the model. (Wooldridge, J. M. 2010)

VIF Scores for Independent Variables

Multicollinearity Diagnosis of Regression Model

Variable	Variance Inflation Factor (VIF)
ESG	1.00
RM.RF	1.33
SMB	1.27
HML	1.05
Interest	1.92
GDP	1.88

Correlation Matrix of Independent Variables

This table shows the Pearson correlation coefficients.

	ESG	RM.RF	SMB	HML	Interest	GDP
ESG	1.00	0.00	−0.01	0.01	−0.03	−0.01
RM.RF	0.00	1.00	0.46	−0.05	−0.07	0.13
SMB	−0.01	0.46	1.00	−0.01	0.04	0.14
HML	0.01	−0.05	−0.01	1.00	−0.21	−0.13
Interest	−0.03	−0.07	0.04	−0.21	1.00	0.66
GDP	−0.01	0.13	0.14	−0.13	0.66	1.00

Tables 5 & 6 *Show the two multicollinearities tests the left table shows a VIF score test and the right table shows a correlation matrix.*

To test for heteroscedasticity, where the residual variance changes with the values of the independent variables, I ran the Breusch-Pagan test. The p-value of the test was virtually zero,

which strongly implied that the residuals' variance in the data was unequal. (Breusch & Pagan, 1979)

Breusch-Pagan test
data: model_fama_pooled
BP = 66.343, df = 4, p-value = 1.341e-13

Given these results, to correct for heteroscedasticity, I implemented robust standard errors in later analyses. This adjustment ensures a more reliable estimation of standard errors and confidence intervals despite the presence of heteroscedasticity. (Breusch & Pagan, 1979)

The Shapiro-Wilk test results significantly reject the null hypothesis of normality, showing that the residuals from the model are not normally distributed. In the context of financial data analysis, meeting non-normal distributions of residuals is a common scenario. Financial datasets often show attributes such as skewness, kurtosis, or volatility clustering that deviate from the ideal normal distribution due to the complex dynamics of financial markets and the influence of external factors. (Appendix 4)

Shapiro-Wilk normality test
data: residuals (model_fama_pooled, type = "pooled")
W = 0.98473, p-value < 2.2e-16

In practice, achieving perfectly normally distributed data in finance is almost impossible. Market data is often influenced by unpredictable events, market sentiments, and macroeconomic changes, which can lead to anomalies and skewness in data distribution. Therefore, while statistical tests like the Shapiro-Wilk offer valuable insights, they must be interpreted with an understanding of the inherent characteristics of financial data.

Meeting all the statistical assumptions needed for robust analysis in the world of finance, particularly when dealing with real-world data such as stock returns and ESG ratings, can be exceedingly challenging and often nearly impossible. The complex nature of financial markets and the inherent variability in economic data often lead to violations of theoretical assumptions (Cont, 2001). Despite these challenges, the Pooled OLS Panel Regression is still a practical and effective modelling choice for my analysis. This approach allows me to continue to derive

meaningful insights while acknowledging and adjusting for the limitations and imperfections inherent in real-world financial data. (Wooldridge, J. M. 2010)

Chapter 4 Data Analysis

In this chapter, I will explore the influence of ESG ratings on stock returns. The investigation aims to uncover if certain characteristics, such as those related to value stocks or growth stocks as defined by the Fama and French model, show a more pronounced relationship with ESG ratings. This detailed analysis will span various aspects including summary statistics, panel regressions, and portfolio construction to discern patterns in stock performance across different sectors.

To analyze the impact of ESG ratings on stock returns, I will employ panel regression techniques. This will allow for a robust examination of the data, accounting for unobserved heterogeneity and providing insights into the temporal dynamics of ESG effects on stock returns. The regression analysis will help find if certain factors like company size or book-to-market ratios influence the strength of the relationship between ESG ratings and stock performance. Using the insights gained from the regression analysis, I will construct portfolios based on ESG ratings within each sector. These portfolios will be evaluated for their returns and standard deviation. The goal is to decide if higher ESG ratings correlate with better returns, thereby offering a practical investment insight. I will compare the performance of portfolios across different sectors to see if certain industries show a stronger link between ESG practices and stock market performance. This will include testing for differences in returns and risk measures among the portfolios.

4.1 Descriptive statistics

Examining the three sectors and their corresponding descriptive statistics reveals significant differences among them. The data is presented in two *tables 7 & 8*, which highlight the variations across the sectors of Energy, Industrial, and Technology. *Table 7* includes the entire data set, consisting of 40 companies in Energy, 39 in Industrials, and 28 in Technology. *Table 8* refines this data by removing outliers to assess the impact on the overall results. This has been done by removing the top 25% volatile companies.

Statistic	Energy	Industrials	Technology
Number of Observations	2,240	2,184	1,568
Number of Companies	40	39	28
Average Return (%)	0.15	0.40	0.73
Std. Dev. of Return (%)	5.30	4.27	5.27
Annualized Average Return (%)	7.94	23.03	46.15
Annualized Std. Dev. of Return (%)	38.21	30.81	38.00
Min_ESG	23.2	9.7	22.8
Max_ESG	92.6	95.0	85.5
Avg_ESG	62.9	61.0	60.4

***Table 7** presents descriptive statistics using simple returns for the full data sheet.*

Statistic	Energy	Industrials	Technology
Observations	1,512	1,792	1,176
Number of Companies	27	32	21
Average Return (%)	0.14	0.34	0.46
Standard Deviation of Return (%)	3.72	3.78	3.39
Annualized Average Return (%)	7.50	19.39	26.96
Annualized SD of Return (%)	26.79	27.25	24.45

Table 8 *presents descriptive statistics with the removal of 25% most volatile stocks*

In *Table 7*, the average weekly returns for the different sectors show notable disparities. The Energy sector recorded a modest average weekly return of 0.15%, while the Industrials Sector achieved a higher return of 0.40%, and the Technology sector led with an average return of 0.73%. The significant difference between the returns of the Technology and industrial sectors compared to Energy could suggest various underlying factors. These variations might show the Energy sector has experienced a challenging year; a plausible scenario given the global issues that have particularly affected this industry. The geopolitical tensions arising from the conflict between Ukraine and Russia, for example, have had pronounced impacts, especially on European companies. Given the companies analyzed are based in the EU and the U.S., it is conceivable that those in the EU felt these effects more acutely. The Energy sector posted an annualized return of 7.94%, significantly trailing behind the Industrial and Technology sectors, which yielded returns of 23.03% and 46.15%, respectively. These disparities highlight the robust performance of Technology and the returns in Energy. The risk profiles of the sectors present intriguing insights. Both the Energy and Technology sectors showed similar weekly risks, recorded at 5.30% and 5.27%, respectively. In contrast, the industrial sector showed a lower risk

at 4.27%. However, when viewed on an annualized basis, the standard deviation for Energy was 38.21% and for Technology was 38%, while Industrials registered at 30.81%. This data underscores a notable alignment between higher returns and increased risk, particularly in the Technology sector.

To obtain a clearer picture of the underlying patterns, outliers were removed from the dataset, leading to a revised distribution of companies, Energy was reduced from 40 to 27, Industrials from 39 to 32, and Technology from 28 to 21 companies (*Table 8)*. This adjustment significantly altered the risk profiles, with Industrials appearing as the riskiest sector, showing an annualized standard deviation of 27.25%. Notably, Technology's returns decreased from 46.15% to 26.96%, reflecting the impact of excluding the most volatile companies. Exploring the ESG ratings within these sectors reveals that average ratings are comparably close, ranging from 60.4 to 63. Despite similar averages, the spread between the minimum and maximum ESG ratings varied more. Industrials recorded the lowest minimum ESG rating at 9.7 and the highest maximum at 95, showing a wide dispersion of ESG practices. The Energy and Technology sectors presented the smallest scores of 23.2 and 22.8, respectively, with the largest scores of 92.6 for Energy and 85.5 for Technology.

These ESG ratings are critical for portfolio construction, especially in analyzing the potential impact of sectoral allocation on overall performance. The variation in ESG ratings suggests that unrestricted portfolios might inadvertently lean towards more Energy and industrial stocks, potentially increasing exposure to volatility, as seen in the Energy sector's performance.

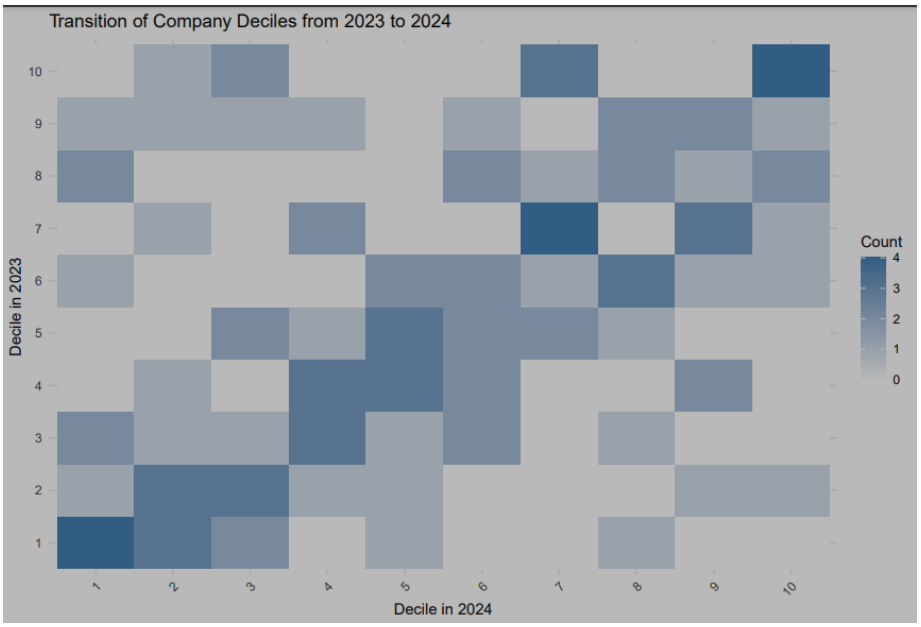


Table 9 *shows the transitions of companies' deciles from 2023 to 2024.*

Before delving into the regression analysis, it was crucial to assess the dynamics of ESG ratings over a year, given the importance of variance in our single-year dataset. To this, I analyzed how ESG ratings shifted among companies on an annual basis by ranking them into ten deciles. This categorization was based on their ESG ratings from January 6, 2023, to January 5, 2024, where companies in the top decile rank 10 had the highest ESG ratings and those in the bottom decile rank 1 had the lowest ESG rating *(Table 9)*.

The distribution of companies across the deciles was structured with eleven companies in each of the first seven deciles and ten in the last three, to investigate significant year-over-year movements within these rankings. A graphical analysis, which colour-codes the number of companies in each rank from dark blue to lighter shades or blank, revealed intriguing patterns *(Table 9)*.

- The darkest blue shows a maximum of four companies that kept consistent rankings across the two observed years. *(Table 9)*
- Notably, of those that achieved the highest rank in 2023, only four remained in that position by 2024. *(Table 9)*

Further details in *Appendix 2* illustrate dramatic shifts, such as companies plummeting from rank 10 to rank 2 or 3 within a year. These substantial rank changes underscore the fluidity and volatility in ESG performance among firms.

These findings raise intriguing questions about the potential impact of such ESG rating variances on the stock returns of these companies. The substantial year-over-year shifts in ESG ranks not only strengthen the interest in this area of study but suggest a potentially significant relationship between changes in ESG ratings and stock performance. This exploration sets the stage for a deeper investigation into whether ESG rating dynamics can explain the return profiles of these companies or if there exists a broader correlation between ESG changes and market returns.

4.2 Regression Analysis of Stock Returns

This section presents the findings from the empirical investigation using panel regression models to explore the influence of various economic and market factors on stock returns. Two distinct models are employed, the Macroeconomic Model (*Panel Regression 1)* and the Fama-

French Model (*Panel Regression 2)*. The Macroeconomic model analyzes the impact of broad economic indicators using log returns to stabilize the data and mitigate the influence of outliers, while the Fama-French Model uses simple returns to directly capture market-driven effects without transformation. *(Table to be continued on following page due to space constraints)*

4.2.1 Analysis of the Macroeconomic Model Using Log Returns

Variable	Macroeconomic Model	Fama-French Model
	Coefficient (Std. Error)	
ESG	0.005 (0.005)	0.005 (0.005)
Interest	-0.787*** (0.246)	-
GDP	0.117 (0.074)	-
Market Premium (RM.RF)	-	0.141*** (0.035)
Size Premium (SMB)	-	-0.050 (0.043)
Value Premium (HML)	-	0.030 (0.034)
Observations	5,992	5,992
R^2	0.002	0.003
Adjusted R^2	0.002	0.002
Note: *p<0.1; **p<0.05; ***p<0.01		

Panel regression 1 *with log return for the Macroeconomic and Fama-French Model*

The Macroeconomic Model incorporates variables such as ESG ratings, interest rates, and GDP growth to assess their collective and individual impacts on stock returns:

ESG Impact, the coefficient for ESG 0.005 with a standard error of 0.005 shows a positive, but statistically insignificant, relationship with stock returns. This suggests a potential alignment between corporate governance and financial performance, though the effect is not robust enough to be considered statistically significant within the context of this model.

Interest Rates, with a coefficient of -0.787 and standard error of 0.246, significant at the 1% level, the negative impact of rising interest rates on stock returns is strongly supported, corroborating the theoretical expectation that higher rates generally dampen investment and consumer spending.

GDP Growth, the GDP coefficient of 0.117 standard error of 0.074, though positive, did not reach statistical significance, showing that while economic growth may help market performance, other unmodeled factors or the short analysis period might have diluted this effect.

4.2.2 Examination of the Fama-French Model Using Simple Returns

Variable	Macroeconomic Model	Fama-French Model
	Coefficient (Std. Error)	
ESG	0.007 (0.005)	0.007 (0.005)
Interest	-0.391 (0.270)	-
GDP	0.054 (0.078)	-
Market Premium (RM.RF)	-	0.143*** (0.037)
Size Premium (SMB)	-	-0.093** (0.046)
Value Premium (HML)	-	0.024 (0.036)
Observations	5,885	5,885
R^2	0.001	0.003
Adjusted R^2	0.0003	0.002
Note: *p<0.1; **p<0.05; ***p<0.01		

Panel regression 2 *with simple return for the Macroeconomic and Fama-French Model*

The Fama-French Model focuses on the market premium, size premium, and value premium to explore their influence on stock returns.

Market Premium (RM.RF)**,** this component shows a significant positive effect coefficient of 0.143, standard error of 0.037, significant at 1%, affirming the risk-return trade-off where higher market exposure is expected to yield higher returns.

Size Premium (SMB), contrary to the typical positive SMB effect, a negative coefficient of -0.093, standard error of 0.046, significant at 5% is present, suggesting that larger companies

outperformed smaller counterparts during the study period, and it suggests that the dataset might be more large companies than smaller.

Value Premium (HML), the coefficient of 0.024, standard error of 0.036 for the value premium was positive but not significant, showing that the advantage of high book-to-market stocks was not clear in this analysis frame.

4.2.3 Summaries of findings

The regression analyses undertaken through both the Macroeconomic Model and the Fama-French Model offer valuable insights into the factors influencing stock returns, advocating the complexity and nature of financial markets. Each model offers perspectives that deepen the understanding of the dynamic interplay between various economic and market-driven elements.

ESG impact findings show a positive but statistically non-significant relationship between ESG ratings and stock returns, suggesting that while ESG practices may correlate with improved financial performance, their impact within the restrictions of this study's period may not be statistically significant. Interest Rates proved a significant negative impact of rising interest rates on stock returns, confirming traditional economic theories that posit higher interest rates dampen investment and consumer spending. This significant finding underscores the sensitivity of stock returns to policy changes. GDP Growth, although the relationship between GDP growth and stock returns was positive, it did not achieve statistical significance. This outcome suggests that economic growth, while generally beneficial to market performance, might be overshadowed in the short term. Market Premium, the model's findings reinforce the fundamental finance principle that greater market exposure should yield higher returns, as shown by the significant positive effect of the market premium. Size Premium, the study saw a significant negative relationship where larger companies outperformed smaller ones. This suggests that during the study period, market and economic conditions might have favored larger firms, possibly due to their perceived stability or better resilience against market shocks and that the dataset might consist of larger companies. Value Premium showed a minimal positive but non-significant effect of the value premium highlighting that the expected advantage of high book-to-market stocks was not clear within the study's framework.

In summary, this empirical investigation helps the understanding of stock market behavior, providing a solid foundation for further research and practical application in financial analysis and portfolio management. The nuanced insights from the study point to the potential for ESG

factors to play a more significant role as data availability improves. Building on the groundwork laid in this comprehensive analysis, the next chapter will delve deeper into sector-specific dynamics. I will explore how the Fama-French factors, interest rates and GDP rates, including ESG ratings, influence the Technology, industrial, and Energy sectors. This focused investigation aims to uncover potential correlations between these sectors providing a more segmented understanding of market behavior.

4.2.4 Fama French Model with Sectors

Simple Returns	Technology	Industrials	Energy
	Coefficient (Std. Error)		
ESG	0.011 (0.011)	0.012* (0.006)	0.004 (0.010)
Market Premium (RM.RF)	0.041 (0.077)	0.259*** (0.053)	0.101 (0.065)
Size Premium (SMB)	-0.214** (0.095)	-0.187*** (0.065)	0.083 (0.080)
Value Premium (HML)	0.042 (0.075)	0.090* (0.051)	-0.052 (0.063)
Observations	1,540	2,145	2,200
R^2	0.004	0.014	0.003
Adjusted R^2	0.002	0.012	0.001
Note: *p<0.1; **p<0.05; ***p<0.01			

Panel regression 3 *with simple return for the Fama-French Model with sector-specific variables*

In this section, I will begin by analyzing the impact of the Fama-French Model using simple returns to investigate any characteristic differences between the sectors. This analysis aims to discern how specific sectoral traits may influence stock returns and potentially offer deeper insights into the effects of ESG ratings. By examining the nuances of the Market Premium, Size Premium, and Value Premium within distinct sectors, I hope to uncover patterns that could

explain variations in financial performance and enhance the understanding of the interplay between ESG factors and traditional financial metrics.

4.2.4.1 Technology Sector

ESG Impact, the ESG coefficient of 0.011 suggests a slight positive impact on returns within the Technology sector, although this effect is not statistically significant. This outcome shows that while ESG factors are gaining relevance, the current sample size or period might not be sufficient to capture a robust effect fully.

Market Premium, the coefficient of 0.041, although not statistically significant, suggests that market movements have a marginal influence on Technology sector stocks.

Size Premium, the significantly negative coefficient of -0.214, significant at the 5% level, shows that smaller technology companies tend to underperform compared to larger firms. Moreover, it suggests the Technology sector tilts more towards large cap.

Value Premium, the coefficient of 0.042 for the value premium, although not statistically significant, suggests that traditional value factors, such as high book-to-market ratios, may not be the main determinants of returns in the Technology sector.

4.2.4.2 Industrials Sector Analysis

ESG Impact, the ESG coefficient of 0.012 in the industrial sector suggests a modest positive impact on returns, showing the potential benefits of ESG integration. This result, while only marginally significant, underscores the growing relevance of sustainable practices.

Market Premium, the significant coefficient of 0.259, significant at the 1% level, proves strong responsiveness of industrial sector stocks to market conditions.

Size Premium, the negative coefficient of -0.187, significant at the 5% level, shows that larger industrial firms tend to outperform smaller ones. Moreover, it suggests the Industrial sector tilts more towards large cap.

Value Premium, a positive coefficient of 0.090, significant at the 10% level, implies that value-oriented strategies may be effective in the industrial sector, pointing to potential undervaluation in higher book-to-market ratio stocks.

4.2.4.3 Energy Sector Analysis

ESG Impact, the exceptionally low ESG coefficient of 0.004 shows that ESG factors have a minimal influence on stock returns in the Energy sector. This impact is not statistically significant, reflecting the slow incorporation of ESG considerations into this traditionally conservative sector.

Market Premium, the coefficient of 0.101, though not statistically significant, shows a level of market sensitivity. This suggests that energy stocks are moderately influenced by broader markets and economic trends.

Size Premium, the slight positive coefficient of 0.083 is not statistically significant, showing that there is no clear size advantage in the Energy sector. This suggests a more balanced performance across different firm sizes.

Value Premium, the negative coefficient of -0.052 is not statistically significant, implying that value factors do not play a significant role in driving returns in the Energy sector.

4.2.4.4 Summary of Findings

Across all sectors, particularly in Technology and Industrials, there is a growing positive relationship between ESG factors and stock returns. While not always statistically significant, the positive coefficients suggest that ESG considerations are increasingly relevant to investors. This trend aligns with findings from Friede, Busch, and Bassen (2015), who documented a positive link between ESG performance and financial returns in studies.

The Technology and Energy sectors showed a small response to market movements. In contrast, the Industrial sector shows a strong positive response. The negative size premium in the Technology and Industrial sector underscores that larger firms generally outperform smaller ones, this indicates that the Technology and Industrial sector tilts towards large-cap stocks. This contrasts with the minimal size effects seen in the Energy sector.

Across the Technology and Energy sectors, the value premium shows minimal impact, showing that traditional value metrics such as book-to-market ratios are less significant. However, the Industrials sector showed a significant relationship, suggesting value stocks tended to have higher returns than growth stocks in the period examined, which could indicate the Industrials sector consists of more value stocks.

4.2.5 Macroeconomic Model with Sectors

In this section, I will examine the impact of macroeconomic factors on stock returns across the Technology, Industrial, and Energy sectors using the Macroeconomic Model. This analysis will allow me to see how economic indicators like GDP growth, interest rates, and ESG factors affect each sector. I will compare the influence of ESG on stock returns in this model with those seen in the Fama-French Model, offering insights into the consistency of ESG changes across different analytical frameworks. This focused approach will help me understand sector-specific sensitivities to macroeconomic shifts and the robustness of ESG factors in influencing stock returns.

Log Returns	**Technology**	**Industrials**	**Energy**
	Coefficient (Std. Error)		
ESG	0.008 (0.009)	0.010 (0.006)	-0.001 (0.010)
Interest	0.045 (0.450)	-0.905** (0.369)	-1.259*** (0.447)
GDP	-0.353*** (0.135)	-0.141 (0.111)	0.700*** (0.134)
Observations	1,568	2,184	2,240
R^2	0.008	0.011	0.012
Adjusted R^2	0.006	0.010	0.011
Note:	*p<0.1; **p<0.05; ***p<0.01		

Panel regression 4 *with log return for the Macroeconomic Model with sector specific variables*

4.2.5.1 Technology Sector

ESG Impact, like the slight positive impact noted in the Fama-French analysis, the ESG coefficient of 0.008 in the Macroeconomic Model suggests a marginal influence on Technology

sector returns. While not statistically significant, this trend underscores a growing focus and potential relevance of sustainability issues within the sector.

Interest Rates, the coefficient of 0.045, though not statistically significant, hints at the Technology sector's relative insulation from interest rate fluctuations, possibly due to its robust growth trajectories and lower reliance on debt financing compared to more capital-intensive industries.

GDP Growth, the significant negative coefficient of -0.353 is intriguing and suggests that periods of general economic growth may not necessarily help the Technology sector which could be due to investment cycles that do not always align with overall economic conditions.

4.2.5.2 Industrials Sector

ESG Impact, as seen in the Fama-French model, the coefficient of 0.010 here, highlights that ESG considerations are affecting financial performance in the Industrial sector. This could be because of better regulations and standards or because in this sector there is more focus on carbon emissions.

Interest Rates, the significant negative coefficient of -0.905 emphasizes the Industrials sector's vulnerability to rising interest rates, which can dampen capital spending and investment in this traditionally capital-heavy sector. (Bernanke & Kuttner, 2005)

GDP Growth, the negative coefficient of -0.141, though not significant, suggests that other factors might more critically influence the sector beyond macroeconomic growth.

4.2.5.3 Energy Sector

ESG Impact, as in earlier analyses, the negligible ESG coefficient of -0.001 confirms that ESG factors currently have minimal impact on the Energy sector's returns.

Interest Rates, a highly significant negative coefficient of -1.259 dramatically underscores the Energy sector's sensitivity to interest rate changes, reflecting its heavy dependence on financing for large-scale infrastructure projects. (Bernanke & Kuttner, 2005)

GDP Growth, the positive coefficient of 0.700, significant at the 1% level, robustly aligns with expectations that economic growth directly boosts energy demand, helping sector returns.

4.2.5.4 Summaries of findings

The analysis showed that while the Technology sector was distinct during the period, both Energy and Industrials showed a negative relationship between interest rates and stock returns. This was expected, as increased interest rates typically have a negative impact on companies due to the higher cost of borrowing (Bernanke & Kuttner, 2005).

The Technology sector stood out with a negative statistically significant relationship between GDP growth and stock returns. Typically, higher GDP growth rates are associated with increased stock returns due to the boost in economic demand. However, the Industrial sector showed a negative relationship, while the Energy sector showed a statistically significant positive relationship, which fits the expectation that economic growth should boost energy demand.

The negative relationship with interest rates and GDP growth rates suggests that certain stocks performed differently during the one year analyzed. This could indicate that despite increasing interest rates and lower GDP growth rates, the Technology sector remained robust, reflecting its resilience in the face of macroeconomic challenges.

Chapter 5 Portfolio Composition and Performance Evaluation

In this chapter, I will make a detailed analysis of portfolio composition and performance. The preceding examination has revealed significant disparities in returns, volatility, and ESG ratings among these sectors, providing a foundational understanding that shapes the asset allocation strategies for the constructed portfolios.

The Energy Sector showed the lowest returns coupled with high risk. External macroeconomic factors and geopolitical tensions, particularly those affecting global energy markets, might have influenced this sector. Nonetheless, the Energy sector showed a notable positive response to GDP growth, underscoring its economic sensitivity and potential for recovery in favorable conditions.

The Industrial Sector displayed moderate returns with relatively lower risk, suggesting its potential as a stabilizing factor within diversified investment portfolios. This sector's performance reflects a balance of resilience and steady growth, making it a reliable part in the face of market fluctuations.

The Technology Sector stood out as the highest performer in terms of returns, albeit at a higher risk. The sector's significant risk is matched by its potential for high rewards, driven by rapid innovation and the escalating demand for technological solutions.

These insights are pivotal in guiding the strategic construction of ten diversified portfolios, designed to assess the influence of sector-specific dynamics alongside ESG ratings on overall portfolio performance.

5.1 Portfolio A

As part of my empirical investigation into the relationship between ESG performance and stock returns, the portfolios were methodically constructed to incorporate varied weights across the three major sectors. This strategic design allows me to assess how sector-specific dynamics interact with ESG ratings to influence investment returns and risk profiles.

Detailed *Portfolio A* Composition

- The 10 portfolios were created based on their ESG ranking on January 5. 2023 where 1 is the highest-ranking companies and 10 lowest.
- Portfolios 1-7: Making up an equal number of stocks from the Energy and Industrial sectors, four each and three from the Technology sector. This composition reflects the substantial presence and historical stability of the Energy and Industrial sectors while using the growth potential of the Technology sector.
- Portfolios 8 and 9: Adjust the balance slightly by including four stocks each from Energy and Industrials but reduce the Technology part to two stocks.
- Portfolio 10: Offers a different diversification approach by including four Energy stocks, three Industrials stocks, and three Technology stocks.

Rationale Behind Portfolio Weights

The allocation strategy was carefully crafted to evaluate the impact of sector distribution on portfolio returns and risk. By keeping a consistent number of stocks from the Energy and Industrial sectors and varying the Technology allocation, I aim to isolate the effects of sector volatility on overall portfolio dynamics. The varied compositions of Portfolios 8, 9, and 10 further enrich this analysis, offering insights into how slight shifts in sector weighting can affect the risk-return profile.

5.1.1 Descriptive Analysis of Portfolio Performance

Portfolio	Avg ESG	Avg Return (%)	SD of Return (%)	Annualized Return (%)	Annualized SD (%)
portfolio 1	71.30	0.48	5.51	28.56	39.75
portfolio 2	70.51	0.36	3.95	20.46	28.47
portfolio 3	67.84	0.63	5.11	38.46	36.82
portfolio 4	66.24	0.34	4.95	19.58	35.66
portfolio 5	66.09	0.50	4.19	29.40	30.23
portfolio 6	60.89	0.41	4.09	23.75	29.53
portfolio 7	60.20	0.30	5.31	16.66	38.30
portfolio 8	55.43	0.40	5.00	23.21	36.06
portfolio 9	51.02	0.22	5.21	12.31	37.56
portfolio 10	51.16	0.25	5.90	13.82	42.57

Table 10 *shows the descriptive statistics for 10 portfolios with weight construction with simple returns. (Average ESG shows the average ESG rating for the full year)*

The offered descriptive statistics reveal a range of outcomes that correlate ESG ratings with financial performance metrics across the portfolios. This analysis investigates how higher ESG ratings might influence return profiles and risk levels, and whether these influences justify integrating ESG considerations into strategic investment decisions.

Portfolios with higher ESG ratings generally exhibit higher returns, with Portfolio 3 leading at an annualized return of 38.46% and an average weekly return of 0.63%. Conversely, Portfolio 9, which has the second lowest ESG ratings, shows the least annualized return at 12.31% and an average weekly return of 0.22%. This could suggest a positive correlation between higher ESG ratings and superior financial performance.

The returns from Portfolio 1 through Portfolio 10 illustrate a declining trend as ESG ratings decrease, reinforcing the potential financial benefits of higher ESG commitments. Expect Portfolio 8, which generated a higher return than the top Portfolios. This is interesting as Portfolio 8 only holds 2 technology stocks, which were the sector that had the highest return.

The standard deviation of returns, indicative of risk, does not show a clear correlation with ESG ratings. For instance, Portfolio 1, despite having the highest ESG rating, shows a high annualized standard deviation of 39.75%, like that of Portfolio 10, which has the lowest ESG rating and a standard deviation of 42.57%.

This observation suggests that while higher ESG ratings might enhance returns, they do not necessarily equate to lower risk, highlighting the complexity of risk factors beyond ESG ratings. (Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. 2019)

5.1.2 Risk & Return Z-test

The findings show that higher ESG ratings do not reduce portfolio risk. To rigorously assess whether there is a significant difference in the financial performance and risk levels between Portfolio 1, with the highest ESG ratings, and Portfolio 10, with the lowest, a Z-test was conducted. This statistical method provides a robust framework for assessing the hypothesis that portfolios with higher ESG ratings not only yield higher returns but show lower risk profiles compared to those with lower ESG ratings. The results of this test are crucial for confirming the theoretical advantages of ESG integration in portfolio management, as discussed in earlier sections.

Comparison Metric	Z-value	P-value (Two-tailed)
Annualized Returns	1.8248	0.0680*
Annualized SD	-0.3490	0.7271

Table 11 *shows the z-test results between portfolio 1 and portfolio 10 (The z-test is calculated by subtracting portfolio 1 - portfolio 10)* *p<0.1; **p<0.05; ***p<0.01.

The analysis involving a Z-test on the annualized returns from Portfolio 1 and Portfolio 10 generated a Z-value of 1.8248. This statistic confirms that Portfolio 1, with higher ESG ratings, delivered statistically significantly higher returns compared to Portfolio 10. A P-value of 0.0680, falling under the 0.1 threshold, further substantiates this performance difference as

significant. This evidence strongly supports the notion that investing in portfolios with robust ESG credentials can yield higher financial results, highlighting that the integration of ESG considerations into investment strategies is beneficial not only ethically and regulatorily but financially.

In terms of risk, measured by the annualized standard deviation of returns, the Z-test reveals a Z-value of -0.3490. The P-value of 0.7271 far exceeds the usual level of significance, showing no statistically significant difference in the volatility between Portfolio 1 and Portfolio 10. This suggests that while higher ESG ratings positively affect returns, they do not necessarily correlate with reduced risk. Therefore, the lower risk level seen in Portfolio 1, while slightly better than that of Portfolio 10, does not differ significantly in statistical terms.

To support the claim that there is a significant difference in annual returns between Portfolio 1 and Portfolio 10, I plan to conduct a regression analysis incorporating a dummy variable. In this model, Portfolio 1 is denoted by a value of 1, and Portfolio 10 is indicated by a value of 0. This analytical approach is intended to enhance the insights gained from the initial Z-test, providing a robust statistical framework to determine whether the returns between the two portfolios significantly differ.

$$Return_i = \beta 0 + \beta 1 \cdot Portf olio_i + \varepsilon_i$$

Here, β0 is the average return of Portfolio 10, β1 captures the difference in returns between Portfolio 1 and Portfolio 10, and ϵi is the error term.

Variable: Simple return	Estimate	Std. Error	t-Statistic	p-Value
(Intercept)	0.0024	0.0024	1.025	0.3056
Portfolio_dummy	0.0023	0.0033	0.700	0.4843

Regression 5 *Presents a regression for Portfolio 1 and Portfolio 10, with Portfolio 1 as 1 and Portfolio 10 as 0 in the Portfolio dummy* - *p<0.1; **p<0.05; ***p<0.01.

In the regression analysis, the intercept, representing the average return of Portfolio 10, is estimated at 0.0024. However, with a p-value of 0.3056, this average return is not statistically significant at the conventional 5% level, indicating that it cannot be confidently distinguished from zero within this sample.

Further, the coefficient associated with the Portfolio_dummy variable, which measures the differential in returns between Portfolio 1 and Portfolio 10, is estimated at 0.0023. The corresponding p-value of 0.4843 indicates that this difference in returns is not statistically significant. This finding does not align with the Z-test results for annualized returns, which suggested only a marginally significant difference at 10%.

Thus, the regression analysis reinforces the conclusion that the observed differences in returns between the two portfolios are not substantial enough to be considered statistically significant at conventional levels. These results suggest a lack of robust evidence to support the notion that Portfolio 1 outperforms Portfolio 10 based on its ESG ratings.

5.1.3 Panel Regression Fama-French for Portfolio A

The descriptive statistics and later panel regression analysis of 10 portfolios, categorized by ESG ratings, offer intriguing insights into the behavioral dynamics underpinning these investment groups. This analysis employs the Fama-French three-factor model to explore underlying characteristics that might explain the observed performance across these portfolios.

Dependent Variable **Simple return**	**Portfolio 1**	**Portfolio 2**	**Portfolio 3**	**Portfolio 4**	**Portfolio 5**
Constant	0.004* (0.002)	0.003 (0.002)	0.01* (0.003)	0.003 (0.003)	0.004** (0.002)
RM.RF	0.07 (0.13)	0.15 (0.09)	0.27** (0.13)	0.13 (0.12)	0.24** (0.12)
SMB	-0.16 (0.16)	-0.25** (0.11)	-0.19 (0.15)	-0.06 (0.14)	-0.24** (0.12)
HML	-0.01 (0.13)	-0.11 (0.09)	0.04 (0.11)	-0.10 (0.11)	0.06 (0.09)
Observations	605	605	605	605	605
R^2	0.001	0.01	0.004	0.003	0.01

	Portfolio 6	Portfolio 7	Portfolio 8	Portfolio 9	Portfolio 10
Constant	0.004** (0.002)	0.003 (0.002)	0.002 (0.002)	0.003 (0.002)	0.003 (0.003)
RM.RF	0.14 (0.10)	0.14 (0.13)	0.40** (0.12)	-0.13 (0.13)	-0.07 (0.15)
SMB	-0.14 (0.12)	0.05 (0.15)	-0.29* (0.15)	0.18 (0.16)	0.10 (0.18)
HML	0.15 (0.09)	0.04 (0.12)	0.27 (0.12)	0.03 (0.12)	0.01 (0.14)
Observations	605	605	550	550	550
R^2	0.01	0.004	0.02	0.01	0.001

Panel regression 6 *shows the portfolio regression for the 10 portfolios with the Fama-French Model. In the () is the standard error* - *p<0.1; **p<0.05; ***p<0.01.

Portfolio 1 and Portfolio 2 show the same direction of the coefficients for the Fama-French Factors. Portfolio 1 exhibits a negative SMB coefficient of -0.07 and an HML of -0.01, suggesting a preference for larger, growth-oriented stocks over smaller, value-based stocks.

Portfolio 2 similarly shows a negative significant SMB of -0.25 and an HML of -0.11, reinforcing the trend observed in Portfolio 1 where large, growth stocks outperform portfolios with higher ESG ratings. Even though I cannot fully say that these Portfolios consist of larger stocks and growth stocks it is still interesting to focus on the characteristics regarding ESG ratings.

While the high ESG-rated portfolios showed a positive RM.RF, SMB and HML. The two lowest portfolios show the opposite of the high ESG portfolios. Portfolio 9 and Portfolio 10 both have a negative relationship with RM.RF and a positive relationship with SMB and HML. Portfolio 9 has SMB and HML coefficients of 0.18 and 0.03 and Portfolio 10 shows SMB and HML coefficients of 0.10 and 0.01.

Portfolios 2, 5, and 8 show significant negative relationships with the SMB factor, showing a consistent preference for larger stocks. Both Portfolio 2 and 5 are significant at a 5% level and interestingly these portfolios show relatively low standard deviations. This correlation may suggest that portfolios leaning towards larger stocks tend to show lower volatility, aligning with the general market behavior where larger firms are typically less volatile.

The analysis reveals a potential pattern where portfolios with higher ESG ratings share similar investment characteristics favoring large stocks. While those with lower ESG ratings appear to favor smaller stocks. These tendencies suggest that ESG considerations could be influencing portfolio compositions in significant ways, potentially aligning certain financial behaviors with sustainability metrics. This will be further investigated in the next Portfolio, where I will analyze the ESG ratings impact without sector weights.

5.2 Portfolio B

In this analysis, I explore the impact of ESG ratings on stock returns by constructing 10 portfolios solely based on their ESG ratings as of January 6, 2023, without considering sector allocation, return, or risk factors. This method differs from our earlier weighted portfolio approach, which considered sector-specific characteristics and adjusted for sector volatility.

Portfolio	Average ESG	Average Return (%)	SD of Return (%)	Annualized Return (%)	Annualized SD (%)
1	71.46	0.51	5.38	30.19	38.82
2	71.27	0.51	4.38	30.23	34.74
3	67.61	0.43	4.37	24.89	31.54
4	66.15	0.45	4.58	26.41	33.00
5	68.70	0.25	4.62	14.05	33.33
6	58.67	0.34	4.21	19.09	33.33
7	60.64	0.31	5.77	17.37	41.58
8	55.41	0.40	4.83	22.95	34.82
9	53.69	0.41	5.77	17.35	41.61
10	46.92	0.41	4.94	23.95	35.63

Table 12 *shows the descriptive statistics for 10 portfolios without weight construction with simple returns. (The average ESG showcases the average ESG rating for the whole)*

5.2.1 Descriptive Statistics and Portfolio Performance

Initial observations from this unweighted portfolio construction reveal patterns like those seen in the weighted approach. The top-ranked portfolios, specifically Portfolio 1 and Portfolio 2, achieved remarkable returns of 30.19% and 30.23%, respectively. This performance contrasts with the lower ESG-rated Portfolios 9 and 10, which returned 17.35% and 23.95%. This disparity underscores the potential positive correlation between high ESG ratings and higher stock returns, even in the absence of sector-based weighting.

However, an interesting deviation appears when examining risk, measured as standard deviation. Unlike weighted portfolios where risk could be managed more precisely across different sectors, the unweighted approach here allows for less diversification. This could potentially increase volatility, especially if a portfolio concentrates on the inherently volatile Energy sector.

For instance, while Portfolio 1 showed higher returns, it had a higher standard deviation compared to Portfolio 10. The portfolios showing the highest standard deviation were Portfolio 7 at 41.58% and Portfolio 9 at 41.61%, which showed lower returns.

5.2.2 Risk and Return Z-test.

Metric	Z-value	P-value
Annualized Return	0.8533	0.3935
Annualized SD	0.4367	0.6623

Table 13 *shows the z-test results between portfolio 1 and portfolio 10 (The z-test is calculated by subtracting portfolio 1 - portfolio 10)* *p<0.1; **p<0.05; ***p<0.01.

In the first *Portfolio A* construction approach, where portfolios are weighted by sectors, the Z-test on annualized returns between Portfolio 1 and Portfolio 10 resulted in a Z-value of 1.8248 *(table 11)*. This shows a statistically significant difference at the 10% threshold, with a P-value of 0.0680 *(table 11)*. This outcome supports the hypothesis that higher ESG ratings can lead to enhanced financial performance, suggesting that integrating ESG considerations into investment strategies can yield financial benefits alongside ethical and regulatory advantages.

Conversely, in *Portfolio B* construction, which focuses solely on ESG ratings without sector weighting, the Z-test on annualized returns produced a Z-value of 0.8533 with a P-value of 0.3935. This result is not statistically significant, showing no substantial difference in returns between the highest and lowest ESG-rated portfolios. This finding challenges the effectiveness of ESG ratings as the sole criterion for portfolio construction, suggesting that the positive impact of ESG on financial returns may be less clear without considering sector-specific factors.

The examination of risk across two portfolio constructs, which vary in ESG ratings, revealed no statistically significant differences in their associated volatilities. In the first risk assessment, Portfolio 1, characterized by higher ESG scores, presented a Z-value of -0.3490, paired with a P-value of 0.7271, indicating an absence of statistical significance *(table 11)*. Similarly, the second risk assessment involving Portfolio 10, which has lower ESG scores, resulted in a Z-value of 0.4367 and a P-value of 0.6623. These statistical outcomes consistently demonstrate that higher ESG ratings do not necessarily confirm a risk reduction.

As in earlier *Portfolio A*, the regression for Portfolio 1 and 10 has been applied to *Portfolio B*. To see the calculation look at *section 5.1.2*.

Term	Estimate	Std. Error	t-Statistic	p-Value
(Intercept)	0.0041	0.0019	2.05	0.0405**
Portfolio_dummy	0.0004	0.0027	0.169	0.866

Regression 7 *Presents a regression for Portfolio 1 and Portfolio 10 with Portfolio 1 as 1 and Portfolio 10 as 0 in the Portfolio dummy* - *p<0.1; **p<0.05; ***p<0.01.

The regression analysis identified the intercept, representing the average return of Portfolio 10, as 0.0041. The associated p-value of 0.0405 indicates that this average return is statistically significant at the 5% level, affirming that Portfolio 10 does yield a notable return under the model's assumptions.

In contrast, the analysis of the coefficient for the Portfolio_dummy variable, which measures the differential in returns between Portfolio 1 and Portfolio 10, yields an estimate of 0.0004 with a standard error of 0.0027. The resulting t-statistic of 0.169 and a p-value of 0.866 reveal that the differences in returns between the two portfolios are not statistically significant.

These findings corroborate those from the Z-test, reinforcing the conclusion that any apparent discrepancies in returns between Portfolio 1 and Portfolio 10 do not reach statistical significance.

5.2.3 Panel Regression for Portfolio B with the Fama-French Factors

Portfolios	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
RM.RF	0.093(0.127)	0.179 (0.113)	0.202** (0.103)	0.250** (0.107)	0.139 (0.109)	0.127 (0.099)	0.412*** (0.135)	0.049 (0.119)	0.164 (0.143)	-0.222* (0.122)
SMB	-0.085 (0.156)	-0.219 (0.139)	-0.092 (0.126)	-0.233* (0.131)	-0.105 (0.134)	-0.060 (0.122)	-0.219 (0.166)	0.022 (0.147)	0.043 (0.175)	0.044 (0.150)
HML	0.001 (0.122)	-0.013 (0.109)	-0.019 (0.099)	0.005 (0.103)	0.010 (0.105)	0.094 (0.095)	0.095 (0.130)	0.081 (0.115)	-0.097 (0.137)	0.093 (0.117)
Constant	0.005** (0.002)	0.004 ** (0.002)	0.003 (0.002)	0.003 (0.003)	0.002 (0.002)	0.003* (0.002)	0.002 (0.002)	0.004* (0.002)	0.002 (0.003)	0.005** (0.002)
Observations	605	605	605	605	605	605	605	550	550	550
R^2	0.001	0.006	0.007	0.010	0.003	0.004	0.016	0.001	0.005	0.008
F Statistic	0.589	3.445	4.016	6.124	1.682	2.511	9.673**	0.779	2.646	4.461

Panel regression 8 *shows the portfolio regression for the 10 portfolios with no weights with the Fama-French Model - (1) means portfolio 1 and (10) means portfolio 10 - The () for each coefficient is the Std Error.* - *p<0.1; **p<0.05; ***p<0.01

In the regression analysis of ESG portfolios constructed without sector-specific weights, trends seen closely follow those from prior analyses in *Portfolio A*. This similarity in patterns between the two approaches reinforces certain dynamics within ESG investing, particularly in relation to portfolio responses to market conditions based on ESG ratings. Here, I will summarize key

characteristics and notable differences unveiled in this round of analysis, especially highlighting how portfolios align or deviate from earlier findings.

High ESG-rated portfolios 1, 2, and 3 continue to prove characteristics like those seen in earlier analyses. Specifically, these portfolios typically show more favorable responses to market conditions. Portfolios 1 and 2 consistently show negative coefficients for SMB, showing a preference for larger companies. This preference may suggest that larger companies, often with better resources and governance structures, are more capable of integrating and benefiting from ESG practices. These portfolios' alignment with larger firms supports the idea that size plays a crucial role in the ability to effectively implement ESG measures and use them for financial performance. In contrast to their higher-rated counterparts, the lower-rated portfolio 10 displays distinctly different characteristics. Interestingly, these portfolios often show a performance trend favoring small-cap stocks. This observation aligns with discussions in the literature review, which posits that smaller companies may find it more challenging to implement comprehensive ESG strategies compared to their larger counterparts. In the context of my analysis, one interesting parallel appears with the findings presented by Luo (2022), who noted that higher ESG ratings are associated with improved stock liquidity. Luo argues that companies with robust sustainability practices tend to attract more trading activity, reflecting a growing investor preference for such firms. This observation is particularly relevant to my study's results, which show that not only do companies with higher ESG ratings perform better financially, but they tend to be larger compared to smaller firms.

The alignment of results, regardless of sector weighting, underscores the robustness of ESG factors as significant influencers of portfolio characteristics. This consistency across different construction methodologies enhances the reliability of ESG as a factor in portfolio management. The observed tendency of lower ESG-rated, smaller-cap portfolios to perform differently from larger firms highlights potential scalability challenges in ESG implementation. It reinforces the notion from the literature that larger companies, with more resources and perhaps more scrutiny from investors and regulators, are better positioned to integrate and capitalize on ESG initiatives.

5.3 Implications for Investment Strategies

The comparative analysis of two portfolio methods, one focused on diversifying sectors and the other purely on ESG ratings, reveals intriguing insights about the influence of sector-specific adjustments on portfolio risk and return profiles. While integrating ESG criteria into investment strategies has shown potential for yielding higher returns, the absence of sector-specific balancing raises important considerations about risk exposure.

Both portfolio strategies yielded high returns, with the sector-weighted portfolios performing particularly well, reinforcing the notion that sustainable practices might enhance financial performance. This is consistent with the observed trend where portfolios with higher ESG ratings delivered stronger returns. Although my study does only find statistically significant outperformance of higher ESG-rated portfolios in one of the portfolio methodologies, it does see a trend where portfolios with higher ESG ratings generally achieved better average returns than those with lower scores. This observation aligns with the broader findings of Friede, Busch, & Bassen (2015) and Whelan et al. (2021), suggesting that while the effects may not always reach statistical significance, the direction of the relationship between ESG integration and financial performance still is positive.

Despite efforts to manage risk through diversification in the first portfolio method, the analysis shows that the risk levels between the diversified portfolios and those constructed solely based on ESG ratings are not markedly different. This observation suggests that while sector diversification is traditionally viewed as a method to mitigate risk, ESG-centric portfolios, even without explicit sector balancing, do not necessarily show higher risk. The choice of standard deviation could influence the outcome, as the average standard deviation does not reflect the interrelationships between the companies. Therefore, the standard continuously might not fully capture the benefits of diversification.

5.4 Portfolio C

In this section, I will analyze the performance of long and short portfolios within different sectors based on their ESG ratings. The long and short portfolios are constructed by selecting the top and bottom five companies, respectively, based on their ESG ratings as of January 6, 2023. For each sector Energy, Industrial, and Technology three long portfolios are forming the five highest ESG-rated companies and three short portfolios making up the five lowest ESG-rated companies. This results in 55 observations for each company within the portfolios, totaling 275 observations per portfolio. By comparing the returns and volatility of these portfolios, I aim to understand how ESG ratings impact financial performance across these extreme value differences. *(Table to be continued on following page due to space constraints)*

Metric	Energy	Industrials	Technology
Avg Weekly Return Long (%)	0.13	0.62	0.53
Avg Weekly Return Short (%)	0.15	0.30	0.49
Weekly SD Long (%)	5.01	4.83	5.93
Weekly SD Short (%)	6.87	4.11	5.67
Annualized Return Long (%)	6.99	37.78	31.87
Annualized Return Short (%)	8.22	17.08	29.20
Annualized SD Long (%)	36.10	34.80	42.74
Annualized SD Short (%)	49.56	29.67	40.85
Avg Weekly Return Net Long-Short (%)	-0.02	0.31	0.04
Annualized Return Net Long-Short (%)	-1.14	17.73	2.08

Table 14 *Portfolio performances between long and short, with the 5 highest ESG-rated companies in long and 5 lowest in short for each sector.*

5.4.1 Descriptive Statistics

In the energy sector, an intriguing pattern appears where companies with lower ESG ratings outperform those with higher ratings. This inverse relationship challenges the common hypoth-

esis that higher ESG ratings typically correlate with better financial outcomes. The energy sector's unique regulatory and commodity challenges might disproportionately affect companies based on their ESG standings, making this a critical area for deeper investigation.

Moving to the industrial sector, a positive relationship between high ESG ratings and higher returns suggests that in this sector, sustainability could be linked to operational efficiency and improved market positioning. This relationship prompts a deeper exploration into which specific ESG factors like waste management or sustainable sourcing are most influential in driving these returns. Comparing these results with industrial benchmarks could further clarify whether companies focused on ESG genuinely outperform or are merely riding the wave of broader industry trends.

In the Technology sector, the marginal difference in returns between companies with high and low ESG ratings suggests a more nuanced impact of ESG factors. The rapid innovation cycles typical of this sector might moderate the impact of ESG practices on financial returns, showing a potential lag effect where ESG factors influence long-term value rather than immediate financial gains. Segmenting the analysis by subsector could reveal differing sensitivities to ESG issues, highlighting areas where ESG integration is most impactful.

5.4.2 Regressions for Long/Short

Technology

Technology Long	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	0.0176	0.2077	0.0850	0.9322
SMB	-0.2850	0.2554	-1.1155	0.2656
HML	-0.1691	0.2016	-0.8388	0.4022

Table 15 *Fama French regression for Technology long stocks*

The regression results for the long portfolio in the technology sector show that none of the Fama-French factors are statistically significant. This suggests that the returns for this portfolio are not significantly influenced by these common risk factors.

Technology Short	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	-0.4837	0.1959	-2.469	0.0141**
SMB	0.0171	0.2407	0.0714	0.9431
HML	0.1799	0.1911	0.9413	0.3473

Table 16 *Fama French regression for Technology short stocks*

For the short portfolio, the market premium is statistically significant with a negative coefficient, showing that as the market performs well, the short portfolio tends to perform poorly. This aligns with the expected behavior of a short portfolio. The size and value premiums are not significant.

To understand the overall impact of being in a long or short position within the technology, Energy and Industrial sectors, I have created a dummy variable where long positions are assigned a value of 1 and short positions a value of 0. This regression aims to decide whether there is a significant difference in returns between long and short positions.

Technology	Coefficient	Standard Error	t-Statistic	P-value
Intercept	0.0049	0.0034	1.4125	0.1583
Dummy	0.0003	0.0049	0.0799	0.9362

Regression 9 *Technology dummy variable between long and short portfolio*

The regression results suggest that, within the technology sector, the choice between taking a long or short position does not significantly affect the returns. Both long and short positions yield similar returns, as shown by the non-significant dummy variable.

Energy

Energy Long	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	0.1517	0.1758	0.8629	0.3889
SMB	-0.0545	0.2162	-0.2524	0.8008
HML	-0.0208	0.1717	-0.1214	0.9034

Regression 10 *Fama French regression for Energy long stocks*

The regression results for the long portfolio in the energy sector show that none of the Fama-French factors are statistically significant. This suggests that the returns for this portfolio are not significantly influenced by these common factors.

Energy Short	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	0.1165	0.2401	0.4854	0.6277
SMB	0.4012	0.2954	1.3580	0.1755
HML	-0.1764	0.2322	-0.7595	0.4481

Regression 11 *Fama French regression for Energy short stocks*

For the short portfolio, none of the Fama-French factors are statistically significant either. This implies that the market premium, size premium, and value premium do not significantly affect the returns of the short portfolio in the energy sector.

Energy	Coefficient	Standard Error	t-Statistic	P-value
Intercept	0.0015	0.0036	0.4193	0.6751
Dummy	-0.0002	0.0051	-0.0429	0.9657

Regression 12 *Energy dummy variable between long and short portfolio*

The regression results suggest that, within the energy sector, the choice between taking a long or short position does not significantly affect the returns. Both long and short positions yield similar returns, as shown by the non-significant dummy variable. This result is consistent with the earlier findings where individual factors like the market premium, size premium, and value premium did not significantly influence either the long or short portfolio returns.

Industrial

Industrial Long	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	0.0792	0.1692	0.4684	0.6398
SMB	-0.2642	0.2080	-1.27	0.2051
HML	0.0582	0.1634	0.3564	0.7218

Regression 13 *Fama French regression for Industrial long stocks*

The regression results for the long portfolio in the Industrial sector show that none of the Fama-French factors are statistically significant. This suggests that the returns for this portfolio are not substantially influenced by these factors.

Industrial Short	Coefficient	Standard Error	t-Statistic	P-value
RM.RF	0.1710	0.1444	1.1843	0.2373
SMB	-0.2335	0.1772	-1.3177	0.1887
HML	-0.0268	0.1389	-0.1930	0.8470

Regression 14 *Fama French regression for Industrial short stocks*

For the short portfolio, the results are similar. None of the Fama-French factors are statistically significant, implying that the market premium, size premium, and value premium do not have a meaningful impact on the returns of the short portfolio in the Industrial sector.

Industrial	Coefficient	Standard Error	t-Statistic	P-value
Intercept	0.0030	0.0027	1.1233	0.2617
Dummy variable	0.0031	0.0038	0.8222	0.4112

Regression 15 *Industrial dummy variable between long and short portfolio*

The regression results show that, within the Industrial sector, the choice between taking a long or short position does not significantly affect the returns. This consistency across the board highlights that the traditional Fama-French factors do not play a significant role in explaining the returns within the Industrial sector, suggesting that other factors might be more influential. Interestingly, despite the long portfolio achieving an annual return of 37.78% and the short portfolio achieving only 17.08%, the regression analysis shows no statistical significance in the difference between these returns. This shows that, while there is a notable difference in the raw returns, this difference is not statistically robust.

In summary, the regression analysis for the Industrial sector reveals that the traditional Fama-French factors do not significantly explain the returns for either long or short portfolios. Despite

the notable difference in raw annual returns between the long (37.78%) and short (17.08%) portfolios, this difference is not statistically significant. The limited sample size may contribute to the lack of statistical significance, suggesting that more historical data or a larger sample might be necessary to uncover significant relationships. Further research should explore more variables and sector-specific dynamics to better understand the drivers of performance in the Industrial sector.

Chapter 6 Discussion

The findings from this investigation into the impact of ESG ratings on financial performance, particularly stock performance, reveal patterns that are both interesting and indicative of the complexities associated with ESG implementation. Despite low statistical significance in the broader market, observations within specific sectors align with diverse results reported in existing research. For instance, the meta-studies by Friede, G., Busch, T., & Bassen, A. (2015). However, contrasting findings by Gantchev, Giannetti, and Li (2024) suggest that ESG funds may underperform compared to non-ESG funds, showing that the benefits of ESG may not always translate into superior financial returns. This research supports the narrative that while ESG investments can lead to reduced risk, as suggested by Luo (2022), Hong, H., & Kacperczyk, M. (2009), and Hartzmark & Sussman (2023), the financial returns may not always be immediate or significant, particularly in the short term as also proven in this study. The sector-specific results further complicate the picture. The Industrial sector, encompassing Aerospace & Defense, Railroads, Waste Management, Airlines, and Marine Shipping, displayed a statistically significant positive relationship between high ESG ratings and stock returns, aligning with the sector's high involvement in ESG-related issues. Conversely, the Energy sector, which plays a significant role in ESG matters, showed no difference in performance between high and low ESG-rated companies during the study period. In the Technology sector, the relationship between ESG ratings and stock performance was positive but not statistically significant. This pattern was observable during portfolio construction and the long/short strategies, where the highest-rated ESG technology stocks outperformed their lower-rated peers. The regression analysis, especially with the macroeconomic factors and the Fama-French model, showed that both the Industry and Technology sectors were significantly related to the SMB factor but neg-

atively, which could imply that both sectors consisted mostly of larger companies. This observation aligns with the broader research suggesting that larger companies are better positioned to implement effective ESG practices due to their greater resources. (Luo, 2022)

The portfolio construction results further revealed that the highest ESG-rated portfolios were mostly composed of large stocks, although this was not statistically significant. This supports the view that it is easier for larger companies to implement and keep robust ESG frameworks (Luo,2022).

These sector-specific portfolio findings highlight the need for a nuanced understanding of how different sectors respond to ESG ratings, upon economic conditions as well as inherent industry characteristics. Future research should explore these dynamics over longer periods and across more varied economic conditions to verify the consistency of the patterns seen here. The integration of ESG ratings into financial performance analysis requires both sector-specific insights and a broader understanding of the macroeconomic factors influencing these relationships. The evaluation of Environmental, Social, and Governance practices within corporate and investment landscapes continues to be a subject of intense debate. This discussion delves deeper into the inherent challenges posed by the current standardization and transparency of ESG metrics. It specifically addresses the methodologies employed by rating agencies and their predominant reliance on singular data sources (Berg, F., Kölbel, J. F., & Rigobon, R., 2022). Critiques often underscore the variable outcomes in the field, spanning a spectrum of positive, neutral, and negative impacts (Berg, F., Kölbel, J. F., & Rigobon, R., 2022). This variability is deeply linked to the analytical methodologies used in employing ESG ratings. Literature suggests that studies focusing on the environmental and social pillars are more likely to discover significant relationships (Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F., 2019). However, these findings are far from uniform and can vary substantially based on the chosen analytical approach (Berg, F., Kölbel, J. F., & Rigobon, R., 2022). A primary concern within the field of ESG evaluation is the reliance on established rating sources like MSCI and Morningstar, which, despite their widespread recognition, are not immune to criticism. These sources are often criticized for their methodologies and the potential discrepancies in their ratings. For instance, it has been seen that companies can sometimes achieve higher ESG ratings without making substantive changes to their practices, a phenomenon that potentially undermines the credibility of ESG metrics. This discrepancy raises significant questions about the integrity and accountability of rating agencies. (Berg, F., Kölbel, J. F., & Rigobon, R., 2022) On the other hand, the

divergence in ESG ratings can be seen as advancing the discussion on how to measure ESG and evolve the landscape. As highlighted in the study 'Aggregate Confusion: The Divergence of ESG Ratings,' significant differences among rating agencies' methodologies have been demonstrated. This variation helps us understand the complexities in ESG ratings, suggesting that a one-size-fits-all approach may not be proper. For researchers, these differences offer an opportunity to explore and refine ESG measurement techniques. Moreover, for investors, the existence of varying ESG ratings underscores the importance of consulting multiple sources when evaluating a company's sustainability performance. This approach can offer a more rounded view and mitigate the risk of relying on potentially biased or incomplete data from a single rating agency. By considering different perspectives, investors can make more informed decisions that better align with their values and investment goals, thereby supporting the continued evolution and refinement of ESG evaluation standards. (Berg, F., Kölbel, J. F., & Rigobon, R., 2022)

'Rational Sustainability' by Edmans critically examines the methodology used by companies and the full understanding of the term ESG. Edmans advocates for a more rational approach to sustainability where he criticizes the way ESG is implemented at companies or as an investor. He uses another term for ESG, Rational Sustainability where he breaks the term into two points. He believes ESG should be rational, meaning it should make sense or create value. Companies should not implement ESG criteria if it does not make sense for the company. It should be rational. The second part of the term, Sustainability, means long-term. He believes that ESG initiatives should be long-term and something that creates long-term value for the company. (Alex Edmans, 2024) For example, in my research, the findings from the Technology and Energy sectors showed no significant relationship between ESG ratings and stock performance, while the Industrial sector proved a significant positive relationship at a 10% confidence level. Furthermore, the overall portfolio analysis revealed a positive relationship for higher ESG-rated companies, although it was not statistically significant. These sector-specific findings highlight the critical need for more robust standardization practices and enhanced transparency in rating methodologies. Thus, the integration of diverse data sources and the consideration of short-term impacts, as proven in my study, is crucial for advancing the field of ESG research and practice. Such approaches ensure that ESG metrics reflect genuine improvements in corporate behaviors and keep their role as a reliable tool for assessing corporate responsibility and

guiding investment decisions. This enriched discussion aims to bridge the gap between empirical data and theoretical critiques, fostering a more comprehensive understanding of ESG practices and adding a critical perspective to the ongoing debate surrounding the efficacy of ESG investments. It discusses that while ESG practices may enhance a firm's resilience during economic crises, the overall benefits and effects on financial performance can significantly vary across different sectors and economic contexts. The discussion on the role and impact of ESG in investment strategies and corporate governance is indeed endless and evolving. There are different beliefs on how ESG criteria should be implemented, each shaped by different industry experiences, regulatory environments, and stakeholder expectations. As the global economic landscape continues to change, so will the strategies for integrating ESG factors into investment and business practices. This ongoing evolution invites continuous dialogue and debate, ensuring that ESG practices stay dynamic and responsive to new information and emerging trends.

Chapter 7 Conclusion

Does ESG ratings (short-term) explain stock return?

This study has examined the correlation between ESG ratings and stock returns over a one-year period. Despite extensive analysis, there is no evidence to conclusively determine that ESG ratings have a significant impact on stock returns in the short term. While the tests conducted have been thorough, they have not supported the hypothesis that ESG ratings significantly influence overall stock returns during this period. However, there appears to be a nuanced relationship within certain sectors. A minor yet positive correlation was observed in the Industrial sector, suggesting that ESG ratings could potentially explain stock performance in specific industries. Conversely, this influence was not the same in the Energy and Technology sectors, where no statistically significant correlations were detected. These findings indicate that the effect of ESG ratings may be sector-specific rather than even across all sectors.

Do high-ESG portfolios outperform low-ESG portfolios?

The comparative analysis of high-ESG and low-ESG portfolios has yielded mixed results. Notably, *Portfolio A* showed a significant positive difference in the Z-test of annual returns between the highest and lowest ESG-rated portfolios, suggesting a measure of outperformance

by the high-ESG portfolio. However, this pattern was not consistent across other portfolios, with *Portfolios B and C* showing no significant differences in performance between high-ESG and low-ESG portfolios. Although high-ESG ratings tended to correlate with marginally better performance, these differences were not statistically significant in most cases.

What are the methodological challenges in measuring the real impact of ESG ratings on stock performance?

The study faced numerous methodological challenges, primarily related to the scope and sources of ESG data. The reliance on a single data provider for ESG ratings might have introduced bias, as different agencies employ diverse methodologies that can lead to variations in ratings. Such discrepancies highlight the critical need for employing multiple data sources to achieve a comprehensive analysis. Furthermore, the differential impact of ESG ratings across various sectors complicates the ability to generalize findings. For example, sectors like Energy may experience more pronounced effects of environmental criteria, influencing ESG ratings differently compared to the Technology sector. This diversity suggests that industry-specific factors must be considered when evaluating the influence of ESG ratings on stock performance. In conclusion, while ESG ratings might influence stock returns in specific sectors, their overall impact on short-term stock performance remains uncertain. The methodological challenges inherent in measuring the real impact of ESG ratings involve a complex approach to data analysis and interpretation. Researchers and investors must navigate these complexities to fully understand the dynamics between ESG ratings and stock performance, emphasizing the importance of long-term studies and diversified data sources to uncover more definitive relationships.

References

Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C. (2019). "Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash." Retrieved from SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3583611

Amel-Zadeh, A., & Serafeim, G. (2018). Why and how investors use ESG information: Evidence from a global survey. SSRN. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2925310

Aswani, J., Raghunandan, A., & Rajgopal, S. (2023). Are carbon emissions associated with stock returns? Retrieved from https://academic.oup.com/rof/article/28/1/75/7100359

Atkins, B. (2020). Demystifying ESG: Its history & current status. Forbes. Retrieved from https://www.forbes.com/sites/betsyatkins/2020/06/08/demystifying-esgits-history--current-status/?sh=15993e6e2cdd

Bankrate. (2023). ESG investing statistics. Bankrate. Retrieved May 15, 2024, from https://www.bankrate.com/investing/esg-investing-statistics/#stats

Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate confusion: The divergence of ESG ratings. SSRN. Retrieved from https://academic.oup.com/rof/article/26/6/1315/6590670

Bernanke, B. S., & Kuttner, K. N. (2005). What explains the stock market's reaction to Federal Reserve policy? The Journal of Finance, 60(3), 1221-1257. https://doi.org/10.1111/j.1540-6261.2005.00760.x

Bolton, P., & Kacperczyk, M. (2020). Does corporate social responsibility affect the cost of capital? Journal of Banking & Finance, 35(9), 2388-2406. https://doi.org/10.1016/j.jbankfin.2011.02.007

Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. Econometrica, 47(5), 1287-1294. https://doi.org/10.2307/1911963

Chava, S. (2014). Environmental externalities and cost of capital. Management Science, 60(9), 2223-2247. Retrieved from https://www.jstor.org/stable/24550583

Corporate Finance Institute. (2023). ESG (Environmental, social, and governance). Retrieved from https://corporatefinanceinstitute.com/resources/esg/esg-environmental-social-governance/

Cont, R. (2001). Empirical properties of asset returns: Stylized facts and statistical issues. Quantitative Finance, 1(2), 223-236. https://doi.org/10.1088/1469-7688/1/2/304

Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019). Do institutional investors drive corporate social responsibility? International evidence. Journal of Financial Economics, 131(3), 693-714. https://doi.org/10.1016/j.jfineco.2018.08.013

Edmans, A. (2021). Grow the pie: How great companies deliver both purpose and profit. Cambridge University Press.

Edmans, A. (2024). Rational sustainability. Retrieved from SSRN: https://ssrn.com/abstract=4701143

European Financial Reporting Advisory Group. (2022). Draft ESRS E1 Climate Change. Retrieved from https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2F08%2520Draft%2520ESRS%2520E1%2520Climate%2520Change%2520November%25202022.pdf

European Commission. (2023). Commission adopts European sustainability reporting standards. Retrieved from https://finance.ec.europa.eu/news/commission-adopts-european-sustainability-reporting-standards-2023-07-31_en

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. Journal of Financial Economics, 33(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

FactSet. (2023). At a glance: FactSet Truvalue SASB scores datafeed. Retrieved from https://insight.factset.com/resources/at-a-glance-factset-truvalue-sasb-scores-datafeed
Federal Reserve Bank of St. Louis. (2023). Effective Federal Funds Rate [FEDFUNDS]. Retrieved from https://fred.stlouisfed.org/series/FEDFUNDS

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. Journal of Sustainable Finance & Investment, 5(4), 210-233. https://doi.org/10.1080/20430795.2015.1118917

Gantchev, N., Giannetti, M., & Li, R. (2024). Sustainability or performance? Ratings and fund managers' incentives. Journal of Finance.

Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. Journal of Portfolio Management, 45(5), 69-83. https://doi.org/10.3905/jpm.2019.45.5.069

Global Sustainable Investment Alliance. (2022). Global sustainable investment review 2022. Retrieved from https://www.gsi-alliance.org/wp-content/uploads/2023/12/GSIA-Report-2022.pdf

Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. Journal of Financial Economics, 93(1), 15-36. https://doi.org/10.1016/j.jfineco.2008.09.001

Hartzmark, S. M., & Shue, K. (2023). Counterproductive sustainable investing: The impact

elasticity of brown and green firms. SSRN. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4359282

Hartzmark, S. M., & Sussman, A. B. (2019). Do investors value sustainability? A natural experiment examining ranking and fund flows. SSRN. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3016092

Heinkel, R., Kraus, A., & Zechner, J. (2001). The effect of green investment on corporate behavior. Journal of Financial and Quantitative Analysis, 36(4), 431-449. Retrieved from https://www.jstor.org/stable/2676219

Hsiao, C. (2003). Analysis of Panel Data (2nd ed.). Cambridge University Press.

Investopedia. (2023). Environmental, social, and governance (ESG) criteria. Retrieved from https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp

Krueger, P., Sautner, Z., & Starks, L. (2020). The importance of climate risks for institutional investors. Review of Financial Studies, 33(3), 1067-1111. https://doi.org/10.1093/rfs/hhz137

Luo, Di. (2022). ESG, liquidity, and stock returns. Journal of Financial Markets, 61, 100-118. Retrieved from https://www.sciencedirect.com/science/article/pii/S104244312200018X

Luo, L., & Balvers, R. (2017). Social screens and systematic boycott risk. SSRN. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2474255

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2014). Firm-value effects of carbon emissions and carbon disclosures. The Accounting Review, 89(2), 695-724. Retrieved from https://www.jstor.org/stable/24468367

Pastor, L., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. Journal of Financial Economics, 142(2), 550-571. https://www.sciencedirect.com/science/article/abs/pii/S0304405X20303512

TechTarget. (2023). A timeline and history of ESG investing rules and practices. Retrieved from https://www.techtarget.com/sustainability/feature/A-timeline-and-history-of-ESG-investing-rules-and-practices

Whelan, T., Atz, U., Van Holt, T., & Clark, C. (2021). NYU-RAM ESG Paper 2021. New York University Stern School of Business. Retrieved from https://www.stern.nyu.edu/sites/default/files/assets/documents/NYU-RAM_ESG-Paper_2021%20Rev_0.pdf

Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data (2nd ed.). MIT Press.

Appendix

A.1 The following calculations has been integrated in the financial analysis:

Log return.

$$R = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

Simple return

$$Simple\ Return = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Average weekly simple return

$$\text{Average Weekly Simple Return} = \frac{\sum_{i=1}^{n} \text{Weekly Simple Return}_i}{n}$$

Average weekly log return

$$\text{Average Weekly Log Return} = \frac{\sum_{i=1}^{n} \text{Weekly Log Return}_i}{n}$$

Annual simple return

$$\text{Annual Simple Return} = (1 + \text{Average Weekly Simple Return})^{52} - 1$$

Annual log return

$$\text{Annual Log Return} = \text{Average Weekly Log Return} \times 52$$

Standard deviation weekly

$$\text{SD} = \sqrt{\text{Variance}}$$

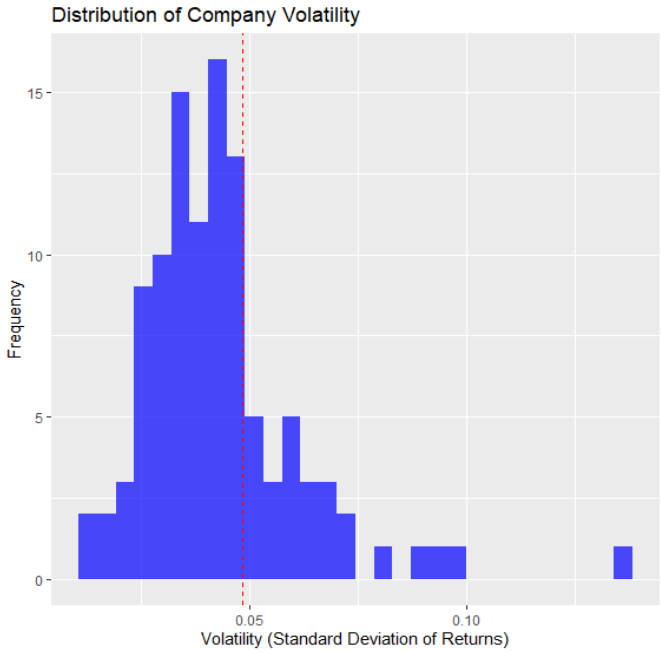
Annual standard deviation

$$\text{Annual SD} = \text{Weekly SD} \times \sqrt{52}$$

A.2 Ranking of the companies into deciles for 2023 and 2024:

Yearly ESG Rating Changes Comparison of ESG Ratings from January 6, 2023, to January 26, 2024				
Company	ESG Rating (Start)	Rank (Start)	ESG Rating (End)	Rank (End)
SMS	91.10	10	91.10	10
WEIR	86.70	10	69.70	7
DSV	85.90	10	79.20	10
PSTG	85.50	10	80.30	10
FDM	85.10	10	81.10	10
EOG	83.20	10	69.80	7
HTG.L	82.70	10	50.00	3
MRO.L	82.50	10	44.20	2
IMI.L	80.10	10	69.80	7
ROR	79.80	10	49.90	3
AMD	78.70	9	53.10	4
SU	77.90	9	76.10	10
PXD	76.80	9	47.50	2
STMPA	75.60	9	67.40	6
MGNS	74.40	9	73.10	8

A.3 Distribution of standard deviation of return:



A.4 Norm QQ-Plot: