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The impact of ESG criteria on the financial metrics of S&P 500 companies

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Abstract

This study delves into the intricate connections between ESG criteria and the financial performances of S&P 500 companies, from 2012 to 2023. The results suggest a statistically significant negative relationship between overall ESG scores and stock returns, and a positive one between ESG scores and Return on Assets/Return on Equity, albeit smaller for the former. Notably, both equally weighted and value-weighted portfolio sorts demonstrate a negative link between ESG global/individual scores and portfolio returns, as well as for our other financial metrics. The influence of ESG criteria on financial performance appears to differ across industries, potentially leading to greater underperformance for companies with lower ESG scores compared to their sector peers, albeit with results lacking robustness in our analysis. Finally, it appears that more rigorous sustainable practices serve as a protective element against volatility in financial metrics, especially during turbulent times like the COVID-19 pandemic.

Contents

1. Introduction

This paper seeks to shed light on the ongoing discourse surrounding Environmental, Social, and Governance (ESG) criteria and their possible correlation with the financial performance of a company. Indeed, the recent shift from the classic profit-centric paradigm to a more diverse stakeholder-oriented approach has fueled the growth of Sustainable Finance, with ESG criteria serving as guiding tenets. At the start of 2020, global sustainable investment reached USD35.3 trillion in five major markets (United States, Canada, Japan, Australasia comprising Australia and New Zealand and European Union), representing a 15% increase in the past two years and a 55% increase in the past four years (Global Sustainable Investment, 2022). In 2022, the International Finance Corporation, the largest global development finance institution focused on the private sector in emerging markets and developing economies, prioritized these criteria in every individual investment, reflecting its commitment of over $30 billion to emerging markets (International Finance Corporation, 2023). Embracing both Corporate Social Responsibility (CSR) and sustainable practices, this approach strives to redefine the definition of success in the financial terrain. As a result, attention naturally began to focus on the connection between sustainable investments and financial performance.

Nevertheless, despite the driving force aiming to challenge financial investment traditions, a clear consensus on the impact of ESG preoccupations on stock returns is yet to be found. Proponents argue that there is a clear positive correlation (M. Chen & Mussalli, 2020), others assert a more timorous stance, pointing at neutrality (Zehir & Aybars, 2020) and some contend that a negative link exists between sustainable portfolios and returns (Luo, 2022). Notably, certain studies specifically focus on the peculiar COVID-19 period (Teti et al., 2023) while others opt to completely exclude it from their analysis (Ouchen, 2022). Nonetheless, by making these choices, none of these papers investigate the potential difference between pre-COVID-19 and post-COVID-19 eras on the relationship between ESG and performance. Regarding Return on Assets (ROA) and Return on Equity (ROE), the debate seems less polarizing, as most argue about a positive relationship between ESG matters and both metrics (Aydoğmuş et al., 2022; Buallay, 2019). This is likely because ESG investing places greater emphasis on the long-term financial stability and sustainability of firms, rather than short-term speculation in the stock market, thereby naturally aligning more closely with ROA/ROE than with stock returns. (Wen et al., 2022). To substantiate their claims, numerous studies concentrate on specific markets, with Europe and North America noticeably occupying a prominent position as preferred choices, as these regions are home to some of the largest and most developed financial markets in the world (Alastair, 2020; Ainger & Krukowska, 2021; Alastair, 2021). Indeed, European countries demonstrate a greater involvement of companies in ESG initiatives, likely influenced by the presence of ambitious ESG legislation throughout all European Union (NAVEX, 2021; BNP Paribas, 2021; ING, 2023). In contrast, the United States exhibits a more fragmented environment concerning ESG across different states, with several exercising their veto power in favour of an anti-ESG mentality. This decision not only hinders the establishment of cohesive policies across the country but also alters financial market results as a whole (Garrett & Ivanov, 2022). However, although ESG investments encounter significantly less ideological resistance in Europe compared to the US, the latter experiences a more extensive coverage of ESG data. This is largely attributed to the fact that prominent ESG rating companies, which provide ESG scores, are predominantly originally from the United States.

This paper aims to address this ESG challenge by focusing on the paramount question: 'To what extent does a firm's ESG score influence its financial returns?'. This query will be answered through a specific lens. Firstly, the datasets used are sourced from Refinitiv and the Wharton Research Data Services. These datasets, combined into one, span various years, from 2012 to 2023, particularly encompass very recent ones, a facet that has been relatively underexplored in prior research. What is more, the incorporation of the pivotal COVID-19 period alongside non-COVID years serves to enrich the depth and relevance of the analysis. This approach allows for a nuanced examination of potential differences between the COVID and non-COVID states, shedding light on how the pandemic may have influenced the relationship between ESG factors and financial performance. While the focus of this research primarily rests on stock returns, the analysis also encompasses other key financial metrics such as Return on Assets (ROA) and Return on Equity (ROE), providing a more extensive view of performance. Moreover, the geographical focus of the study centers on the United States of America. Since this area does not benefit from mandatory ESG reporting requirements compared to its European counterpart (Cicchiello et al., 2023), this study focuses on this region of the world to investigate whether this landscape has evolved regarding the discourse on ESG's impact on stock returns and financial metrics, particularly in the aftermath of the recent Securities and Exchange Commission's (SEC) 2021 announcement urging enhancements in non-financial disclosures in the US (Gibson, 2021). Synthesizing these elements, this analysis seeks to contribute to the understanding of the intricate interplay between ESG factors and financial performance in the American context, offering valuable insights for investors, policymakers, and researchers alike.

The findings of this analysis reveal a significant negative correlation between both overall and individual ESG scores and stock returns. This negative relationship persists across both equally weighted and market capitalization-weighted portfolios. Conversely, ESG scores demonstrate a small, occasionally negligible yet positive correlation with return on assets and a strongly positive correlation with return on equity, as indicated by both regressions and portfolio analyses. While it appears that the impact of ESG varies across industries, with industries possessing higher ESG scores generally facing more significant penalties when deviating from these principles compared to their counterparts with very low ESG scores, the overall effect appears to be modest in its influence and is not directly derivable from this analysis. Lastly, there is evidence to suggest that higher ESG scores acted as a protective barrier for industries during the COVID-19 pandemic, resulting in reduced risk exposure.

The paper will follow a structured approach to address the research objectives. Pursuing this introduction, the second section will provide a comprehensive literature review, delving into previous research related to sustainable finance, ESG criteria agencies, and the intersection of ESG factors with financial performance, with a specific focus on the considerations within the United States context. Following this, the third section will outline the methodology and data structure utilized in the study, detailing the processes involved in data collection and descriptive statistics. Subsequently, the fourth section will present the methodology employed for data preprocessing, portfolio construction and regressions, to see ESG criteria's impact on stock returns, return on assets and return on equity. Finally, sections 5 and 6 will offer an in-depth analysis of the statistical methods used, present the findings, engage in discussions, and draw conclusions based on the results obtained. Additionally, a consideration of limitations and suggestions for future research will be provided in the concluding section.

2. Literature

2.1 The arrival of sustainable finance and ESG criteria agencies

The embryones of environmental, social, and governance principles can be traced back decades ago. Even before pointing out sustainable investment precisely, a growing discourse emerged, stating that business strategy should not solely revolve around profit maximization and that companies that have a purpose that reaches beyond that goal are expected to be the subject of durable long-term growth (Friedman, 1970).
In 1990, the birth of the Domini 400 Social Index, now recognized as the MSCI KLD 400 Social Index, marked a significant milestone. This pioneering index, the first of its kind, introduced a capitalization-weighted methodology to monitor sustainable investments. One of the initial efforts aiming to explore the relationship between social responsibility and investment performance utilized the aforementioned index (Sauer, 1997).

However, the contemporary understanding of ESG, as we recognize it today, began to shape in the mid-2000s. The pivotal moment came with the release of the "Who Cares Wins" report (United Nations, 2004), widely acknowledged as the first mainstream mention of ESG in its modern context. The WCW paper notably highlighted the discrepancy in the adoption of ESG issues among investors, emphasizing that progress has not been uniform. Subsequently, the sustainability concept gained even more prominence with the 2015 Paris Climate Agreement, seen as a promising approach to international climate policy, albeit met with skepticism regarding its ability to urgently decarbonize the global economy (Falkner, 2016). The same year, the United Nations further solidified its commitment to sustainable practices with the adoption of the 2030 Agenda, aimed at guiding the transition toward a more sustainable and inclusive global economy (United Nations, 2015).

ESG criteria vary and are defined by different agencies, peculiarly lacking a universal benchmark, leading to variations in weightings and scoring systems. This lack of standardized information poses challenges for companies aiming to qualify for sustainability indices and investors seeking sustainable targets, along with the deficiency in transparency (Escrig-Olmedo et al., 2010). A renowned classification places agencies in three different categories (Li & Polychronopoulos, 2020). Firstly are the fundamental ESG data providers, such as Refinitiv/Thomson Reuters and Bloomberg, aggregating publicly available data without offering any value-adding score, leaving the users to assess materiality and construct portfolios using their methodologies. Comprehensive ESG data providers, including MSCI and Sustainalytics, Vigeo Eiris, ISS, TruValue Labs, and RepRisk, employ a mix of objective and subjective data from various sources, develop their own ratings methodology, and utilize hundreds of metrics to determine overall ESG scores, often supplementing company ratings with additional information gathered through interviews, questionnaires, and independent analysis, as well as extracting data from public sources like websites and newspapers. Specialist ESG data providers, including TruCost (now owned by S&P Global), Carbon Disclosure Project (CDP), and Equileap, focus on specific ESG issues such as environmental/carbon scores, corporate governance, human rights, or gender diversity, catering to investors aiming to address particular concerns within those domains.

Another critique of ESG criteria valid across various agencies is that ESG rating agencies fall short of fully incorporating sustainability principles into their assessments of corporate sustainability. Notably, they inconsistently prioritize aspects such as environmental concerns and corporate governance and lack explicit integration of life-cycle thinking and risk assessment processes. (Escrig-Olmedo et al., 2019).

2.2 The intersection of ESG factors and financial performance

The tie between sustainable practices and financial profit spurs mixed deliberations, with general perceptions leaning towards the complexity of understanding the seemingly intricate relationship between the two. Numerous studies highlight the positive relationship between the integration of environmental, social, and governance considerations and the financial metrics of return on assets (ROA) and return on equity (ROE) (Alareeni & Hamdan, 2020; Whelan et al., 2021).

Eccles et al. (2014) compare high sustainability and low sustainability companies and finds that the former outperforms the latter in terms of both stock market and accounting measures over a period of 18 years, indicating that sustainability practices are associated with better performance. Building on this positive association, Aydoğmuş et al., 2022 found that firms with high ESG scores are likely to experience enhanced financial performance and attract investors, especially during periods of market volatility such as the COVID-19 pandemic. Similar results were found in this specific context by other researchers (Teti et al., 2023; Broadstock et al., 2021).

Other studies, excluding the COVID-19 era, show that ESG portfolios are characterized by lower volatility and greater resilience to crises compared to the market benchmark portfolio (Ouchen, 2022). This seems to point to the possibility that the observed positive effects are applicable across various periods in time. Similarly, Buallay, 2019, observed that, while the association among individual ESG disclosures varies, overall high ESG scores positively impact financial metrics, with environmental disclosure exhibiting a positive influence on ROA and Tobin's Q. Additionally, G. Zhou et al., 2022 emphasized the positive association between improved ESG performance enhanced operating capacity and increased market value, particularly for companies not state-funded. Shanaev & Ghimire, 2022 focused on US-traded firms rated by MSCI and revealed that ESG rating changes, particularly downgrades, significantly influence stock performance, with consistent negative abnormal returns, emphasizing the importance of ESG risk factors.

On a different note, Rodionova et al., 2022 analyzed the stock performance of large logistics companies in the US and found that a green logistics portfolio tends to outperform a non-green one, supporting the positive relationship between a company's commitment to ESG policy and its stock performance. However, the positive link between ESG and financial performance is not always deemed universal. Yin et al., 2023 found mixed results in the Chinese context, suggesting that strong ESG performance significantly impacts stock returns, but mostly for non-state-owned companies in eastern regions.

In contrast, Dreyer et al., 2023 quasi-replicated previous works on the underperformance of sustainable investments and concluded that there is no consistent evidence of underperformance or a tendency for sustainable portfolios to catch up with their peers, suggesting that, if ESG is a legitimate proxy for sustainability, the costs of investing in such portfolios are of marginal importance for portfolio managers. Another study's conclusion are also tepid with regard to the impact of ESG criteria, finding no significant effect on portfolio performance (Zehir & Aybars, 2020).

On the other hand, Luo, 2022 suggests a negative link between ESG ratings and financial returns, noting that lower ESG-rated firms tend to yield higher returns. The study breaks down the ESG components, emphasizing that the environmental and social premiums are more pronounced than the overall ESG premium, while the governance premium is deemed insignificant. The connection between ESG and liquidity is also highlighted, indicating potential advantages for institutional investors and practical implications for firms in terms of lowering capital costs. Bolton & Kacperczyk, 2021 mention the presence of a carbon premium, which manifests as higher stock returns for companies with elevated carbon emissions, across all sectors. This would suggest that companies with lower environmental scores could potentially generate higher returns.

2.3 ESG considerations in the United States

In contrast with the European Union, which has implemented explicit directives focused on ESG disclosure and conduct requirements, sustainable investment strategies and reporting in the United States have predominantly stemmed from voluntary efforts. The Securities & Exchange Commission (SEC) rules the financial reporting system, and serves as the main federal regulatory channel for ESG disclosure since there is a lack of comprehensive policy framework backing environmental, social and governmental initiatives (Sulkowski & Jebe, 2022).

As mentioned before, the United States' stance on ESG regulations is heavily politicized, resulting in a fragmented map where each state decides whether to support the movement or not. State and local governments exert considerable influence in shaping ESG policies, reflecting the deepening ideological divisions across the country. This led to the emergence of distinct pro-ESG and anti-ESG factions, with alliances forming among states sharing similar perspectives, deepening a certain asymmetry of information as well (Behbin, 2023). The intricate and ever-changing web of ESG investing regulations poses significant challenges for investment providers serving diverse state investment funds, as well as for investors seeking clarity amid this complex terrain (Furdak, 2023).

However, recent regulatory developments, such as the SEC's announcement regarding the need for improved non-financial disclosure and the intention to develop a comprehensive framework for climate-related and ESG disclosures, as well as President Joe Biden's executive orders demonstrating his pro-ESG stance, suggest a potential shift towards more standardized and consistent ESG reporting in the US. A proposed Rule called "The Enhancement and Standardization of Climate-Related Disclosures for Investors", introduced in March 2022, mandates registrants to disclose climate change-related risks in their registration statements and periodic reports. This includes information on the governance of climate-related risks, potential impacts on the company's strategy, business model, and outlook, as well as the incorporation of this information into financial estimates. Additionally, after a phased-in period, companies will need to report scope 1 and 2 greenhouse gas emissions along with certain scope 3 emissions. Another proposed rule, called "Enhanced Disclosures by Certain Investment Advisers and Investment Companies About Environmental, Social, and Governance Investment Practices", put forward in June 2022, focuses on ESG disclosure obligations for investment advisors. If implemented, advisors will be required to furnish additional details regarding their ESG investment practices, aiming to provide investors with more consistent and comparable information. Such regulations could enhance the transparency, comparability, and reliability of ESG information, thereby potentially strengthening the relationship between ESG criteria and stock returns in the United States over time.

2.4 Hypothesis development

Many papers already explored the relationship between S&P 500 stock returns and ESG matters (Alareeni & Hamdan, 2020; Ademi & Klungseth, 2022; Nguyen et al., 2022). However, a notable dearth in research persists regarding the potential nuances concerning both industry-specific impacts and temporal dynamics, especially in the wake of the recent COVID-19 outbreak. This paper aims to forge a connection between how the interplay between ESG criteria and stock returns fluctuates across diverse sectors and how it morphs within the backdrop of a pandemic, all intertwined with our context, given our specific lens focusing solely on large-cap companies in the US. As previously mentioned, the relationship between the sustainability of a company and the performance of its stocks remains enigmatic, with experts wrestling to reach unanimity on the matter. Other financial metrics, such as return on assets and return on equity, appear to be less divisive (Aydoğmuş et al., 2022; Buallay, 2019). Within our contextual prism, we attempt to dissect the nature of these connections. This forms our initial set of hypotheses.

H1.0: An S&P 500 company's stock return is influenced by its ESG score
H1.1: An S&P 500 company's return on assets is positively influenced by its ESG score
H1.2: An S&P 500 company's return on equity is positively influenced by its ESG score

Before venturing into broader grounds, we want to dive into the specifics of ESG criteria in isolation, yet again within this distinctly specific context. Each pillar of ESG potentially exerts a distinct influence, varying in both strength and/or direction. Existing research is again very divisive on the potential impact of each pillar on stock returns, with some suggesting an unclear correlation (Broadstock et al., 2021; Naffa & Fain, 2022; Dreyer et al., 2023). Hence, our second set of hypotheses unfolds as follows:

H2.0: A S&P 500 company's E score is related to its financial performance
H2.1: A S&P 500 company's S score is related to its financial performance
H2.2: A S&P 500 company's G score is related to its financial performance

Industries assign varying degrees of importance to ESG criteria based on numerous factors, including their geopolitical circumstances, as evidenced by existing documentation (Galbreath, 2013). While it is idealistic to anticipate universal excellence in ESG scores across fields, one might wonder whether the effect of ESG criteria may fluctuate contingent on a company's economic sector. Naturally, we could think that industries which are expected to excel in the sustainability field could suffer more from a lower score, as they might be highly scrutinized and expected to demonstrate leadership in sustainability and social responsibility. Those within sectors traditionally associated with lower ESG ratings might enjoy a premium due to their exceptional scores when compared to their lower industry-wide expectations. Hence, forming our third hypothesis:

H3: S&P 500 companies belonging to industries with lower average scores exhibit a more positive relationship between ESG criteria and financial performance compared to those expected to excel but don't

Lastly, we pivot to temporality, attempting to excavate potential disparities between the pre-COVID and post-COVID realms. Due to the recent nature of these events, sparse literature delves into the COVID era, let alone comparing it with previous periods. Given the extraordinary nature of this event, it would be naive to assume that stock prices remained unaffected, as market sentiment played a significant role in shaping investor behaviour during this period. Initially, the outbreak induced widespread apprehension among investors, leading to a pronounced bearish sentiment as both uncertainty and fear regarding the virus's impact on society prevailed. However, optimism emerged periodically, heartened by government measures and positive news about vaccine development, triggering bullish market comebacks. Nonetheless, persistent uncertainty surrounding the pandemic's trajectory, including concerns about new variants and vaccine distribution challenges, tempered investor optimism, contributing to an overall exceptionally volatile market (Chaudhary et al., 2020; Baek et al., 2020; Onali, 2020). Moreover, the context of the COVID-19 pandemic was marked by the dire state of the U.S. economy. The scale of the pandemic's impact was staggering, reminiscent of the severe recessions seen only once before since the Great Depression of 1930. Similarly, the U.S. experienced a significant economic downturn from the fourth quarter of 2019 through the final quarter of 2020, accompanied by a substantial increase in the unemployment rate, which tripled during April and May 2020 (Naeem et al., 2023). During this turbulent period, ESG considerations appear to have provided a degree of stability amidst market volatility, with companies boasting higher ESG scores demonstrating greater resilience in terms of stock prices (Engelhardt et al., 2021; D. Zhou & Zhou, 2021). This observation appears to be well-supported and non-conflictual, prompting us to further investigate whether this resilience can also be generalized to financial metrics, giving our final hypothesis.

H4: S&P 500 companies with high ESG scores exhibited lower volatility and greater profitability in their financial performance during the COVID-19 crisis compared to their counterparts with lower ESG scores

3. Data

3.1 Data collection and description

To uncover the nature of the relationship between ESG criteria and financial performance metrics, the analysis concentrates on data retrieved mainly from the rating agency Thomson Reuter Refinitiv, using Eikon Datastream as well as the Wharton Research Data Services. The data relevant to the stocks originates from the United States of America, in concordance with the topic focusing on S&P 500 stocks. As one of the world's most significant financial markets, the United States benefits from a well-established infrastructure for reporting ESG data, which vastly facilitates both its collection and analysis due to its availability and completeness (Alareeni & Hamdan, 2020). Moreover, due to the global economic influence of the US, studying the S&P 500 stock returns permits comprehending how ESG considerations may affect not only American companies but also broader economic trends and global investment strategies as a whole.

The primary focus of this thesis is on the independent variables ESG scores, both global and individual, provided by Thomson Reuters[1]. Their ESG scores, available since fiscal year 2002 for approximately 1,000 companies mainly from the United States and Europe, encompass over 400 company-level measures across 10 categories such as CSR Strategy and Innovation (Eikon, 2017). Since it is the S&P 500 companies we are concentrating on, our database naturally includes around 500 scores per year.
Our analysis will leverage multiple ESG measures, including numeric scores for each pillar (Environmental, Social, and Governmental), which are calculated by assigning weights to different categories within each pillar. For example, the Environmental score is derived by allocating percentages to categories such as 11% for the Resource score (a company's

[1]A detailed overview of the variables, along with their description, is provided in Appendix A.

capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions), 12% for the Emission score (a company's commitment and effectiveness towards reducing environmental emission), and 11% for the Innovation score (a company's capacity to reduce the environmental costs and burdens for its customer). Notably, the distribution of weights among pillars is not uniform, with the Social aspect comprising more than 35% of the global score, unlike its counterparts which are assigned to a lower weight. According to the findings of Naffa & Fain, 2022, ESG scores tailored to specific industries lack comparability across sectors. Hence, their methodology as well as ours, guided by Morningstar's approach, facilitates cross-sector comparison through standardization. Further elaboration on this approach will be provided in the next chapter of this paper.

Furthermore, this paper incorporates dependent variables representing various financial metrics, with the total return variable being of particular importance as it directly pertains to our subject and has been widely analyzed by academics regarding ESG matters (Luo, 2022; La Torre et al., 2020; Gibson Brandon et al., 2021). It represents a stock's return (which proxies for a company) for each month, including the price change and any relevant dividends. Our analysis employs excess returns, which are computed by subtracting the risk-free rate from the total return values at the relevant time. Return on assets and return on equity serve as our additional dependent variables. They are utilized to bring a more nuanced view of our interrogations regarding the link between financial performance and sustainability, and similarly to excess stock returns, have been used by numerous researcher in this same context (Buallay, 2019; Aydoğmuş et al., 2022; Nguyen et al., 2022).

This study also incorporates control variables including Market Capitalization, Beta, Size and Book-Market Ratio. Fama French 5-factors (Market Beta, SMB, HML, CMA, RMW), crucial for factor construction, were also retrieved from the Wharton Research Data Services. This classic Fama French 3-factor model enhanced by incorporating momentum, called the Carhart four-factor model, is also included.

The treatment of data included removing the missing values in ESG values, which represented 7% of the database. However, data with occasional missing monthly returns yet corresponding yearly ESG scores were retained as all S&P 500 companies had a copious amount of monthly return data available.

3.2 Descriptive statistics

This chapter focuses on the relevant summary statistics for this research, including tables and graphs, utilized to describe the key characteristics and patterns observed within the dataset, which runs from 2013-2023 and includes 61748 observations from 500 companies in the United States.

Table 3.1: Summary statistics

	Mean	SD	Min	Max	Count
Total Return	0.014	0.079	-0.237	0.298	61748
Excess Total Return	0.014	0.079	-0.237	0.298	61748
Return on Assets	0.141	0.089	-0.089	0.448	48753
Return on Equity	0.216	0.360	-0.694	3.120	48753
ESG Score	56.626	18.434	6.068	95.162	61748
Environmental Pillar Score	50.120	27.703	0.000	98.546	61748
Social Pillar Score	58.514	20.590	1.608	98.118	61748
Governance Pillar Score	59.367	20.676	1.140	99.462	61748
Company Market Cap*	51.32	91.01	2.54	801.21	61748
Beta	1.050	0.461	0.069	3.702	32247
Risk-Free Rate	0.001	0.001	0.000	0.003	61748
Excess Return on the Market	0.010	0.044	-0.134	0.137	61748
SMB	-0.001	0.026	-0.083	0.071	61748
HML	0.000	0.035	-0.139	0.128	61748
Momentum	0.003	0.036	-0.124	0.100	61748
RMW	0.003	0.020	-0.047	0.072	61748
CMA	0.002	0.022	-0.068	0.077	61748

*The company market capitalization is expressed in billions

Table 3.1 provides a comprehensive overview of summary statistics for each numerical variable in our database, winsorized at the 0.5% level (see methodology in chapter 4). Notably, the total stock returns and excess returns exhibit identical values up to three decimal places (for readability purposes, we truncate to three digits), but diverge slightly at the fourth, indicating a marginal difference. This discrepancy is unsurprising, considering the average Risk-Free Rate, which approaches zero. The financial metrics demonstrate similar magnitudes across the board, with Return on Equity (ROE) standing out as the highest. These values are all consistently positive on average. This suggests that, over the entire ten-year period covered by our database, the S&P 500 companies experienced average positive returns. The total return, excess total return, ROA, and ROE, here expressed as decimals, are presented in percentages for all following analyses. The average ESG scores, both overall and across individual pillars, fluctuate between 50 and 60, with the Environmental score displaying the most volatility. Some environmental scores register as 0, not due to data absence, as the database contains Not Available (NA) values for those entries. This could be attributed to certain companies, primarily those operating in industries known for their significant environmental impact or those unwilling to prioritize environmental initiatives. For instance, companies in sectors such as heavy manufacturing, mining, oil and gas extraction, and chemical production are often associated with high levels of pollution and may face challenges in implementing or demonstrating commitment to environmental sustainability. These instances of null scores represent 0.14% of the database.

Beta values approximate 1, indicating a close alignment with market movements, which is expected for S&P stocks as S&P 500 index is a broad representation of the overall stock market in the United States. The Fama-French factors generally exhibit low values, with Small Minus Big (SMB) being slightly negative on average. This could be attributed to companies in the dataset being predominantly large-cap stocks, which is consistent with the composition of the S&P 500.

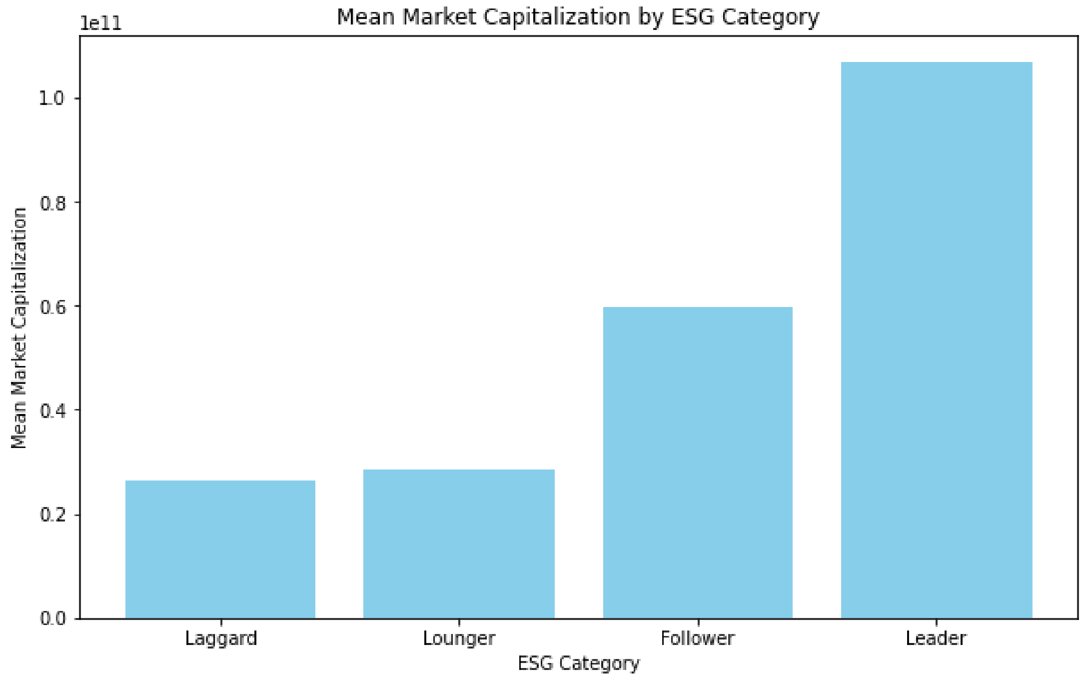


Figure 3.1: Mean market capitalization by ESG category

This histogram illustrates the average market capitalization across different ESG categories. The classification of companies into ESG categories, based on their respective ESG scores, is thoroughly discussed in the data preparation section of chapter 4. For clarity, 'Laggards' are defined as companies scoring below 40 out of 100, 'Loungers' fall within the range of 40 to 50, 'Followers' encompass scores between 50 and 60, and 'Leaders' represent scores of 60 and above. Notably, there is a discernible trend where companies with higher ESG scores tend to exhibit higher market capitalization on average. This correlation might be attributed to their potentially greater financial resources, enabling them to invest in and adopt more extensive and robust sustainable practices.

The heatmap presented below displays the correlation matrix among our numerical variables. As expected, stock return exhibits an almost perfect correlation with excess returns. The correlation among ESG scores is logical, given that the overall ESG score is derived from the aggregation of individual environmental, social, and governance scores. Furthermore, individual ESG scores are interrelated due to shared underlying factors, such as corporate governance practices and environmental impact assessments. Additionally, the positive correlation between CMA (Conservative Minus Aggressive) and HML (High Minus Low) factors can be attributed to their conceptual relationship within the Fama-

French three-factor model. CMA represents the profitability spread between conservative and aggressive firms, while HML captures the spread in returns between portfolios of high and low book-to-market (value) stocks. Consequently, companies exhibiting conservative financial policies (higher CMA) tend to align with the characteristics of value stocks (higher HML), leading to a positive correlation between the two factors. Lastly, the excess return on the market is positively correlated to the stock returns and excess stock returns. As seen before, this is to be expected, given that we are analyzing S&P 500 stocks.

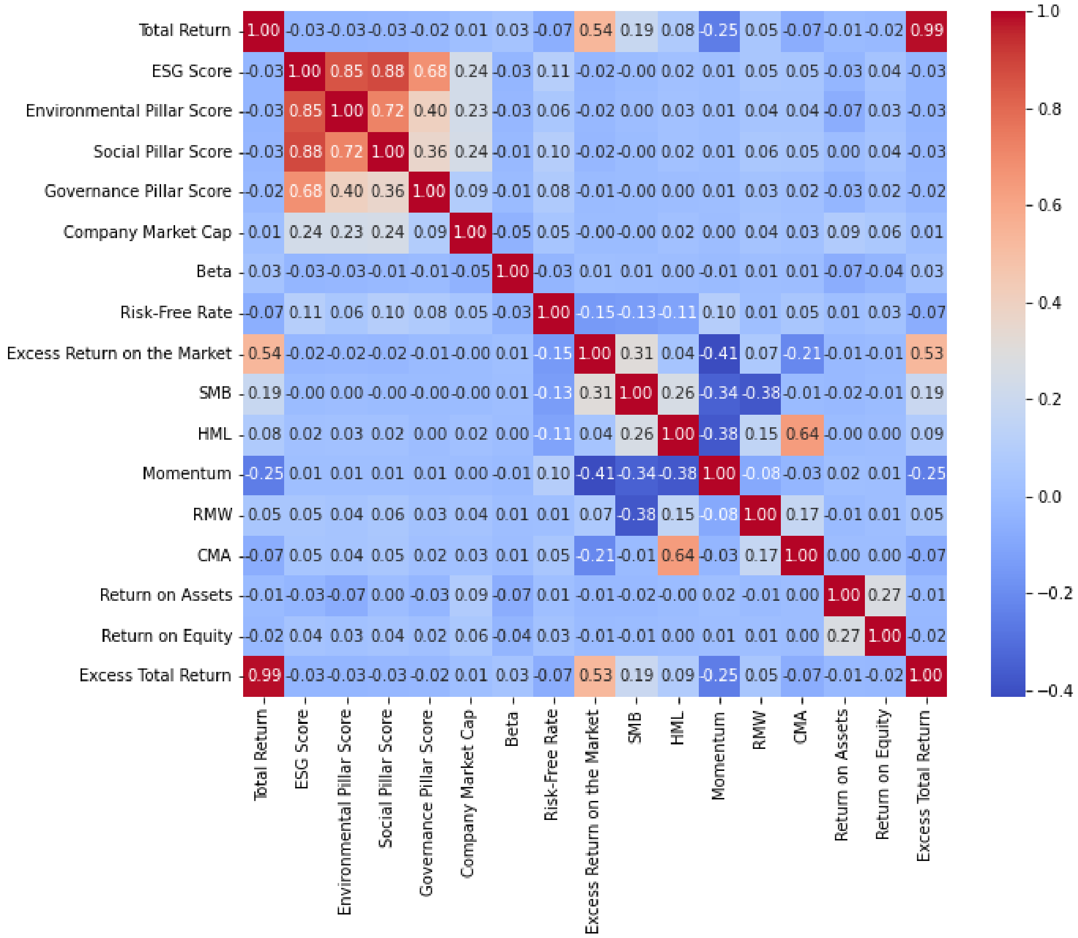
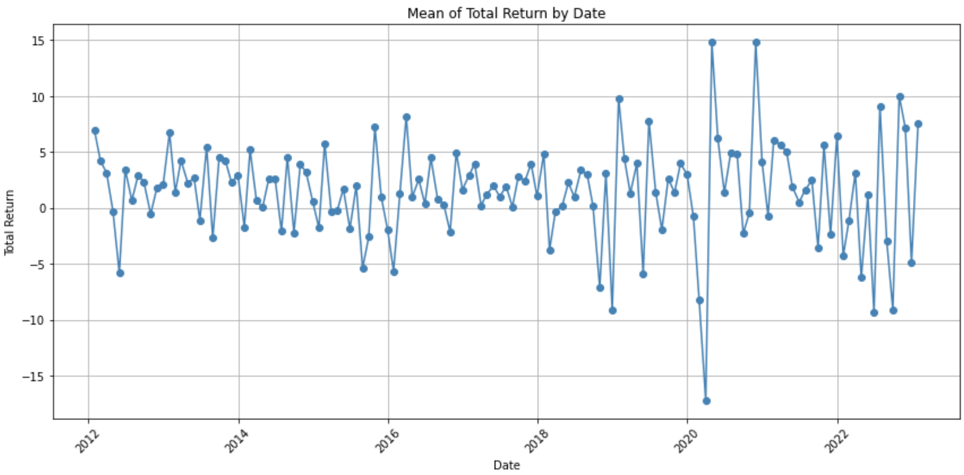
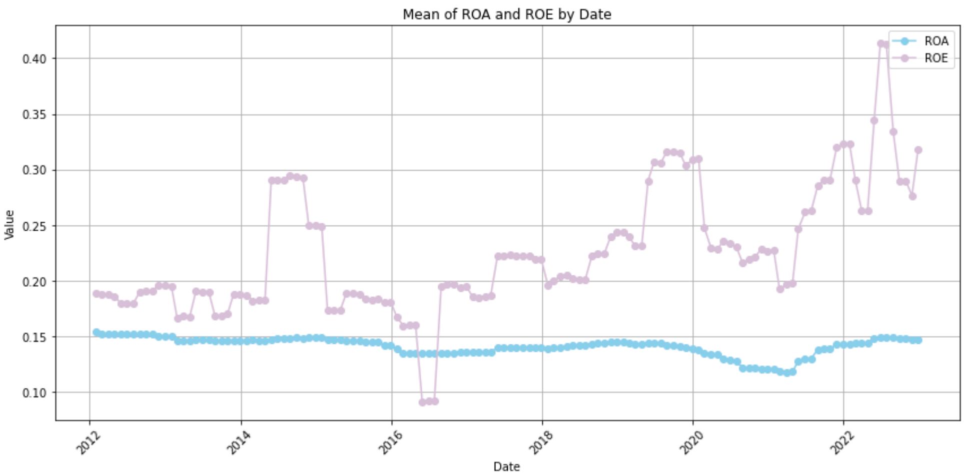


Figure 3.2: Heatmap of numeric variables



(a) Mean of total returns by date



(b) Mean of ROA/ROE by date

Figure 3.3: Comparison of mean of total returns and ROA/ROE by date

The following two graphs illustrate the temporal evolution of our financial metrics. Firstly, we examine the trend in total stock returns. A notable observation is the significant dip observed at the beginning of 2020, corresponding to the outbreak of the COVID-19 pandemic and its impact on financial markets starting from the very end of February. This downturn is followed by a remarkable surge, leading to unprecedented highs that persist until early 2021. Furthermore, the year 2022 exhibits increased volatility compared to the pre-pandemic years, indicating a shift in market dynamics since the onset of the pandemic. The return on equity demonstrates substantial fluctuations over time, with notable peaks observed in late 2014, late 2019, and 2023, alongside dips at the end of 2016 and following the COVID-19 outbreak in early 2020. Conversely, the return on assets exhibits more modest variations, although a decline is evident post-pandemic, with a gradual return to pre-pandemic levels by early 2022.

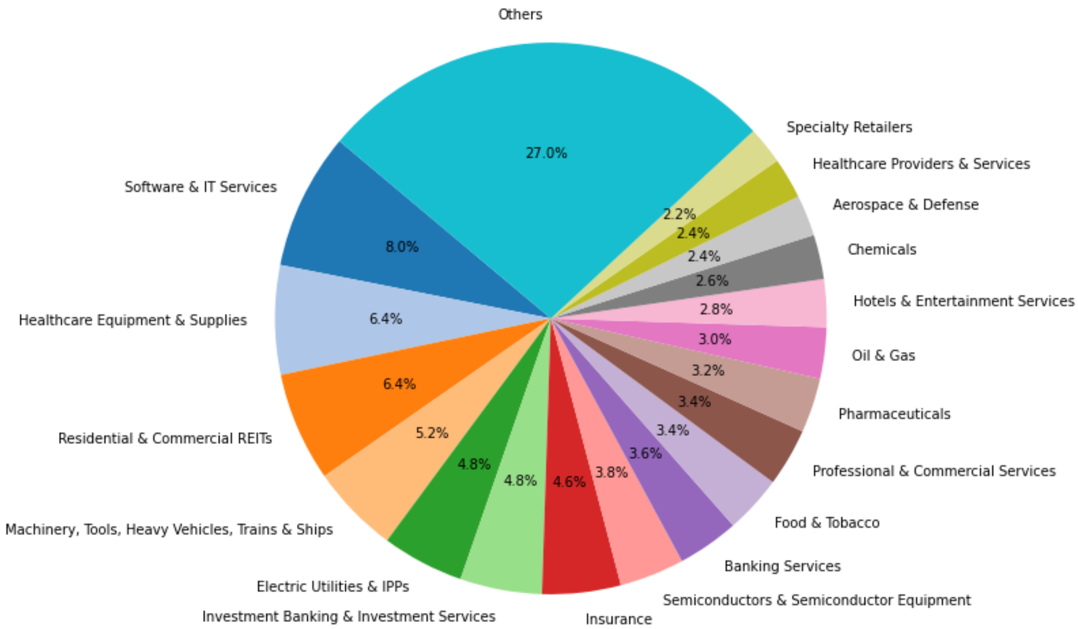


Figure 3.4: Distribution of Industries

Lastly, we examine the distribution of our dataset across 47 industries. Overall, the distribution appears scattered, with no industry category dominating in terms of representation. The 'Others' category encompasses industries representing less than 2% of the database. Notably, prominent industries include software and IT services, healthcare equipment and supplies, as well as residential and commercial REITs. In addressing hypothesis 3, we will focus on industries with a sufficient number of stocks, namely the ten largest industries depicted in the pie chart, each of which consistently includes more than 15 companies per year within their respective category.

4. Methodology

4.1 Data preparation

Firstly, the dataset undergoes preprocessing to ensure data integrity and consistency. This includes cleaning the data to handle missing values and merging various datasets related to ESG scores, financial factors, and company-specific information. For example, datasets containing ESG ratings, market returns, risk-free rates, and company market capitalization are combined to create a comprehensive dataset ready for analysis. Once the data is prepared, the next step involves standardization. As mentioned before, this is a crucial step to ensure that comparisons across companies from different industries are meaningful and consistent. ESG scores are standardized to a common scale, mean-centered and scaled by the standard deviation, following this formula from Naffa & Fain (2022):

$$zESG_i = \frac{ESG_i - \mu_{peer}}{\sigma_{peer}} \tag{4.1}$$

ESG_i represents the company-level score, while μ_{peer} and σ_{peer} represent the mean and standard deviation of the score of their peers in this industry, respectively. Lastly, the scores are normalized on a scale from 0 to 100, with a mean of 50 and standard deviation of 10:

$$Norm_{ESG_i} = 50 + (zESG \times 10) \tag{4.2}$$

This standardization is necessary for the evaluation of diversified portfolios containing various industry groups. However, it is not applied when addressing hypothesis 3, as each portfolio comprises only one industry.

The newly calculated scores enable us to categorize companies based on their ESG performance, aligning with the framework established by Triguero et al. (2016). This categorization system encompasses four distinct groups, each delineated by specific score ranges. Firstly, companies falling below an ESG score of 40 out of 100 are classified as Laggards or Sceptics, constituting 18% of our database. Moving up the spectrum, those with scores between 40 and 50 are designated as Loungers, which can further be divided into pragmatists or conservatives, although this subdivision holds minimal relevance for our analysis. They account for 28% of the database. The next tier, comprising scores between 50 and 60, houses Followers or Visionaries, representing the largest segment at 37%. Lastly, companies surpassing a score of 60 are qualified as Leaders or Enthusiasts, commanding 17% of our database.

Lastly, we made sure both dependent and independent variables were winsorized at 0.5% level except for the ESG global and individual scores. Since the ESG scores are represented as straightforward values ranging from 0 to 100, there is theoretically no need for winsorization. Furthermore, for the regressions, the standard errors and t-statistics were adjusted following Newey & West (1986)'s approach. Indeed, to address potential concerns regarding heteroskedasticity and/or autocorrelation in parts of our work including time-series analysis, we adjust the standard errors of estimated values to mitigate the influence of these issues. Like numerous studies, we opt for a predetermined lag length of six months, which is not inherently data-driven.

4.2 Panel data analysis

To test our set of hypotheses, we first employ the Ordinary Least Squares (OLS), as it is very often the preferred method for ESG analyses made by scholars (Alamsyah & Muljo (2023), Rahman et al. (2023)). This choice is also driven by the method's suitability for analyzing relationships between variables commonly found in ESG research settings, such as company-level scores and financial performance metrics, due to its robustness and ability to provide easily interpretable results. Additionally, OLS is well-suited for handling panel data structures, typical in ESG studies where data is collected over multiple periods for the same entities. The first hypothesis regarding the link between a company's global ESG score and its financial performance will be evaluated using the following equation:

$$R_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t} \tag{4.3}$$

where $R_{i,t}$ are the company's monthly excess returns, ESG is the standardized ESG score, FF5 being the 5 Fama French factors (Market Risk Premium, Small Minus Big, High Minus Low, Robust Minus Weak, Conservative Minus Aggressive) and $\epsilon_{i,t}$ is the error term.

Our upcoming hypotheses align closely with the previous set, but this time, they centre on studying each ESG pillar's impact on finance performance individually.

$$\begin{aligned} R_{i,t} &= \alpha_0 + \alpha_1 E_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t} \\ R_{i,t} &= \alpha_0 + \alpha_1 S_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t} \\ R_{i,t} &= \alpha_0 + \alpha_1 G_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t} \end{aligned} \tag{4.4}$$

where E, S and G represent the Environmental, Social and Governance scores, respectively, all other things being equal.

Moving forward, we address our third hypothesis concerning potential industry variations in the impact of ESG on returns. We conduct separate regressions for the 10 industries with the most data. We opt not to use dummy variables to avoid potential multicollinearity issues, which could affect coefficient estimation and interpretation. Additionally, given our ample dataset, we are not concerned about reduced statistical power and precision due to insufficient observations relative to regressors in the separate industry-specific regressions. Presented here is the generalized form of our equations:

$$R_{i,t,industry} = \alpha_0 + \alpha_1 ESG_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t,industry} \tag{4.5}$$

with industry taking the values of the following list: 'Software and IT Services', 'Healthcare Equipment and Supplies', 'Residential and Commercial REITs', 'Machinery, Tools, Heavy Vehicles, Trains and Ships', 'Electric Utilities and IPPs', 'Investment Banking and Investment Services', 'Insurance', 'Semiconductors and Semiconductor Equipment', 'Banking Services', 'Food and Tobacco'. The value of i determines the industry, as each stock only belongs to one industry.

At last, we are examining our fourth hypothesis concerning the influence of COVID-19 on our potential links. Our regression analysis will focus solely on the year 2020, with pre-COVID years serving as control variables. Additionally, post-COVID analysis will be conducted to observe any aftermath effects, although a full explanation may be challenging at this time. Here are the formulas:

$$\begin{aligned} R_{i,t,COVID} &= \alpha_0 + \alpha_1 ESG_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t,COVID} \\ R_{i,t,pre-COVID} &= \alpha_0 + \alpha_1 ESG_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t,pre-COVID} \\ R_{i,t,post-COVID} &= \alpha_0 + \alpha_1 ESG_{i,t} + \sum_{n=2}^{6} \alpha_n FF5_{n,i,t} + \epsilon_{i,t,post-COVID} \end{aligned} \tag{4.6}$$

4.3 Portfolio construction

Our portfolio formation approach is inspired by the methodology outlined in Bali et al. (2016), in our case tailored to study the correlation between Environmental, Social, and Governance (ESG) factors and financial performance.

To conduct our univariate portfolio analysis, we first categorize entities into portfolios using predetermined breakpoints that segment the sample. These breakpoints for each period t are determined by the percentile of the cross-sectional distribution of the sorting variable, which in this case is the standardized ESG scores, at time t. We define the breakpoints formula as:

$$B_{k,t} = Qrtl_{p_k}(ESG_t) \tag{4.7}$$

where Qrtl(Z) denotes the q-th quartile of the set Z and ESG_t signifies the collection of valid values of standardized ESG scores across all entities i in the sample during period t.

Staying consistent with our previous ESG classification, for each month we determine three breakpoints to create four portfolios, with Portfolio 1 representing entities with the lowest ESG scores and categorized as laggards, while Portfolio 4 comprises entities with the highest scores and identified as leaders. Subsequently, we make sure to get a sufficient number of entities, effectively oscillating between 124 and 125. Having a substantial number of entities in each portfolio enhances the precision of our estimate for the true mean value of each portfolio, making it a desirable outcome (Bali et al., 2016).
This division is implemented using the following formula:

$$P_{k,t} = \{i|B_{k-1,t} \leq ESG_{i,t} \leq B_{k,t}\} \; for \; k \; \in \{1...n_p\} \tag{4.8}$$

with $P_{k,t}$ being the k-th portfolio for period t, $ESG_{i,t}$ being the standardized ESG score at time t for entity i and $B_{k-1,t}$ and $B_{k,t}$ being the breakpoints for the (k-1)-th and k-th portfolios for period t, respectively.

Our next objective is to compute the mean value of our outcome variable Y, total stock returns, for each of the n_p portfolios during each period t to determine weights. Numerous approaches can be considered for this calculation. The two most prevalent methods are making the portfolios equally weighted (assigning a weight of $1/n_t$ to each portfolio) or using the market capitalisation to calculate weights $W_{i,t}$ for entity i at time t, as per the following formula:

$$\overline{TR}_{k,t} = \frac{\sum_{i \in P_{k,t}} W_{i,t} \; TR_{i,t}}{\sum_{i \in P_{k,t}} W_{i,t}} \; for \; k \; \in \{1...n_p\} \tag{4.9}$$

To assess the robustness of our methodology, we use both portfolio weighting practices, as they both bear pros and cons.

Market capitalization weighting reflects the market's valuation of each commodity and provides diversified exposure across various industries. However, it may introduce biases towards overvalued companies and vulnerability to market bubbles due to the disproportionate influence of the aforementioned larger companies. On the other hand, equal weighting assigns the same weight to every entity in the portfolio, regardless of its market capitalization. This approach avoids overexposure to large companies and encourages diversification, but it may underperform during periods of large-cap outperformance.

Additionally, one last portfolio will be created. Referred to as the long-short portfolio or "4-1" in our study, it is the difference in average values between portfolio 4 and portfolio 1. This disparity in averages serves as the primary metric for identifying a cross-sectional relationship between the sorting variable and the outcome variable and is calculated as so:

$$\overline{TR}_{4-1,t} = \overline{TR}_{4,t} - \overline{TR}_{1,t} \tag{4.10}$$

We employ the one-year-ahead excess stock return $\overline{ER}_{t+1}$ as our outcome variable, which is just the one-year-ahead total stock return minus the risk-free rate. Since $\overline{ER}_{t+1}$ reflects the excess return of the stock in the year following the calculation of the ESG score, the average excess stock returns depict the returns that would have been obtained by an investor who, at the end of year t, constructed portfolios based on the previous year's ESG scores and maintained these portfolios without making additional trades throughout year t+1.

At last, regression analyses are conducted on the ESG-sorted portfolios 1 to 4-1, incorporating various control variables. We test the Fama French 3-factor model, 5-factor model, and the Fama French Carhart model which includes momentum.

4.4 Fama McBeth regressions

To ensure the comprehensiveness of our analysis, we employ Fama & MacBeth (1973)'s approach, an alternative statistical methodology to the non-parametric portfolio analysis. This method is designed to investigate the relationship between pairs of variables, usually operating under the common assumption that the relationship of interest, as well as the association between each control variable and the outcome variable of interest, follows a linear pattern. This regression analysis is conducted using a two-step procedure. The initial step involves running periodic cross-sectional regressions of the dependent variable, denoted as Y, on one or more independent variables such as X1, X2, etc., utilizing data from each period t. Subsequently, the time series of each regression coefficient is analyzed in the second step to ascertain whether the average coefficient significantly deviates from zero.

In our scenario, the periodic cross-sectional regressions are fivefold. In all specifications, the dependent variable Y designates the one-year-ahead excess return of the given stock. The initial four specifications involve each independent variable alone: beta, Size (the natural logarithm of Market Capitalization), Book-to-Market ratio and ESG score. The final specification incorporates all independent variables. The general formula for the first four specifications is:

$$ER_{i,t+1} = \delta_{0,t} + \delta_{j,t} X_{i,t} + \epsilon_{i,t+1} \tag{4.11}$$

The last specification is:

$$ER_{i,t+1} = \delta_{0,t} + \delta_{1,t}\beta_{i,t} + \delta_{2,t} Size_{i,t} + \delta_{3,t} BM_{i,t} + \delta_{4,t} ESG_{i,t} + \epsilon_{i,t+1} \tag{4.12}$$

where j represents the index for each independent variable (j=1 for β, 2 for Size, 3 for BM and 4 for ESG), $X_{i,t}$ represents the corresponding independent variable, $\delta_{0,t}$ represents the intercept term for each specification, $\delta_{j,t}$ represents the coefficient for each independent variable and $\epsilon_{i,t+1}$ represents the error term.

After conducting these regressions, the second and last step of the Fama & MacBeth (1973) regression procedure is to calculate the time-series averages of the periodic cross-sectional regression coefficients, as well as other regression results such as R-squared, adjusted R-squared, and the number of observations. The results, along with other findings following the methodology discussed in this chapter, are detailed in the next section.

5. Findings and assessment of results

5.1 The impact of ESG scores on financial performance

Beginning with our initial set of hypotheses, we delve into the examination of the relationship between ESG criteria and financial metrics. Utilizing regression analyses and portfolio strategies outlined in the methodology section, we present the following outcomes:

Table 5.1: Regression between Fama French 5 Factors + ESG global score and stock returns

Variable	**Coefficient**	**Std Err**	**t-stat**	**p-value**
α	1.0836	0.167	6.487	0.000
$R_m - R_f$	0.9806	0.008	120.328	0.000
SMB	9.1974	1.523	6.039	0.000
HML	12.9368	1.306	9.905	0.000
RMW	8.2381	1.826	4.512	0.000
CMA	1.8046	2.029	0.889	0.374
ESG_{global}	-0.0143	0.003	-4.385	0.000

Firstly, the intercept coefficient (α) of 1.0836 indicates the expected stock return when all independent variables are zero. The coefficient for the excess return on the market ($R_m - R_f$) stands out significantly at 0.9806, with a very low p-value, suggesting a strong positive association between market returns and stock returns. This finding aligns with the conventional wisdom that stock returns tend to track overall market performance closely. Moreover, the coefficients for the size (SMB) and value (HML) factors are also notable, with coefficients of 9.1974 and 12.9368, respectively, both statistically significant at a 95% confidence level. These coefficients indicate that stocks of smaller size and those considered undervalued (value stocks) tend to outperform in terms of returns, which is consistent with literature regarding Fama-French factors. Accordingly, the coefficients for the profitability (RMW) and investment (CMA) factors show statistically significant positive relationships with stock returns, albeit with smaller magnitudes compared to the market, size, and value factors.

The coefficient for the global ESG score stands out with a negative value of -0.0143, indicating a negative relationship with stock returns. The negative sign suggests that higher ESG scores are associated with lower stock returns on average. This finding may reflect the market's perception that companies with stronger ESG practices may prioritize social and environmental responsibility over short-term profitability, potentially leading to lower returns.

For our two other metrics' regressions, which are portrayed in Appendix B as Table B.1 and Table B.2, the coefficients associated with ESG scores are observed to be -0.0004 for Return on Assets (ROA) and 0.0037 for Return on Equity (ROE). One possible explanation for the near-null effect on ROA could be that ESG scores might not significantly influence a company's operational efficiency and profitability, key components of ROA. However, for ROE, which also incorporates aspects of a company's financial leverage, profitability, and efficiency, the slightly positive effect of ESG scores might indicate that companies with higher ESG scores tend to have slightly better financial performance.

The Fama-MacBeth results presented in Table 5.2 reveal significant insights into the relationship between various factors and stock returns. Notably, the Size factor demonstrates the most substantial impact on stock returns, with its δ_0 coefficient exhibiting ten times more magnitude than other individual factors estimated. In its individual specification, Size emerges as the sole significant coefficient alongside ESG criteria. However, in the full specification adding the other factors, particularly ESG criteria, into the regression model, the coefficient for Size diminishes, and ESG loses its significance. This observation suggests that Size may subsume some of the effects of ESG criteria on stock returns, indicating potential overlap or shared explanatory power between these variables. Both Size and ESG exhibit negative coefficients across all specifications, consistent with our previous results. The negative coefficient for Size could be attributed to the dominance of very

Table 5.2: Summarized Fama McBeth Regression Results

Coefficient	Value	(1)	(2)	(3)	(4)	(5)
δ_0	Average	0.9428	8.9788	1.4739	2.1841	7.0378
	Standard error	0.2846	2.2283	0.4393	0.6427	1.4765
	t-statistic	3.3127	4.0294	3.3552	3.3985	4.7665
$\delta_1 = \beta$	Average	0.4738				0.3658
	Standard error	0.4166				0.4050
	t-statistic	1.1374				0.9032
$\delta_2 =$ Size	Average		-0.3132			-0.2379
	Standard error		0.0778			0.0627
	t-statistic		-4.0258			-3.7908
$\delta_3 =$ Book/Market	Average			-0.1380		-0.4021
	Standard error			0.3647		0.3406
	t-statistic			-0.3783		-1.1803
$\delta_4 =$ ESG	Average				-0.0139	-0.0026
	Standard error				0.0055	0.0056
	t-statistic				-2.5259	-0.4639
R^2		0.0567	0.0126	0.0335	0.0064	0.1002
Adj. R^2		0.0542	0.0100	0.0309	0.0038	0.0907
n		384	384	384	384	384

large-cap companies, as we are centering around S&P 500, which overshadow the effects of smaller-cap companies, hence concealing the size effect. Moreover, the higher R-squared values associated with the Size factor compared to ESG indicate that Size has greater explanatory power in explaining variations in stock returns, aligning with existing literature.

Finally, our attention shifts to the results of portfolio construction. Initially, we examine both Tables B.3 and B.4 introduced in Appendix B, presenting the equally weighted and value-weighted versions of our ESG sorted portfolios, respectively. A notable observation across both tables is the consistently negative scores for the long-short portfolio in every model specification, indicating once more that ESG scores tend to negatively impact stock returns. This suggests that investors may be willing to pay a premium for stocks with higher ESG scores, anticipating better performance due to their perceived sustainability and ethical practices. However, if these stocks are overpriced relative to their actual fundamentals or earnings potential, it could lead to lower returns for individual investors who purchase them. Conversely, investing in stocks with lower ESG ratings may offer a price discount, as they may be undervalued by the market due to perceived environmental, social, or governance risks. This could potentially lead to better investment results for those who choose to invest in companies with lower ESG scores, as they may benefit from a revaluation of these stocks over time.

Upon inspecting the betas for each model, it becomes apparent that the β_{mkt} values for portfolios hover around 1, signifying a significant sensitivity to market movements. Given that the S&P 500 index encompasses a broad array of the largest and most established U.S. companies, it is reasonable to anticipate such results. Additionally, betas are smaller for companies with higher ESG scores across all specifications, as evidenced by the negative values of betas for the long-short portfolio. This suggests lower volatility for stocks belonging to companies with higher ESG scores, aligning with existing literature.

The most notable disparity between the two tables lies in the sign of the SMB coefficient: positive for equally weighted and negative for market cap weighted portfolios. This discrepancy can be clarified by considering the composition of the S&P 500, predominantly consisting of large-cap companies. In a value-weighted portfolio, where larger companies carry more weight, the performance is heavily influenced by these very large-cap stocks, potentially dampening the size effect. Conversely, in an equally weighted portfolio, each stock carries the same weight regardless of market capitalization, granting smaller-cap stocks a proportionally greater influence on performance. Hence, the size effect, represented by the SMB factor, may manifest more prominently in equally weighted portfolios of S&P 500 stocks.

HML coefficients exhibit interesting dynamics in our analysis. When significant its direction varies between equally weighted and market cap weighted portfolios. Since very large companies are typically associated with growth characteristics, their stocks are more likely to be classified as growth stocks rather than value stocks. Therefore, when the portfolio is value-weighted, the performance of these large growth companies can dominate, leading to a negative HML coefficient. In contrast, equally weighted portfolios give each stock the same weight, regardless of its market capitalization. This means that smaller companies have a proportionally larger impact on the portfolio's performance. Since smaller companies are more likely to exhibit value characteristics, such as higher book-to-market ratios, equally weighted portfolios may exhibit a positive HML coefficient, reflecting the historical outperformance of value stocks compared to growth stocks.

Other coefficients such as CMA, RMW, and momentum are predominantly insignificant in these ESG-sorted portfolios, hence not interpretable in this context.

Table 5.3: Alphas and t-statistics (in parenthesis) from the regressions on Portfolios constructed on Return on Assets and Return on Equity, sorted on ESG Scores, Value Weighted

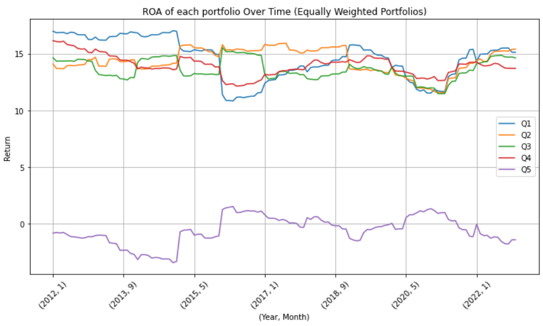
Model	1	2	3	4	4-1
α (ROA)	14.613	15.132	15.271	16.948	2.334
	(35.817)	(33.640)	(47.605)	(32.909)	(4.025)
α FF5 (ROA)	14.616	15.166	15.285	16.895	2.278
	(35.892)	(35.614)	(46.963)	(33.753)	(4.163)
α (ROE)	19.706	28.057	26.270	35.495	15.788
	(12.279)	(7.663)	(17.835)	(11.535)	(4.745)
α FF5 (ROE)	19.838	28.310	26.252	35.381	15.543
	(12.296)	(7.726)	(18.192)	(11.615)	(4.642)

Table 5.4: Alphas and t-statistics (in parenthesis) from the regressions on Portfolios constructed on Return on Assets and Return on Equity, sorted on ESG Scores, Equally Weighted

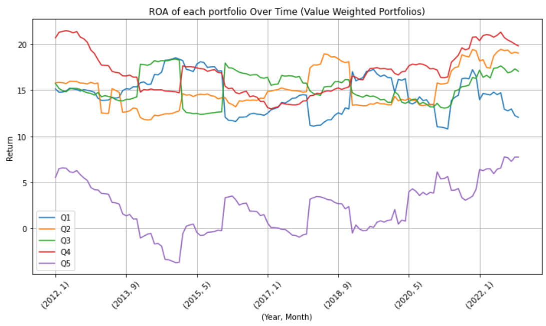
Model	1	2	3	4	4-1
α (ROA)	14.562	14.357	13.637	13.958	-0.603
	(36.387)	(59.574)	(73.757)	(73.091)	(-2.294)
α FF5 (ROA)	14.574	14.416	13.654	13.959	-0.615
	(37.864)	(62.226)	(76.904)	(77.054)	(-2.382)
α (ROE)	19.373	21.714	22.773	26.190	6.816
	(9.594)	(13.852)	(33.646)	(11.437)	(2.356)
α FF5 (ROE)	19.533	21.914	22.670	26.257	6.724
	(9.500)	(13.611)	(34.195)	(11.647)	(2.307)

Similarly, we construct portfolios sorted by ESG criteria, this time focusing on Return on Assets and Return on Equity. To diversify our approach, this time we interpret graphs and solely showcase the alphas of our regressions on portfolios.

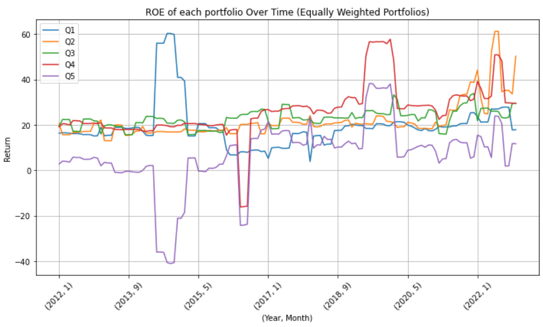
Several noteworthy observations can be retrieved from Tables 5.3 and 5.4. Firstly, it is evident that the long-short portfolios yield positive returns across most scenarios, except for ROA in the equally weighted approach. This suggests that ESG scores have a generally positive impact on both Return on Assets and Return on Equity, with the effect being more prominent for the latter. Moreover, the long-short portfolios perform more favorably in the market cap weighted scheme, indicating a greater disparity in returns between higher and lower ESG score portfolios. This discrepancy is largely attributable to the construction of these portfolios. In an equally weighted portfolio, each stock carries equal weight regardless of its market capitalization, leading to a relatively larger influence of smaller companies with potentially lower ROA and ROE. Consequently, this results in lower average returns for the long-short portfolio in the equally weighted approach.



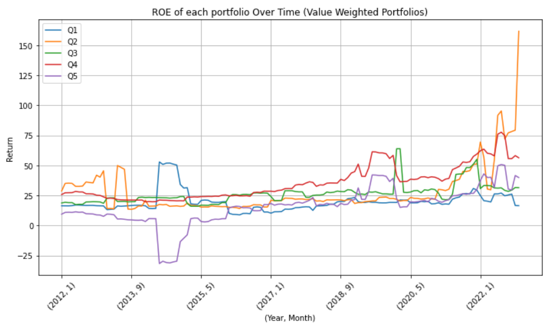
(a) ROA of each portfolio Over Time (Equally Weighted)



(b) ROA of each portfolio Over Time (Value Weighted Portfolios)



(c) ROE of each portfolio Over Time (Equally Weighted Portfolios)



(d) ROE of each portfolio Over Time (Value Weighted Portfolios)

Figure 5.1: Over time evolution of each ESG sorted portfolio's ROA and ROE

Finally, the subsequent graphs presented in Figure 5.1 visually reinforce our earlier observations, highlighting the trends over time. In these graphs, Q1 represents the portfolio with the lowest ESG scores, while Q5 denotes our long-short portfolio. Notably, for ROE, there was a noteworthy dip in 2014 for the long-short portfolio, attributed to the peak performance of the portfolio with the lowest ESG scores. Conversely, a similar pattern emerges for the portfolio with the highest ESG scores, albeit occurring later, around late 2019 to early 2020, suggesting that companies with higher ESG scores performed relatively better during the early stages of the COVID-19 pandemic. A similar trend is observed for ROA, indicating a turning point for companies with high ESG scores around the end of

2019 and onwards, evidenced by the upward trajectory. Interestingly, this effect appears more pronounced in the equally weighted scheme, highlighting the predominant influence of large-cap companies in driving these trends.

5.2 The influence of ESG individual scores on financial performance

Subsequently, we delve into the individual analysis of each ESG criterion, starting with the regressions.

Table 5.5: Regression between Fama French 5 Factors + Environmental score and stock returns

Variable	Coefficient	Std Err	t-stat	p-value
α	0.8557	0.118	7.269	0.000
$R_m - R_f$	0.9808	0.008	120.373	0.000
SMB	9.1033	1.522	5.980	0.000
HML	13.0282	1.306	9.978	0.000
RMW	8.0416	1.823	4.410	0.000
CMA	1.6916	2.029	0.834	0.404
$Environmetal\ Score$	-0.0098	0.002	-4.339	0.000

The additional tables corresponding to the Social and Governance criteria can be found in Appendix B as Tables B.5 and B.6. The coefficients derived from the Fama-French model exhibit similar patterns to those observed in the global ESG regressions, hence the interpretation is the same. Notably, all ESG criteria demonstrate a negative impact on stock returns, aligning with the negative relationship observed with the global ESG score, since it aggregates these three criteria. Regarding Table B.7 also presented in Appendix B, the findings corroborate previous observations: the coefficients associated with each pillar are positive for ROE but nearly negligible (close to zero) for ROA.

Next, let's shift our focus to portfolio construction results for each pillar individually. Here, our attention solely focuses on the alphas within our long-short portfolios concerning the Fama-French 5-factor model.

These results presented in Table 5.6 unveil distinct impacts of each ESG criterion individually on our financial metrics. Firstly, regarding stock returns, we observe consistent negative effects across all criteria, albeit with small variations in magnitude. Notably, the E criterion appears to exert the most significant impact, followed by S and then G. This suggests that having higher environmental factors might have a stronger influence on stock returns compared to its counterparts, irrespective of the portfolio formation strategy. In

Table 5.6: Alphas and t-statistics (in parenthesis) from the regressions on Portfolios constructed on stock returns, sorted on E, S and G Scores, Equally and Value Weighted

	Equally Weighted			Value Weighted		
	$(4-1)_E$	$(4-1)_S$	$(4-1)_G$	$(4-1)_E$	$(4-1)_S$	$(4-1)_G$
FF5 Excess Stock Return	-0.513	-0.418	-0.262	-0.487	-0.378	-0.188
	(-5.179)	(-5.999)	(-2.592)	(-3.736)	(-3.895)	(-1.114)
FF5 ROA	-1.425	-0.043	-1.034	0.215	3.011	2.541
	(-3.906)	(-0.159)	(-3.731)	(3.280)	(11.44)	(4.334)
FF5 ROE	7.438	0.364	3.144	13.653	7.080	12.174
	(2.309)	(0.165)	(1.064)	(3.990)	(3.757)	(3.659)

the case of Return on Assets (ROA), we observe a negative impact for equally weighted portfolios. However, in value-weighted portfolios dominated by larger-cap companies, ROA turns positive. Both of these findings align with previous conclusions. In these value-weighted portfolios, the Environmental (E) factor appears to have the least impact, while Social (S) and Governance (G) factors exhibit similar influences. This might be because in larger-cap companies, particularly those in industries with lower environmental impact or where environmental considerations are less material to financial performance, the influence of the E criterion on ROA may be comparatively smaller. Also, the environmental impact of larger-cap companies may have longer-term implications that are not fully captured within shorter-term financial metrics like ROA. While environmental sustainability initiatives can lead to cost savings and operational efficiencies over time, their impact on ROA may be more gradual and realized over the longer term. Similarly, in Return on Equity (ROE), where all coefficients are positive as expected, the Social factor appear to have the weakest impact in value-weighted portfolios, contrasting with Environmental and Governance factors, which show stronger influences. Indeed, the direct impact of social measures on financial metrics like ROE may be less pronounced in larger-cap companies. Since social factors often encompass aspects related to employee satisfaction, community engagement, and customer relations, they may be more difficult to quantify in financial terms, hence having less of an influence on ROE compared to E and G factors.

5.3 Nexus between industry, ESG criteria, and financial performance

This section stresses the potential impact of industry-specific factors on this paper's analysis. As outlined in the methodology section, we focus solely on the top 10 industries by instrument count each year to ensure robust data coverage. Our objective is to examine whether companies within better-performing industry groups face greater penalties when underperforming compared to their counterparts in less prosperous industries.

We initiate this investigation with a regression analysis, augmented by the inclusion of each industry group's mean for comparison purposes. The results of the regressions, detailed in Table B.8 of Appendix B, reveal that most ESG metrics are negative but lack statistical significance, rendering interpretations unreliable. Nevertheless, noteworthy variations emerge in the specifications of individual companies, particularly evident in the vastly different sizes and directions of the Fama French 5 factors coefficients (FF5). For instance, certain industries exhibit negative SMB coefficients (e.g., Software and IT Services, Electric Utilities, Food and Tobacco), indicating that larger companies within these sectors tend to outperform smaller firms. Conversely, industries like Healthcare Equipment and Supplies, Semiconductors, and Machinery and Tools appear less prone to mitigating the effects of smaller firms, as reflected by their FF5 coefficients. This diversity in industry specifications extends to other Fama-French factors, underscoring the intricate dynamics at play within each sector. The means of the industry groups range from approximately 50 to 70. Notably, sectors with extreme scores tended to comprise only a few industries. Therefore, we were unable to include them in our analysis. Standard errors across our sample remain consistent for each industry, spanning from 10 to 20.

We now turn our focus to the portfolios that are industry-specific within our sample. Tables B.9 and B.10, which can be found in Appendix B present the results of our portfolios with n representing the number of unique instruments in each category per year. The results present some contradictions regarding the hypothesis. Software and IT, the industry with one of the lowest means, exhibit better performance when they have lower ESG scores (e.g., Portfolio 1) than for example Food and Tobacco which has a higher mean. Software and IT Services show higher values for Portfolio 1 (1.0943 for FF5 equally weighted, 1.4540 for value weighted) compared to Food and Tobacco, which has lower values for Portfolio 1 (0.2852 for FF5 equally weighted, 0.6100 for value weighted). However, Insurance, with a slightly lower mean than Software and IT Services, does not show higher values than the latter, although still higher than Food and Tobacco. The long-short portfolios are not consistently significant, but when they are, they align with this trend.

Further analysis comparing less extreme means, such as Semiconductors and Electric Utilities, indicates that the hypothesis may not hold universally. Semiconductors exhibit a lower Portfolio 1 score than Food and Tobacco, while Electric Utilities have a higher one than Software and IT Services. This inconsistency suggests two potential explanations: First, the hypothesis might be oversimplified when considering only the mean ESG score. Another possibility is that the hypothesis holds only when comparing extreme scores, where there is a significant difference between them. It's plausible that the premium associated with ESG performance may not have a discernible effect when ESG scores reach a certain threshold or level of parity. Therefore, this phenomenon would likely only manifest significantly in cases where ESG scores are very low. However, due to the limited number of companies in lower and higher ESG industries in our sample, this aspect cannot be thoroughly tested. Ultimately, the relationship between industry-specific effects and ESG performance might be more nuanced and not follow a straightforward pattern based solely on mean ESG scores.

5.4 ESG matters and financial performance amidst times of crisis

Finally, we will examine whether the COVID-19 pandemic had an impact on the relationship between ESG criteria and stock returns. In Table B.11 of Appendix B, we observe a higher beta for the year 2020, suggesting increased volatility during this period. Moreover, the average excess stock return more than doubled, indicating significant fluctuations in stock performance, although probably due to the increase of beta. Interestingly, contrary to the typical interpretation of Fama-French factors, we observe that value stocks outperformed growth stocks, while stocks of companies with high operating profitability underperformed, and those with weak investment profitability performed better. This divergence from the expected trends underscores the unique nature of this period. Despite these fluctuations, the ESG Score remains consistent, maintaining a negative trend, albeit slightly increasing in absolute value in 2020. Similar work is done for Return on Assets and Return on equity (Tables B.12 and B.13 in Appendix B). The interpretations of coefficients mirror those observed for stock returns, and are aligning with our previous observations of these financial metrics. Specifically, we continue to observe a negative or near-null relationship between ROA and ESG, while ROE maintains a positive correlation with ESG amidst times of crisis.

Table 5.7: Alphas, betas and t-statistics sorted on ESG score, for stock returns, equally weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	0.660	0.186	-0.473	-0.451	-0.847	-0.395	0.671	0.003	-0.327
	(8.051)	(3.016)	(-4.720)	(-1.084)	(-5.306)	(-1.238)	(1.616)	(0.013)	(-2.436)
β	0.925	1.015	0.090	1.144	1.055	-0.089	1.005	0.976	-0.028
	(30.187)	(55.040)	(3.510)	(19.067)	(134.83)	(-1.474)	(55.848)	(24.501)	(0.628)

Table 5.8: Alphas, betas and t-statistics sorted on ESG score, for stock returns, value weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	0.779	0.271	-0.507	0.388	-0.739	-1.128	0.671	0.513	-0.157
	(10.568)	(3.771)	(-3.938)	(1.394)	(-3.098)	(-2.960)	(5.916)	(5.486)	(-0.850)
β	0.919	0.984	0.064	1.074	0.957	-0.117	1.025	0.949	-0.0764
	(31.50)	(57.347)	(2.039)	(21.457)	(22.864)	(-1.295)	(42.283)	(32.129)	(-1.892)

Upon examination of each portfolio through Tables 5.7 and 5.8, it becomes evident that the year impacted by the COVID-19 pandemic stands out distinctly. Surprisingly, stocks with higher ESG ratings fared considerably worse than those with lower ESG scores during this period. However, in equally weighted portfolios, both categories experienced negative performance, indicating that larger-cap companies likely performed better than their small-cap counterparts, despite their poor ESG ratings. Notably, across all periods, except for pre-COVID equally weighted portfolios, the volatility consistently appears lower for high ESG companies compared to lower-rated ones. This disparity becomes more pronounced from 2020 onwards. These observations align with the notion that ESG criteria exert a protective influence on stock returns during crises. However, this effect does not necessarily enhance returns; rather, it mitigates portfolio volatility. Return on Asset and Return on Equity results are presented in Tables B.14, B.15, B.16 and B.17 of Appendix B. As anticipated, higher-rated ESG companies demonstrate positive and greater average returns. However, the volatility, being mostly non-significant, cannot be interpreted.

6. Conclusion and consideration of limitations

This study aims to investigate the connection between various financial metrics (stock returns, return on assets, return on equity) and Thomson Reuters ESG ratings, both for the global ESG score and for each pillar seperately. While existing literature has explored this relationship, it has not thoroughly examined potential industry-specific effects or the impact of COVID-19 aftermath within the S&P 500. This study fills this gap by examining how changes in ESG ratings affect this relationship both during times of crisis and for different sectors. Using regression analysis, including the Fama McBeth approach, with ESG scores (both global and individual) as independent variables and Fama French 5 Factors as control variables, as well as portfolio sorts on ESG scores, the study covers the period from 2012 to 2023, analyzing around 500 US firms annually.

Firstly, the results indicate a negative correlation between stock returns and ESG scores, both on a global and individual level. This relationship remains consistent across portfolios formed using either equally weighted or value weighted approaches, highlighting the robustness of these findings. Specifically, firms with low ESG scores tend to outperform those with high ESG scores in terms of stock returns, which corroborates the findings of Luo (2022). This paper offers insight into a possible rationale for these conclusions within our particular framework. The author asserts that the ESG premium can be explained as follows: high ESG firms, known for their sustainability and transparency, tend to attract a larger investor base compared to low ESG firms. In times of economic uncertainty and liquidity shortages, high-ESG firms provide reassurance to investors amid adverse economic conditions. Consequently, investors may experience diminished returns from stocks of high-ESG firms due to their high liquidity. Given our focus on S&P 500 firms, which are typically large and established, their stocks predominantly exhibit high liquidity, thus supporting this outcome. This aligns with the study's narrative, suggesting that investing in stocks with lower ESG ratings may present a discount due to their less attractive characteristics, while investing in stocks of sustainable firms could yield lower returns for individual investors if those stocks are overpriced, despite investors potentially willing to pay a premium for sustainable investments. Conversely, Return on Assets (ROA) and Return on Equity (ROE) exhibit a positive correlation with ESG scores, consistent with existing literature (Aydoğmuş et al., 2022; Buallay, 2019). ROA reflects a company's profitability relative to its total assets, while ROE gauges a corporation's profitability and efficiency in generating profits. This positive association could be attributed to companies with higher ESG scores demonstrating superior cost-saving measures, improved profitability, and more efficient risk management strategies including sustainability practices. Furthermore, their positive brand reputation, derived from their commitment to transparency and ESG-conscious approach, could consequently attract more stakeholders.

Secondly, the outcomes specific to industries reveal a greater level of complexity. While there appears to be some validity to the notion that a lower ESG score from a company among higher ESG-performing peers in the industry could be more detrimental than if the same were to occur among less ESG-conscious counterparts, this effect lacks robustness in our analysis. Although it intuitively seems plausible, particularly in cases where there is a noteworthy disparity in scores, we cannot definitively establish this in our paper due to insufficient data within industries exhibiting extreme variations. Additionally, the concept of a "carbon premium," as discussed in Bolton & Kacperczyk, 2021 could be explored in further detail: industries with lower environmental performance, and consequently lower ESG scores, may demonstrate better outcomes than their high-performing counterparts, regardless of their actual performance.

Thirdly, there appears to be a shielding effect from ESG criteria during times of crisis. High ESG firms demonstrate reduced portfolio volatility during the COVID-19 outbreak, with this effect persisting even years later, as the disparity in volatility between high and low ESG firms remains larger than pre-COVID levels. Return on Assets and Return on Equity indicate higher returns for firms with higher ESG scores, although the lack of significance in volatility prevents us from drawing definitive conclusions. Nevertheless, this suggests that sustainable practices can enhance a firm's financial performance during crises, aligning with existing literature (La Torre et al., 2020; G. Zhou et al., 2022).

Finally, we ought to delve deeper into our contextual considerations. It is apparent that the outcomes were somewhat shaped by the choice of our rating agency, Thomson Reuters. The divergence in ESG ratings is a substantial topic in its own right, potentially influencing the observed relationship. On average, there exists a notably low correlation between ratings (Christensen et al., 2022), implying that alternative ESG data providers could yield different results in this context. Considering additional sources like MSCI and Bloomberg could have offered a more comprehensive and nuanced perspective on our research topic. Gibson Brandon et al. (2021) and several other scholars have identified a positive correlation between stock returns and ESG rating disagreement. Additionally, the inclusion of ESG disclosure in this context appears to have a beneficial effect on financial performance (Z. Chen & Xie, 2022).

Furthermore, it's worth noting our focus on the United States, which, despite hosting the majority of sustainable finance rating agencies, lacks coherence nationwide in this domain. Despite a growing investor demand in America for more sustainable funds (Dreyer et al., 2023), the absence of unified legislation and divisions within the country could potentially impact stock markets and result in a continued underestimation of sustainability risks, as discussed extensively by Garrett & Ivanov (2022). Exploring multiple countries around the world and comparing regions such as Europe to the US could have enhanced the robustness and completeness of our results. Finally, the inclusion of S&P 500 constituents, large firms by definition, notably influenced the outcomes, particularly evident when forming portfolios based on equally weighted or value-weighted approaches. Further research could explore the inclusion of smaller-cap firms from indices such as the S&P 600.

A. Variable description

Table A.1: Variables retrieved on Eikon

Variable	Description	Source
Total Return	The monthly total return of a stock. Incorporates the price change and any relevant dividends for the specified period.	Thomson Reuters
CUSIP	Committee on Uniform Securities Identification Procedures Identifier for US companies.	Thomson Reuters
TRBC Economic Sector	TRBC Classifies companies with increasing granularity by Economic Sector, Business Sector, Industry Group, Industry and Activity	Thomson Reuters
Market Capitalization	The Company Market Capitalization represents the sum of market value for all relevant instrument-level share types.	Thomson Reuters
Size	The natural logarithm of Company Market Capitalization	Thomson Reuters
Beta	A measure of how much the stock moves for a given move in the market. It is the covariance of the security's price movement in relation to the market's price movement.	Thomson Reuters
ESG Score	Refinitiv ESG Score is an overall company score based on the self-reported information in the environmental, social and corporate governance pillars.	Thomson Reuters
Environmental Pillar Score	The environmental pillar measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems.	Thomson Reuters
Social Pillar Score	The social pillar measures a company's capacity to generate trust and loyalty with its workforce, customers and society, through its use of best management practices.	Thomson Reuters
Governance Pillar Score	The corporate governance pillar measures a company's systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders.	Thomson Reuters

Table A.2: Variables retrieved on WRDS

Variable	Description	Source
Return on Assets	This value is calculated as the Income After Taxes for the fiscal period divided by the Average Total Assets.	WRDS
Return on Equity	This value is calculated as the Income After Taxes for the fiscal period divided by the Average Total Equity.	WRDS
Book-to-Market	This value is calculated as the Common Shareholder Equity divided by the Current Market Capitalisation.	WRDS
MKTRF (or Rm-Rf)	Excess return on the market. It is calculated as the value-weight return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates).	WRDS
SMB (Small Minus Big)	The average return on the nine small portfolios minus the average return on the nine big portfolios.	WRDS
HML (High Minus Low)	The average return on the two value portfolios (that is, with high BE/ME ratios) minus the average return on the two growth portfolios (low BE/ME ratios).	WRDS
HML (High Minus Low)	The average return on the two value portfolios (that is, with high BE/ME ratios) minus the average return on the two growth portfolios (low BE/ME ratios).	WRDS
RMW (Robust Minus Weak)	The average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios.	WRDS
CMA (Conservative Minus Aggressive)	The average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios.	WRDS
UMD (Momentum)	The average return on the two high prior return portfolios minus the average return on the two low prior return portfolios.	WRDS

B. Supplementary Results

Table B.1: Regression between Fama French 5 Factors + ESG global score and ROA

Variable	Coefficient	Std Err	t-stat	p-value
α	0.1602	0.002	70.935	0.000
$R_m - R_f$	-0.0001	0.000	-1.240	0.215
SMB	-0.0694	0.021	-3.370	0.001
HML	0.0108	0.018	0.610	0.542
RMW	-0.0598	0.025	-2.423	0.015
CMA	0.0181	0.027	0.658	0.511
ESG_{global}	-0.0004	4.42e-05	-8.588	0.000

Table B.2: Regression between Fama French 5 Factors + ESG global score and ROE

Variable	Coefficient	Std Err	t-stat	p-value
α	0.0445	0.018	2.443	0.015
$R_m - R_f$	-0.0014	0.001	-1.545	0.122
SMB	-0.0399	0.166	-0.240	0.810
HML	-0.0073	0.142	-0.052	0.959
RMW	0.1653	0.199	0.831	0.406
CMA	-0.0017	0.221	-0.007	0.994
ESG_{global}	0.0037	0.000	10.313	0.000

Table B.3: Models Portfolio Value-Weighted Excess Stock Returns Summary, sorted on ESG Scores

Model	Coefficient	1	2	3	4	4-1
Excess Return	α	0.8474	0.7162	0.6732	0.3864	-0.4609
		(3.0094)	(2.1360)	(2.2604)	(1.5594)	(-4.1623)
CAPM	α	-0.1923	-0.3506	-0.3890	-0.6039	-0.4116
		(-2.7056)	(-3.8006)	(-3.2807)	(-6.7567)	(-3.7678)
	βmkt	0.9645	0.9896	0.9854	0.9187	-0.0458
		(45.7827)	(28.8142)	(28.8491)	(54.2678)	(-1.6286)
FF3	α	-0.2083	-0.3735	-0.4390	-0.6475	-0.4392
		(-3.1975)	(-3.8452)	(-4.3348)	(-9.3516)	(-4.1628)
	βmkt	0.9776	1.0094	1.0279	0.9549	-0.0227
		(45.8072)	(28.2444)	(47.1412)	(53.1989)	(-0.7518)
	βsmb	-7.6640	-9.2289	-21.4216	-20.2921	-12.6280
		(-2.2129)	(-1.8647)	(-5.2652)	(-6.5782)	(-2.2248)
	βhml	5.8149	-8.7246	-6.9285	9.4842	3.6693
		(1.2015)	(-2.1368)	(-1.9244)	(3.3275)	(0.6074)
FF5	α	-0.1936	-0.3806	-0.4337	-0.6972	-0.5036
		(-2.9264)	(-4.0801)	(-4.3100)	(-10.9908)	(-4.8378)
	βmkt	0.9708	0.9974	1.0091	0.9658	-0.0050
		(37.6287)	(27.3597)	(45.2212)	(49.5974)	(-0.1277)
	βsmb	-8.1972	-5.0967	-17.4731	-15.4457	-7.2485
		(-2.0498)	(-0.9104)	(-3.4164)	(-4.5903)	(-1.1250)
	βhml	8.4654	-9.5714	-5.5177	0.8583	-7.6071
		(1.5855)	(-1.9241)	(-1.3146)	(0.2578)	(-1.1078)
	βrmw	0.3496	10.9583	12.0119	7.5556	7.2061
		(0.0618)	(1.5164)	(2.3173)	(1.8704)	(0.8649)
	βcma	-6.2809	-2.0480	-7.6744	17.2565	23.5374
		(-0.5904)	(-0.2187)	(-1.2411)	(4.0118)	(1.9384)
FFC	α	-0.2264	-0.3706	-0.4422	-0.6332	-0.4068
		(-3.2772)	(-3.3968)	(-4.2597)	(-9.9206)	(-3.9620)
	βmkt	0.9894	1.0076	1.0300	0.9455	-0.0439
		(41.0846)	(31.1540)	(52.1671)	(47.1998)	(-1.3174)
	βsmb	-6.5974	-9.3971	-21.2335	-21.1310	-14.5336
		(-1.7909)	(-1.7292)	(-5.7824)	(-6.5285)	(-2.3299)
	βhml	6.9134	-8.8979	-6.7347	8.6202	1.7069
		(1.4564)	(-2.3596)	(-1.5389)	(2.6967)	(0.3027)
	βmom	3.7903	-0.5979	0.6687	-2.9812	-6.7715
		(0.7830)	(-0.1089)	(0.1419)	(-1.3034)	(-1.3064)

Table B.4: Models Portfolio Equally-Weighted Excess Stock Returns Summary, sorted on ESG Scores

Model	Coefficient	1	2	3	4	4-1
Excess Return	α	0.6843	0.4652	0.4476	0.2710	-0.4133
		(2.2040)	(1.4915)	(1.5058)	(0.9145)	(-3.6616)
CAPM	α	-0.4180	-0.6191	-0.6226	-0.8012	-0.3833
		(-4.1488)	(-4.7484)	(-4.6802)	(-5.9273)	(-3.4799)
	βmkt	1.0226	1.0059	0.9928	0.9947	-0.0279
		(26.5704)	(27.4728)	(32.7652)	(32.0981)	(-1.1335)
FF3	α	-0.3833	-0.5998	-0.6144	-0.7976	-0.4143
		(-4.4161)	(-6.6720)	(-7.2035)	(-10.3099)	(-4.6510)
	βmkt	0.9932	0.9887	0.9848	0.9901	-0.0031
		(31.5410)	(43.0648)	(56.5900)	(58.8991)	(-0.1006)
	βsmb	15.1328	7.1184	1.8147	-0.7908	-15.9236
		(3.3530)	(2.0805)	(0.5472)	(-0.2798)	(-4.3182)
	βhml	2.2067	14.0145	17.9136	23.4245	21.2178
		(0.4440)	(3.5510)	(5.2272)	(8.2404)	(5.4865)
FF5	α	-0.3588	-0.6117	-0.6415	-0.8294	-0.4706
		(-4.2543)	(-7.3515)	(-8.2404)	(-11.7809)	(-5.0196)
	βmkt	0.9699	0.9806	0.9785	0.9889	0.0190
		(34.0927)	(58.7435)	(54.6457)	(53.9762)	(0.5790)
	βsmb	17.2561	10.9950	7.5641	4.3991	-12.8571
		(3.7880)	(3.2643)	(2.0006)	(1.6224)	(-3.0630)
	βhml	6.9713	12.2512	13.5444	18.1236	11.1523
		(1.2491)	(1.9940)	(2.5844)	(3.9056)	(3.5871)
	βrmw	9.2393	9.6080	13.0327	10.8227	1.5834
		(1.6062)	(1.5645)	(2.5527)	(2.2405)	(0.2853)
	βcma	-14.4444	0.5742	5.3690	8.3415	22.7859
		(-1.3925)	(0.0642)	(0.7182)	(1.4232)	(3.4724)
FFC	α	-0.3665	-0.5866	-0.5982	-0.7694	-0.4029
		(-4.1505)	(-6.3212)	(-6.6422)	(-10.7449)	(-4.4659)
	βmkt	0.9823	0.9801	0.9742	0.9718	-0.0105
		(27.7459)	(39.7831)	(52.7571)	(50.3699)	(-0.3357)
	βsmb	14.1486	6.3415	0.8627	-2.4438	-16.5924
		(3.0062)	(1.6475)	(0.2329)	(-1.0273)	(-4.2741)
	βhml	1.1931	13.2143	16.9331	21.7222	20.5291
		(0.2292)	(3.4871)	(4.8856)	(6.9099)	(5.0975)
	βmom	-3.4973	-2.7610	-3.3829	-5.8740	-2.3766
		(-0.8528)	(-0.7074)	(-0.9590)	(-1.8746)	(-0.8267)

Table B.5: Regression between Fama French 5 Factors + Social score and stock returns

Variable	**Coefficient**	**Std Err**	**t-stat**	**p-value**
α	2.7111	0.478	5.673	0.000
$R_m - R_f$	0.9806	0.008	120.338	0.000
SMB	9.1946	1.523	6.039	0.000
HML	12.9537	1.306	9.920	0.000
RMW	8.2337	1.825	4.512	0.000
CMA	1.8036	2.029	0.889	0.374
Environmetal Score	-0.0421	0.009	-4.919	0.000

Table B.6: Regression between Fama French 5 Factors + Governance score and stock returns

Variable	**Coefficient**	**Std Err**	**t-stat**	**p-value**
α	0.7552	0.147	5.128	0.000
$R_m - R_f$	0.9813	0.008	120.446	0.000
SMB	9.0176	1.522	5.924	0.000
HML	13.0197	1.306	9.969	0.000
RMW	7.8542	1.823	4.309	0.000
CMA	1.5325	2.028	0.756	0.450
Environmetal Score	-0.0077	0.003	-2.714	0.007

Table B.7: Regression coefficients for every pillar score in the FF5 regression (ROA/ROE)

Variable	**Coefficient**	**Std Err**	**t-stat**	**p-value**
Environmetal Score ROE	0.0021	0.000	8.654	0.000
Social Score ROE	0.0054	0.001	5.823	0.000
Governance Score ROE	0.0010	0.000	3.185	0.001
Environmetal Score ROA	-0.0006	3.03e-05	-18.426	0.000
Social Score ROA	9.931e-05	0.000	0.857	0.392
Governance Score ROA	-0.0006	3.83e-05	-15.084	0.000

Table B.8: Regressions for 10 different industries

Industry	α	$R_m - R_f$	SMB	HML	RMW	CMA	$ESG\ Score$
Software and IT Services	1.0468	1.0524	-13.4635	-9.7107	-17.4097	-26.6939	-0.0091
$mean = 52.25$	(3.444)	(39.246)	(-2.687)	(-2.271)	(-2.887)	(-4.024)	(-1.627)
Healthcare Equipment and Supplies	1.2123	0.9537	12.4463	-36.9840	-0.7170	18.8446	-0.0121
$mean = 54.16$	(3.585)	(32.629)	(2.286)	(-7.906)	(-0.109)	(2.596)	(-2.072)
Residential and Commercial REITs	1.6351	1.2152	57.0068	-29.7722	-23.0703	53.5945	-0.0183
$mean = 56.14$	(0.651)	(7.483)	(1.755)	(-1.154)	(-0.619)	(1.381)	(-0.420)
Machinery, Tools etc.	0.4514	1.0573	26.2581	17.5846	29.6514	-18.0376	-0.0049
$mean = 52.63$	(1.190)	(37.600)	(5.003)	(3.913)	(4.696)	(-2.582)	(-0.660)
Electric Utilities and IPPs	0.6140	0.5504	-31.9868	-3.9960	25.5505	29.7382	-0.0071
$mean = 61.92$	(0.948)	(17.486)	(-5.420)	(-0.790)	(3.616)	(3.795)	(-0.717)
Investment Banking and Investment Services	1.4828	1.1187	2.9412	45.0419	-25.4403	-47.2173	-0.0162
$mean = 56.51$	(3.277)	(35.636)	(0.501)	(9.015)	(-3.624)	(-6.088)	(-2.120)
Insurance	0.2920	0.8711	-8.6630	41.5574	-11.3578	2.5835	0.0034
$mean = 50.35$	(0.640)	(30.488)	(-1.618)	(9.070)	(-1.786)	(0.364)	(0.402)
Semiconductors and Semiconductor Equipment	1.0290	1.2687	20.8103	4.3113	17.6571	-37.2032	-0.0057
$mean = 61.28$	(1.510)	(27.880)	(2.437)	(0.591)	(1.731)	(-3.285)	(-0.535)
Banking Services	0.4484	1.0203	17.6364	127.0419	-42.0050	-87.9968	-0.0005
$mean = 59.49$	(1.130)	(42.188)	(3.871)	(32.678)	(-7.734)	(-14.603)	(-0.079)
Food and Tobacco	0.6750	0.6295	-14.2595	-14.7269	39.6087	71.3250	-0.0082
$mean = 71.55$	(0.827)	(19.028)	(-2.312)	(-2.776)	(5.340)	(8.621)	(-0.721)

Table B.9: Portfolios alphas and t-statistics for 10 industries, sorted on ESG scores, equally weighted

Industry	Excess Return	1	2	3	4	4-1
Software & IT Services	Excess Return	2.1017	1.5617	1.5144	1.5954	-0.5063
$n = 40$		(5.3802)	(4.5778)	(4.7041)	(5.5949)	(-1.9936)
	FF5	1.0943	0.4777	0.4197	0.4557	-0.6386
		(4.7933)	(3.4024)	(2.5896)	(2.2798)	(-2.8611)
Healthcare Equipment & Supplies	Excess Return	1.8972	1.3245	1.7926	1.4277	-0.4694
$n = 32$		(4.0466)	(3.6037)	(4.7466)	(4.6449)	(-1.7549)
	FF5	0.8455	0.2843	0.7249	0.3914	-0.4541
		(3.2852)	(1.2265)	(3.6584)	(2.5079)	(-1.7573)
Residential & Commercial REITs	Excess Return	1.4214	1.0448	1.0299	0.9004	-0.5210
$n = 32$		(3.3348)	(2.9428)	(2.7697)	(2.1568)	(-1.5740)
	FF5	0.6234	0.1260	0.0459	-0.1701	-0.7935
		(2.0255)	(0.3776)	(0.1315)	(-0.5398)	(-2.9472)
Machinery, Tools, etc.	Excess Return	1.5621	1.2926	1.4135	1.3144	-0.4330
$n = 26$		(3.8159)	(3.1955)	(3.4688)	(2.8041)	(-2.1937)
	FF5	0.5251	-0.0124	0.2497	0.0921	-0.4049
		(2.7384)	(-0.0618)	(1.2428)	(0.3672)	(-3.6673)
Electric Utilities & IPPs	Excess Return	1.0409	0.9198	0.9612	0.8244	-0.2164
$n = 24$		(3.7085)	(3.1868)	(3.9029)	(3.0479)	(-0.7880)
	FF5	0.1113	0.1759	0.3761	0.1109	-0.0004
		(0.5065)	(0.5792)	(1.3741)	(0.4127)	(-0.0017)
Investment Banking	Excess Return	2.1783	1.4090	1.5199	1.5139	-0.6644
$n = 24$		(4.9057)	(2.8308)	(3.2576)	(2.7968)	(-1.7092)
	FF5	1.2875	0.2759	0.2809	0.3479	-0.9396
		(4.4862)	(1.3867)	(1.4669)	(1.3694)	(-2.4982)
Insurance	Excess Return	1.3397	1.4732	1.4798	1.3505	0.0109
$n = 23$		(5.0532)	(4.6073)	(3.8230)	(3.1633)	(0.0458)
	FF5	0.5693	0.6124	0.5474	0.4018	-0.1675
		(3.2333)	(2.8460)	(2.5213)	(1.7479)	(-0.8541)
Semiconductors	Excess Return	2.3351	2.1835	1.9265	2.2523	-0.0828
$n = 19$		(3.5349)	(3.7329)	(2.8688)	(4.1967)	(-0.1941)
	FF5	1.1134	0.8017	0.4589	0.8517	-0.2617
		(2.5845)	(2.0659)	(0.8095)	(2.4214)	(-0.6359)
Banking Services	Excess Return	1.4804	1.2262	1.3464	1.4451	-0.0354
$n = 18$		(2.7590)	(2.1761)	(2.0787)	(2.4531)	(-0.1469)
	FF5	0.6341	0.3661	0.4347	0.4775	-0.1566
		(2.6628)	(1.5162)	(1.8376)	(2.4150)	(-0.6337)
Food & Tobacco	Excess Return	1.1070	0.9181	1.1180	0.9184	-0.1886
$n = 17$		(3.3038)	(3.2951)	(4.4056)	(3.3525)	(-0.6458)
	FF5	0.2852	0.0419	0.1873	0.0233	-0.2619
		(0.9952)	(0.1683)	(0.9536)	(0.0855)	(-0.7731)

Table B.10: Portfolios alphas and t-statistics for 10 industries, sorted on ESG scores, market cap weighted

Industry	Excess Return	1	2	3	4	4-1
Software & IT Services	Excess Return	2.4221	1.6999	1.6289	1.7089	-0.7132
$n = 40$		(4.3842)	(4.9611)	(4.9219)	(4.5279)	(-1.5699)
	FF5	1.4540	0.6327	0.5172	0.6538	-0.8003
		(4.3332)	(3.2381)	(2.5074)	(3.0245)	(-2.2345)
Healthcare Equipment & Supplies	Excess Return	2.1266	1.3989	1.8860	1.4020	-0.7246
$n = 32$		(4.1467)	(3.9111)	(5.3334)	(5.0363)	(-2.1425)
	FF5	0.9801	0.4114	0.8530	0.3740	-0.6061
		(3.3556)	(1.9467)	(4.3624)	(2.0117)	(-1.8369)
Residential & Commercial REITs	Excess Return	1.6359	1.4749	0.9936	0.8513	-0.7847
$n = 32$		(2.5918)	(4.1010)	(2.8784)	(2.1873)	(-1.6041)
	FF5	0.6779	0.4152	0.1396	-0.1041	-0.7821
		(1.5311)	(1.5341)	(0.4131)	(-0.3345)	(-1.8468)
Machinery, Tools, etc.	Excess Return	1.6813	1.3047	1.5758	1.3735	-0.3078
$n = 26$		(3.8307)	(3.1289)	(3.6949)	(2.8530)	(-0.7958)
	FF5	0.6100	-0.0485	0.4253	0.0637	-0.5463
		(2.7278)	(-0.2081)	(1.9163)	(0.2279)	(-1.9986)
Electric Utilities & IPPs	Excess Return	1.4993	1.5829	1.4921	1.3602	-0.1391
$n = 24$		(5.6096)	(5.2061)	(3.4710)	(3.0408)	(-0.4395)
	FF5	0.6985	0.6770	0.5001	0.3766	-0.3219
		(3.1927)	(2.9718)	(2.1697)	(1.5679)	(-1.3421)
Investment Banking	Excess Return	2.4221	1.6999	1.6289	1.7089	-0.7132
$n = 24$		(4.3842)	(4.9611)	(4.9219)	(4.5279)	(-1.5699)
	FF5	1.4540	0.6327	0.5172	0.6538	-0.8003
		(4.3332)	(3.2381)	(2.5074)	(3.0245)	(-2.2345)
Insurance	Excess Return	1.4993	1.5829	1.4921	1.3602	-0.1391
$n = 23$		(5.6096)	(5.2061)	(3.4710)	(3.0408)	(-0.4395)
	FF5	0.6985	0.6770	0.5001	0.3766	-0.3219
		(3.1927)	(2.9718)	(2.1697)	(1.5679)	(-1.3421)
Semiconductors	Excess Return	2.1266	1.3989	1.8860	1.4020	-0.7246
$n = 19$		(4.1467)	(3.9111)	(5.3334)	(5.0363)	(-2.1425)
	FF5	0.9801	0.4114	0.8530	0.3740	-0.6061
		(3.3556)	(1.9467)	(4.3624)	(2.0117)	(-1.8369)
Banking Services	Excess Return	1.6359	1.4749	0.9936	0.8513	-0.7847
$n = 18$		(2.5918)	(4.1010)	(2.8784)	(2.1873)	(-1.6041)
	FF5	0.6779	0.4152	0.1396	-0.1041	-0.7821
		(1.5311)	(1.5341)	(0.4131)	(-0.3345)	(-1.8468)
Food & Tobacco	Excess Return	1.6813	1.3047	1.5758	1.3735	-0.3078
$n = 17$		(3.8307)	(3.1289)	(3.6949)	(2.8530)	(-0.7958)
	FF5	0.6100	-0.0485	0.4253	0.0637	-0.5463
		(2.7278)	(-0.2081)	(1.9163)	(0.2279)	(-1.9986)

Table B.11: Regression between ESG Scores, FF5 and stock returns for 2020, pre- and post-COVID

	pre-COVID			2020			post-COVID		
	Coefficient	Std	t-stat	Coefficient	Std	t-stat	Coefficient	Std	t-stat
α	1.1236	0.172	6.541	2.8504	0.897	3.177	1.3587	0.468	2.902
$R_m - R_f$	0.9906	0.011	86.280	1.0649	0.032	33.242	0.9724	0.013	72.926
SMB	7.3027	1.793	4.072	3.1639	7.310	0.433	8.6652	3.003	2.885
HML	-1.6040	1.942	-0.826	17.8942	6.200	2.886	20.2446	2.118	9.560
RMW	0.2778	2.763	0.101	-43.0126	10.637	-4.044	8.8839	3.049	2.914
CMA	3.0265	3.179	0.952	-37.3047	10.308	-3.619	0.5751	3.105	0.185
$ESG\ Score$	-0.0163	0.003	-4.694	-0.0564	0.016	-3.471	-0.0189	0.009	-2.208

Table B.12: Regression between ESG Scores, FF5 and ROA for 2020, pre and post COVID

	pre-COVID			2020			post-COVID		
	Coefficient	Std	t-stat	Coefficient	Std	t-stat	Coefficient	Std	t-stat
α	0.1640	0.003	51.011	0.0880	0.008	11.165	0.1081	0.007	16.133
$R_m - R_f$	0.0003	0.000	1.518	0.0008	0.000	2.987	0.0023	0.000	11.945
SMB	0.1219	0.034	3.632	0.4840	0.064	7.539	-0.0371	0.043	-0.865
HML	0.4942	0.036	13.596	0.2333	0.054	4.284	0.4551	0.030	15.021
RMW	-0.2235	0.052	-4.323	1.0314	0.093	11.040	-0.0690	0.044	-1.581
CMA	-0.2989	0.060	-5.023	0.6066	0.091	6.700	-0.6950	0.044	-15.645
$ESG\ Score$	-0.0016	6.48e-05	-24.214	0.0002	0.000	1.359	-0.0004	0.000	-3.541

Table B.13: Regression between ESG Scores, FF5 and ROE for 2020, pre and post COVID

	pre-COVID			2020			post-COVID		
	Coefficient	Std	t-stat	Coefficient	Std	t-stat	Coefficient	Std	t-stat
α	0.088	0.020	4.381	-0.070	0.051	-1.367	-0.046	0.045	-1.014
$R_m - R_f$	0.0003	0.001	0.249	0.003	0.002	1.743	0.0007	0.001	0.530
SMB	-0.1005	0.211	-0.475	-0.0547	0.419	-0.130	-0.0704	0.289	-0.243
HML	0.4127	0.229	1.802	0.3865	0.356	1.087	0.5458	0.204	2.673
RMW	-0.4366	0.326	-1.340	0.0261	0.610	0.043	0.0336	0.294	0.114
CMA	-0.2150	0.375	-0.574	-0.2542	0.591	-0.430	-1.0689	0.299	-3.571
$ESG\ Score$	0.0013	0.000	3.283	0.0051	0.001	5.511	0.0050	0.001	6.042

Table B.14: Alphas and t-statistics sorted on ESG score, for ROA, value weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	14.764	16.165	1.401	14.252	17.618	3.365	13.984	19.612	5.627
	(27.470)	(31.420)	(2.687)	(52.058)	(150.680)	(8.628)	(25.581)	(31.987)	(8.388)
β	0.021	0.0725	0.051	-0.046	-0.0144	0.031	-0.023	-0.073	-0.050
	(0.312)	(1.346)	(0.884)	(-1.973)	(-2.206)	(1.090)	(-0.513)	(-1.427)	(-2.401)

Table B.15: Alphas and t-statistics sorted on ESG score, for ROE, value weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	18.991	29.784	10.788	19.918	39.220	19.306	23.324	57.001	33.68
	(9.336)	(12.457)	(3.126)	(104.950)	(93.511)	(35.833)	(25.141)	(11.913)	(7.809)
β	-0.187	0.211	0.398	-0.130	0.138	0.269	-0.042	-0.551	-0.508
	(-1.853)	(0.767)	(1.416)	(-6.185)	(1.462)	(2.354)	(-0.437)	(-1.404)	(-1.600)

Table B.16: Alphas and t-statistics sorted on ESG score, for ROA, equally weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	14.802	14.080	-0.722	12.234	13.013	0.779	14.303	13.734	-0.569
	(31.360)	(61.507)	(-2.281)	(55.966)	(208.245)	(4.909)	(27.989)	(83.938)	(-1.539)
β	0.051	0.030	-0.020	0.0138	0.0193	0.005	-0.058	-0.021	0.037
	(1.385)	(1.218)	(-0.996)	(0.896)	(3.519)	(0.384)	(-1.378)	(-1.303)	(1.362)

Table B.17: Alphas and t-statistics sorted on ESG score, for ROE, equally weighted

	pre-COVID			2020			post-COVID		
	1	4	4-1	1	4	4-1	1	4	4-1
α	18.767	23.819	5.051	18.663	28.781	10.118	22.397	35.010	12.613
	(7.063)	(9.419)	(1.376)	(54.394)	(30.976)	(11.365)	(16.297)	(13.899)	(9.651)
β	-0.174	0.136	0.310	0.0006	0.672	0.671	-0.131	-0.323	–0.192
	(-1.222)	(0.517)	(1.078)	(0.026)	(1.938)	(1.918)	(-1.424)	(-1.185)	(-0.902)

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