Enhancing Portfolio Returns: an Analysis of Responsible Screening Strategies in Australian Financial Markets

Faculty of Behavioural Management and Social Sciences (BMS)

MSc Business Administration (BA) – Financial Management (FM)

First supervisor: Dr. X. Huang

Second supervisor: Dr. L. Shen

Key words: Responsible investing, ESG, Screening, Portfolios

NOVEMBER 20, 2024

S.J PRINSEN
S2607336

Abstract

This study investigates whether responsible investment screening strategies can deliver positive abnormal returns, while identifying the factors that drive such outperformance. Focusing on the Australian financial market, a market frequently overshadowed by studies on larger markets such as the U.S., Europe, and China, thereby addressing a significant gap in the responsible investing literature. Three portfolios were constructed based on Positive, Negative, and Ethical screening methods with thresholds derived from Environmental, Social, and Governance (ESG) data. The portfolios were evaluated through regression analyses using the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model to assess abnormal returns, with additional comparisons made between the strategies using difference portfolios. The findings reveal that both Positive and Negative screening strategies generate significant positive abnormal returns, challenging established views in the literature. Although the Ethical screened portfolio does not exhibit significant abnormal returns, it achieves the highest compounded returns and second highest Sharpe ratio, suggesting its potential for stable, high-performing investments. These results demonstrate that ESG screening strategies not only enhance portfolio performance but also align financial returns with ethical principles, thereby appealing to socially conscious investors. By offering a practical framework for investors and fund managers to integrate ESG considerations, this research bridges the gap between financial objectives and sustainability imperatives. Additionally, it contributes to the theoretical discourse on ESG integration, providing a foundation for further exploration of responsible investing strategies in diverse market contexts.

Table of Contents

1. Introduction

1.1 Background

Recognizing the importance to address Environmental, Social, and Governance (ESG) issues, numerous companies have embraced the significance of ESG considerations within their corporate social responsibility initiatives. This shift has not only demonstrated a heightened corporate awareness but has also catalysed a corresponding response from investors. Investors are now rethinking their investment approaches, aligning with the principles of responsible and sustainable investing, both grounded in ESG criteria(Talan et al., 2024). This evolution signifies a collective acknowledgment within the business and investment spheres that financial decisions can, and should, be informed by a broader commitment to environmental sustainability, social equity, and ethical governance.

According to the Global Sustainable Investment Alliance (GSIA)[1]**,** the worldwide "sustainable investment" market grew from $13.3 trillion at the start of 2012 to $30.3 trillion at the start of 2022. They also present the proportions of sustainable investing assets relative to total managed assets per region dating from 2014 to 2022 (Figure 1). However, the growth of sustainable investments has not kept pace with the broader market. In Europe, this trend has been evident over the long term, with the percentage of assets classified as sustainable declining by approximately 5% annually. This decline may be partly due to increasing regulatory requirements for more detailed disclosures, along with a shift towards more risk-averse reporting practices, as the industry matures and the definitions and approaches to sustainable investing evolve. A similar pattern is also observed in the Canadian and U.S. markets, where the reported assets in sustainable investing saw a decline between 2020 and 2022, likely driven by more conservative reporting practices.

REGION	2014	2016	2018	2020	2022
Europe	59%	53%	49%	42%	38%
United States	18%	22%	26%	33%	13%
Canada	31%	38%	51%	62%	47%
Australia & New Zealand	17%	51%	63%	38%	43%
Japan		3%	18%	24%	34%

Figure 1: Proportion of sustainable investing assets relative to total managed assets 2014-2022
This figure illustrates the percentage of total managed assets allocated to sustainable investments across different regions over time. The data reflects regional variations and shifts in sustainable investment practices.

Over the past two decades, Australia has witnessed a notable surge in responsible investing, reflecting a growing awareness and commitment to sustainability principles within the investment landscape. Responsible investment assets under management crossed the one trillion mark, reaching 1.3 trillion AUD (or 40%) of total managed funds in 2020, and 1.5 trillion AUD (or 43%) in 2021, compared to just 983 billion AUD in 2019 (GSIA Report 2022)[1].

The introduction of Recommendation 7.4 of the ASX Corporate Governance Council's Corporate Governance Principles and Recommendations contributed to this surge as the ESG reporting improved considerably over the past years (Figure 2). The recommendation entails that listed entities should disclose whether they have any

[1] GSIA Report 2022

material exposure to economic, environmental, and social sustainability risks – and, if so, how they manage or intend to manage those risks[2].

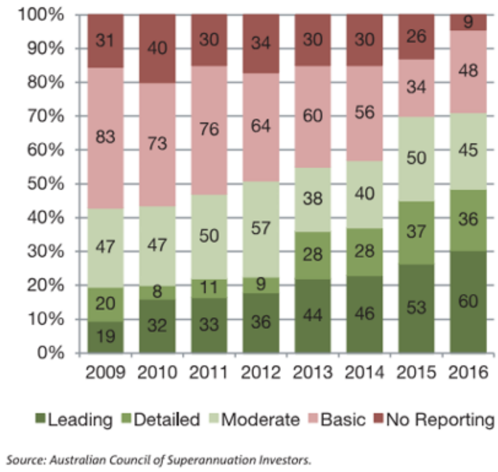


Figure 2: Quality of ASX200 ESG reporting levels, 2009-2016
This figure illustrates the progression of Environmental, Social, and Governance (ESG) reporting quality among companies in the ASX200 index from 2009 to 2016. The data is categorized into six reporting levels: No Reporting, Basic, Moderate, Detailed, and Leading, with scores ranging from 0% to 100%. The chart tracks how the percentage of companies at each reporting level evolved over the eight-year period, providing insight into the increasing emphasis on comprehensive ESG disclosures within Australia's largest publicly listed companies.

With an increasing focus in ESG factors, investors and financial institutions demonstrate a heightened interest in aligning their portfolios with ethical and sustainable practices. The rise of responsible investing in Australia is evident in the proliferation of investment products tailored to ESG criteria, as well as the integration of sustainable considerations into the decision-making processes of institutional investors.

Regulatory bodies and industry associations such as the Responsible Investment Association Australasia (RIAA) [3] have played a pivotal role in promoting responsible investing in Australia, contributing to the establishment of guidelines and standards that encourage transparency and accountability. The Responsible Investment Association Australasia's (RIAA) mission is "to promote, advocate for, and support approaches to responsible investment that align capital with achieving a healthy and sustainable society, environment and economy"[4]. According to the report from the RIAA responsible investment constituted $633.2 billion of assets under management in Australia as of 31 December 2015[3]. As environmental concerns, social impact, and ethical governance continue to gain prominence, the degree of responsible investing in Australia is poised for further growth, marking a pivotal shift toward more conscientious and sustainable financial practices.

[2] Martin Foo's Review of Socially Responsible Investing (May 2027)
[3] [Responsible Investment Association Australasia]
[4] GSIA Report 2022

1.2 Research Problem

While numerous research papers globally explore the correlation between returns and sustainability factors, there is a limited body of literature specifically addressing this relationship within the context of Australia (Giese et al., 2019; Kempf & Osthoff, 2007). Humphrey & Lee (2011) investigate the performance of Socially Responsible Investment (SRI) equity funds in the Australian market, providing valuable insights into a relatively underexplored area. The findings indicate that there is no significant difference in returns between SRI funds and conventional funds. Additionally, the study examines the impact of screening intensity on fund performance and risk. While the intensity of screening does not significantly affect total returns, there is weak evidence suggesting that more stringent screening may lead to improved risk-adjusted performance. However, the research also identifies a curvilinear relationship, where excessive screening can result in under-diversification, thereby potentially increasing idiosyncratic risk. Additionally, Jones et al. (2008) examine the financial performance of socially responsible investment (SRI) funds in Australia over a decade, highlighting the growth of the SRI fund management industry in the country. It addresses the challenges in assessing SRI fund performance, emphasizing that factors such as fund size and age can influence results, potentially overshadowing the impact of the SRI stance itself. Overall, these papers enhance the understanding of SRI fund performance in Australia, shedding light on the complexities of integrating ethical considerations into investment strategies within the Australian financial market. Given the pronounced significance of responsible and sustainable investing in the Australian financial markets, this study aims to delve more profoundly into the impact that the incorporation of sustainable investing exerts on portfolio performance, with a specific focus on the return on investment. The overarching research question for this research is: To what extent do screening strategies in investment portfolios contribute to higher abnormal returns in the Australian financial markets?

This study contributes to the literature in two ways. First, many papers in the literature use the financial markets in Europe, China, and the US as samples when analysing responsible investing(Auer, 2016; Lee et al., 2010; Zhang et al., 2022). This focus is understandable, given that these are the largest and most influential financial markets. However, with responsible investments in the Australian financial markets growing significantly, it is valuable to extend research to this expanding market. This study provides empirical evidence on the returns of responsible investment strategies within the emerging financial markets in Australia, thereby contributing to the literature by addressing this important and underexplored area.

Moreover, there is a notable gap in the literature regarding direct comparative analyses of screening techniques, when researching the effectiveness of these approaches in generating returns. While existing studies often examine the returns of portfolios after applying individual screening techniques such as negative screening or positive screening, thereby evaluating the performance of specific approaches, they do not directly compare multiple screening methods against one another (Auer, 2016; Trinks & Scholtens, 2017). This study addresses this gap by systematically comparing the performance of different screening strategies to identify which approach yields the highest abnormal returns.

The rest of the thesis is structured as follows: the literature review provides a comprehensive review of the relevant literature on the impact of responsible investing on portfolio performance, with a focus on the debate between screening strategies. The following part outlines the methodology employed in this study, detailing aspects such as data collection, variable selection, portfolio construction and statistical analysis. Then comes the empirical findings, offering a comparative analysis of investment returns between several screened portfolios. The following section discusses the implications of the findings, along with identification of study limitations and recommendations for future research directions. Finally, the last section concludes the thesis by summarizing key findings and reaffirming the significance of the research contributions.

2. Literature review

This section contains multiple key concepts and definitions, presents a theoretical framework that will be used as the foundation for this research. Moreover, themes and patterns will be analysed, the methodological approaches will be addressed and compared.

2.1 Responsible Investing: Concepts and Theoretical Frameworks

As mentioned in the introduction, investors today not only look at financial performance but also to sustainable factors known as ESG factors. There is much literature on this topic and thus also many different names of this new type of investing. The most popular are sustainable investing, responsible investing and ESG investing. This study focuses mainly on the term responsible investing. Papers describing this term of investing are all written slightly different; however, a common definition can be drawn: an investment approach aimed at achieving financial objectives while deliberately considering and addressing environmental, social, and governance (ESG) impacts(Do, 2021; Tripathi & Kaur, 2020). It involves making investment decisions that not only seek to yield high returns but also consider social, ethical, and environmental concerns. Socially Responsible Investments (SRIs) encompass an investment process that integrates social, environmental, and ethical considerations into the decision-making process, reflecting a commitment to align financial goals with responsible and sustainable practices (Morelli, 2023). This shift in investment decision making has shed light on new investment strategies and new types of investors. Do (2021) discussed a trading strategy centred on socially responsible ratings: purchasing stocks with favourable socially responsible ratings and sell stocks with low socially responsible ratings. The research of Tzouvanas & Mamatzakis (2021), illustrated in Figure 3 shows the return and risk of environmental against non-environmental stocks over the sample period, revealing that environmental stocks apparently exceed non-environmental stocks both in return and risk.

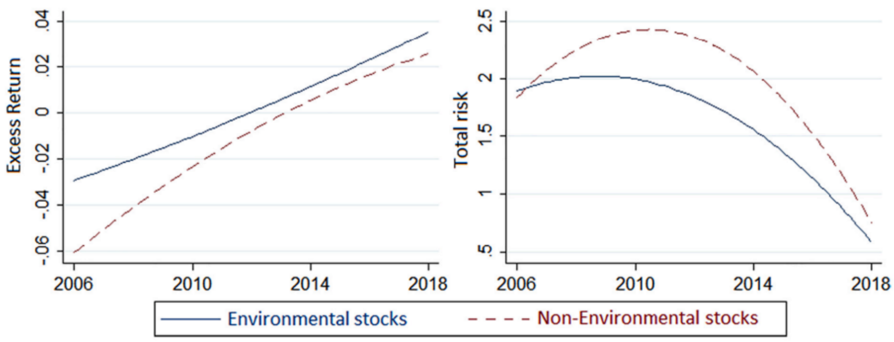


Figure 3: Excess return and Total risk for Environmental and Non-Environmental stocks.
This figure compares the excess return and total risk of Environmental and Non-Environmental stocks from 2006 to 2018. Excess return is calculated as the return above the risk-free rate, while total risk is measured by the standard deviation of stock returns. The chart highlights the performance and volatility differences between these two groups of stocks over the 13-year period, providing insights into the financial characteristics and market behaviour of environmentally-focused versus non-environmentally focused companies.

Furthermore, recent literature provides information on the creation of new types of investors as opposed to traditional investors. According to Díaz et al. (2024) the main difference between socially responsible investors and traditional investors is that SRI investors are willing to accept lower expected returns from companies that align with these preferences, resulting in a lower cost of capital. Nonetheless, there still must be accounted for the risk preferences of the investor. As risk adverse investors are less likely to accept lower expected returns than more risky investors. The examination of investor preferences is grounded in the concept of an observable trade-off between risk and return. Investors either seek to minimize risk while achieving a specific level of anticipated return, or endeavour to maximize expected returns while maintaining a predetermined level of risk (Rodríguez et al., 2021). More specifically Pedersen et al. (2021) consider three types of investors: ESG-unaware, ESG-aware, and ESG-motivated investors. The relationship between expected excess return with ESG score for these different types of investors is illustrated in Figure 4.

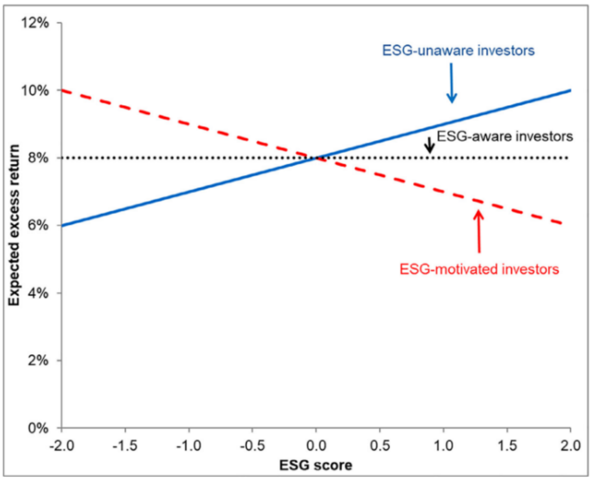


Figure 4: Relationship expected excess return with ESG score for different types of investors.
This figure illustrates the relationship between expected excess return and ESG score, differentiated by three types of investors: ESG-unaware (blue line), ESG-aware (black dotted line), and ESG-motivated (red dotted line). The chart shows how the expected excess return varies with ESG scores across these investor categories, highlighting differing levels of responsiveness to ESG factors

First, ESG-unaware investors are characterized by their lack of awareness regarding ESG scores, as they primarily strive to maximize their unconditional returns without considering environmental, social, and governance factors. Second, ESG-aware investors are investors with awareness of ESG considerations and who maintain mean-variance preferences, but they utilize the ESG scores of assets to adjust their evaluations of both risk and expected returns. Finally, ESG-motivated investors are driven by ESG considerations, leverage ESG information and possess a preference for elevated ESG scores. Essentially, these investors aim to construct a portfolio that achieves an optimal balance between a high expected return, minimal risk, and a consistently high average ESG score.

Moreover, corporate social responsibility (CSR) also has an impact on investors decision making. According to Gao et al. (2023) while individuals tend to prioritize financial over non-financial information, corporate social responsibility (CSR) does influence them, as evidenced by investors providing more positive earnings estimates when the CSR performance is favourable. The readability level of CSR reports also play a role in shaping investors' decision-making processes. However, Albuquerque et al. (2019) argue that investors prioritize corporate governance over CSR. This can be explained by the fact that companies with elevated CSR levels tend to have increased investments in brand capital, as evidenced by higher advertising expenditures, which, in turn, result in lower stock returns.

This study delves into responsible investing strategies. The literature surrounding these strategies and in particular screening methods has expanded significantly, reflecting their growing popularity among investors who prioritize environmental, social, and governance (ESG) factors. With the rise of ESG-aware investors, the demand for investment approaches that align with ethical and sustainability principles has surged, prompting a deeper exploration of screening methodologies and their implications for portfolio management. With the primary purpose of the studies similar to one paper written by Dumitrescu et al. (2023) which is to examine whether responsible screening strategies can generate abnormal returns for investors compared with their conventional benchmarks and identify the strategies and attributes that drive the outperformance.

According to the Global Sustainable Investment Alliance (GSIA)[5], there are seven responsible investment strategies: Negative/Exclusionary Screening, Positive/Best-in-Class Screening, Norms-Based Screening, Integration of ESG Factors, Sustainability-Themed Investing, Impact Investing, and Corporate Engagement and Shareholder Action. However, through a comprehensive review of the literature on responsible investments, five primary strategies for responsible investment have been identified. These responsible investment strategies are presented in Table 1.

Table 1: Responsible investment strategies
This table presents five key Responsible Investment (RI) strategies, along with definitions for each. Each strategy represents a distinct approach to integrating responsible practices within investment decision-making.

Responsible Investment strategy	Definitions
Negative/Exclusionary screening	The exclusion of certain companies involved in harmful or controversial activities, often referred as “sin-stocks” (Trinks & Scholtens, 2017).
Positive/Best-in-class screening	The selection of companies based on their superior Environmental, Social, and Governance (ESG) or sustainability performance relative to their industry peers (Kempf & Osthoff, 2007) .
Ethical screening	Evaluation of companies based on specific ethical criteria. Investors can exclude or include certain companies or industries in their investment portfolios (Dupre et al., 2005). Can be seen as the combination of positive and negative screening.
Integration of ESG factors	Incorporating ESG criteria into the investment decision-making process alongside financial information(Díaz et al., 2024).
Corporate engagement and shareholder action	A strategy that addresses social, environmental, and economic impacts in a responsible and ethical manner can decrease systematic risk and increase firm value, especially for firms with high product differentiation (Albuquerque et al., 2019).

While it is essential to acknowledge all responsible investment strategies, this study concentrates specifically on screening strategies, with a particular emphasis on negative screening, positive screening, and ethical screening. Focusing on these screening methods allows for a detailed analysis of their impact on portfolio performance. These strategies offer clear and measurable criteria for the inclusion and exclusion of investments, facilitating easier comparison. Positive and negative screening are the most used and the most literature can be found on these screening methods. They represent two distinct approaches to ethical investment selection. Positive screening involves assessing whether a company upholds policies and practices that align with ethical principles and sustainability goals. Companies meeting these criteria are considered for inclusion in the investment portfolio. This method prioritizes companies with a proactive stance on ethical issues, such as environmental conservation, social responsibility, and robust governance practices. On the other hand, negative screening revolves around the exclusion of firms and assets involved in activities deemed detrimental to ethical considerations. This approach seeks to avoid investing in companies engaged in practices that conflict with ethical values, such as environmental degradation, human rights violations, or unethical

[5] Global Sustainable Investment Alliance (2018).

business conduct. By employing negative screening, investors aim to align their portfolios with their ethical beliefs and values, thereby promoting responsible and sustainable investment practices (Yadav et al., 2023).

2.2 Implementation Strategy & Performance

The conventional approach to portfolio construction historically drew upon the traditional mean–variance approach proposed in Markowitz (1952), which maximizes the return for a given risk portfolio considering the standard deviation of asset returns as the risk measure. Many academic papers in recent years have proposed frameworks that extend beyond Markowitz's conventional approach to portfolio construction by integrating the crucial aspect of sustainability. These frameworks highlight the growing importance of integrating sustainability considerations into the processes of making investment decisions.

2.2.1 Optimization model

The framework outlined by Pedersen et al. (2021) aims to optimize both the Sharpe ratio and ESG criteria simultaneously. They identify and construct portfolios by estimating the costs and benefits of responsible investing through an ESG-efficient frontier based on ESG measures.

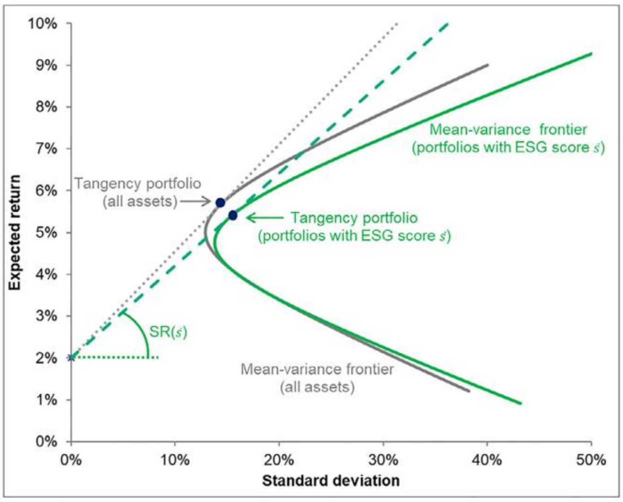


Figure 5: ESG-efficient frontier

This figure provides a visual representation of the investment strategy for investors concerned with both the Sharpe ratio and ESG factors. It demonstrates that ESG-aware investors should select a portfolio located to the right of the standard tangency portfolio, within the ESG-efficient frontier. This means that, for each given expected return, there is a higher level of risk compared to the tangency portfolio of ESG-unaware investors, indicating the willingness of ESG-aware investors to accept increased risk to achieve ESG goals. This framework enables investors to enhance portfolio optimization by incorporating ESG criteria alongside traditional financial metrics.

The model introduced by (Steuer & Utz, 2023). transitions from a bi-criterion approach, focusing on risk and return or the Sharpe ratio and ESG score, to a tri-criterion model that aims to minimize risk, maximize return, and maximize the ESG score. In other words, the model evolves from a two-dimensional efficient frontier to a three-dimensional efficient surface. This shift implies that the investor's objective is no longer solely to identify the optimal risk/return trade-off point on the efficient frontier but to determine the optimal risk/return/ESG trade-off point on the efficient surface (Steuer & Utz, 2023).

The shape and curvature of the efficient surface illustrate how ESG factors influence the optimal portfolio selection process. Investors can visually assess how different portfolios balance financial performance with ESG values. By exploring this surface, investors can identify portfolios that align with their preferences for risk management, financial performance, and sustainability goals. The efficient surface provides a more comprehensive view of the investment landscape, enabling investors to make informed decisions that reflect their values and objectives.

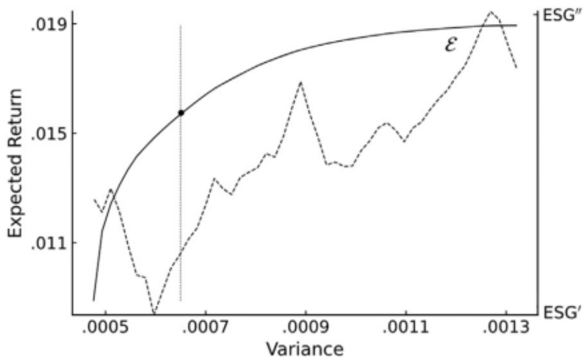


Figure 6: Efficient surface.
This figure serves as a visual representation of the multidimensional decision-making process in sustainable investing, offering a detailed view of the interplay between risk, return, and ESG factors. With ϵ being the efficient frontier, the line represents securities to maximize expected return for each level of risk. The dotted line in the figure represents the ESG scores of portfolios along the efficient frontier. It shows how ESG considerations vary across different portfolios that are part of the efficient frontier. The dot on the efficient frontier labeled as the investor's most preferred selection indicates a specific portfolio chosen based on the investor's risk-return preferences and ESG criteria.

By interpreting Figure 6, investors can make informed decisions that align with their financial objectives and sustainability values. The incorporation of ESG factors in investment strategies poses certain challenges and drawbacks. Dimson et al. (2020) note that companies receiving high ESG scores from one rating agency often receive lower scores from others. They explore the reasons behind these discrepancies and the variations in weighting across different ESG rating frameworks. Despite claims by asset managers about the usefulness of ESG ratings, Dimson et al. (2020) also examine the effectiveness of portfolios and indexes screened based on ESG credentials. Similarly, Avramov et al. (2021)highlight the absence of a reliable metric for assessing true ESG performance. They find that ESG rating uncertainty reduces investor demand for stocks, especially among ESG-sensitive investors like norm-constrained institutions, particularly in green stocks. Additionally, their research shows that brown stocks outperform green stocks only when rating uncertainty is low, and the negative return predictability of ESG ratings is not consistent across all firms.

2.2.2 Performance screening methods

In this section, we examine the performance of the screening methods. Examining if portfolios who use screening methods out-, under-, or equal perform the market.

In the context of ESG portfolios, according to Lin & Swain (2024) on the one hand, outperformance refers to a situation where the abnormal return (α) of the ESG portfolio exceeds that of benchmark portfolio or market index ($\alpha_{portfolio} > \alpha_{benchmark/market}$). This indicates that the ESG portfolio delivers higher returns after adjusting for systematic risk, even though it may exhibit higher volatility or greater co-movement with the market, making it less resilient during market downturns. On the other hand, underperformance occurs when the abnormal return of the ESG portfolio is lower than that of its benchmark portfolio/market index ($\alpha_{portfolio} < \alpha_{benchmark/market}$), meaning the ESG portfolio delivers lower risk-adjusted returns. Interestingly, portfolios underperforming tend to be more resilient, as they have lower exposure to systematic market risks. Then, equal performance is defined as the situation where the abnormal return of the ESG portfolio is equivalent to that of the benchmark portfolio/market index ($\alpha_{portfolio} = \alpha_{benchmark/market}$). In this case, investors may still view the portfolio favourably, as ESG-motivated investors might be willing to accept the same or slightly lower returns due to their ethical considerations.

The findings regarding the effects of these screening approaches on investment performance have been varied. Table 9 in the appendix provides a concise overview of the screening approaches discussed in the literature, along with the performance measures employed and the results of the respective studies.

Pástor et al. (2021)present a sophisticated model that incorporates ESG considerations into asset pricing frameworks, offering valuable insights into the implications of sustainable investing on financial markets. Central to their model is a two-factor asset pricing framework, wherein stocks are priced based on the market portfolio and an ESG factor. This innovative approach recognizes the impact of ESG characteristics on investment returns, with a simplified version of the ESG factor capturing the differential performance of green and brown portfolios. A noteworthy implication of this model is the concept of three-fund separation, wherein investors hold the market portfolio, the risk-free asset, and an ESG portfolio. The composition of the ESG portfolio is contingent upon the greenness of assets, reflecting the varying degrees of positive and negative externalities associated with "green" and "brown" firms, respectively. However, the model does not explicitly state whether ESG portfolios consistently outperform or underperform the market, but it highlights the influence of ESG factors on pricing.

Amon et al. (2021) explore the integration of the environmental score weighting approach (E-weighting) with screening techniques targeting fossil fuel-related companies in investment portfolios across the US and Europe. Their study reveals that negative screening in Europe has minimal impact on financial performance (i.e., neither outperforms nor underperforms the market), whereas excluding fossil fuel-related firms in the US leads to improved financial outcomes, indicating outperformance of the screened portfolios compared to the market. Furthermore, their comparative analysis suggests that investors prioritizing environmental considerations can attain outperformance by combining negative screening with E-weighting strategies.

Bertelli & Torricelli (2024)investigate the effectiveness of portfolio screening strategies based on ESG scores, integrating sustainability principles into portfolio theory. They assess the risk-adjusted performance of ESG-screened portfolios against a benchmark-passive portfolio using the Sharpe Ratio and alphas from both a one-factor model and the Carhart four-factor model. The study demonstrates the long-term outperformance of ESG-screened portfolios, particularly those using low exclusion threshold negative screening strategies, compared to the benchmark portfolio. However, the study also suggests that ESG portfolios do not always provide systematic risk over-compensation during periods of financial distress, meaning the outperformance may not be consistent in such periods.

Auer et al. (2016) compare Socially Responsible Investment (SRI) portfolios with a benchmark representing a broad diversified stock market index. The study constructs portfolios using negative screens based on Sustainalytics ESG scores and finds that while positive screens may negatively impact performance (i.e., underperform the market), negative screens with low cut-off rates outperform passive benchmark strategies, leading to outperformance. Additionally, the integration of environmental, social, and governance screens within the rated universe further enhances performance, particularly in governance selection. Thus, investors can use negative screens and additional ESG criteria to build portfolios that are both sustainable and capable of outperforming the market.

In summary, the literature on the performance of screening methods in portfolio construction presents varied results. While some screening approaches, particularly those involving negative screening and ESG integration, show evidence of outperformance, this is not universally the case. Pástor et al. (2021) highlight the impact of ESG factors on pricing but stop short of definitively proving consistent outperformance or underperformance of ESG portfolios. Amon et al. (2021) show that screening out fossil fuel-related companies leads to outperformance in the US, whereas the same approach in Europe has minimal financial impact. Bertelli & Torricelli (2024)demonstrate long-term outperformance of ESG-screened portfolios but caution that this may not hold during periods of financial distress. Auer (2016) finds that negative screening, particularly with low cut-off rates, can lead to outperformance, while positive screening may result in underperformance. Portfolio performance is thus heavily influenced by the specific screening methods applied and the regional context, highlighting the importance of tailoring screening strategies to the investment environment.

2.3 Hypotheses

To contribute to the literature and fill the presented research gap, the following hypotheses have been drawn up for the goal to answer the research question. The three hypotheses which will be tested are:

Hypothesis 1: Positive screening

The first hypothesis examines the impact of incorporating positive screening in investment portfolios on returns within the Australian financial markets.

- H0: Portfolios incorporating positive screening strategies do not yield higher abnormal returns in the Australian financial markets.
- H1: Portfolios incorporating positive screening yield higher abnormal returns in the Australian financial markets.

The rationale behind this hypothesis is based on the assumption that companies with strong ESG practices are better equipped to manage risks, foster innovation, and leverage long-term trends such as regulatory changes and growing consumer demand for sustainable products. In theory, these firms are expected to outperform over time due to their strategic foresight and reduced exposure to reputational and operational risks. Existing literature supports this perspective, with studies such as Dumitrescu et al. (2023)demonstrating that positive screening strategies can generate abnormal returns, particularly within socially responsible investment (SRI) funds. Research suggests that investors often view firms with strong ESG profiles as having more robust fundamentals, which can increase both demand for their stocks and overall performance. However, these effects can be market-specific, as other studies, such as Giese et al. (2019), have shown that the impact of ESG strategies can vary across regions. This hypothesis aims to examine whether similar positive financial outcomes from positive screening strategies are observed in the Australian financial market.

Hypothesis 2: Negative screening

The second hypothesis investigates the effect of incorporating negative screening in investment portfolios on returns within the Australian financial markets.

- H0: Portfolios incorporating negative screening strategies do not yield higher abnormal returns in the Australian financial markets.
- H1: Portfolios incorporating negative screening yield higher abnormal returns in the Australian financial markets.

The underlying assumption is that by excluding companies involved in controversial activities, investors can align their portfolios with their values without necessarily compromising financial returns. However, some argue that by excluding certain sectors, investors may forgo potential profit opportunities, which could lead to underperformance. The literature provides mixed evidence on negative screening's impact on portfolio returns. Al Ayoubi & Enjolras (2022) argue that negative screening approach of excluding unethical firms in this case companies in the industry of fossil fuels, increases their ethical standpoint but does not affect financial performance of the portfolio. This hypothesis aims to examine whether negative screening in the Australian financial markets leads to superior abnormal returns, adding to the debate on whether this strategy optimally balances ethical objectives with financial performance.

Hypothesis 3: Ethical screening

The third hypothesis investigates the effect of incorporating ethical screening in investment portfolios on returns within the Australian financial markets.

- H0: Portfolios incorporating ethical screening strategies do not yield higher abnormal returns in the Australian financial markets.
- H1: Portfolios incorporating ethical screening yield higher abnormal returns in the Australian financial markets.

This approach integrates ethical values into investment decisions while still aiming to deliver competitive financial performance. Ethical screening aligns with the broader concept of Socially Responsible Investing (SRI), which has evolved to include not just ethical concerns but also financial returns.Fu et al. (2020) argue that ethical investing does not necessarily result in negative abnormal returns. Instead, it suggests the potential for positive abnormal returns, as constrained portfolios can occasionally outperform unconstrained ones. This conclusion challenges traditional methods, which often overlook ethical constraints, and highlights the use of the Sharpe ratio in evaluating risk-adjusted returns. Together, these findings support the view that ethical investing can be designed to achieve financial performance that is either comparable to or superior to conventional approaches, without incurring additional costs.

3. Methodology

This section outlines the empirical approach used to evaluate the performance and estimate the abnormal returns of screened portfolios. The methodology is divided into three main parts: asset selection through screening criteria, the assessment of financial performance using various models such as the Fama-French models and CAPM model, and a detailed description of the data collection process. This includes defining control variables and applying the models to a sample of Australian companies in alignment with the research objectives.

3.1 Portfolio formation

3.1.1 Asset selection

In this study, we test three screening methods: positive screening, negative screening, and ethical screening. We use these screening methods to construct three portfolios. These portfolios are constructed by evaluating four primary variables: ESG combined score (Environmental, Social, and Governance) score and the score of each pillar separately, retrieved from the database Refinitiv Eikon. The ESG Combined Score offers a quantitative representation of environmental, social, and governance criteria, serving as a crucial tool for investors interested in analysing the sustainability practices of potential investments. Furthermore, to gain a deeper understanding of companies' sustainability practices, we decided evaluating not only the combined ESG score but also evaluate each pillar individually. This will lead to investors gaining nuanced insights that can guide decisions regarding the long-term sustainability and resilience of their portfolios.

Amon et al. (2021) analysed firms categorized as green and polluted based on their environmental impact. Green firms were defined as the top 30% in terms of environmental performance, while polluted firms were identified as the bottom 30%. We adopted this classification methodology as the basis for determining our screening threshold. Bertelli & Torricelli (2024) conducted an analysis to determine whether screened portfolios perform better in the long term versus the short term, and to assess the impact of various screening features. The study utilized different exclusion and inclusion thresholds, examining their effects over the period from 2007 to 2021. Specifically, for ESG criteria, they employed exclusion thresholds of 10%, 20%, and 30% for negatively screened portfolios, and inclusion thresholds of 70%, 80%, and 90% for positively screened portfolios. The results demonstrated that all screened portfolios achieved a higher average excess return compared to the benchmark in the long term, while short-term performance did not show improvement. However, the performance of these portfolios was also influenced by risk. Negatively screened portfolios outperformed overall, as their slightly higher risk did not negate the positive impact of the higher excess return. Conversely, positively screened portfolios faced a higher level of risk, which offset the benefits of excess return. The 90% ESG threshold for positively screened portfolios showed significantly lower performance compared to the other thresholds. This outcome was attributed to the high screening threshold excessively narrowing the investment set, thereby excluding potentially profitable stocks. There was minimal difference between the returns of the 70% and 80% thresholds, although the 80% threshold exhibited a higher risk factor. For negatively screened portfolios, the 10% threshold underperformed in returns relative to the other thresholds. The returns for the 20% and 30% thresholds were similar, but the 30% threshold carried a significantly higher risk factor, which outweighed its higher return compared to the 20% threshold.

In conclusion, for a balanced consideration of return and risk, the optimal thresholds for positively screened portfolios would be between 70% and 80%, while for negatively screened portfolios, the ideal range would be between 20% and 30%.

Having reviewed the relevant literature on the performance impacts of applying specific thresholds for portfolio screening, we are now positioned to construct the three portfolios for this study, each incorporating distinct screening criteria and thresholds. First, the positive screened portfolio was constructed by including only companies with high scores on each individual ESG pillar. Analysing the descriptive statistics of the sample, previewed in Table 3, gave us a basis to create a threshold to include companies in the positive screened portfolio. We concluded that for this portfolio, we wanted to ensure that only the top-performing companies regarding all pillars. This approach guarantees that only those companies demonstrating high standards in all ESG pillars are selected.

Thus, the threshold criteria we set for this portfolio is:

- Environmental score > 52.18 (75th percentile)
- Social score > 67.17 (75th percentile)
- Governance score > 72.91 (75th percentile)

Similarly, the negative screened portfolio was constructed using a similar approach but with a focus on exclusion criteria. We used the environmental score, social score and governance score each to identify stocks for exclusion from the portfolio. In addition, industry classification was considered an additional criterion to exclude companies from certain sectors (e.g., tobacco, fossil fuels) known for poor ESG practices. This method ensures that companies with undesirable characteristics or operating in ethically questionable industries are excluded(Trinks & Scholtens, 2017). Again, using the descriptive statistics of the sample as a basis, we formed the threshold criteria to determine which companies to exclude for the construction of the negative screened portfolio. This approach ensures that companies performing poorly regarding ESG score, and Environmental score are excluded along with companies in undesirable industries.

Thus, the threshold criteria for excluding companies are:

- Environmental score < 13.14 (25th percentile)
- Social score < 35.42 (25th percentile)
- Governance score < 36.81 (25th percentile)
- Companies in sectors: Oil, Gas & Consumable fuels, Metals & Mining, Chemicals and Paper & Forest products

Lastly, the ethical screened portfolio was constructed by combining the approaches of the positive and negative screened portfolios. This involved including companies that meet high overall ESG score while simultaneously excluding those that fall short of these criteria or belong to undesirable industries (Trinks & Scholtens, 2017). This comprehensive screening approach aims to create a portfolio that adheres to strict ethical standards.

Thus, the threshold criteria for this portfolio are:

- Include companies from original sample with ESG scores > 57.11 (75th percentile)
- Exclude companies in sectors: Oil, Gas & Consumable fuels, Metals & Mining, Chemicals and Paper & Forest products

To gain more in-depth insights of the relationships between the three screening approaches and their financial performances we created difference portfolios. In principle, six difference portfolios could have been constructed; however, the three not explicitly mentioned are identical to the ones presented, differing only in sign. For the sake of clarity and conciseness, only the positive difference portfolios are discussed. The three portfolios representing the difference between each screened portfolio are presented in Table 2:

Table 2: Difference portfolios
This table presents the construction of the difference portfolios with each difference portfolio named in the first column, along with the explanation and the formula used to calculate the difference portfolios.

Difference portfolios	Explanation	Formula
Difference $portfolio_{(P-E)}$	$Positive_{\text{screened portfolio}}$ - $Ethical_{\text{screened portfolio}}$	$R_{P-E}-Rf=\alpha_{P-E}+\beta_{P-E}(Rm-Rf)+\epsilon_{P-E}$
Difference $portfolio_{(N-P)}$	$Negative_{\text{screened portfolio}}$ - $Positive_{\text{screened portfolio}}$	$R_{N-P}-Rf=\alpha_{N-P}+\beta_{N-P}(Rm-Rf)+\epsilon_{N-P}$
Difference $portfolio_{(E-N)}$	$Ethical_{\text{screened portfolio}}$ - $Negative_{\text{screened portfolio}}$	$R_{E-N}-Rf=\alpha_{E-N}+\beta_{E-N}(Rm-Rf)+\epsilon_{E-N}$

Constructing these portfolios presented significant challenges, as each portfolio was comprised of a varying number of assets that adhere to their specific screening criteria. In the existing literature, it is more common to compare a single socially responsible investment (SRI) portfolio against a market portfolio, which serves as a benchmark (Dumitrescu et al., 2023). However, this research aims to not only assess the financial impacts of each screening approach but also to directly compare the various screening strategies against one another. This comparative analysis seeks to provide deeper insights into which screening method is most effective. Ultimately, to serve as a valuable resource for future investors, enhancing their understanding of the screening approaches best suited to their financial goals and overall investment strategy.

The rigorous process of constructing difference portfolios is outlined as follows. The initial and critical step was aligning the data, as comparing the differences among portfolios through OLS regression was not feasible when the observations did not correspond. To facilitate accurate comparisons, the data was organized according to year, ensuring that each portfolio adhered to a consistent format. Following, OLS regression was conducted for each difference portfolio using the regression formulas seen above in Table 2(Jensen et al., 1972; Lintner, 1965b; Sharpe, 1964). Allowing for the estimation of alphas and the assessment of the effectiveness of the different screening strategies. Through applying this methodology, this study aims to provide a comprehensive understanding of the relative effectiveness of each screening approach in generating abnormal returns, ultimately offering valuable insights for investors who are interested in socially responsible investing.

3.1.2 Portfolio weights

With the screening criteria established and the asset allocation for each portfolio determined, the next step is to select an appropriate weighting approach for portfolio construction. The literature presents various weighting methodologies, among which the most prevalent are the equal-weighted approach, the value-weighted approach, and the optimal weighting approach(Pedersen et al., 2021; Zhang et al., 2022).

The equal-weighted approach assigns an identical weight to each asset within a portfolio. This method is straightforward to implement and inherently provides diversification by ensuring that each asset contributes equally to the portfolio's overall performance. In contrast, the value-weighted approach assigns unequal weights to assets based on their market capitalization. In this approach, larger companies with higher market values receive greater weight. This method reflects the actual market influence of each asset and is frequently used in market indices and portfolio construction. A comprehensive analysis of these two approaches is presented in the study by Zhang et al. (2022). The researchers employed both the equal-weighted and value-weighted methods to evaluate which approach yields higher returns. For the value-weighted approach, weights were adjusted monthly according to the float-adjusted market capitalization of the stocks. The findings indicated that the results of the equal-weighted and value-weighted approaches were largely consistent with each other, suggesting minimal differences in performance outcomes between the two methods. This implies that, while the weighting methodologies differ, the overall impact on portfolio returns may be similar.

Furthermore, the optimal weighted approach is more complex than the other two approaches. In the optimal weighted approach, each stock in a portfolio is assigned a weight based on its contribution to the portfolio's overall expected return and risk. This approach can be seen in Pedersen et al. (2021). This approach has been explained earlier in this paper in section 2.2.1.

In this paper, we opted for an equal-weighted approach for several reasons. First, equal weighting is a straightforward and intuitive method for portfolio construction, simplifying implementation and removing the need for complex calculations or extensive data on asset values. This simplicity allows for easy monitoring of the portfolio's composition and performance, without requiring frequent rebalancing based on market movements. Additionally, equal weighting reduces the risk of over-concentration, as each asset contributes an equal portion to the portfolio. This promotes diversification and distributes risk more evenly across investments. However, it's worth noting that equal weighting may lead to higher turnover and transaction costs due to the frequent rebalancing required to maintain equal allocations. In contrast, value-weighted portfolios, which allocate weights based on market capitalization, can become overly concentrated in a few large-cap companies, potentially skewing the portfolio's performance toward these dominant firms. The equal-weighted approach avoids this bias, enabling smaller companies to contribute proportionately to the portfolio's returns.

$$Weight\ of\ an\ asset = \frac{1}{n} \tag{1}$$

Where:

$Weight\ of\ an\ asset = The\ proportion\ of\ the\ total\ portfolio\ allocated\ to\ a\ specific\ asset$

$n = Number\ of\ assets\ in\ the\ portfolio$

3.1.3 Time horizon

For portfolio formation, this study uses historical data from 2019 - 2023 to capture long-term performance trends and to reflect dynamic market conditions and variations in company performance, with a timeline of this period presented in Figure 7. The return data for the period 2019 - 2023, sourced from Refinitiv Eikon, is reported on an annual basis. For the portfolio construction, the returns are compounded annually to accurately reflect the cumulative growth of investments over the multi-year period. This ensures that the effects of compounding are accounted for, providing a more realistic measure of overall performance compared to a simple arithmetic average.

This approach balances the need for historical context with the goal of achieving a stable and robust portfolio assessment. However, it is important to acknowledge that the period from 2019 to 2023 includes the COVID-19 pandemic, which had a profound impact on global markets and corporate performance. This study does not go into detail in the market volatility, disruptions to business operations, and rapid economic shifts during this period. However, it is important to mention that while this five-year window offers a relatively recent and relevant snapshot of performance trends, the pandemic years could skew the analysis of long-term trends or portfolio stability. While extending the time-period could have offered a more comprehensive analysis, the chosen five-year window was selected for its relatively lower proportion of missing data compared to longer periods, such as ten years or more, thereby ensuring the dataset's robustness and reliability. This methodology aligns with practices observed in similar studies, such as Sandu (2024) which also utilized Refinitiv Eikon scores.

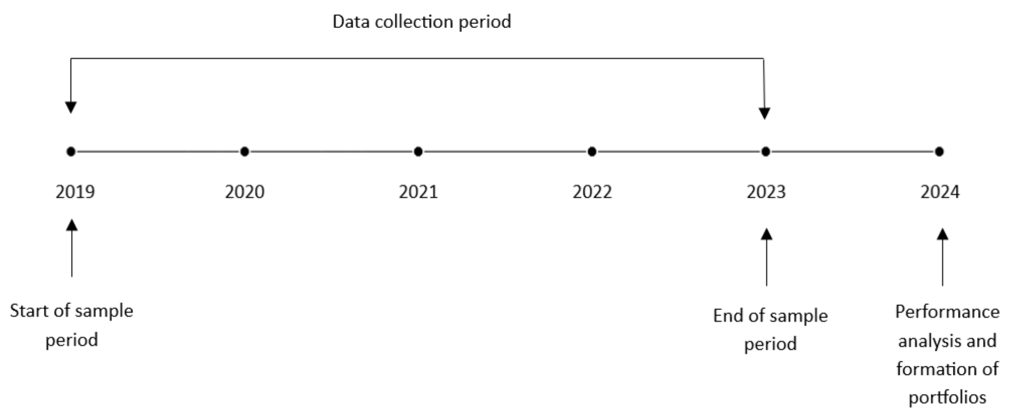


Figure 7: Timeline data analysis and portfolio formation
This timeline illustrates the portfolio formation and performance evaluation process for the period 2019 to 2024. Data collection began in 2019, marking the start of the sample period, and continued annually through 2023. In 2024 portfolios are formed according to the historical data retrieved over the 5-year sample period. This approach enables a robust assessment of long-term trends, balancing recent market dynamics with historical performance insights to evaluate portfolio stability and overall performance trends.

3.2 Assessing financial performance (estimating abnormal returns)

In line with the benchmark paper established by Dumitrescu et al. (2023) we will compute the returns of the portfolios and evaluate them using two asset pricing models: the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model.

The Capital Asset Pricing Model (CAPM) calculates the expected return of an investment based on the market return and the risk-free rate (Lintner, 1965; Sharpe, 1994). In this study, the market return $(R_m - R_f)$ will be derived from the S&P/ASX All Ordinaries Index, a key benchmark for the Australian stock market. The risk-free rate (R_f) will be obtained from the yield on Australian government bonds with a maturity corresponding to the investment horizon. Additionally, the computation of returns for the securities will be calculated using the formula $(P_t - (P_{t-1}))$, where P_t is the price at time t and P_{t-1} is the price at the previous time period.

This approach ensures that the risk-free rate accurately reflects current market conditions and provides a reliable basis for estimating expected returns. The formula used for this model is:

$$R_p - R_f = \alpha + \beta\,(R_m - R_f) + \mathcal{E} \qquad (2)$$

Where:

$R_p = Return\ of\ the\ Portfolio$

$R_f\ =\ Riskfree\ rate\ from\ Australian\ government\ bonds$

$\alpha = Abnormal\ return\ (alpha)$

$R_m\ =\ Market\ return\ from\ the\ S\&P/ASX\ all\ ordinaries\ index$

β = Sensitivity of the portfolio to the market risk premium

Ɛ = Error term

The Fama-French three-factor model incorporates multiple factors: market factor, size factor and value factor. Table 4 presented later in the methodology section provides an overview of the variables chosen explicitly for each factor for the usage of this model. The formula used for the model is:

$$R_p - R_f = \alpha + \beta_m\big(R_m - R_f\big) + \beta_{SMB}\ \times SMB + \beta_{HML}\ \times HML +\ \mathcal{E} \qquad (3)$$

Where:

$R_p =\ Return\ of\ the\ portfolio$

$R_f =\ Risk - free\ rate$

$R_m\ =\ Return\ of\ the\ market$

$\alpha = Abnormal\ return\ (alpha)$

$\beta_m\ =\ The\ sensitivity\ of\ the\ portfolio\ to\ the\ market\ risk\ premium.$

$\beta_{SMB}\ =\ The\ sensitivity\ of\ the\ portfolio\ to\ the\ size\ factor\ (SMB).$

$SMB = Size\ factor\ representing\ the\ return\ difference\ between\ small\ and\ large\ companies$

$\beta_{HML} =\ The\ sensitivity\ of\ the\ portfolio\ to\ the\ value\ factor\ (HML).$

$HML = Value\ factor\ representing\ the\ return\ difference\ between\ value\ stoks\ and\ growth\ stocks$

$\mathcal{E}\ =\ Error\ term$

For the Fama-French regression conducted for each portfolio for 2024 later seen in Table 7, the analysis is based on 12 monthly returns. This approach is widely recognized and commonly employed in academic literature (Pedersen et al., 2021; Steuer & Utz, 2023). The decision to use monthly intervals aligns with the nature of ESG screening, which is fundamentally a long-term investment strategy designed to integrate sustainability and ethical principles into portfolio management over time.

Through these two asset pricing models we calculate Jensen's alpha, which determines the excess return of an investment portfolio compared to the expected return predicted by the asset pricing models (Jensen, 1968). This performance measure can be interpreted in the following manner, a positive alpha indicates that the portfolio has outperformed the market, after adjusting for the risk taken. A negative alpha works vice versa and an alpha with the value of zero means that the portfolio performed the same as expected based on its risk level. Jensen's alpha is a valuable tool for evaluating the performance of a portfolio relative to its expected return based on its risk.

The Sharpe ratio measures the excess return per unit of risk, with risk defined as the standard deviation of the portfolio's excess return (Sharpe, 1994). The formula of the Sharpe ratio is as follows:

$$Sharpe\ Ratio = \frac{Rp - Rf}{\sigma p} \tag{4}$$

With:

$R_p = Return\ of\ the\ portfolio$

$R_f\ =\ Riskfree\ rate$

$\sigma p\ =\ Standard\ deviation\ of\ the\ portfolio's\ excess\ return$

The selection of the risk-free rate is critical for accurately calculating the Sharpe Ratio, as it serves as the baseline for assessing the excess returns generated by the portfolio relative to its risk. Lally (2002) writes that when deciding the term of the risk-free rate, the risk-free rate should be matched according to the asset or investment life. This can be seen in the paper Ahadzie & Jeyasreedharan (2024) where they use the 90- day accepted bill rate is used as the proxy for the risk-free rate, as they are more focussed on the short-term return data. Given that the analysis covers a 5-year period, it was essential to align the risk-free rate with the time horizon of the study. Therefore, the average yield over the five-year time period on the Australian 5-year government note was chosen as a proxy, providing a relevant and stable benchmark for risk-free returns within the Australian context. Since the S&P ASX All Ordinaries Index, which includes the largest companies listed on the Australian Securities Exchange, was the sample used in this analysis, using a risk-free rate based on Australian sovereign debt ensures consistency between the investment horizon and market conditions, leading to more accurate Sharpe Ratio calculations.

Finally, the Sharpe Ratio was computed by dividing the excess return by the standard deviation of the portfolio's returns, providing a comprehensive measure of the portfolio's risk-adjusted performance. A high Sharpe ratio indicates better risk-adjusted returns, while a low Sharpe ratio indicates that the portfolio does not yield enough return for the amount of risk taken. This ratio helps investors understand how much excess return they are receiving for the extra volatility endured by the investment. Moreover, using both the Sharpe ratio and Jensen's alpha enhances the validity of the performance assessment. Relying on a single performance measure could result in less reliable results. By employing both measures, we ensure a more comprehensive and robust evaluation of the portfolios' performance, providing a clearer picture of their abnormal returns. These performance measures are widely used in the literature on responsible investments, indicating their reliability and effectiveness. This is supported by an analysis done of the literature of which an overview of all the performance measures used in the articles can be seen in Table 9 in the Appendix. Only two papers used non-standard performance measures: Díaz et al. (2024) included Treynor's ratio alongside Jensen's alpha, and Esparcia et al. (2023) used Kappa (K) and the Farinelli-Tibiletti measure. This prevalence indicates the reliability and effectiveness of the Sharpe ratio and Jensen's alpha in evaluating portfolio performance.

3.3 Data collection

3.3.1 Sample

The data collection process for this research involved obtaining information from Refinitiv Eikon, which is a financial information platform that provides real-time and historical data that can be used by financial professionals for analytics of financial markets. The initial step included the selection of the sample using the screener function available on Refinitiv Eikon. The sample chosen was the S&P ASX All ordinaries index. The S&P/ASX All Ordinaries Index comprises the top 500 companies listed on the Australian Securities Exchange (ASX) by market capitalization. This index spans a diverse array of industries and sectors, offering a broad representation of the Australian stock market. The All Ordinaries includes a wide range of companies, from large multinational corporations to smaller firms, thereby providing a well representation of the overall market.

Moreover, the index was specifically chosen because it provides a broad representation of the Australian equity market across various sectors and market capitalizations. Once the sample was identified, the subsequent phase involved retrieving data from the chosen stocks. To streamline this process, using the screener function in Refinitiv Eikon, a careful examination of the data library was conducted. Where specific variables relevant to the research were selected for inclusion in this study. Scanning through the data acquired of the sample through Refinitiv Eikon, we found that for certain variables there were still many missing values, with the most missing values being for the ESG variables. The number of missing values per variable can be seen in Table 3 later in this paper. Indicating that this dataset still needed to be processed before it could be properly analysed. Thus, the collected data was cleaned and processed to remove all the missing values and any anomalies. This step was crucial to ensure the reliability of the subsequent analysis. To provide a comprehensive overview of the sample, we generated descriptive statistics shown in Table 3.

Table 3: Descriptive statistics of the sample
This table presents the descriptive statistics for the sample at firm-level, representing the averages of each variable from 2019-2023. The columns display the count of observations, the mean, standard deviation, minimum, 25th percentile (Q1), median (50th percentile), 75th percentile (Q3), and maximum value for each variable. The total return is annually compounded. These statistics provide an overview of the central tendency, dispersion, and range of the data, offering insights into the distribution of the variables within the sample.

Variables	Count	Mean	STD Dev	Min	25%	50%	75%	Max
ESG combined score	350	45.02	17.78	3.62	31.64	45.06	57.11	89.56
Environmental pillar score	350	35.05	25.32	0.00	13.14	32.79	52.18	95.04
Social pillar score	350	50.13	21.19	4.90	35.42	49.64	67.17	97.59
Governance pillar score	350	54.04	22.81	1.23	36.81	55.34	72.91	98.68
Market cap (million)	500	8,570.53	16,297.26	65.39	823.61	2,736.42	6,942.36	215,687.99
Closing Price	500	12.46	26.87	0.02	2.03	10.60	38.67	298.67
Total assets (million)	481	16,119.25	103,912.97	4.49	279.10	1,027.97	3,932.51	1,254,076
Total liabilities (million)	481	13,225.29	97,056.09	0.44	97.29	468.22	2,138.40	1,180,988
Gross profit (million)	428	1,202.64	4,120.54	-91.12	66.48	229.98	877.30	54,193.88
Total return	478	0.23	1.41	-0.84	-0.11	0.09	0.34	27.96

Analysing Table 3 provides a comprehensive view of environmental, social, and governance (ESG) scores for a sample of 350 entities, facilitating a nuanced assessment of how these firms perform across each ESG domain as well as their aggregated overall performance. The "ESG combined score" serves as a cumulative indicator, reflecting a firm's total performance across the environmental, social, and governance pillars. In addition, individual scores for the "Environmental pillar," "Social pillar," and "Governance pillar" allow for a more detailed examination of specific performance areas.

Examining the ESG combined score, we observe an average score of 45.02, with a standard deviation of 17.78. This average suggests a moderate overall performance across firms, while the relatively high standard deviation indicates significant variability in performance levels. The range of ESG combined scores is from 3.62 to 89.56, illustrating that some entities perform exceptionally well, while others score quite low. The median score, at 45.06, closely approximates the mean, implying a reasonably symmetrical distribution of scores around the centre.

Breaking down the combined ESG score into its constituent pillars, the environmental pillar exhibits an average score of 35.05 and a notably high standard deviation of 25.32. This substantial variance in environmental scores suggests that organizations differ more in their environmental initiatives compared to their overall ESG performance. The median environmental score is 32.79, which is lower than the medians for both social and governance scores, indicating that firms may face more challenges in achieving consistent high performance in environmental areas.

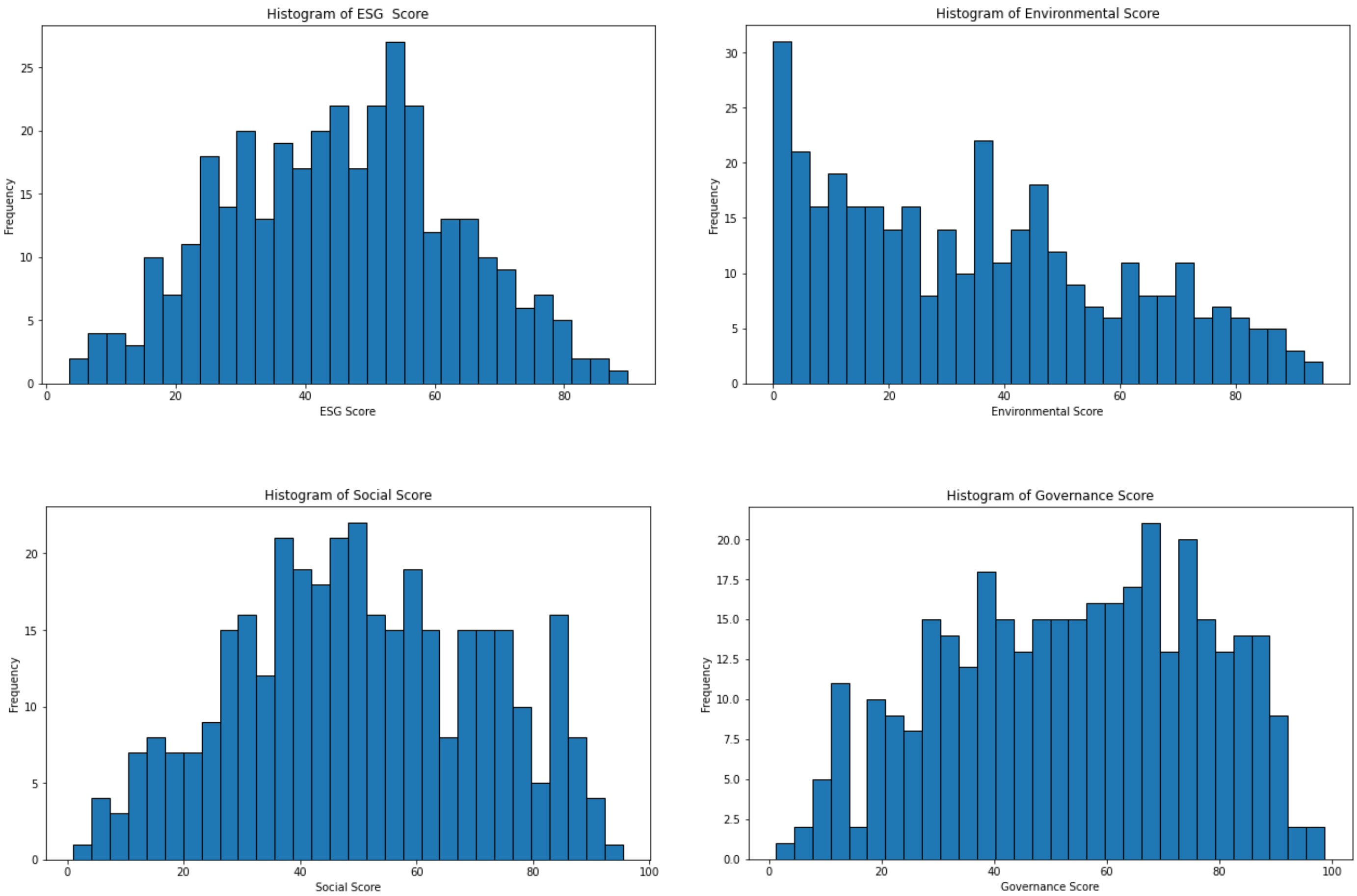
The social pillar score, on the other hand, shows a higher mean of 50.13 and a slightly narrower standard deviation of 21.19, with scores spanning from 4.90 to 97.59. The higher mean and lower spread in the social pillar compared to the environmental pillar suggest that firms are, on average, performing better and with greater consistency in social responsibility measures. The median social score of 49.64 aligns closely with the mean, indicating a less skewed distribution in the social dimension relative to the environmental scores.

The governance pillar demonstrates the highest average score at 54.04, with a standard deviation of 22.81 and a range of scores from 1.23 to 98.68. This elevated mean, along with relatively high interquartile range values (36.81 at the 25th percentile and 72.91 at the 75th percentile), suggests that firms tend to perform more consistently and at higher levels in governance compared to the environmental and social pillars. Additionally, the governance median score (55.34) closely approximates the mean, further suggesting a symmetrical distribution in governance scores.

In summary, the analysis indicates that governance is the strongest and most consistent ESG pillar, while environmental scores show both a lower mean and higher variability, highlighting it as an area of potential improvement. Social performance lies between these two, with moderate levels of consistency and mean performance. These findings underscore where stakeholders may focus efforts to enhance ESG outcomes, particularly emphasizing the need for improved environmental performance.

To further illustrate the descriptive statistics, histograms were generated and are presented in Figure 8. These visualizations offer insights into the distribution and central tendencies of the ESG scores within our sample.

Figure 8: Histograms of Environmental, Social, Governance and Combined ESG score.
This figure presents histograms displaying the distribution of scores across four dimensions: Environmental, Social, Governance, and Combined ESG. Each histogram illustrates the frequency of various scores within each category, providing insight into the spread and central tendencies of ESG scores. The histograms allow for visual comparison of score distributions, highlighting potential variations in how companies perform in each dimension of ESG and in their overall combined score.



3.3.2 Variables

In this study, the selection of main variables was guided by the models used to assess the performance of the portfolios and portfolio screening criteria. The selection was made through using the screener function of Refinitiv Eikon. Initially, to facilitate the subsequent application of the Fama-French model for data analysis, it was necessary to procure data for computing its constituent factors, namely: the size factor, value factor and the market factor. These factors are presented in Table 4, along with their respective abbreviations used in the formula, the variables selected for their computation, and an explanation of each variable.

Table 4: Main control variables

This table provides an overview of the main control variables used in the analysis, including the size factor (SMB), value factor (HML), and market factor (R_m–R_f). Each factor is defined along with its abbreviation, variable, and explanation.

Factor	Abbreviation	Variable	Explanation
Size Factor	SMB	Market Capitalisation	Represents the average return difference between portfolios of small-cap stocks and large-cap stocks. Calculated as the average return on three portfolios of small-cap stocks minus the average return on three portfolios of large-cap stocks[6].
Value Factor	HML	Book to market ratio	Factor captures the average return difference between value stocks and growth stocks. It is calculated as the average return on two portfolios of high book-to-market (value) stocks minus the average return on two portfolios of low book-to-market (growth) stocks[7].
Market Factor	(R_m-R_f)	Market return Risk-free rate	The excess return of the market over the risk-free rate. Captures the premium investors demand for taking risk of investing in the market instead of a risk-free asset.

[6] French, K. R. (n.d.). *Fama/French benchmark factors*.

[7] French, K. R. (n.d.). *Fama/French benchmark factors*.

Furthermore, in addition to the required financial data, non-financial information on firms is essential for assessing their non-financial performance and will aid in the construction of the screened portfolios. These key variables are presented in Table 5. The selection of these variables is significant for investors who aim to make informed and socially responsible investment decisions.

Table 5: Key ESG variables
This table outlines the primary ESG variables used in this study, including the ESG Combined Score and individual pillar scores for Environmental, Social, and Governance dimensions. Each score reflects a company's performance in specific areas of sustainability, as defined and sourced from Refinitiv Eikon.

Variable	Explanation	Data source
ESG combined Score[8]	Aggregate score that evaluates a company's performance across three key dimensions of sustainability: Environmental (E), Social (S), and Governance (G).	Refinitiv Eikon
Environmental pillar score[9]	Score assesses a company's environmental impact, resource use, and policies aimed at mitigating environmental risks.	Refinitiv Eikon
Social pillar score[10]	Score evaluates a company's approach to managing relationships with employees, customers, and the communities it operates in.	Refinitiv Eikon
Governance pillar score[11]	Score assesses the company's management and oversight practices to ensure accountability and alignment with shareholder interests.	Refinitiv Eikon

[8] "ESG Combined Score" definition sourced from Refinitiv Eikon
[9] "Environmental Pillar Score" definition sourced from Refinitiv Eikon
[10] "Social Pillar Score" definition sourced from Refinitiv Eikon
[11] "Governance Pillar Score" definition sourced from Refinitiv Eikon

3.3.3 Data Pre-Processing

To prepare for the analysis it was critical to first ensure that the dataset had been processed and cleaned. This was done to ensure more reliable and less bias results. This process involved multiple steps, including handling missing data, managing outliers, all of which were necessary to ensure the consistency, accuracy, and reliability of the dataset used for modelling and analysis.

The initial stage of the data preprocessing process started with importing python libraries that facilitated data manipulation, visualization, and various preprocessing tasks. The second stage was the handling of missing data which was one of the most important and time-consuming steps in the preprocessing phase, given the impact missing values can have on the reliability of any subsequent analysis. Multiple imputation methods were employed, as varying proportions of missing data across different variables required tailored approaches to ensure accurate handling. First, for variables with only a few missing values, such as Total Assets, simple imputation techniques were employed. Specifically, the median of the available data was used to fill in missing values. The decision to use median imputation was driven by its robustness to outliers, as the median is less affected by extreme values compared to the mean(Arciniegas-Alarcón et al., 2021). This approach helped maintain the dataset's overall distribution without being disproportionately influenced by large outliers. Moreover, in cases where there was a moderate amount of missing data, more advanced imputation techniques were required. For example, the Gross profit column was handled using the K-Nearest Neighbors (KNN) imputation method. By examining the values of the five nearest data points (n_neighbors=5), KNN imputation filled in the missing values in a way that preserved the relationships between variables. This method was particularly effective in maintaining the structure and correlations within the data, ensuring that no artificial patterns were introduced through imputation. Finally, for cases with multiple missing data, it was decided against list wise deletion and instead chosen for multiple forms of imputation. This choice was based on the literature on handling missing data. Pampaka et al. (2016) explains that, while list-wise deletion is not always ideal, it is still criticized because it involves introducing imputed data into the original dataset. However, they claim that using available data to estimate missing values can reduce bias in the results caused by the 'missingness' of data (Pampaka et al., 2016). To support this assertion, Durrant (2009) emphasizes that imputation is used to maintain the sample size and reduce the loss of valuable information, which can potentially enhance the overall efficiency of the analysis. Such columns with multiple missing data were the ESG Combined Score, Social Pillar Score, Governance Pillar Score, and Environmental Pillar Score, an even more sophisticated imputation method was necessary. The RandomForestRegressor model was chosen for imputation because its ability to handle nonlinearity, interactions, and missing values(Jaafar et al., 2024). The dataset was first divided into two sets: one for training (containing complete data) and another for prediction (containing rows with missing data). A RandomForestRegressor model was then trained using relevant features such as Total Assets, Total Liabilities, and Market Cap. The model's performance was evaluated using metrics such as Mean Squared Error (MSE) and R^2 Score to ensure that the imputed values were both accurate and reliable. This approach allowed for the imputation of missing data while preserving the complex interdependencies between the variables, making the dataset more suitable for subsequent analysis.

Another important aspect of data preprocessing involved the detection and handling of outliers. Outliers can significantly skew results and reduce the accuracy of statistical models, making it essential to address them before proceeding with any form of analysis. Two main methods were used for detecting and managing outliers: the Z-score method and the Interquartile Range (IQR) method. The Z-score method works by measuring the number of standard deviations (Z-scores) a data point is away from the mean, any data point with an absolute Z-score greater than 3 was flagged as a potential outlier (Yaro et al., 2023). This method allowed for the detection of outliers across all columns, ensuring that any abnormally large or small values that could distort the analysis were properly addressed. In addition to Z-score analysis, the IQR method was employed to detect outliers based on the spread of the middle 50% of the data. The IQR is calculated as the difference between the 75th percentile (Q3) and the 25th percentile (Q1), and any data point that lies beyond 1.5 times the IQR below Q1 or above Q3 was flagged as an outlier(Vinutha et al., 2018). This method was particularly useful for identifying outliers in skewed distributions, as it focuses on the range of values where most of the data points are concentrated. Outliers detected through these methods were removed, as their small number minimized the impact on the dataset's overall structure. Specifically, the limited presence of outliers allowed for their exclusion without significantly altering the underlying distribution or reducing the dataset's representativeness. By removing these few outliers, the preprocessing step enhanced the accuracy and reliability of subsequent analyses, preventing extreme values from disproportionately influencing statistical models or skewing insights. This selective removal was especially important in ensuring that the dataset maintained a realistic range of values, thus supporting more precise and generalizable results.

In conclusion, the data preprocessing was a multi-step process designed to enhance the quality and reliability of the dataset, making it suitable for subsequent analysis. By addressing missing values through a combination of simple and advanced imputation techniques, identifying and removing duplicates, and detecting outliers using robust statistical methods, the dataset was transformed into a clean and well-structured form. These preprocessing steps ensured that the data was ready for modelling and analysis, ultimately contributing to more accurate and meaningful results in the final research findings.

4. Results

In this section, the research findings are presented in a structured manner. First, the descriptive statistics for each portfolio is outlined, providing a clear overview of key metrics to facilitate portfolio comparisons. Followed by the performance evaluation of the portfolios using measures such as the Sharpe Ratio and abnormal return in the form of Jensen's Alpha. Finally, statistical tests are conducted to assess and compare the performance of the different screening approaches used in the analysis.

4.1 Descriptive statistics

This section examines the descriptive statistics of each individual portfolio which are presented in Table 6. They provide a foundational basis for the analyses presented in this research. By offering insights into the relationships among the variables, the descriptive statistics facilitate a deeper understanding of the data. This understanding, in turn, informs our discussions regarding the implications of these findings for investment strategies within the framework of socially responsible investing.

Table 6: Descriptive statistics per portfolio

This table presents the descriptive statistics for each portfolio at firm-level containing averages over the period 2019-2023, encompassing both financial and non-financial data. The variables included span from ESG analytics to market capitalization and total return which is annually compounded. For each portfolio, the table details the count (representing the number of firms that passed the threshold criteria), mean, standard deviation (SD), and quartiles, including the minimum, 25th percentile, median (50th percentile), 75th percentile, and maximum values. Additionally, the Sharpe ratio is provided for each portfolio, offering insight into risk-adjusted returns.

Panel A: Positive screened portfolio

Variable	Count	Mean	StDev	Min	25%	50%	75%	Max
ESG combined score	39	66.58	14.76	35.61	51.91	70.84	78.30	89.56
Environmental pillar score	39	71.04	12.06	53.23	60.25	69.86	80.97	95.04
Social pillar score	39	80.40	7.26	68.28	74.58	82.12	84.96	97.59
Governance pillar score	39	84.74	6.66	73.84	80.39	84.61	89.08	98.68
Market cap (million)	39	32,363.98	49,174.02	796.85	4,934.87	10,325.32	42,012.47	215,687.99
Total Return	39	0.12	0.08	-0.08	0.07	0.12	0.18	0.30
Sharpe ratio		0.9464						

Panel B: Negative screened portfolio

Variable	Count	Mean	StDev	Min	25%	50%	75%	Max
ESG combined score	188	53.69	12.76	30.77	43.93	53.26	61.11	89.56
Environmental pillar score	188	44.78	21.63	13.71	26.58	40.06	61.95	95.04
Social pillar score	188	58.54	16.02	35.72	44.12	55.65	70.69	97.59
Governance pillar score	188	63.17	16.21	37.27	48.48	63.71	76.04	95.62
Market cap (million)	188	8,529.19	19,890.90	170.30	619.39	2,262.91	7,416.97	163,983.22
Total Return	188	0.12	0.15	-0.26	0.03	0.11	0.19	0.85
Sharpe ratio		0.5580						

Panel C: Ethical screened portfolio

Variable	Count	Mean	StDev	Min	25%	50%	75%	Max
ESG combined score	20	68.42	6.66	58.20	62.47	67.95	72.27	81.37
Environmental pillar score	20	61.72	16.42	34.40	51.86	60.32	72.78	87.32
Social pillar score	20	74.33	8.68	57.20	68.99	72.53	81.61	90.53
Governance pillar score	20	78.40	13.52	46.11	68.04	79.06	89.96	98.68
Market cap (million)	20	12,335.71	19,098.31	674.48	2,101.52	5,682.74	9,552.74	63,340.47
Total Return	20	0.25	0.22	-0.02	0.12	0.18	0.34	0.83
Sharpe ratio		0.9871						

First, we analyse the statistics of positive screened portfolio presented in Panel A. The strict screening criteria is reflected in the high scores across all ESG pillars, combined with relatively low standard deviations, indicating consistent adherence to ESG standards among the portfolio companies. The ESG Combined Score has a mean of 66.58 and a standard deviation of 14.76, indicating that while companies generally perform well in terms of environmental, social, and governance (ESG) standards, there is notable variation across the portfolio. A closer analysis of the individual pillars reveals that the Environmental Pillar Score, with an average of 66.58 and a standard deviation of 12.06, shows significant disparities in environmental practices among companies, with some placing less emphasis on environmental concerns. In contrast, the Social Pillar Score has an average of 80.40, reflecting stronger performance in social responsibility, and its relatively low standard deviation of 7.26 suggests minimal variation. The Governance Pillar Score averages 84.74, with a standard deviation of 6.66, indicating a generally high level of governance across the companies in the portfolio. In terms of financial metrics, the portfolio exhibits a broad range of market capitalizations, spanning from 796.85 million AUD to 215.69 billion AUD, with an average of approximately 32 billion AUD. This suggests a composition of both small-cap and large-cap firms, though the high standard deviation (49 billion AUD) points to a concentration of larger firms within the portfolio. This finding is particularly interesting as it contradicts existing literature on the Australian financial markets, which suggests that "SRI funds on aggregate generally tilt their portfolios towards smaller stocks" (Humphrey & Lee, 2011). This discrepancy may be attributed to the fact that the sample in this study consists of a larger proportion of large-cap companies compared to smaller firms. Additionally, larger companies may have more resources available to allocate toward ESG initiatives, potentially allowing them to meet higher ESG standards more effectively than smaller companies. Lastly, the mean total annually compounded return is 0.12, with a relatively narrow range from -0.08 to 0.30, signifying that most companies in the portfolio have delivered positive returns, although with varying degrees of success. The compounded return of 12% indicates that, overall, these positively screened companies achieve a moderate growth rate, although some negative outliers are present.

Secondly, we analyse the negative screened portfolio which employs less strict screening criteria compared to the positive screened portfolio, and this is evident in the descriptive statistics presented in Panel B. The ESG scores for this portfolio are significantly lower, with a much higher standard deviation, indicating significant variability in environmental, social, and governance performance across the companies. The portfolio's ESG scores indicate a moderate overall ethical standing among the companies included, which was expected given the screening criteria of the portfolio. The ESG Combined Score has a mean of 53.69, with a standard deviation of 12.76, suggesting that while companies generally adhere to moderate environmental, social, and governance (ESG) standards, there is considerable variation across the portfolio. A closer examination of the individual pillars reveals that the Environmental Pillar Score has the lowest average at 44.78 and the highest standard deviation of 21.63, implying significant differences in the environmental practices among companies, with some placing less emphasis on environmental issues. In contrast, the Social Pillar Score averages 58.54, indicating stronger performance in social responsibility, though a standard deviation of 16.02 suggests a moderate degree of variation. The governance pillar score averages 63.17 accompanied with a standard deviation of 16.21 indicates that companies are highly focussed on governance. From a financial perspective, the mean market capitalization of 8.52 billion AUD is notably lower than that of the positive screened portfolio. However, the portfolio's high standard deviation of 19.8 billion AUD highlights the presence of both smaller firms and a few significantly larger firms, with the distribution skewed toward the latter. Lastly, the average total return of 0.12 indicates a similar mean return compared to the positive screened portfolio. However, the broader range of returns, from -0.26 to 0.85, reveals that while some companies in the portfolio performed exceptionally well, others experienced negative returns. The relatively high standard deviation of 0.15 further reflects the varied performance outcomes within this portfolio.

Third, we analyse the statistics of the ethical screened portfolio presented in Panel C. The ESG scores across all pillars reflect the impact of the ethical screening criteria, with the ESG combined score averaging 68.42 and a standard deviation of 6.66, indicating relatively low variability in ESG performance among portfolio companies. The Environmental pillar score, with a mean of 61.72 and a standard deviation of 16.42, suggests a moderate focus on environmental sustainability, though the higher variability implies that environmental practices vary more across companies. The Social pillar score, averaging 74.33, is notably higher, demonstrating a strong commitment to social responsibility, while its standard deviation of 8.68 indicates consistency in this area. The Governance pillar score stands at 78.40, reflecting robust corporate governance practices, though there is greater variability here (standard deviation of 13.52), suggesting differences in governance standards among firms. In terms of financial metrics, the portfolio shows a wide range of market capitalizations, from 674.48 million AUD to 63.34 billion AUD, with an average market cap of 12.33 billion AUD. The high standard deviation of 19 billion AUD highlights the inclusion of both small- and large-cap companies, though there is a significant concentration of larger firms. This finding contrasts with existing literature, which typically argues that socially responsible investment (SRI) funds tend to be more heavily weighted toward smaller companies (Jitmaneeroj, 2023). The significant presence of larger companies in this portfolio may reflect their greater capacity to invest in meeting ESG standards, an advantage that smaller firms may not have to the same extent. Regarding performance, the portfolio's mean total compounded return is 0.25, being the highest of all three portfolios. Ranging from -0.02 to 0.83, indicating that most companies within the portfolio have delivered positive returns, although with some variability. The mean compounded return of 25% suggests that, overall, these ethically screened companies achieve relatively higher financial growth compared to the other screened portfolios, although there are some negative outliers.

Finally, we analyse the resulting Sharpe Ratios per portfolio, which offer insights into the performance of the different investment strategies under specific screening criteria. The positive screened portfolio, with a Sharpe Ratio of 0.9464, demonstrates strong risk-adjusted returns, notably outperforming the negative screened portfolio, which has a Sharpe Ratio of 0.5580. This suggests that the positive screening approach yields better risk-return trade-offs than the negative screening strategy. However, the ethical screened Portfolio, with a Sharpe Ratio of 0.9871, performs better than the negative screening strategy and even slightly outperforms the positive screened portfolio. These results indicate that the ethical screening approach provides the most favourable balance of risk and return among the three portfolios analysed, while the positive screened portfolio offers a moderate alternative with relatively stable and consistent returns per unit of risk, making it an appealing option for investors seeking both ethical considerations and reasonable risk-adjusted performance.

This finding is particularly significant given that the ethical screened portfolio follows strict screening criteria, which often leads to the exclusion of high-performing assets that do not meet ethical standards. Traditionally, it has been expected that such stringent criteria would result in lower performance due to a narrower selection of investment opportunities. However, the superior risk-adjusted performance of this portfolio suggests that ethical screening can effectively mitigate risk while maintaining a favourable return profile. This result contrasts with existing literature, as Fu et al. (2020) argue that ethical investing does not generally produce high Sharpe ratios. Notably, both the positive and ethically screened portfolios exhibit higher Sharpe ratios than the negatively screened portfolio, which raises the possibility that screening criteria of selecting only the top 25% ESG, may result in portfolios predominantly composed of large-cap stocks, as evidenced in Panel A and Panel C. Large-cap companies tend to face fewer risks compared to smaller growth-oriented firms and are often associated with more stable returns, which could explain the higher Sharpe ratios observed.

This unexpected outcome invites further discussion on the potential benefits of ethical investing, particularly its capacity to enhance resilience during market volatility. It underscores the importance of balancing ethical considerations with financial performance, as investors increasingly strive to align their investment strategies with personal values while still achieving competitive returns. This finding challenges the traditional view of a trade-off between ethical screening and performance, suggesting instead that ethical portfolios can deliver strong risk-adjusted returns, warranting further exploration in future research.

4.2 Risk-adjusted returns of the portfolios

This section presents the findings from the empirical analysis of the three constructed portfolios: positive screened, negative screened, and ethical screened. The performance and risk characteristics of each portfolio are evaluated through two key financial models: the Capital Asset Pricing Model (CAPM) and the Fama-French Three-Factor Model. Additionally, the results of the three difference portfolios, which provide further insight into the comparative performance of these screening strategies, will also be shown.

First, the Fama-French Three-Factor Model results will be examined. This model adds two additional factors—size (SMB) and value (HML)—to capture risks beyond market exposure, allowing for a more nuanced understanding of each portfolio's risk-return profile. The inclusion of the size and value factors will shed light on whether smaller firms or high book-to-market stocks contribute to the performance of the portfolios. Next, the CAPM regression results will be discussed, providing insights into the relationship between each portfolio's excess returns and the market returns, with a focus on the portfolios' beta and alpha coefficients. This analysis aims to understand the portfolios' exposure to market risk and the potential for generating returns independent of the market. Through these analyses, we aim to assess how the different screening strategies (positive, negative, and ethical) impact the risk-adjusted returns of the portfolios, and whether they offer any potential for excess returns beyond traditional market factors. The results will help identify the relative strengths and weaknesses of each portfolio in relation to market risk, size, and value factors, offering a comprehensive view of their financial performance.

Table 7: Regression results Fama-French three factor model
This table summarizes the regression results of the Fama-French three-factor model for the positive, negative, and ethical screened portfolios over the year 2024, with each 12 observations (signifying monthly returns). The model outputs include the alphas, which represent the excess returns of each portfolio beyond what is predicted by the model, along with the factor sensitivities to the market risk premium (Mrkt-Rf), small minus big (SMB), and high minus low (HML). The significance levels of the alphas are denoted by ***, **, and *, indicating significance at the 1%, 5%, and 10% levels, respectively. The corresponding t-statistics are provided in parentheses. Additionally, the adjusted R-squared (Adj. R^2) values indicate the proportion of variance in the portfolio returns that can be explained by the model.

SRI screening portfolios	Alpha	Mrkt-Rf	SMB	HML	Adj.R^2
Positive screened portfolio	0.0392**	0.5035***	-0.0034	0.0013	0.556
	[2.407]	[13.610]	[-1.947]	[1.430]	
Negative screened portfolio	0.0598***	0.8798***	-0.0007	0.0017**	0.811
	[4.597]	[21.595]	[-0.505]	[2.411]	
Ethical screened portfolio	0.0287	0.5944***	0.0025	-0.0031	0.637
	[0.824]	[11.295]	[0.678]	[-1.617]	

Analysing Table 7, we first look at the positive screened portfolio, which shows a statistically significant alpha of 0.0392 at the 5% level ($p < 0.05$), with a t-statistic of 2.407. This indicates that, after controlling for market, size, and value factors, the positive screened portfolio generates significant positive abnormal returns. The rejection of the null hypothesis (H0) is supported by these results, confirming that positive screening does indeed contribute to higher abnormal returns. Therefore, the findings support the alternative hypothesis (H1), suggesting that incorporating positive screening into portfolios can lead to superior performance in terms of abnormal returns within the Australian financial markets. Moreover, the market excess return (Mrkt-Rf) has a significant positive coefficient of 0.5035 ($p < 0.01$), indicating a strong sensitivity to the overall market. The negative coefficient on the SMB factor is not significant (-0.0034, $p > 0.10$). Thus, suggesting that the portfolio is not significantly influenced by size. The HML factor, which reflects the value vs. growth tilt, is also not statistically significant (0.0013, $p > 0.10$), indicating no strong preference for either value or growth stocks. The adjusted R-squared for the model is 0.556, meaning that approximately 55.6% of the variance in portfolio returns is explained by the model.

A related study investigating the financial performance of socially responsible investment (SRI) funds employing positive screening methods within the Australian financial markets found that these funds tended to underperform relative to the broader market (Jones et al., 2008). Given that both studies focus on the same market context, the contrasting findings warrant closer examination and highlight an intriguing discrepancy in the existing literature. The results of this research, which demonstrate that portfolios utilizing positive screening can generate significant abnormal returns, contribute meaningfully to the ongoing debate regarding the effectiveness of positive screening as a strategy for enhancing investment performance. This divergence in outcomes not only enriches the academic discourse but also opens avenues for future research. Subsequent investigations could delve deeper into the specific factors that influence the financial performance of SRI funds, particularly for investors inclined to adopt a positive screening approach yet hesitant about its potential financial benefits. By providing additional evidence and insights, future studies may empower investors to make more informed decisions regarding their investment strategies, ultimately fostering a better understanding of the interplay between ethical considerations and financial returns.

Next, we analyse the negative screened portfolio, which exhibits an even larger alpha of 0.0598, highly significant at the 1% level ($p < 0.01$) with a t-statistic of 4.597. This alpha is larger than that of the positive screened portfolio, suggesting that the exclusion of certain stocks based on negative criteria may lead to higher returns. Consequently, the null hypothesis (H0) can be rejected, and the alternative hypothesis (H1) is supported, indicating that negative screening does indeed lead to higher abnormal returns in the Australian financial markets. Furthermore, the market excess return coefficient for the negative screened portfolio is notably high at 0.8798 ($p < 0.01$), significantly exceeding the coefficient observed for the positive screened portfolio, indicating strong sensitivity to overall market movements. In contrast to the positive screened portfolio, only the HML factor is statistically significant in the negative screened portfolio, with a value of 0.0017 and a t-statistic of 2.411, meeting the 5% significance level. This positive HML coefficient suggests a preference for growth-oriented investments over value stocks. The SMB factor, with a value of -0.0007 and a t-statistic of -0.505, is not statistically significant, indicating no meaningful tilt towards or against small-cap stocks in this portfolio. The adjusted R-squared for this portfolio is 0.811 suggesting that 81.1% of the variation in returns is explained by the model. While Trinks & Scholtens (2017) argue that negative screening leads to opportunity costs and can lead to under- performance, and Amon et al. (2021) argue that negative screening of fossil fuel firms does not significantly impact portfolio performance. The findings of this study are very interesting as they go so far as to conclude that negative screening can lead to positive abnormal returns. So, the findings of this research bring other literature in question and contributes to the literature by providing evidence in Australian financial markets. Furthermore, this study lays the groundwork for future investigations into the financial implications of negatively screened portfolios, encouraging scholars and practitioners alike to explore the factors that may enhance performance and inform investment decisions in the realm of socially responsible investing.

Moreover, we analyse the ethical screened portfolio, which combines both positive and negative ESG criteria, presents a different picture. With an alpha of 0.0287, this portfolio's returns are not statistically significant ($p > 0.10$), as reflected by a t-statistic of 0.824. This suggests that the ethical screening criteria does not lead to significant outperformance compared to the market expectations. The market factor has a large and highly significant positive coefficient (0.5944, $p < 0.01$), indicating strong sensitivity to market movements, similar to that of the positive screened portfolio but much lower than the negative screened portfolio. As a result, the null hypothesis (H0) cannot be rejected for this portfolio, and there is no evidence to support the alternative hypothesis (H1). This finding indicates that, within the Australian financial markets, ethical screening does not yield higher abnormal returns. Moreover, the SMB factor (0.0025, t-statistic = 0.678) and the HML factor (-0.0031, t-statistic = -1.617) are not statistically significant ($p > 0.10$), implying that the ethical screened portfolio does not exhibit a strong preference for either large or small-cap stocks, nor does it show a distinct tilt towards value or growth investments. The adjusted R-squared for this portfolio is 0.637 suggesting that 63.7% of the variation in returns is explained by the model. These findings align with the existing literature indicating that ethical screening does not significantly enhance portfolio value and may, in fact, contribute to underperformance relative to the market (Auer, 2016; Trinks & Scholtens, 2017). This research reinforces the notion that investors should exercise caution when attempting to combine positive and negative screening approaches. The integration of both methods may result in an overly stringent exclusion process, which could lead to the forfeiture of high-return stocks that, while potentially less ethical, may offer substantial financial benefits. Thus, this study highlights the importance of critically evaluating the implications of screening strategies in socially responsible investing, suggesting that a more selective approach could optimize portfolio performance without compromising ethical objectives.

In summary, both positive and negative screened portfolios generate strong significant positive abnormal returns, with the negative screened portfolio exhibiting the highest alpha. This finding may encourage investors aiming to maximize financial performance to consider adopting negative screening methods. By filtering out companies with poor environmental, social, or governance (ESG) scores, investors can mitigate exposure to firms with substantial reputational, regulatory, or operational risks. Conversely, the results of this study underscore that positive screening presents a valid alternative for investors who prioritize ethical alignment. Although the financial returns associated with positive screening may not reach the levels observed with negative screening, this approach enables investments that resonate with values such as social responsibility and environmental stewardship. This insight implies that investors might choose positive screening when they place greater importance on ethical considerations rather than purely financial metrics, ensuring that their portfolios are aligned with broader ESG objectives while still achieving favourable returns. For both individual and institutional investors with ESG mandates, this research provides critical evidence regarding the financial outcomes linked to various screening strategies. For instance, investors deeply committed to ethical investing can now make more informed decisions on how to align their portfolios with their values while still securing competitive financial returns. The findings empower investors to assess whether positive screening, which focuses on identifying high-performing ESG firms, or negative screening, which excludes firms with poor ESG scores, is more suitable given their financial goals and ethical priorities. This is particularly beneficial for investors who may be apprehensive about potential trade-offs between ethical investing and financial performance. With clear evidence on the relative financial impacts of these strategies, investors are better positioned to make informed decisions that strike a balance between achieving returns and upholding social responsibility.

Table 8: Performance of SRI portfolios using the CAPM model

This table illustrates the CAPM model alphas for the positive, negative and ethical screened portfolios. Additionally, it provides the difference portfolios between each SRI portfolio. The significance levels of the alphas are denoted by ***, **, and * indicating significance at the 1%, 5%, and 10% levels, respectively. The associated t-statistics are shown in the parentheses.

SRI portfolios	Alpha
Positive screened portfolio	0.0676*** [5.424]
Negative screened portfolio	0.0764*** [9.476]
Ethical screened portfolio	0.1087 [1.628]
Difference portfolio $_{(P-E)}$	0.0270 [0.569]
Difference portfolio $_{(N-P)}$	0.0185** [1.987]
Difference portfolio $_{(E-N)}$	-0.0071 [-0.217]

Analysing the results generated using CAPM model portrayed in Table 8, we find that the positive screened portfolio yields a significant alpha of 0.0676, with a t-statistic of 5.424 ($p < 0.01$), suggesting that there is enough evidence to conclude that incorporating positive screening strategies yield higher abnormal returns in the Australian financial markets. The significant alpha suggests that incorporating ESG factors into investment decision-making may lead to outperformance, indicating that investors seeking socially responsible strategies can opt for a positive screening approach. This finding indicates that the positive screened portfolio yields significant positive abnormal returns when considering solely the market factor as well as when additional factors such as the value and size factors are considered.

The negative screened portfolio shows a significant alpha of 0.0764, with a t-statistic of 9.476 ($p < 0.01$), indicating that this portfolio generates a statistically significant positive abnormal return. This result suggests that negative screening, which excludes companies based on undesirable ESG characteristics, produces higher abnormal returns compared to positive screening. Supporting Hypothesis 2, which states that portfolios incorporating negative screening strategies yield higher abnormal returns. The superior performance of the negative screened portfolio may be attributed to the exclusion of companies that are more likely to face regulatory challenges, reputational damage, or financial instability due to their ESG risks. Investors who employ negative screening are not only avoiding companies with poor ESG practices but also potentially reducing exposure to financial risks, leading to enhanced returns.

The ethical screened portfolio does not exhibit a statistically significant alpha (0.1087, $p > 0.10$), indicating that there is no evidence of abnormal returns after controlling for market, size, and value factors. This result suggests that ethical screening, which attempts to balance both inclusion and exclusion based on ESG factors, does not lead to significant abnormal returns. The lack of significance in the alpha value indicates that ethical screening does not offer the same financial benefits as negative screening. Thus, this finding does not support Hypothesis 3, which hypothesizes that portfolios incorporating ethical screening strategies yield higher abnormal returns. Suggesting that the combination of both positive and negative ESG criteria may dilute the potential financial impact of these strategies. While ethical screening reflects a balanced approach to responsible investing, the absence of significant abnormal returns implies that this strategy may not provide a distinct financial advantage over traditional investment strategies in the Australian market.

Additionally, the difference portfolios offer valuable insights into the relative performance of the various screening strategies employed. The difference between the negative and positive screened portfolios (N-P) is 0.0185, with a t-statistic of 1.987, indicating that the negative screened portfolio significantly outperforms the positive screened portfolio at the 5% level ($p < 0.05$). This positive alpha suggests that while both strategies yield positive abnormal returns, the negative screening approach has a more pronounced positive impact on portfolio performance. This result emphasizes the effectiveness of negative screening as a strategy for generating abnormal returns, aligning with Hypothesis 2. Moreover, the difference between the positive and ethical screened portfolios (P-E) reveals an alpha of 0.0270 with a t-statistic of 0.569, which is not statistically significant ($p > 0.10$). Although this result does not reach significance, it suggests a potential trend where the positive screened portfolio may perform slightly better than the ethical screened portfolio. However, the lack of statistical significance indicates that any advantage of positive screening over ethical screening is not robust. Lastly, the difference between the ethical and negative screened portfolios (E-N) shows an alpha of -0.0071 with a t-statistic of -0.217, which is also not statistically significant. This finding suggests that the ethical screened portfolio does not significantly outperform the negative screened portfolio.

In summary, these findings show that both positive and negative screening strategies contribute to significantly higher abnormal returns, with negative screening having the most significant impact. Ethical screening, however, does not lead to statistically significant abnormal returns, suggesting that a balanced approach to ESG factors may not be as financially effective as a focused inclusion or exclusion strategy. This finding contradicts the findings of the study from(Auer, 2016) who suggest that investors can implement ethical screening without sacrificing performance, and in some cases, may even achieve higher returns. These contradicting results present an interesting opportunity for future investigation on the influence of ethical screening has on the financial returns of portfolios. These results have important implications for investors and portfolio managers. Investors who prioritize financial performance alongside ESG criteria may find negative screening to be the most effective strategy, as it not only aligns with responsible investing principles but also maximizes abnormal returns. For those who adhere to stricter ESG standards, the positive screening approach is a viable option, as it also delivers positive abnormal returns, albeit to a lesser extent. Ethical screening, however, may not offer a distinct financial advantage. Ultimately, the findings suggest that carefully selecting or excluding companies based on ESG factors can enhance portfolio performance, particularly when negative screening is applied.

According to the literature, the negative screening approach typically excludes industries involved in activities that are considered detrimental to ESG considerations. These industries often include Oil, Gas & Consumable Fuels, Metals & Mining, Chemicals, and Paper & Forest Products(Trinks & Scholtens, 2017). However, our analysis reveals that not all these industries, which are typically labelled as the most harmful in ESG terms, had the lowest combined ESG scores. For instance, the chemicals industry had an ESG score higher than average, and Metals & Mining performed better than expected, with almost 20 other industries scoring lower in terms of overall ESG performance (Figure 9). When analysing individual ESG pillars for each industry, we found a more diverse set of industries with low scores (Figure 10,11,12 in the appendix). Health Care REITs consistently had the lowest scores across all ESG pillars, followed closely by the Machinery industry, which ranked second lowest in nearly every pillar. The Paper & Forest Products industry, as suggested by the literature, also scored poorly across all pillars, including the combined ESG score, aligning with existing research.

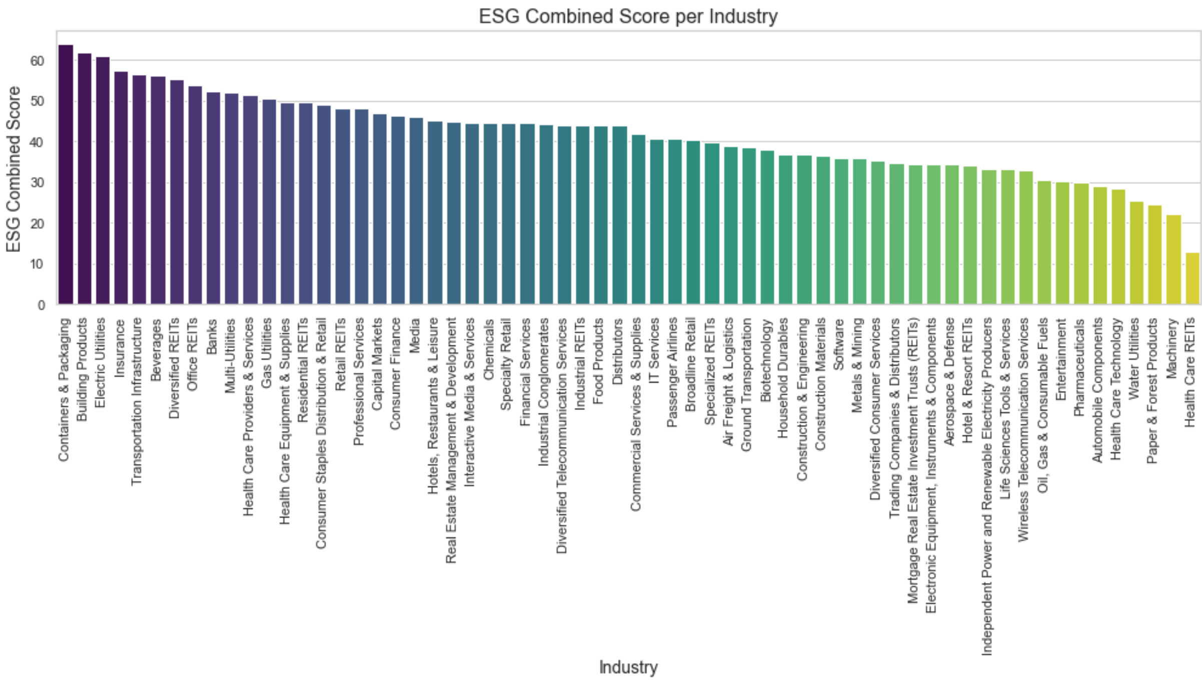


Figure 9: ESG combined Score per Industry
This figure presents the combined ESG scores across various industries, providing a comparative analysis of Environmental, Social, and Governance performance. The combined score reflects the aggregated ESG performance of companies within each industry, highlighting the sectors with the highest and lowest levels of sustainability practices.

Based on these findings, the industries that should be considered for exclusion under a negative screening approach, according to ESG performance, include Health Care REITs, Machinery, and Paper & Forest Products. These results provide new evidence in the ongoing debate over which industries are truly harmful from an ESG perspective, considering both individual pillar scores and the overall combined ESG considerations. This analysis highlights the need for a more nuanced understanding of industry-specific ESG impacts in the context of negative screening strategies.

5. Conclusion

This study aimed to identify whether screening strategies could contribute to higher abnormal returns, particularly in the context of Australia's financial markets. While much of the existing literature focuses on dominant markets such as the U.S., Europe, and China, this research expands the narrative, addressing a crucial gap by investigating the potential of responsible screening methods in an evolving market. Building on a theoretical shift from traditional two-dimensional risk-return models to the more holistic risk/return/ESG framework proposed by scholars such as Pedersen et al. (2021) and Steuer & Utz (2023), this study applied rigorous quantitative methods, including the Capital Asset Pricing Model (CAPM) and the Fama-French three-factor model. These analyses examined the financial implications of applying various ESG screening thresholds to investment portfolios.

The findings provide compelling evidence of the effectiveness of screening methods in enhancing portfolio performance. Both positive and negative screening strategies were associated with significant positive abnormal returns, with negative screening emerging as particularly advantageous, generating the highest alpha. These results underscore the financial viability of responsible investing, demonstrating that portfolios guided by ESG criteria can outperform those without such considerations. Negative screening, in particular, revealed its potential to mitigate financial risks by excluding companies with low ESG scores, whereas positive screening favoured stable returns and higher ESG standards, evidenced by a favourable Sharpe ratio. Ethical screening further contributed to the conversation by achieving the highest compounded total returns, challenging the conventional notion that stringent ESG filters constrain financial performance. However, the ethical screened portfolio did not retrieve significant positive abnormal returns as compared to the other screened portfolios. These insights emphasize that the choice of screening strategy depends on the investor's priorities, whether they focus on financial performance, ethical values, or a balanced approach.

By integrating these findings, this research advances theoretical understanding and practical application in the field of responsible investing. The validation of the three-dimensional risk/return/ESG model highlights the importance of aligning investment practices with sustainability objectives while maintaining competitive returns. It also reinforces the growing relevance of ESG integration in portfolio optimization strategies, particularly as Australia's financial markets increasingly adopt responsible investing principles. The study's emphasis on regional market conditions further underscores the necessity of tailoring ESG strategies to local contexts, illustrating the dynamic interplay between financial performance and ethical considerations.

Looking ahead, this research paves the way for further exploration of ESG's role in diverse market environments. Future studies could extend this work by examining the long-term sustainability of different screening strategies across various asset classes and market conditions. Additionally, sector-specific analyses could identify industries where ESG factors are particularly impactful, enabling more targeted and effective screening practices. Exploring these areas would not only deepen our understanding of responsible investing but also support the broader implementation of ESG principles in investment strategies worldwide.

To sum up, this study bridges a significant gap in the literature by demonstrating that ESG screening can enhance financial performance without compromising ethical standards, particularly within Australia's financial markets. By challenging the perceived trade-off between profitability and sustainability, the findings affirm that these objectives are not mutually exclusive. This research provides both a practical guide for investors and fund managers and a theoretical foundation for future research, highlighting the potential of ESG-based screening to align financial objectives with broader sustainability values.

6. Limitations

As with any empirical analysis, this study faces several limitations that should be acknowledged. One of the primary limitations concerns the comparison of the three portfolios, each of which has a different sample size due to the distinct screening processes used. These portfolios apply varying criteria for asset inclusion which results in differing numbers of assets in each portfolio. This discrepancy in sample size can affect the comparability of the portfolios, potentially introducing bias or causing certain asset characteristics to be unequally represented. In general, larger sample sizes provide more reliable statistical inferences, while smaller samples may introduce greater variability, reducing the robustness of the findings. Consequently, the difference in sample sizes could influence the overall performance metrics, such as returns and risk measures, and may impact the conclusions drawn regarding the financial effects of various ESG screening strategies. Future research could address this limitation by standardizing the portfolio construction process or ensuring more comparable sample sizes across the different screening categories.

Another limitation relates to the data used in the analysis. The data was sourced from Refinitiv Eikon, which is a highly regarded and widely used platform. However, the results might vary if data from other providers, such as Bloomberg, were utilized. Different data providers may have slight variations in both financial and ESG metrics, leading to potential discrepancies in the results. Furthermore, although this study used a longer time horizon of approximately five years to capture a broad spectrum of market conditions, I encountered a notable issue with the availability of ESG data. While Refinitiv Eikon provided robust historical financial data, it lacked comprehensive historical ESG data, particularly for the earlier part of the period analysed. This limitation is significant, given that ESG factors are central to this study. The lack of historical ESG data is somewhat expected, as ESG reporting, and analysis have only gained prominence in more recent years. ESG information was not as widely tracked or standardized a decade ago as it is today, which may have affected the accuracy and completeness of the analysis for the earlier part of the study period.

7. References

Al Ayoubi, K., & Enjolras, G. (2022). Does disinvestment from fossil fuels reduce the financial performance of responsible sovereign wealth funds? *Journal of Multinational Financial Management*, *64*. https://doi.org/10.1016/j.mulfin.2022.100731

Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science*, *65*(10), 4451–4469. https://doi.org/10.1287/mnsc.2018.3043

Amon, J., Rammerstorfer, M., & Weinmayer, K. (2021). Environmental portfolios—evidence from screening and passive portfolio management. *Sustainability (Switzerland)*, *13*(22). https://doi.org/10.3390/su132212647

Arciniegas-Alarcón, S., García-Peña, M., Rengifo, C., & Krzanowski, W. J. (2021). Techniques for robust imputation in incomplete two-way tables. *Applied System Innovation*, *4*(3). https://doi.org/10.3390/asi4030062

Auer, B. R. (2016). Do Socially Responsible Investment Policies Add or Destroy European Stock Portfolio Value? *Journal of Business Ethics*, *135*(2), 381–397. https://doi.org/10.1007/s10551-014-2454-7

Avramov, D., Cheng, S., Lioui, A., & Tarelli, A. (2021). Sustainable Investing with ESG Rating Uncertainty. *Journal of Financial Economics*, *145*(2).

Bertelli, B., & Torricelli, C. (2024). The trade-off between ESG screening and portfolio diversification in the short and in the long run. *Journal of Economics and Finance*. https://doi.org/10.1007/s12197-023-09652-9

Díaz, A., Escribano, A., & Esparcia, C. (2024). Sustainable risk preferences on asset allocation: a higher order optimal portfolio study. *Journal of Behavioral and Experimental Finance*, *41*, 1–15. https://doi.org/10.1016/j.jbef.2024.100887

Dimson, E., Marsh, P., & Staunton, M. (2020). Divergent ESG Ratings. *The Journal of Portfolio Management*, *47*(1), 75–87. https://doi.org/10.3905/jpm.2020.1.175

Do, T. K. (2021). Socially responsible investing portfolio: An almost stochastic dominance approach. *International Journal of Finance and Economics*, *26*(1), 1122–1132. https://doi.org/10.1002/ijfe.1840

Dumitrescu, A., Järvinen, J., & Zakriya, M. (2023). Hidden Gem or Fool's Gold: Can passive ESG ETFs outperform the benchmarks? *International Review of Financial Analysis*, *86*. https://doi.org/10.1016/j.irfa.2023.102540

Dupre, D., Girerd-Potin, I., & Kassoua, R. (2005). Adding an Ethical Dimension to Portfolio Management. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.394101

Durrant, G. B. (2009). Imputation methods for handling item-nonresponse in practice: methodological issues and recent debates. *International Journal of Social Research Methodology*, *12*(4), 293–304. https://doi.org/10.1080/13645570802394003

Esparcia, C., Diaz, A., & Alonso, D. (2023). How important is green awareness in energy investment decisions? An environmentally-based rebalancing portfolio study. *Energy Economics*, *128*. https://doi.org/10.1016/j.eneco.2023.107174

Fu, Y., Wright, D., & Blazenko, G. (2020). Ethical Investing Has No Portfolio Performance Cost. *Research in International Business and Finance*, *52*. https://doi.org/10.1016/j.ribaf.2019.101117

Gao, J., Hartmann, F. G. H., Zhang, M., & Chen, Y. (2023). The impact of CSR performance and CSR disclosure readability on investors' earnings estimates. *Accounting and Finance*, *63*(S1), 1157–1186. https://doi.org/10.1111/acfi.12938

Giese, G., Lee, L.-E., Melas, D., Nagy, Z., & Nishikawa, L. (2019). Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance. *Journal of Portfolio Management*, *45*(5).

Humphrey, J., & Lee, D. (2011). Australian socially responsible funds: peformance, risk and screening intensity. *Journal of Business Ethics*, *102*, 519–535.

Jaafar, N. N., Rosdi, M. N. A., Jamaludin, K. R., Ramlie, F., & Talib, H. A. (2024). *Imputation Analysis of Time-Series Data Using a Random Forest Algorithm* (pp. 51–60). https://doi.org/10.1007/978-981-99-8819-8_4

Jensen, M. C. (1968). The Performance of Mutual Funds in the Period 1945-1964. *The Journal of Finance*, *23*(2), 389–416. https://doi.org/10.2307/2325404

Jensen, M. C., Black, F., & Scholes, M. S. (1972). The Capital Asset Pricing Model: Some Empirical Tests. *Studies in the Theories of Capital Markets*.

Jitmaneeroj, B. (2023). Time-varying fund manager skills of socially responsible investing (SRI) funds in developed and emerging markets. *Research in International Business and Finance*, *64*. https://doi.org/10.1016/j.ribaf.2023.101877

Jones, S., Van Der Laan, S., Frost, G., & Loftus, J. (2008). The investment performance of socially responsible investment funds in Australia. *Journal of Business Ethics*, *80*(2), 181–203. https://doi.org/10.1007/s10551-007-9412-6

Kempf, A., & Osthoff, P. (2007). The Effect of Socially Responsible Investing on Portfolio Performance. *European Financial Management*, *13*(5), 908–922. https://doi.org/10.1111/j.1468-036X.2007.00402.x

Lally, M. (2002). *DETERMINING THE RISK FREE RATE FOR REGULATED COMPANIES*.

Lee, D. D., Humphrey, J. E., Benson, K. L., & Ahn, J. Y. K. (2010). Socially responsible investment fund performance: the impact of screening intensity. *Accounting & Finance*, *50*(2), 351–370. https://doi.org/10.1111/j.1467-629X.2009.00336.x

Lin, X., & Swain, R. B. (2024). Performance of negatively screened sustainable investments during crisis. *International Review of Economics & Finance*, *93*, 1226–1247. https://doi.org/10.1016/j.iref.2024.04.001

Lintner, J. (1965a). Security prices, risk, and maximal gains from diversification. *Journal of Finance*, *20*(4), 587–615.

Lintner, J. (1965b). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *The Review of Economics and Statistics*, *47*(1), 13–37. https://doi.org/10.2307/1924119

López Prol, J., & Kim, K. (2022). Risk-return performance of optimized ESG equity portfolios in the NYSE. *Finance Research Letters*, *50*. https://doi.org/10.1016/j.frl.2022.103312

Markowitz, H. (1952). Portfolio selection. *Journal of Finance*, *7*, 77–91.

Morelli, G. (2023). Responsible investing and portfolio selection: a shapley - CVaR approach. *Annals of Operations Research*. https://doi.org/10.1007/s10479-022-05144-x

Pampaka, M., Hutcheson, G., & Williams, J. (2016). Handling missing data: analysis of a challenging data set using multiple imputation. *International Journal of Research & Method in Education*, *39*(1), 19–37. https://doi.org/10.1080/1743727X.2014.979146

Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, *142*(2), 550–571. https://doi.org/10.1016/j.jfineco.2020.12.011

Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, *142*(2), 572–597. https://doi.org/10.1016/j.jfineco.2020.11.001

Rodríguez, Y. E., Gómez, J. M., & Contreras, J. (2021). Diversified behavioral portfolio as an alternative to Modern Portfolio Theory. *North American Journal of Economics and Finance*, *58*. https://doi.org/10.1016/j.najef.2021.101508

Sandu, D.-M. (2024). The Effect of ESG Scores on Portfolio Performance. Evidence from Europe. *Proceedings of the International Conference on Business Excellence*, *18*(1), 442–450. https://doi.org/10.2478/picbe-2024-0038

Sharpe, W. F. (1964). CAPITAL ASSET PRICES: A THEORY OF MARKET EQUILIBRIUM UNDER CONDITIONS OF RISK*. *The Journal of Finance*, *19*(3), 425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Sharpe, W. F. (1994a). The Sharpe ratio. *Journal of Portfolio Management*, *21*(1), 49–58.

Sharpe, W. F. (1994b). The Sharpe Ratio. *The Journal of Portfolio Management*, *21*(1), 49–58. https://doi.org/10.3905/jpm.1994.409501

Steuer, R. E., & Utz, S. (2023). Non-contour efficient fronts for identifying most preferred portfolios in sustainability investing. *European Journal of Operational Research*, *306*(2), 742–753. https://doi.org/10.1016/j.ejor.2022.08.007

Talan, G., Sharma, G. D., Pareira, V., & Muschert, G. W. (2024). From ESG to holistic value addition: Rethinking sustainable investment from the lens of stakeholder theory. *International Review of Economics and Finance*, *96*. https://doi.org/10.1016/j.iref.2024.103530

Trinks, P. J., & Scholtens, B. (2017). The Opportunity Cost of Negative Screening in Socially Responsible Investing. *Journal of Business Ethics*, *140*(2), 193–208. https://doi.org/10.1007/s10551-015-2684-3

Tripathi, V., & Kaur, A. (2020). Socially responsible investing: performance evaluation of BRICS nations. *Journal of Advances in Management Research*, *17*(4), 525–547. https://doi.org/10.1108/JAMR-02-2020-0020

Tzouvanas, P., & Mamatzakis, E. C. (2021). Does it pay to invest in environmental stocks? *International Review of Financial Analysis*, *77*. https://doi.org/https://doi.org/10.1016/j.irfa.2021.101812

Vinutha, H. P., Poornima, B., & Sagar, B. M. (2018). Detection of Outliers Using Interquartile Range Technique from Intrusion Dataset. In *Advances in Intelligent Systems and Computing* (Vol. 701, pp. 511–518). https://doi.org/10.1007/978-981-10-7563-6_53

Yadav, S., Kumar, A., Mehlawat, M. K., Gupta, P., & Charles, V. (2023). A multi-objective sustainable financial portfolio selection approach under an intuitionistic fuzzy framework. *Information Sciences*, *646*. https://doi.org/10.1016/j.ins.2023.119379

Yaro, A. S., Maly, F., & Prazak, P. (2023). Outlier Detection in Time-Series Receive Signal Strength Observation Using Z-Score Method with Sn Scale Estimator for Indoor Localization. *Applied Sciences*, *13*(6). https://doi.org/10.3390/app13063900

Zhang, X., Zhao, X., & He, Y. (2022). Does It Pay to Be Responsible? The Performance of ESG Investing in China. *Emerging Markets Finance and Trade*, *58*(11), 3048–3075. https://doi.org/10.1080/1540496X.2022.2026768

8. Appendix

Table 9: Summary of literature

This table provides a comprehensive summary of research studies examining various screening approaches in responsible investment, the performance measures used, and their respective findings. Each entry includes the type of screening approach (e.g., negative, positive, or ESG integration), the performance metrics employed (e.g., excess return, risk-adjusted return), and the key results or conclusions drawn by the study.

Paper	Screening approach	Measure of Performance	Results
Responsible Investing: The ESG-efficient frontier (Pedersen et al., 2021)	Integration of ESG, Negative screening	Sharpe ratio	Removing the lowest ESG assets may lead Sharpe ratio-maximizing investors to select portfolios with lower ESG scores than unconstrained investors.
Sustainable risk preferences on asset allocation: a higher order optimal portfolio study (Díaz et al., 2024)	Integration of ESG	Jensen's Alpha Treynor's Ratio	Jensen's Alpha: the excess of return of the SRI portfolio is more than double the value of the traditional portfolio. Treynor's Ratio: SRI portfolio 50% higher than that obtained by the traditional portfolio and twice the value of the market portfolio.
How important is green awareness in energy investment decisions? An environmentally based rebalancing portfolio study (Esparcia et al., 2023)	Positive screening	Sharpe ratio Kappa (K) Farinelli-Tibiletti (FT)	Green investment reduces the carbon footprint and reveals a risk-return spread favouring green over brown energy, adding value for environmentally concerned investors. Portfolios in Q1 generally show a better risk-return ratio than Q4, except from July 2017 to December 2019, when poor sustainability portfolios underperformed, likely due to TCFD recommendations for transmitting and revealing financial information and greenwashing spillover effects.
Risk-return performance of optimized ESG equity portfolios in the NYSE (López Prol & Kim, 2022)	Integration of ESG factors	Sharpe ratio	Sustainable portfolios often underperform less sustainable ones, with best ESG deciles showing lower returns and volatility, resulting in lower Sharpe ratios.
Does it pay to invest in environmental stocks?	Impact/community investing	Jensen's Alpha Sharpe ratio	Firms with higher EP have higher equity valuation and lower risks, particularly idiosyncratic risk. EP firms offer favourable market

(Tzouvanas & Mamatzakis, 2021)			returns and risks, making them valuable for portfolios and contributing to economic sustainability.
The Opportunity Cost of Negative Screening in Socially Responsible Investing (Trinks & Scholtens, 2017)	Negative screening	Jensen's Alpha	Screening incurs opportunity costs, as avoiding controversial firms can lead to underperformance compared to unscreened portfolios. This trade-off between values and returns shows that screening impacts performance. Investors must decide if the 'price' is worth it.
Sustainable investing in equilibrium	Integration of ESG factors	Jensen's Alpha	Stocks of greener firms have lower ex ante CAPM alphas, especially with low risk aversion and strong ESG preference. Green stocks show negative alphas, whereas brown stocks positive. However, unexpectedly strong ESG concerns can lead green stocks to outperform brown stocks despite lower alphas.
Sustainable investing with ESG rating uncertainty (Avramov et al., 2021)	Impact investing	Jensen's Alpha	ESG rating uncertainty reduces demand for stocks, especially among ESG-sensitive investors. Brown stocks outperform green stocks only with low rating uncertainty. The negative return predictability of ESG ratings doesn't apply to other firms.
The Investment Performance of Socially Responsible Investment Funds in Australia (Jones et al., 2008)	Positive screening	Jensen's alpha	Based on returns SRI funds under-perform the key market benchmarks by between 3% and 5% over the sample period. When looking at individual funds, 67.2% of the individual funds have negative Jensen alpha values, and a further 43.1% of these values are significantly negative.
Environmental portfolios – evidence from screening and passive portfolio management (Amon et al., 2021)	Negative screening		Significant risk is explained by return differences between clean and polluting (CMP) stocks. Negative screening of fossil fuel firms does not

			significantly reduce portfolio performance. Combining negative screening with environmental-scoring-based asset allocation is viable for responsible investors, leveraging both strategies. The CMP factor in the Fama-French model shows significant factor loading in both regions, indicating a risk premium based on firms' environmental performance.
The trade-off between ESG screening and portfolio diversification in the short and in the long run (Bertelli & Torricelli, 2024)	Negative screening	Sharpe ratio Jensen's Alpha	Negatively screened portfolios significantly outperform the benchmark in terms of SR, while positively screened portfolios do not show significant long-term overperformance. All screened portfolios have higher average excess returns compared to the benchmark, but their performance is risk dependent. Neither screening strategies systematically improves short-term performance, though marginal overperformance occurs during periods of temporary financial distress.
Do Socially Responsible Investment Policies Add or Destroy European Stock Portfolio Value? (Auer, 2016)	Ethical screening	Sharpe ratio	Investors can use ethical screening without sacrificing performance, sometimes achieving higher returns. Negative screens with low cut-off rates are recommended over positive screens. An ESG screen excluding unrated stocks boosts mean returns to 0.84%, reduces volatility to 5.22%, and raises the Sharpe ratio to 0.16. Additional governance screens further enhance performance, while environmental and social screens do not add significant value but also do not reduce the benefits of the 'rated only' screen. Thus, investors can create more environmentally and socially friendly portfolios without compromising performance.

Does it pay to be responsible? (Zhang et al., 2022)	Impact investing	Jensen's Alpha	There is a non-linear relationship between ESG performance and asset returns. ESG pillars impact returns differently: environmental (E) shows a non-linear pattern, social (S) generates negative alpha, and governance (G) generates positive alpha. Good ESG performance is linked to worse future profitability (lowering firm value) and a lower cost of equity capital (increasing firm value).
Socially responsible investing and the performance of Eurozone corporate bond portfolios. (Dupre et al., 2005)	Social screening	Abnormal returns	High-rated portfolios based on Social and ESG scores yield positive and statistically significant abnormal returns at the 5% level, while low-rated portfolios exhibit neutral performance. They also present abnormal returns, except for those formed based on the Corporate Governance dimension. Overall, integrating ESG criteria into bond portfolio selection does not compromise financial performance.
Hidden Gem or Fools Gold: Can Passive ESG ETFs outperform … (Dumitrescu et al., 2023)	ESG integration	Abnormal returns	No statistically significant difference in performance between SRI ETFs and their benchmarks. Positive screening strategies, such as environmental inclusion, generated abnormal returns for SRI ETFs, with an alpha of 7.81% annually.

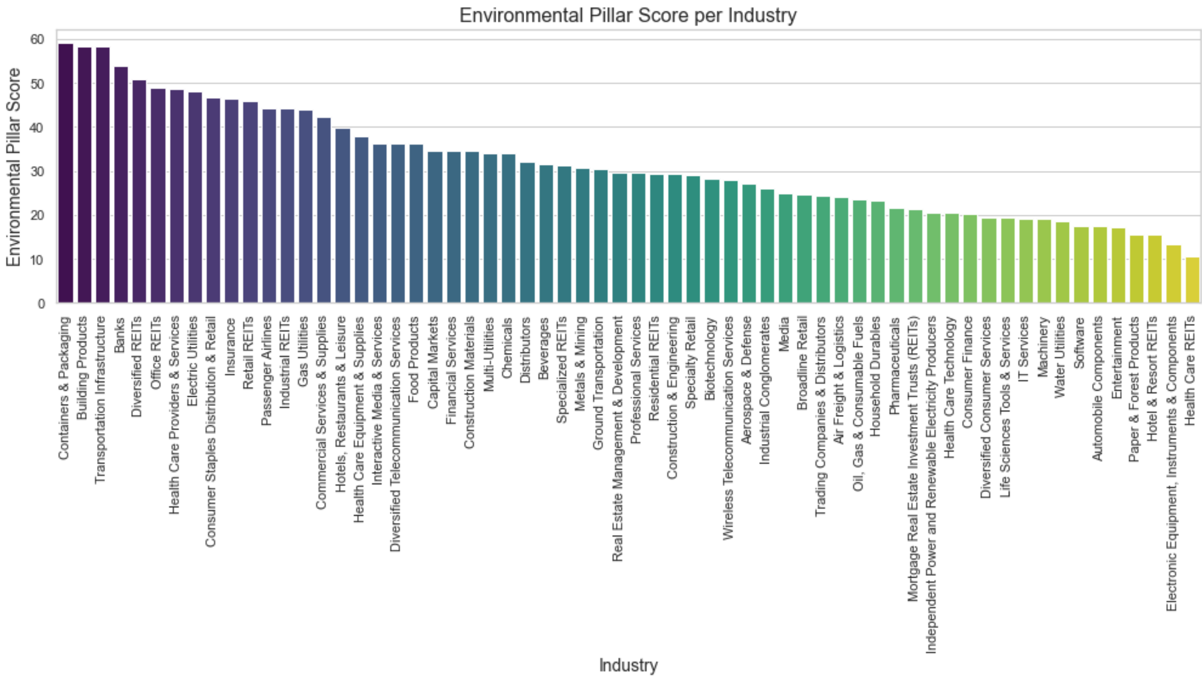


Figure 10: Environmental Pillar Score per Industry

This figure presents the Environmental (E) scores across various industries, offering a comparative analysis of sustainability practices related to environmental factors such as resource usage, emissions, and waste management. The chart highlights industry-specific performance on environmental criteria, identifying sectors with stronger or weaker environmental responsibility.

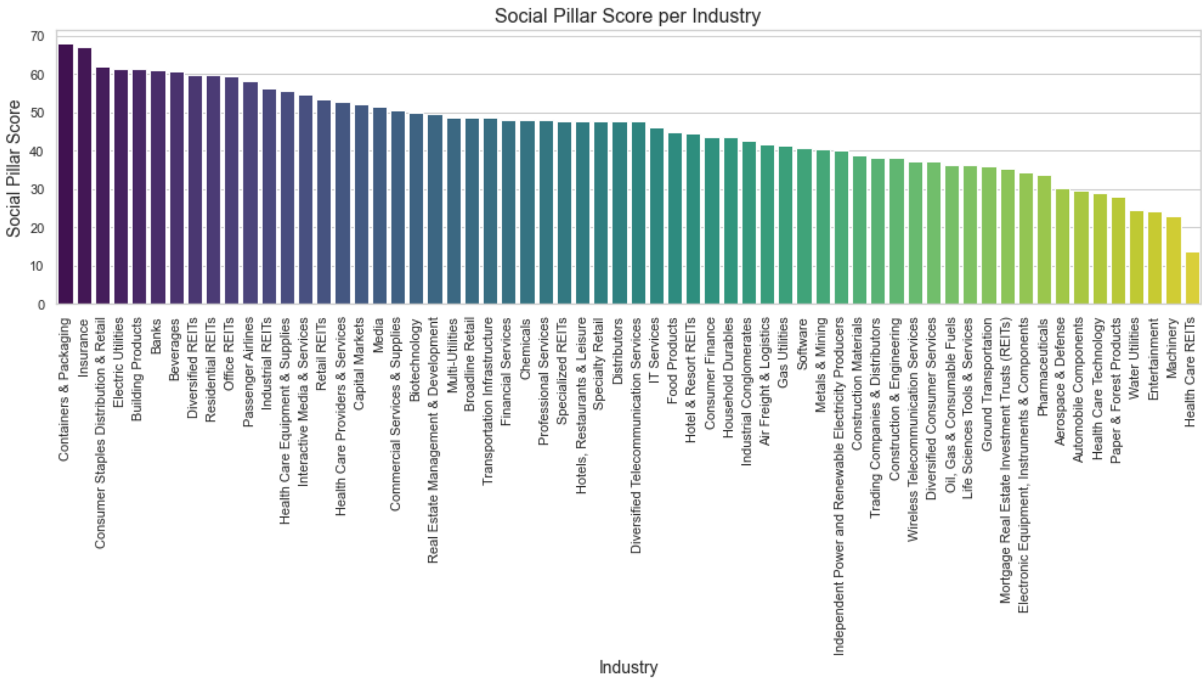


Figure 11: Social Pillar Score per Industry

This figure shows the Social (S) scores across different industries, evaluating performance in areas such as labour practices, community engagement, and human rights. The chart provides an overview of how companies within various sectors address social issues, highlighting trends and disparities in their social responsibility efforts.

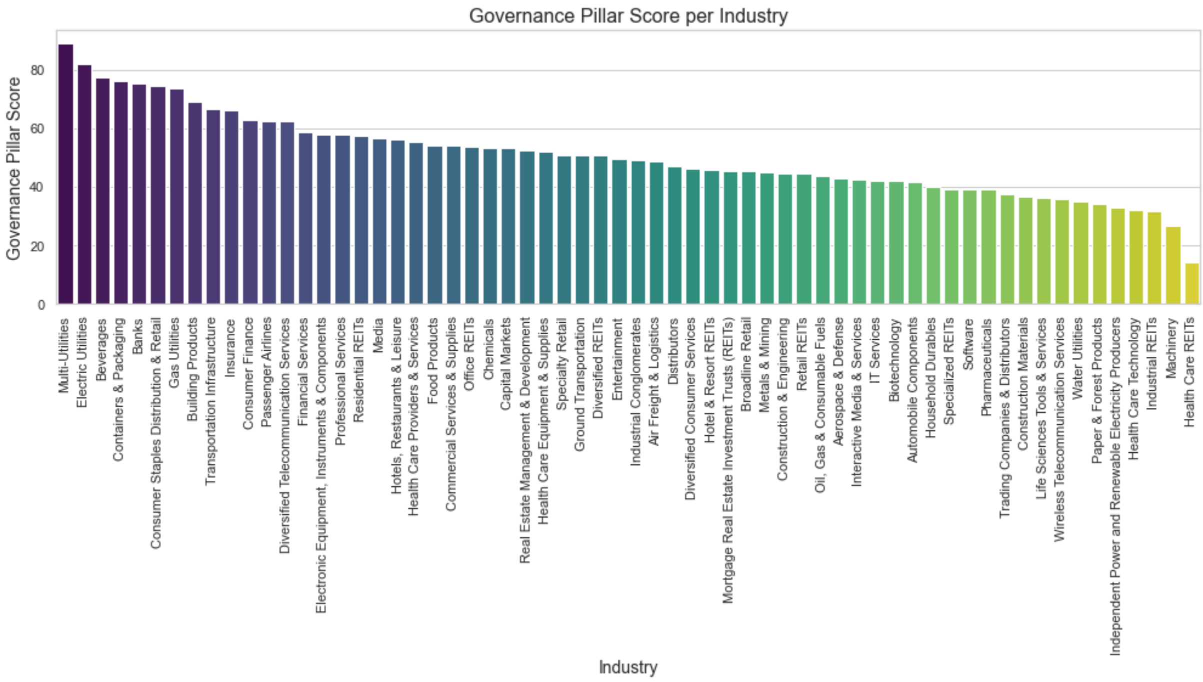


Figure 12: Governance Pillar Score per Industry
This figure presents the Governance (G) scores across industries, reflecting corporate governance practices including board structure, executive compensation, and shareholder rights. The chart offers a sector-wise comparison of governance standards, helping to identify industries with stronger or weaker adherence to good governance principles.