UNIVERSITY OF
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ESG

Balancing the Books and the Planet: A Quantitative Analysis of Risk-Adjusted Returns in ESG and Traditional Funds

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Abstract

The demand for sustainable investment has increased in the last decade. "Environmental, Social and Governance" (ESG) are characteristics within sustainable investment and are commonly considered in private investing. The purpose of this study is to analyze the risk-adjusted return between an ESG-fund portfolio and a traditional fund portfolio, during a five year time period from 2018-2023. The analysis consists of 43 ESG funds and 42 traditional funds, where the funds have been selected according to their specific rating they received from the Morningstar Sustainability Rating and geographical location. To investigate the purpose, methods such as the Fama-French three factor regression and OLS regression have been used.

In particular, we address the potential concerns of investors who invest their money in mutual funds and the research questions were as follows: 1) Does a difference exist between the risk-adjusted returns of an ESG and traditional fund portfolio? 2) How substantial is that difference and in favor of what portfolio? The findings show that there exists a difference in risk-adjusted returns between an ESG portfolio and a traditional portfolio. When investing in an ESG portfolio, the investor assumes a heightened degree of overall risk, in contrast to investing in a traditional portfolio. This due to that ESG portfolio return being on average less than the traditional return. These results could be helpful for investors when looking to diversify their portfolios while still making investments in accordance with their values.

Keywords: *Capital Asset Pricing Model (CAPM), Fama-French three-factor model, ESG, Sharpe ratio, OLS Regression Analysis, Modern Portfolio Theory*

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1. Introduction

The first chapter will present an introduction and background of the thesis subject. The background will formulate motives for the problem statement. From this presentation, the research questions and purpose are provided together with the limitations of the thesis.

ESG funds, which stand for Environmental, Social, and Governance funds, have gained significant popularity as an investment option in the past decade, primarily due to growing awareness of the detrimental social and environmental impacts caused by businesses. The fundamental objective of ESG funds is to invest in companies that prioritize sustainability, social responsibility, and ethical business practices (Yue et al., 2020). Given that these funds aim to align investors' values with their investments, it is imperative to determine whether they offer diversification benefits to investors. This research examines the risk-adjusted returns of ESG funds and traditional funds over the last five years, which holds relevance and provides a foundation for further investigation, given the escalating demand for sustainable investments prompted by climate change and other environmental risks.

Previous studies, such as the work conducted by Yue et al. (2020), have explored the potential risks associated with the increasing demand for sustainable investments. These studies incorporate models like the Capital Asset Pricing Model and the Fama-French three-factor model to analyze the subject. In a similar vein, this research investigates the risk-adjusted returns of two different fund portfolios, one consisting of 43 ESG funds and one 42 traditional funds by utilizing both Fama-French three-factor regression and Ordinary Least Squares (OLS) regression.

1.1 Background

The latest report from the Intergovernmental Panel on Climate Change (IPCC) highlights that greenhouse gas emissions have reached unprecedented levels in human history over the past decade. Urgent actions are necessary to restrict global warming to below 2°C. Financial regulators, central banks, and investors play a major role in fostering climate risk awareness and supporting the development and implementation of climate policies through heightened awareness. The financial market must actively contribute to the transition toward a more sustainable planet (IPCC, 2022).

Sustainable investment has various definitions in the literature, but a common thread among them is the growing importance of considering environmental, social, and governance factors. Climate change, increasing temperatures, and air pollution are significant factors contributing to the rising demand for sustainable investments (Yue et al., 2020). Environmental, social, and governance investing implies incorporating some form of ESG considerations into investment decisions. It is not merely a singular strategy or a distinct asset class and approaches to ESG investing may vary among investors (Grim & Berkowitz, 2020). ESG represents a set of standards that companies need to adhere to when evaluating potential investments, while also raising awareness among their customers and investors.

Morningstar, an independent American fund rating institute, employs risk, costs, and historical returns as key factors in its fund ratings. Many investors seek to incorporate ESG considerations into their investment decisions and invest in assets that align with their values. ESG screening serves as a method to satisfy ethical motivations, align investment funds with investor objectives, and mitigate investor risks (Morningstar, 2022).

1.2 Research questions and purpose

The present study aims to compare the size of the risk-adjusted returns of two different portfolios consisting of traditional funds (non-ESG) and sustainable funds (ESG) respectively. It also aims to establish dissimilarities between portfolios that incorporate or exclude ESG funds. With that purpose two research questions have been developed and are as follows:

1) Does a difference exist between the risk-adjusted returns of an ESG and traditional fund portfolio?
2) How substantial is that difference and in favor of what portfolio?

The paper aims to inform and educate regular consumers when choosing between buying ESG funds and/or traditional funds. The importance of the paper lies in regular consumers understanding how making sustainable investment choices may affect their returns and the level of risk they are taking for making a, for example sustainable fund choice.

Unlike prior literature, this paper takes a distinct perspective by prioritizing the analysis of recent data as the landscape for sustainable investing has and still is undergoing substantial changes making this paper up to date and more relevant in terms of data sampling.
Previous research undertaken by Yue et al. (2020) has centered on older datasets and increased risk due to the growing popularity of ESG funds as well as having attention centered to European data. This paper diverges from that trajectory, utilizing high-performing funds, with a solely North American focus, selected based on the large financial flows of the targeted geographic area but also emphasizes the newly collected data as the most important discrepancy from previous studies.

2. Theory framework

In the subsequent section, the theoretical framework that underpins this paper will be covered, which to a certain degree serves as the foundation for the analysis of the obtained results.

2.1 Modern Portfolio Theory

Modern portfolio theory (MPT) occupies a pivotal position within various asset pricing models, serving as the progenitor of the Capital Asset Pricing Model (CAPM) and ultimately paving the way for the Fama-French three-factor model. Devised by Harry Markowitz in 1952, this theory encompasses methodologies for diversifying and allocating assets within a financial portfolio to optimize the expected return, taking into account the owner's risk tolerance. The theory sought to mitigate idiosyncratic risk, which pertains to the inherent risk associated with a specific investment due to its distinct characteristics (Markowitz, 1952).

Markowitz's seminal work encompasses a two-stage approach to portfolio construction, with particular emphasis on the second stage as the focal point of his paper. The second stage centers on the selection of portfolios based on future expectations. Markowitz explores various investment behavior rules, commencing with the notion of maximizing discounted expected returns. However, this particular rule is ultimately dismissed due to its failure to imply the superiority of diversified portfolios. Subsequently, Markowitz considers an alternative rule that places significance on desirable expected returns and undesirable return variance. This rule exhibits greater merit and is subjected to further exploration, elucidating the intricate relationship between future beliefs and portfolio selection. Moreover, Markowitz delves into the maximization of discounted or capitalized future returns, only to conclude that this rule neglects the crucial aspect of diversification (Markowitz, 1952).
According to Markowitz, certain portfolios offer maximum expected returns for a given level of risk, and any deviation from this optimal allocation results in a diminished risk-adjusted return. This concept, widely known as the Efficient Frontier, forms the crux of Markowitz's research. Modern Portfolio Theory (MPT) suggests that rational investors, in accordance with their individual risk aversion, should invest in an efficient portfolio. A higher tolerance for risk translates into a favorable trade-off, as it yields a higher return. Consequently, the level of return is contingent upon the investor's degree of risk aversion. Markowitz underscores the significance of risk consideration and advocates for the rejection of rules that fail to support

diversification. However, it is important to note that, like many other theories, MPT relies on assumptions that may not always align with reality. Assumptions such as risk-averse investors, efficient markets, and rational investors have been criticized as unrealistic by Dr. Myles E. Mangram (2013) and Berk & Tutarli (2020).

2.2 Capital Asset Pricing Model (CAPM)

William F. Sharpe (1963) elucidated the advantages of diversification through the utilization of an index model, known as the Capital Asset Pricing Model (CAPM), thus becoming its pioneering proponent. The CAPM is a theoretical framework that predicts the association between the risk of an asset and its anticipated return. This association serves two pivotal functions. Primarily, it furnishes a yardstick for evaluating prospective investments in terms of their rate of return. Additionally, it enables the estimation of expected returns on assets that have not undergone market trading. The efficacy of the model is contingent upon two sets of underlying assumptions.

1. ***The investor behavior***
    - a. *Investors are rational, mean-variance optimizers.*
    - b. *The planning horizon will be a single period.*
    - c. *Homogeneous expectations, means that all investors have the same input lists.*
2. ***The market structure***
    - a. *All assets are publicly held and traded on public exchanges.*
    - b. *At a common risk-free rate, the investors can borrow or lend. Also, short positions are allowed.*
    - c. *There are no taxes.*
    - d. *There are no transaction costs.*

The CAPM equation is an expected return-beta relationship. This implies that asset risk premiums should be proportional to beta in the CAPM. Beta is the variable that shows how strongly the asset answers to marketwide shocks.

$$1.\quad E(r_i) = R_f + B_i\,(E(r_m) - R_f)$$

1.CAPM equation

Where:

$E(r_i)$ = *expected return on asset i*

R_f = *risk-free rate of return*

B_i = *beta value for asset i*

$E(r_m)$ = *average return on the capital market*

The sum of the risk-free rate of return (the value in money over time) plus a risk premium (like compensation for the insecurities about the investment returns) shows the total expected rate of return (Bodie et al., 2022). The CAPM model is not as applicable in this study as it excludes important factors, but is relevant for further theory review such as the Fama-French three-factor model, which is a development of the CAPM.

2.3 Fama-French three-factor model

The three-factor model, developed by Eugene Fama and Kenneth French (1993), constitutes an expansion of the Capital Asset Pricing Model (CAPM) and aims to provide a more comprehensive explanation of stock returns. This model incorporates additional risk factors beyond market risk, including value and size risks, to account for the observed variations in stock returns. The three factors in this model are book-to-market value, size of firms, and excess return on the market. Additional variables such as profitability and investment are added to the newer five-factor model (Fama & French, 2015).

The book-to-market value factor, or HML, reflects the difference between high book-to-market ratio and low book-to-market ratio stocks. This factor captures the value risk premium that value stocks offer over the market, with the assumption that value stocks outperform growth stocks. The value risk premium is the excess return generated by value stocks over growth stocks.

The size of firms factor, or SMB, reflects the difference between small-cap and large-cap stocks, with the expectation that smaller firms offer higher returns as they are more exposed to market frictions and risks. Finally, the excess return on the market factor Rm-Rf, or alpha, captures the degree to which a portfolio's actual return deviates from its expected return based on the three factors (Womack & Zhang, 2003).

The three-factor model has become a popular tool in empirical asset pricing research, as it allows for a more nuanced understanding of stock returns and the underlying factors driving them. Moreover, the model has been the subject of numerous empirical studies such as Nofsinger & Varma (2014), Bauer et al. (2006), and Kreander et al. (2005) that have supported its effectiveness in explaining the cross-sectional variation of stock returns. As such, it has played a key role in shaping the field of asset pricing and has advanced our understanding of the sources of systematic risk in financial markets.

2.4 Morningstar Sustainability Rating

The Morningstar Sustainability Rating employs a methodology for gauging the extent of environmental, social, and governance (ESG) risks associated with a fund, relative to other funds, utilizing a rating system. This rating system serves as a tool for investors to evaluate portfolios based on their environmental, social, and governance attributes. The rating itself is represented by a scale of 1 to 5 “globes”, where a higher number of globes indicates a lower ESG risk, while a rating of one globe suggests a high ESG risk (Morningstar, 2021). A more comprehensive elucidation of the Morningstar Sustainability Rating and the procedural intricacies of the rating process can be found in Appendix A.

2.5 ESG and sustainable development

Sustainable investment is a broad concept with different definitions of what it can imply. But, all definitions stress the importance of including ESG factors while processes like investment valuation and traditional financial analysis are being made. ESG is a continuously evolving area within sustainable development and can within finance be described in terms such as socially responsible investing, sustainable investing, responsible investing, and thematic investing (Yue et al., 2020).

Socially responsible investing is one term when describing sustainable development within finance. It takes financial return and ethical behavior into consideration to achieve social and environmental change. With ESG criteria it is possible to evaluate investee companies´ activities from an environmental, social, and governance impact point of view (Aw et al., 2017). Sustainable investment has become a much-prioritized question in finance. To make the environment greener, many financial institutions have begun to be actively involved in the sustainability process. The main issue for the financial sectors when valuing investment strategies are the sustainability and profitability aspects (Yue et al., 2020). Bauer et al (2005) go on by claiming that ESG funds were less sensitive toward a fluctuating market which is in line with the initial claim of Yue et al. that ESG investing tends to have a smaller risk than traditional investing (2020).

2.6 IPCC

IPCC stands for Intergovernmental Panel on Climate Change and is the United Nations body for evaluating the science associated with climate change. The latest IPCC report says that since the Paris Agreement took place, the scope of financial flows from climate finance has become greater than before to fulfill the long-term goals of the Paris Agreement. Climate finance and the financial sector are much needed to enable climate-related risks and sustainable development, but also with the importance of consistent and future-caring political leadership (IPCC, 2022).

When people invest in ESG funds and sustainable investment, companies are encouraged to handle material ESG risks and are driven to accomplish net-zero emissions commitments. The investors can have different approaches but they all have the same motivations as improving investments or improving the world and avoiding negative impact (Hale, 2021).

2.7 Literature review

In the article *"Sustainable Funds' Performance Evaluation"* the authors, Xiao-Guang Yue et al. (2020), study if no additional risks in investing are created when sustainable investment is increasing in popularity. To identify various approaches to the main risk, several aspects of sustainable investments were analyzed. The study measures the performance and economic returns of sustainable and traditional funds. By using quantitative analysis, possible benefits and advantages of sustainable investment could be investigated. The used samples were compared to each other and consisted of 30 sustainable and traditional funds each. To rate different market portfolios three models were used, the Fama-French three-factor model, Capital Asset Pricing Model, and the Carhart four-factor model.

Later on, they found that the Fama-French three-factor model was the best model to explain the results of the sustainable and traditional funds' because it had the strongest explanatory power compared to the other models. Methods that were calculated and analyzed were among others Sharpe ratios, kurtosis, skewness, standard deviations, and annual returns. They did not find any clear evidence to acknowledge that sustainable funds, compared to traditional ones, could yield higher returns. However, the result of the study showed that traditional funds are riskier than sustainable funds, but the authors also point out that the risk in socially responsible assets increases together with increasing demand (Yue et.al., 2020).

With this review, we would like to continue investigating sustainable and traditional funds. Instead of just studying the risk, we want to proceed by examining how the risk-adjusted return differs in ESG funds contrary to traditional funds. Another study that also has proceeded this is in the master thesis *"Differences in Risk-adjusted Return Between Conventional and Sustainable Funds - a study of the Swedish Fund Market",* where the authors examine the risk-adjusted return for conventional and sustainable funds to see if there is a difference in yield during the market crisis that arose with the Covid pandemic. Based on a quantitative study design they analyzed the funds with various evaluation models, for example, Sharpe and Treynor ratios.

In the result, they found a difference between sustainable funds and conventional funds, where sustainable funds performed the best risk-adjusted return. Both Sharp and Treynor ratios indicated that the sustainable funds recovered quicker, which means enhanced risk-adjusted returns. Sustainable funds were proven to handle risk better when responding to market changes and therefore they concluded that private investors can expect a higher risk-adjusted return when investing in sustainable funds, particularly when ESG characteristics are taken into account (Michaelsson & Svensson, 2021).

3. Methodology and data

The following section will provide the hypothesis, data collection, timeframe, choice of funds, and their criteria as well as an explanation of data and regressions.

3.1 Hypothesis

Hypothesis 1:
Ho: Significant differences between an ESG and traditional fund portfolio measured in risk-adjusted return do not exist

Ha: Significant differences between an ESG and traditional fund portfolio measured in risk-adjusted return do exist

Hypothesis 2:
Ho: Effect on Russel 1000 index does not vary significantly between an ESG fund portfolio and a traditional fund portfolio

Ha: Effect on Russel 1000 index does vary significantly between an ESG fund portfolio and a traditional fund portfolio

Hypothesis 3:
Ho: Effect of influencing factors does not vary significantly between an ESG fund portfolio and a traditional fund portfolio according to the Fama-French three-factor model

Ha: Effect of influencing factors varies significantly between an ESG fund and a traditional fund according to the Fama-French three-factor model

3.2 Data Collection

In the process of conducting the analysis, data has been sourced from reputable databases such as Refinitiv Eikon, the Morningstar Database, the U.S. Department of the Treasury, and Kenneth R. French Data Library. The dataset encompasses information on fund performances, the 5-year monthly US Treasury Rate, fund standard deviations, and data for the Fama-French regression (SMB, HML), see Appendix B. The adoption of risk-adjusted return as the key performance metric stems from the paper's emphasis on evaluating fund portfolio performance, concerning diverse risk types and levels of volatility. Notably, the Sharpe ratio has been chosen as the pertinent measurement, given its established utility in previous research studies, as elucidated by Mallin et al. (1995).

To ensure the selection of appropriate ESG funds for the study, comprehensive data on ESG ratings and other sustainability metrics has been meticulously gathered from publicly available sources. As for the risk-free rate of return which will be used in the calculation of the Sharpe ratio, the 5-year monthly US treasury rate will be used as so similarly used in previous studies by Auer & Schuhmacher (2016) and Michaelsson & Svensson (2021) who used the Swedish equivalent (2021). The risk-free rate of return is used for the calculation of risk-adjusted returns and provides a strong match for the elected 5-year timeframe which makes it highly relevant for the matched dataset. The 5-year monthly US treasury rate was sourced from the U.S. Department of Treasury database and was chosen as it constitutes a large influence on North American markets augmenting its position in terms of financial statements (2023).

It is worth mentioning that only equity funds have been included in the analysis, as bonds (except corporate bonds) and other similar investment vehicles do not exert as significant direct impact on the environment, unlike individual companies. Thus, equity funds have been deemed the most relevant investment category for this study to capture the pure effect of corporate environmental damage. Data which was collected from Morningstar and Refinitv Eikon was put together into panel data based on time series data. This was done in Microsoft Excel and consisted of 101 traditional funds and 77 ESG funds. Some of the funds did not have return data reaching back five years which led to them being removed and resulted in a smaller set of funds, 42 and 43 respectively. The chosen data was structured with 43 ESG and 42 traditional funds, see Appendix C, having monthly returns spanning from 2018-01-31 to 2023-01-31.

3.3 Timeframe and index choice

Academic research necessitates the utilization of contemporary data, particularly in the realm of sustainable investing, where the landscape has witnessed considerable transformations over the past decade. Accordingly, a 5-year timeframe spanning from 2018-01-31 until 2023-01-31 has been chosen to yield a substantial dataset that conforms to the specified criteria for funds. This temporal restriction allows for the acquisition of a robust dataset while recognizing extraneous factors such as the impact of the COVID-19 pandemic and the invasion of Ukraine on the financial markets.

Furthermore, this research recognizes the potential influence of incorporating environmental, social, and governance (ESG) funds compared to a traditional fund portfolio. The primary objective is to investigate whether a portfolio with ESG funds leads to discernible changes in risk-adjusted returns compared to traditional ones. This analysis underscores the fluidity of financial markets and the necessity of incorporating current data to ensure the accuracy and relevance of the research findings.

To analyze the performance of ESG and traditional funds, a market benchmark index, namely the Russell 1000 index, has been incorporated. This inclusion facilitates a comparison in terms of both market performance and portfolio performance. To assess the fund portfolio performance between ESG and traditional, the Russell 1000 index has been selected as a suitable benchmark with data for this spanning the same periods as for fund performance data collected (Refinitiv Eikon, 2023). This index comprises the 1000 largest companies in the United States, determined by their market capitalization. The choice of this particular index is substantiated by the fact that the data sampling for this study primarily consists of the most successful North American funds, predominantly from the United States, who tend to invest in large capitalization companies. Companies valued at more than 10 billion dollars are considered large capitalization or large-cap for short. Moreover, these funds possess substantial net asset values, which results in a strong correlation with large-cap companies, as supported by Chen (2006).

3.4 Fundchoice and criteria

The present study utilizes a sample dataset obtained from the esteemed Morningstar database, (Morningstar, 2023) and Refinitiv Eikon (Refinitiv, 2023), renowned as one of the most expansive repositories of financial data on a global scale. The criteria for defining traditional funds in the sample dataset are as follows:

1. Morningstar Sustainability Rating: A comprehensive evaluation of a fund's environmental, social, and governance (ESG) factors. Traditional funds in the sample

dataset are identified as those with a maximum of one out of five Morningstar Sustainability Rating globes, indicating a modest ESG performance.

2. Morningstar Rating: An assessment that considers risk-adjusted return and volatility. Traditional funds in the sample dataset are limited to those with the highest Morningstar rating of five stars, signifying a top-tier position among investment vehicles in terms of performance.
3. Assets Composition: Traditional funds in the sample dataset are defined as those primarily invested in stocks (equity funds) with a substantial net asset value exceeding 10 billion dollars, denoting a considerable scale of operations.
4. Market Focus: The sample dataset exclusively includes traditional funds with a predominant focus on the North American market, chosen for its substantial trade flows and liquidity, which provide ample data for analysis.

In the context of conventional funds, as denoted by Michaelsson and Svensson (2021), the present study adopts a conservative approach by establishing a sustainability rating threshold of no more than one globe out of a total of five. This deliberate choice serves multiple purposes: to distinguish the study from prior research endeavors, to explore alternative perspectives, and ultimately, to yield a different set of outcomes.

In addition, the criteria for defining ESG funds in the sample dataset are as follows:

1. Morningstar Sustainability Rating: ESG funds in the sample dataset are limited to those with the highest Morningstar Sustainability Rating of five globes, denoting an exemplary performance in terms of ESG factors.
2. Morningstar Rating: ESG funds included in the sample dataset are exclusively those with the highest Morningstar rating of five stars, reflecting exceptional market performance.
3. Assets Composition: ESG funds in the sample dataset are defined as those primarily invested in stocks (equity funds) with a substantial net asset value exceeding 10 billion dollars, indicating a considerable scale of operations.
4. Market Focus: Similar to traditional funds, ESG funds in the sample dataset are restricted to those with a predominant focus on the North American market, chosen for consistency in data analysis and leveraging the larger trade flows and liquidity in this market for robust findings.

The choice of only including top-performing funds is selective and not a randomized dataset which makes it difficult to infer from future events due to performance being of historical nature, meaning there is no insurance they will continue being top performers in the future. Numerous academic studies, such as those conducted by Naqvi et al. (2021), Reboredo et al. (2017), and Yue et al. (2020), have employed Morningstar as the primary data source for their research. This choice of utilizing Morningstar as a data collection tool lends credibility and rigor to the research, as it is supported by established scholarly literature.

3.5 Regression analysis and quantitative method

In the majority of quantitative research endeavors, the utilization of regression analysis involving independent and dependent variables are commonly employed, given its well-established approach to identifying correlation. Correlation, in this context, refers to the elucidation of the relationship for observed phenomena, as opposed to mere description (Bryman & Bell, 2015). In this particular study, the independent variables under consideration are denoted as ESG and traditional for the two separate regression equations that will be run separately with the benchmark index Russell 1000 as the dependent variable. The inclusion of both dependent and independent variables is justified by the need to establish causal relationships, which will be examined in this paper through hypothesis testing.

Skewness and kurtosis metrics are employed to quantify the risks arising from deviations of fund returns from a normal distribution, thereby giving rise to "high-moments" risks. Skewness, as a measure of asymmetry, evaluates the extent of distortion in comparison to the symmetrical normal distribution. The degree of light-tailedness or heavy-tailedness of the data relative to a normal distribution can be assessed using the kurtosis metric (Yue et al., 2020).

The definition of skewness:

$$S = \frac{1}{n} \frac{\sum_{i=1}^{n} (r_i - \bar{r})^3}{\sigma^3}$$

2.Skewness equation

The definition of kurtosis:

$$E_k = \frac{1}{n}\frac{\sum_{i=1}^{n}(r_i - \bar{r})^4}{\sigma^4} - 3$$

3.Kurtosis equation

Where:

r_i = *the return in the period i*

$\bar{r}$ = *the mean for the returns*

n = the number of days in a year

σ = *the returns standard deviation*

The Fama-French regression, which will also be tested using the data collected, describes the fund returns in its own way using three factors; SMB, HML, and Market Risk (Yue et al., 2020). The reason for including the Fama-French three-factor model is to include other factors that might affect the expected rate of return of the funds such as those included in the model. In this paper the model aids in including the fact that smaller companies tend to outperform larger companies in the long run, and companies with a value focus perform better than those with a growth focus. Extensive studies conducted by Fama and French have demonstrated that the model can explain the majority of the returns observed in diversified investment portfolios and helps in weighting the portfolios according to the underlying assumptions of the model ie accounting for the small caps stocks outperforming the large-cap stocks (SIZE/SMB) but also the value stocks outperformance of growth stocks (HML).

$$R_{it} - R_{ft} = \alpha_{it} + \beta_1 (R_{Mt} - R_{ft}) + \beta_2 SMB_t + \beta_3 HML_t + \epsilon_{it}$$

4.Fama-French three factor equation

Where:

Rit = total return of a stock or portfolio i at time t

Rft = risk-free rate of return at time t

RMt = total market portfolio return at time t

Rit −Rft = expected excess return

RMt−Rft = excess return on the market portfolio (index)

SMBt = size premium (small minus big)

HMLt = value premium (high minus low)

β1,2 and 3 = factor coefficients

For this paper a quantitative method for analysis has been chosen as large amounts of data are being analyzed. For this quantitative method, the linear regression analysis has been deemed fit as the analysis includes identifying variables that might or do have an impact on the subject in this case risk-adjusted return. The general benefit of using regression analysis is it allows for the identification of which factors are most important, which ones to remove, and how they interact as well as where the effect comes from in contrast to for example the two-sample t-test which only tells you that a difference exists (Waller & Johnson, 2013).

3.6 Sharpe ratio

For the designated investment vehicles, the computation of the Sharpe ratio was undertaken to facilitate a more rigorous evaluation of risk-adjusted returns across the two portfolios. In the OLS regression model, the Sharpe ratio (Sharpe, 1994) assumes the role of both the dependent variable as well as the independent variables.

$$\frac{Rp - Rf}{\sigma_p}$$

5.Sharpe ratio equation

Where:

Rp = return of the portfolio/stock
Rf = risk-free rate of return (in this case the 5-year US treasury rate
σ_p *= standard deviation of portfolio/stock which is the measure of risk/volatility*

The Sharpe ratio, as described by Dowd (2000), serves as a metric for evaluating the risk-adjusted performance of an investment. It incorporates the standard deviation, the risk-free rate, and the excess return of the selected investment. Standard deviation, a statistical measure widely employed, quantifies the variability of an asset over a specified time horizon (Nelson & Witte, 2012). A higher standard deviation indicates greater volatility, implying that the investment exhibits more pronounced fluctuations compared to an investment with a lower standard deviation (ibid).

The Sharpe ratio represents a straightforward and commonly utilized approach for assessing risk-adjusted returns in the field of finance. It can be applied to various types of investments and has been employed by Ledoit & Wolf (2008) in their examination of asset performance testing, encompassing stocks, and funds.

Despite its utility in measuring risk-adjusted returns, the Sharpe ratio is not exempt from criticism. Mcleod & van Vuuren (2015), for instance, argue that while a fund with the highest Sharpe ratio may outperform the risk-free rate (e.g., the 5-year US treasury bond), it may not necessarily yield the highest excess return relative to the level of risk undertaken. The Sharpe ratio fails to discern whether the observed risk or deviation stems from upside risk or downside risk i.e. if the investment is deviating up or down. A fund that exposes itself to substantial downside risk (high risk) could yield the same Sharpe ratio as a fund characterized by significant volatility on the upside. For this, skewness has been employed to capture these upside and downside moments. Nevertheless, the inherent nature of the Sharpe ratio precludes the manifestation of such distinction (ibid).

The study will employ panel data analysis to examine fund performance returns spanning the years 2018-01-31 to 2023-01-31 using monthly data of fund performances, the Russell 1000 index benchmark performance, and the 5-year US treasury rate. Panel data refers to a dataset in which the behavior of entities (i.e., funds) is observed over a period of time. Specifically, the chosen methodology for analysis is the Fama-French three-factor regression as well as linear regression, utilizing the Ordinary Least Squares (OLS) method (Djurfeldt et al., 2018). OLS is employed to estimate the parameters of a linear regression model assuming no multicollinearity which is reasonable as there is only one independent variable and random sampling. Further assumptions of OLS are linearity, homoscedasticity, no autocorrelation and normal distribution of errors.

By minimizing the difference between observed and predicted values, or the sum of squared errors, OLS estimators are considered highly efficient in linear regression, as demonstrated by Karafiath's comparison of statistical estimators, including Weighted Least Squares (WLS) and Cochrane-Orcutt Least Squares (CLS) (1994). In the specified equations, two OLS regressions with a single independent x-variable, as well as two Fama-French three-factor regressions will be conducted separately. Homoscedasticity is also assumed, as it is one of the OLS assumptions, implying that conditional variance of the unobserved observations is expected to be constant. This approach does not allow for the inclusion of unobservable variables that remain constant over time but does not limit the ability to analyze causal dynamics, as implied by Bell and Jones (2015).

Below you find the OLS regression equation for the ESG portfolio:

$$Sharpe\ ratio_{Russell\ 1000} = B_0 + B_1 ESG + U$$

6.ESG regression equation

Where:

$Sharpe\ ratio_{Russell\ 1000}$ = The dependent variable of the regression model measured in Sharpe ratio

ESG = Monthly Sharpe ratio. A significant ESG variable shows that changes in the ESG variable correlates with changes in the Sharpe Ratio

For the traditional portfolio:

$$Sharpe\ ratio_{Russell\ 1000} = B_0 + B_1 traditional + U$$

7.Traditional regression equation

Where:

$Sharpe\ ratio_{Russell\ 1000}$ = The dependent variable of the regression model measured in Sharpe ratio.

$traditional$ = Monthly Sharpe ratio. A significant traditional variable shows that changes in the traditional variable correlates with changes in the Sharpe Ratio.

3.7 Discussion of method, sources, and assumptions

To enhance the scholarly quality of the paper, it is imperative to reinforce the validity and reliability of its content. This chapter aims to elucidate the underlying assumptions, employed data collection sources and adopted methodologies. To ensure reliability, three crucial factors have been considered, namely inter-observer consistency and stability (Bryman & Bell, 2015).

The selection of Morningstar as the primary database for data collection was deliberate. The utilization of 5-year returns as a form of data is advantageous due to its inherent resistance to manipulation. These returns directly reflect the quantitative performance of funds, leaving little room for subjective interpretation or potential interference, thereby mitigating inter-observer issues (ibid).

However, it is important to acknowledge the inherent bias in Morningstar's sustainability rating and Morningstar's risk rating concerning the collected funds. Nevertheless, the decision to employ this well-established and widely utilized system was made due to its recognized status as an international standard for measuring sustainability and risk in financial investments.

Moreover, the collection of the monthly 5-year treasury rate was sourced from the Refinitiv Eikon database. This particular data, being quantitative in nature, provides a robust foundation for analysis and is difficult to tamper with, rendering it highly reliable. The regression analyses were executed multiple times using Microsoft Excel to ensure consistent and dependable outcomes. In addition to these methodological considerations, the present study draws upon previous research, studies, and well-recognized theories and models. By incorporating these established frameworks, the paper strengthens the theoretical underpinnings and overall foundation of the research endeavor (Bryman & Bell, 2015).

The utilized global Fama-French factors encompassed developed economies and were predicated on returns expressed in US dollars, as sourced from Kenneth R. French's Data Library. The computational undertaking of deriving the Fama-French factors in this particular thesis extends beyond its purview due to its advanced nature. Consequently, the decision was made to employ the factors provided by Kenneth R. French library.

This selection restricts the analysis to returns denominated in US dollars, as alternative currencies cannot accommodate the utilization of Fama-French factors. The adoption of US dollars as the currency of reference in turn dictates the selection of a risk-free rate, with the 5-year US treasury rate being consistently employed. Therefore, the chosen variables shape the perspective of an investor utilizing US dollars.

3.8 Explanation of data

To compare the Sharpe ratios of traditional and ESG portfolios, there is a need to analyze their average returns over each month. This involves combining the returns of all the funds in each portfolio to obtain a single value for each month during the five-year period. Let's take the ESG portfolio as an example. It consists of 43 funds, and we have recorded their monthly returns 60 times, resulting in 2580 observations in total. These observations span from January 31, 2018, to January 31, 2023. To illustrate, let's focus on the date of January 31, 2018. For this specific month, we calculate the average return of the 43 ESG funds and treat it as a single value for the row corresponding to January 31, 2018. This process is repeated for all the months in both portfolios, resulting in one aggregated value for each month.

The same process is used to calculate the monthly standard deviation of the portfolios. The monthly absolute returns constitute the foundation of the Sharpe ratio calculation where the monthly five-year US treasury rate is used as well as average monthly standard deviations. The OLS regressions x-variables are the monthly Sharpe ratios (60 observations) and the Y-variables are the Russell 1000 index monthly Sharpe ratio (60 observations), also for which the five-year US treasury rate was used as well as its monthly standard deviation. For the Fama-French regression the Sharpe ratio was not used as it entails other components in its calculations.

The Fama-French factors are derived from the construction of six value-weight portfolios based on size and book-to-market ratios. SMB (Small Minus Big) represents the difference between the average return of three small portfolios and the average return of three large portfolios:

SMB = 1/3 (Small Value + Small Neutral + Small Growth) - 1/3 (Big Value + Big Neutral + Big Growth).

HML (High Minus Low) indicates the disparity between the average return of the two value portfolios and the average return of the two growth portfolios:
HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth).

Rm-Rf refers to the excess return of the market (alpha), which is the value-weighted return of all CRSP (Center for Research and Security Prices) firms incorporated in the United States and listed on the NYSE, AMEX, or NASDAQ. These firms possess a CRSP share code of 10 or 11 at the commencement of month t, along with reliable shares and price data at the start of t, in addition to dependable return data for t. The excess return data for the Fama-French regression is pre-computed by subtracting the one-month US treasury rate (obtained from Ibbotson Associates) (Kenneth French Library, 2023).

4. Results

In the following section, results from the descriptive statistics as well as the regressions will be presented. First, an overview of the values provided by Microsoft Excel is given, and then a further explanation of the numbers and their meanings. For each of the regression output illustrations, there is a reported coefficient and its p-value for each of the independent variables.

The purpose of the paper is to inform and educate regular consumers when choosing between buying ESG funds and/or traditional funds. This is by comparing the size of the risk-adjusted returns of the two different portfolios consisting of traditional funds (non-ESG) and sustainable funds (ESG).

4.1 Descriptive statistics

Table 1. Descriptive statistics ESG and traditional

ESG	**Descriptive measurements**	**Traditional**	**Descriptive measurements**
Mean Sharpe	-0,48	Mean Sharpe	-0,17
Mean return	0,92	Mean return	0,86
Standarderror	0,14	Standarderror	0,14
Median Sharpe	-0,44	Median Sharpe	-0,10
Standard deviation	1,07	Standard deviation	1,06
Variance	1,14	Variance	1,13
Kurtosis	2,25	Kurtosis	0,62
Skewness	-0,77	Skewness	-0,13
Range	6,48	Range	5,69
Minimum	-4,45	Minimum	-2,98
Maximum	2,03	Maximum	2,71
Monthly 5-year observations for 43 ESG funds	2580	Monthly 5-year observations for 42 traditional funds	2520

Based on the data presented in Tables 1 the mean provides us with an indication of the average risk-adjusted return. Table 1 shows that the ESG and traditional portfolio both had a negative mean sharpe indicating that either risk-free rate was greater than the portfolio return or that the return of the portfolios were negative. In this case the mean returns were positive but could not outperform the mean return of the risk-free rate. The standard deviation, on the other hand, offers insight into the dispersion of the dataset concerning the mean, which is high for both portfolios, as standard deviations larger than 1 are considered high. A higher standard deviation suggests a greater level of volatility, in this case also referred to as risk.

Kurtosis serves as a measure of the thickness or heaviness of the tails of a distribution, as well as the presence of outliers or extreme values. In this particular case, the data exhibits a leptokurtic distribution, as evidenced by the positive kurtosis value in table 1. The positive value suggests that the tails of the distribution are thinner, resulting in a smaller dispersion of values and a departure from a more centralized distribution around the mean, as one would observe in a normal distribution (mesokurtic) which is the case in table 1.

Skewness, which assesses the symmetry of a distribution, indicates that the distribution in question is negatively skewed. This implies that the mass of the distribution is concentrated on the right side of the curve. An interpretation of the data could be that potential deviations from the mean are going to be negative, meaning future returns could be negative in this case. It can also be inferred that there are more large positive returns and fewer small negative returns. The minimum and maximum values in the dataset reflect the lowest and highest observed values, respectively. Furthermore, the range represents the numerical difference between the smallest and largest values within the dataset. Upon further visual examination of the dataset using a scatter plot, see Appendix D, it becomes evident that the data demonstrates homoscedasticity, a finding consistent with the assertions put forth in the methodology section.

Table 2. Descriptive statistics 5-year U.S. Treasury rate

US treasury rate	Descriptive measurements
Mean	1,83
Standarderror	0,14
Median	1,71
Standard deviation	1,13
Variance	1,28
Kurtosis	-0,97
Skewness	0,23
Range	4,06
Minimum	0,21
Maximum	4,27
Monthly observations	60

In this instance, the standard deviation, as an alternative perspective, provides valuable insights into the extent of dispersion exhibited by the dataset in relation to its mean. Notably, the magnitude of the standard deviation is substantial, as values exceeding 1 are classified as significant. A heightened standard deviation implies an elevated degree of volatility. It is noteworthy that the standard deviation for the risk-free rate surpasses that of the portfolios, yet manages to surpass them in performance due to markedly superior mean returns. In the context at hand, kurtosis manifests a distribution characterized by slender tails, indicative of a flatter curve. This metric quantifies the probability of encountering extreme values within the distribution's tails, a probability that is observed to be low in this instance due to the low kurtosis value. Consequently, a more concentrated dispersion around the mean is discerned. Regarding the skewness of the data, an inference can be drawn that deviations from the mean are skewed towards the positive realm which shows that there are not that many positive large returns but more small negative returns.

Table 3. Descriptive statistics Russell 1000 index

Russell 1000 index	Descriptive measurements of Sharpe ratio
Mean	-0,16
Standarderror	0,13
Median	0,03
Standard deviation	1,05
Variance	1,11
Kurtosis	0,00
Skewness	-0,33
Range	4,81
Minimum	-2,47
Maximum	2,33
Monthly observations	60

The neutral kurtosis value suggests that the tails of the distribution are thinner, resulting in a smaller dispersion of values and has a more centralized distribution around the mean, as one would observe in a normal distribution (mesokurtic) which is the case in the Russell 1000 index in table 3. In this case one could say that the possibility of outliers are close to 0 due to the kurtosis value 0. As for the skewness the negative value indicates that there are more large positive returns and fewer small negative returns.

4.2 Regressions

Table 4. Results of the Fama-French three-factor regression

Research Object	P-value	Market-Rf Coefficient	SMB-coefficient	HML-coefficient	Adjusted R^2
ESG funds	0,33	0,09	-0,03	0,00	0,01
Traditional funds	0,00	0,75*	0,50*	0,47*	0,70

Notes: * denote significance at a 5% level

In the context of the traditional Fama-French regression analysis, it is observed that the coefficients associated with SMB (Small Minus Big) and HML (High Minus Low) exhibit positive values, thereby implying that the portfolio's performance is favorable when small stocks outperform large stocks, and when value stocks outperform growth stocks. Additionally, the p-value for the traditional Fama-French regression exhibits a level below the chosen significance level of 5 %, thus suggesting a statistically significant relationship.

Conversely, upon conducting the ESG (Environmental, Social, and Governance) Fama-French regression analysis, it is noted that no statistical significance is observed at the conventional 5% significance level. Furthermore, the Adjusted R square value, approaching zero, indicates a lack of fit for the ESG portfolio, thereby suggesting a discrepancy between the expected and observed outcomes with no significant relationship between independent and dependent variable.

The Adjusted R square of the Fama-French regressions is observed for ESG at 0,01 and for traditional it is 0,70 which provides insight into the proportion of variability in the dependent variable that can be explained by the independent variables in this particular case. It serves as a measure of the predictive power of the independent variables in explaining the observed variability in the dependent variable which was very low for ESG compared to traditional.

Table 5. Results of the OLS regression

Research object	P-value	Coefficient independent variable	Adjusted R^2
ESG funds	0,00	0,39*	0,14
Traditional funds	0,00	0,95*	0,92

Notes: * denote significance at a 5% level

For the OLS regressions, there is a significant effect at the 5 % significance level between ESG, traditional funds, and benchmark performance as shown in the regression output in Table 5.

In the OLS regression analysis with only one independent variable, the Adjusted R square is not as pertinent. However for consistency the Adjusted R square has been used for both the OLS and Fama-French regressions. In the Fama-French regression outputs, where three independent variables are used, the Adjusted R square assumes relevance. The Adjusted R square accounts for the effects and explanatory power of the independent variables, which the regular R square does not consider. Furthermore, the Adjusted R square increases as more independent variables are added, even though it may not indicate statistical significance which is important to consider (Djurfeldt et al., 2018). The aforementioned analysis demonstrates that the ESG portfolio presents a higher degree of diversification which may be owed to its reduced correlation with the Russel 1000 index, in contrast to the traditional portfolio which exhibits a R-square of 0.92. Both the Russel 1000 index and the traditional portfolio follow a nearly identical normal distribution pattern.

Upon evaluating the Sharpe ratios for the traditional portfolio and the Russel 1000 index, they exhibit considerable similarity, unlike the ESG portfolio. Our main independent variable can be concluded to be relevant and the sign is as expected. It was stated in the theory section with evidence from Bauer et al. (2005) that ESG funds were less sensitive towards market fluctuations, which is in line with the received data showing a smaller correlation to Russell 1000 index benchmark as well as the initial claim made by Yue et al. This indicates that ESG investing tends to have a smaller risk than traditional investing in terms of correlation to market but not risk defined as standard deviation of returns (2020).

5. Analysis

The subsequent chapter will present the analysis of the research paper through the utilization of multiple evaluation models. The statistical technique of regressions was used, employing the Ordinary Least Squares (OLS) method, along with the application of the French-Fama three-factor models, to determine the significance of the obtained results. Furthermore, the chapter will answer the research questions of the paper: 1) Does a difference exist between the risk-adjusted returns of an ESG and traditional fund portfolio? 2) How substantial is that difference and in favor of what portfolio?, and compare the output of data with the chosen benchmark index Russell 1000.

5.1 Limitations

While asset pricing models can serve as a sound foundation for analyzing the anticipated return of a given asset, certain underlying assumptions in the Capital Asset Pricing Model (CAPM), which represents a refined iteration of Harry Markowitz's Modern Portfolio Theory (Markowitz, 1952), have been subjected to criticism due to their implausibility, thereby undermining the model's efficacy necessitating the paper to use a more refined model based on CAPM, ie the Fama-French three-factor model, which besides market risk, includes size risk and price (Fama & French, 1993). Indeed, Raei et al. (2011) and Maiti (2020) have levied criticisms against the validity of the CAPM model, highlighting key areas of concern such as the dilution of other risks besides market risk, which serve to weaken the model's potency.

5.2 Hypotheses 1 and 2

The first null hypothesis was as follows: *Significant differences between an ESG and traditional fund portfolio measured in risk-adjusted return do not exist,* and the second null hypothesis: *Effect on Russel 1000 index does not vary significantly between an ESG fund portfolio and a traditional fund portfolio.*

In terms of performance, the ESG portfolio demonstrated an inferior Sharpe ratio of -0,48, underperforming both the traditional portfolio with a Sharpe ratio of -0,17, and the Russell 1000 index with an average Sharpe ratio of -0,16, throughout the five-year period. This entails that an investor takes a slightly larger risk (standard deviation) when investing in a pure ESG portfolio and less risk with a traditional portfolio or an index fund consisting of Russell 1000 companies. The null hypothesis for hypothesis 1 is rejected as differences do exist between risk-adjusted returns. The negative Sharpe ratios are interesting to examine as they indicate that none of the portfolios are able to outperform the risk-free rate i.e. the 5-year US treasury rate.

Inspection of Table 1 elucidates a discernible risk factor associated with the negative skewness of the Sharpe observed in the ESG portfolio, which suggests an asymmetric distribution of risk-adjusted returns. In contrast, the traditional portfolio showcases a more symmetric dataset, as evidenced by a skewness value of -0,13. Skewness serves as a diagnostic tool to discern the positioning of outliers in relation to the distribution curve, with positive skewness signifying the predominance of outliers on the right-hand side of the curve. Moreover, it can be visually observed that the mean Sharpe of the portfolios differs in which the traditional one outperformed the ESG portfolio contradicting the conclusion made by Michaelsson & Svensson (2021) that ESG funds outperform traditional ones in terms of risk-adjusted return. The normally distributed index in this case is not in line with Eugene Fama's claims that stock market returns are not normally distributed (Hagerman, 1978).

Drawing parallels to Modern Portfolio Theory (MPT), it also becomes evident that the ESG fund portfolio, characterized by a bit higher risk but smaller returns, is not in line with the fundamental tenets of MPT, which posits that higher risk should yield greater returns for which the traditional portfolio did compared to the ESG portfolio.

According to conventional economic theory, as exemplified by MPT and the seminal work of Markowitz (1952), the ability to freely select investments through diversification should enhance returns. However, when examining ESG funds, which possess a more limited range of options, one would expect them, per this foundational economic theory, to underperform traditional portfolios. Accordingly, the ESG portfolio does so in terms of risk adjusted returns. These cumulative findings do not challenge the assumptions of this fundamental economic theory but warrant further investigation and careful interpretation as the ESG landscape is constantly changing.

As seen in table 1, traditional funds experience a somewhat similar risk in terms of standard deviation which is in contrast to remarks made by Michaelsson & Svensson (2021). Furthermore, Yue et al. (2020) found that traditional funds are riskier, these remarks were not the same as those made in this paper, which exhibited almost similar standard deviations for the ESG and traditional portfolios, but lower risk adjusted return for ESG compared to traditional.

Upon careful examination of the obtained results, it can be inferred that traditional funds manifest a more favorable Sharpe ratio in comparison to ESG funds in this study. This notable outcome is attributed to the traditional funds' capacity to generate larger absolute returns while concurrently exhibiting somewhat similar standard deviations. It is worth noting that these findings are not in line with the similar assertions made by Kreander et al. (2005) as well as Bauer et al. (2006).

The statistical significance of the OLS regressions indicates that changes in the ESG/traditional portfolio correlates with shifts in the Russel 1000 index. Correspondingly, the good R-squared value for traditional signifies that the model explains a good proportion of the variability in the dependent variable Russel 1000 index for which ESG does not. The traditional variable has a positive coefficient indicating that it increases the index Sharpe by 0,95 when one unit change occurs in the independent variable. At the 5% significance level, hypothesis 2 is rejected for both the traditional and ESG regression.

5.3 Hypothesis 3

The third null hypothesis reads as follows: *Effect of influencing factors does not vary significantly between an ESG fund portfolio and a traditional fund portfolio according to the Fama-French three-factor model.*

In this instance, the Fama-French three-factor regression output for traditional presented in Table 4 exhibits an inferior Adjusted R squared value, suggesting a smaller degree of explanatory capability compared to the Ordinary Least Squares (OLS) regression. This disparity in performance could potentially be attributed to the specific independent variables incorporated in the Fama-French model, which possesses less informative explanatory characteristics. As the values are positive, it indicates that the portfolio does well when small stocks are outperforming large stocks and when value stocks are outperforming growth stocks the traditional portfolio is doing good. The Fama-French regression did not have a lot of explanatory power and was not a good fit for the ESG portfolio returns which is not in line with findings of Yue et al (2020).

The negative coefficient value for ESG shows that the ESG portfolio is not going well when small stocks are outperforming large ones (SMB) and the positive coefficient for HML indicates that the ESG portfolio is doing well when value stocks are outperforming growth stocks. The intercept shows that the ESG fund portfolio has excess returns over its benchmark. As the p-values for the ESG Fama-French regression are higher than the chosen significance level of 5 % or 0,05 the null hypothesis cannot be rejected and a statistically significant relationship does not exist for the ESG Fama-French regression meaning the effect does not vary for the ESG portfolio. The proposition posited by Fama-French, which asserts the superiority of small-cap stocks over large-cap stocks and value stocks over growth stocks is invalidated in the context of this study, as the findings demonstrate the contrary for ESG. This contradicts the values for the traditional Fama-French regression which opted for positive p-values indicating significant relationship as well as positive coefficients. Although it exhibited a negative intercept in this case meaning less return than the market. As seen in table 4, the p-values for the Fama-French regressions differ, thus at the 5% significance level, hypothesis 3 is rejected for the traditional regression.

The outcomes suggest that for risk diversification, it is advantageous to incorporate ESG investments into one's portfolio alongside traditional funds or Russell 1000 index funds. This inclusion of ESG investments serves as a means to mitigate potential losses stemming from index returns, given the comparatively lower correlation between the ESG portfolio and the Russel 1000 index. Therefore, investors seeking diversification and greener investments while minimizing their ecological footprint would find it more favorable to include an ESG portfolio as a viable alternative to an e.g. traditional portfolio in line with Bauer et al. (2005) that ESG funds were less correlated to a shifting market.

6. Conclusion

In the last concluding chapter, the major findings of the study will be summarized and the research questions will be answered. Suggestions for further research conclude the chapter.

The demand for sustainable investment has increased over the last decade. ESG funds are a growing concept due to the need to invest greener since climate-related problems are soaring. This study aimed to highlight ESG funds' effect on portfolio diversification over the past five years (2018-2023) assessed in risk-adjusted returns. The research questions were as follows:

- Does a difference exist between the risk-adjusted returns of an ESG and a traditional fund portfolio?
- How substantial is that difference and in favor of what portfolio?

To answer the research questions, two samples were collected, one portfolio with ESG funds and the other portfolio with traditional funds. The funds were collected due to their specific rating, according to the Morningstar Sustainability Rating. With different methods, the analysis could reveal important findings regarding the performance of the ESG portfolio compared to the traditional portfolio and the Russell 1000 index. The ESG portfolio exhibited higher risk measured in standard deviation but the contributing factor was mostly the lower return, indicated by its inferior Sharpe ratio and asymmetric distribution of risk-adjusted returns. Contrary to some previous claims, the traditional portfolio outperformed the ESG portfolio in terms of mean Sharpe ratio.

The ESG portfolio demonstrated a more unfavorable Sharpe ratio compared to the traditional portfolio and the benchmark index, supported by previous research. The evidence further confirms the performance differential, favoring traditional funds, with statistically significant results. As for the Fama-French regression which intended to explain returns in a different manner, the results were in favor of the traditional portfolio although the ESG portfolio was not a good fit for the aforementioned model. In terms of risk diversification, incorporating ESG investments alongside traditional or index funds appears beneficial in mitigating potential losses. These results may be helpful for investors looking to diversify their portfolios while still making investments in line with their values. Consequently, the present study successfully rejects the null hypothesis for the OLS and the traditional Fama-French regression, thereby establishing the existence of a performance differential between ESG and traditional funds, favoring the latter in terms of superior performance.

6.1 Further research

Further research on ESG funds performance can be conducted, for example, by looking at other countries than North America or testing other evaluation methods such as the Fama-French five-factor model which also considers profitability and investment. The data in the analysis extends during the Covid-19 pandemic as well as the Russian invasion of Ukraine, any specific analysis has not been made to study more closely how the pandemic and the war affected economic performance. This could be done by extending the regressions with more variables for example. These two events are interesting factors to look at closer as to how they affected the financial market and the performance of ESG funds and traditional funds.

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Appendix

Appendix A: The Morningstar Sustainability Rating

Morningstar has a specific method to evaluate whether a fund has a lower or higher ESG risk. This is known as the Morningstar Sustainability Rating, which is a way to help investors assess portfolios on environmental, social and governance factors. The method was released in 2016, together with Sustainalytics a Morningstar owned company, and has evolved to its present state where ESG risks in a fund, compared with other funds, can be measured through a rating. To calculate the Morningstar Sustainability Rating a five-step process is required. The rating is then expressed in 1-5 numbers of “globes”, where 1 globe is the lowest and 5 globes is the highest. High ESG risk for a portfolio means a low amount of globes and low ESG risk means a high amount of globes. Important to mention is that the rating of the fund is determined in relation to other funds who belong in the same Morningstar Global Category, which means that the ESG risk could vary thus a better or lower rating if the funds are in different global categories (Morningstar, 2021).

The rating process

Step 1: Identify if the fund is suitable for a rating

In the first step the fund will be identified if it is suitable for a rating. This is determined by looking at the portions of the fund´s holding to see if any are exposed to ESG risk. In a potential ESG risk assessment the included portfolio holdings are called Qualified Holdings. This means that these holdings can be calculated for a rating in the future since they include material ESG risk. Morningstar has a classification system for the qualified holdings where they divide them into corporate, sovereign and “other”. A subset of the qualified holdings are Eligible Holdings, which are holdings where a risk ratings framework exists and can therefore lead to a measure of risk for the Morningstar Sustainability Rating.

Step 2: Portfolio Corporate Sustainability Score and Portfolio Sovereign Sustainability Score

This step includes calculation of the Portfolio Corporate Sustainability Score and the Portfolio Sovereign Sustainability Score for each portfolio. These scores are an asset-weighted average of Sustainalytics’ company-level ESG Risk Rating and Country Risk Rating.

$$(1)\ Portfolio\ Corporate\ Sustainability\ Score = \sum_{i=1}^{n} ESGRisk_i \times RescaledHoldingsWeight_i$$

$$(2)\ Portfolio\ Sovereign\ Sustainability\ Score = \sum_{i=1}^{n} CountryRisk_i \times RescaledHoldingsWeight_i$$

For holdings 1 to n where Rescaled Holdings Weight ≠ 0

The scores measures from 0 to 50 and is then divided into five risk categories. Lower score imply lower risk, which is the preferred result.

Table 5. Risk Categories

Score Range	Risk Category
0-9.99	Negligible Risk
10-19.99	Low Risk
20-29.99	Medium Risk
30-39.99	High Risk
>40	Severe Risk

Source: Morningstar/Sustainalytics

Step 3: Historical

In this step the Historical Corporate Sustainability Score and Historical Sovereign Sustainability Score is calculated. This is the Morningstar Portfolio Corporate and Sovereign Sustainability Scores as a weighted average of the following 12 months.

i represents the number of months from present

$$(3)\ Historical\ Corporate\ Sustainability\ Score = \frac{\sum_{i=0}^{11}(12-i) \times Portfolio\_Corporate\_Sustainability_i}{\sum_{i=0}^{11} i + 1}$$

$$(4)\ Historical\ Sovereign\ Sustainability\ Score = \frac{\sum_{i=0}^{11}(12-i) \times Portfolio\_Sovereign\_Sustainability_i}{\sum_{i=0}^{11} i + 1}$$

Step 4: Portfolio Corporate Sustainability Rating and Portfolio Sovereign Sustainability Rating

By ranking the previously calculated “historical” scores, respectively, of all scored funds within a Morningstar Global Category the Portfolio Corporate Sustainability Rating and Portfolio Sovereign Sustainability Rating can be calculated. Based on a normal distribution the scored funds are ranked and then obtain a rating from 1-5, with 1 being the highest risk and 5 the lowest. Lower risk implies a higher sustainability rating. It is a requirement that the Global Category need to have at least 30 portfolios including Historical Corporate- or Historical Sovereign Sustainability Scores for funds in the same category to receive a score. The rating 3 is equal to a median scoring portfolio.

Table 6. Summary of Corporate and Sovereign Sustainability Ratings Distribution

Distribution	Rating
Best 10% (Lowest risk)	5
Following 22.5%	4
Following 35%	3
Following 22.5%	2
Worst 10% (Highest risk)	1

Source: Morningstar/Sustainalytics

Step 5: Calculate the Morningstar Sustainability Rating

Lastly, by combining the Portfolio Corporate Sustainability Rating and Portfolio Sovereign Sustainability Rating proportional Morningstar Sustainability Rating can be calculated. Proportional to the relative contribution of its corporate and sovereign positions. Corporate Contribution Percent and Sovereign Contribution Percent each stands for the percentage weight between the corporate and sovereign portions of a portfolio.

$$(5)\ Morningstar\ Sustainability\ Rating = (Corporate\ Sustainability\ Rating\ *\ Corporate\ Contribution\ Percent) + (Sovereign\ Sustainability\ Rating\ *\ Sovereign\ Contribution\ Percent)$$

The Morningstar Sustainability Rating is decided from the calculation above and the result is rounded to the nearest whole number. This value is equal to how many globes a fund obtains. The more globes a fund receives, the lower ESG risk (Morningstar, 2021).

Appendix B: Aggregated dataset

Date	RUSSELL 1000 Sharpe	Traditional Sharpe	ESG Sharpe	Montly 5 year treasury	Market risk factors	SMB	HML	RF	ESG return-mrf	Traditional return-mrf
2018-01-31	-0,14	0,34	-0,39	2,52	5,57	-3,15	-1,33	0,12	1,61	4,26
2018-02-28	-0,22	-1,25	-0,59	2,65	-3,65	0,23	-1,07	0,11	1,33	-4,18
2018-03-29	-0,76	-0,78	-2,06	2,56	-2,35	4,05	-0,23	0,11	-1,75	-1,75
2018-04-30	-0,95	-0,33	-2,56	2,79	0,28	1,14	0,54	0,14	-2,57	0,85
2018-05-31	0,13	-0,18	0,36	2,68	2,65	5,26	-3,18	0,14	3,28	1,55
2018-06-29	-0,23	-0,32	-0,61	2,73	0,48	1,15	-2,33	0,14	1,35	0,86
2018-07-31	-0,22	-0,11	-0,60	2,85	3,19	-2,23	0,47	0,16	1,46	2,07
2018-08-31	0,03	-0,09	0,09	2,74	3,44	1,13	-3,98	0,16	2,76	2,09
2018-09-28	0,01	-0,60	0,02	2,94	0,06	-2,28	-1,69	0,15	2,83	-0,43
2018-10-31	-0,45	-1,67	-1,23	2,98	-7,68	-4,77	3,44	0,19	0,29	-6,22
2018-11-30	-0,53	-0,19	-1,42	2,84	1,69	-0,68	0,28	0,18	-0,24	1,63
2018-12-31	0,31	-1,93	0,85	2,51	-9,57	-2,37	-1,85	0,2	4,03	-8,11
2019-01-31	0,03	0,97	0,09	2,43	8,4	2,89	-0,46	0,21	2,41	7,47
2019-02-28	-0,16	0,16	-0,44	2,52	3,4	2,05	-2,67	0,18	1,44	3,21
2019-03-29	-0,03	-0,27	-0,07	2,23	1,1	-3,03	-4,1	0,19	1,89	0,59
2019-04-30	0,05	0,18	0,13	2,28	3,97	-1,74	2,14	0,21	2,34	3,05
2019-05-31	0,31	-1,15	0,82	1,93	-6,94	-1,31	-2,35	0,21	3,40	-4,48
2019-06-28	0,04	0,86	0,11	1,76	6,93	0,27	-0,72	0,18	1,81	6,20
2019-07-31	0,14	-0,23	0,38	1,84	1,19	-1,93	0,47	0,19	2,44	0,40
2019-08-30	0,16	-0,60	0,44	1,39	-2,58	-2,37	-4,77	0,16	2,12	-2,00
2019-09-30	0,25	-0,10	0,66	1,55	1,43	-0,97	6,74	0,18	2,72	0,82
2019-10-31	-0,29	0,14	-0,79	1,51	2,06	0,29	-1,92	0,16	-0,27	2,08
2019-11-29	0,24	0,33	0,65	1,62	3,87	0,79	-2	0,12	2,83	3,26
2019-12-31	-0,10	0,23	-0,27	1,69	2,77	0,73	1,77	0,14	1,01	2,78
2020-01-31	-0,42	-1,61	-1,14	1,32	-0,11	-3,11	-6,23	0,13	-1,14	-7,48
2020-02-28	-1,65	-1,68	-4,45	0,89	-8,13	1,07	-3,79	0,12	-8,30	-8,30
2020-03-31	-0,06	-2,98	-0,16	0,37	13,39	-4,86	-13,95	0,13	-0,08	-15,83
2020-04-30	0,26	2,31	0,71	0,36	13,65	2,47	-1,26	0	1,80	12,83
2020-05-29	-0,39	1,08	-1,05	0,3	5,58	2,47	-4,89	0,01	-1,84	6,11
2020-06-30	0,11	0,56	0,30	0,29	2,46	2,7	-2,17	0,01	0,89	3,31
2020-07-31	-0,32	0,95	-0,86	0,21	5,77	-2,32	-1,37	0,01	-1,56	5,35
2020-08-31	0,75	1,24	2,03	0,28	7,63	-0,22	-2,96	0,01	4,41	6,95
2020-09-30	-0,15	-0,59	-0,41	0,28	-3,63	0,04	-2,68	0,01	-0,57	-2,89
2020-10-30	-0,46	-0,51	-1,25	0,38	-2,1	4,37	4,22	0,01	-2,18	-2,36
2020-11-30	0,43	2,71	1,15	0,36	12,47	5,81	2,13	0,01	2,70	14,95
2020-12-31	0,45	1,05	1,22	0,36	4,63	4,89	-1,5	0,01	2,85	6,01
2021-01-29	-0,27	0,12	-0,72	0,45	-0,03	7,34	2,97	0,01	-1,03	1,07
2021-02-26	0,35	0,96	0,95	0,75	2,78	2,06	7,17	0	2,69	5,90
2021-03-31	-0,05	0,32	-0,14	0,92	3,08	-2,37	7,39	0	0,63	2,65
2021-04-30	0,28	0,54	0,76	0,86	4,93	-3,2	-0,95	0	2,41	3,75
2021-05-28	-0,26	0,19	-0,69	0,79	0,29	-0,25	7,09	0	-0,62	1,82
2021-06-30	-0,22	-0,04	-0,60	0,87	2,75	1,7	-7,83	0	-0,36	0,68
2021-07-30	0,05	-0,20	0,13	0,69	1,27	-3,99	-1,78	0	0,95	-0,40
2021-08-31	0,03	0,26	0,08	0,77	2,91	-0,43	-0,15	0	0,93	2,18
2021-09-30	-0,14	-0,55	-0,37	0,98	-4,37	0,72	5,09	0	0,22	-1,99
2021-10-29	-0,08	0,96	-0,22	1,18	6,65	-2,34	-0,49	0	0,73	6,35
2021-11-30	0,01	-0,99	0,04	1,14	-1,55	-1,32	-0,45	0	1,21	-4,17
2021-12-31	-0,25	0,53	-0,67	1,26	3,1	-1,65	3,26	0,01	-0,13	4,12
2022-01-31	-0,78	-0,96	-2,10	1,62	-6,25	-5,93	12,75	0	-2,67	-3,54
2022-02-28	-0,22	-0,61	-0,60	1,71	-2,29	2,21	3,08	0	0,48	-1,55
2022-03-31	-0,86	0,02	-2,31	2,42	3,05	-1,6	-1,8	0,01	-2,31	2,51
2022-04-29	-0,27	-1,71	-0,74	2,92	-9,46	-1,4	6,17	0,01	1,41	-6,32
2022-05-31	-0,39	-0,47	-1,05	2,81	-0,34	-1,83	8,39	0,03	0,63	0,25
2022-06-30	-0,41	-2,23	-1,11	3,01	-8,43	2,1	-5,98	0,06	0,68	-9,08
2022-07-29	-0,19	0,85	-0,51	2,7	9,57	2,8	-4,1	0,08	1,59	7,18
2022-08-31	-0,71	-1,10	-1,93	3,3	-3,77	1,37	0,3	0,19	-0,82	-2,83
2022-09-30	-0,35	-2,16	-0,95	4,06	-9,35	-0,79	0,06	0,19	1,94	-7,80
2022-10-31	-0,54	0,63	-1,46	4,27	7,83	0,09	8,05	0,23	1,05	7,45
2022-11-30	-0,66	0,30	-1,77	3,82	4,6	-3,4	1,38	0,29	-0,07	5,14
2022-12-30	-0,66	-1,64	-1,77	3,99	-6,41	-0,68	1,32	0,33	0,05	-5,18
2023-01-31	-0,36	0,69	-0,96	3,63	6,65	5,02	-4,05	0,35	1,32	6,98

Appendix C: The funds collected

ESG PORTFOLIO
AAF-Parnassus US ESG Eqs I$
AAF-Parnassus US ESG Eqs R$
AB Intl Health Care A USD
AB Intl Health Care I USD
AB Sustainable US Thematic I USD
BGF Sustainable Energy D2 EUR
BGF Sustainable Energy D4 EUR
BGF Sustainable Energy D4 GBP
BGF Sustainable Energy I2
BGF Sustainable Energy X2
BNY Mellon Long-Term Glbl Eq GBP X Acc
Brown Advisory US Sust Gr USD A Inc
Brown Advisory US Sust Gr USD C Acc
Brown Advisory US Sust Gr USD C Inc
DNB Teknologi S TRE
Folksam LO Världen
GS Global Sust EQ-I Cap EUR
GS Global Sust EQ-R Cap EUR
GuardCap Global Equity I EUR Acc
GuardCap Global Equity I USD Acc
Mirova Global Sust Eq N/A EUR NPF
Pictet-Premium Brands I dy GBP TRE
Pictet-Premium Brands I EUR
Pictet-Premium Brands I USD
Pictet-Premium Brands Z EUR
RobecoSAM Smart Energy Eqs F EUR TRE
RobecoSAM Smart Energy Eqs I CHF TRE
RobecoSAM Smart Energy Eqs I EUR TRE
RobecoSAM Smart Energy Eqs I USD TRE
Schroder ISF Glbl Sust Gr A Acc USD
Schroder ISF Glbl Sust Gr C Acc USD
Skandia Time Global
Swedbank Robur Globalfond A
Swedbank Robur Technology A
Swedbank Robur Transition Global
Threadneedle (Lux) Global Focus AU
Threadneedle (Lux) Global Focus AU EUR
Threadneedle (Lux) Global Focus IE EUR
Threadneedle (Lux) Global Focus IU
Threadneedle (Lux) Global Focus ZE
Threadneedle (Lux) Global Focus ZU EUR
Threadneedle (Lux) Global Focus ZU
UBAM 30 Global Leaders Equity IC EUR

TRADITIONAL FUND PORTFOLIO
AB Select US Long/Short I
AB Select US Long/Short Advisor
American Century Small Cap Growth R5
American Century Small Cap Growth Y
American Century Small Cap Growth R6
Baron Real Estate Retail
Baron Real Estate Institutional
Baron Real Estate R6
Baron Partners Retail
Baron Partners R6
Baron Partners Institutional
Fidelity Advisor® Capital Development O
Fidelity® Large Cap Stock
Fidelity Advisor® Large Cap A
Fidelity Advisor® Large Cap I
Goldman Sachs GQG Ptnrs Intl Opps R
Goldman Sachs GQG Ptnrs Intl Opps Inv
Goldman Sachs GQG Ptnrs Intl Opps R6
Goldman Sachs GQG Ptnrs Intl Opps Instl
Goldman Sachs GQG Ptnrs Intl Opps A
Hood River Small-Cap Growth Instl
Hood River Small-Cap Growth Retirement
Kopernik Global All-Cap A
Kopernik Global All-Cap I
Neuberger Berman Large Cap Value R3
Neuberger Berman Large Cap Value Inv
Neuberger Berman Large Cap Value A
Neuberger Berman Large Cap Value Tr
Neuberger Berman Large Cap Value Instl
Neuberger Berman Large Cap Value Adv
Neuberger Berman Large Cap Value C
PIMCO StocksPLUS® Intl (USD-Hedged) A
PIMCO StocksPLUS® Intl (USD-Hedged) C
PIMCO StocksPLUS® Intl (USD-Hedged) I2
PIMCO StocksPLUS® Intl (USD-Hedged) Inst
Smead Value I1
Smead Value Investor
Smead Value Y
Smead Value R2
Smead Value A
State Street Hedged Intl Dev Eq Idx K
Tweedy, Browne International Value Fund

Appendix D: Homoscedastic scatter plots of absolute return data