The Sustainable Era

The Excess Return on Swedish Sustainable Global Equity Funds

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Abstract:
This thesis explores the relationship between the performance of Swedish global equity funds and the level of sustainability, as measured by the Morningstar Globe Rating, using a Fama-French six-factor model, globe rating categories, and time effects. Treating the Morningstar Globe Rating as a time-invariant variable, a sample of 80 Swedish global equity funds are divided into two sustainability groups, 'Low' and 'High', grouping funds with 1-3 globes into a reference group. The fund performance, in US Dollars, is observed between 2018 to 2022. Firstly, the findings indicate that funds with a high sustainability rating have an insignificantly greater performance, on average, in terms of excess return. Secondly, funds with a high sustainability rating do not exhibit a lower level of risk, as measured by the variance of the excess return. Lastly, the thesis shows that Fama-French factors, specifically those from the Fama-French five-factor model, along with time effects, play a significant role in explaining the observed excess return in Swedish global equity funds. Overall, investors do not experience a negative impact on excess returns or variance by selecting more sustainable Swedish global equity funds, as measured by the Morningstar Globe Rating. These results differ from what would be expected from traditional economic theory, where the reduction of diversification and lost opportunities at high returns predict lower excess returns or higher risk. Rather, these results are more in agreement with the predictions of the Porter hypothesis, where good environmental regulation is predicted to stimulate innovation, efficiency and competitiveness, generating profitability.

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Preface

Keywords

Fama-French, ESG, Morningstar, Morningstar Globe Rating, funds, global equity funds, sustainability, excess return

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Content

1. Introduction

1.1 Background

Sustainability is a current topic that affects all areas of human existence, including the environment, the climate, business, politics, and investment decisions. As such, the topic of sustainability involves multiple actors and has consequences for the profitability of investment decisions. However, the consequences are unclear, as traditional economic theory predicts negative effects on returns and risk, whereas others argue that consideration of sustainability manages risk and promotes innovation and efficiency. Regardless, the reality of the consequences are important, with regard to the possibility of aligning individual economic interests with the common good of a sustainable future.

The overall climate goal for European Union (EU) countries is to achieve climate neutrality by 2050. This entails a reduction of greenhouse gas emissions in the EU by 55 percent by 2030 compared to 1990 levels. These goals are binding for all EU member states through the European Parliament and Council Regulation (EU) 2020/04554l, dated 11 January 2021, on common climate neutrality. In 2022, the EU Commission reached a consensus on a climate package consisting of proposed reforms aimed at attaining the set objectives. The negotiations on these reforms will commence in 2023 among EU member states and the European Parliament (Sveriges Riksbank 2023). The consequences of climate change and the measures taken to mitigate them affect the conditions for the Swedish central bank (Sveriges Riksbank 2023), to fulfill its mandate regarding price stability and financial stability. The Riksbank identifies and assesses risks associated with climate change in its stability analysis and is required to consider sustainability in its asset management (Sveriges Riksbank 2023).

The Swedish Environmental Protection Agency (Naturvårdsverket n.d.) has conducted an assessment and found that despite improvements in various aspects of transitioning to a net-zero emissions goal, there is uncertainty surrounding Sweden's ability to meet the interim targets for 2030 and 2040. This uncertainty primarily stems from future reduction obligation levels, particularly in light of the decision to lower these levels between 2024 and 2026. The findings of the Swedish Environmental Protection Agency's assessment, which form the basis for the government's forthcoming climate policy action plan and climate report in 2023, indicate that Sweden will not achieve its climate goals for 2030 if a significant reduction in the obligation to reduce diesel and gasoline is implemented and sustained. Although progress has been made towards the long-term climate goal of achieving net-zero emissions by 2045, additional efforts are required in various areas to facilitate a successful transition (Naturvårdsverket n.d.).

The pursuit of sustainable investments has gained significant attention in recent years as investors increasingly consider environmental, social, and governance (ESG) factors in their decision-making processes. This growing interest in sustainable investing has prompted researchers to explore the financial implications of integrating sustainability criteria into investment strategies and whether it comes at the cost of lower returns (Derwall, Guenster, Bauer & Koedijk 2005). Maintaining a clean and healthy environment is considered a collective good, but it is also a social dilemma. This is because people often choose to engage in activities that benefit themselves but harm the environment globally. The more people are involved, the less likely they are to take voluntary action to protect the environment (Davidovic, Harring & Jagers 2020). Therefore, an argument for sustainable investments is that they will yield better outcomes for the environment and that sustainable choices will mitigate or prevent unwanted outcomes from unsustainable alternatives. Organizations and companies, both private and public, have developed sustainability classifications for financial assets to make it easier for investors to make sustainable investments, such as the Morningstar Globe Rating (Morningstar 2021b) and the Sustainable Finance Disclosure Regulation (SFDR) from the European Union (European Commission n.d.). However, in the case of mutual funds, the limitations imposed on a sustainable mutual fund reduce the possibility of removing idiosyncratic risk through diversification and the possibility of investing in an asset with a high return, when it does not meet sustainability criteria. Therefore, the sustainability requirements may yield an exclusion of assets and also affect the risk and return of such mutual funds as a whole. However, there have been ongoing discussions whether sustainable investing entails a cost or a premium.

According to Friede, Busch and Bassen (2015), scholars and investors have conducted over 2,000 studies on the relationship between ESG and organizations' financial performance since 1970. This indicates that ESG integration into sustainable investment is gaining ground in mainstream financial markets. However, the pace at which mainstream investors shift towards ESG-based sustainable investment is relatively slow (Maiti 2021). Maiti (2020) argues that risk factors evolve over time, causing prominent asset pricing models to lose efficacy. Thus, the author also suggests that ESG factors will dominate future asset pricing models.

To increase company value through ESG efforts, it is essential that actions taken to improve ESG ratings lead to either higher returns or reduced risk. However, it is important to acknowledge that there is a possibility that being socially and environmentally responsible can actually lower value for certain companies. The evidence supporting the notion that corporate responsibility improves a company's operating performance, thereby increasing cash flows, is not particularly strong. On the other hand, there is more solid evidence suggesting that failing to prioritize ESG factors can result in higher costs of equity and debt, making funding more expensive for companies (Cornell & Damodaran 2020).

The ability to incorporate sustainability into investment decisions is of interest to investors, seeking returns and risk management, and other stakeholders, with an interest in a sustainable future. Previous research has examined the interplay between the Fama-French factors and an ESG factor, in predicting rate of return or excess return. However, there is limited research on the Swedish fund market. Although there are multiple studies, related to global markets, that have shown that sustainability is an insignificant factor (Yue, Han, Teresiene & Merkyte

2020; Xiao, Faff, Gharghori & Min 2013; Naffa & Fain 2021; Kapri 2021), there is also research that has shown that incorporating a sustainability factor is advantageous in explaining the rate of return or excess return (Maiti 2021; Díaz, Ibrushi & Zhao 2020; Gregory, Stead & Stead 2020).

A core function of a fund is eliminating idiosyncratic risk, through diversification. In recent years, among the more common limitations has been the exclusion of companies, from the stock portfolios, whose main business relates to weapons, alcohol, tobacco, gambling, and pornography. Hebb (2013) defines responsible investing as one of three distinct forms of investing. The first form is ‘impact investing,’ which prioritizes investments aimed at improving society as a whole. This approach stands in contrast to the more common perspective of ‘finance-first investing’, where maximizing financial returns takes precedence. Responsible investing occupies the middle ground between these two approaches, striking a balance between returns and sustainable factors through a cost-benefit analysis. While impact investing may be viewed as the most beneficial means of societal improvement, it is worth exploring whether profitability and sustainability can coexist.

Although the subject of certain assets being excluded, for sustainability reasons, is not new, there is limited research on the risk and return on sustainable Swedish global equity funds. This thesis intends to investigate this further and investigate whether a sustainability profile is beneficial or detrimental, in terms of achieving as high excess return as possible for investors, including in relation to the level of risk.

1.2 Aim

The aim of this thesis is to examine the relationship between Swedish global equity funds' performance, sustainability profiles, and risk level, using a Fama-French six-factor model and the Morningstar Globe Rating, as a measure of a fund's sustainability profile.

1.3 Research questions

In order to achieve the aim of this thesis, the following research questions are addressed:

- Does a higher level of sustainability, in Swedish global equity funds, predict a higher excess return than a lower level of sustainability?
- Does a higher level of sustainability, in Swedish global equity funds, entail a lower risk level than a lower level of sustainability?
- To what extent can the Fama-French factors explain the Swedish global equity funds’ excess return?

1.4 Disposition of the Thesis

This paper is divided into several sections, as follows: Section 1 consists of an introduction that contextualizes the topic of the excess returns on sustainable funds, why it was a topic of interest, what the research questions were, and what the disposition of the essay is. Section 2 provides a theoretical background on the topic and previous research. Section 3 presents the hypotheses. Section 4 describes the methodology and data. Section 5 presents the results and findings. Section 6 discusses the results and limitations. Section 7 presents a conclusion, based on the results and discussion.

2. Previous Research & Theory

2.1 Previous research

The following section discusses the previous research related to the main areas of the study. The selection of theory is primarily adapted based on previous studies with similar topics, but also suitable for the specific focus of this work. In this section, risk aversion, the risk of investing in ESG funds, factors that drive a mutual fund, the historical performance of ESG funds, and the Fama-French models used in studies related to risk and investing in ESG funds is presented.

2.1.1 Risk aversion

Risk aversion is a fundamental concept in financial decision-making that describes the extent to which individuals prefer certainty over uncertainty (Kahneman & Tversky 1979). Risk-averse investors typically prefer lower-risk investments that offer lower expected returns, while risk-seeking investors are willing to accept higher risk in exchange for potentially higher returns (Tversky & Kahneman 1992).

The sustainability profile is an important factor that can affect investor behaviour. Many studies have found that investors are willing to accept lower expected returns, in exchange for investing in funds that have a positive sustainability profile (Bauer, Derwall & Otten 2006). This is because sustainable investing can be seen as a way to reduce risk, by avoiding investments in companies that may face regulatory or reputational risks, due to environmental or social issues (Clark, Feiner & Viehs 2014). Several studies have examined the relationship between risk aversion and sustainability performance. For instance, Clark, Feiner and Viehs (2014) find that investors with high-risk aversion are more likely to invest in sustainable mutual funds, which have a higher ESG score.

2.1.2 The risk of investing in ESG-funds

Krueger, Sautner and Starks (2020) investigate the impact of climate risks on institutional investors and their investment decisions. They argue that institutional investors face challenges in integrating climate risks into their decision-making processes and suggest that addressing these risks requires a better understanding and management of climate risk exposures. The authors note that incorporating climate risks into investment decisions can enhance risk-adjusted returns and contribute to achieving long-term investment objectives. Furthermore, they recommend that investors consider climate risks in their asset allocation strategies and engage with companies to encourage them to adopt more sustainable practices. The authors provide empirical evidence that institutional investors' portfolio performance is sensitive to climate risks. They find that ESG factors negatively affect stock prices, increase stock return volatility, and reduce stock liquidity, especially for companies that are more exposed to climate risks.

Nofsinger and Varma (2014) investigate the performance of socially responsible mutual funds during market crises compared to conventional mutual funds in terms of risk. The authors find that socially responsible funds outperform conventional funds during periods of market crises but underperform during non-crisis periods. The results are particularly pronounced for funds that focus on ESG attributes and use positive screening techniques, indicating that socially responsible investing can mitigate the risk of downside losses during market crises. The study suggests that the asymmetric return pattern is driven by the funds' socially responsible attributes, rather than the differences in fund portfolio management or the characteristics of the companies in the fund portfolios. The findings have implications for investors seeking downside protection and suggest that socially responsible mutual funds can provide a hedge against market risks.

2.1.3 Return and other factors that drive a mutual fund

According to Bodie, Kane and Marcus (2021, p. 1 & 10), higher returns can be achieved in the investment environment by taking greater risks, where the risk-return tradeoff is applicable, and assets with higher risk should offer higher expected returns compared to those with lower risk. Both casual observation and formal research indicate that investment risk is a critical consideration for investors, just as expected return is. Therefore, abnormal return should refer to the difference between the actual and expected return of securities. Theories have been proposed about the relationship between risk and expected return in rational capital markets. However, there is no established theory regarding the levels of risk that should exist in the marketplace. Thus, the estimation of the level of risk facing investors can, at best, be based on historical experience (Bodie, Kane & Marcus 2014, p. 117). According to Martin (2017), the equity premium is important in determining the risk premium in the Capital Asset Pricing Model (CAPM), while asset prices are linked to the determination of expected return. Research by Greenwood and Shleifer (2014) indicates a high correlation between investors' expectations and past returns. However, there is a negative correlation between investor expectations and model-based expected returns, which indicates a lack of consistency with the returns predicted by rational expectations investor models.

Carhart (1997) argues that mutual funds tend to exhibit short-term persistence in performance, the persistence of good performance fades over time while the persistence of poor performance is much more long-lasting. In other words, funds that perform well in the short run do not necessarily continue to do so in the long run, whereas funds with poor performance tend to maintain their poor performance over an extended period. The study finds that; 1) past performance is not a reliable predictor of future success, and investors need to consider various other factors beyond past performance when selecting mutual funds, 2) High expense ratios, high turnover ratios with associated trading costs, and taxes have a significant negative impact on fund performance. In other words, funds with high fees tend to underperform, and investors need to be mindful of the fees charged by mutual funds before investing. The author highlights the difficulty in identifying what makes for successful stock-picking, as past performance is not a reliable indicator of future success and high fees can decrease returns. Therefore, investors should consider a range of factors, including fees, investment strategy, and the fund manager's track record, to select mutual funds that offer the best risk-adjusted returns.

Liu and Soe (2019) investigate the consistency of mutual fund performance over time. The authors create a scorecard to measure the persistence of mutual fund performance and analyze the data of US equity mutual funds over the period of three and five consecutive 12-month periods and two non-overlapping three- and five-year periods. They find that top-performing mutual funds are more likely to maintain their performance in the following year compared to bottom-performing mutual funds. However, the persistence of performance declines over longer time horizons. The results provide insights into the relevance of past performance in the selection of mutual funds and show that only a few fund managers consistently outperformed their peers, but as the time horizon increases, there was a dramatic fall in persistence. In particular, the authors show that there is an inverse relationship between the ability of top-performing funds and the time horizon length. Only 3 percent of equity funds maintained their top-quartile status at the end of the five-year measurement period.

2.1.3 The concept and performance of ESG funds

A sustainability profile is an increasingly important factor in investment decision-making, as investors recognize that ESG practices can impact a company's long-term financial performance. The profile assesses a company's environmental, social, and governance practices and their impact on financial performance. ESG factors analyzed in sustainability profiles include a company's energy efficiency, carbon footprint, labour practices, executive compensation, and board diversity.

According to Baumgartner and Ebner (2010), sustainability profiles have become increasingly important in investment decision-making, due to the growing awareness of the importance of sustainable practices. The incorporation of ESG factors into investment decisions has led to the development of various sustainability rating systems, such as the Morningstar Globe Rating and the Dow Jones Sustainability Index. These systems aim to provide standardized and comparable data on ESG performance, enabling investors to compare and evaluate the sustainability profiles of different companies.

Renneboog, Horst and Zhang (2008) note that sustainability in business is a complex and multidimensional concept. However, sustainability profiles provide a way to assess a company's progress towards sustainable practices. They enable investors to evaluate a company's sustainability and potential risks and opportunities for investment.

Silva and Cortez (2016) find that green funds, particularly those in Europe, tend to lag behind the benchmark. The results indicate varying performance and risk over time. Underperformance is particularly pronounced during periods of low short-term interest rates and non-crisis periods, highlighting the need to use conditional models when evaluating the performance of green funds. However, during crisis periods, the performance of green funds improves compared to non-crisis periods. Additionally, the study finds regional differences in the investment strategies of green funds, with some European funds appearing to be more focused on value stocks than their US counterparts and other socially responsible funds.

The European Securities and Markets Authority (ESMA) (2022) finds that ESG funds have a higher exposure to large-cap companies and a greater focus on developed economies, which is found to be correlated with lower ongoing costs. The empirical analysis confirms previous findings that funds intended for institutional clients, passive funds, and more recently launched funds are associated with lower costs. However, even after controlling for these factors, ESG funds remained less expensive than non-ESG funds. Over the period from April 2019 to September 2021, ESG funds were found to be, on average, 0.080 percentage points cheaper than non-ESG funds. Additionally, the study finds that ESG funds created specifically as ESG funds tend to have lower fees than those that were originally launched as conventional funds and later converted to ESG funds. Similarly, impact funds are typically cheaper than ESG funds that employ other ESG strategies.

Doyle (2018) discusses the current shortcomings of ESG ratings and proposes recommendations to enhance their reliability and usefulness for investors. The authors argue that the existing ratings primarily focus on disclosure rather than actual company risks, leading to inconsistencies and a lack of transparency among different rating agencies. These issues raise concerns about the efficacy of ESG ratings in assessing company risks and sustainability. To address these concerns, the authors put forward the following recommendations: Firstly, they suggest standardizing ESG disclosure by incorporating risk-related information into regulatory filings. The adoption of universal disclosure techniques and standardized metrics would ensure consistency and comparability across companies, improving the assessment of ESG risks. Secondly, the authors propose adjusting ESG ratings to account for company size, geographic reporting, and industry sector differences. Recognizing the value of non-financial ESG information, rating agencies should consider variations in information quantity at different levels and compare companies to state-owned and privately held entities to provide a comprehensive perspective for investors. Transparency is another critical aspect emphasized in the recommendations. ESG rating agencies should clearly communicate how ESG factors impact ratings. Material factors should be identified and given priority to ensure the accuracy and relevance of the ratings. Furthermore, the authors stress the importance of evaluating rating agencies and disclosing their performance. Assessing the effectiveness of ESG ratings in mitigating financial risks and identifying investment opportunities would provide valuable insights for investors. It is crucial for rating agencies to fulfill their fiduciary duty by disclosing their success rate.

2.1.4 Fama-French model used in studies related to risk and investing in ESG-funds

2.1.4.1 Fama-French Three-Factor (FF3) model

Maiti (2021) explores the potential of ESG factors as a risk factor in financial markets and examines the relationship between ESG and stock returns using the FF3 model. The author's result indicates that ESG is a significant risk factor that can explain the variations in stock returns beyond the traditional factors. Moreover, the study suggests that ESG can complement the traditional risk factors in capturing the systematic risks in the market. The findings suggest that ESG should be considered as an important factor when evaluating the risk-return tradeoff in investment decisions. Additionally, the results support the view that ESG should be integrated into the investment process to improve portfolio performance and reduce risk.

According to Yue et al. (2020), sustainable funds are less risky than traditional funds. The authors used, among others, the FF3 model to value different market portfolios and to analyze different views on sustainable investments to identify various approaches to risk management. However, they did not find clear evidence that sustainable funds generate higher returns compared to traditional funds or benchmark indices.

Xiao et al. (2013) investigate whether a sustainability factor carried a risk premium after controlling for the FF3 factors using standard asset pricing models, by conducting both cross-sectional and time-series tests. The authors find that the FF3 model has significant explanatory power for global equity returns. However, the sustainability factor has neither a significant negative nor positive impact on the returns of global shares. Therefore, major institutional investors can incorporate sustainability mandates without fear of breaching their fiduciary obligations, due to a potential negative impact on returns.

Díaz, Ibrushi and Zhao (2020) examine the rising importance of ESG factors during the Covid-19 pandemic. The study investigates the impact of ESG ratings on industry returns and their explanatory power beyond the traditional FF3 model. The authors construct the ESG factor based on the difference in returns between firms in the top ESG quartile and those in the bottom ESG quartile. The study finds that the ESG factor significantly explains industry returns and the Environmental and Social dimensions of ESG are the main drivers of the ESG impact on different industries. The findings suggest that ESG factors should be considered in investment decisions, especially during times of crises, such as the Covid-19 pandemic. The study has important implications for investors, policymakers, and corporate managers in integrating ESG factors into their investment strategies to improve returns and manage risks.

2.1.4.2 Fama-French Five-Factor (FF5) model

Monasterolo and de Angelis (2020) analyze low-carbon and carbon-intensive indices in the EU, US, and global stock markets to investigate whether markets respond to climate announcements by rewarding low-carbon assets or penalizing carbon-intensive assets, which presents a significant obstacle to decarbonizing portfolios. To achieve this, the authors assess whether financial markets priced the Paris Agreement (PA) by decreasing the systematic risk and increasing the portfolio weights of low-carbon indices, while decreasing those of carbon-intensive indices. The authors perform three primary analyses. Firstly, they extend the market model to examine the performance of low-carbon and carbon-intensive stock market indices in terms of systematic risk (beta) before and after the PA. Secondly, they test for a structural break in the beta after the PA by utilizing the FF5 model. Finally, they apply Markowitz's portfolio optimization to investigate whether the optimal weights of low-carbon indices increase after the PA, compared to the optimal weights of carbon-intensive indices. The authors show that the correlation between low-carbon and carbon-intensive indices decrease after the PA, and the systematic risk for the low-carbon indices consistently decreases. The stock markets' reaction is mild for most carbon-intensive indices, and the weight of low-carbon indices in an optimal portfolio tend to increase after the PA. The authors suggest that stock market investors start to consider low-carbon assets as a viable investment opportunity after the PA, but they do not yet penalize carbon-intensive assets.

Naffa and Fain (2021) investigate the risk-adjusted performance of ESG pure factor portfolios in global equity markets from 2015 to mid-2019. The authors examine ESG leaders, followers, loungers, and laggards, and apply a spanning regression approach, based on the FF5 model, to test the validity of ESG factors in explaining the cross-section of expected returns. The authors find that the ESG portfolios do not generate significant alphas and find no evidence for ESG as a valid new factor in the FF5 model. Therefore, there is no sufficient evidence for the ESG factors to be considered as additional factors in the FF5 model. The authors also examine the performance of ESG leader, follower, and laggard portfolios individually. ESG leader portfolios demonstrate significant negative risk-adjusted returns, though the results were not robust. The environmental follower portfolio shows positive risk-adjusted performance, with significant results for four model specifications, but fails the robustness checks. All ESG laggard portfolios underperform, yet the results remain statistically insignificant. Based on these findings, the authors conclude that their factor portfolios do not have robust significant alphas and that the FF5 model most effectively explains stock returns.

2.1.4.3 Fama-French Six-Factor (FF6) model

Kapri (2021) uses the FF6 model, among other Fama-French models, to assess risk-adjusted returns. The author uses ESG rating data from Morningstar and factor data from Kenneth R. French's database to analyze a sample of US-based equity mutual funds rated by Morningstar between January 1999 and October 2020. The study explores the implications of ESG ratings during market downturns. The findings reveal statistically significant negative abnormal returns for low ESG-rated funds, while high ESG-rated funds demonstrate no statistically significant abnormal returns. Additionally, high ESG-rated funds outperform low ESG portfolios during the sample period. Introducing market downturn dummy variables suggests positive alphas for both high and low ESG portfolios, although these alphas are not statistically significant. The spread of high minus low ESG returns, with the dummy variable, was positive but not statistically significant.

Gregory, Stead and Stead (2020) combine the FF5-model and a momentum factor, i.e. the FF6 model, to predict a sustainability factor premium, allowing for a better estimation of the impact of sustainable strategic management practices on the cost of equity. The authors suggest that following sustainable strategic management practices can lead to a reduction in the cost of equity worldwide. Specifically, the cost of equity was reduced by 1.6% to 2.9% per year. The presence of elevated social and environmental risks within the economic system affects firms differently based on their approach to asset allocation decisions. Firms that fail to incorporate social and environmental costs into their decision-making processes experience a higher cost of equity compared to those that embrace sustainable strategic management and internalize such costs. This observation is attributed to the expenses associated with factor substitution arising from the amplification of shared environmental and social risks.

The combined analysis of the FF6 model and ESG rating remains relatively unexplored in the existing literature, likely due to the relatively new addition of momentum to the FF5 model. While the incorporation of ESG factors in asset pricing models has gained traction, there is a scarcity of research that specifically examines the integration of ESG scores within the framework of the FF6 model. This scarcity serves as a new area of scientific exploration into sustainability and Fama-French-type models.

2.2 Theory

The following section discusses the theoretical framework related to the main areas of the study. The selection of theory is primarily adapted based on previous studies with similar topics, but also suitable for the specific focus of this work. In this section, the Efficient Market Hypothesis (EMH), Modern Portfolio Theory (MPT), the Porter Hypothesis, the Fama-French six-factor model (FF6), risk, alpha and an overview of the Morningstar Globe Rating are presented.

2.2.1 Global Mutual Equity Funds

Open-end investment companies, commonly known as mutual funds, are the prevailing form of investment companies with over 90% of investment company assets attributed to them (Bodie, Kane & Marcus 2014, p. 96). Mutual funds are priced daily based on their net asset value (NAV) and can be traded at any time. Mutual funds tend to specialize in a particular category of the security market, such as high-yield bonds or mid-cap stocks (Bodie, Kane & Marcus 2014, p. 101). Elton and Gruber (2013) have identified four types of mutual funds which include open-end funds, closed-end funds, exchange-traded funds, and unit investment trusts. The largest type of mutual funds is typically the open-end funds. Mutual funds are investment companies that pool money from numerous investors to invest in various securities.

According to Bodie, Kane and Marcus (2014, p. 97), equity funds primarily invest in stocks, but portfolio managers may also include fixed-income or other types of securities based on their discretion. These funds typically hold between 4% and 5% of their assets in money market securities to ensure they have sufficient liquidity to meet potential share redemptions. Stock funds are traditionally categorized based on their focus on capital appreciation or current income. Income funds generally hold shares of companies that have consistently high dividend yields, while growth funds prioritize prospects for capital gains over current income. However, the classification of these funds is primarily concerned with the level of risk they assume, with growth stocks and funds generally considered riskier and more sensitive to changes in economic conditions than income funds. As such, the focus of this study will be on mutual equity funds that primarily invest in stocks.

2.2.2 Efficient Market Hypothesis

Eugene F. Fama developed the Efficient Market Hypothesis (EMH), which states that the market is efficient and that, in an efficient market, asset prices reflect all currently available information. This means that prices adjust, as there is new information, that it is not possible to outperform the market, in the long run, and that there are no possibilities for arbitrage, as assets are correctly valued (Fama 1970). Arbitrage refers to the practice of taking advantage of price discrepancies between two or more markets by buying and selling the same or similar assets in different markets to earn a profit with little or no risk. In other words, it involves exploiting market inefficiencies to make a profit without taking any market risk.

Arbitrage opportunities arise when there are differences in the price of the same asset in different markets, or when there is a difference in the price of two related assets that should theoretically have the same price (Bodie, Kane & Marcus 2014, p. 327-328). The underlying theory of EMH asserts that short-term financial over or underperformance of individual funds is largely explained by luck, with investment strategy being a significant factor only in certain cases. Fund managers are considered to lack the ability to consistently outperform the market over the long term, and for individual investors, there is no rationale for paying high management fees (Eakins & Mishkin 2018, p. 158-172).

According to Bodie, Kane and Marcus (2014, p. 353-354), there are three forms of the EMH which differ in their interpretation of the extent to which all available information is reflected in asset prices. The weak form of EMH asserts that historical asset price data is already incorporated into current prices, making a technical analysis of past data irrelevant in predicting future returns. In the semi-strong form, all publicly available information about a company is also considered in asset prices. The strong form of EMH posits that all public and private information about a company is included in asset prices. However, a strong form is unlikely, as it is impossible to reflect a company's private information, such as undisclosed news, in asset prices.

EMH has been the subject of considerable debate among academics and practitioners, with some arguing that markets are not completely efficient due to various factors such as information asymmetry and behavioural biases. However, empirical evidence generally supports the idea of market efficiency, with numerous studies finding little evidence of persistent abnormal returns that could be used to consistently outperform the market. According to Bouattour and Martinez (2019), arbitrage is possible, if there is information asymmetry or insider trading. Market efficiency suggests that available information on sustainability rating and macroeconomic factors ought to be reflected in the price of the financial assets.

2.2.3 Modern Portfolio Theory

Modern Portfolio Theory (MPT) was introduced by Harry Markowitz in 1952 as a way to construct efficient portfolios that maximize returns for a given level of risk (Markowitz 1952). The theory assumes that investors are risk-averse and aim to maximize future returns while minimizing variance, with risk aversion determining the trade-off between higher returns and greater risk (Sharpe 1964). MPT relies on the concept of expected returns and standard errors of returns to measure risk and return, respectively (Lintner 1965).

MPT suggests that there exists a set of portfolios on which the investor can obtain the highest possible level of return for each unit of risk, the efficient frontier. Thus, any deviation from the efficient frontier should result in a suboptimal risk-adjusted return, leading Markowitz to argue that rational investors should invest in portfolios on the efficient frontier and that the optimal portfolio is determined by the risk aversion of individual investors. However, some investors are prepared to take on risk in favour of higher returns, a trade-off determined by the risk aversion of the individual investor (Markowitz 1952).

Markowitz's (1952) main point is that diversification can significantly reduce portfolio risk. The author explains the power of diversification and how investing in different asset classes, with low covariances, can minimize idiosyncratic risk in a portfolio. Any restrictions on the investment universe could lead to fewer investment opportunities and higher risk. However, critics have argued that MPT has several inherent shortcomings that have impeded the effectiveness of the theory. Omisore, Yusuf and Nwufo (2012) examined the significance and practicality of the MPT and identified significant flaws, such as its oversimplified assumptions and direct association of risks with returns. Lukomnik and Hawley (2021) argues that the MPT and the market-dominant theories that emerged with it, such as EHM, CAPM, random walk, and others, are characterized by both brilliance and profound flaws. These flaws are attributed to omissions, commissions, and self-imposed constraints, and stem from a number of unrealistic or misguided assumptions. Moreover, they have not been able to adapt to the changes that their own performative characteristics have brought about in the capital markets.

2.2.4 Porter Hypothesis

The Porter hypothesis suggests a positive relationship between environmental regulations and economic performance, contrary to the conventional belief that environmental regulations burden businesses and hinder economic growth. Porter (1995) argues that well-designed and effectively implemented regulations could actually stimulate innovation, efficiency and competitiveness in industries, resulting in overall economic benefits. According to the Porter hypothesis, when firms are faced with stringent environmental regulations, they are compelled to develop cleaner technologies, adopt more sustainable practices, and improve resource efficiency. The need to comply with regulations creates incentives for companies to innovate and find new ways of reducing their environmental impact. In turn, these innovations lead to cost savings, increased productivity, and competitive advantages in the market. The key idea behind the Porter hypothesis lies in the belief that environmental regulations could drive firms to invest in research and development to develop innovative solutions for pollution control, waste reduction, and resource efficiency. Such investments often result in the creation of new products, processes, and technologies that enhance productivity and competitiveness. The Porter hypothesis also emphasizes the role of regulations as a feedback mechanism for firms. By setting environmental standards, regulations inform companies about the desired levels of performance and encourage them to continuously improve. As firms strive to meet or surpass these standards, they drive further innovation, efficiency gains, and technological advancements. It is worth noting that the Porter hypothesis does not advocate for a complete absence of regulations or an overly burdensome regulatory environment. Instead, it highlights the potential benefits of well-designed and carefully implemented regulations that stimulate innovation and promote sustainable practices (Porter 1995). As such, the Porter hypothesis serves as an argument for the potential advantage of sustainable investments, despite traditional economic theory predicting losing opportunities at high returns from unsustainable investments and losing opportunities of lowering risk by diversifying investments.

2.2.5 Risk

There are multiple measures of risk, which are suitable depending on the perspective on risk, what the measure will be used for, and ease of calculation. Risk measures are not always considered risk by actual investors. Hence, it is important to consider this aspect in assessing risk. Some of these risk measures will be addressed in this section, including beta and deviation measures of return.

Beta is a key concept in finance that refers to the sensitivity of an asset's returns to changes in the market returns. It is a measure of systematic risk, which is the risk that is inherent in the entire market or market segment and cannot be diversified away by holding a diversified portfolio. The beta of an asset is typically calculated by regressing its returns against the returns of a broad market index, such as MSCI World Index, in the case of global investing.

Levy (1984) proposed a framework for measuring risk and performance across alternative investment horizons. The author emphasized the importance of considering both the aggressive and defensive betas when evaluating an investment's risk characteristics. Aggressive beta is associated with assets that tend to rise more than the market in upturns but also fall more than the market in downturns, i.e. the return has greater volatility than that of the market portfolio. Defensive beta, on the other hand, is associated with assets that tend to rise less than the market in upturns but also fall less than the market in downturns, i.e. the return has lower volatility than that of the market portfolio. The author argues that a stock is aggressive if its one-month beta exceeds one and its 12-month beta exceeds 1.5. A stock is considered defensive if both the one-month beta and 12-month beta are less than 0.6 and neutral if the one-month beta and 12-month beta are greater than 0.9 but less than 1.1.

Another measure of risk is the deviations from the anticipated return. However, expectations are typically not directly observable in practice, so it is reasonable to approximate the variance. This is possible by taking the average squared deviations from the projected expected return. Therefore, another important concept related to risk is variance, which is a measure of the dispersion of an asset's returns around its expected value (Bodie, Kane & Marcus 2014, p. 132-133).

Two related concepts are upside and downside risk, which refer to the potential gains and losses associated with an investment or decision. Risk measures commonly focus on quantifying the downside risk, prioritizing the assessment of potential losses. For comparison, the standard deviation, which is an example of a deviation risk measure, considers both the upside and downside risk. In the context of investing, investors typically only regard downside risk as risk. This bias towards perceiving downside risk as more important can be attributed to loss aversion and the desire to protect capital. When investors consider the distribution in relation to risk, they commonly focus on the likelihood of extreme events or deviations from the expected outcomes. These extreme deviations are often referred to as tail risks and represent improbable scenarios. Such outcomes may have a significant impact on investments, as they are improbable but high-impact events. Therefore, understanding and accounting for the various characteristics of the distribution is crucial for accurately assessing risk (Chong, Jin & Phillips 2013).

2.2.6 Performance of Investment

The term ‘alpha’ in finance is commonly used to denote the performance of an investment compared to a benchmark. In other words, alpha measures the excess returns that an investment generates above its expected excess return, based on its level of risk relative to the market and investment styles, in Fama-French-type factor models. A positive alpha indicates that the investment has outperformed the model prediction, while a negative alpha indicates underperformance (Bodie, Kane & Marcus 2021, p. 405-406).

The concept of alpha is closely related to two major theoretical frameworks in finance: the EMH and MPT. According to EMH, see section 2.2.2, all available information is already reflected in market prices, and, therefore, it is impossible to consistently generate positive alpha by analyzing publicly available information. This implies that beating the market consistently is essentially a matter of luck or insider trading, rather than skill. According to MPT, see section 2.2.3, investors seek to maximize the risk-adjusted returns. If the model’s variables fully explain the excess return and maximization of the risk-adjusted return is achieved, the market is efficient and alpha should be zero, due to no arbitrage. However, if investors are prevented from making certain investments, then the risk-adjusted return would be lower than the optimum, due to lower excess returns, which would yield a negative alpha, or higher risk, which would yield higher risk measures, such as variance or betas, or both lower excess returns and higher risk. If the model does not fully explain excess return, MPT could provide a framework to construct portfolios to maximize alpha.

Despite the theoretical framework provided by EMH and MPT, empirical evidence suggests that investors try to generate positive alpha. Del Guercio and Reuter (2014) examined the relationship between mutual fund performance and the incentive to generate alpha. The authors found that the vast majority of mutual funds failed to generate significant alpha after accounting for expenses and that mutual fund managers have a strong incentive to generate alpha, as higher alpha is associated with greater fund flows and higher management fees. However, this incentive may lead managers to take on excessive risk, which could result in poor performance and higher fund expenses.

2.2.7 The Fama-French Six-Factor Model (FF6) with ESG score

The FF6 model is an extension of what was originally the CAPM. The extension of the CAPM has happened in multiple steps, in the form of the FF3 model, the Carhart four-factor model, the FF5 model, and, finally, the FF6 model, which includes the variables of the prior models. The variables added, in the extensions of CAPM, control for differences in investment styles. This section will outline the constituent variables of the FF6 model, by describing them in the context of the models in which they were introduced.

The CAPM is a financial model that establishes a linear relationship between the required return on an investment and risk. Specifically, it predicts the expected return on risky assets, such as stocks (Bodie, Kane & Marcus 2014). This model is based on the interplay between an asset's beta, the risk-free rate, and the equity risk premium, which is the anticipated return on the market minus the risk-free rate (Bodie, Kane & Marcus 2014).

In an intuitive way, the CAPM and the Fama-French are related because they both attempt to explain the relationship between expected returns and risk. However, the following presented models go beyond the CAPM by incorporating additional factors that can help explain differences in expected returns between assets. By including more factors, the subsequent models can capture more of the variation in expected returns than the CAPM alone.

The FF3 expands upon the CAPM by adding two additional factors: size and value (Fama & French 1992). Fama and French argue that the size and value of companies are important determinants of expected returns, beyond the market risk factor. Small companies and value companies tend to outperform larger and growth companies, respectively (Fama & French 1993). The FF3 model is called as such because it considers three factors: 1) the market factor (MKT), 2) the size factor (SMB) and 3) the value factor (HML). The market factor measures the excess market return or excess return on the market portfolio, the size factor captures the fact that small companies tend to outperform large companies, while the value factor captures the fact that value stocks tend to outperform growth stocks over time (Fama & French 1993).

The Carhart four-factor model is a financial model developed by Mark Carhart in 1997 to explain mutual fund performance. The model builds on the earlier three-factor model developed by Fama and French (1993), which includes market risk, size, and value as factors that can explain mutual fund returns. The Carhart model adds a fourth factor, momentum, to the FF3 model. The momentum factor measures the tendency of stocks that have performed well in the past to continue performing well in the future, and vice versa (Carhart 1997).

The FF5 model is an extension of the FF3-model. The FF5 model builds on the FF3 model by adding two new factors: 1) profitability (RMW) and 2) investment (CMA). The profitability factor (RMW) measures the difference in returns between high and low-profitability firms, while the investment factor (CMA) measures the difference in returns between firms with high and low levels of investment. The FF5 model was developed to better capture the cross-section of expected stock returns, particularly for value and small-cap stocks (Fama & French 2015).

In 2018, Fama and French (2018) expanded the FF5 model by incorporating the momentum factor. The inclusion of the momentum factor in the model originated from Carhart's (1997) addition of the factor to the FF3 model. The momentum factor captures the phenomenon wherein stocks that have exhibited above-average returns in previous periods tend to continue performing well in subsequent periods, while stocks with below-average returns in the past tend to underperform in the future. This factor provides insight into the persistence of stock performance over time, highlighting the tendency for winners to keep winning and losers to continue losing.

The FF6 model is designed to explain asset returns based on the factors of market risk, size, value, profitability, investment, and momentum. Adding additional factors, such as ESG scores, may help capture additional sources of risk or return, but it may also make the model more complex and less stable over time. Furthermore, the inclusion of a sixth factor requires additional data to be collected and analyzed, which adds to the computational complexity. This requires a rigorous evaluation of the statistical significance of the new factor, as well as its correlation with the existing factors in the model.

In summary, the FF6 model factors are:

- Market factor (Market, MKT)
  - The return on a fund is affected by changes in the overall market, as measured by a market index such as the S&P 500.
- Size factor (Small Minus Big, SMB)
  - The size of the companies in a fund's portfolio can also affect its returns, with small-cap stocks generally carrying more risk than large-cap stocks.
- Value factor (High Minus Low, HML)
  - The value factor reflects the tendency of value stocks (those with lower price-to-earnings ratios) to outperform growth stocks (those with higher price-to-earnings ratios) over the long term.
- Profitability factor (Robust Minus Weak, RMW)
  - The profitability factor measures the performance of stocks with high profitability ratios (such as return on assets) compared to those with low ratios.
- Investment factor (Conservative Minus Aggressive, CMA)
  - The investment factor captures the performance of companies that invest more than expected, based on their size and value.
- Momentum factor (Winners Minus Losers, WML)
  - The momentum factor measures the performance of a momentum strategy that involves buying stocks that have performed well (winners) and selling stocks that have performed poorly (losers).

The FF6 model equation is:

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{ir}RMW_t + \beta_{ic}CMA_t + \beta_{iw}WML_t + \varepsilon_{it}$$

- R_{it} is the return of portfolio *i* in period *t*.
- R_{ft} is the risk-free rate in period *t*.
- α_{it} is the intercept or alpha, which measures a portfolio's performance that is not explained by the model's variables.
- β_{iM} is the exposure of a portfolio to the market factor (MKT) factor.
- R_{Mt} is the return of the market portfolio in period *t*.
- $R_{Mt} - R_{ft}$ is the market risk premium, which measures the excess return of the market portfolio over the risk-free rate in period *t*.
- β_{is} is the exposure of a portfolio *i* to the size (SMB) factor.
- SMB_t stands for 'Small Minus Big', the size factor, in period *t*.
- β_{ih} is the exposure of a portfolio *i* to the value (HML) factor.
- HML_t stands for 'High Minus Low', the value factor, in period *t*.
- β_{ir} is the exposure of a portfolio *i* to the profitability (RMW) factor.
- RMW_t stands for 'Robust Minus Weak', the profitability factor, in period *t*.
- β_{ic} is the exposure of a portfolio *i* to the investment (CMA) factor.
- CMA_t stands for 'Conservative Minus Aggressive', the investment factor, in period *t*.
- β_{iw} is the exposure of a portfolio *i* to the momentum (WML) factor.
- WML_t stands for 'Winners Minus Losers', the momentum factor, in period *t*.
- ε_{it} is the error term of the portfolio *i* in period *t*.

(Fama & French 2015; Fama & French 2018).

In recent years, ESG factors have become increasingly relevant to investors as they seek to invest in companies that are not only financially sound but also responsible corporations. At the same time, the FF3, FF5 and FF6 model has been widely used to explain stock returns. However, none of the models takes into account ESG factors, which may have an impact on returns. In previous research, authors have tried to combine the FF6 model with ESG scores to better understand the relationship between a company's financial performance and its ESG practices (Kapri 2021; Gregory, Stead & Stead 2020). This approach has the potential to provide a more comprehensive framework for investors to evaluate companies and make more informed investment decisions. In this context, this study aims to examine the potential benefits and limitations of combining the FF6 model with ESG scores to analyze stock returns and inform investment decisions.

In this paper, the FF6 model is extended by adding a seventh factor, sustainability, and half-year time effect dummy variables. Therefore the equation used in this paper is:

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{im}MGR_i + \beta_{iM}(R_{Mt} - R_{ft}) + \beta_{is}SMB_t + \beta_{ih}HML_t + \beta_{ir}RMW_t + \beta_{ic}CMA_t$$

$+ \beta_{iw} WML_t + \beta_t D_t + \varepsilon_{it}$

- β_{im} is the exposure of a portfolio i to the sustainability (Morningstar) factor.
- MGR_i stands for 'Morningstar Globe Rating', the sustainability factor of portfolio i, a dummy variable for mutual funds having a 'high' or 'low' sustainability rating.
- β_t is the half-year time effect of period *t*.
- D_t is the half-year time dummy for period *t*.

2.2.8 Morningstar Globe Rating

Morningstar is a financial information and research company founded and based in Chicago, USA (Morningstar n.d.) that provides a Sustainability Rating for mutual funds and exchange-traded funds (ETFs) to help investors evaluate the sustainability performance of their investments (Morningstar 2021b). Morningstar introduced the Morningstar Sustainability Rating in 2016, in collaboration with Sustainalytics, a company now owned by Morningstar (Sustainalytics n.d.). Sustainalytics calculates and provides Morningstar with data on company-specific ESG scores, which serve as the foundation for Morningstar's sustainability rating (Morningstar 2021b) as a tool to assist investors in evaluating their portfolios in terms of ESG factors. The Sustainability Rating is calculated for both actively managed investment products and indexes utilizing Morningstar's database of portfolio holdings (Morningstar 2021b).

The Morningstar Sustainability Rating offers investors a means to evaluate the degree to which the companies held in a fund are managing their ESG risks and opportunities. The rating also enables investors to compare funds within categories and benchmark the funds against one another. These ratings may serve as a preliminary screen for investors who have an interest in sustainability and ESG. They can be a valuable starting point for investors who are looking to learn more about a manager's investment process and its relationship to sustainable investing. The ratings may also help investors determine the sustainability level of their portfolios. However, it is important to note that the ratings should not be the sole basis for making an investment decision. This is because they do not reflect a fund's absolute or risk-adjusted performance, nor do they include any qualitative evaluation of the fund's merits by Morningstar.

The Morningstar Sustainability Ratings are derived from two distinct components: the first is company-level ESG risk ratings and the second is the country risk ratings (Morningstar 2021b). The Morningstar Sustainability Ratings are calculated in five steps: 1) Determining the portfolio holdings that may have significant ESG risks and categorizing them within either the corporate or sovereign risk rating frameworks, 2) Calculate the 'Portfolio Corporate Sustainability Score' and 'Portfolio Sovereign Sustainability Score' over the past 12 months, 3) Use the score in step two and three to derive a 'Historical Corporate Sustainability Score' and 'Historical Sovereign Sustainability Score', 4) The determination of a 'Portfolio

Corporate Sustainability Rating' and 'Portfolio Sovereign Sustainability Rating' is contingent upon their respective historical scores in relation to the 'Morningstar Global Category'. The corporate and sovereign scores and ratings are derived separately, albeit utilizing the same methodology in parallel and 5) The 'Morningstar Sustainability Rating' is computed by merging the Corporate and Sovereign Ratings in proportion to the corresponding contributions of the corporate and sovereign positions. The resulting rating is then rounded to the nearest whole number, as exemplified in Table 1 (Morningstar 2021a; Morningstar 2021b).

Table 1: An example of corporate and sovereign sustainability rating

Corporate Sustainability Rating	**Corporate Contribution %**	**Sovereign Sustainability Rating**	**Sovereign Contribution %**	**Morningstar Sustainability Rating**
4	50	2	50	3
4	80	2	20	4
4	20	2	80	2

Source: Morningstar (2021b).

The ESG scores are assigned on a scale of 0 to 100 relative to other firms in the global industry peer group of companies. However, it is essential to note that two companies with the same ESG score, but belonging to different peer groups, may not exhibit an equivalent level of environmental, social, and corporate governance (ESG) performance. A score of 50 implies that the company's ESG performance is average relative to its peers, while a score of 70 or higher indicates that the company is rated at least two standard errors above average in its peer group. On the other hand, a score of 30 or lower means that the company's ESG score is rated at least two standard errors below average in its peer group (Investopedia 2023). Morningstar ranks all scored funds within a category by their Portfolio Sustainability Scores and divides them into five groups along a bell curve distribution (Morningstar 2021b). A fund's rating is depicted by one to five globes. For example, a fund with a 5-globe rating indicates that its holdings have strong ESG credentials, while a fund with a 1-globe rating suggests that its holdings have weak ESG credentials. The Sustainability Rating allows investors to easily compare the ESG performance of different funds and make more informed investment decisions.

Table 2: An example of sustainability groupings

Morningstar Sustainability Rating	**Percent Rank**	**Rating**
5 globes	Top 10%	High
4 globes	Next 22.5%	Above Average
3 globes	Next 35%	Average
2 globes	Next 22.5%	Below Average
1 globe	Bottom 10%	Low

Source: Morningstar (2021c).

The rating methodology takes into account a range of ESG factors such as the fund's overall ESG risk exposure and how well the fund's management team incorporates ESG considerations into its investment decisions. The methodology evaluates a fund's ESG-related risks and opportunities, as well as how the fund's holdings are managed and governed from an ESG perspective. A fund's investment strategy and sector focus, recognise that ESG considerations can vary significantly across different industries. Additionally, the methodology considers the degree to which a fund's holdings align with various ESG-related themes, such as clean energy or social responsibility (Morningstar 2021b).

The Sustainability Rating is updated on a monthly basis, based on the most recent data available. This allows investors to stay informed about the ESG characteristics of the funds they own or are considering investing in, and allows for ESG considerations in their investment decisions. By highlighting the sustainability performance of mutual funds and ETFs, Morningstar aims to encourage greater attention to ESG issues within the investment industry (Morningstar 2021b).

3. Hypotheses

The following section discusses the hypotheses related to the main areas of the study and the selection of the hypotheses that have been tested in this thesis.

3.1 Hypotheses

The purpose of this study is to investigate whether or not sustainable funds yield a higher excess return than non-sustainable funds, including in relation to the taken risk. The hypotheses are as follows:

1. H_1: A sustainable profile affects a Swedish global equity fund’s expected excess return positively.
2. H_2: Swedish global equity funds with a high sustainability rating have, on average, a lower risk level, compared to low-rated funds.
3. H_3: Fama-French factors can explain the Swedish global equity fund’s excess return.

We expect to see higher excess returns on sustainable funds. We also expect a lower risk level, measured by the standard error, for high sustainability-rated funds, compared to funds with a low sustainability rating. Additionally, we expect that Fama-French factors can explain the Swedish global equity funds’ excess return.

4. Material and Methodology

4.1 Material

In this section, we present the sources of data used in our research and provide an overview of the materials obtained from Refinitiv Eikon and Morningstar. The focus of our study is on Swedish global equity funds, and Refinitiv Eikon and Morningstar have been identified as useful sources of financial data, for the purpose of this thesis.

4.1.1 Data Sources

The data for the Swedish global equity funds were gathered from several different sources. Firstly, the Swedish global equity funds were collected from Refinitiv Eikon. Refinitiv Eikon is a platform that provides financial data, news and trading tools to financial professionals. It is designed to help traders, analysts and portfolio managers to make more informed decisions by providing them with a wide range of information such as market data and company information (Refinitiv n.d.). More specifically, the data on rolling returns was gathered using the Refinitiv Eikon add-in in Excel. Secondly, the sustainability rating was collected from Morningstar, in the form of the Morningstar Globe Rating. Morningstar is a financial services company that provides data and analysis on financial instruments such as stocks, mutual funds, exchange-traded funds (ETFs) and bonds (Morningstar n.d.). Thirdly, the factor data for the FF6 model, specifically for developed economies, were obtained from Kenneth R. French's website (French 2023a; 2023b), where historical data for the model is provided. As mentioned, Kenneth R. French, along with co-author Eugene F. Fama, are renowned for their work on the value effect and multifactor asset pricing models (French n.d.).

The reason for using data from multiple sources and constructing a data set is that there are no public data sets that correspond to the criteria needed to answer the research questions. Since the data material is constructed by the authors of this paper, the advantages of the data set are specificity, control, flexibility and uniqueness. Therefore the aim of the thesis is likely to be achieved. However, a disadvantage of using this data may be that it could contain biases in the data collection which could impact the validity or that the data set is incomplete because some data points may be missing. In order to address these disadvantages, the data in the dataset has been cross-checked, whenever possible, with multiple sources, such as Yahoo Finance and Investing.com.

4.1.2 Fund Selection

A decision was made to select Swedish global equity funds for analysis, rather than Swedish equity funds. One reason for the decision was to have a sufficient number of data points to analyze, in part due to few Swedish equity funds having a rating of 1 or 5 globes. A second reason was to not be limited in the time period that could be assessed, as the choice of a Fama-French model necessitated the finding of the Fama-French factors. These factors were only available for Sweden up until 2019, from the Swedish House of Finance at Stockholm School of Economics. Calculating the factors for the following years, in addition to the original goal of the thesis, would have been beyond the scope of a bachelor's thesis. The final reason for the decision was that the historic Morningstar Globe Rating was not available to students at the university, leaving a years-long gap between the end date of the latest possible time frame and the date of the rating. This would have made the necessary assumption, that the present Morningstar Globe Rating is the same as the historic rating or that the present rating is predictive of historic returns, less plausible. Hence, Swedish global equity funds were selected for analysis instead.

Multiple steps were taken to select funds of interest. Using Refinitiv Eikon, filters were applied to select open-ended global equity funds, domiciled and registered for sale in Sweden, and traded in the currency Swedish Krona (SEK), see Table 7 in the Appendix. Next, funds were selected based on whether or not they had a Morningstar Globe Rating. This entailed the exclusion of funds without a rating and of funds that had been liquidated or merged within the time frame of interest, as only the latest sustainability rating was available. Next, funds that had no data on rolling returns, for the selected time period, were removed. Finally, multiples of the same fund, with different share classes, explicitly or implicitly, were removed, leaving only funds that paid no dividends, had the longest series of return data, had the lowest minimum initial investment, and were more widely available for trade. If distinguishing characteristics between the share classes were unclear, other than fees, share class A was retained. The full list of selected funds can be seen in the Appendix, Table 8 and 9.

4.1.3 Data Length

When using the Fama-French models, combined with ESG scores, to analyze mutual fund performance, the appropriate length of data is a subject of ongoing debate in academic literature. While the choice of data length depends on the research question and the frequency of data collection, studies have mainly used a 5-year or 10-year time horizon to analyze mutual fund performance with the Fama-French models. The appropriate length of data may vary depending on the research question and the specific market conditions being analyzed. It is important to ensure that the data is consistent and accurate to account for any changes in the fund's investment strategy or management team over the time period being analyzed. However, this requires careful consideration of the potential impact of the additional factor on the interpretation and stability of the model. In this paper, a 5-year time period, from January 2018 to December 2022, was selected, given fast changes and growing interest in the topic.

4.1.4 Defects and risks in the data

There is an assumption that a fund's sustainability rating has remained constant from January 1st, 2018 to December 31st, 2022, since historic sustainability ratings are stored in 'Morningstar Direct', a database that is inaccessible to the authors. The sustainability rating used in the study was collected on April 20th, 2023. This could potentially impact the study's findings, as the assumption of time-invariance may have been violated.

Out of the data set, only one fund had a sustainability rating of 1 globe, while two funds had a rating of 2 globes. The remaining funds had a rating of 3, 4, or 5 globes. Therefore, the funds with a sustainability rating of 1, 2 or 3 globes have been put in a common ‘low sustainability rating’-group and those with 4 or 5 globes in a ‘high sustainability rating’-group, as the categories with 1 and 2 globes did not have a large enough number of funds to enable a clearer comparison, more about this in Chapter 4.2.5.

During the data collection, the sampled funds had been active for shorter and longer periods, including ones that had been merged or liquidated. Funds with longer histories are prone to survivorship bias, since poorly performing funds are often merged with or discontinued, leaving only the successful and profitable ones. Elton, Gruber, and Blake's (1996) study examined 361 funds between 1976 and 1993, and only 216 survived until the end, with the rest either merged, disappeared, or limited. The authors argued that virtually all fund-based studies are affected by survivorship bias in some way. Hence, the study's results may be affected if one portfolio has been subject to more or less survivorship bias than the other. In this thesis, it was not possible to include funds that had been merged or liquidated, as these lacked a Morningstar Globe rating.

Panel data analysis with random effects and time effects has become increasingly popular in economics and other social sciences due to its ability to control for unobserved heterogeneity and to capture time-invariant unobservable characteristics of individuals or entities. However, it is important to note that panel data analysis comes with several risks that must be carefully considered. One major risk is the potential for bias due to unobserved heterogeneity that is not captured by the model. Another risk is that the results may be sensitive to model specification and assumptions made regarding the distribution of error terms (Wooldridge 2001).

4.1.5 Fama-French Factors, currency, risk free rate and excess return

The choice of analyzing the effect of the Morningstar Globe Rating on the excess return on global equity funds, in combination with using a Fama-French model, limited the possible alternatives for which Fama-French factors, risk-free rate, and currency were to be used. The available global Fama-French factors were for developed economies, based on returns denominated in US Dollars, from Kenneth R. French’s website (French 2023a; 2023b). As mentioned before, calculating the Fama-French factors in this thesis would be beyond its scope. Therefore, the factors from Kenneth R. French were chosen. This limited the analysis to one based on returns in US Dollars, as there was a currency risk, and the Fama-French factors could not be used, as is, in another currency. The choice of Fama-French factors included a choice of risk-free rate and market index. Specifically, the U.S. one-month T-bill rate was used and the market index consisted of the securities used by French to calculate the factors (French 2023a). Hence, the choice of variables resulted in the perspective of an investor using US Dollars.

4.2 Method

In this section, we outline the methodology employed to analyze the relationship between the dependent and independent variables, with regard to the excess return on Swedish global equity funds. Our analysis primarily relies on pooled OLS regression analysis, a widely used statistical technique for examining the impact of independent variables on a dependent variable.

4.2.1 Panel Regression Choice

When using panel data, which was done when following multiple funds over time, there is a need to identify an appropriate regression type for the panel data. The Hausman test and the Breusch-Pagan Lagrange Multiplier (BPLM) test are common tools to guide the decision. These tests are statistical tools that help identify whether the data is best modeled by a fixed effects or random effects panel regression (Hausman 1978) and by a random effects panel regression or a pooled OLS regression (Breusch & Pagan 1979), respectively. However, the degrees of freedom for the Hausman test are determined by the number of independent variables varying across time and individuals, as implied and clarified by J.M. Wooldridge (2001, p. 290; 2021), of which there were none in this thesis. Additionally, the fixed effect model includes all time-invariant variables, such as the used sustainability rating, in an individual dummy variable for each fund. These aspects left the BPLM test as the relevant test to conduct, see Table 5, and excluded a panel regression with fixed effects as an alternative.

4.2.3 Levene's Test

Levene's test is a statistical test used to assess the equality of variances across multiple groups or samples. The test is less sensitive to non-normality than a regular F-test and is based on a one-way ANOVA between groups, with observations replaced by absolute deviation from the group mean, median, or 10% trimmed mean, where the 10% largest and 10% smallest values in each group are deleted. If the p-value is below the significance level, it indicates that the variances across groups are significantly different. If the p-value is above the significance level, there is insufficient evidence to reject the null hypothesis, suggesting similar variances (Brown & Forsythe 1974).

4.2.4 Deviations from normally distributed excess returns and tail-risk

The distribution of variables are not necessarily normally distributed, giving rise to over- or underestimation of risk, by the standard error measure, and a changed tail-risk, from the fatness or thinness of the tails of the distribution. The asymmetry and tailedness of the distribution are measured by skewness and kurtosis, respectively. The formula for skewness is as follows:

$$Skew = E\left[\frac{(R-\overline{R})^3}{\hat{\sigma}^3}\right]$$

$E = Expectation\ operator$

$R = Excess\ return$

$\overline{R} = Average\ excess\ return$

$\hat{\sigma} = observed\ standard\ error$

The direction of the distribution’s asymmetry is shown by whether the skewness is positive or negative. If the skewness is 0, the distribution is symmetric. If the skewness is negative, the left tail of the distribution is fatter and extreme negative values are more likely than extreme positive values. Hence, the standard distribution underestimates the risk. If the skewness is positive, the right tail of the distribution is fatter and extreme positive values are more likely than extreme negative values. Hence, the standard error overestimates risk, as positive volatility is not a concern for investors (Bodie, Kane & Marcus 2021). The skewness of the chosen variables was calculated, see Table 5, and, in the appendix, Table 10 and 11.

Kurtosis is a second measure of deviation from a normal distribution, specifically whether the distribution is more or less spread out from the mean, i.e., if the tails of the distribution are fatter or thinner, respectively. The basic formula for kurtosis is as follows:

$$Kurtosis = E\left[\frac{(R-\overline{R})^4}{\hat{\sigma}^4}\right]$$

$E = Expectation\ operator$

$R = Excess\ return$

$\overline{R} = Average\ excess\ return$

$\hat{\sigma} = observed\ standard\ error$

For the normal distribution, the expected value for kurtosis is 3. Higher kurtosis values entail fatter tails, meaning an increased probability of extreme outcomes (Bodie, Kane & Marcus 2021, p. 138-139). The excess kurtosis can be found by subtracting kurtosis by 3, though Stata reports regular kurtosis values. The kurtosis of the chosen variables was calculated, see Table 5, and, in the appendix, Table 10 and 11.

4.2.5 Panel Regression

When choosing a strategy for the panel data analysis, the following steps were taken. Firstly, frequency histograms of the excess return were created to identify the existence of extreme values, see Figure 1 in the Appendix. Secondly, winsorizing at the 1st and 99th percentile of the excess returns was conducted, to remove extreme values, as these can disproportionally affect mean values and statistical tests. Thirdly, descriptive statistics of the continuous variables were taken, including the skew and kurtosis of the dependent and independent variables, to assess whether the data were approximately normally distributed, and assess downside risk and the probability of extreme outcomes. Fourthly, the appropriateness of a random effect or fixed effects panel regression model, for the panel data analysis, would normally have been assessed by conducting the Hausman test. This statistical test would have allowed for the comparison of fixed-effects and random-effects models by assessing the correlation between the independent variables and the error term. However, there were no independent variables that varied across both time and individuals, rendering the application of the Hausman test impossible in this particular context, see Table 5, due to having no degrees of freedom. Fifthly, whether the variance of the random effect was zero, i.e. the null hypothesis of the BPLM test, was assessed using the BPLM test. This test is commonly employed to detect unequal variances in a regression model and can show whether a random effects model is needed. The BPLM test was conducted and, considering the impossibility of assessing time invariant variables with a fixed effects model, pooled ordinary least squares (OLS) regression was chosen for the analysis, see Table 5. Sixthly, a pairwise correlation test was conducted to assess the correlation of the model's independent variables, see Table 4. Seventhly, the equality of variances of the excess returns, between the sustainability groupings, was examined with Levene's test, to assess if the variance of the excess return differed between the sustainability groupings, see Table 6. Lastly, residual-versus-fitted plots were created for the winsorized and non-winsorized data, to identify if the error term correlated with the excess return, and to identify which set of excess return data was appropriate for analysis, see Figure 3 and 4 in the Appendix.

This thesis utilised the above strategy to analyze the data of fund excess returns, i.e. longitudinal data of multiple funds' excess returns, following the same funds over time and allowing direct comparison with the market excess return. By subtracting the risk-free rate from the fund return, excess return provided a measure of the return earned by taking on the additional risk associated with the fund. Funds with a sustainability rating of 1, 2, or 3 globes were grouped together as a 'Low sustainability rating' category, due to few funds having a rating of 1 or 2 globes, creating the reference group. Funds with a sustainability rating of 4 or 5 globes were classified as a 'High sustainability rating' category. The dummy variables were 'Low sustainability rating' (reference group) and 'High sustainability rating'.

Both the non-winsorized and winsorized data were reported in the descriptive statistics. Non-winsorized refers to the original data having not been modified or adjusted to account for outliers. In this approach, extreme values are not altered or replaced, and the data distribution remains unchanged. On the other hand, winsorized data refers to a modified version of the original data, where outliers were adjusted by replacing them with less extreme values. Winsorizing involves replacing the extreme values with values located at a specified percentile of the data distribution. The 1% winsorized data would replace values below the 1st percentile with the value at the 1st percentile and values above the 99th percentile with the value at the 99th percentile. This process reduces the impact of outliers on statistical analysis, while preserving the overall shape of the data distribution.

The model used for the regression was the FF6 model, with the addition of a dummy variable for the sustainability grouping (‘Low’ and ‘High’), based on the Morningstar Globe Rating, and dummy variables for half-year time effects (2018-2022), using spring 2018 as the reference group. The sustainability variable allowed for assessing sustainability-related performance not explained by the other variables, particularly the FF6 variables. The time effects enabled controlling for some omitted variable bias, that would impact performance in the chosen time interval. More specifically, the time effects allowed accounting for common shocks or events that affected all observations equally, but varied over time, such as the COVID-19 pandemic or macroeconomic events. By including half-year dummies as fixed effects, it was possible to control for effects of these time-varying events and isolate the relationship between the independent variables and the dependent variable. Conducting a pooled OLS where the regression was clustered based on fund name, yielded standard errors robust to heteroscedasticity and autocorrelation.

5. Results

In this section, results obtained through the method outlined above will be presented. First, descriptive statistics of the included variables, for the chosen Swedish global equity funds, will be presented. Second, the correlation table of the included variables will be presented. Lastly, the results of the regression and regression choice tests will be presented. Later, the results presented in this section will be discussed in relation to economic theory and prior research.

5.1 Descriptive Statistics

In the Appendix, Figure 1 showed the frequency distribution of the excess return, indicating the existence of extreme values. In the Appendix, Figure 2 showed the frequency distribution after winsorizing the excess return with the 1st and 99th percentile. The residual-versus-fitted plots, Figure 3 and 4 in Appendix, showed a negative correlation between the error term and the dependent variable, when using winsorized data, but not for the non-winsorized data, indicating that winsorizing created the negative correlation. The result serves as an argument for retaining the outliers, rather than removing them from the analysis, as a negatively correlated error term suggests an omitted variable. Hence, primarily the non-winsorized results will be addressed.

There were different numbers of Swedish global funds receiving the five respective Morningstar Globe Ratings. Specifically, there was one fund with a ranking of one globe, two with a ranking of two globes, 27 with a ranking of three globes, 31 with a ranking of four globes, and 19 with a ranking of five globes, see Table 8 and 9 in Appendix. There were 1439 observations for the reference category, 'Low', with a globe ranking of 1-3, and 2805 observations for the 'High' category of the Morningstar globe ranking, with a total of 4244 observations of 80 Swedish mutual funds. The observations were of funds that had rolling returns data until the end of the chosen time period, January 2018 to December 2022, though not necessarily from the start of the time period.

As can be seen in Table 10 and 11 in the Appendix and Table 3 below, there were seemingly differences in the excess returns between different Morningstar globe categories, prior to statistical testing. The mean excess returns were 0.409%, 0.395% and 0.417% for the total sample, low and high ranking groups, respectively. The standard errors were 5.419%, 5.515% and 5.370% for the total sample, low and high ranking groups, respectively. The skewness values were -0.402, -0.426, and -0.388 for the total sample, low and high ranking groups, respectively. Lastly, the kurtosis values were 3.419, 3.674 and 3.270 for the total sample, low, and high ranking groups, respectively.

As shown in Table 10 and 11 in the Appendix and Table 3 below, the values of the continuous variables differed in the different rating groups. However, these differences may not be significant. For the FF6 factors, the difference was due to the constituent funds having differed in the time span for which there was data. In all categories, the excess return was lower than the market excess return, whereas the standard error was greater, for the non-winsorized data. The skewness of the excess return was greater, i.e. more negative, than that of the market excess return, for all fund rating categories. The kurtosis was greater, i.e. more positive, than that of the market excess return, for all fund rating categories, for the non-winsorized data.

Table 3: Summary statistics of the entire set of funds

	Count	Mean	Min	Max	Variance	Standard Error	Skewness	Kurtosis
Excess Return	4244	0.409	-24.226	20.182	29.366	5.419	-0.402	3.419
Excess Return, Winsorized	4244	0.421	-12.898	12.556	27.982	5.290	-0.348	2.879
Market Excess Return	4244	0.513	-13.770	13.340	28.000	5.292	-0.319	3.071
Small Minus Big	4244	-0.307	-4.440	3.160	2.598	1.612	0.017	2.601
High Minus Low	4244	-0.066	-9.240	11.960	13.556	3.682	0.555	3.902
Robust Minus Weak	4244	0.388	-2.910	4.590	2.351	1.533	0.108	3.383
Conservative Minus Aggressive	4244	0.194	-5.360	8.090	5.415	2.327	0.855	4.615
Winners Minus Losers	4244	0.501	-10.920	6.680	9.882	3.144	-0.828	4.821

5.3 Correlation Matrix

The correlation matrix, Table 4, shows the extent to which the constituent independent variables of the model varied in a linear relationship with each other, taking a value between -1 and 1. Of note are the correlations between the variables RMW and HML, with a correlation coefficient of -0.553, and CMA and HML, with a correlation coefficient of 0.850. The mentioned correlations exceeded having a correlation coefficient of 0.5.

Table 4: Pairwise correlation matrix

	MktRF	SMB	HML	RMW	CMA	WML
MktRF	1					
SMB	0.194***	1				
HML	-0.0697***	0.126***	1			
RMW	0.182***	-0.271***	-0.553***	1		
CMA	-0.274***	-0.0232	0.850***	-0.387***	1	
WML	-0.408***	-0.161***	-0.465***	0.166***	-0.155***	1

* p<0.05, ** p<0.01, *** p<0.001

5.4 Fama-French Sustainability Regression Choice and Outcome

As described in Chapter 4.2.5, the Hausman test and BPLM test for random effects were used to inform the regression choice, testing for the appropriateness of a panel regression with fixed or random effects or a pooled OLS regression. There was no result to the Hausman test, as there were no independent variables varying across both time and individuals, leaving 0 degrees of freedom. The BPLM test did not reject the null hypothesis of there being no random effects, see Table 5.

The results of the regression of monthly excess return, on Swedish global equity funds, on the FF6 factors, Morningstar Globe Rating based categorization, and time effects, in the form of half year dummies, can be seen in Table 5. Multiple variables were significant. At the 0.1% significance level, the Market Excess Return, High Minus Low, Conservative Minus Aggressive, and the dummy variables for spring 2019 to spring 2021, and spring 2022 were significant. At the 1% level, fall 2022 was significant. Finally, at the 5% level, Small Minus Big and Robust Minus Weak were significant. Additionally, there was a statistically significant constant, at the 0.1% level. The sustainability rating was insignificant. In comparison, for the regression with the winsorized excess return, Small Minus Big was not significant, whereas fall 2021 was, at the 5% level.

Table 5: Pooled OLS regression of monthly excess returns, non-winsorized and winsorized, on the constructed FF6 model variables, sustainability rating, and time effects. The standard errors are robust standard errors. Hausman test and BPLM test for regression choice, with p-values as results

	Excess Return		Excess Return, Winsorized	
High Sustainability Rating	0.035	(0.060)	0.014	(0.057)
Market Excess Return	0.946***	(0.014)	0.930***	(0.012)
Small Minus Big	0.065*	(0.031)	0.037	(0.026)
High Minus Low	-0.146***	(0.033)	-0.184***	(0.029)
Robust Minus Weak	0.087*	(0.037)	0.081*	(0.035)
Conservative Minus Aggressive	0.158***	(0.044)	0.199***	(0.039)
Winners Minus Losers	0.020	(0.014)	0.020	(0.013)
2018 Fall	-0.168	(0.147)	-0.145	(0.142)
2019 Spring	-0.927***	(0.150)	-0.779***	(0.156)
2019 Fall	-0.952***	(0.178)	-0.975***	(0.178)
2020 Spring	0.680***	(0.116)	0.511***	(0.125)
2020 Fall	1.403***	(0.194)	1.351***	(0.191)
2021 Spring	0.924***	(0.152)	0.982***	(0.149)
2021 Fall	-0.202	(0.132)	-0.262*	(0.129)
2022 Spring	-1.583***	(0.144)	-1.577***	(0.139)
2022 Fall	-0.712**	(0.239)	-0.607**	(0.220)
Constant	0.503***	(0.076)	0.505***	(0.076)
Observations	4244		4244	
R-squared	0.870		0.878	
Robust standard errors in parentheses				
* p<0.05, ** p<0.01, *** p<0.001				
Hausman Test	-		-	
BPLM Test for Random Effects	1.000		1.000	

Table 6 shows the result of Levene's test on the variances of the excess return, for low and high sustainability funds. The test did not reject the null hypothesis that the variances were the same for low and high sustainability funds. These results applied to both non- and winsorized excess returns.

Table 6: Levene's Test of equal variances, for the excess return of the Swedish global equity funds

	Excess Return			Excess Return, Winsorized		
	Mean	Median	10% Trimmed Mean	Mean	Median	10% Trimmed Mean
F(1, 4242)	0.3972	0.3946	0.4142	0.1174	0.1329	0.1408
P-value	0.5286	0.5299	0.5199	0.7319	0.7154	0.7075

6. Discussion

In the chosen regression model, the FF5 model's variables, in the chosen FF6 model, were statistically significant, as were many of the time variables and the constant. Some of the chosen variables had a correlation coefficient above 0.5. As noted earlier, the primary variables of interest, i.e. the dummy for the sustainability rating, were not statistically significant. This section will discuss the findings, what they mean, and potential reasons for the findings.

6.1 Sustainability

The inclusion of Morningstar globe ratings, as dummy variables, yielded no significant results. The H_1 of the thesis was that "a sustainable profile affects a Swedish global equity fund's expected excess return positively". There was an insignificant positive difference, in the excess return of funds with a high sustainability rating, of 0.035 percentage points, on average. Hence, the results showed no significant advantage or disadvantage, on average, to excess return, from the Morningstar Globe Rating. This means that the results did not support the hypothesis, which is consistent with earlier mentioned examples of sustainability being an insignificant factor (Yue et al. 2020; Xiao et al. 2013; Naffa & Fain 2021; Kapri 2021), although there are also prior examples of sustainability being advantageous (Maiti 2021; Díaz, Ibrushi & Zhao 2020; Gregory, Stead & Stead 2020). In relation to the theoretical background, the results do not show the disadvantage predicted by traditional economic theory, when losing investment opportunities, suggesting that positive effects, or a reduction of negative effects, on performance, in line with the predictions of the Porter hypothesis. However, for this thesis, the grouping and the lack of historical sustainability rating, as well as underlying assumptions of the model possibly being false, may be explanations behind the lack of significant results.

The grouping of funds of different ratings into 'Low' and 'High' sustainability ratings may have had an influence on the results. It could be argued that a Morningstar globe rating of 3 is not low, meaning that such funds would not be valued as such by investors, which would reduce the difference to the funds originally placed in the 'High sustainability rating' category. However, considering the distribution of the ratings of Swedish global equity funds, the funds with a rating of 3 were not on the lower end.

Another aspect to the rating, is that the chosen model relies on the assumption that the present Morningstar globe rating is applicable to or highly predictive of the rating of the past, or, alternatively, that the current rating is representative of historic characteristics that investors have prized, but are not captured by the FF6 model variables. This distinction is motivated by the fact that the Morningstar globe rating has undergone changes in its construction during the examined time interval. There is limited support for the assumption of backward applicability, as the 'Historical Portfolio Sustainability Score', a weighted average of the last 12 months' sustainability risk, is part of determining the globe rating. Provided that the underlying characteristics of the globe rating were known to the market, prior to changes in the construction of the globe rating, the characteristics would already have been prized by the market, based on the EMH. Provided that the underlying sustainability characteristics of the funds remained the same or similar during the time, the present globe rating would have been applicable to earlier points in the time period. However, if the globe rating provided new information itself, or served as an incentive to provide more sustainability-related information, the assumption of backward applicability of the current rating would not hold, making the rating an issue of disclosure of sustainability characteristics.

For the model to be predictive of excess return, there is also a need for investors to value sustainability, of the kinds measured by the rating, and in a similar fashion how they are valued by the rating, relative to each other. This includes how sustainability relates to the riskiness of the investment. Additionally, investors would need to value the sustainability of a fund's assets relative to others in the same 'Morningstar Global Category', rather than in an absolute sense or relative to assets within some other category in the same or another categorization system. However, the globe rating is commonly used, including in research, indicating that the rating is perceived to be of value, which supports the idea that the construction of the rating is aligned with the perception of investors.

As the chosen model includes sustainability rating as a dummy variable, and not interactions, the model also assumes that variability of the excess return, from the sustainability rating, is not a result of an interaction with the other variables. The assumption of the model is that differently ranked funds would, on average, have a different intercept, i.e. under- or overperformance which is not explained by the other variables. However, the model does not assume a different impact from the other variables, based on globe ranking. E.g. the model does not assume a different outperformance by small capitalization companies relative to large capitalization companies, based on globe ranking. However, the residual-versus-fitted plot, see Figure 3, did not suggest that there was an omitted variable.

6.2 Risk

There are multiple measures of risk and this section will address risk as measured by variation in excess return. As mentioned previously, there was no significant difference in the excess return or the variance, based on the sustainability category, though the variance is not the sole value relevant to assessing risk. As for the investor, negative outcomes, particularly a higher risk of such, are considered a risk, meaning it is of interest to assess the skew and kurtosis of the variation. As for the hypothesis, H_2, it posited that Swedish global equity funds, with a high sustainability rating, have, on average, a lower risk level, compared to low-rated funds. The hypothesis was not supported by Levene's test, see Table 6. With regards to the skew and kurtosis, they have not undergone statistical testing.

For all of the sustainability ranking categories, the skewness of the excess return was somewhat more sizable and negative than that of the market excess return, see Table 10 and

11 in the Appendix and Table 3. The low sustainability group had a somewhat more sizable skewness, and the high sustainability group somewhat less, than the skewness of the excess return of the entire set of funds. The high category also differed the least in skewness compared to the market. A negative skewness entails an increased risk of extreme negative values, which is of particular interest for an investor, due to loss aversion and not considering extreme positive outcomes as a risk. The skewness values, in the summary statistics, indicated that the risk was relatively lower for the high ranking funds, in a manner relevant to an investor, though the skewness was not much larger than what would be expected for a normal distribution, and all the rankings were seemingly riskier, with regards to downside risk, than the market. This is aligned with the hypothesis, though it has not been statistically tested.

With regards to the kurtosis of the funds' excess return, low sustainability rated funds had a higher kurtosis than high sustainability rated funds. The higher kurtosis entailed a higher probability of extreme values, indicating that lower sustainability rated funds had a higher risk level than highly rated funds. Like with the skew, this was aligned with the hypothesis, though it had not been statistically tested, and the values were close to what would have been expected from a normal distribution.

Reiterating, there are different measures of risk. The variance of the excess return has been tested and has not been found to differ significantly between sustainability ratings, which did not support hypothesis H_2. The skew and kurtosis were aligned with the hypothesis, but had not been tested for significance and did not differ much from a normal distribution. The skew and kurtosis, for the market excess return, were lower than for the excess return, entailing a lower risk of negative and extreme values. The hypothesis, H_2, has not been supported.

6.3 Fama-French Six-Factor Variables

The third hypothesis of the thesis, H_3, posited that the Fama-French factors can explain the Swedish global equity fund's excess return. In the model, each variable has a beta, see Table 5, indicating the sensitivity of the excess return of the Swedish global equity funds to the individual variables. The betas give indications of the risk that the funds carry, as well as their composition. There is also an alpha, which is the performance that is not explained by the other variables.

The market excess return is the difference between the returns of the market, which carries risk, and the risk-free rate, which is assumed to not carry risk. The beta is the sensitivity of Swedish global equity funds' excess return to the market, i.e. systemic risk. The coefficient of the variable entails that the excess return on Swedish global equity funds changed by 0.946 percentage points, on average, as the market excess return changed by 1 percentage point. As such, Swedish global equity funds carried lower systemic risk than the market portfolio, when controlling for investment style, through the Fama-French factors, but did not benefit as much from the market performing well.

The coefficient of the ‘Small Minus Big’ variable indicates the Swedish global equity fund’s sensitivity to the return of smaller market capitalization companies compared to larger capitalization companies, where smaller market capitalization companies outperform larger capitalization companies in the long run. For each percentage point change of such difference in return, Swedish global funds’ excess return changed positively and significantly by 0.065 percentage points, on average. As the coefficient was positive, it indicates that Swedish global equity funds were overweight smaller market capitalization stocks, or behaved as if they were. Under the EMH, this sensitivity to SMB would be considered compensation for the greater risk of small-cap stocks.

The coefficient of the ‘High Minus Low’ variable, i.e. the value premium, indicates the Swedish global equity fund’s sensitivity to the return of high book-to-market value ratio companies, compared to low book-to-market value ratio companies, where companies with a high book-to-market value ratio are expected to outperform. The excess return of Swedish global equity funds decreased negatively and significantly by 0.146 percentage points, on average, for each percentage point increase of the high book-to-market value ratio portfolio outperformance, compared to the low book-to-market value ratio portfolio. This indicates that Swedish global equity funds were overweight growth stocks, or behaved as if they were.

The coefficient of the ‘Robust Minus Weak’ variable, i.e. the profitability factor, indicates the Swedish global equity fund’s sensitivity to the return of companies with high operating profitability compared to low operating profitability, where those with high operating profitability are expected to have higher returns. The excess return of Swedish global equity funds increased positively and significantly by 0.087 percentage points, on average, for each percentage point increase of the high profitability portfolio outperformance, compared to the low profitability portfolio. This indicates that Swedish global equity funds were overweight high-profitability stocks, or behaved as if they were.

The coefficient of the ‘Conservative Minus Aggressive’ variable, i.e. the investment factor, indicates the Swedish global equity fund’s sensitivity to the return of companies with low investment compared to high investment, where those with low investment are expected to have higher returns. For each percentage point the conservative portfolio outperformed the aggressive portfolio, the excess return on Swedish global equity funds increased positively and significantly by 0.158 percentage points, on average. This indicates that Swedish global equity funds were overweight conservative stocks, or behaved as if they were.

The coefficient of the ‘Winners Minus Losers’ variable, i.e. the momentum factor, indicates the Swedish global equity fund’s sensitivity to the profitability of a momentum strategy, that involves buying stocks that have performed well (winners) and selling stocks that have performed poorly (losers). There was no significant effect and, hence, the result did not support the hypothesis that this variable is among those that explain the Swedish global equity fund’s excess return.

The alpha is the performance that is not explained by the explanatory variables. Under the EMH, the alpha is expected to be 0 over time. There was a significant and positive alpha for Swedish global equity funds of 0.503 percentage points. Hence, Swedish fund management of Swedish global equity funds outperformed the model prediction, on average, by 0.503 percentage points.

All of the factors in the FF6 model, except 'Winners Minus Losers', were found to be statistically significant in their relationship with the Swedish global equity funds' excess return. Therefore, the results provided support to hypothesis three (H_3), that the Fama-French factors could explain the Swedish global equity fund's excess return. The results supported the notion that the FF5 factors have a significant relationship with the Swedish global equity funds' excess return. Therefore, H_3 was supported because of the significant result of the factors.

6.4 Time Effects

There were statistically significant time effects for multiple half-year periods. Multiple events took place during the studied time interval, such as the COVID-19 pandemic, expansionary monetary and fiscal policy, lockdowns, supply chain disruptions, high inflation, contractionary monetary policy, and war in Europe. These events have taken place during different, albeit often overlapping, time periods. The time effects can be seen as an attempt at reducing omitted variable bias from such disrupting events, along with other variations that would be of little consequence over a longer period of time. As such, the time effects do not specifically identify the source of the variation, though the net average effect in the time interval of the time dummy can be seen, relative to the spring of 2018.

The coefficients of the time dummies show over- or underperformance that is not explained by the FF6 variables or sustainability variable, for the aforementioned time periods, relative to the spring of 2018. In the spring and fall of 2019, the Swedish global equity funds had an excess return that underperformed by 0.927 and 0.952 percentage points, on average, respectively. In spring 2020, fall 2020, and spring 2021, the Swedish global equity funds had an excess return that outperformed by 0.680, 1.403, and 0.924 percentage points, on average respectively. In the spring and fall of 2022, the Swedish global equity funds had an excess return that underperformed by 1.583 and 0.712 percentage points, on average, respectively. For some of these observations, possible explanations have been identified, including the lack of a significant result for fall 2021.

Although there were multiple potential reasons for the time effects, only some have been identified. The reasons for the underperformance in 2019 are unknown. Spring 2020 saw the spread of COVID-19, the institution of lockdowns, and the commencement of expansionary fiscal and monetary policies. Although the pandemic and the lockdowns hindered many regular economic activities, and there was a dip in the stock markets, the lockdown and expansionary policies created a different environment for financial markets. There were fewer opportunities to spend money in the real economy, combined with expansionary policies, making cheap money available, and narratives about the pandemic being a temporary state, after which there would be opportunities to return to regular life. As such, there was maintenance of expectations of future cash flows, possibilities for companies to increase their assets through loans, and the possibility for companies to use borrowed money to engage in share buybacks, increasing the value of the remaining shares. Additionally, with fewer opportunities to consume, but remaining opportunities to invest, the flow of money into the financial market likely increased, increasing valuations. Fall 2020 and spring 2021 also had lockdowns and expansionary policies. Considering the insignificance of fall 2021, it may have been due to the change in conditions that generated overperformance. This result is in-line with the previous research presented by Silva and Cortez (2016) in Chapter 2.1.3.

In the fall of 2021, the overperformance ended. Although there were still lockdowns and expansionary policies, inflation began to rise. Higher inflation reduces the real return on investment, and carries the risk of increased interest rates, making money more expensive and reducing consumption, all of which would reduce the present value of future cash flows, which would lead to lower returns. In the spring of 2022, inflation continued to increase and Russia invaded Ukraine, resulting in sanctions that severely increased energy prices in Europe, increasing inflation further. Additionally, the impact of the pandemic on supply chains, including on attitudes to globalization and the functioning of the just-in-time system, further reduced the present value of future cash flows, due to inefficiencies increasing costs, increasing costs creating a need for new relative pricing, creating further inefficiency, and further inflation leading to further increases in interest rates. These problems persisted throughout the fall of 2022. Many of the above-mentioned circumstances may be considered major reasons for the underperformance in spring and fall 2022, by 1.583 and 0.712 percentage points, respectively. During the fall of 2021, the supply chain disruptions and inflation could have been counteracting circumstances that had previously generated overperformance, resulting in no significant correlation.

6.5 Potential Issues and Limitations

The applied model and methodology had limitations that need addressing, beyond what has already been done. There was high correlation between some variables, see Table 4. This limits the precision and reliability of the predictor. The time aspect may also have been relevant to the usefulness of the Fama-French factors. As has been shown, there were multiple time effects that were significant. Given that the Fama-French variables concerned company characteristics that yield higher returns over time, the chosen time interval entailed limitations as to how predictive the Fama-French variables may be, especially considering how eventful the examined period was. Without the time effects, one or more of the variables may not have been statistically significant, yielding less usefulness in predicting future outcomes, using historic data from a shorter time interval, and indicating less certainty in shorter-term outcomes from the model.

7 Conclusions

The aim of this thesis is to examine the relationship between Swedish global equity funds' performance, sustainability profiles, and risk level, using a FF6 model and the Morningstar Globe Rating, as a measure of a fund's sustainability profile. It was hypothesized that Swedish global equity funds, with a more sustainable profile, would have a higher expected excess return, a lower risk level, and that Fama-French variables would be able to explain the excess return on Swedish global equity funds.

The results show no significantly different excess return in higher rated funds, only an insignificant positive effect, on average, and no significant difference in the variance of the funds with different ratings. Hence, the H_1 and H_2 are not supported. However, there are some differences, in the skew and kurtosis, between the globe ratings, as well as between the Swedish global equity funds and the market portfolio. However, these differences are not tested for significance. The nature of the difference of the skew and kurtosis, of the funds with different globe rankings, is consistent with a decrease in downside risk with a higher level of sustainability.

Out of the FF6 variables, the variables from the FF5 model are significant, when returns were measured in US Dollars. Hence, the H_3 is supported. Together with time effects, the FF6 variables explain much of the performance of Swedish global equity fund performance, within the chosen time period. Additionally, there remains an outperformance, with regards to excess return, that is not explained by the chosen variables. However, the examined Swedish global equity funds underperform, on average, relative to the market, with regard to excess return, variance, skew, and kurtosis. The market beta, i.e. the market sensitivity, is less than 1, meaning the risk from the market, or systemic risk, is lower than for the market portfolio for Swedish global equity funds, when controlling for investment style.

This thesis contributes to the field of economics by examining the relationship between the excess return on Swedish global equity funds and having a low or high sustainability rating, as characterized by the Morningstar Globe Rating, as well as by testing if the FF6 factors explain the excess returns of Swedish global equity funds. Such a relationship is of interest to the field of economics, as a tool for aligning individual and collective economic interests, specifically regarding sustainability. The relationship is also of interest as the EMH and MPT predict that sustainability requirements reduce the potential to diversify, increasing idiosyncratic risk, where increased risk is thought to be compensated by higher returns, but may not yield a maximal risk-adjusted return. Meanwhile, an argument for sustainable investments involves risk management, hypothetically reducing risk, which would reduce returns, if returns are a compensation for risk. Another argument for sustainable investments is the potential for sustainability requirements to stimulate innovation and efficiency, as per the Porter hypothesis. The findings do not support a difference in excess returns and risk, based on increasing levels of sustainability, as measured by the Morningstar Globe Rating, for Swedish global equity funds. As such, Morningstar Globe Rating has not been shown to make a difference in these regards, meaning that they have not been shown to be an indicator of better or worse outcomes for investors interested in sustainable investments, in the form of Swedish global equity funds, providing some support to the Porter hypothesis.

If a similar study was to be conducted again, certain aspects could be improved in the model and methodology. It is conceivable that sustainable practices would interact with portfolio composition, such as being overweight large capitalization companies, due to supposed differences in risk and the idea of how risk is compensated with a higher return. Hence, it could be of interest to include interaction terms with the FF6 model variables. Considering the redundancy of HML (Fama & French 2015), which also results in a high correlation with other variables, it may be of interest to attempt a model without HML. Additionally, it may be of interest to replace the globe rating with its constituent sustainability categories and scores, to assess if they are predictive of excess returns. It could be of interest to include control variables, such as for fees, which reduces returns, and for the top regions or countries, as well as industry sectors, into which the fund has allocated its resources. Provided that such data is accessible, it would also be of value to include the historic sustainability rating, rather than assuming it is time invariant.

References

Bauer, R., Derwall, J. & Otten, R. (2007). The Ethical Mutual Fund Performance Debate: New Evidence from Canada. *Journal of Business Ethics*, 70(2), pp. 111–124. doi:10.1007/s10551-006-9099-0

Baumgartner, R.J. & Ebner, D. (2010). Corporate sustainability strategies: sustainability profiles and maturity levels. *Sustainable Development*, 18(2), pp. 76–89. doi:10.1002/sd.447

Bodie, Z., Kane, A., & Marcus, A. (2014). *Investments*. 10th ed., McGraw-Hill Education.

Bodie, Z., Kane, A., & Marcus, A. (2021). *Investments*. 12th ed., McGraw-Hill Education.

Bouattour, M. & Martinez, I. (2019). Efficient market hypothesis: an experimental study with uncertainty and asymmetric information. *Finance Contrôle Stratégie*, 22(4). doi:10.4000/fcs.3821

Breusch, T. S., & Pagan, A. R. (1979). A Simple Test for Heteroscedasticity and Random Coefficient Variation. *Econometrica*, 47(5), pp. 1287–1294. doi:10.2307/1911963

Brown, M. B., & Forsythe, A. B. (1974). Robust Tests for the Equality of Variances. *Journal of the American Statistical Association*, 69(346), pp. 364–367. doi:10.2307/2285659

Carhart, M.M. (1997). On Persistence in Mutual Fund Performance. *Journal of Finance*, 52(1), pp. 57–82. doi:10.1111/j.1540-6261.1997.tb03808.x

Clark, G.L., Feiner, A. & Viehs, M. (2014). From the Stockholder to the Stakeholder: How Sustainability Can Drive Financial Outperformance. *SSRN Electronic Journal*. doi:10.2139/ssrn.2508281

Chong, J., Jin, Y., & Phillips, M. (2013). The Entrepreneur's Cost of Capital: Incorporating Downside Risk in the Buildup Method. *MacroRisk Analytics*. https://www.macrorisk.com/wp-content/uploads/2013/04/MRA-WP-2013-e.pdf

Cornell, B. & Damodaran, A. (2020). Valuing ESG: Doing Good or Sounding Good?. *The Journal of Impact and ESG Investing*, 1(1), pp. 76–93. doi:10.3905/jesg.2020.1.1.076

Díaz, V., Ibrushi, D., & Zhao, J. (2021). Reconsidering systematic factors during the Covid-19 pandemic – The rising importance of ESG. *Finance Research Letters*, 38, 101870. ISSN 1544-6123. doi:10.1016/j.frl.2020.101870

Doyle, T. (2018). *Ratings That Don't Rate. The Subjective World of ESG Ratings Agencies*. American Council for Capital Formation. https://accfcorpgov.org/wp-content/uploads/2018/07/ACCF_RatingsESGReport.pdf

Eakins, S. G., & Mishkin, F. S. (2018). *Financial Markets and Institutions*. Pearson.

Elton, E.J. & Gruber, M.J. (2013). Mutual Funds. *Handbook of the Economics of Finance*, pp. 1011–1061. doi:10.1016/b978-0-44-459406-8.00015-9

European Commission. (n.d.). *Sustainability-related disclosure in the financial services sector* [fact sheet]. https://finance.ec.europa.eu/sustainable-finance/disclosures/sustainability-related-disclosure-financial-services-sector_en

European Parliament and of the Council Regulation (EU) 2020/04554 of 11 January 2021 on common climate neutrality (OJ C 10, 11.1.2021, p. 69–69). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020AE4554&qid=1686092076840

European Securities and Markets Authority. (2022). *The drivers of the costs and performance of ESG funds*. doi:10.2856/260634

Davidovic, D., Harring, N., & Jagers, S. C. (2020). The contingent effects of environmental concern and ideology: institutional context and people's willingness to pay environmental taxes. *Environmental Politics*, 29(4), pp. 674-696. doi:10.1080/09644016.2019.1606882

Del Guercio, D. & Reuter, J. (2014). Mutual Fund Performance and the Incentive to Generate Alpha. *The Journal of Finance*, 69(4), pp. 1673–1704. doi:10.1111/jofi.12048

Derwall, J., Guenster, N., Bauer, R., & Koedijk, K. (2005). The Eco-Efficiency Premium Puzzle. *Financial Analysts Journal*, 61(2), pp. 51-63. doi:10.2469/faj.v61.n2.2716

Elton, E. J., Gruber, M. J., and Blake, C. R. (1996). Survivor Bias and Mutual Fund Performance. *The Review of Financial Studies*, 9(4), pp. 1097-1120. doi:10.1093/rfs/9.4.1097

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, 25(2), pp. 383–417. doi:10.2307/2325486

Fama, E. F., & French, K. R. (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*, 47(2), pp. 427–465. doi:10.2307/2329112

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

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), pp. 1-22. doi:10.1016/j.jfineco.2014.10.010

Fama, E. F., & French, K. R. (2018). Choosing factors. *Journal of Financial Economics*, 128(2), pp. 234-252. doi:10.1016/j.jfineco.2018.02.012

French, K. R. (2023a). *Fama/French Developed 5 Factors*. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed

French, K. R. (2023b). *Developed Momentum Factor (Mom)*. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed

French, K. R. (n.d.). *Biography*. http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/biography.html [2023-04-25]

Friede, G., Busch, T., & Bassen, A. (2015). ESG and Financial Performance: Aggregated Evidence from More Than 2000 Empirical Studies. *Journal of Sustainable Finance & Investment*, 5(4), pp. 210-233. doi:10.1080/20430795.2015.1118917

Gregory, R. P., Stead, J. G., & Stead, E. (2020). The global pricing of environmental, social, and governance (ESG) criteria. *Journal of Sustainable Finance & Investment*, 11(4), pp. 310-329. doi:10.1080/20430795.2020.1731786

Greenwood, R., & Shleifer, A. (2014). Expectations of Returns and Expected Returns. *Review of Financial Studies*, 27(3), pp. 714-746. doi:10.1093/rfs/hht082

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica,* 46(6), pp. 1251–71. doi:10.2307/1913827

Hebb, T. (2013). Impact investing and responsible investing: what does it mean?. *Journal of Sustainable Finance & Investment*, 3:2, pp. 71-74, doi:10.1080/20430795.2013.776255

Investopedia. (2023). *Morningstar Sustainability Rating*. https://www.investopedia.com/terms/m/morningstar-sustainability-rating.asp [2023-04-13]

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), pp. 263-292. doi: 10.2307/1914185

Kapri, T. (2021). *Implications of mutual funds' ESG score on performance*. Master's thesis, School of Accounting and Finance. University of Vaasa. https://osuva.uwasa.fi/bitstream/handle/10024/12986/UniVaasa_2021_Kapri_Tomi.pdf

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

Levy, H. (1984). Measuring Risk and Performance over Alternative Investment Horizons, *Financial Analysts Journal*, 40(2), pp. 61–68. doi:10.2469/faj.v40.n2.61

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics*. doi:10.2307/1924119

Liu, B., & Soe, A. M. (2019). *Does past performance matter? The persistence scorecard*. S&P Dow Jones Indices. https://www.spglobal.com/spdji/en/documents/spiva/persistence-scorecard-december-2019.pdf

Lukomnik, J., & Hawley, J. P. (2021). *Moving beyond modern portfolio theory: Investing that matters*. Routledge.

Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, 7(1), pp. 77-91. doi:10.2307/2975974

Martin, I. (2017). What is the Expected Return on the Market?. *The Quarterly Journal of Economics*, 132(1), pp. 367–433. doi:10.1093/qje/qjw034

Maiti, M. (2020). A critical review on evolution of risk factors and factor models. *Journal of Economic Surveys*, 34(2), pp. 175-184. doi:10.1111/joes.12344

Maiti, M. (2021). Is ESG the succeeding risk factor?. *Journal of Sustainable Finance & Investment*, 11(3), pp. 199-213. doi:10.1080/20430795.2020.1723380

Monasterolo, I., & de Angelis, L. (2020). Blind to carbon risk? An analysis of stock market reaction to the Paris Agreement. *Ecological Economics*, 169, 106571. doi:10.1016/j.ecolecon.2019.106571

Morningstar (n.d.). *About Us*. https://www.morningstar.com/company/about-us [2023-03-30]

Morningstar. (2019). *Morningstar Sustainability Rating* [brochure]. https://www.morningstar.com/content/dam/marketing/shared/Company/Trends/Sustainability/Detail/Documents/SustainabilityRatingMethodology2019.pdf

Morningstar. (2021a). *Fakta om Morningstars hållbarhetsbetyg* [fact sheet]. https://www.morningstar.se/se/news/202095/fakta-om-morningstars-h%C3%A5llbarhetsbetyg.aspx

Morningstar. (2021b). *Morningstar Sustainability Rating* [brochure]. https://www.morningstar.com/content/dam/marketing/shared/research/methodology/744156_Morningstar_Sustainability_Rating_for_Funds_Methodology.pdf

Morningstar. (2021c). *The Morningstar Sustainable Investing Handbook* [brochure]. https://www.morningstar.com/content/dam/marketing/shared/Company/Trends/Sustainability/Detail/Documents/Morningstar-Sustainable-Investing-Handbook.pdf

Naffa, H., & Fain, M. (2021). A factor approach to the performance of ESG leaders and laggards. *Finance Research Letters*, 102073. doi:10.1016/j.frl.2021.102073

Naturvårdsverket. (n.d.). *När Sverige de nationella klimatmålen?* [fact sheet]. https://www.naturvardsverket.se/amnesomraden/klimatomstallningen/sveriges-klimatarbete/nar-sverige-de-nationella-klimatmalen

Nofsinger, J., & Varma, A. (2014). Socially responsible funds and market crises. *Journal of Banking & Finance*, 48, pp. 180-193. doi:10.1016/j.jbankfin.2013.12.016

Omisore, I., Yusuf, M., & Nwufo, C. I. (2012). The modern portfolio theory as an investment decision tool. *Journal of Accounting and Taxation*, 4(2), pp. 19-28. doi:10.5897/JAT11.036

Porter, M. E., & van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives*, 9(4), pp. 97–118. doi:10.1257/jep.9.4.97

Refinitiv. (n.d.). *Refinitiv Eikon* [brochure]. https://www.refinitiv.com/en/products/eikon-trading-software

Renneboog, L., Horst, T. J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), pp. 1723-1742. doi:10.1016/j.jbankfin.2007.12.039

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), pp. 425-442. doi:10.2307/2977928

Silva, F., & Cortez, M. C. (2016). The Performance of US and European Green Funds in Different Market Conditions. *Journal of Cleaner Production*, 135, 558-566. doi:10.1016/j.jclepro.2016.06.112

Sustainalytics. (n.d.). *About Us* [brochure]. https://www.sustainalytics.com/about-us

Sveriges Riksbank. (2023). *Riksbankens Klimatrapport 2023*. https://www.riksbank.se/globalassets/media/rapporter/klimatrapport/2023/klimatrapport-pdf/riksbankens-klimatrapport-2023.pdf

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, 5(4), pp. 297-323. doi:10.1007/BF00122574

Wooldridge, J. M. (2001). *Econometric analysis of cross section and panel data*. The MIT Press.

Wooldridge, J. M. (@Jeff Wooldridge) (2021). *Agree with Andrew on clustering. And with that data structure, I don't see how you can get away with using [...]* [statalist online forum post], 21 June. https://www.statalist.org/forums/forum/general-stata-discussion/general/1615570-is-it-possible-to-make-the-hausman-specification-test-by-comparing-two-way-error-component-models?p=1615659#post1615659 [2023-06-08]

Xiao, Y., Faff, R., Gharghori, P., & Min, B. (2013). An Empirical Study of the World Price of Sustainability. *Journal of Business Ethics*, 114(2), pp. 297-310. doi:10.1007/s10551-012-1342-2

Yue, X.-G., Han, Y., Teresiene, D., Merkyte, J., & Liu, W. (2020). Sustainable Funds' Performance Evaluation. *Sustainability*, 12(19), 8034. doi:10.3390/su12198034

Appendix

Table 7: Fund selection criteria in Refinitiv Eikon

Search Criteria	Option
Lipper Classification Scheme	Equity Global
Country Registered for Sale	Sweden
Instrument Type	Open-End Funds
Currency	Swedish Krona
Domicile	Sweden

Table 8: Swedish global equity funds in the low sustainability grouping

	Morningstar Globe Rating
Quesada Vision A	1
Movestic Global	2
Navigera Tillväxt 1	2
Avanza Global	3
Brobacke Global Allokering A	3
Captor Scilla Global Equity C	3
Carnegie Listed Private Equity A	3
Cicero Offensiv Hållbar A	3
Consensus Global Select A	3
Handelsbanken Auto 100 Criteria (A1 SEK)	3
Handelsbanken Global High Dividend Low Volatility Criteria (A1 SEK	3
Handelsbanken Global Index Criteria (A1 SEK)	3
Handelsbanken Multi Asset 100 (A1 SEK)	3
Handelsbanken Multi Asset 120 (A1)	3
Indecap Guide 2 C	3
Indecap Guide Global C	3
Länförsäkringar Global Index	3
Lundmark Climate Impact Fund	3
Movestic Global Hållbar	3
Navigera Aktie 1	3
Nordea Institusjonella Aktiefonden Världen icke-utd	3
Öhman Global A	3
Öhman Global Growth A	3
SEB Dynamisk Aktiefond	3
Sensum Strategy Global A	3
Simplicity Green Impact A	3
Spets A	3
Spiltan Globalfond Investmentbolag	3
SPP Mix 100	3
Storebrand Global All Countries A SEK	3

Table 9: Swedish global equity funds in the above high sustainability grouping

	Morningstar Globe Rating
AMF Aktiefond Global	4
AMF Strategifond Global	4
Carnegie Global Quality Companies A	4
Cicero Global A	4
Handelsbanken Global Tema (A1 SEK)	4
Lancelot Camelot A	4
Länförsäkringar Global Klimatindex	4
Länsförsäkringar Global Vision A	4
Lärarfond Offensiv	4
Naventi Offensiv Flex	4
Navigera Aktie 2	4
Navigera Global Change	4
Nordea Aktieallokering	4
Nordea Inst Aktiefonden Stabil icke-utd	4
Öhman Marknad Global A	4
Placerum Polar B	4
SEB Global Aktiefond A	4
SEB Stiftelsefond Balanserad A	4
SEB Stiftelsefond Utland	4
Storebrand Global Multifactor A SEK	4
Storebrand Global Plus A SEK	4
Storebrand Global Solutions A SEK	4
Swedbank Robur Access Global A	4
Swedbank Robur Aktiefond Pension	4
Swedbank Robur Allemansfond Komplett	4
Swedbank Robur Bas 100 A	4
Swedbank Robur Fokus	4
Swedbank Robur Global High Dividend A	4
Swedbank Robur Global Impact	4
Swedbank Robur Kapitalinvest	4
Tellus Globala Investmentbolag A	4
AMF Aktiefond Världen	5
Folksam LO Världen	5
GodFond Sverige & Världen	5
Handelsbanken Global Dynamisk Strategi (A1 SEK)	5
Handelsbanken Global Selektiv (A1 SEK)	5
KPA Etisk Aktiefond	5
Nordic Equities Global Stars	5
Penser Sustainable Impact A	5
PriorNilsson Realinvest A	5
SEB Aktiesparfond	5
Skandia Global Exponering A	5
Skandia Time Global	5
Skandia Världen	5
Storebrand Global Low Volatility A SEK	5
Swedbank Robur Forbundsfond Global	5
Swedbank Robur Globalfond A	5
Swedbank Robur Talenten Aktiefond Mega J	5
Swedbank Robur Transition Energy A	5
Swedbank Robur Transition Global A	5

Table 10: Summary statistics of the low sustainability grouped funds.

	Count	Mean	Min	Max	Variance	Standard Error	Skewness	Kurtosis
Excess Return	1439	0.395	-24.226	17.179	30.411	5.515	-0.426	3.674
Excess Return, Winsorized	1439	0.419	-12.898	12.556	28.368	5.326	-0.321	2.926
Market Excess Return	1439	0.525	-13.770	13.340	28.733	5.360	-0.307	3.008
Small Minus Big	1439	-0.284	-4.440	3.160	2.642	1.626	0.011	2.587
High Minus Low	1439	0.018	-9.240	11.960	14.035	3.746	0.525	3.770
Robust Minus Weak	1439	0.387	-2.910	4.590	2.478	1.574	0.107	3.235
Conservative Minus Aggressive	1439	0.250	-5.360	8.090	5.662	2.379	0.796	4.424
Winners Minus Losers	1439	0.504	-10.920	6.680	10.037	3.168	-0.877	4.881

Table 11: Summary statistics of the high sustainability grouped funds

	Count	Mean	Min	Max	Variance	Standard Error	Skewness	Kurtosis
Excess Return	2805	0.417	-23.759	20.182	28.841	5.370	-0.388	3.270
Excess Return, Winsorized	2805	0.422	-12.898	12.556	27.794	5.272	-0.362	2.854
Market Excess Return	2805	0.507	-13.770	13.340	27.634	5.257	-0.326	3.105
Small Minus Big	2805	-0.318	-4.440	3.160	2.575	1.605	0.019	2.608
High Minus Low	2805	-0.109	-9.240	11.960	13.310	3.648	0.570	3.973
Robust Minus Weak	2805	0.389	-2.910	4.590	2.286	1.512	0.108	3.463
Conservative Minus Aggressive	2805	0.165	-5.360	8.090	5.289	2.300	0.886	4.721
Winners Minus Losers	2805	0.500	-10.920	6.680	9.806	3.132	-0.802	4.787

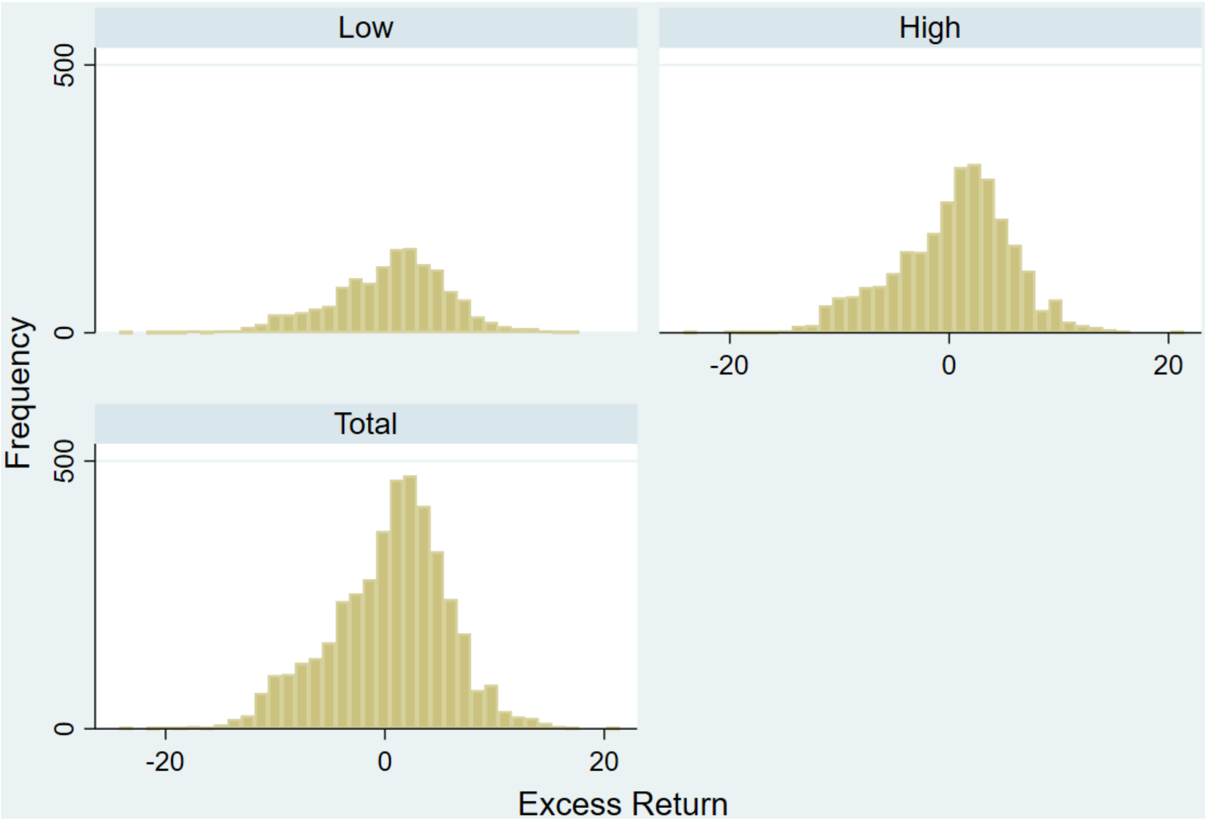

Figure 1: Histogram of the frequency of excess returns, in percent, based on monthly data, without removal of extreme values, for low and high sustainability rated funds and the total sample

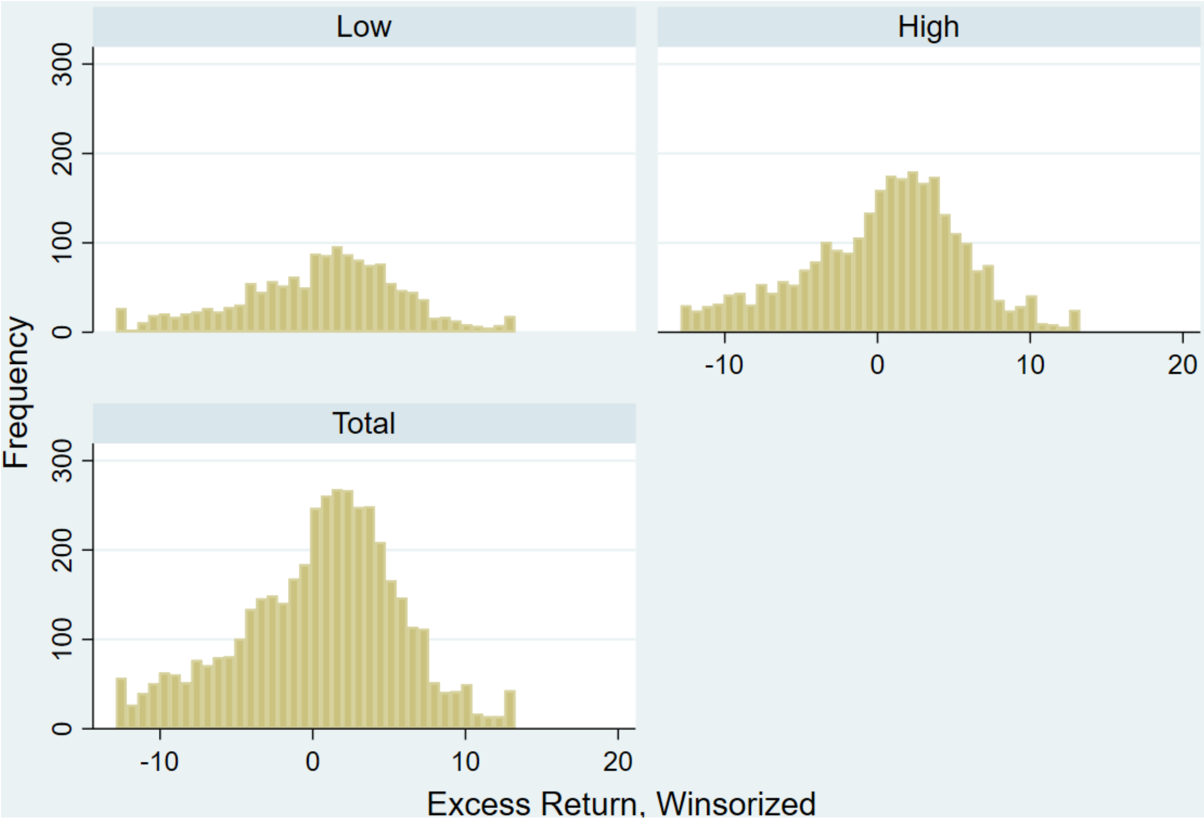

Figure 2: Histogram of the frequency of excess rolling returns, in percent, based on monthly data, with winsorized extreme values at the 1st and 99th percentiles, for low and high sustainability rated funds and the total sample

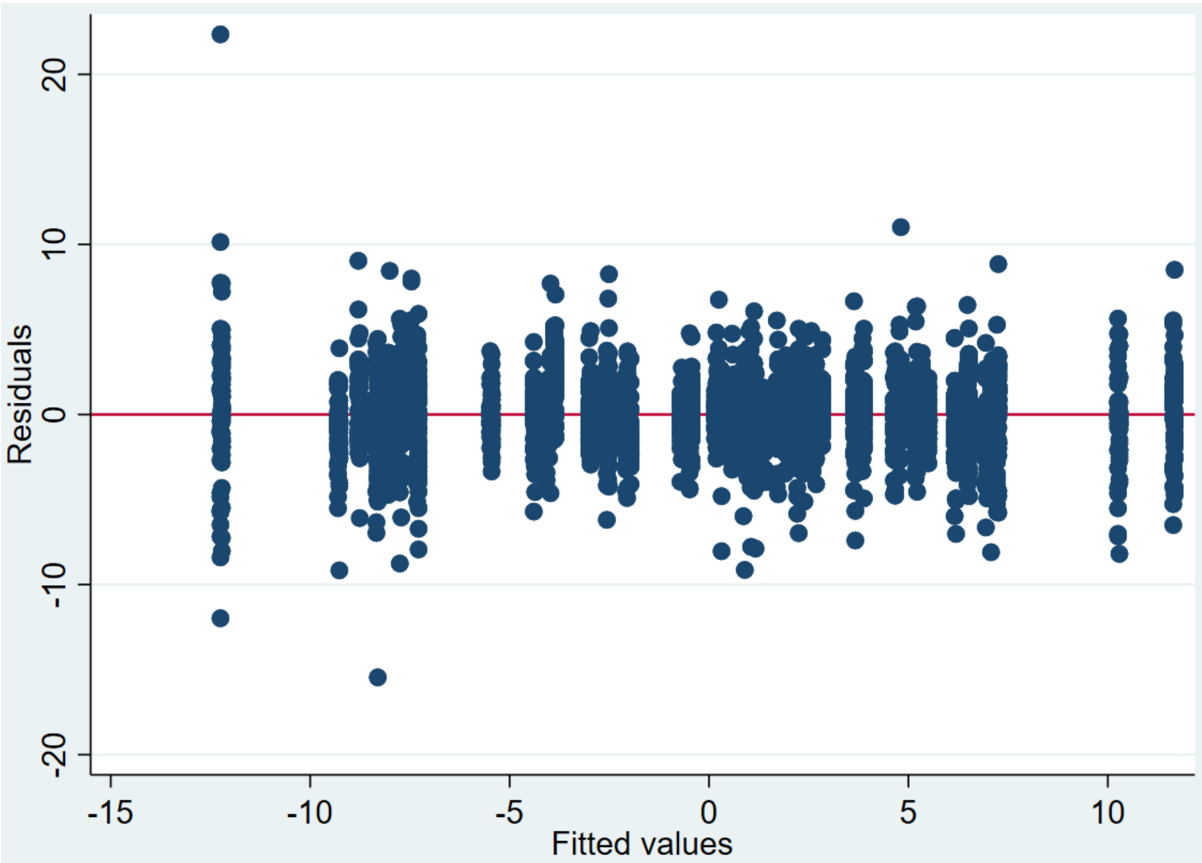

Figure 3: Residual-versus-fitted plot of the regression of the non-winsorized excess return

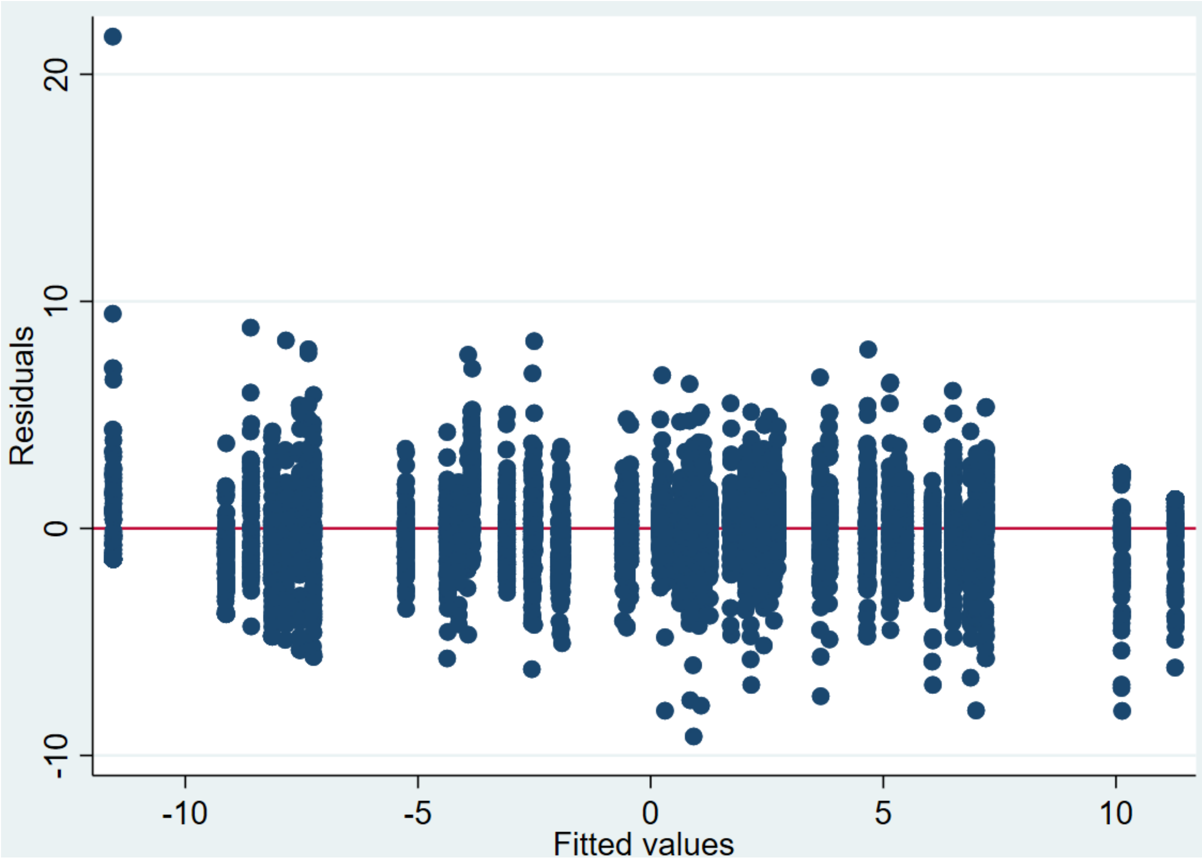

Figure 4: Residual-versus-fitted plot of the regression of the winsorized excess return