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ESG and Fund Performance

Comparing Funds with Different Strategic Benchmarks

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Abstract

This thesis aims to identify if there is a positive relationship between ESG and fund performance, and if this relationship is different depending on the strategic benchmark of the funds and how they differ between the given strategic benchmark. Four groups of funds connected to a specific strategic benchmark are divided based on their ESG score into a high ESG score group and low ESG score group. The benchmarks are Euro STOXX 50 TR, MSCI Europe Small Cap TR, FTSE AW/Technology TR and S&P Global Infrastructure TR. To make this analysis, OLS regressions are made with average monthly return as dependent variables and Carhart four-factor model as independent variables over a five year period, April 2018 to March 2023. Sharpe and Treynor ratios were also used as supplements. The results show that there is no clear relationship between ESG and fund performance, where for some benchmark groups the low ESG group is superior to the high ESG, and other benchmarks show the opposite. There are no major differences of the relationship between ESG score and fund performance when comparing the groups with different benchmarks, nor within each set of funds, indicating that there is no clear evidence that a relationship exists.

Keywords: ESG, Efficient Market Hypothesis, Risk-Adjusted Return, Strategic Benchmarks

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1. Introduction

1.1. Background

Investments on the stock market have always been related to trends in the world. ESG is one trend that is very popular in today's investment climate, and will probably continue to be. The increased interest in ESG is due to the fact of uncertainty in the future; climate change risk, social inequalities and threat of biodiversity loss (MSCI, 2023). ESG stands for environmental, social and governance, where all three parts are affected by different factors. Environmental is connected to climate change, such as emissions of carbon dioxide and how much the company contributes to this. Social is about a company's stakeholders, this could be for example the well being of their employees or about safety and quality of their product. Governance is everything that has to do with laws and regulations, which could be shareholders rights or executive compensation (Deloitte, 2022). The goal of ESG is to capture all the non-financial risks and opportunities inherent to a company's day to day activities. The growing interest in ESG investments is something that is being seen around the world. 88% of public companies and around two-thirds of privately owned companies have ESG initiatives in place, according to a survey from NAVEX Global from 2020. Around 89% of investors consider ESG issues in some form when thinking about doing investments and just 13% of global investors think of ESG as something that will not stick around for the foreseeable future, according to a 2022 study made by Capital Group. According to Morningstar, global ESG fund assets reached about 2.5 trillion dollars at the end of 2022, which further strengthens the argument that there is a growing interest in sustainable investments (Baker, 2023).

The problem with ESG investment is that companies that prioritize this sort of investments might experience larger costs to be able to reach a high, or target ESG score, to attract new customers and adjust to their sustainability requirements. This in hand will be costly for investors, since it could lead to lower returns on funds. ESG is a relevant subject and some companies are adjusting their operations to more sustainable ones, as seen by the statistics above, but this could be something that investors have to pay the price for in terms of return compared to companies that do not prioritize sustainability. Younger investors that come into the market seem to expect their investments to reflect ESG concerns, which is a sign that this is a preference that is here to stay. If we are to counter the climate changes that are occurring

today, companies will play a huge part in altering this change in investments, where the non-financial aspects are being more prioritized than ever before (Baker, 2023).

1.2. Problem description

ESG is a widely popular topic in today's world, and a lot of funds seem to invest more in companies that prioritize ESG. The question that arises from this is whether investors have to sacrifice something if they are to invest in ESG? Is there some kind of tradeoff between financial return and sustainability? When people go to the market to invest, return is and will usually be one of the most important factors for a rational investor, and since the corporate focus on ESG is currently a trendy field in investing, some investors might overlook this if they are to maximize profit. The problem is therefore if there are differences in financial performance between ESG focused mutual funds and non-ESG mutual funds, and to classify ESG focus, funds will be divided based on an ESG score. To this, the research will compare different strategic benchmarks for funds to see if there are differences in performance, based on ESG score, depending on the funds investment strategy.

1.3. Aim of study

The aim of this study is to investigate the relationship between ESG and fund performance, to see if funds that prioritize ESG investments have worse or better performance compared to funds that do not prioritize ESG and moreover, to see if there are differences for funds performance depending on their investment benchmark. Four groups of funds with different strategic benchmarks have been selected. These groups will be divided based on ESG score within their group with the same strategic benchmark and from this the research aims to see if there are different effects of ESG based on the strategic approach of funds.

From the aim and problem description, the following research questions arise:

1. Is there a positive relationship between ESG score and fund performance?
2. Is the relationship between ESG and fund performance the same depending on what strategic benchmark the funds have?

This research aims to find answers to these two research questions.

2. Theoretical Framework

2.1. ESG - Environmental, Social and Governance

Environmental, Social and Governance (ESG) is a framework that focuses on a firm's sustainability and ethical impact. The Environmental part refers to aspects such as greenhouse gas emissions and climate risks in general. Social brings to attention the relationship between organizations and stakeholders, question of interest is for example fair wages and societies where they operate. Governance is about the leadership of the firm, management incentives versus stakeholder expectation and shareholder rights. Investors are increasingly considering ESG factors when making investment decisions. This is due to growing concerns about climate change, social inequality, and corporate ethics. Companies that score well on ESG criteria are more likely to attract socially responsible investors, who are looking for companies and funds that align with their values (MSCI, 2023).

2.2. Modern Portfolio Theory

The economist Harry Markowitz published his paper *Portfolio Selection* (1952) which was the introduction of the Modern Portfolio Theory (MTP). Markowitz stated that investors could optimize their portfolios based on risk and return. The assumption is that investors are risk-averse and therefore, at a given level of expected return, every rational investor will choose the portfolio of assets that has the lowest risk. The theory argues that investment with a high expected return comes with a higher amount of risk, and lower level of risk equals lower returns. The most important aspect of the theory is consequently to diversify, and through that method maximize portfolio returns based on a certain amount of risk. The MTP and Markowitz was awarded the Nobel prize in Economic Sciences in 1990 in regards to its contribution to how households and firms should allocate their financial assets, in order to optimize portfolio returns based on a given level of risk (The Nobel Prize, 1990).

2.3. Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) is closely associated with Eugene Fama's paper *Efficient Capital Markets* (1970). The theory suggests that the share price on listed assets reflect all information, and that it is impossible to achieve consistent alpha. Based on the theory, investors should therefore benefit by investing in a passive portfolio such as a S&P500 ETF. According to EMH, the market can be efficient in three different forms. Firstly,

the weak form states that the present stock price reflects all available information known to the public, but not yet announced information regarding the asset. Furthermore, it suggests that past data on price is independent of the price in the future. It therefore also implies that technical trading analysis cannot contribute to excess returns due to the fact that future stock prices will be based on new information, and not historical data. The other form is semi-strong. Beyond the weak form's assumptions, the semi strong form suggests that new information that becomes available affects the share price quickly. So in this stage, neither fundamental analysis will be able to accurately foresee future price movements. Lastly, the strong form of the EMH implies that prices reflect all information. That being both private and public, which states that no one can consistently outperform the market, not even insiders in the company (Malkiel, 1989).

2.4. Sharpe Ratio

The Sharpe ratio is named after the economist William Sharpe (1966) and was introduced to compare the return of an investment with its associated risk. The ratio incorporates return of the investment through taking a portfolio's excess return over the risk free rate. Then divide that by the standard deviation of the return, which is the risk aspect of the formula. According to Sharpe's theory, the ratio suggests that a higher ratio indicates a better investment as that indicates maximizing returns but reducing the volatility in the returns, and therefore the risk. When comparing two portfolios, the one with higher Sharpe ratio can either have higher returns, lower risk or both, while the opposite can be said about the one with a lower ratio. Therefore, it is preferable to invest in the portfolio or asset that has the highest value relative to its peers (Berk, DeMarzo, 2019). Following formula (1) visualizes how the Sharpe ratio is calculated:

$$\text{Sharpe Ratio} = \frac{\text{Excess Portfolio Return}}{\text{Portfolio Volatility}} = \frac{E[R_P] - r_f}{\text{SD}(R_P)} \quad (1)$$

2.5. Treynor Ratio

The Treynor ratio was developed by Jack Treynor (1973). It has similarities with the earlier mentioned Sharpe ratio, with the difference being that instead of using standard deviation on returns, the beta of the portfolio is used. The beta parameter represents the changes in the portfolio's return, in relation to the market in general. Beta values of 1 indicates that the asset

moves along with the market, a value above 1 suggests that the asset is more volatile than the market, and the opposite for beta values below 1. Likewise with the Sharpe ratio, a higher value for the Treynor ratio is preferable because it suggests that the investment generates better returns in relation to its systematic risk. It is important to acknowledge that even though a higher Treynor value can be concluded as a better risk versus return ratio, twice as high ratio doesn't necessarily mean twice as good investment. Because of its similarities with Sharpe, but also the differences in how risk is incorporated, it is good to use both metrics to gain valuable results (Berk, Demarzo, 2019). Below a formula (2) is included to demonstrate how the Treynor ratio is calculated:

$$\text{Treynor Ratio} = \frac{\text{Excess Portfolio Return}}{\text{Portfolio Beta}} = \frac{E[R_P] - r_f}{\beta_P} \quad (2)$$

2.6. Carhart Four-Factor Model

The Carhart four-factor model (1997) is a financial tool widely used to explain the risk and return of portfolios or funds. Developed by Mark Carhart in 1997, it builds on the three-factor model proposed by Fama and French (1992) and includes an additional factor that measures momentum's impact on portfolio returns.

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}SMB_t + \beta_{3,i}HML_t + \beta_{4,i}MOM_t + \varepsilon_{i,t} \quad (3)$$

$r_{i,t}$ = return on the individual portfolio at time t

$r_{f,t}$ = risk-free rate at time t

$\alpha_{i,t}$ = four factor alpha, risk-adjusted return for the individual portfolio

$r_{m,t} - r_{f,t}$ = market excess return at time t

SMB_t = small.minus-big factor at time t

HML_t = high-minus-low factor at time t

MOM_t = momentum factor at time t (UMD, up-minus down)

$\varepsilon_{i,t}$ = error term for portfolio i at time t

The alpha from the equation above indicates the risk-adjusted abnormal return. A positive sign on the alpha indicates that the portfolio outperforms the market whereas a negative alpha shows that the portfolio underperforms the market. The second variable, $(r_{m,t} - r_{f,t})$, also known as the MKT variable, is the market excess return. A value above one indicates that the portfolio in question is more exposed to market risk compared to the market, and a value

under one for the variable shows the opposite, that the portfolio is less exposed to market risk.

Company size is a factor that is taken into account with the SMB variable. The variable is from the Fama and French (1992) three factor model. A negative SMB factor means that the portfolio mostly consists of large market capitalization firms and to the contrary, a positive coefficient indicates that it mostly consists of stocks with small market capitalization.

Moving on to the HML variables, the factor takes the book-to-market value ratio of a company into consideration. This was also developed by Fama and French, where they found that there was a positive relationship between the book-to-market ratio and return. Considering this, a positive sign for this variable indicates that a portfolio consists of more value stocks whereas a negative sign shows that a portfolio consists of more growth stocks.

Finally, the fourth variable MOM, the momentum factor and also referred to as the UMD factor, up-minus down. This factor was the addition to the Fama and French model and creates the Carhart four-factor model. Carhart (1997) discovered that high performing firms usually continue to perform well whereas the same relationship is seen for low performing companies, that they tend to continue to perform poorly. From this, a negative sign for the coefficient shows that the portfolio buys losing stocks and sells winning, and a positive sign indicates the opposite, that the portfolio sells losing stocks and buys winning ones.

3. Literature Review

The growing interest in ESG investments has also led to lots of studies being done in this field. This part of the thesis carefully looks at different researches made and highlights that the performance of ESG funds can vary depending on various factors such as the specific ESG criteria used, the fund's investment strategy, and market conditions. A study made by Friede et al. (2015) looks at over 2000 empirical studies, tracing back to the early 1970s. The results show that 90% of studies find a nonnegative relationship between ESG and corporate financial performance, with the majority reporting positive findings that appear stable over time. Positive relationships are found for ESG investing in emerging markets, corporate bonds, and green real estate. Looking at different geographical locations, the study shows that ESG funds active in Europe perform relatively worse than ones active in the US, which indicates that there are differences depending on where the fund is active.

Mallin et al. (1995) conducted research about the financial performance of ethical investment funds and is a vastly cited study in the ESG area. The study looks at 29 ethical and non-ethical trust funds in the UK between 1986 and 1993, comparing their performance during this period. Results show that the ethical funds outperform non-ethical funds on a risk-adjusted basis. It is mentioned that the weakly superior performance of ethical funds that was found through the research suggests that there was an increase in awareness and interest in ethical investments, hence leading to the ethical funds outperforming the non-ethical ones. Research done by Duran-Santomil et al. (2019) and Goncalves et al. (2021) also showed that sustainability scores had a positive impact on performance and that the risk-adjusted performance was better for mutual funds that invested in companies with higher scores. The Carhart-four factor model was used for the risk-adjusted analysis. The first one draws this conclusion looking at Morningstar's Sustainability scores connected to firms and Goncalves et al. focused on performance during crisis. The results from that was that green mutual funds provided higher risk-adjusted returns to investors during crisis periods whereas the results were mixed for non-crisis periods. Nonetheless, both of these studies see a positive relationship between fund performance and high sustainability.

Other studies that find these kinds of relationships are research from Nagy et al. (2016) and Lean et al. (2015), where the difference for their studies are that they compare the

performance of sustainable funds to the performance of the MSCI World Index and the market benchmark. Nagy et al. looks at two different strategies based on ESG data - a tilt strategy and momentum strategy. They found that both portfolios outperform the MSCI World Index over an eight year period. This leads to the conclusion that investors that can take active risk and at the same time improve the ESG profile, can use such strategies in their investment processes and see themselves profitable. The research done by Lean et al. looks at socially responsible investment (SRI) funds in Europe and North America during a 10 year period. In this analysis they find that SRI funds outperform the market benchmark in both regions and that North American funds perform better than European funds, the latter being the same conclusion that Friede et al. finds, that there are geographical differences for fund performance.

While analyzing different thesis there was noticeable that there is a large difference in results depending on which country that was being evaluated. For example, in Duque-Grisales and Aguilera-Caracuel (2021), the authors examine countries in Latin America, especially Brazil, Chile, Colombia, Mexico and Peru. Between the years 2011 to 2015 they found a relationship between financial performance and ESG, but in the opposite way compared to earlier mentioned papers. They suggest that there is a statistically negative correlation between the two factors in Latin America. To support the thesis that this correlation can be affected by geographical factors, Renneboog et al. (2021) have published a paper that concluded that many socially responsible investments (SRI) funds in the US, the UK and in many continental European countries together with Asia-Pacific countries, underperform their benchmarks by approximately 2.2-6.5%. Moreover, when Renneboog et al. separated France, Japan and Sweden from the analysis, they could not establish that performance of SRI funds was not statistically different from regular funds. Additionally, the paper overall determined that screening for corporate governance and social aspects results in lower risk-adjusted returns.

Furthermore, adding to the effects of geographical aspects on ESG and fund performance, the results are heavily dependent on the time frame that is being studied. In Climent and Soriano's (2011) paper on US mutual funds, there were mixed results. Their entire time frame was 1987 to 2009, where the authors found that environmental funds had lower returns when compared against conventional funds with similar investment strategies and characteristics. Although, when adjusting the time frame and analyzing the specific period between 2001

until 2009, green funds in the US and their comparable conventional funds were quite similar in aspects of adjusted returns.

On the other hand, there is plenty of research that cannot conclude a significant relationship between ESG scores and fund performance. Milonas et al. (2022) examines the performance of 80 European and 64 US funds that invest in companies following ESG principles compared to conventional funds. Using various measures of performance, the study finds that there is no statistically significant difference between ESG and non-ESG funds, although ESG funds have slightly higher returns than non-ESG funds. The authors acknowledge that these benefits are likely associated with investor demand and awareness of ESG issues. Plagge and Grim (2020) find similar results in their research. They investigate the performance characteristics of ESG equity funds in the US market over a 15-year period. Their study finds that while return and risk differences of ESG funds can be significant, they appear to be mainly driven by fund-specific criteria rather than a homogeneous ESG factor.

Furthermore, Hartzmark and Sussman (2019) also focused on the US market, where they concluded that ESG factors are a huge aspect in fund management. Being categorized as a high sustainability fund receive net inflows of more than \$24 billion, while those categorized as low sustainability receive net outflows of more than \$12 billion. Although the study suggests that sustainability is viewed positively in terms of predicting future performance, it does not find evidence that high-sustainability funds outperform low-sustainability funds.

Looking at another empirical analysis that uses ESG ratings and fund performance, Ferrari et al. (2021) compare the performance of funds with low ESG score and funds with high ESG score in Europe. The study is done to see if funds with high ESG ratings outperform funds with low ones, and this analysis provides evidence that funds with higher ratings have superior efficiency, hence better performance compared to the ones with lower ratings. This study also provides a specific point of view because the selection of funds are at the two extremes of ESG ratings, low and high, and therefore excluding funds with blended ratings. The results are however that there is a positive relationship between high ESG scores and performance, providing a similar conclusion as the two first researches mention in this part, Friede et al. and Mallin et al.

Given the various results from the previous literature, and ongoing research in this area, this thesis will focus on analyzing the performance of ESG and non-ESG funds using different benchmark indexes. By studying multiple benchmarks, the aim will be to gain insights into how ESG factors may influence fund performance across different industries and investment categories, which is the main difference between this study and previous research within this subject. In contrast to the studies mentioned, this approach will lead to more comparable results due to the fact that the funds chosen will be quite similar to each other. Furthermore, this method allows to explore potential variations in the relationship between ESG and fund performance within that benchmark, and will provide a comprehensive analysis of the impact of ESG considerations on investment outcomes.

4. Data

In the process to collect data, Refinitiv Eikon was the main source for data collection. Refinitiv is one of the world's largest providers of financial data and infrastructure and hence has high credibility in what the database offers (Refinitiv, 2022). Some of the researchers in the literature review, such as Goncalves et al., also used Refinitiv as a database. Other sources such as Applied Quantitative Research (AQR) were used to collect complementary data. The time frame for the data is 5 years, between April 2018 and March 2023, where monthly observations of return were collected. The reason for this time frame was that this was the most recent data available and this research wants to explore recent data. Since the research will analyze monthly observations, the decision was taken to look at 5 years since this gives enough observations for statistical meaningful results. The central limit theorem states that a sample of more than 30 observations is considered sufficiently large. This research will have 5 years of monthly observations which will give a total 60 observations per analysis, which is therefore considered a good amount of observations (Turney, 2022).

4.1. Sample and Criterias

To collect the data that would fit this thesis, certain criterias were used to narrow down the data. The first criteria was that the funds had to have an ESG score, otherwise the funds would not be able to be divided into groups based on ESG score. Another criteria was that the fund total net asset should be larger than 100 million US dollars. This is because the research focuses on funds that are well established in the market, so the decision was made to draw the line at 100 million US dollars in total net assets for this research. Another reason for this criteria is that funds with larger total net assets have easier accessible data and will give more reliable results. The next criteria was that the fund must have a launch date before 1st of January 2018. If a fund does not have this it would not be within the timeframe for this research and hence not provide enough data for the analysis.

Furthermore, the strategic benchmarks Euro STOXX 50 TR, MSCI Europe Small Cap TR, FTSE AW/Technology TR and S&P Global Infrastructure TR were selected to divide funds based on their investment strategies. The two first benchmarks are focused on the European market whereas the other two are focused on a worldwide basis. The reason for this selection was that the groups should be as diversified as possible to see differences in how ESG affects

return in different sectors. Another reason for the selection of benchmarks was that these benchmarks were some of the most used ones for funds compared to other benchmarks. One that focuses on small cap funds, one that focuses on technology, another with focus on infrastructure and the last one is designed to represent the 50 largest companies in the eurozone (Investing, 2023). Using these criterias and benchmarks, a total of 320 funds were selected where the amount of funds with the benchmark Euro STOXX 50 TR was 125, 74 funds with the benchmark MSCI Europe Small Cap TR, 63 with FTSE AW/Technology TR and 58 funds with the technical benchmark S&P Global Infrastructure TR.

This will bring 4 groups of funds with each group having one of the strategic benchmarks as investment strategy. Furthermore, the groups will be divided into two groups within their group based on ESG score. From this a statistical analysis will be done within each group to compare what effect ESG has based on the different investment strategies and to this a comparison will be made to see if there are differences between the groups of different investment strategies. To summarize, eight regressions will be conducted to first see what effect ESG has within the groups based on investment strategy, and then compare the results from the four groups to see if ESG has different effects based on the funds strategic benchmark.

4.2. ESG Score

Refinitiv (2022) uses 10 main themes based on publicly traded data to measure a company's relative ESG performance, commitment and effectiveness. Emissions, environmental product innovation, human rights and shareholders are examples of some of the themes that Refinitiv uses. Using these themes, an ESG score based on percentage rate (between 0 and 100 percent) are used to determine ESG scores for companies and funds. The database is updated on a weekly basis, including recalculations of ESG scores, which means that if a company changes something related to the environment, their ESG score will change. Using the ESG scores provided by Refinitiv, the four groups of funds are split into two groups within their benchmark group based on their score, where the groups will be one with “high” score and one with “low” score. The split is based on the ESG score from the respective benchmark groups and the split for the high ESG score will be the top 25 percent of the group and for the low ESG score, the bottom 25 percent.

Due to limitations in the database with ESG scores for funds, the most recent available ESG score for each fund is used over the whole period of time for this research. One of the reasons for this assumption is that the database that is being used, Refinitiv Eikon, started to provide ESG scores for funds in 2020, compared to firms where the scores have been available since 2002. The data stream and time series functions do not work for funds in the same way as for firms when it comes to ESG score, hence this decision (Refinitiv, 2020).

4.3. Dependent and Independent Variables

The dependent variable for this research is the monthly return of the funds. As for the independent variables, Carhart four factor model will be used. Historical values for the model were collected from Applied Quantitative Research, AQR, which has monthly values for the model from all markets around the world (AQR, 2023). Since the funds used in this research are traded all around the world or in Europe, European and worldwide values are used for the model.

5. Methodology

This section outlines the methodology used to conduct our study and describes the models employed. Our analysis focuses on comparing the performance on ESG funds and conventional funds. We use four different groups where the different technical indicator benchmarks for these funds are: EURO Stoxx 50 TR, MSCI Europe Small Cap, FTSE AW/Technology and S&P Global Infrastructure. By comparing within the groups we will make sure that the funds investment strategies and orientations are quite similar. This will lead to a more reliable analysis on the effect of the ESG-aspect of these funds.

In this paper, the Carhart model will be utilized to assess the risk-adjusted returns of both ESG funds and non ESG funds. The methodology involves running Ordinary Least Squares (OLS) regressions by employing the monthly returns of the portfolios and the four-factor model. Through this approach, it will be determined if there is statistical significance in the coefficients for each factor and their values will be analyzed.

The OLS regressions, along with the Sharpe and Treynor ratios, will be crucial elements of the analysis, helping to evaluate the performance of the funds and compare them against different benchmarks. There are some tests that will be performed to test for some of the OLS assumptions. The first will be to see if multicollinearity is present, which is when the variables in the regression are correlated to each other and therefore give worse results if it exists. To test this, a variance inflation factor (VIF) will be conducted. Secondly, there will be a test for heteroskedasticity to show if the variance of the independent variables are independent. For this assumption, a Breusch-Pagan test will be performed to test for heteroskedasticity (Valchanov, 2021).

5.1. Carhart Four-Factor Model

The Carhart four-factor model (1997) will be utilized to examine the relationship between ESG factors and fund performance. Specifically, the model will be applied to assess the influence of four factors on the excess returns of the high ESG and low ESG funds portfolios. The values for the Carhart four-factor model are taken from applied quantitative research (AQR, 2023).

By analyzing the influence of these four factors on the excess returns of the ESG and

conventional fund portfolios, it can provide valuable insights into the effectiveness of ESG factors in enhancing fund performance. The model will be used in the OLS regressions as the independent variables. Overall, the Carhart four-factor model will make it possible to conduct a robust analysis of the relationship between ESG and fund performance, which can prove beneficial for investors and fund managers alike.

5.2. Sharpe Ratio

The Sharpe ratio will be used as one of the performance evaluation metrics (Sharpe, 1966). It will be calculated for both funds with high and low ESG scores using their monthly returns over a five year period. This is then subtracted by the risk-free rate, which is monthly observations of 1-month Treasury Bill. The standard deviation is then calculated for the monthly return observations for each fund. These values are then concluded into one Sharpe ratio for each of the high and low ESG portfolios. By comparing the Sharpe ratios of the two portfolios, it can be determined which one generated higher returns relative to their level of risk. This will be repeated four times for each of the benchmark indexes. This comparison will help to evaluate the relative performance of ESG- and conventional funds within each benchmark group.

It is important to note that the Sharpe ratio has some limitations, such as its assumption of normal distribution of investment returns and its failure to account for extreme events that may affect investment returns. However, it remains a valuable tool for investors and fund managers to assess the risk-adjusted performance of their investments, and we believe it will be useful in our analysis of ESGs impact on fund performance.

5.3. Treynor Ratio

Furthermore, the Treynor ratio will be used as a measure to evaluate the performance of the different funds (Treynor, 1973). Unlike the Sharpe ratio that uses the standard deviation of returns, the Treynor ratio uses beta as a measure of risk. We will calculate the Treynor ratio for both portfolios using their monthly returns and beta coefficients. The excess portfolio return is calculated in the same way as in the Sharpe ratio. Beta is calculated by taking the covariance of the funds monthly returns and the related strategic benchmark of that fund, and dividing that by the variance of the strategic benchmark. The reason to use the strategic benchmark as the market value was that it should represent that specific industry and

investment strategy, instead of the market as a whole which will be the case when using S&P500 for the US. This is done for all four benchmarks, and will enable us to compare the returns of the two portfolios against their systematic risk, which is measured by the beta coefficients.

The Treynor ratio shares some of its limitations with Sharpe. However, it is believed that using the Treynor ratio in conjunction with the Sharpe ratio will provide a more comprehensive evaluation of the funds performance relative to its risk, based on ESG factors.

6. Results & Analysis

In this section the results of the research will be provided. This will include OLS regressions for all groups as described in the data section and selected tests to test for OLS assumptions. To this, some descriptive statistics will be provided.

6.1. Descriptive Statistics

The descriptive statistics consist of the different portfolios of funds analyzed in this paper. Specifically, focus will be at the mean and standard deviation of returns, as well as the beta, Sharpe and Treynor ratios.

Table 1: Descriptive Statistics

	Mean	Std	Min	Max	Beta	Sharpe	Treynor
EURO STOXX 50	0,007326	0,055422	- 0,161841	0,180902			
High ESG	0,006319	0,054031	- 0,180159	0,165379	1,145178	0,543294	0,004496
Low ESG	0,006068	0,055170	- 0,166344	0,118278	1,116583	0,348717	0,004611
MSCI Europe Small Cap	0,003060	0,068515	- 0,213683	0,182279			
High ESG	0,004867	0,061472	- 0,202468	0,143012	0,800194	0,303211	0,004620
Low ESG	0,006611	0,064227	- 0,183915	0,150937	0,850037	0,315251	0,006401
FTSE ALL-WORLD TECHNOLOGY	0,014200	0,064514	- 0,128556	0,137341			
High ESG	0,012949	0,058679	- 0,111101	0,152168	0,979602	0,628425	0,012023
Low ESG	0,010414	0,072230	- 0,156599	0,203332	1,000056	0,364853	0,009243
S&P Global Infrastructure	0,005827	0,053166	- 0,229597	0,129101			
High ESG	0,006120	0,042840	- 0,195781	0,104060	0,900929	0,371407	0,005494
Low ESG	0,009077	0,046419	- 0,224379	0,124138	0,874306	0,331507	0,009044

Beginning with the EURO STOXX 50, the average monthly returns for the high, respectively low ESG funds are worse than the index benchmark. The "Std" column stands for standard deviation of returns, and these are all very similar indicating that there is not that much of a difference in the volatility. For the beta value, the high ESG portfolio has a higher beta coefficient, indicating that it is more sensitive to market movements than low ESG.

These metrics above are then the foundation in calculating Sharpe and Treynor ratios. As of the Sharpe ratio there is a higher value for high ESG ratings. This suggests that the environmentally friendly funds generate higher excess return compared to the conventional funds, relative to the volatility and therefore risk taken. However, the Sharpe ratios for both investments are positive, indicating that they have generated returns that are higher than the risk-free rate.

The Treynor ratios for high ESG and low ESG are 0.004496 and 0.004611, respectively. This would indicate that low ESG generated a higher excess return for each unit of systematic risk taken. But because of the small difference in the values there is not really a big difference in the aspect of the Treynor ratio.

Furthermore, for MSCI Europe Small Cap and the high and low portfolios, there is a slight advantage for the low ESG funds in regards to Sharpe and Treynor ratios. This suggests that for small cap funds there is an advantage for conventional funds with a lower ESG score- Both regarding the average monthly return metrics, as well as per the risk associated numbers which indicate that the low portfolio generated a better risk adjusted return compared to the high ESG score portfolio. Moreover, the values for standard deviation are higher than for the EURO STOXX funds. This suggests that smaller companies are riskier than large companies, and should therefore create higher returns.

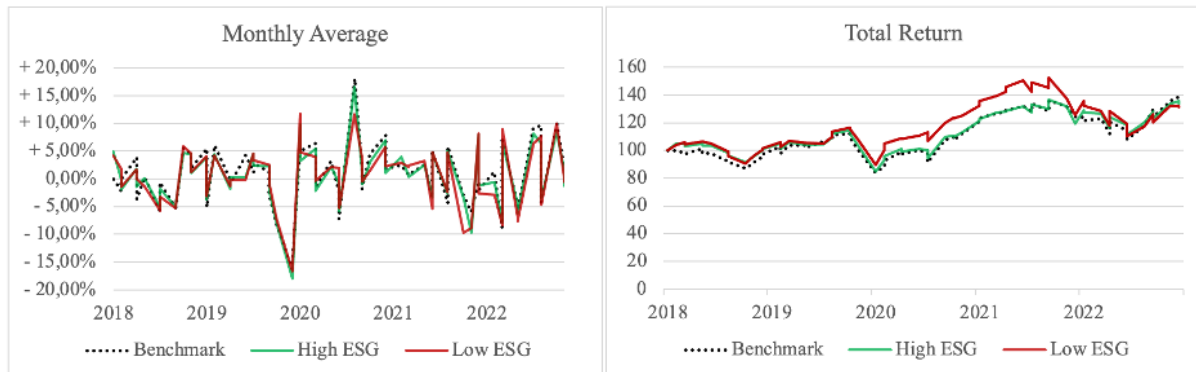
In contrast, the technology index FTSE ALL-WORLD TECHNOLOGY Index has the highest returns out of the four indexes and also its related high and low portfolios. The environmentally friendly funds perform better in terms of risk adjusted returns, which can be confirmed by the values seen in Sharpe and Treynor. This implies that in the tech industry it is more profitable to invest in the funds with higher ESG scores rather than lower scores.

Similar to the small cap funds, the funds with the S&P Global Infrastructure as their benchmark, have achieved higher returns for the low ESG funds portfolio. In terms of risk-adjusted performance, the Sharpe ratio for the low ESG portfolio is higher than that of the high ESG portfolio, suggesting that the low ESG portfolio has a better risk-adjusted return. This is also supported by the Treynor ratio, with the low ESG portfolio having a higher ratio compared to the high ESG portfolios, implying that the low ESG portfolio generated a higher return per unit of systematic risk.

6.2. Portfolio Returns

In order to make it clear regarding the different portfolio returns, relative to their benchmark, an imaginary investment is made into a portfolio that is equally weighted including the different funds, one for high ESG and one for low ESG. This is repeated for every four of the benchmarks. This is then plotted into graphs which shows the total return of the investment after the five year time frame, ranging from April 2018 - March 2023.

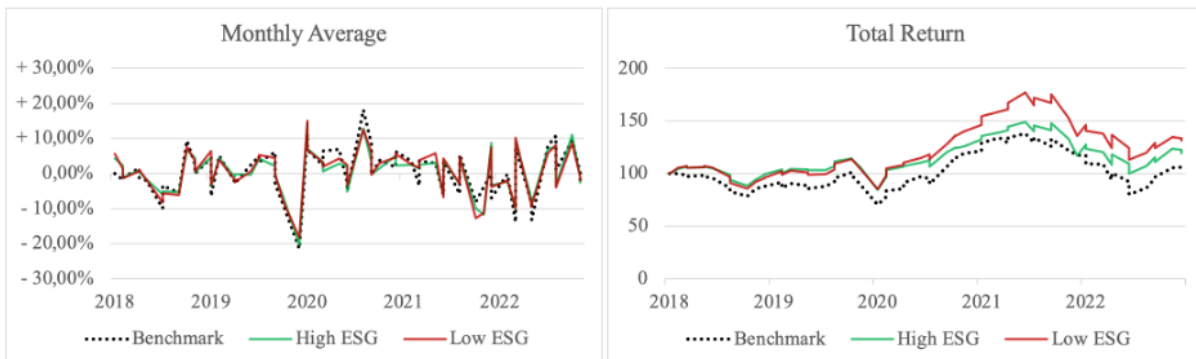
Figure 1 and 2: EUROSTOXX Performance



Firstly, in figure 1 the monthly average returns are shown for the two portfolios and the EURO STOXX benchmark. There are no big differences in this graph which suggests that the volatility is similar between the high and low portfolios compared to the benchmark. This is also supported by the standard deviation mentioned above with all the three having values within the range of approximately 0,054 to 0,055.

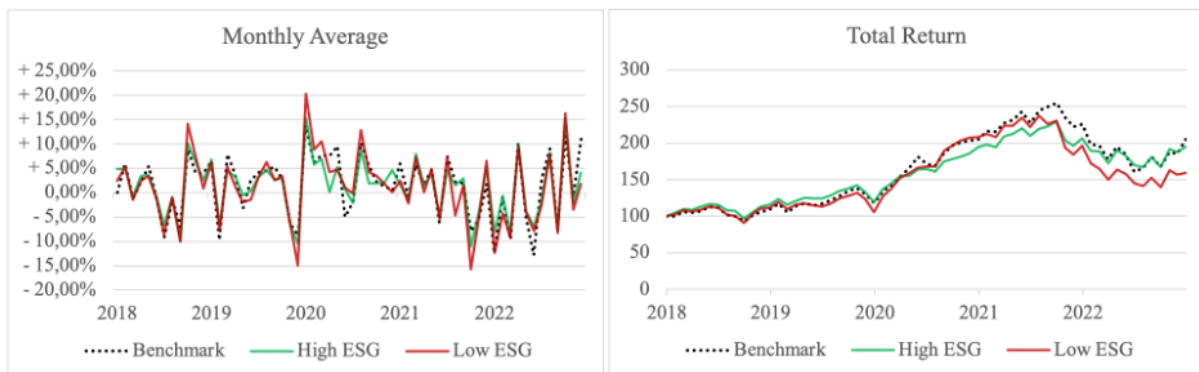
Moving on to figure 2, the total investment of 100 dollars generated returns of 41,6% for the benchmark, 33,8% for the high ESG portfolio and 31,3% for the low ESG portfolio. The low one outperformed both the other two until late 2021, where it dropped more than the other two investments. Overall, there is not much of a difference to be said regarding total return based on the ESG aspect of these funds because of its similar returns at the end of the time frame.

Figure 3 and 4: MSCI Europe Small Cap Performance



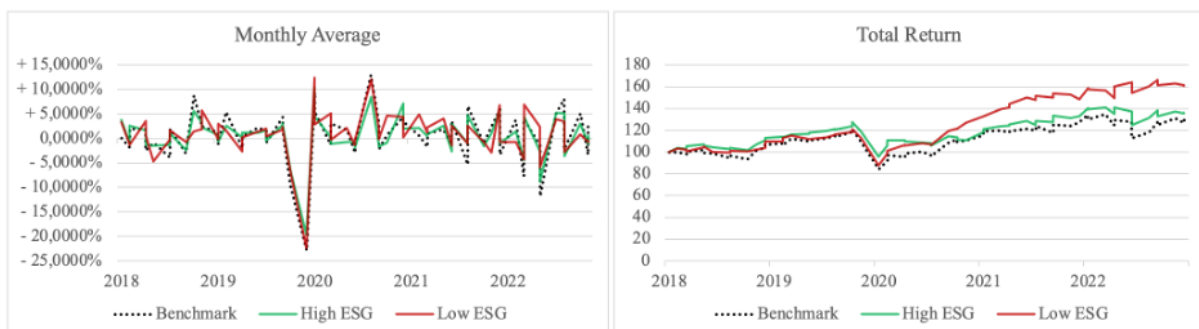
The same comparison is made for small cap funds and the benchmark index. For these funds there is a more visible difference between the three graphs. The benchmarks total return equals 4,3%, the high ESG 19,4% and the low ESG score portfolio 31,2%. These values suggest that the funds with lower ESG rating performed the best during the chosen time frame, in comparison with high scores and the benchmark itself. Worth mentioning is that the high ESG score portfolio also performed noticeably better than the benchmark.

Figure 5 and 6: FTSE ALL-WORLD TECHNOLOGY Performance



For the technology sector, there have been quite many ups- and downs as seen in figure 5. Despite the volatile sector, especially in 2022, all three graphs show greater return in comparison with the other benchmarks. The benchmark generated returns of 106,3%, followed by the high ESG score portfolio coming in at 95,8% and the low portfolio at 59,9%. By these results it is quite a noticeable difference between ESG funds and conventional funds, where the ESG funds outperformed the other portfolio, but still the benchmark itself performed the best.

Figure 7 and 8: S&P Global Infrastructure



Lastly, the performance metrics for the infrastructure industry. The benchmarks generated returns of 29,8%, the high ESG portfolio 36,3% and the low ESG portfolio 60,9%. This shows a large outperformance by the non-ESG funds in comparison with ESG funds and the infrastructure benchmark index. This marks that the conventional funds have been the better investment during the past five years.

To summarize, the different statistics mentioned in this section all differ depending on which of the different industries that were chosen to analyze. There is no clear relationship that suggests that ESG funds outperform or underperform relative to non-ESG funds that have the same benchmark index. Instead the results are very different for every industry with data that both conclude that ESG funds perform better than non-ESG, that non-ESG funds perform better, and also that there is not that much of a difference in the historical performance nor the risk aspects of the investments. For the EURO STOXX and FTSE Technology funds, there was a slight overperformance for the ESG funds compared to the non-ESG funds. But in both of these cases, the fund portfolios underperformed its benchmark index. For the MSCI Small Cap and S&P Infrastructure, the low ESG score funds performed better than the ESG funds by quite a large margin. These low ESG portfolios of funds also outperformed its benchmark index. Based on these metrics, it can be concluded that there is no clear relationship between ESG score and fund performance solely, on the grounds of these benchmarks, which connected to the second research question, means that there are no significant effects between ESG and fund performance depending on strategic benchmark. This is supported by the literature review mentioned earlier in the report, where Climent and Soriano (2011), Milonas et al. (2022) and Plagge and Grim (2020) discuss that there are no clear evidence that ESG and fund performance are related and that other factors affect the funds under- or overperformance such as time frame, geographical location, industry and investment strategy.

6.3 VIF and Breusch-Pagan Tests

To validate the results from the regressions made, which is shown in section 6.4, two separate tests were made to test for multicollinearity and heteroskedasticity. To test for multicollinearity, a VIF-test was performed. There are different takes on what value on a VIF test is good or bad, some say that a VIF value lower than 10 indicates that multicollinearity does not exist (Vittinghoff, 2012) whereas other sources (Johnston, Jones and Manley, 2018) say that the value should be lower than 2,5 to make this statement. However, there is no multicollinearity present for the independent variables used for this research since the VIF

test shows a mean value of 1,6. This is under the mentioned values, concluding that multicollinearity does not exist.

Table 2: VIF

Variable	VIF	1/VIF
MKT	2,12	0,472
HML	1,97	0,508
SMB	1,23	0,812
UMD	1,09	0,197
Mean VIF	1,60	

Breusch-Pagan tests were also performed to test if heteroskedasticity exists in the model. The results from the test show that we do not reject the null hypothesis, which states that there is constant variance among the residuals, since the p-value for all tests is above a significance level of 10%. This means that heteroskedasticity is not present in the model and the output is reliable. The Breusch-Pagan test was conducted for all 8 regressions, with the same results of not rejecting the null hypothesis.

Table 3: Breusch-Pagan

Infrastructure High ESG	Test Statistic	p-value	Infrastructure Low ESG	Test Statistic	p-value
Breusch-Pagan Test	0,99	0,32	Breusch-Pagan Test	1,09	0,29
Technology High ESG	Test Statistic	p-value	Technology Low ESG	Test Statistic	p-value
Breusch-Pagan Test	0,31	0,57	Breusch-Pagan Test	0,33	0,57
EURO STOXX High ESG	Test Statistic	p-value	EURO STOXX Low ESG	Test Statistic	p-value
Breusch-Pagan Test	0,09	0,76	Breusch-Pagan Test	0,00	0,97
Small Cap High ESG	Test Statistic	p-value	Small Cap Low ESG	Test Statistic	p-value
Breusch-Pagan Test	0,01	0,93	Breusch-Pagan Test	0,01	0,90

6.4 Regressions

Looking at the regressions made for this research, with average monthly return as the dependent variable and Carhart-four factor model as independent variables, eight regressions were made. Two regressions for each group of funds with selected benchmarks, one with high ESG scores and one with low scores. The R-squared for all regressions are between 0,848 and 0,935, which is a high goodness-of-fit level for all regressions. Worth noting is that the alpha metrics, performance versus the market, will differ from the earlier performance section. This is due to the fact that for the regressions, aggregated equity portfolio values from AQR (2023) were used, and not the benchmark indexes as in the prior sections 6.1 and 6.2. The reason for that is that the AQR data set provides these fixed values, which are widely accepted and recognized in the industry. The fixed values from AQR are chosen for the Carhart regression because the funds used in the research are traded globally or in Europe. Therefore, it is appropriate to use European and worldwide values as they are more representative of the investment universe in which the funds operate.

Table 4: Regression Infrastructure

Variable	Infrastructure High ESG	Infrastructure Low ESG
Alpha	0,0022*** (0,0024)	0,0029*** (0,0025)
MKT	0,052 (0,058)	0,051 (0,062)
SMB	0,301 (0,201)	0,383** (0,187)
HML	0,159 (0,096)	0,159 (0,098)
UMD	0,326*** (0,088)	0,324*** (0,088)

Note: this table shows two of the regressions performed, with MKT, SMB, HML, UMD and alpha as variables. The standard errors are reported in the parentheses for each variable.

Significant at 10% level. ** Significant at 5% level. * Significant at 1% level.*

The group of funds with the benchmark S&P Global Infrastructure TR (USD), shows an alpha of 0,0022 for the group with high ESG score and 0,0029 for the ones with low ESG score, both being significant at a 1% level. These values are close to zero, but still positive, which indicates that these two sets of funds outperformed the market in terms of performance. The MKT factor is insignificant for both groups and therefore no conclusions can be made for this variable. Looking at the SMB factor, the coefficient is 0,3 and 0,38 for the high respectively low ESG, which suggests that the fund group with low ESG invest in stocks with smaller market capitalization compared to the one with high ESG. However, the variable is insignificant for the high ESG regression. The third factor in the Carhart-four factor model, HML, is insignificant for both portfolios. Moving on to the UMD factor, the momentum factor, both groups show a positive and similar beta which indicates that both high and low ESG funds have an investment style of buying winners and selling losers. This statement can be supported since the variable is significant at a 1% level.

Table 5: Regression Technology

Variable	Technology High ESG	Technology Low ESG
Alpha	0,0026*** (0,0026)	0,0021*** (0,0027)
MKT	0,093 (0,069)	0,096 (0,069)
SMB	0,350* (0,206)	0,347* (0,201)
HML	0,125 (0,103)	0,122 (0,104)
UMD	0,357*** (0,092)	0,361*** (0,094)

Note: this table shows two of the regressions performed, with MKT, SMB, HML, UMD and alpha as variables. The standard errors are reported in the parentheses for each variable.

Significant at 10% level. ** Significant at 5% level. * Significant at 1% level.*

Furthermore, looking at the results for the funds with the strategic benchmark FTSE AW/Technology TR, the alpha is significant at a 1% level and has the values of 0,0026 and 0,0021 for the high respectively low ESG groups. This indicates that both groups of funds

slightly outperform the market. The market and the HML variables are both insignificant and no conclusions can be drawn from these values. The SMB and UMD factor shows no significant difference between the two portfolios, where the beta for the high ESG is 0,35 and 0,357, and for the low ESG is 0,347 and 0,36. Significance at a 10% for SMB factor and at 1% for the UMD factor for both groups. The positive values for the SMB factor shows that both groups of funds tend to invest in small market capitalization stocks and for the UMD factor, the positive value shows that the groups buy winners and sell losers.

Table 6: Regression Small Cap

Variable	Small Cap High ESG	Small Cap Low ESG
Alpha	0,0011*** (0,0029)	0,0011*** (0,0028)
MKT	0,0677 (0,0656)	0,0717 (0,0646)
SMB	0,478** (0,196)	0,493** (0,196)
HML	0,339*** (0,106)	0,344*** (0,107)
UMD	0,574*** (0,096)	0,585*** (0,096)

Note: this table shows two of the regressions performed, with MKT, SMB, HML, UMD and alpha as variables. The standard errors are reported in the parentheses for each variable.

Significant at 10% level. ** Significant at 5% level. * Significant at 1% level.*

Moving on to the groups with the benchmark MSCI Europe Small Cap TR USD, the MKT variable is again insignificant and will therefore not be interpreted. Alpha is 0,0011 for both portfolios, indicating that the groups to some degree outperform the market. The SMB factor is 0,478 for the groups with high ESG and 0,49 for the ones with low, which shows that both groups of funds invest in small capitalization firms, where the low ESG have a somewhat higher beta for this variable. Significance is found at a 5% level for the variable. Looking at the HML factor, the beta is 0,34 for both groups of funds. The positive sign for this variable can be interpreted that both groups of funds have more value stocks than growth stocks. The beta of the UMD variable is quite similar for the two groups, 0,574 for the high ESG and 0,585 for the low ESG group. This indicates that both groups have investment strategies to

buy winners and sell losers and the low ESG group has a slightly higher beta. Both the UMD and HML variables are significant at a 1% level.

Table 7: Regression EUROSTOXX

Variable	Euro STOXX High ESG	Euro STOXX Low ESG
Alpha	0,0015*** (0,0027)	0,0013*** (0,0028)
MKT	0,058 (0,0639)	0,066 (0,0649)
SMB	0,464** (0,187)	0,472** (0,194)
HML	0,335*** (0,103)	0,338*** (0,105)
UMD	0,547*** (0,089)	0,563*** (0,095)

Note: this table shows two of the regressions performed, with MKT, SMB, HML, UMD and alpha as variables. The standard errors are reported in the parentheses for each variable.

Significant at 10% level. ** Significant at 5% level. * Significant at 1% level.*

Finally, the regression results for groups of funds with the technical benchmark Euro STOXX 50 TR EUR. The alpha is significant at a 1% level, the beta for the group of high ESG funds is 0,0015 and for the low 0,0013. This indicates that the performance is very close to the market, just a fraction above for both groups. The MKT variable is insignificant so no interpretations will be made. The SMB factor is 0,464 and 0,472 for the high respectively low ESG groups and are significant at a 5% level. This indicates, as mentioned before, that these groups of funds tend to invest in small capitalization firms and the group of high ESG scores does it to a higher extent. Beta of the HML factor is 0,335 for the high ESG group and 0,337 for the low group, both significant at a 1% level. Results for this variable are very similar and show that both sets of funds consist of more value stocks rather than growth stocks. Moving on to the final variable, the UMD, both are significant at a 1% level. The beta for the group of high ESG funds is 0,547 whereas for the low ESG is 0,563. This indicates that the group of low ESG funds invest slightly more in winners compared to the high ESG group, and both sell losers.

To conclude the results from the regression, the variable of MKT is not significant for any of the models at a 10% level. Overall the results are similar and no major differences can be seen between high ESG groups of funds and the low ESG groups for either strategic benchmark. The alpha for all groups are very alike and very close but above zero, showing that the performance of the funds compared to the market nearly has no difference, where the groups slightly outperform the market. When looking at the other variables the results are not very different within each group, with the largest difference in coefficients being around 0,015 units when comparing the high ESG group against the low one for each set of funds. This can be interpreted as there not being a major difference in fund performance based on the ESG score of the fund.

Moving on, looking at the difference between the groups, that is differences depending on strategic benchmark, there are some noticeable differences. One of them is the difference in the SMB factor between the technology and small cap groups. The variable is higher for small cap, indicating that this set of funds invest in more small capitalization stocks, which makes sense since the strategic benchmark is Euro small cap. Something else to note with the SMB variable is that it is positive for the benchmark Euro STOXX, which is odd considering that this benchmark focuses on the 50 largest firms in Europe. It is significant but should not be considered reliable since this benchmark has a focus on large companies. Other differences between the benchmarks is with the HML and UMD variables, where infrastructure and technology have lower coefficients on both compared to small cap and Euro STOXX. This indicates that small cap and Euro STOXX funds tend to invest in winners and that the portfolio consists more of value stocks compared to the other two benchmarks. The difference is small, but there is still a difference looking at these two variables. Other than that, the results show no significant differences between the groups.

Moreover, analyzing the results from the regression, it can be said that there are no significant differences in the coefficients from the Carhart-four factor model when comparing within the groups, that is high ESG against low ESG. This is in line with research mentioned in the literature section done by Milonas et al. (2022) and Plagge and Grim (2020), that comes to the conclusion that there is no significant relationship between ESG scores and fund performance.

7. Conclusion

To conclude this research, the results show that there is not a clear relationship between ESG and fund performance. Looking at the ending part of section 6.2, the difference in performance based on ESG is very different when comparing the benchmarks, where some of them have the low ESG group of funds as superior in terms of performance and others have the opposite. This means that ESG funds perform differently when looking at different indexes, which can be concluded that ESG scores and fund performance do not have a clear relationship. Looking at the regressions, there is no major difference between the variables either within or between the strategic benchmark groups, which can be concluded as no clear relationship between ESG and fund performance depending on the benchmark. As mentioned in the results part, the results is in line with the research done by Climent and Soriano (2011), Milonas et al. (2022) and Plagge and Grim (2020), who discuss that there are no clear evidence that ESG and fund performance are related in either a positive or negative way, concluding that other factors affect the funds under- or overperformance such as time frame, geographical location, industry and investment strategy.

The results from this thesis are in line with the Efficient Market Hypothesis (EMH). Based on the data chosen for this research, there is no statistical significant relationship between ESG scores and fund performance. Investors cannot expect to outperform the market by screening funds based on high or low ESG ratings. The findings therefore align with EMH that suggests that financial markets are efficient and reflect all available information in the asset prices.

Another point of view of the results, as an investor, is that there is no trade-off between investing sustainable and achieving high returns. As stated, the results show no clear relationship between ESG scores and fund performance, which indicates that investors do not have to sacrifice returns in order to invest their money in funds or firms that are focusing on sustainability within the three aspects of ESG.

Some limitations with this thesis, and within this subject, is that there is no general thing such as ESG-scores. Every different provider such as Refinitiv, MSCI or Morningstar has different ways of calculating the scores. This limits the possibility of comparison between research that uses different databases, since results can differ depending on provider. Another limitation is

the use of four different benchmarks, in order to gain meaningful results, it would be of great value to include multiple benchmarks within the same field. For example, include more infrastructure benchmarks in order to see if the effects of ESG is the same for the whole industry, or if it is just a coincidence.

To further research this subject, it would therefore be interesting to include more or other benchmarks that could be looked at to see if there are differences in other industries or based on their investment strategy. This would be interesting in order to see if and where ESG has an impact. Furthermore, looking at different timeframes and a longer time period could be beneficial to find more valuable inputs within the area. Also to incorporate effects during periods of crises would be meaningful in order to gain understanding if there are differences in ESG and fund performance during different market conditions and world economic situations.

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