THE PERFORMANCE OF ETFS WITH HIGH ESG SCORE IN COMPARISON TO THE S&P 500 INDEX AND THE STOXX EUROPE 600 INDEX

Lappeenranta–Lahti University of Technology LUT

Bachelor's thesis

2023

Elias Laari

Examiner: Henri Huovinen

ABSTRACT

Author:	Elias Laari
Title:	The performance of ETFs with high ESG score in comparison to the S&P 500 Index and the STOXX Europe 600 Index
School:	LUT School of Business and Management
Degree programme:	Business Administration, Strategic Finance
Supervisor:	Henri Huovinen
Keywords:	ESG, Exchange-Traded Funds, Risk-Adjusted performance

The purpose of this bachelor's thesis is to compare exchange-traded funds (ETFs) with high environmental, social, and governance (ESG) scores to the Standard and Poor's 500 and STOXX Europe 600 indices. The data is sourced from Refinitiv and Yahoo Finance. The study employs a quantitative sample of 10 ETFs, with 5 from Europe and 5 from the US. Risk-adjusted measures such as Sharpe ratio, Treynor ratio, Jensen's alpha, and Information ratio will be utilized to evaluate the risk-adjusted returns of the selected ETFs. Additionally, the study will assess the key factors behind the returns using the Fama-French five-factor and momentum factor analysis. The time frame for the study is 2013-2022.

TIIVISTELMÄ

Tekijä:	Elias Laari
Tutkielman nimi:	Korkeasti ESG-pisteytettyjen ETF:ien suoriutuminen verrattuna S&P 500- ja STOXX Europe 600 -indekseihin
Akateeminen yksikkö:	LUT-kauppakorkeakoulu
Koulutusohjelma:	Kauppatieteet, Strateginen rahoitus
Ohjaaja:	Henri Huovinen
Hakusanat:	ESG, ETF-rahastot, riskiin suhteutettu tuotto

Tämän kandidaatintutkielman tarkoituksena on verrata korkeasti ESG-pisteytettyjä pörssinoteerattuja rahastoja (ETF) Standard & Poor's 500 -indeksiin ja STOXX Europe 600 -indeksiin. Tutkimuksen aineisto on kerätty Refinitiv- ja Yahoo Finance -palveluista. Tutkimus toteutettiin kvantitatiivisin tutkimusmenetelmin, 10 pörssinoteeratun rahaston aineistolla, joista 5 on Euroopasta ja 5 Yhdysvalloista. Riskisuhteutettuja mittareita, kuten Sharpen lukua, Treynorin lukua, Jensenin alfaa ja Information ratiota, käytetään valittujen ETF:ien arviointiin suhteessa riskiin sekä valittuihin indekseihin. Lisäksi tutkimuksessa arvioidaan tärkeimpiä tekijöitä tuottojen takana käyttäen Fama-Frenchin viisifaktorimallia ja momenttifaktorianalyysia. Tutkimuksen aikaväli on vuodet 2013-2022.

Table of contents

1 Introduction 1
1.1 Aim of the study and research questions 2
1.2 Structure 3
1.3 Limitations 4
2 Theoretical framework 5
2.1 ESG 5
2.1.1 Criticism on ESG 6
2.2 Exchange-Traded Funds 7
2.3 Previous studies 8
3 Data and methodology 10
3.1 Data 10
3.1.1 ESG Score 10
3.2 Performance metrics 11
3.2.1 Sharpe ratio 12
3.2.2 Treynor ratio 12
3.2.3 Jensen's alpha 13
3.2.4 Information ratio 14
3.2.5 Beta 14
3.3 Factor analysis 15
3.4 Risk-free rate 16
3.5 Benchmark indices 17
3.5.1 S&P 500 17
3.5.2 STOXX Europe 600 19
4 Results 20
4.1 ETFs performance in comparison to indices 20
4.2 Risk-adjusted performance 22
4.3 Fama-French five factor and momentum analysis 25
5 Conclusions 27
References 30

1 Introduction

Sustainable investing has become an increasingly popular trend in recent years, as investors seek to align their investments with their values. Environmental, Social, and Governance (ESG) ETFs (Exchange Traded Funds) have emerged as a popular investment instrument that allows investors to invest in companies that meet certain sustainability criteria while maintaining a diversified portfolio (Journal of Financial Planning, 2020). Moreover, ESG performance is increasing the value of a company (Piechocka-Kaluzna, Tluczak, Lopatka, 2021).

This bachelor's thesis aims to analyse the performance of American ETFs with high ESG-score in comparison to the S&P 500 index, and European ETFs with high ESG-score in comparison to the STOXX Europe 600 index. The S&P 500 tracks the largest 500 publicly traded companies in the US, while the STOXX 600 tracks the largest 600 companies in Europe. The research will involve a comprehensive analysis of the risks and returns of ETFs with high ESG score, as well as a factor analysis and an assessment of the impact of ESG criteria on the performance of these ETFs. The thesis will also investigate whether ESG ETFs offer diversification benefits and whether they can provide superior risk-adjusted returns relative to traditional index funds.

The data used in this research will be sourced from Refinitiv, Yahoo Finance and Kenneth French's Data Library, and the analysis will cover a period of 10 years to provide a comprehensive picture of the performance of ESG ETFs relative to traditional indices in the American and European markets.

Furthermore, the research could offer new insights about sustainable investing and its effect on financial performance, thus providing a more in-depth understanding of how ESG criteria affects investment performance. Although the topic of ESG and financial

performance has been previously researched, there are varying findings in the existing literature. Giese et al. (2019) noted that “the existing literature found positive, negative, and nonexistent correlations between ESG and financial performance, although the majority of researchers found a positive correlation”. (Giese, Lee, Melas, Nagy, Nishikawa, 2019)

1.1 Aim of the study and research questions

The aim of the study is to evaluate the performance of ESG ETFs compared to traditional indices, and to assess the impact of ESG criteria on the performance of these funds. The following research questions will direct and shape the direction of this study:

Question 1: “How does the performance of ETFs with high ESG score compare to that of the S&P500 and STOXX 600?”

This research question seeks to evaluate the performance of ESG ETFs relative to traditional indices and assess whether ESG criteria has a positive or negative impact on the performance of these funds.

Question 2: “How have ETFs with high ESG score performed in terms of risk-adjusted returns?”

This question delves deeper into the analysis of ESG ETFs' performance by considering the level of risk taken to achieve the returns. Specifically, this question aims to evaluate whether the performance of ESG ETFs is better or worse than the traditional indices when considering the level of risk taken. The analysis will consider various risk-adjusted performance measures such as Jensen’s Alpha, Sharpe ratio, and Treynor ratio.

Question 3: “What are the key factors that contribute to the returns of ETFs with high ESG score in comparison to traditional indices, based on a factor analysis of financial performance indicators?”

This research question aims to identify the key factors that contribute to the returns of ESG ETFs in comparison to traditional indices by conducting a factor analysis which involves Fama-French five-factor model and momentum factors.

1.2 Structure

The structure of this thesis consists of six main chapters. The first chapter introduces the topic of ESG performance and its comparison with the market index. The chapter will also present the research questions that will guide the study and the motivation behind the research.

The second chapter will focus on the theoretical framework of the study. This chapter will also explore the modern portfolio theory and its application to the ESG market, along with a discussion on the different measures of portfolio performance.

The third chapter will present the data and methods used in the study. This chapter will provide an overview of the data sources, and the methodology used for data analysis will also be discussed in this chapter.

The fourth chapter will present the results of the study. This chapter will include a comparison of the performance of ESG ETFs with the selected market index, using different measures of performance such as raw returns, risk-adjusted returns, various performance ratios and a factor analysis based on Fama-French five-factor model and momentum factors.

The final chapter will present the conclusion and provide a summary of the study's main findings. Finally, the reliability of the study will be assessed, and the thesis will conclude with a reflection on the research process and the value of the study.

1.3 Limitations

While this study aims to provide insights into the performance of ESG ETFs and their relationship with traditional indices, there are several limitations that need to be acknowledged.

Firstly, the study is limited by its time frame, which is set to the past 10 years from 2013 to 2022. This may limit the generalizability of the study's findings, as the performance of ESG ETFs may differ in other time periods or market conditions.

Secondly, the study relies on secondary data sources, such as Refinitiv database, LUT Primo, Scopus, Yahoo Finance and Google Scholar. While these sources provide a wealth of information, they may be subject to biases or errors, which could impact the accuracy of the study's findings.

Thirdly, the study only focuses on ETFs with high ESG rating, and it does not include any other types of investment instruments, such as funds or individual stocks. This may limit the study's scope and prevent a comprehensive analysis of the impact of ESG criteria on investment performance. The study does not include ETFs with low ESG rating either.

2 Theoretical framework

In this chapter, the theoretical framework that underpins the study of ESG and ETFs will be discussed, including how their profits and risk-adjusted performance are measured. To assess the performance of these investment instruments, various metrics will be examined, such as returns, volatility, and risk-adjusted measures such as the Sharpe ratio. Factor analysis will also be conducted to identify which factors contribute to growth, using the Fama-French five-factor model and momentum as the factors.

Furthermore, this chapter will provide an overview of the literature on ESG and ETFs, and the research on their performance. By establishing a theoretical framework for the study, it is possible to analyse the impact of ESG criteria on investment outcomes.

2.1 ESG

ESG investing is a relatively new approach to investing that has gained more attention recently. ESG which stands for Environmental, Social, and Governance, refers to a set of criteria used by investors to evaluate a company's sustainability and social impact in addition to its financial performance. The goal of ESG investing is to identify companies that are making a positive impact on society and the environment while still generating attractive financial returns. (Clark, Feiner & Viehs, 2015)

There has been a growing interest in ESG investing, with many investors seeing it as a way to align their investments with their values. Recently, the number of ESG funds and ETFs has increased dramatically, and there is evidence that investors are allocating more capital to these strategies. 10 years ago, ESG-focused investment instruments were not as widely available as they are currently thus finding ESG-themed funds tracing to early 2010s is not as common as to find more recent funds (Cockrell, Phillips & Volker, 2020). A study by Hale (2020) found that ESG funds had record-breaking pace of attracting new assets in 2019, implicating that ESG-themed funds have becoming more popular.

Several studies have examined the performance of ESG funds and ETFs relative to traditional benchmarks. A study by Clark et al. (2015) found that companies with higher ESG ratings tend to outperform their peers over the long term.

In addition to performance, there are other factors to consider when evaluating ESG investments. For example, ESG investing can help investors manage risks associated with climate change and other environmental or social factors. ESG investing can also be useful for identifying companies with strong governance practices, which can reduce the risk of financial scandals and other corporate misconduct. (Thomson Reuters, 2021)

Overall, there is growing evidence that ESG investing can provide attractive financial returns while also aligning investments with social and environmental values. However, more research is needed to fully understand the performance and risk characteristics of ESG funds and ETFs, particularly in different market environments.

2.1.1 Criticism on ESG

ESG has faced criticism over its selection criteria for investments and ratings. The metrics used for ESG ratings can be too vague or subjective, leading to inconsistent or unreliable data that may not accurately reflect a company's true sustainability practices (Baldi & Pandimiglio, 2022). Additionally, ESG investing can result in a lack of diversification in a portfolio, which could increase risk and reduce returns.

Another critique of ESG investing is the potential for "greenwashing", where companies prioritize marketing their ESG practices over actually implementing them in a meaningful way. According to Chen, Luu & Yu (2020), “Greenwashing is when firms disclose large

quantities of ESG data but have poor ESG performance". Greenwashing can lead to investors being misled and investing in companies that are not truly sustainable. According to Burbano & Delmas (2011), market external factors, like consumer demand, investor demand and competitive pressure, are important drivers of greenwashing. Companies with poor ESG performance be exposed to temptation of misleading the investors and consumers with ESG data which does not give a realistic image of their actual ESG performance.

Moreover, ESG investing may be used as a way for investors to feel good about their investments without making significant changes to their overall investment strategy.

2.2 Exchange-Traded Funds

Exchange-traded funds (ETFs) are investment funds that are traded on an exchange, like individual stocks. ETFs hold a basket consisting of underlying assets such as stocks, bonds, or commodities and track a specific index or benchmark. Investors buy and sell shares of an ETF throughout the trading day, providing an easy and low-cost way to access a diversified portfolio. ETFs tend to have lower expense ratios than mutual funds (Hill, Nadig & Hougan, 2015). ETFs have gained popularity in recent years due to their flexibility and cost-effectiveness in comparison to traditional mutual funds.

There are various types of ETFs available, including equity ETFs, bond ETFs, commodity ETFs, and currency ETFs. Equity ETFs invest in a portfolio of stocks and track an equity while bond ETFs invest in a portfolio of bonds and track a bond index (Ashworth, 2020). Commodity ETFs invest in commodities such as gold, oil, and agriculture products. Currency ETFs invest in foreign currencies and track the exchange rate movements.

ETFs offer investors the opportunity to invest in a diversified portfolio with a single trade. The diversification offered by ETFs can reduce the overall risk of an investor's portfolio. Moreover, ETFs can be a great tool for investors looking to invest in a specific market or sector. For instance, an investor can buy an ETF that tracks the performance of a specific

industry or geography. However, especially highly specialized ETFs have the potential to expose investors to more volatility and risks, that may not be expected (Lettau & Madhavan, 2018).

In summary, ETFs are investment funds that trade on an exchange and track a specific index or benchmark. They offer advantages over mutual funds such as lower expense ratios and greater flexibility. There are different types of ETFs, including equity, bond, commodity, and currency ETFs, providing a wide range of options to choose from. ETFs are an effective way to diversify an investment portfolio while keeping costs low.

2.3 Previous studies

A study conducted by Dumitrescu, Järvinen & Zakriya (2023) found out that SRI (Socially Responsible Investing) ETF and ESG ETF portfolios underperformed its portfolio benchmark, but in 2020-2022 the ESG ETF portfolio significantly outperformed the benchmark. According to Dumitrescu et al. "ETFs' performance can be explained by increasing industry competition and declining market concentration" (Dumitrescu, Järvinen & Zakriya, 2023). The study also found out that investing in ESG and SRI ETFs had gotten significantly more popular during the period. In 2015 only 31 SRI ETFs were available in the United States, but in 6 years the number had grown for almost four times.

In research conducted by Pavlova & de Boyrie (2022) the researchers examine the risk-adjusted returns of ESG ETFs before and during the COVID-19 market crash. According to Pavlova & de Boyrie the ESG ETFs did not underperform the benchmark during that period (Pavlova & de Boyrie, 2022). Before COVID-19 pandemic, ETFs with lower rated sustainable ETFs outperformed both the market and ETFs with high ESG rating. During the COVID-19 market crash, high ESG ratings did not protect ETFs from suffering losses, but the ETFs did not perform worse than the market. The study states that the ESG ETFs did not underperform the benchmark. However, it does not state that the ESG ETFs would have been performing better in terms of risk-adjusted returns.

A study conducted by Ouchen (2022) found out that ESG portfolios are less turbulent than benchmark portfolios, indicating that the ESG portfolios have a smaller volatility than the benchmarks. In this study, the volatility of the chosen ESG ETFs will be measured by risk-adjusted measurement such as beta and Sharpe's ratio.

In a study conducted by Fain, Naffa & Trinidad Segovia (2020) the researchers analysed nine ESG themed equity portfolios using Fama-French five-factor model. The researchers were addressing the question whether investing in ESG themed equity portfolios could generate positive risk-adjusted returns. According to Fain et al. environmental and disruptive technology megatrends "yielded positive and significant alphas relative to the passive strategy, although this outperformance becomes statistically insignificant in the Fama-French 5-factor model context" (Fain, Naffa & Trinidad Segovia, 2020).

Ang, Madhavan & Sobczyk (2021) researched the ESG exposures of funds using factor analysis. Their study found that funds with high ESG score tend to have different factor loadings than low-scoring ESG funds; highly ESG scoring funds usually have high quality and momentum factor loadings. While this is not directly related to the performance of the funds in terms of returns, it could still explain the performance of funds with high ESG score in comparison to the low-scoring funds, if those factors are crucially contributing to the returns of the funds.

3 Data and methodology

3.1 Data

The data used in this study was collected from the Refinitiv database. The study includes 10 different ETFs, five from the United States and five from Europe. All the ETFs used in the study had a high ESG score, which was calculated by Refinitiv using their own ESG measures. The collected data is from 2013-2022.

3.1.1 ESG Score

Refinitiv's ESG scores provides an assessment of a company's ESG performance, based on publicly reported data. These scores reflect the ESG data framework and are an evaluation of a company's relative ESG performance and capacity, considering industry materiality and company size biases. (Refinitiv, 2023)

Refinitiv ESG scores are based on more than 630 company-level ESG measures, which are used to assess the overall score. The selection of measures is based on factors such as comparability, impact, and data availability, and they may differ across different industries. (Refinitiv, 2023)

The 10 categories of ESG measures are split into three groups of scores, environmental, social, and corporate governance groups. The final ESG score is reflecting the company's ESG performance, based on publicly reported information. The ESG score is a comparative sum of the category weights, for the environmental and social categories, but the weight varies between the industries. The weight is the same for all companies in governance group, regardless of the industry (Refinitiv, 2023). The approach taken in this study involves considering the overall ESG performance score, without differentiating between its three different dimensions.

The ESG score are ranked in four different quartiles. In the first quartile, scores range between 0-25. In that category the scores indicate poor ESG performance and insufficient level of transparency in the ESG data reporting. In the second the scores are >25-50, indicating satisfactory ESG performance. Third quartile consists of scores between >50-75, indicating good performance in ESG criteria and above average performance in transparency regarding to ESG data reporting. In the fourth quartile ESG scores range between >75-100, indicating excellent ESG performance and a high level of reporting data for ESG material. (Refinitiv, 2023) All the ETFs chosen for this study have ESG score of 75 or higher.

Ticker	ETF Name	ESG Score
DLN	WisdomTree U.S. LargeCap Dividend Fund	75
ISUS.L	iShares MSCI USA Islamic UCITS ETF	76
IWY	iShares Russell Top 200 Growth ETF	77
IYW	iShares U.S. Technology ETF	75
SUSA	iShares MSCI USA ESG Select ETF	76

Table 1. ESG Scores of American ETFs. Refinitiv.

Ticker	ETF Name	ESG Score
EUFN	iShares MSCI Europe Financials ETF	80
EUMV.MI	Ossiam Europe ESG Machine Learning	80
EXV4.DE	iShares STOXX Europe 600 Health Care UCITS ETF	86
HEDJ	WisdomTree Europe Hedged Equity Fund	81
SC00.F	Invesco STOXX Europe 600 Optimised Chemicals UCITS ETF	81

Table 2. ESG Scores of European ETFs. Refinitv.

3.2 Performance metrics

Performance metrics are crucial in evaluating investment strategies and measuring the effectiveness of investment decisions. In this chapter, several commonly used metrics for

measuring risk-adjusted profits will be discussed. These metrics include the Sharpe ratio, Treynor ratio, Jensen's alpha, and information ratio.

3.2.1 Sharpe ratio

$$Sharpe\ ratio\ = \frac{R_p\ -\ R_f}{\sigma_p}$$

With,

$$R_p\ =\ Portfolio\ return$$

$$R_f\ =\ Risk\ \ free\ rate$$

$$\sigma_p\ =\ Standard\ deviation\ of\ portfolio's\ excess\ return$$

The Sharpe ratio is a measure of risk-adjusted returns that considers the volatility of an investment, thus making the returns risk-adjusted (Fabozzi, 2019). Sharpe ratio is calculated by subtracting the risk-free rate of return from the return on the portfolio, and the divided by the standard deviation of portfolio's excess return. Sharpe ratio is used to measure the reward to volatility trade-off (Bodie, Kane & Marcus, 2005). In general, a higher Sharpe ratio indicates a more desirable portfolio (Sharpe, 1966).

3.2.2 Treynor ratio

$$Treynor\ ratio = \frac{R_p\ -\ R_f}{\beta_p}$$

With,

$$R_p\ =\ Portfolio\ return$$

$$R_f = Risk\ free\ rate$$

$$\beta_p = Portfolio's\ beta$$

The Treynor ratio is a measure used to assess the risk-adjusted return of a portfolio. The Treynor ratio formula considers both the return of the portfolio and its systematic risk (Bodie, Kane & Marcus, 2005). Like Sharpe ratio, it is calculated as the portfolio return subtracted by the risk-free rate, but it is divided by the portfolio's beta, which measures the systematic risk of the portfolio.

3.2.3 Jensen's alpha

$$Jensen's\ alpha = R_p - [R_f + \beta_p(R_m - R_f)]$$

With,

$$R_p = Portfolio\ return$$

$$R_f = Risk\ free\ rate$$

$$\beta_p = Portfolio's\ beta$$

$$R_m = Market\ return$$

Jensen's alpha is a risk-adjusted performance measure that calculates the average return on a portfolio or investment, representing the excess return of the portfolio after accounting for the systematic risk inherent in the market (Bodie, Kane & Marcus, 2005). Jensen's alpha is calculated by subtracting the expected return of the portfolio, based on the CAPM ($R_f + \beta_p(R_m - R_f)$), from the actual return of the portfolio, and then adjusting for risk. An alpha that is positive implies that the portfolio has performed better the benchmark, while a negative alpha indicates that the portfolio is underperforming the benchmark.

3.2.4 Information ratio

$$Information\ ratio = \frac{R_p - R_m}{\sigma_{ER}} = \frac{\alpha}{\omega}$$

With,

$$R_p = Portfolio\ return$$

$$R_m = Market\ return$$

$$\sigma_{ER} = Tracking\ error$$

The information ratio measures the risk-adjusted returns of a portfolio and compares them to a chosen benchmark. It displays possible excess returns in comparison to the benchmark, as well as the consistency in generating those returns. Information ratio can be calculated by subtracting portfolio return by the return of the benchmark, and then dividing it by tracking error, which is the standard deviation of the α (Schneider, 2010). A high information ratio indicates that a portfolio or investment is generating excess returns relative to its benchmark, while a low information ratio suggests that the portfolio is underperforming relative to its benchmark.

3.2.5 Beta

$$Beta = \frac{Cov(R_p, R_m)}{Var(R_m)}$$

With,

$$R_p = Portfolio\ return$$

$$R_m = Market\ return$$

$$Cov(R_p, R_m) = Covariance\ of\ the\ portfolio\ and\ the\ market$$

$$Var(R_m) = Variance\ of\ the\ market$$

Beta measures the volatility of a portfolio in relation to the overall market, determining the risk of the portfolio in comparison to the market. It compares the systematic risk of the portfolio in comparison to the volatility of the market or benchmark index. The market beta is 1, and beta can be seen as a multiplier to the changes in the market. For example, if market raises for 2%, a portfolio with a beta of 1,25 is expected to raise for 2,5%. Beta can be negative. The higher the beta, the riskier the portfolio is. Portfolios with high betas tend to overperform the benchmark indices during bull market, but underperform during bear market (Levinson, 2006).

3.3 Factor analysis

The Fama-French five-factor model is an extension of the classic Capital Asset Pricing Model (CAPM) that explains the expected returns of an asset or portfolio based on five factors: market risk, size, value, profitability, and investment (Dirkx & Peter, 2020). The model assumes that small-cap, value-oriented stocks with high profitability and low investment are expected to outperform the market in the long term, while large-cap, growth-oriented stocks with low profitability and high investment are expected to underperform (Horstmeyer, Liu & Wilkins, 2022).

Momentum factor analysis, on the other hand, is a strategy that looks at stocks that have performed well recently and assumes that they will continue to perform well in the near future. On Kenneth R. French's Data Library (2023), momentum is calculated as "the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios". Momentum is a separate factor from the Fama-French five-factor model but can be combined with it to improve portfolio performance analysis. By combining the Fama-French five-factor model with momentum factor analysis, it is possible to evaluate which factors have the most impact on their portfolio's performance.

3.4 Risk-free rate

In this thesis The U.S. 1-month treasury bill will be used as a risk-free rate for the ETFs focusing in the United States and the German 3-month bond will be used as a risk-free rate for the ETFs focusing in Europe.

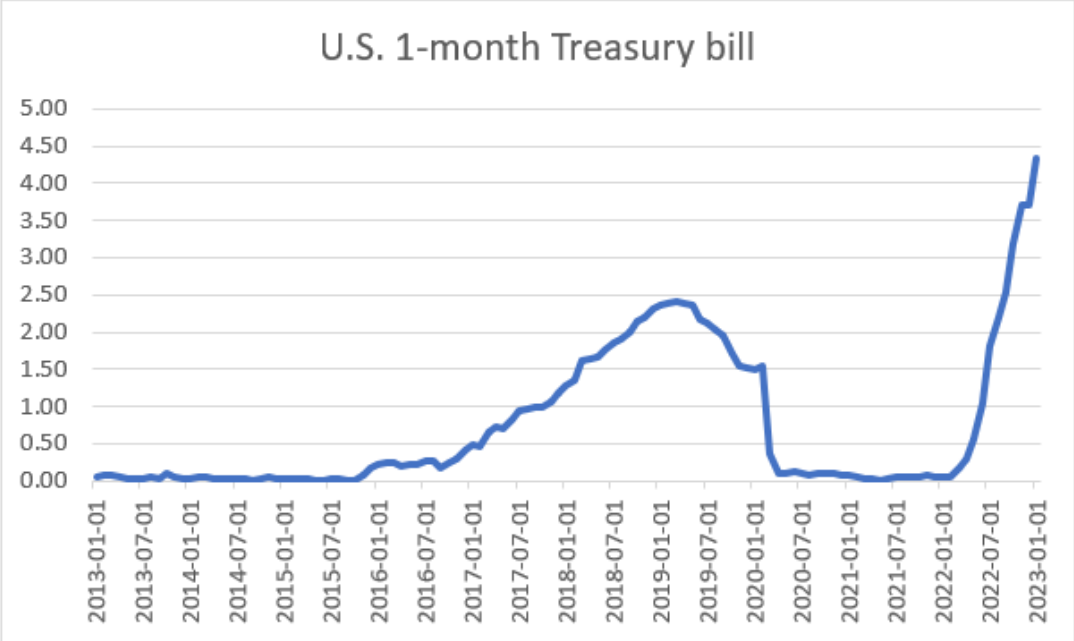

Figure 1. United States 1-month Treasury bill rate. Federal Reserve Economic Data.

Treasury bills are debt securities with maturities of less than one year that are issued by the US government to finance its short-term funding needs. Bonds and notes are also types of debt securities issued by the government, but with longer maturities than bills (Hayes, 2022). The main difference between these securities is the length of time for which the government is borrowing money.

The U.S. 1-month treasury bill has been close to 0.00 between 2013 and 2016, and after 2016 it has been growing steadily until 2019. In 2020, mostly due to the COVID-19 pandemic and its effect on the global economy, the rate has been plummeting close to 0.00. In 2022 the rate has been hiking in order to control the raising inflation.

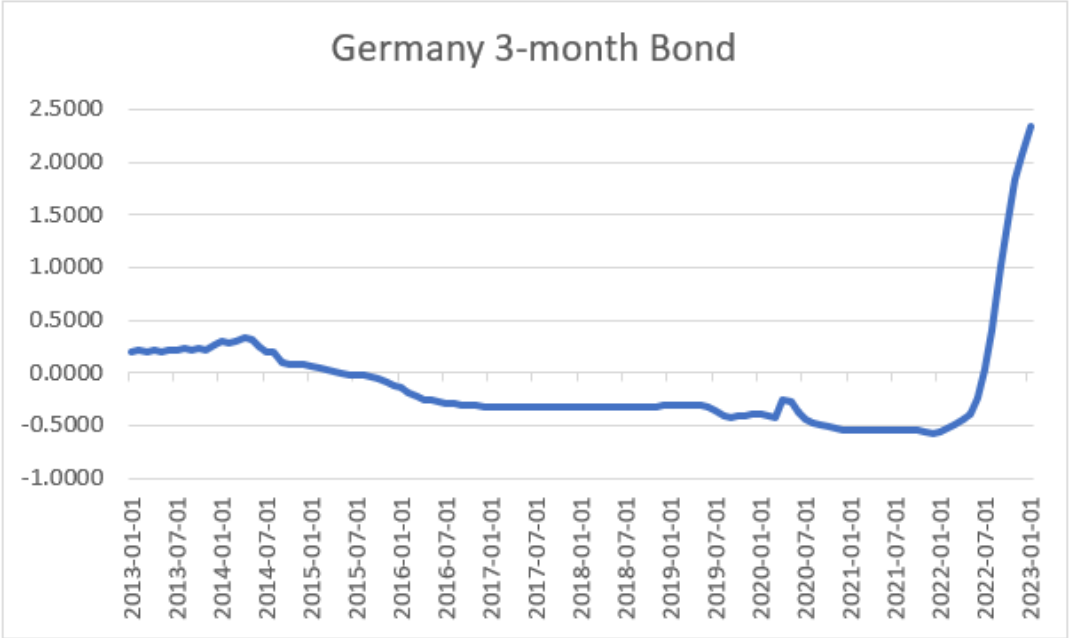

Figure 2. Germany 3-month Bond rate. Federal Reserve Economic Data.

The German 3-month bond will be used as a risk-free rate for European ETFs due to Germany being a strong and stable European economy, and it is commonly used as a risk-free rate in Europe for research.

The rate of German 3-month bond has been negative for a relatively long time between the years 2015 and 2022. In 2022 the rate has been raising strongly, for the same reason as the U.S. 1-month treasury bill, to control the accelerating inflation.

3.5 Benchmark indices

This thesis uses Standard & Poor's 500 index (S&P 500) and STOXX Europe 600 index as the benchmark indices to measure the performance of the chosen ETFs.

3.5.1 S&P 500

The chosen benchmark for evaluating the performance of ETFs focusing on the United States of America is the S&P 500 index. The S&P 500 is a stock market index that tracks the

performance of 500 large-cap companies listed on the US stock exchanges. This index is widely recognized and frequently used to measure the performance of investment portfolios and to evaluate the effectiveness of investment strategies in the American market. The S&P 500 is weighted by market capitalization, which means that larger companies have a greater impact on the performance of the index (Tretina & Curry, 2021). The S&P 500 is weighted heavily on the technology sector (Trainer, 2021).

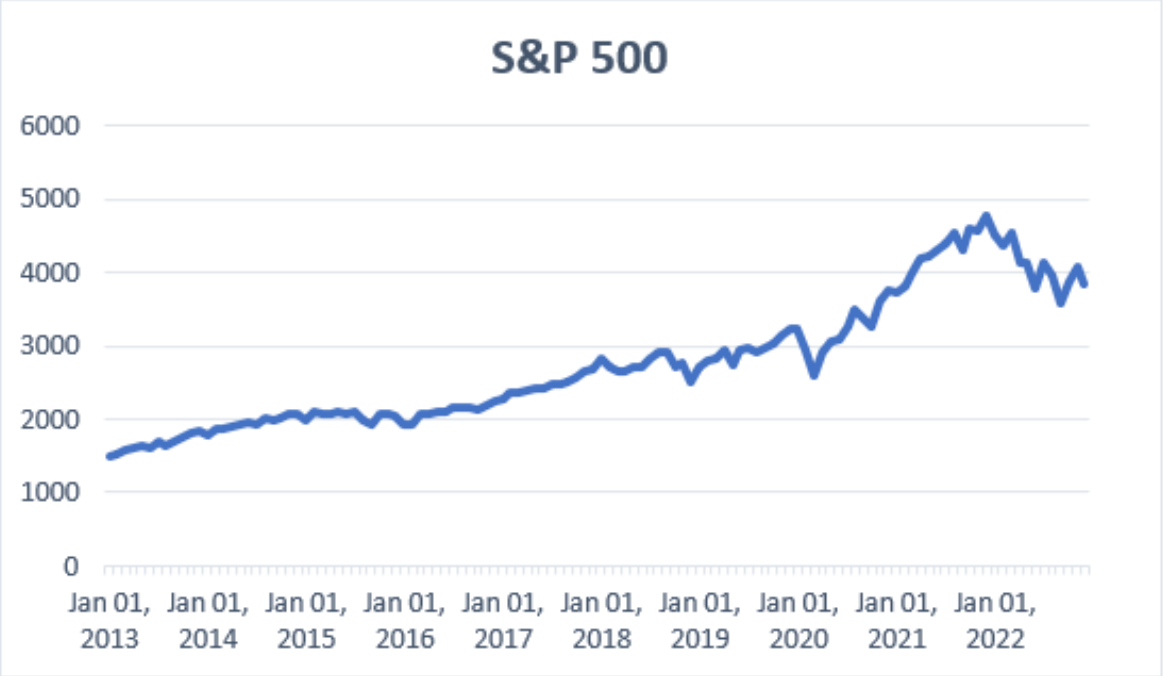

Figure 3. Standard & Poor's 500 index. Yahoo Finance.

Between the years 2013 and 2022 S&P 500 has seen its value growing for 156,29%. From 2013 it has grown rather steadily before facing a drop in the early 2020, mostly due to the effects of COVID-19 pandemic on the global economy. Following that, the index has reached record-high level, reflecting the bull market and a strong growth in technology sector (Figà-Talamanca & Patacca, 2022). In 2022 the index has shrunk, because of aggressive interest rate hikes to control inflation, fears of recession and Russia-Ukraine war (Wang, 2022).

The S&P 500 Index was chosen for this study because it provides a wide market breadth. It is also commonly used benchmark for portfolios in academic research. All the chosen ETFs are focusing on the United States; therefore S&P 500 is a suitable equivalent for the chosen ETFs.

3.5.2 STOXX Europe 600

The benchmark for evaluating the performance of the chosen ETFs on the European market is STOXX Europe 600. The STOXX Europe 600 Index is a stock market index that measures the performance of 600 European companies from 17 European countries and is widely used as a benchmark for European equity markets (Qontigo, 2023). STOXX Europe 600 is a subset of STOXX Global 1800 Index (STOXX, 2023).

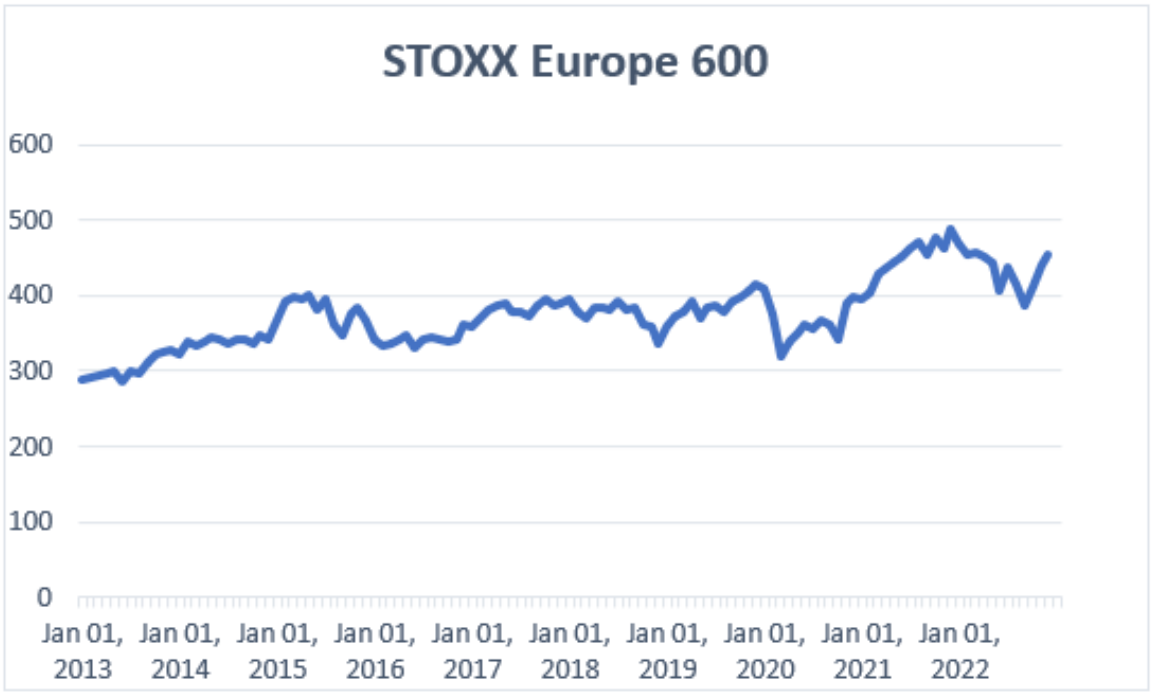

Figure 4. STOXX Europe 600 index. Yahoo Finance.

In 2013-2022 STOXX Europe 600 Index has not grown as much as S&P 500, seeing modest growth of 57,79%. In 2013-2019 the index has seen both losses and gains, ending that period in a rather slow growth. In 2019, the index gained around 23%, supported by

improving economic data and the European Central Bank's monetary stimulus measures (Reisenbichler, 2020). However, in 2020, the index had a sharp decline of around 13%, due to the COVID-19 pandemic. Following that, STOXX Europe 600 has had similar movements with S&P 500, mostly due to the same reasons that have affected the S&P 500 Index.

4 Results

The results and findings of the study will be presented in this chapter. The first section presents the annualized returns and volatilities of the chosen ETFs. In the second section, the risk-adjusted measures will be covered. The third section will present the results of the Fama-French five-factor and momentum factor analysis.

4.1 ETFs performance in comparison to indices

In the tables 3, 4 and 5, the average annualized returns and annualized volatilities will be presented in the selected time frame, 2013-2022. Table 3 presents the results of the selected benchmark indices, S&P 500 and STOXX Europe 600. In table 4 the results are covered for the American ETFs and table 5 presents the results for the European ETFs.

Name	Average annualized return	Volatility p.a.
S&P 500	9,87%	14,81%
STOXX Europe 600	4,67%	14,17%

Table 3. Annualized returns and volatilities of benchmark indices.

The benchmark indices had average annualized returns of 9,87% and 4,67% respectively. S&P 500 averaged clearly higher returns than STOXX Europe 600. This could be explained by the weighing of the indices as well as the growing American economy. The annualized volatility for the indices was rather alike.

Ticker	ETF Name	Average annualized return	Volatility p.a.
DLN	WisdomTree U.S. LargeCap Dividend Fund	11.39 %	13.94 %
ISUS.L	iShares MSCI USA Islamic UCITS ETF	9.96 %	30.18 %
IWY	iShares Russell Top 200 Growth ETF	15.18 %	16.55 %
IYW	iShares U.S. Technology ETF	17.56 %	18.74 %
SUSA	iShares MSCI USA ESG Select ETF	12.39 %	15.46 %

Table 4. Annualized returns and volatilities of American ETFs.

The best performing ETF in terms of average annualized return was iShares U.S. Technology ETF with the returns 17,56% annually. Higher risk seems to provide higher returns, as its annualized volatility was 18,74% in the selected time frame. The returns could be explained by the success of technology sector in the recent years, which has been affecting the results of technology stocks and funds. All the chosen ETFs beat the S&P 500 Index in term of annualized returns. Albeit iShares MSCI USA Islamic UCITS ETF performed worse than the other ETFs, it had narrowly higher returns than S&P 500 Index. Apart from the WisdomTree U.S. LargeCap Dividend Fund, all the ETFs had higher volatility than the benchmark index, indicating that the chosen ETFs have been riskier investment instrument. Although iShares MSCI USA Islamic UCITS ETF narrowly beat the index, it had volatility of 30,18%, which is significantly higher than its peers or the benchmark index. It seems to have more risk and it could be a rather questionable choice for a portfolio seeking for long-time profits. The ETF with the lowest ESG score alongside with WisdomTree U.S. LargeCap Dividend Fund, iShares U.S. Technology ETF, had the best average returns, whereas ETFs with slightly higher ESG scores did not have as high returns.

Ticker	ETF Name	Average annualized return	Volatility p.a.
EUFN	iShares MSCI Europe Financials ETF	2,98%	24,00%
EUMV.MI	Ossiam Europe ESG Machine Learning	6,72%	11,69%
EXV4.DE	iShares STOXX Europe 600 Health Care UCITS ETF	6,90%	13,13%
HEDJ	WisdomTree Europe Hedged Equity Fund	8,43%	18,24%
SC00.F	Invesco STOXX Europe 600 Optimised Chemicals UCITS ETF	7,66%	16,56%

Table 5. Annualized returns and volatilities of European ETFs.

The best performing European ETF in terms of average annualized returns was WisdomTree Europe Hedged Equity Fund. It recorded the average returns of 8,43% annually. Invesco STOXX Europe 600 Optimised Chemicals UCITS ETF had annualized average returns of 7,66%. The average returns of Ossiam Europe ESG Machine Learning and iShares STOXX Europe 600 Health Care UCITS ETF were rather close to each other, being 6,72% and 6,90% respectively. With the average returns of 2,98%, iShares MSCI Europe Financials had the worst performance. It was the only ETF which had lower average annualized returns than the benchmark index (4,67%). The volatility, 24,00%, of that ETF was also significantly higher than the volatility of the benchmark index or the other ETFs. Ossiam Europe ESG Machine Learning and iShares STOXX Europe 600 Health Care UCITS ETF had both higher returns and lower annualized volatilities than the benchmark index. WisdomTree Europe Hedged Equity Fund and Invesco STOXX Europe 600 Optimised Chemicals UCITS ETF had higher volatilities than the STOXX Europe 600 Index, but in this time frame higher risk brought higher returns for these 2 ETFs.

4.2 Risk-adjusted performance

In this section the ETFs will be measured using risk-adjusted measures, Sharpe ratio, Treynor ratio, Jensen's alpha, Information ratio and beta, and compared to those of S&P 500 Index and STOXX Europe 600 Index. Information ratio cannot be calculated for benchmark indices. Table 6 portrays the used risk measures for the benchmark indices, table 7 presents the risk measures for the chosen American ETFs, and table 8 presents those for the chosen European ETFs.

Name	Sharpe	Treynor	Alpha	Beta
S&P 500	0,6191	0,09174	0	1
STOXX Europe 600	0,3295	0,0466	0	1

Table 6. Risk measures for benchmark indices.

As table 6 illustrates, S&P 500 has a Sharpe ratio of 0,6191 and a Treynor ratio of 0,09174. The Sharpe ratio for STOXX Europe 600 is 0,3295 and the Treynor ratio is 0,0466. Both benchmark indices have alpha of 0, because it is constant for market indices, as well as beta of 1.

Ticker	ETF Name	Sharpe	Treynor	Alpha	IR	Beta
DLN	WisdomTree U.S. LargeCap Dividend Fund	0,7675	0,1172	0,0233	1,3261	0,9120
ISUS.L	iShares MSCI USA Islamic UCITS ETF	0,3068	0,1588	0,0391	0,01	0,5832
IWY	iShares Russell Top 200 Growth ETF	0,8752	0,1364	0,0531	3,251	1,0624
IYW	iShares U.S. Technology ETF	0,8995	0,1481	0,0641	3,045	1,1386
SUSA	iShares MSCI USA ESG Select ETF	0,7566	0,1133	0,0222	2,7901	1,0326

Table 7. Risk measures for American ETFs.

The best American ETF by Sharpe ratio and Jensen's alpha appears to be iShares U.S. Technology ETF, which is also the best-performed ETF by annual returns. According to Sharpe ratio, the other ETFs performed rather well and had a Sharpe ratio higher than the benchmark index, but iShares MSCI USA Islamic UCITS ETF did not perform so well; the Sharpe ratio is only 0,3068. That is caused by the ETFs high volatility. However, it has the best Treynor ratio, measuring the systematic risk. According to the Treynor ratio, all of the chosen ETFs outperformed the benchmark index. All the ETFs have positive alpha, which indicates that all of the chosen ETFs have outperformed the benchmark index. According to the information ratio, all the ETFs, except iShares MSCI USA Islamic UCITS ETF, performed well. iShares MSCI USA Islamic UCITS ETF had an information ratio of 0,01, which is a poor performance.

All in all, according to the risk-adjusted measures, the chosen American ETFs, apart from iShares MSCI USA Islamic UCITS ETF, seem to have performed reasonably well in the chosen time frame. Although it has the highest Treynor ratio, it performs rather poorly on other measures, and it also had the lowest annualized average returns. However, none of the ETFs performed in an excellent manner according to Sharpe ratio; none of them has a Sharpe ratio of 1 or more.

Ticker	ETF Name	Sharpe	Treynor	Alpha	IR	Beta
EUFN	iShares MSCI Europe Financials ETF	0,1243	0,0219	-0.0336	-0.3832	1,3590
EUMV.MI	Ossiam Europe ESG Machine Learning	0,5749	0,0939	0,0338	0,999	0,7157
EXV4.DE	iShares STOXX Europe 600 Health Care UCITS ETF	0,5255	0,1031	0,0377	0,7565	0,6693
HEDJ	WisdomTree Europe Hedged Equity Fund	0,4619	0,0758	0,0285	1,7296	1,1939
SC00.F	Invesco STOXX Europe 600 Optimised Chemicals UCITS ETF	0,4623	0,0719	0,0268	1,4713	1,0649

Table 8. Risk measures for European ETFs.

The chosen European ETFs have a different ranking in risk-adjusted performance in comparison to the returns. WisdomTree Europe Hedged Equity Fund, which had the best average annualized returns, ranks second lowest in Sharpe ratio and third highest in Treynor ratio. Ossian Europe ESG Machine Learning has the highest Sharpe ratio, although it ranks second lowest in average annualized returns. The ETF with highest Sharpe ratio is iShares STOXX Europe 600 Health Care UCITS ETF, and it also has second highest Treynor ratio. The ETF with lowest Sharpe and Treynor ratio is iShares MSCI Europe Financials ETF, which also has the only negative alpha in the conducted research. All the other ETFs have positive alpha, indicating that the ETFs outperformed the benchmark index.

According to risk-adjusted measures, the chosen European ETFs performed rather well, except iShares MSCI Europe Financials ETF, which had pretty poor results in every measure. It had also higher volatility than its peers and the lowest annualized average

returns of the entire research, and it was the only ETF to perform worse than the benchmark index in terms of returns.

American ETFs outperformed European ETFs in risk-adjusted measures as well as in annualized average returns. Most American ETFs had better results in terms of Sharpe ratio, Treynor ratio, Jensen's alpha and Information ratio, except for iShares MSCI USA Islamic UCITS ETF, which had a rather mediocre Sharpe ratio even in comparison to the European ETFs.

4.3 Fama-French five factor and momentum analysis

In this section the results of factor analysis will be presented. The factor analysis will be conducted by using Fama-French five-factors and momentum factor. Fama-French five factors are the following: Small Minus big (SMB), High Minus Low (HML), Robust Minus Weak (RMW), Conservative Minus Aggressive (CMA) and Rm-Rf, meaning the return of the market minus the risk-free rate. These five factors combined with the momentum factor are used to describe what factors contribute to the returns of the ETFs chosen for this study.

Factor	DLN	ISUS.L	IWY	IYW	SUSA
Mkt-Rf	0.0456	0.0108	0.0452	0.0623	0.035
SMB	0.0251	0.0166	0.0766	-0.0344	0.0811
HML	0.0304	0.0364	0.0435	0.0131	0.0346
RMW	0.0343	0.0646	0.0953	-0.0859	0.0195
CMA	0.0129	0.264	0.0632	0.0127	0.023
MOM	-0.043	0.0233	0.4032	0.236	0.0223
R-squared	0.9012	0.8722	0.8328	0.9345	0.8741

Factor	EUFN	EUMV.MI	EXV4.DE	HEDJ	SC00.F
Mkt-Rf	0.0157	0.0381	0.0341	0.0251	0.0281
SMB	0.0266	0.0645	0.0235	0.0152	0.0371
HML	0.0522	0.0655	0.0452	0.0327	0.0151
RMW	0.3053	0.893	0.1132	0.0195	0.0252
CMA	0.0143	0.0165	0.0639	0.0759	0.0342
MOM	0.0467	0.0118	0.0235	0.0246	-0.0108
R-squared	0.8492	0.8665	0.8673	0.9017	0.8392

Table 9. Fama-French five factor and momentum analysis.

Table 9 illustrates the results for the factor analysis; in the upper section the results are shown for the American ETFs whereas the lower section has the results for European ETFs.

In almost all cases quality factors (HML) values are significant, indicating that the quality of the investment instrument contributes to the returns of the chosen ETFs. Most of the size factors are almost significant indicating that the size of the companies in the portfolio has contributed to the returns. The profitability factor (RMW) and momentum factor (MOM) explain some of the returns in the chosen ETFs. As in the study conducted by Ang et al. the quality factor has a large contribution to the returns of funds with high ESG rating.

Momentum factor has also explains some of the returns, but not as significantly as in the study by Ang et al. There are some differences between American and European ETFs, for example American ETFs having higher r-squared, which indicates the goodness-of-fit. Although there are slight regional differences between the factors behind the returns of the ETFs, it seems that both groups of highly ESG rated ETFs have same factors contributing to their returns.

Technology sector has seen significant growth in the recent years, which could explain the importance of quality factor as well as size and profitability factors. Technology companies which have high ESG score have had remarkable returns, thus contributing to the returns of the ETFs with high ESG score.

5 Conclusions

The aim of the thesis was to examine the success of ETFs with high ESG score during the years 2013-2022. ESG ETFs are a relatively new phenomenon in the financial markets, so the material for the thesis consisted of only five ETFs per market, making it a total of 10 ETFs. The selection process was based on the ETF funds' launch date, which had to be before January 1st, 2013, and the high ESG score. The selected ETF funds invested their assets either in European or U.S. markets. Standard and Poor's 500 Index and STOXX Europe 600 Index were selected as the benchmark indices. The success of ETFs with high ESG Score was evaluated using the average annualized return, volatility, Sharpe ratio, Treynor ratio, Jensen's alpha, Information ratio, beta and Fama-French five-factor and momentum factor analysis.

This thesis has three main research questions. The first research question is: "How does the performance of ETFs with high ESG score compare to that of the SP500 and STOXX 600?". The second research question is: "How have ETFs with high ESG score performed in terms of risk-adjusted returns?". Finally, the third research question is: "What are the key factors

that contribute to the returns of ETFs with high ESG score in comparison to traditional indices, based on a factor analysis of financial performance indicators?".

"How does the performance of ETFs with high ESG score compare to that of the S&P500 and STOXX 600?"

To answer this research question, ETFs with high ESG score outperformed the benchmark indices, apart from one ETF which was beaten by the benchmark index. In general, the ETFs had comfortably higher average annualized returns than the benchmarks. Out of the American ETFs all outperformed the S&P500 Index, even though the worst performing ETF beat the index only narrowly. 4 out of 5 European ETFs beat the STOXX Europe 600 Index, when iShares MSCI Europe Financials ETF was beaten by the benchmark index.

In the study conducted by Dumitrescu, Järvinen & Zakriya (2023) SRI ETF and ESG ETF portfolios underperformed its portfolio benchmark, but in 2020-2022 the ESG ETF portfolio significantly outperformed the benchmark. However, in this study, vast majority of the selected ETFs outperformed the benchmark indices in the selected time frame, providing a result that is different in comparison to the study conducted by Dumitrescu et al.

"How have ETFs with high ESG score performed in terms of risk-adjusted returns?"

In the selected period of time, 2013-2022, the chosen ETFs performed well in terms of risk-adjusted returns. Once again, the iShares MSCI Europe Financials ETF was the worst performer, but in general other ETFs saw good results in the used measures, Sharpe ratio, Treynor ratio, Information ratio, Jensen's alpha and beta. Out of the American ETFs, iShares MSCI USA Islamic UCITS ETF did not perform as well as its counterparts, and some of its measures were worse than the ones of benchmark index.

Pavlova & de Boyrie found out in their study, that ESG ETFs did not underperform benchmarks during the COVID-19 pandemic in terms of risk-adjusted terms. The outcome is similar as in this thesis, but however, in this thesis the selected ETFs did not only perform in a similar fashion as the benchmarks; the vast majority of the ETFs outperformed the benchmark, and some of them did that rather clearly. The ETFs did that on a 10-year time frame, and that could indicate that the ESG ETFs are capable of outperforming the benchmarks also in long term.

"What are the key factors that contribute to the returns of ETFs with high ESG score in comparison to traditional indices, based on a factor analysis of financial performance indicators?"

In order to answer this question, a factor analysis was conducted. By utilizing the Fama-French five-factor and momentum factors, it was found out that especially the quality, profitability and size factors contributed to the returns of ETFs with high ESG score. Momentum factor also had a part of the contribution, but it did not have as crucial part as in the study conducted by Ang et al. (2021). Although there were slight differences between the American and the European ETFs, both of the groups had rather similar outcomes.

The small size of the dataset limited the accuracy of the research findings, especially when evaluating the performance of high ESG scoring ETFs. Difficulties arose in compiling the dataset because there were not many funds with a sufficiently high ESG score at the beginning of the study period in 2013. The number of ETFs with a high ESG score has only increased in recent years. On the other hand, if these newer ETFs had been used in the study, the time period would have been quite short, which would not necessary have proved reliable results. In the future, it would be interesting to conduct further research on a larger sample size to see how high ESG scoring ETFs have performed using the metrics used in this study.

References

Ang, A., Madhavan A. & Sobczyk, A. (2021). Toward ESG Alpha: Analyzing ESG Exposures through a Factor Lens. Financial Analysts Journal, 77(1), 69–88. https://doi.org/10.1080/0015198X.2020.1816366

Ashworth, W. (2020) 6 Common ETF Types for Your Portfolio. Investopedia. [online document] [Accessed 22 March 2023] Available at: https://www.investopedia.com/investing/popular-etf-types-for-your-portfolio/

Baldi, F. & Pandimiglio, A. (2022) The role of ESG scoring and greenwashing risk in explaining the yields of green bonds: A conceptual framework and an econometric analysis. Global finance journal. [Online] 52100711–.

Bodie, Z., Kane, A., Marcus, A. J. (2005) Investments. 6th ed. Boston (MA): McGraw-Hill.

Burbano, V. C. & Delmas, M. A. (2011). The Drivers of Greenwashing. California Management Review, 54(1), 64–87.

Chen, C. H., Luu, B. V., Yu, E.P. (2020). Greenwashing in environmental, social and governance disclosures. Research in International Business and Finance, 52, 101192–. https://doi.org/10.1016/j.ribaf.2020.101192

Clark, C. L., Feiner, A., Viehs, M. (2015) From the Stockholder to the Stakeholder: How Sustainability Can Drive Financial Outperformance. SSRN, 12-13

Cockrell, S., Phillips, M., Volker, J. (2020) A student-managed investment fund course design structure. Managerial Finance, 46, (4), 473-480

Dirkx, P., Peter, F. J. (2020) The Fama-French Five-Factor Model Plus Momentum:

Evidence for the German Market. Schmalenbach Business Review. 72, 661–684

Dumitrescu, Järvinen, J., & Zakriya, M. (2023). Hidden Gem or Fool's Gold: Can passive ESG ETFs outperform the benchmarks? International Review of Financial Analysis, 86, 102540–.

Fabozzi, F. J. (2008) Handbook of finance. Hoboken (NJ): Wiley.

Fain, M., Naffa, H. & Trinidad Segovia, J. E. (2020). Performance measurement of ESG-themed megatrend investments in global equity markets using pure factor portfolios methodology. PloS One, 15(12), e0244225–e0244225.

Figà-Talamanca, G. & Patacca, M. (2022). An explorative analysis of sentiment impact on S&P 500 components returns, volatility and downside risk. Annals of Operations Research.

French, K. R. (2023) Detail for Monthly Momentum Factor (Mom). Kenneth R. French's Data Library. [online document] [Accessed 21 March 2023] Available at: https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library/det_mom_factor.html

Giese, G., Lee, L-E., Melas, D., Nagy, Z., Nishikawa, L. (2019) Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance. Journal of portfolio management. [Online] 45 (5), 69–83.

Hale, J. (2020) Sustainable Fund Flows in 2019 Smash Previous Records. Morningstar. [online document] [Accessed 26 March 2023] Available at: https://www.morningstar.com/articles/961765/sustainable-fund-flows-in-2019-smash-previous-records

Hayes, A. (2022) Treasury Bills (T-Bills): What You Need to Know to Invest. Investopedia. [online document] [Accessed 22 April 2023] Available at: https://www.investopedia.com/terms/t/treasurybill.asp

Hill, J.M., Nadig, D. & Hougan, M. 2015, A Comprehensive Guide to Exchange-Trade Funds (ETFs).

Horstmayer, D., Liu, Y., Wilkins, A. (2020) Fama and French: The Five-Factor Model Revisited. CFA Institute. . [online document] [Accessed 21 March 2023] Available at: https://blogs.cfainstitute.org/investor/2022/01/10/fama-and-french-the-five-factor-model-revisited/

Journal of Financial Planning (2020) ESG Funds Gaining Popularity; Advisers Look to Equities During Pandemic. 33 (6), 18–18.

Lettau, M. & Madhavan, A. (2018) Exchange Traded Funds 101 For Economists. Policy File

Levinson, M. (2006) Guide to the Financial Markets. 4th ed. London: Economist Books.

Ouchen, A. (2022) Is the ESG portfolio less turbulent than a market benchmark portfolio? Risk management (Leicestershire, England). [Online] 24 (1), 1–33.

Pavlova, I. & de Boyrie, M. E. (2022). ESG ETFs and the COVID-19 stock market crash of 2020: Did clean funds fare better? Finance Research Letters, 44, 102051–.

Piechocka-Kaluzna A., Tluczak A., Lopatka P. (2021) The Impact of CSR/ESG on the Cost of Capital: A Case Study of US Companies. European Research Studies Journal 24, (3), 536-546

Qontigo (2023) STOXX Europe 600. [online document] [Accessed 18 April 2023] Available at: https://qontigo.com/index/sxxr/

Refinitiv (2023) Refinitiv ESG company scores. [online document] [Accessed 24 March 2023] Available at: https://www.refinitiv.com/en/sustainable-finance/esg-scores

Reisenbichler. (2020). The politics of quantitative easing and housing stimulus by the Federal Reserve and European Central Bank, 2008–2018. West European Politics, 43(2), 464–484.

Schneider, C. (2010) How useful is the information ratio to evaluate the performance of portfolio managers? Hamburg: Diplomica Verlag.

Sharpe, W. F. 1966. Mutual fund performance. The Journal of Business, 39, (1), 119-138

STOXX (2023) STOXX Europe 600. [online document] [Accessed 18 April 2023] Available at: https://www.stoxx.com/document/Indices/Factsheets/2023/March/SXXP.pdf

Thomson Reuters (2021) Understanding ESG and ESG-related risks [online document] [Accessed 25 March 2023] Available at:

https://legal.thomsonreuters.com/en/insights/articles/risk-management-of-esg-factors

Trainer, D. (2021) S&P 500 & Sectors: ROIC Vs. WACC Through 1Q21. Forbes. [online document] [Accessed 18 April 2023] Available at:

https://www.forbes.com/sites/greatspeculations/2021/06/04/sp-500--sectors-roic-vs-wacc-through-1q21/?sh=19fd41784fc4

Tretina, K., Curry, B. (2021) What Is The S&P 500? How Does It Work? Forbes. [online document] [Accessed 18 April 2023] Available at: https://www.forbes.com/advisor/investing/what-is-sp-500/

Wang, E. (2022) Wall Street ends 2022 with biggest annual drop since 2008. Reuters. [online document] [Accessed 18 April 2023] Available at: https://www.reuters.com/markets/us/futures-slip-last-trading-day-torrid-year-2022-12-30/