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Corporate Social Responsibility and Financial Performance

An empirical study

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ABSTRACT:

In the last few decades, the social impact of the corporate world has become increasingly important to the society. This has resulted into an increased awareness of the corporate social responsibility (CSR) of the corporate world. This has led to an increase in the socially responsible investing (SRI) that invest only in CSR compliant assets. At the time of conducting this thesis research, the increased availability of ESG related ratings have become increasingly integrated into the traditional data based investment decision process. This thesis is attempting answer the question whether the companies that have a high ESG rating exhibit a superior financial performance. This study initiate this study by reviewing earlier research results and fundamental theories in both ESG and financial areas. The thesis problem statement is split into research hypothesis. The first hypothesis is trying to understand whether the stocks of companies with high ESG ratings show a better performance than stock of companies with low ESG ratings. The second hypothesis tries to understand whether companies with high ESG ratings are significantly exposed to the profitability and investment factors of the Fama and French's six factors asset pricing model. The profitability and investment factors are used as they are considered key measures of the expected return of a corporation.

The used ESG related rating that are used in the study encompasses the ESG rating, the ESG 10 sub-categories rating and the newly published ESG controversies rating. The empirical analysis is separated into distinct parts. In the first part of the analysis, the ESG and the 10 ESG subcategories rating are considered over the full 15 years form 2006 to 2020. The created portfolios are not rebalanced every year, but the average of the collected scores are computed. In the second part, ESG and ESG controversies ratings are considered for the same time period of 2006 to 2020. Initial portfolios based on the 2006 data are created.

The outcome of the thesis research is that hypothesis 1 is rejected as the research failed to show that high ESG and high ESG controversies rated portfolios perform better than low ESG and high ESG controversies rated portfolios. The hypothesis 2 is also rejected as the analysis failed to show that ESG rating based portfolios are exposed to the profitability factor and that ESG controversy based portfolios are exposed to the profitability and investment factors. This leads the research to concluded that it has not successfully shown that highly ESG related ratings of companies have a positive effect on their stock's performance.

KEYWORDS: ESG, SRI, Financial performance, Corporate Responsibility

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1 Introduction

1.1 Research background

Throughout history, the activity of investment has largely been driven by the prospect of a financial return. Other reasons for investing have been driven by political, religious or other similar agendas that were considered of great importance for the individual investor. This socially responsible behavior could have been observed already in the ancient roman society where importance were given to corporations acting socially responsible through financing asylums for poor and old people, hospitals and orphanages. Similar types of corporate socially responsible activities could also be observed later in the middle ages. (Chaffe. 2017)

Looking across time, the social corporate actions became intertwined with the religious philosophy and the corporate social activities were largely focusing on helping with the problems of poverty, ignorance and child labor. These corporate social actions were often categorized as philanthropy. By the start of the twenties century, they were largely focused on creating welfare schemes for the working class. An example of such activities, was the Young Men's Christian Association (YMCA) that was present in the UK and the US. After the second world war and particularly in the 1960s, a growing protest culture emerged that created pressure on corporations with regards to civil rights and to anti-war movements. Similar type of movement emerged in the form of the Sullivan principles that called for an economic embargo of South Africa to support the abolishment of the Apartheid system in the country. (Harrison. 1966; Carroll et. al. 2010; Waterhouse. 2017)

Today, the political, religious or other similar agendas have largely been included into the social responsibility awareness movement and the general consumer is increasingly paying attention to the social impact of the corporate world. The corporate social responsibility movement is currently mainly defined by the Corporate Social Responsibility (CSR) and the Social Responsible Investment (SRI) frameworks. CSR is an internal

regulatory business framework that steers the actions of an individual corporation and SRI is a discipline of investing that focus their investment effort into corporations that are compliant with CSR. The SRI investor is using the criteria of environmental, social and governance (ESG) to identify their investment targets. There is an increase in the quantity of the Environment, Social and Governance (ESG) related data. This increase of available ESG related data is enabling investors to make a more SRI educated investor decisions. The availability of a richer ESG rating system is steadily becoming more integrated into the investment decision making process. This integration into the investment decision making process, makes it relevant to research if a strategy of conducting investment in a socially responsible fashion is producing a competitive return compared to a non-socially responsible investment strategy. (KPMG. 2020; USSIF. 2021; Campbell. 2007)

This thesis constitutes an addition to the existing research into the understanding of the financial impact of ESG on corporate performance. This research concentrates on increasing the available knowledge with regards to a deeper granularity of the current ESG scoring system in the form of the ESG subcategories that constitute the overall ESG scoring methodology and also the more recently made available ESG controversies sustainability scoring.

1.2 Research problem statement

The consumers and the society are increasingly aware of the corporate world's corporate social responsibility (CSR). This has led to an increase in the socially responsible investing (SRI) that limits its investment universe to assets that are considered CSR compliant. In the United States alone, professionally managed SRI has reached 17,1 trillions dollar by the end of 2019. Considering this growth from the investor perspective, this development puts forward the question whether the companies that qualify for a high level of ESG related ratings exhibit a superior financial performance. This will help discover whether SRI is resulting into a superior financial return or has a neutral effect on the financial return. (USSIF. 2020; Derwall et. al. 2011; Reeneboog et. al. 2008; Halbritter et. al. 2015)

This thesis research aims to produce more knowledge within the area of Social Responsible Investment related research and wishes to answer the following problem statement: **"Does the highly ESG related ratings of companies have a positive effect on their stocks' performance?"**

Some research show that socially responsibly managed corporations are exhibiting a higher financial return. Other research have found that corporations with high CSR score do not show significantly higher financial return than corporations with low CSR score. Early conducted research related to ESG focused mostly on SRI related investment funds' performance and it is mainly during the last 20 years that SRI related research has been conducted using ESG screening based portfolios. The created ESG screened portfolios are tested to see if they exhibit significant academic results. These tests are conducted by analyzing the portfolio's timeseries data using asset pricing models. Many of the earlier conducted ESG and stock performance related studies have used the Carhart's four factors asset pricing model and Fama and French's three factors asset pricing model. This thesis is using the more recently published Fama and French's six factors asset pricing model (FF6F). (Hong et. al. 2009; Ghoul et. al. 2011; Dhaliwal et. al. 2011; Margolis et. al. 2008; Humphrey et. al. 2014; Khan et. al. 2016; Reeneboog et. al. 2008; Halbritter et. al. 2015; Fama et. al. 2018; Fama et. al. 2015)

This leads this thesis to attempt to answer the above defined problem statement through the definition of the first research hypothesis:

Hypothesis 1: High ESG related rated stocks perform better than low ESG rated stocks

Typically, asset pricing models are used to analyze the financial return of stock portfolio. The valuation of a corporation is largely dictated by its expected return. The expected return is in turn extracted from the stock's current price and the expected dividends. The stock's current price is indicated by the corporation's market to book ratio and the expected dividend is indicated the corporation's future profitability and investment levels. This allows for a deduction that the expected returns are determined by the

corporation's market to book ratio and its expected levels of future profitability and investment. The dividend discount model (DDM) helps explain the relationship between the expected return, profitability and investment. The DDM states that the value of a stock is equal to the discounted value of all future dividends of the stock. (Miller et. al. 1961) (Fama et. Al. 2015; Fama et. Al. 2018)

Miller and Modigliani formulate that the corporate market value is dependent on the total earnings of equity, the total book equity and the expected dividends. This formulation can be used to show that the corporate book to market value is positively related to expected return if the expected profitability and the investment are held constant. Fama and French use the Miller and Modigliani formulation to show that there is a tendency that corporations with respectively high/low book to market value to have a low/high profitability and investment level. This can be used to deduce that corporations with respectively high expected financial return to have a low profitability and investment level. The profitability at year t is defined as the yearly turnover subtracted the cost of goods sold (COGS), the interest costs, the sales general and administration costs (SG&A) at year t. The resulting figure is then divided by the book equity at year t-1 to compute the profitability number. The investment in period t is given as the change in total assets from year t-2 to year t-1. That number is then divided by the total assets at year t-2 to compute the investment number. A high level of profitability is usually linked to a high level of financial return and a low level of investment is usually linked with a high level of financial return. (Miller et. al. 1961; Fama et. Al. 2015; Fama et. Al. 2018)

This leads this thesis to attempt to answer the above defined problem statement through the definition of the second research hypothesis:

Hypothesis 2: High ESG related scored company's share are significantly exposed to the profitability and investment factors of the Fama and French's 6 factors asset pricing model.

2 Theoretical overview

2.1 Efficient market hypothesis

The Efficient market hypothesis defines that the financial market is efficient when the market price of an asset reflects all available information about that asset. This definition is conditional to that the stock market is in equilibrium, which means that an average investor is unable to extract higher financial return than the overall stock market performance in the long run. The background for that lack of the ability of finding higher return is due to the existing competition among investors that rapidly eliminate any available arbitrage opportunities. This stock market investor view constitutes the basis of a passive investment strategy where the investor usually invest into a market-weighted portfolio. (Fama. 1970; Bodie et al. 2018)

2.1.1 Rejecting the efficient market hypothesis

Despite the research introduced above, the efficient market hypothesis is largely a rejected hypothesis. Some research found that the markets are not always efficient, and the efficiency level varies across the different markets. These findings represent the foundation of active investing, where the investor seeks to discover the stocks that are wrongly priced and through trading them achieve an abnormal return. This in turn means that some investors have the possibility to perform better than the market and that the efficient market hypothesis does not always hold. Financial experts have given up on the efficient market hypothesis and see the stock market as only partially efficient. This, in turn, means that the stock market can be partially predictable. The argument put forward for partially efficiency is that there is a psychological and behavior side to the formation of the actual market prices. Research show that market prices are influenced by investor’s behavior and that investor’s action in the market are affected by crowd and behavioral psychology. (Grossman et. al. 1980; Thaler. 1993; Shiller. 2000)

Other studies have found that there are market anomalies in the stock market and that the stock prices can somewhat be predicted. Furthermore, research shows that investors are sometimes behaving irrationally, which in turn result into mispricing in the marketplace. Another sign of presence of inefficiency in the marketplace, is that some investors have been able to take advantage of obtained information to outperform the market. This is further reinforced by the investment performance record of a small number of fund managers that have been able to deliver a consistent superior financial return, that have been able to cover the associated costs and that persisted over longer period of time. The long track record of famous investors such as Warren Buffett, Mario Gabelli, Glenn Greenberg and others in outperforming the market are also an indication that the efficient market hypothesis is only partially valid. Despite all the rejections of the efficient market hypothesis, research has also shown that the market is competitive enough to be considered relatively efficient and that it Is not an easy task for the average investor to deliver similar superior investment track records as detailed above. (Malkiel. 2003; Kosowski et. al. 2006; Greewald et. al. 2001; Samuelson. 1989)

2.2 Modern portfolio theory

The modern portfolio theory originates from the work of Markowitz and Tobin. The authors' efforts rely on the theory that the risk of an individual stock is represented by the variance of its return. But as most investors invest in a portfolio of stocks instead of just individual stocks, the real issue that the investor is facing is the risk that the portfolio as a whole is representing. Markowitz discovered a measure of portfolio risk and the return of specific portfolio, and so the resulting Markowitz model creates an efficient frontier of portfolios. Tobin complemented Markowitz's work by describing a method by which the investor selects the most suited portfolio from the set of efficient portfolios. Sharpe on the other hand developed the single index model that relates the return of an individual stock to the return of a common stock index. Sharpe's model illustrates why the risk of an individual stock in a portfolio is different from the risk that it contributes to the portfolio. (Markowitz. 1952; Tobin. 1956; Sharpe. 1964)

In essence, the investor has to consider two different risks, an unsystematic risk that can be diversified away and a systematic risk that cannot be eliminated through diversification. The investor has the opportunity, through a well-constructed portfolio, to eliminate the unsystematic risks that stems from every single stock. The second component of the overall risk is the systematic risk, also called market risk. This risk represents the risk from the general market or the overall economy and is not possible to eliminate through the act of diversification. In an efficient market, only the systematic risk is rewarded with a financial return. Once all the possible risk and return alternatives have been identified, the investor will allocate their investments into a combination of risky and risk-free assets. The investor's optimum portfolio composition lies on the efficient frontier that depict the optimum portfolio that offers the optimum risk-return combination. The Capital Allocation Line (CAL) represents all the risk-return combination available to the investor. The slope of the CAL represents the reward to volatility ratio or Sharpe ratio and the optimum portfolio is defined by the steepest slope of the CAL. The optimal portfolio, which is the portfolio with the highest Sharpe ratio can be found at the point of tangency portfolio on the CAL. (Markowitz. 1952; Tobin. 1956; Sharpe. 1964; Sharpe. 1966)

2.3 Asset pricing models in efficient market

Given the efficient market hypothesis and the modern portfolio theory, the financial community wanted to understand how to price financial assets. This gave birth to one of the centerpieces of the financial research, the Capital Asset Pricing Model (CAPM). Based on the understanding of the systematic risk, Sharpe, Lintner and Moussin contributed to the discovery of the Capital Asset Pricing Model (CAPM) that explains that expected rate of return of a single stock to the measure of the systematic risk linked to the stock. Since its discovery, CAPM has been a key tool for the finance community to discover the cost of capital of a stock as well as many other important financial applications. The CAPM theory holds under the assumption that the investor is behaving rationally, looking to construct a mean-variance optimal portfolio, is planning one period forward at the time of investment decision and is having all publicly available relevant investment information. Moreover, the CAPM theory requires that all financial assets are publicly trading

on public exchanges, that borrowing and lending mechanisms are available at a risk-free rate, taking a short position on any traded asset is possible and that there are no considerable transaction costs or taxes. According to the CAPM, the market portfolio is the mean-variance efficient tangency portfolio under the assumption that the market is in equilibrium. (Sharpe. 1964; Lintner. 1965; Mossin. 1966).

2.4 Capital Asset Pricing Model

The CAPM is built on the concept that the price of an asset is determined in such a way that the investor can expect a return that compensates for the risk that the investor is taking when investing in that stock. The building blocks of the CAPM are the concepts of the capital market line (CML) and the security market line (SML). The CML represents the expected return of a portfolio in an efficient market. The SML represents the investor's return expressed by the sum of risk-free rate and the relative risk of a stock. A large number of studies of the CAPM have found that the expected returns of an asset cannot be explained solely by its systemic risk. (Sharpe, 1964; Bodie et al., 2018)

2.5 Multi-factor models

Research efforts into alternative models discovered that the fundamental factor of size had an effect that was not explained by the CAPM. This effect could be observed that when assets were sorted by market capitalization, the average return on small stocks were higher than was explained by the CAPM. Another factor discovered was the book-to-market ratio. It was found that stocks that had high book-to-market ratio assets were having a higher return than was explained by the CAPM. As a result, the CAPM was extended by creating multi-factor models that include a variety of systematic security risk components. These systematic risk components are trying to capture the portfolio's exposure to diverse macro-economic factors such as business-cycle risk, inflation risk, energy price risk and other similar risk exposures. (Banz. 1981; Stattman. 1980; Rosenberg et al. 1985; Bodie et al. 2018)

Fama and French discovered that two factors, SMB (Small Minus Big), and HML (High Minus Low) had the ability to explain returns beyond the explanation power of the CAPM. The discovery of these factors led to the development of the Fama and French Three Factor Model (FF3F) for uncovering the expected return of an asset even better. Fama and French continued their research and introduced a five-factor model (FF5F) that represents a further development of the FF3F. In 2018, Fama and French published a six-factor model (FF6F) that complements the FF5F with a momentum factor. The FF6F is an expansion of the FF3F and FF5F and is also built on the concept of the CML and SML introduced earlier. (Fama and French. 1993; Fama and French. 1996; Fama and French. 2015; Fama and French. 2018)

2.6 Measuring the portfolio performance

In general, a single and multi-factor asset pricing model can be used to analyze the financial return of stock portfolio and also a single stock. In this research, the FF6F model is used to investigate how ESG is impacting the stock financial performance and if the FF6F model is capable of explaining the financial return of highly rated ESG stocks.
According to Fama and his colleague, the valuation of any corporation is given by cross-section of the expected returns of the corporation. This expected return is given by the stock's current price and the expected future dividends. The stock's current price is dictated by the corporation's market to book ratio and the future dividends are dictated by the corporation's future profitability and investment. The expected returns are thus determined by its market to book ratio and the expectations of its future profitability and investment. Furthermore, value, size and momentum, although not explicitly, do implicitly give an understanding of the expectations of the stock's future profitability and investment. (Fama et. al. 2015; Fama et. al. 2018)

The dividend discount model (DDM) is key to understand the theoretical statement of Fama and his colleague with regards to the relationship between the profitability and the investment with the expected return. As book to market ratio, size and momentum are implicitly given by the profitability and investment, this thesis will concentrate on

explaining how profitability and investment are key measures to help understand the expected return. The DDM says that the value of a stock is equal to the discounted value of all future dividends of the stock. And Miller et. al. found that the market value of the company is given by the following formula:

$$M_t = \sum_{\tau=1}^{\infty} E(Y_{t+\tau} - dB_{t+\tau})/(1+r)^{\tau}$$

Where

$Y_{t+\tau}$ is the total earnings on equity for the period $t+\tau$

B_t is the total book equity

$dB_{t+\tau}$ is the change in total book equity

r is the internal rate of return on the expected dividends

(Miller et. al. 1961; Fama et. al. 2015)

This formula can be rewritten as follows:

$$\frac{M_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} E(Y_{t+\tau} - dB_{t+\tau})/(1+r)^{\tau}}{B_t}$$

This formula captures three aspects with regards to the expected return. First aspect is that if all but the present value of the stock M_t and the expected return r are kept constant, then a lower M_t or the higher book to market ratio B_t/M_t would indicate a higher expected return. Second aspect is that if all, but the expected future earnings and the expected return are kept constant, then a higher expected future earnings would indicate a higher expected return. Third aspect is that if B_t, M_t and the expected return are held constant, then a higher expected growth in book equity (measured by investment) would indicate a lower expected return. These three aspects allow for a deduction that B_t/M_t can be considered a proxy for the expected return. This deduction is supported by the relationship that exists between M_t and the expected profitability and investment.

Moreover, research shows that $^{B}/_{M}$, profitability and investment are correlated, which allows for another deduction that a high $^{B}/_{M}$ stock also called value stock tend to have a low profitability and investment and a low $^{B}/_{M}$ stock also called growth stock tend to have high profitability and investment. (Miller et. al. 1961; Fama et. al. 2015)

The FF6F additional momentum factor compared to the FF5F was reluctantly added by Fama et. al. due to popular demand from the finance academical community. The resulting time series regression model, stemming from the FF6F formula described above, is given by the formula below:

$$R_{it} - R_{ft} = \alpha_i + \beta_i Mkt_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + m_i WML_t + e_{it}$$

Where R_{it} is the month t return on asset i, R_{ft} is the one-month US T-bill rate at the beginning of t, Mkt_t is the return of the market, SMB_t is the size factor, HML_t is the value factor, RMW_t is the profitability factor, CMA_t is the investment factor, WML_t is momentum factor and e_{it} the regression model's error. (Fama et. al. 2018)

As described above, the FF6F model originates from the CAPM and the CAPM was used as the Jensen's one factor model. This allows for the statement that the intercept alpha α_i represents the excess return that cannot be explained by the FF6F factor model. In the case that all the six factors of the FF6F model fully captures the variation of the excess return, then the alpha α_i would be expected to be equal to zero. In this research, tests are conducts to test for a significantly difference from zero alpha and if the achieved ESG screened portfolios show significant relationship with the profitability and investment value premiums. If a positive relationship is found, it would mean that the study would observe a higher return for profitable companies compared to less profitable companies as well as higher return for conservatively investing companies compared with aggressively investing companies.

2.7 Risk-adjusted return ratios

Comparing the portfolio's performance based on average return is not adequately informing the evaluator. This measure is lacking the information of the risk that is included in the portfolio. It is thus necessary to adjust the measure of return with the risk taken. This measure is defined as a risk-adjusted return. (Treynor. 1965; Sharpe. 1966; Jensen. 1968; Sortino et. al. 1994; Bodie et al. 2018)

2.7.1 Interpreting Jensen's alpha

As reviewed, the alpha is a measure of the portfolio's manager's ability to forecast the development of the stock market. A regression based on Ordinary Least Square (OLS) will give an estimate for the T-statistics, that will help evaluate the significance of the outputted alpha. If the used asset pricing model is correctly pricing the portfolio, then the estimated alpha will not be significant. By using the OLS regression, an t-statistics estimate of alpha is obtained. The t-statistics will support this thesis through evaluating the significance of the estimated alpha and measure the return of the portfolios considering the value premium insinuated by the six factors of the FF6F. (Jensen. 1968)

2.7.2 The portfolio's Sharpe ratio

As introduced earlier, the Sharpe ratio measures the portfolio's reward to volatility tradeoff. The Sharpe ratio is thus the ratio between the excess return and the risk of the portfolio. The Sharpe ratio can be used a performance measure allowing to rank different portfolios against each other. The portfolio with the highest Sharpe ratio is deemed the best. In doing so it is necessary to use the same time horizon. It is tradition to use annualized data to determine the Sharpe ratio of portfolios to be measured against each other. During the ranking, it is usual that the achieved excess return is reported together with the Sharpe ratio. (Sharpe. 1966)

2.8 Socially responsible finance

Much of the financial academic community view that the main purpose of the corporation is to maximize the shareholder value. The American economist Milton Friedman believed that the corporation exists with the main purpose to make as much money as possible for its shareholders and that its performance is measured by the level of profit. With an opposing view, academics such as Robert Edward Freeman believed that the corporation is under obligation towards a broader stakeholder group than only the shareholders. Freeman believed that the performance of the corporation should be measured the shared value created towards all the corporation's stakeholders. Baker and Powell perceive that both of these perspectives are achievable by the corporation. They see that the corporation has the responsibility to maximize shareholder wealth under the condition of maintaining the best interest of its stakeholders and society in the long run. In other words, the corporation's responsibility is to make long-term profits while exhibiting a corporate social responsibility. Socially responsible finance is encompassing both the shareholder and the corporation perspectives. The corporate side is contained in the notion of corporate social responsibility and the investor side in the notion of socially responsible investing. The socially responsible financial research community employs the notions of Environment, Social and Governance (ESG), Socially Responsible Investing (SRI) and Corporate Social Responsibility (CSR) in describing their research. All of these notions are employed in the area of linking the corporation as an entity and its behavior in the society as a socially responsible entity. (Waddock et. al. 1997; Friedman. 1962; Friedman. 1970; Freeman. 1984; Freeman. 1998; Baker et. al. 2005)

2.9 Corporate social responsibility

In the last three decades, corporations have started considering their effect on their stakeholder and on the rest of the society. This has been catalyzed by an increased awareness of consumers and society with regards to the corporation's social impact. The response of the corporations was to initiate corporate social responsibility activities with the aim of improving their social image. Corporate social responsibility (CSR) is an

internal regulatory business framework that steers the actions of a corporation. The CSR framework ensures that corporate actions are executed in compliance with the existing human rights, workers' rights, environmental rights and other similar rights that are in effect where the corporation is operating. The organization that includes CSR into their business model, are committed to behave as a socially responsible entity. Being socially responsible entails contributing to society in an economically, environmentally, and socially sustainable way. (Campbell. 2007; Carroll. 1999)

It is important to bear in mind that the decision to implement CSR is a voluntary decision that a corporation needs to make. In order to operate in country, the corporation is not under the obligation of any CSR specific laws or regulations. With its increased implementation, CSR has been increasingly discussed in the academic world and in the society in general. The proponents put forward that the corporation is more successful when embracing CSR. The argument is that the CSR is steering the corporation to operate with a longer-term perspective rather than seeking to make a quick profit in the immediate term. The opponents put forward that the corporation should concentrate on its primary role of creating wealth for the shareholders. The opponents believe that CSR should be regulated and supervised by the regulators to even the level playing field for all corporations. They put forward that it will diminish the risk of CSR becoming merely a superficial window-dressing activity for some corporations. (Campbell. 2007; Archel et. al. 2011)

Lawrence Heim has found that many managers of corporations see CSR as nothing more than an expense that the corporation incur with no substantial return on investment. As an example of this attitude, Heim puts forward that corporations, confronted with increased environmental regulatory demand, simply move manufacturing and other non-environmental activities overseas to countries with less or no environmental regulation. Heim also brings forward that the political leadership are viewing the heavy environmental regulation as a challenge for the business community. This exportation of the problem overseas can also be observed in the areas of health and safety as well as corporate governance. (Heim. 2018)

2.10 Socially responsible investing

Socially responsible investing (SRI), that is also called sustainable, responsible and impact investing, is a discipline of investing that invest into corporations that are compliant with CSR. The SRI investor is using the criteria of environmental, social and governance (ESG) to identify their investment targets. The SRI investor limits its investment universe to the assets that are related to corporations that are considered CSR compliant. This means that the SRI investor considers a combination of investment criteria based on financials as well as social responsibility. (USSIF. 2021; Derwall et. al. 2011)

In the United States, it is estimated that 17,1 trillion dollars was invested professionally according to sustainable investing strategies by the end of 2019. This represents a 33 percent of the 51,4 total US assets under professional management by the end of 2019. The over long-term growth of US based sustainable investments is depicted in the figure below. (USSIF. 2020)

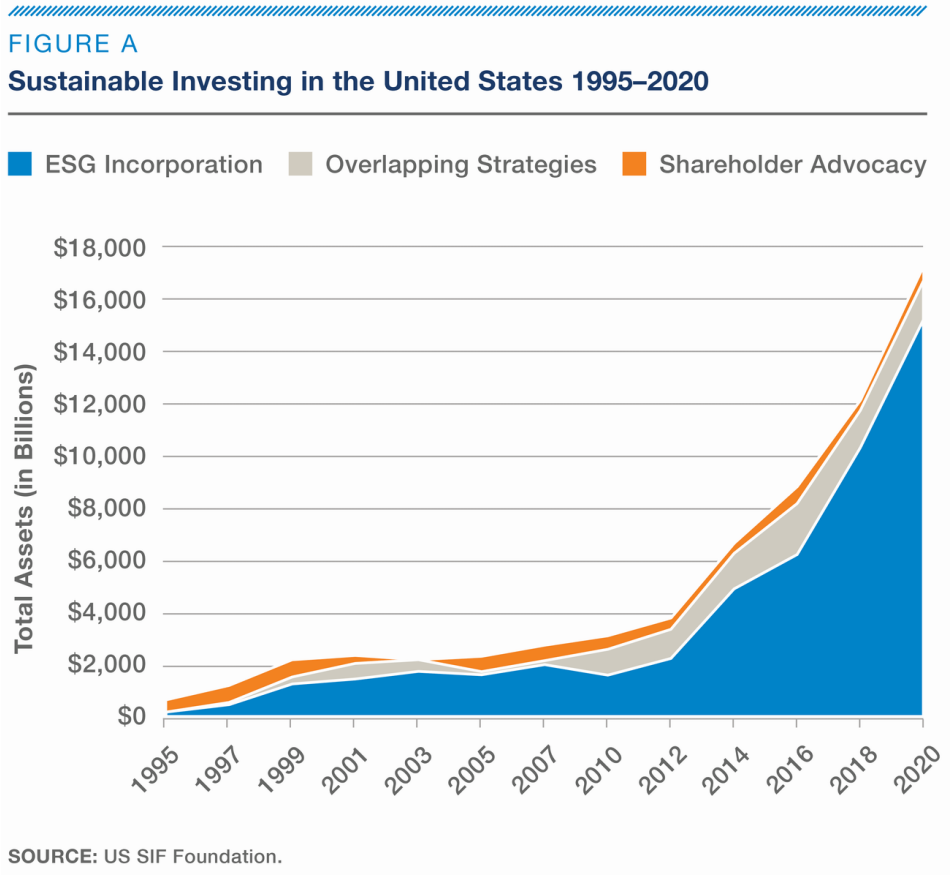

Figure 1. Sustainable Investing in the US 1995-2020 (US SIF Foundation. 2020)

2.11 CSR and financial return relationship

2.11.1 Positive CSR and financial return relationship

A study from the NYU Stern Center for Sustainable Business found that there is a positive correlation between ESG and financial performance. They found that “studies typically focused on risk-adjusted attributes such as alpha or the Sharpe ratio on a portfolio of stocks, 59 percent showed similar or better performance relative to conventional investment approaches while only 14 percent found negative results”. The study further found that “ESG investing appears to provide downside protection, especially during social or economic crises”. Lu and Taylor found that corporations with high ESG score increase the probability of a better financial return. The probability of better return was higher for non-US based corporations compared to US based corporations. Akben-Selçuk found

that CSR has a significant positive relationship with financial return. Akben-Selçuk's research disproves that CSR is to be considered merely a cost with little return on investment. Clarke and colleagues surveyed more than 200 studies and found that 90 percent of the studies demonstrate that corporations with strong CSR exhibit a better financial return and performance. 88 percent of corporations have a better financial return and 80 percent of the corporations show significant relation between a strong ESG score and a strong financial performance. (NYU Stern Center for Sustainable Business. 2020; Lu et. al. 2016; Akben-Selçuk. 2019; Clark et. al. 2014)

All the above reviewed research and studies indicate that investing in high CSR compliant corporations would generate as good or better return than investing in the broader market containing all corporations.

2.11.2 Neutral CSR and financial return relationship

Margolis and colleagues analyzed 167 studies over a period of 36 years and found no significant relationship between a high level of CSR and better financial result in the studied corporation sample. But they also found that high level of CSR did not decrease financial result. Humphrey and Tan found that socially responsible investing does not affect positively nor negatively the financial return. Khan and colleagues found that corporations with a high CSR score do not exhibit significantly higher financial return than corporations with low CSR score. (Margolis et. al. 2008; Humphrey et. al. 2014; Khan et. al. 2016)

All the report and studies mentioned above indicate that the investor does not incur an return impairment in order to invest sustainably.

2.12 ESG Rating

ESG is an acronym for Environmental, Social and Governance and ESG is viewed as implementing an investment decision process based on usual financial factors together

with environmental, social and governance factors. The “E” in ESG stands for the environmental aspects. The ”E” factor is taking into account how the corporation is contributing to the climate change, how it treats waste and how they are improving their energy usage. The “S” in ESG stands for the social aspects. The “S” factor is related to the employee of the company, the local community in which the company is embedded and society at large. The “G” in ESG stands for the governance aspects. The “G” factor is related to the management factors in the company. The ESG ratings are helping the investor reassessing the individual corporation’s expected profitability. Today, it is not enough to assess a company’s financial health solely on its financial valuation. The individual corporation needs to be evaluated based the integrated value stemming from its financial conditions as well as its social, environmental and governance conditions. (Robeco. 2021) (Deloitte. 2021)

2.13 SRI empirical related research

SRI empirical research help discover the relationship of CSR and the corporate financial performance. One of its main targets is to discover if incorporating ESG criteria into the investment process is profitable. There are traditionally two line of SRI related research methods, the first one is focusing on measuring the performance of portfolios created using ESG criteria. In this type of research, the research starts by creating a portfolio using ESG based criteria and then tests are conducted to discover if the portfolio is resulting in significant academic results. These tests are conducted through the analysis of the portfolios’ timeseries data using asset pricing factor models. The second research line focuses on the performance of SRI based funds against conventional funds or some other general benchmarks. Both types of research are relevant for the study of socially responsible investment. (Reeneboog et. al. 2008; Halbritter et. al. 2015)

It has been demonstrated that using portfolios together with factor-based asset pricing models is decreasing the uncertainty of the research estimation. This is due to the diversification that is obtained when many stocks are grouped in a portfolio. This thesis will

mainly use the portfolio-based type of research, as it is deemed to be a better one to answer the research statement of this thesis. (Ang et. al. 2019)
In the rest of this section, selected socially responsible investing research are reviewed. The purpose of this selective review is to give the reader an insight into the methods and data used in some of the latest research around measuring the performance of portfolio created using ESG criteria.

2.13.1 Research conducted by Alexander Kempf and Peer Osthoff

Kempf and Osthoff study whether the SRI based investor is able to improve their investment return using screening based on social and environment criteria. They question the quality of earlier conducted research based on the second type research focused on the performance of SRI based funds against conventional funds or some other general benchmarks. The researchers are of the opinion that the SRI based funds' level of performance is too sensitive to both the individual fund manager's ability and the focus on conducting SRI based investment. This situation makes it difficult to identify whether the realized return is a result the manager's ability or the focus on SRI. The researcher also find that earlier research has narrowed their screening on the environmental part of ESG and missed screening on the other criteria included in ESG. (Kempf et. al. 2007)

The researchers decide to research the performance of portfolios based on screening using six socially responsible criteria. These criteria are community, diversity, employee relations, environment, human rights, and products. The SRI ratings are extracted from the KLD Research and based on companies included in the S&P 500 and the DS 400 indexes. The portfolios are created based on negative, positive, and best-in-class-strategy screening. In each screening, two portfolios are created, and their compositions are dependent on the chosen screening technique. In the negative screening, the lower rated portfolio is composed of stocks that are within at least of the controversial business areas. The controversial business areas are alcohol, tobacco, gambling, military, nuclear power and firearms. (Kempf et. al. 2007)

While the higher rated portfolios are composed of stocks that are not involved in any of the controversial business areas just described. In the positive screening, the higher/lower portfolio is composed of the ten percent highest/lowest rated stocks based on the six criteria introduced earlier. The best-in-class-strategy is also a positive screening-based portfolio creation, but the stocks are divided into different industry based on their SIC codes as a first step and then ranked from highest to lowest based in their SRI ratings. This results into weighted portfolios within each industry. These portfolios are then combined into one portfolio by using industry-based weighting. This leads to industry balanced investment portfolios based on high and low. The screening-based portfolios are then updated based on the new yearly published SRI ratings. The research finally studies the performance of the high and low rated portfolios in the period from 1992 to 2004. (Kempf et. al. 2007)

The portfolios risk-adjusted return is then analyzed using the Carhart's four factor model. The measure of performance used in the research is alpha. Many factors in the Carhart model are found having a significant effect of the return. The outcome of this study is a long-short strategy, where the highest rated portfolio is purchased, and the lowest rated portfolio is sold. Based on the discovered alpha values, the researchers conclude that investors can obtain abnormal return by investing into a long-short strategy described above. By implementing a positive screening, an abnormal return of more than six percent per year can be realized. The best-in-class screening allows for an abnormal return of more than three percent per year. The negative screening is unsuccessful and realized an abnormal loss of 0,76 percent. The conclusion of the research is that SRI ratings are valuable and allows the investor to realize positive abnormal return through socially responsible investment criteria. The research is unable to explain the source of the abnormal return. The researchers are wondering if the abnormal return is an outcome of market mispricing or a compensation for an additional risk factor. (Kempf et. al. 2007)

2.13.2 Research conducted by Meir Statman and Denys Glushkov

This research from 2009 is similar to the one conducted by Kempf and colleague. The time period of the data used is 1992 to 2007, meaning three years more than the research by Kempf and colleague. This research also uses KLD data but are only testing the portfolios based on the best-in-class screening. The purpose of the research is to uncover the return of stocks that are complaint with SRI and the return of the so-called "sin" stocks. This research is in line with the one conducted by Kempf and colleague and the researchers are critical to research conducted based on SRI based funds. As a result, the researchers prefer to study SRI performance through stock return rather than fund return. As introduced, this research is also using the SRI ratings extracted from the KLD Research and based on companies included in the S&P 500 index and DS 400. KLD's rating is based on seven socially responsible parameter and each parameter there are certain number of indicators distributed based on strength and concern. A corporation receives a 1 score if the indicator is showing strength and 0 if it does not. This is similar with the concern indicator, where it scores 1 if it shows and 0 if it does not. The "sin" stocks are picked using KLD classification similar to the Kempf and colleague study. Yearly portfolios are created based on the yearly KLD scores. (Statman et. al. 2009)

Corporations that did not receive any scores on strength or concern during the year are excluded. The left-over corporations are used to create portfolios containing stocks with the highest best-in-class ratings representing the top stocks and stocks containing the lowest best-in-class representing the down stocks. As rating differences are found across the average of each industry, the best-in-class classification used is an industry adjusted best-in-class rating. Using these portfolios, the study discovers if stocks with high rating exhibits a higher return than stocks with low rating within each of the KLD parameters. This is executed by testing top-down based portfolios with both equally and value weighted portfolios. The created portfolios are tested up against three different asset pricing models, CAPM, Fama and French three factor model and Carhart's four factor model. This is done using both the full time period as well as two partial time periods. The p-value of the test outcome are verified at a p value of 1, 5, 10 percent. The outcome

of this research is similar to the one achieved by Kempf et. al. in the sense that stocks from corporation with higher social responsibility rating result into a higher return than stocks with lower rating. The empirical evidence is especially strong when a long-short investment strategy is being used. The research further indicates that the elimination of "sin" stocks from socially responsible portfolios reduces the expected return compared to conventional portfolios that include the "sin" stocks. The study finds that the investor will achieve a good return by adopting a best-in-class strategy. This is especially valid if the investor concentrates the investment effort within the areas of community, employee relations and environment while at the same time avoiding from shunning any stock based on which industry they belong to. (Statman et. al. 2009)

Through testing with multifactor asset pricing models, the research is able to pinpoint which factors are able to explain the return of the created portfolios. Studying the effect of hml factor, the research finds indication that corporations with high rating within the area of community, employee relations, environment and products are largely growth companies. Whereas the effect of hml factor or value factor, is indicating that companies with high rating within diversity, human rights and governance are largely value companies. The factor smb or size factor would help indicate which companies are ranking high within which of the given KLD parameters. (Statman et. al. 2009)

2.13.3 Research conducted by Arian Borgers, Jeroen Derwall, Kees Koedijk and Jenketer Horst

This paper is researching the increasing trend to include ESG criteria into the investment decision making process. The researchers believe that there is an increased interest from the institutional investor community into using rich stakeholder information when creating investment portfolios. The researchers believe that this increased interest will, in the long run, eliminate the difference between the risk adjusted return of high and low ESG-rated portfolios. The timeframe of this study spans from 1991 to 2009 and is using different EGS criteria to create long-short equally and value weighted portfolios. The ESG data is extracted from KLD and is using seven socially responsible areas. This is similar

method as the paper of Statman et. al. reviewed above. This research is looking at nearly similar time frame as the two last papers reviewed above and Carhart's four factor model is used to measure the risk-adjusted return of the created portfolios. The study finds indication that high ESG information stocks produce abnormal returns in the period of 1992 to 2004 in line with the study by Kempf et. al. The research show that this is made possible by errors in the investors' expectations. The findings are deducted using the asset pricing factor model's alphas that are positive and significant up until 2004. From 2004 until 2009, the alphas become non-positive and non-significant. The researchers argue that investors' expectation errors stem from the investor's lack of fully understanding the intangible value of the ESG information. Over time, as the investor become more educated on the ESG information, the expectation errors diminish and eventually disappear. This in turn, renders the early abnormal return into a later normal return. The research finds indications that abnormal return disappeared year 2004 as more and more companies publish CSR reports. This increased reporting stimulated the CSR education of the investor, which in turn led to the decrease of the realized abnormal return. This paper is noteworthy as it supports the notion that the market is not fully efficient in the sense that investor behavior can have an effect on the asset prices. (Borgers et. al. 2013)

2.13.4 Research conducted by Janusz Brzeszczynski and Graham McIntosh

This paper is researching the performance of portfolios created using British SRI stocks. The focus is on understanding the performance investor's SRI based portfolios during the period of 2000 until 2010 and is using the Global-100 list of socially responsible companies. It is noteworthy to understand that the Global-100 list is available to the public at large free of charge and is created by using 10 equally weighted ESG criteria. The researchers argument that little studies have be done to understand the individual investor's SRI based portfolio performance. This performance is measured against the performance of the FTSE100 and the socially responsible FTSE4GOOD indexes. The performance is measured using the risk-adjusted return, the modified Sharpe ratio (MSR), and the Certainty Equivalent Return (CEQ). The asset pricing models used in this study are the Fama and French three factor model and the Carhart's four factor model. This study

is especially interesting as it is including checking for realized dividends and transaction costs, checking for survival bias by using stocks that are no longer traded, and checking the portfolio return up against both conventional and socially responsible indexes. The research is using an equally weighted portfolio that is adjusted annually based on the yearly announced Global-100 list. The total return is then estimated based on the geometric average of each year's return during the ten-year studied timeframe. The portfolio is composed of only UK based stocks that are part of the Global-100 list. The resulting portfolio is containing between 18 to 31 stocks over the studied period. (Brzeszczynski et. al. 2014)

The overall results show that SRI based portfolios realize a higher return than the one realized by FTSE100 as well as the FTSE4GOOD, but the return differences are not significant. Even when the dividends are taken into account, the SRI portfolios exhibit a higher average yearly return that are superior to the benchmark indexes. The estimated MSRs and CEQs are indicating that the SRI portfolio is outperforming both the FTSE100 and the FTSE4GOOD. When testing against the asset pricing models, the return of the portfolio can only be explained by the market factor. This is contradicting with the earlier research of both Kempf et.al. and Statman et. al. detailed above, that had found that other factors had a significant effect on the return. The estimated alphas for both used multifactor models are in the majority of the yearly periods not significantly different from zero. The researchers put forward the argument that, despite the lack of significant empirical evidence that a SRI portfolio clearly outperform market indexes, this study shows that it is possible for a SRI portfolio to outperform the market indexes. (Brzeszczynski et. al. 2014)

2.13.5 Research conducted by Gerhard Halbritter and Gregor Dorfleitner

This paper researches the link between the corporate social responsibility and the financial performance based on ESG ratings. The data used is covering the US market and the ESG data from Asset4, Bloomberg and KLD. The timeframe considered is from 1991 to 2012, where only KLD is able to cover the while period. Asset4 and Bloomberg are only able to respectively covering 2003-2012 and 2006-2012. The three ESG data providers

are providing different ESG data format in terms of the risk and distribution. The paper is making some adjustments to allow for a determination of an overall ESG score based on all the available ESG data. The portfolio creation is similar to the methods employed in the earlier research of both Kempf et.al. and Statman et. al. The stocks are sorted by high and low rated portfolios with a cut-off of 20 percent based on the ESG rating. The researchers then implemented a high-low strategy and the portfolios' returns were subsequently tested. The research also created a value and equally weighted portfolios for each ESG score and each data provider. Carhart's four factor model was used to test the performance of the created portfolios. The solidity of the portfolios was also tested by varying the cut-off level that subsequently changes the portfolios content. To account for sector specific issues, a best-in-class strategy is implemented as well. (Halbritter et. al. 2015)

The study finds that the SRI portfolios exhibit different level of return over the studied time period. This is similar with the previously reviewed papers above. The outcome of this research is that the difference between the high and low rated portfolios is not significant. This in turn means that the study is unable to concluded that there is a positive relationship between a high ESG score and a high return for a corporation. This is contrary to the previous reviewed papers above. This outcome is taking into account both different cut-of levels in the portfolios, for the best-is-class strategy and test of the overall ESG score as well as the individual ESG component score. Through testing against the Carhart's factor model, a clear return degradation can be observed over time and the positive relationship with high ESG ratings and positive return is clearer in the earlier part of the whole time period. This result is in line with the findings of Borgers et. al. that highlights a shift in the year 2004, with falling returns afterwards. The researchers, despite being unable to show a significant abnormal return linked to high ESG rating, put forward that socially responsible investing is worth it despite the lack of higher return reward. (Halbritter et. al. 2015)

2.14 Review of portfolio screening methods

In this paragraph, existing screening processes are reviewed. The process of screening is when the investor makes a decision whether a given stock should be included or excluded in the created investment portfolio. The investor uses negative screening to avoid stocks of companies that are deemed not enough socially responsible and positive screen to add stocks of companies that are deemed socially responsible enough. The development of the screening practices have changed according to the changes of the investor's socially responsible behavior. The major change that has happened over time is the movement from avoiding socially irresponsible assets towards an active promotion of corporate social responsible assets. Early on, the negative screen was the main decision-making vehicle and can be viewed as the first-generation SRI screening method. Positive screening have become more used and is considered the second-generation SRI screening method. (Schueth. 2003; Martini. 2021)

2.14.1 Negative Screening method

As introduced earlier, negative screening is an earlier version of the screening methods. Negative screening is thought to have been used already thousands of years ago where investors, that due to their religious beliefs, would exclude investing in assets that were not in line with their religious belief. This is a style of investment that is still valid and relevant today and is also referred to avoiding "sin" assets. One of the major risks of negative screening is that it creates a danger for the investor to create portfolio with reduced return compared to the market return. This danger stems from the fact that part of the investable highly profitable corporation universe is excluded in the process and also from the resulting reduction of portfolio diversification possibility. Some academic researchers consider negative screening as a sector-based screening because it is typically the assets of a whole business sector that are excluded from the considered investment universe. (Schueth. 2003; Humphrey. 2014; Adler et. al. 2008; Fabozzi et. al. 2008; Humphrey. 2014; Kempf et. al. 2007; Hoepner et. al. 2018)

2.14.2 Positive screening method

As introduced earlier, positive screening is a newer investment strategy. It relates to picking the assets that are compliant with certain defined criteria. Practically, it means that investors seek corporations that fulfill defined ESG criteria and shy away from corporations that do not. These criteria are usually covering the areas of corporate governance, environment, worker's right, diversity, and sustainability. Research into screening methods found that the positive screening is especially able to show positive abnormal return during times of crisis. (Renneboog et. al. 2008; Nofsinger et. al. 2014)

2.15 ESG controversies overview

Refinitiv Thomson Reuters Eikon has since 2018 made an additional sustainability related measure available called EGS controversies. This additional measure indicates a score related to the level that the studied company is exposed to ESG related controversies. There are only limited amount of studies that has taken this measure into account in their research. The author of this thesis was only able to find one noteworthy paper. This paper finds that ESG ratings and ESG controversies score are complementary. (Refinitiv Thomson Reuters Eikon. 2021; Aoudi et. al. 2018)

3 Data

The set of data that is used in connection with this thesis is reviewed in this chapter. The dataset includes publicly available information regarding the stock market, the risk free interest rate, corporate financial information, ESG based ratings including ESG sub-categories and ESG controversies.

3.1 Publicly available data

In the attempt to answer the research question of this thesis, the research concentrates on using publicly available data. The use of public data is mirroring the level of information that is available to the large majority of stock market participating investors. This makes the theoretical framework introduced in the theoretical overview chapter suitable to support the discovery of the relationship between corporate CSR and financial return. The research conducted in this thesis is based on the assumption that the studied corporations are publicly traded and that the associated stock price is reflecting all publicly available information. For the purpose of clarification, the publicly available information also include all publicly available ESG rating information. (Ziegler et. al. 2011)

3.2 Selection of researched companies

As introduced in the first chapter of this thesis, the researched companies are listed on the US stock market. This choice is supported by the probability of discovering a large enough sample of companies with available ESG rating data. According to Refinitiv Thomson Reuters Eikon, the number of companies with available ESG data in their database is over 2900 US based companies. It is a challenging task to collect stock portfolios that would fully represent the US stock market. To ease that challenge, a proxy for the US stock market is used. This thesis chose to concentrates its effort on the companies that are member of the S&P 500 on the 31st of May 2021. The S&P500 index is a stock market free-float capitalization weighted index tracking the performance of 500 large companies listed in the US and is covering approximately 80 percent of the market

capitalization of the US stock market. The S&P 500 index is assumed to be the most suitable and representative of the US stock market index for the purpose of the analysis research conducted in this thesis. (Refinitiv Thomson Reuters Eikon.2021; S&P Down Jones indices. 2021)

3.3 Gathering stock related data

For the purpose of creating the portfolios used in this thesis, the data of the stocks included in the selected S&P 500 index is collected on the 31st of May 2021. The data source is the Refinitiv Thomson Reuters Eikon database, which is one of the most used platforms within financial community (Wallstreetprep. 2021). The gathered monthly return is based on the Return index collected from the Refinitiv Thomson Reuters Eikon database. The Return Index includes the dividend reinvestment and is measured at the end of each month. (Refinitiv Thomson Reuters Eikon. 2021).

The choice of the length of the measured timeframe is based on two aspects. The first one is that an adequate amount of ESG ranking data needs to be available for the research. Adequate amount of data is not available on the Refinitiv Thomson Reuters Eikon database until after 2006 (Refinitiv Thomson Reuters Eikon. 2021). The second one is that the research benefits from using data from both bull and bear stock market. It is therefore decided that this thesis is using a 15-year time frame of 01.06.2006 until the 31.05.2021, as this timeframe fulfill the two described aspects. Moreover, 15 years of daily observations represents 3913 observations, and this can be considered statistically adequate sample size for financial statistical analysis purposes.

If a stock was member of the index any other time than the 31st of May 2021, it would not be considered. This is resulting into a number of 398 stocks in 2006 increasing to 500 stocks in 2021 included in the S&P 500. This phenomena are due to the fact that some of the included companies only existed or were only listed in a portion of the measured time of 15 years' time period. This also explains the increase in the numbers of stocks over time. As this phenomenon is deemed not to have any major impact on the

characteristics of the corporations in our sample, the problematic of a possible bias due to the changing number of stocks is discarded.

3.4 Gathering ESG ranking related data

This thesis will be based on an ESG ranking readily available from the ESG and financial data provider Refinitiv Thomson Reuters Eikon. The Refinitiv Thomson Reuters Eikon ESG related database is covering more than 70 percent of the corporate world and is compiling more than 400 different ESG criteria starting from 2002 onwards. Refinitiv Thomson Reuters Eikon is publishing an updated corporate ESG ranking every year. (Refinitiv Thomson Reuters Eikon. 2021)

3.5 ESG score data

The Refinitiv Thomson Reuters Eikon is measuring over 400 different ESG parameters for each documented corporation. These parameters are collected from the corporate reporting, website content, NGO website content, CSR reporting, and news reporting. The range of ESG scoring is given from 0 to 100, where 100 is the highest score that a company can obtain. In the early time period, considerable blanks can be found in the corporate ESG scoring database where there is no or insufficient ESG data available. The ESG data has become more available over time and the latest yearly ESG ranking is richer in terms of data content. (Refinitiv Thomson Reuters Eikon. 2021; Douglas et. al. 2017)

3.6 ESG controversy score data

A controversy represents a scandal that a company has been involved in. The corporate impact of a controversy might span longer than a year. A controversy could be an event related to legislation, disputes, fines, or lawsuits. Any controversy related news that is captured is registered in the corporate related ESG controversy score. The ESG controversy score is containing information related to 23 different ESG controversies. All controversy scores are revised every year and all the controversy that happened in the year

are registered to the corporate ESG controversy score of that year. The range of ESG controversy scoring is given from 0 to 100, where 100 is the highest score that a company can obtain. (Refinitiv Thomson Reuters Eikon. 2021)

3.7 The asset pricing related data

A large number of the socially responsible finance research papers use the Carhart's four factor model and the Fama and French's three factor model as the asset pricing model for analysis purposes (Kempf et. al. 2007; Statman et. al. 2009; Borgers et. al. 2013; Brzeszczynski et. al. 2014; Halbritter et. al. 2015). This study uses the Fama and French six factor (FF6F) model (Fama and French. 2018). The purpose of this thesis is to research whether the ESG rating influences the stock's return. This means that understanding the performance of the stock portfolios with a high ESG score is explained by the FF6F developed by Fama and French (Fama et. el. 2018).

The research conducted is based on multiple regression analysis. The dependent variable y is defined as the excess return of the screening-based portfolios created during the empirical analysis phase of this thesis. Kenneth French documents the factors' monthly as well as the risk free interest data series that we use in this paper (French. 2021).
This thesis is following the above reviewed papers of Kempf et. al., Borgers et. al., Blitz et. al., Hoepner et. al. that all use the Kenneth French database to gather the data of the independent variables. This research uses FF6F as an analysis tool in this thesis work. These independent variables in the regression model are the smb, hml, rmw, cma and wml factors. The smb, hml, rmw, and cma are collected through the Fama/French North American 5 Factors and the wml is collected through the North American Momentum Factor from the Kenneth French database. (French. 2021)

3.8 The selected proxy for risk free rate

This thesis's research determines the market factor by using the S&P 500 as benchmark and proxy representing the US total market. As a proxy for the risk-free rate, the US one-

month risk-free interest rate available in the Kenneth French database is used. (French. 2021)

3.9 Creating the asset pricing model factors

This thesis is conducting the research with using factors created by the 2x3 sorting method. To understand the background of the choice of the sorting process method, details of sorting methods and the created factors are given in the appendix.

3.10 The monthly market value

The monthly market value (MV) of each corporation is collected through the Refinitiv Thomson Reuters Eikon database. The MV is needed information to determine the weighted return for value-weighted portfolios created during this thesis work. The MV from year t is used to create the portfolios for year t until year t+1. (Refinitiv Thomson Reuters Eikon. 2021)

4 Methodology

4.1 Quantitative research method

The research conducted in this thesis is primarily using quantitative data. Quantitative data is used as it is supporting the discovery of how ESG criteria are influencing the stock financial return (Gorard. 2003). The qualitative research methods would not adequately support the study, the measurement and testing of the gathered data (Burton. 2007).

4.2 Deductive research method

In this thesis, the deductive research method is applied to generate the knowledge of whether ESG ratings is having an effect on the stock financial performance. The deductive research approach is usually associated to the quantitative research method. The deductive research process is often initiated by stipulating a theory that leads to deducted hypotheses that are then subjected to an empirical scrutiny. The empirical scrutiny contains the elements of data collection and empirical findings that support the confirmation or rejection of the hypotheses. The last step is then to use the research to revise the theory if needed. (Bryman. 2015)

4.3 Portfolio creation

In this thesis, the ESG and stock return relationship is researched by grouping stocks into portfolios and using them as the object of analysis. The portfolios are constructed based high and low performers based on selected ESG criteria. These formed portfolios' related data is then designed as time series allowing for research using the factors based asset pricing model. (Kempf et. al. 2007; Statman et. al. 2009)

Positive screened portfolios are used to identify the effect of ESG, ESG sub categories and ESG controversies on return. The portfolios' returns are tested by using the FF6F model and help discover the exposure of the portfolios to the factors of the FF6F model.

The value-weighting used in creating these portfolios is the average market capitalization over the full time-period of 2006 to 2020. If a particular stock has not become listed after 2006, the corresponding weight is not distributed to the rest of the stocks. The weighted part of that would be allocated to that stock is withdrawn and is considered held in cash where it is considered generating zero percent return.

4.3.1 Portfolio spanning the whole research period

In the first part of the empirical analysis, the analysis of the ESG and its subcategories are documented on the overall research period of year 2006 to year 2020. The created portfolios are as a consequence not rebalanced every year, but the average scores over the full research period are considered. In this thesis, the breakpoints used in the design of the created portfolios are 10% and 20% on the higher end of the ESG and subcategory related scoring. (Kempf et. al. 2007; Statman et. al. 2009)

The creation of the long-term effect ESG and its subcategories portfolios is based on the average ESG and its subcategories scores during the period year 2006 to year 2020 without any yearly rebalancing of the portfolio content. For that purpose, eleven different portfolios, based on the ESG and the ESG sub categories, are created for each of the chosen breakpoints. The first one is based on the ESG scoring and the rest of the ten portfolios are each respectively based on the ESG subcategory scoring elements of Resource, Emissions, Innovations, Workforce, Human rights, Community, Product responsibility, Management, Shareholders and Strategy subcategory elements of the ESG score.

The full list of scored companies is then distributed from highest to lowest according to the achieved ESG and its subcategories scores and a positive screening of the top 10% and top 20% are selected as the content of the resulting portfolio. Originally, the breakpoints of 10% and 30% were picked in line with some the earlier research reviewed above (Kempf et. al. 2007; Statman et. al. 2009). But conducted analysis show that the use of the 30% breakpoint creates a risk of overlap between the content of the highest and lowest portfolios especially in the earlier part of the considered 15 years' timeframe.

This risk of overlap stems from the lack of available ESG data for a considerable number of corporations. As a compromise, the breakpoint of 20% is selected instead to allow for robustness testing whether a larger portfolio would yield different result than the one resulting from the use of a 10% based portfolio.

4.3.2 Yearly rebalanced portfolios

In the second and third parts of the portfolio creation, the ESG and controversy scores are documented on a yearly basis from year 2006 to year 2020. For the yearly rebalanced portfolios, the initial portfolios for the year 2006 are created and used for performing the needed research regarding that year. For each consecutive year up until 2020, the corresponding year's portfolios are created. The key characteristic, that the research wants to expose, is the financial return of the portfolios with different scores.
The portfolios are created as value-weighted portfolios for the purpose of this study. The value-weighting is based on the market capitalization of the companies in the dataset. The individual weight of each corporation is given by dividing the individual stock's market capitalization with the total portfolio's market capitalization.

Contrary to the long-term effect portfolios, the yearly rebalanced portfolios are rebalanced every year on the basis of their yearly ESG and controversy score. For every year, two portfolios are created for respectively ESG and controversy and each of these respective portfolios are described as high and low. For each year, the resulting first two high portfolios are based the corporations that are qualifying for the 10% highest score in respectively ESG and controversy. For each year, the two other resulting portfolios are based the corporations that are qualifying for the 10% lowest score in respectively ESG and controversy. To counter a possible risk of too small number of corporations in each created portfolio using the 10% breakpoint, portfolios are also created using the 20% breakpoint level in a similar fashion to the one described for the 10% breakpoint. The 20% breakpoint allows for the discovery of possible alternative results than given by the 10% breakpoint and to test the robustness of achieved test results.

4.4 The portfolio return data and standard deviation

The dataset available for the work conducted in this thesis contains daily stock prices of each of the corporations included in the dataset. In the case that a company does not have a return because it is traded only part of the studied time-period, it will not have an impact on the portfolio's return. The standard deviation of the portfolio returns are determined using the portfolio return data. The portfolio return data and the standard deviation are detailed in the appendix.

4.5 Data testing

The discovered portfolio excess returns are tested against the FF6F model using a multiple regression analysis to discover the alpha and explanation power of the six factors. The data testing methodology is detailed in the appendix.

5 Empirical analysis

5.1 ESG and ESG sub-categories analysis

5.1.1 Portfolio constituents' market value distribution

In the S&P 500 index, 34 companies are having an average market valuation of 100 billion dollars or more and are considered the biggest companies. It seems that the ESG and sub-category score are largely leaning towards the bigger corporations. One major reason can be that it is necessary to have dedicated resources that produce and publish the large amount of ESG based data. The bigger companies are more able to incorporate a structured reporting system that is better able to produce and publish ESG related information. This also is catalyzed by the pressure from society and lobby groups that is mostly towards bigger companies to make ESG related data public. (Drempetic et al. 2020)

5.1.2 Descriptive statistics

5.1.2.1 Portfolio's descriptive statistics

During the analyzed period of 2006 to 2020, an investment in the S&P 500 would have generated a higher average yearly excess return and a lower Sharpe ratio than the top 10 and top 20 ESG based portfolios. Increasing the ESG portfolio from top 10 to top 20 seems to increase the average yearly excess return and the Sharpe ratio.

A further analysis of the ESG sub-category generated portfolios seems to be in line with the these findings. The majority of the sub-category generated portfolios would have delivered less excess return than the S&P500 index based portfolio. But it seems that the S&P500 index generate a worse risk-adjusted return, when taking the Sharpe ratio into account. When the skewness is considered, There is an indication that investors would incur frequent small positive returns and a few large negative returns if investing in the created ESG portfolios. The discovered kurtosis indicate that there are smaller chances that the portfolios would experience extreme returns and is thus considered less risky

than the S&P 500 based portfolio. When increasing the ESG sub-category generated portfolios from top 10 to top 20, the majority of portfolios experience an increase in the excess return and a decrease in the Sharpe ratio. Further details of these analysis and the descriptive statistics are detailed in the appendix.

5.1.2.2 Factors' descriptive statistics

The factors' descriptive statistics indicate that corporations with high book-to-market ratio also referred to as value stocks tend to have low investment levels, that corporations with low profitability carry a higher systematic risk than the market as a whole, that bigger companies are more profitable, that corporations with high profitability are considered growth stocks and that profitable companies have a conservative investment level. More details can be found in the appendix.

5.1.3 Regression related conditions

In order to make use of the regression methodology in successfully conducting empirical analysis, there is a need to verify that the Gauss-Markov assumptions are fulfilled. This ensures that the discovered results are unbiased, efficient, consistent, and normally distributed. It is necessary to control that the conditions are fulfilled for the long-term ESG and the ten ESG subcategories based portfolios. A detailed review of the ESG and ten subcategories based top ten and twenty percent portfolios are available upon request. Based on the conducted tests documented in the appendix, it is assumed that the Gauss-Markov assumptions are fulfilled for the 22 created long-term ESG and the ESG subcategories based portfolios.

5.1.4 Regression analysis

The 22 constructed portfolios are analyzed using multiple regression analysis. The summary of some the key findings are detailed in the tables below. The full details of the conducted regression analysis can be found in the appendix.

	ESG top 10 yearly	resource top 10 yearly	emis-sions top 10 yearly	innova-tions top 10 yearly	work-force top 10 yearly	human rights top 10 yearly	Commu-nity top 10 yearly	prod-uct top 10 yearly	manage-ment top 10 yearly	sharehold-ers top 10 yearly	strategy top 10 yearly
Average market cap	94	88	78	58	75	78	66	67	44	49	78
3 biggest constituents	MSFT, XOM, JNJ	AAPL, MSFT, XOM	MSFT, XON, JNJ	WMT, GE, PG	MFST, XON, JNJ	MFST, XON, JNJ	MSFT, JPM, BAC	MSFT, XON, JNJ	MSFT, GE, WFC	AAPL, MFST, CVX	MSFT, XON, JNJ
3 biggest total value	23 %	30 %	27 %	23 %	29 %	27 %	26 %	32 %	39 %	47 %	27 %
Alpha	No	Yes	No	No	No	No	Yes	No	No	No	No
Beta	0.93	0.98	1	0.97	0.88	0.9	1.04	0.88	0.93	0.97	0.92
Exposed to size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exposed to value	No	No	No	No	No	No	No	No	No	No	No
Exposed to profitability	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No
Exposed to investment	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Exposed to momentum	Yes	No	No	Yes	No	Yes	Yes	No	Yes	No	No

Table 1. The top 10 regression analysis result

	ESG top 20 yearly	resource top 20 yearly	emis-sions top 20 yearly	innova-tions top 20 yearly	work-force top 20 yearly	human rights top 20 yearly	commu-nity top 20 yearly	prod-uct top 20 yearly	manage-ment top 20 yearly	sharehold-ers top 20 yearly	strategy top 20 yearly
Average market cap	70	74	63	60	66	65	56	55	43	41	63
3 biggest constituents	MSFT, XOM, JNJ	AAPL, MSFT, XOM	MSFT, XON, JNJ	MFST, JNJ, WMT	MFST, XON, JNJ	AAPL, MSFY, XON	MSFT, XON, JPM	MSFT, XON, JNJ	MSFT, JNJ, WMT	AAPL, MFST, AMZN	MSFT, XON, JNJ
3 biggest total value	15 %	18 %	17 %	16 %	17 %	21 %	18 %	19 %	22 %	31 %	16 %
Alpha	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Beta	0.95	0.95	0.99	0.96	0.91	0.92	1.01	0.92	0.94	0.95	0.88
Exposed to size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exposed to value	No	No	No	Yes	No	No	Yes	No	No	Yes	No
Exposed to profitability	Yes	No	No	No	Yes	No	Yes	No	No	Yes	Yes
Exposed to investment	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Exposed to momentum	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No

Table 2. The top 20 regression analysis result

With a few exceptions, it is the same biggest corporations that are members of all the created portfolios. The average size is around 70 billion dollars for the top 10 percent based portfolios and around 60 billions dollars for the top 20 percent based portfolios. And the three biggest corporations are on average 30 percent of the total market capitalization for the top 10 percent based portfolios and on average 19 percent of the total market capitalization for the top 20 percent based portfolios. This exposes that the stock performance of the biggest stocks have considerable influence on all of the created portfolio's excess return. 19 out of all the portfolios exhibit a beta below 1 and three are very close to 1. This means that these portfolios are exhibiting a volatility equal or slightly lower than the overall market. Only two of the 11 top 10 percent based portfolios carry an alpha, whereas 10 out of the 11 top 20 percent based portfolios carry an alpha. It seems that the top 20 percent based portfolios perform on average far more returns unexplained by the FF6F asset pricing model than the top 10 percent based ones.

All of the 22 portfolios are significantly exposed to the market and size factor. This makes intuitively sense as the portfolios elements are members of the S&P500 index and the S&P500 index is largely composed of big corporations. One of the thesis research hypothesis is that a high level of score in ESG and its sub categories are exposed to the two factors profitability and investment. 18 of the portfolios are significantly exposed to the investment factor, the four portfolios that are not significantly exposed to the investment factor are the resource top 10, community top 10 shareholders top 10 and top 20. Only 10 of the portfolios are exposed to the profitability factor, These are the ESG top 10, ESG top 20, resource top 10, innovations top 10, workforce top 10 and top 20, shareholders top 10 and top 20, community top 20 and strategy top 20. There are 7 portfolios that are significantly exposed to both profitability and investment factors are ESG top 10, ESG top 20, innovations top 10, workforce top 10 and top 20, community top 20 and strategy top 20.

So the research hypothesis 2 is partially rejected as there are only 7 portfolios listed above that have not rejected the stated hypothesis 2 and 16 of the portfolios rejected the stated hypothesis 2. The ESG top 10, innovations top 10, workforce top 10 and top 20, community top 20 and strategy top 20 based portfolios are significantly exposed to the criteria of profitability and investment. So for these portfolios, profitability and investment are contributing to explaining the excess return of the portfolios.

5.2 Yearly rebalanced ESG portfolios analysis

In this part of the empirical analysis, top and bottom based portfolios are created using a positive screening methodology as covered earlier in this thesis document. The portfolios are rebalanced every year t based on the ESG rating of the previous t-1. Four portfolios are created using positive screening and breakpoints of 10 and 20 percent.

5.2.1 ESG portfolio's descriptive statistics

5.2.1.1 Summary for the full period of 2006 to 2020

The two bottom percent based portfolios perform much better risk adjusted return than the two top based portfolio and the S&P 500 index. The two top based portfolio and the S&P 500 index exhibit a very similar level of risk adjusted return.
A more detailed descriptive statistics can be found in the appendix.

5.2.1.2 Review of the top and bottom percent ESG based portfolios

Measured by the Sharpe ratio, The bottom 10 based portfolio seems to have a higher Sharpe ratio compared to the top 10 based portfolio. But the bottom 10 based portfolio exhibits a higher Sharpe ratio only a little over half the times compared to the S&P 500 index.
The three Sharpe ratios time series can be observed in the figure below.

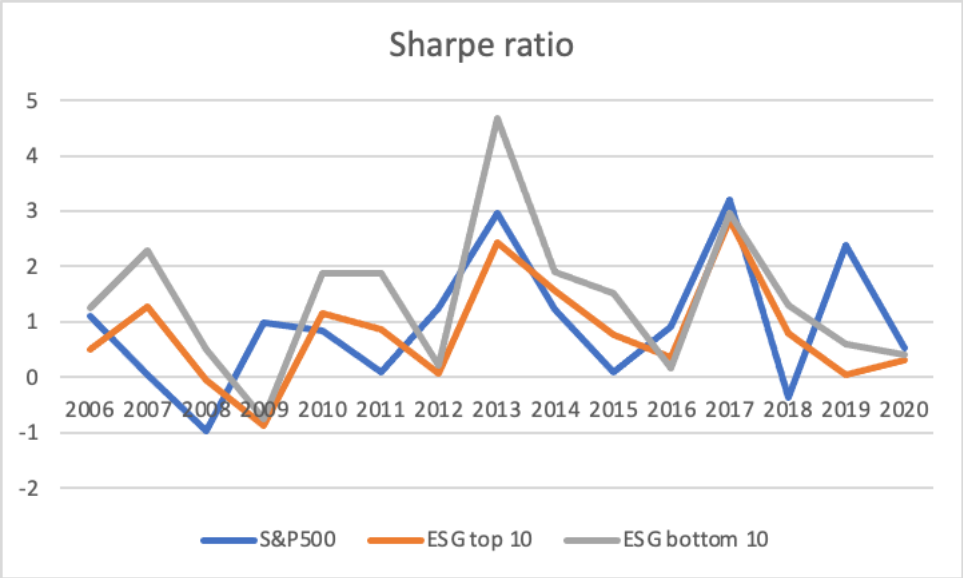

Figure 2. S&P 500, ESG top 10 and bottom 10 Shape ratio

A more detailed descriptive statistics can be found in the appendix.

Measured by the Sharpe ratio, The bottom 20 based portfolio seems to have a higher Sharpe ratio compared to the top 20 based portfolio. But the bottom 20 based portfolio has a higher Sharpe ratio only half of the time compared to the S&P 500 index. The top 20 based portfolio has a higher Sharpe ratio half of the time times compared to the S&P 500 index.

The three Sharpe ratios time series can be observed in the figure below.

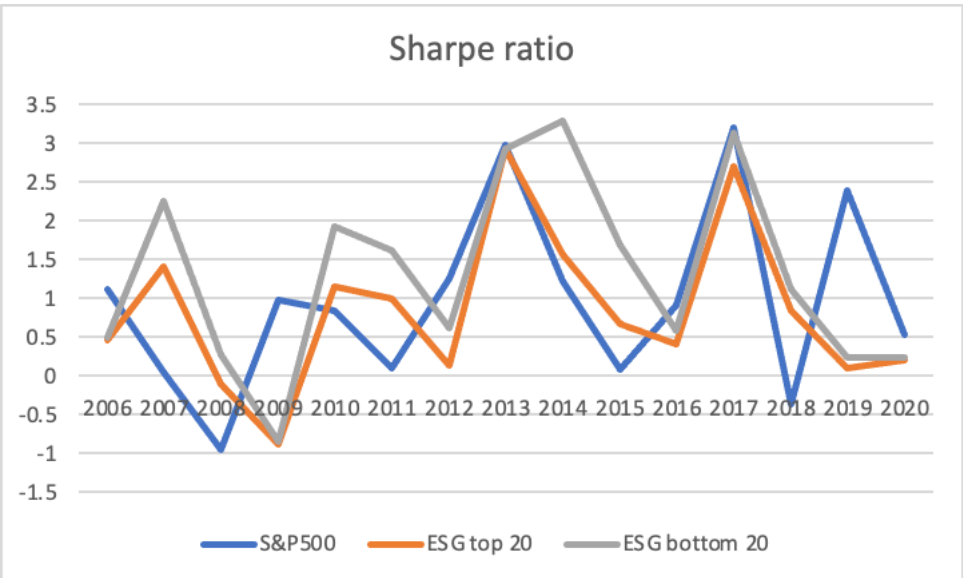

Figure 3. S&P 500, ESG top 20 and bottom 20 Shape ratio

A more detailed descriptive statistics can be found in the appendix.

5.2.2 Regression related conditions

As described in the regression related conditions executed paragraph in the ESG sub-categories analysis section, it is necessary to control that the Gauss-Markov assumptions are fulfilled for the four created top, bottom, 10 percent and 20 percent based portfolios. This supports that the discovered regression results are unbiased, efficient, consistent and normally distributed. The test details of the conducted control of the Gauss-Markov assumptions are available upon request. Based on these conducted tests, it is assumed that the Gauss-Markov assumptions are fulfilled for the four created top, bottom, 10 percent and 20 percent based portfolios.

5.2.3 Regression analysis

The result of the regression analysis of the four portfolios is documented in the table below.

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
ESG top 10%	0.0018 (0.0857)*	0.9654 (< 2e-16)***	-0.3088 (6.38e-11)***	0.0727 (0.1663)	-0.0092 (0.8866)	0.2686 (0.0004)***	-0.0847 (0.0019)***	0.9334
ESG top 20%	0.0017 (0.0277)**	0.9570 (< 2e-16)***	-0.2611 (2.5e-05)***	0.0529 (0.2501)	-0.0873 (0.1277)	0.2525 (0.0001)***	-0.0883 (0.0002)***	0.9486
ESG bottom 10%	0.0092 (1.36e-07)***	0.9143 (< 2e-16)***	0.0802 (0.3289)	-0.2223 (0.0230)**	0.0453 (0.7068)	-0.3027 (0.0303)**	-0.0964 (0.0543)*	0.817
ESG bottom 20%	0.0095 (9.38e-09)***	0.9343 (< 2e-16)***	0.1040 (0.1770)	-0.1744 (0.0562)*	0.0946 (0.4028)	-0.3196 (0.0147)**	-0.1016 (0.0306)**	0.843

***, **, * are indicating significance levels at 1%, 5%, 10%

Table 3. The regression analysis results

For the Top 10 and top 20 based portfolios, it is estimated that it was better to use the robust standard errors. As a result, the regression analysis summary becomes as documented in the table below. The used significance level is still at 5 percent.

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
ESG Top 10%	0.0017 (0.1421)	0.9654 (< 2.2e-16)***	-0.3088 (4.1e-09)***	0.0727 (0.2023)	-0.0092 (0.8729)	0.2686 (0.0088)***	-0.0847 (0.0051)***	0.9334
ESG Top 20%	0.0017 (0.0985)*	0.9570 (< 2.2e-16)***	-0.2611 (4.6e-07)***	0.0529 (0.3529)	-0.0873 (0.1340)	0.2525 (0.0137)**	-0.0883 (0.0035)***	0.9486
ESG Bottom 10%	0.0092 (1.3e-07)***	0.9143 (< 2e-16)***	0.0802 (0.3289)	-0.2223 (0.0230)**	0.0453 (0.7068)	-0.3027 (0.0303)**	-0.0964 (0.0543)*	0.817
ESG Bottom 20%	0.0095 (9.3e-09)***	0.9343 (< 2e-16)***	0.1040 (0.1770)	-0.1744 (0.0562)*	0.0946 (0.4028)	-0.3196 (0.0147)**	-0.1016 (0.0306)**	0.843

***, **, * are indicating significance levels at 1%, 5%, 10%

Table 4. The regression analysis results with robust standard errors

The top 10 and 20 based portfolios do not create any significant alpha, whereas the bottom 10 and 20 based portfolios generate a significant alpha. The alpha is a return that is not explained by the FF6F asset pricing model. This also indicate that the FF6F model is better at explaining the return of the top 10 and 20 based portfolios. This can also be observed through the coefficient of determination difference between the top and bottom based portfolios. In the theoretical review, the research conducted by Kempf et. al. showed a long-short strategy was able to generate significant alpha while Halbritter et.al. was not able to any significant difference. Halbritter et. al. were able to show that higher ESG scores did not have a significant effect on the return. This thesis's above obtained results are against the results of Kempf et. al. and in line with the results of Halbritter et. al. This thesis's results indicate that the low ESG score based portfolio is performing significantly better than the high ESG score based portfolio. (Kempf et. al. 2007) (Halbritter et. al. 2015)

All the portfolios show a high level of coefficient of determination, this indicates that the chosen FF6F asset pricing model has a high level of explanation power on their return.

All the portfolios are positively significantly exposed to the market factor, which is in line of the earlier findings of this thesis. The top based portfolios are negatively significantly exposed to the size factor, which indicates a high level of large corporation in both portfolios. The bottom 10 based portfolio is positively significantly exposed to the value factor, indicating that this portfolio has a larger amount of high book to market ratio corporations. This is in line with this thesis's earlier findings.

All the top based portfolios are significantly positively exposed to the investment factor, indicating that they have an overweight of conservatively investing companies. This is opposite with the bottom based portfolios, that are negatively significantly exposed to the investment factor. This indicate that they have an overweight of companies that are aggressively investing. All the portfolios except the bottom 10 based one are negatively exposed to the momentum factor. The three portfolios are having an overweight of corporations associated with loser stocks. Increasing the portfolio from top 10 to top 20, renders the alpha significant. This means that increasing the portfolio size creates an unexplained monthly excess return of 0.17%. Increasing the portfolio from bottom 10 to bottom 20, renders the value factor insignificant and makes the momentum factor significant. This indicate that the increase of constituents in the portfolio eliminates an overweight of low book to market ratio and get an overweight of companies associated with loser stocks.

As a summary, it can be stated that the hypothesis 1 is rejected as this thesis has not been able to show that high ESG rated portfolios perform better than low ESG rated portfolios. The hypothesis 2 is partially rejected, as no portfolio is exposed to the profitability factor while all the portfolios are exposed to the investment factors.

5.3 Yearly rebalanced ESG controversies portfolios analysis

In this part of the empirical analysis, top and bottom controversies based portfolios are created using a positive screening method as covered earlier in this document.

5.3.1 ESG controversies portfolio's statistics

5.3.1.1 Summary over the ESG controversies the full period of 2006 to 2020

The measured Sharpe ratio clarify that the two top percent based portfolios perform much better risk adjusted return than the two bottom based portfolio and the S&P 500 index. The top 10 portfolio perform even better than the top 20 based portfolio measured in terms of risk adjusted return. A more detailed descriptive statistics can be found in the appendix.

5.3.1.2 Detailed review of the top and bottom 10 percent based portfolios

Measured by the Sharpe ratio, The top 10 based portfolio has the higher Sharpe ratio most of the times compared to the bottom 10 based portfolio. But the top 10 based portfolio only has a higher Sharpe ratio half of the times compared to the S&P 500 index. The bottom 10 based portfolio has a higher Sharpe ratio less than half of the times compared to the S&P 500 index. In summary, The top 10 based portfolio can be said to be better performing measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.

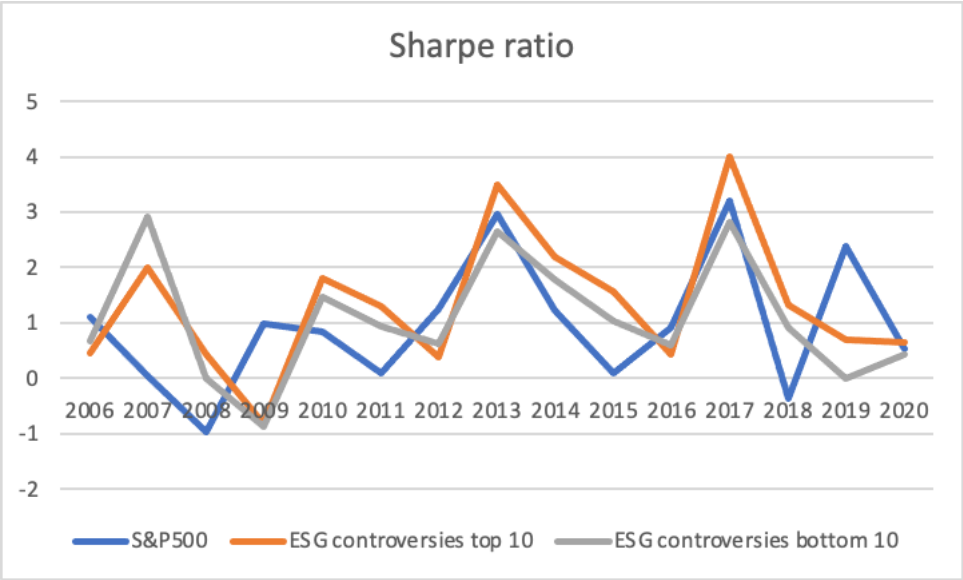

Figure 4. S&P 500, ESG controversies top 10 and bottom 10 Sharpe ratio

A more detailed descriptive statistics can be found in the appendix.

5.3.1.3 Detailed review of the top and bottom 20 percent based portfolios

Measured by the Sharpe ratio, the top 20 based portfolio has the higher Sharpe ratio more than half of the times compared to the bottom 20 based portfolio. But the top 20 based portfolio only has a higher Sharpe half of the times compared to the S&P 500 index. The top 20 based portfolio has a higher Sharpe ratio half of the times compared to the S&P 500 index. In summary, The top 20 based portfolio can be said to be better performing measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.

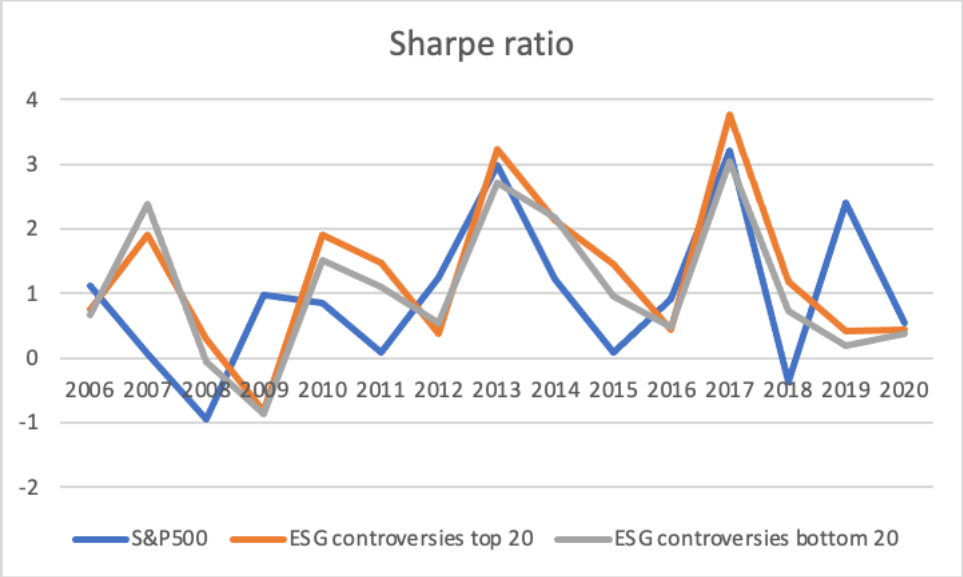

Figure 5. S&P 500, ESG controversies top 20 and bottom 20 Sharpe ratio

A more detailed descriptive statistics can be found in the appendix.

5.3.2 Regression related conditions

As the described in the regression related conditions executed paragraph in the ESG sub-categories analysis section, it is necessary to control that the Gauss-Markov assumptions are fulfilled for the four created ESG controversies top, bottom, 10 percent and 20 percent based portfolios. This supports that the discovered regression results are unbiased, efficient, consistent and normally distributed. In the appendix, test outputs of the conducted control of the Gauss-Markov assumptions can be found. Based on these conducted tests, it is assumed that the Gauss-Markov assumptions are fulfilled for the four created ESG controversies top, bottom, 10 percent and 20 percent based portfolios.

5.3.3 Regression analysis

The result of the regression analysis of the four portfolios is documented below.

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Controversies top 10%	**0.0056 (2.2e-06)*** **	**0.9502 (< 2e-16)*** **	**-0.0322 (0.5673)**	**-0.2592 (0.0001)*** **	**0.0417 (0.6145)**	**0.0310 (0.7447)**	**-0.0089 (0.7950)**	**0.8972**
Controversies top 20%	**0.0049 (5.1e-07)*** **	**0.9693 (< 2e-16)*** **	**0.0359 (0.4381)**	**-0.1227 (0.0260)** **	**0.1345 (0.0493)** **	**-0.0318 (0.6844)**	**-0.0526 (0.0626)* **	**0.9345**
Controversies bottom 10%	**0.0045 (4.1e-05)*** **	**1.0403 (< 2e-16)*** **	**-0.2803 (3.4e-07)*** **	**0.0558 (0.3729)**	**-0.0263 (0.7353)**	**0.1011 (0.2594)**	**-0.0723 (0.0255)** **	**0.9202**
Controversies bottom 20%	**0.0036 (2.2e-05)*** **	**1.0036 (< 2e-16)*** **	**-0.2698 (3.9e-10)*** **	**0.0274 (0.5680)**	**-0.0686 (0.2523)**	**0.0145 (0.0147)** **	**-0.0517 (0.0377)** **	**0.9472**

***, **, * are indicating significance levels at 1%, 5%, 10%

Table 5. The regression analysis results

For the controversies top 20 and bottom 20 based portfolios, it is estimated that it is better to use the robust standard errors discovered. As a result, the regression analysis summary becomes as documented in the table below. The used significance level is at 5 percent.

								R^2

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	0.8972
Controversies top 20%	0.0049 (7.6e-07)***	0.9693 (< 2.2e-16)***	0.0359 (0.4955)	-0.1227 (0.0331)**	0.1345 (0.1057)	-0.0318 (0.7514)	-0.0526 (0.2578)	0.9345
Controversies bottom 10%	0.0045 (4.1e-05)***	1.0403 (< 2e-16)***	-0.2803 (3.4e-07)***	0.0558 (0.3729)	-0.0263 (0.7353)	0.1011 (0.2594)	-0.0723 (0.0255)**	0.9202
Controversies bottom 20%	0.0036 (9.1e-05)***	1.0036 (< 2.2e-16)***	-0.2698 (8e-10)***	0.0274 (0.6265)	-0.0686 (0.1915)	0.0145 (0.0921)*	-0.0517 (0.0544)*	0.9472

***, **, * are indicating significance levels at 1%, 5%, 10%

Table 6. The regression analysis results with robust standard errors

All the portfolios are creating a significant alpha of approximately 0.5% for the top based portfolios and approximately 0.46% for the bottom 10% and the top 20% and 0.36% for the bottom 20%. The coefficient of determinations of the portfolios are quite similar and considered high. All the portfolios show a high level of coefficient of determination, this indicates that the chosen FF6F asset pricing model has a high level of explanation power on their return. All the portfolios are positively significantly exposed to the market factor. The top based portfolios are negatively significantly exposed to the value factor, which indicates a high concentration of low book to market ratio companies in both portfolios. The bottom based portfolios are negatively significantly exposed to the size factor, indicating that these portfolio has a larger amount of large corporations. The bottom 10% based portfolio is significantly negatively exposed to the momentum factor, indicating that they have an overweight of companies associated with a loser stock. Increasing the portfolio from top 10 to top 20, renders no significant change. Increasing the portfolio from bottom 10 to bottom 20, renders the momentum factor insignificant. This indicate that the portfolio eliminate an overweight of companies associated with a loser stock.

As a summary, it can be stated that the hypothesis 1 is rejected as this thesis is not able to show that high ESG controversies rated portfolios perform better than low ESG controversies rated portfolios. The hypothesis 2 is also rejected, as no portfolio is exposed to the profitability and investment factors.

6 Conclusion and discussion

In this chapter, a conclusion of this thesis is attempting to summarize the main findings of this conducted thesis research. Moreover, a discussion section is covering possible thesis outcomes if different decisions and assumptions in executing this thesis research would have been taken.

6.1 Conclusion

The purpose of this thesis is to research whether ESG rating affects the stock performance. This research area stems from the increasing interest to integrate ESG related ratings into the investment management process. The ESG ratings support the investor in understanding how the studied company performs in the three detailed areas. The ratings service providers use proprietary method to determine the individual corporation's ESG related ratings. This lack of standardization means that there are differences in the resulting ESG related ratings depending on which service provider is used. In this thesis, performance indicators of excess return, Sharpe ratio and alpha are used and the Fama and French six factors model is used as the reference asset pricing model. In previous research, The Carhart's four factor model and the Fama and French's three factors model are some of the most used asset pricing models. The decision of taking the newly published Fama and French's six factors model in use in this thesis, is to contribute with empirical research containing some of the latest development within the field of research. Some of the earlier research show that highly ESG rated companies outperform the market by producing abnormal excess return.

This thesis studies how the ESG rating affect the stock return by testing portfolios created using 15 years of historic data. In the first part of the empirical work, portfolios are created based on the 10 and 20 percent highest average ESG and its sub-categories ratings over the full time period of 15 years. All the created portfolios are heavily exposed to some of the biggest listed companies and it is often the same companies represented in the top three measured by market capitalization. This phenomenon seems to be due to

a high level of ESG reporting and a related high level of ESG transparency among these corporations. The ESG ratings are also potentially affected by the easily available ESG information among the biggest listed companies.

Only two of the 11 top 10 percent based portfolios carry an alpha, whereas 10 out of the 11 top 20 percent based portfolios carry an alpha. It seems that the top 20 percent based portfolios perform on average far more returns unexplained by the FF6F asset pricing model than the top 10 percent based ones. All of the 22 portfolios are significantly exposed to the market and size factor. This makes intuitively sense as the portfolios elements are members of the S&P500 index and the S&P500 index is largely composed of bigger corporations. There are 7 portfolios that are significantly exposed to both profitability and investment factors are ESG top 10, ESG top 20, innovations top 10, workforce top 10 and top 20, community top 20 and strategy top 20. So the research hypothesis 2 is partially rejected as there are only 7 portfolios listed above that have not rejected the stated hypothesis 3 and 16 of the portfolios rejected the stated hypothesis 3. The ESG top 10, innovations top 10, workforce top 10 and top 20, community top 20 and strategy top 20 based portfolios are significantly exposed to the criteria of profitability and investment. So for these portfolios, profitability and investment are contributing to explaining the excess return of the portfolios.

The research on the yearly rebalanced ESG rating based portfolios indicates that the ESG bottom 10 percent based portfolio is producing the higher average excess return in 13 out of the 15 years of the period 2006 to 2020 compared to the ESG top 10 percent based portfolio. The ESG bottom 10 and top 10 percent based portfolios are producing the higher average excess return in respective 10 and 8 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index. In 4 out of the 15 years' period, the S&P 500 index is producing a higher excess return than both the bottom and top 10 percent based portfolios. On top of these four periods, the S&P 500 index is producing a higher excess return than the top 10 percent based portfolio but not the top 10 percent based portfolio during 2 periods. The standard deviation of the top 10 percent based portfolio

is lower than the bottom 10 percent based portfolio in 14 out 15 years. Furthermore, the top 10 percent based portfolio has a smaller standard deviation than the S&P 500 index in 6 out of the 15 years. Measured by the Sharpe ratio, The bottom 10 based portfolio has the higher Sharpe ratio 14 out of 15 times compared to the top 10 based portfolio. But the bottom 10 based portfolio only has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index. The top 10 based portfolio has a higher Sharpe ratio 6 out of 15 times compared to the S&P 500 index.

In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 10 percent based portfolios. On top of that, the S&P 500 index has a higher Sharpe ratio than the ESG top 10 percent based portfolio but not the ESG bottom 10 percent based portfolio 3 years out of the 9 years period. In summary, The bottom 10 based portfolio, in line with the findings across the whole research time period of 2006 to 2020, can be said to be better performing measured by the Sharpe ratio. The top 10 and 20 based portfolios do not create any significant alpha, whereas the bottom 10 and 20 based portfolios generate a significant alpha. As a summary of this research, it can be stated that the hypothesis 1 is rejected as this thesis has not been able to show that high ESG rated portfolios perform better than low ESG rated portfolios. The hypothesis 2 is partially rejected, as no portfolio is exposed to the profitability factor while all the portfolios are exposed to the investment factors.

The research on the yearly rebalanced ESG controversies rating based portfolios indicates that the ESG controversies top 10 percent based portfolio is producing the higher average excess return in 11 out of the 15 years of the period 2006 to 2020 compared to the ESG bottom 10 percent based portfolio. The ESG controversies top 10 and bottom 10 percent based portfolios are producing the higher average excess return in respective 10 and 8 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index. In 5 out of the 15 years' period, the S&P 500 index is producing the higher excess return than both the bottom and top 10 percent based portfolios. On top of these five periods,

the S&P 500 index is producing the higher excess return than the bottom 10 percent based portfolio but not the top 10 percent based portfolio during 2 periods.

The standard deviation of the top 10 percent based portfolio is higher than the bottom 10 percent based portfolio in 9 out 15 years. Furthermore, the top 10 percent based portfolio has a higher standard deviation than the S&P 500 index in 13 out of the 15 years. Measured by the Sharpe ratio, The top 10 based portfolio has the higher Sharpe ratio 11 out of 15 times compared to the bottom 10 based portfolio. But the top 10 based portfolio only has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index. The bottom 10 based portfolio has a higher Sharpe ratio 6 out of 15 times compared to the S&P 500 index. In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 10 percent based portfolios. On top of that, the S&P 500 index has a higher Sharpe ratio than the ESG top 10 percent based portfolio but not the ESG bottom 10 percent based portfolio 3 years out of the 9 years period. In summary, The top 10 based portfolio, in line with the findings across the whole research time period of 2006 to 2020, can be said to be better performing measured by the Sharpe ratio.

The ESG controversies top 20 percent based portfolio is producing a higher average excess return in 11 out of the 15 years of the period 2006 to 2020 compared to the ESG controversies bottom 20 percent based portfolio. The ESG controversies bottom 20 and top 20 percent based portfolios are producing a higher average excess return in respective 8 and 7 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index. In 7 out of the 15 years' period, the S&P 500 index is producing the higher excess return than both the bottom and top 20 percent based portfolios. On top of these 7 periods, the S&P 500 index is producing a higher excess return than the bottom 20 percent based portfolio but not the top 20 percent based portfolio during 1 period. Measured by the Sharpe ratio, the top 20 based portfolio has the higher Sharpe ratio 10 out of 15 times compared to the bottom 20 based portfolio and the top 20 based portfolio has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index.

The top 20 based portfolio has a higher Sharpe ratio 7 out of 15 times compared to the S&P 500 index. In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 20 percent based portfolios. In summary, The top 20 based portfolio, in line with the findings across the whole research time period of 2006 to 2020, can be said to be better performing measured by the Sharpe ratio. All the portfolios are creating a significant alpha of approximately 0.5% for the top based portfolios and approximately 0.46% for the bottom 10% and 0.36% for the bottom 20%. The coefficient of determinations of the portfolios are quite similar and considered high. The above results indicate that the high controversies score based portfolio is performing significantly better than the low controversies score based portfolio. As a summary, it can be stated that the hypothesis 1 is rejected as this thesis has not been able to show that high ESG controversies rated portfolios perform better than low ESG controversies rated portfolios. The hypothesis 2 is also rejected, as no portfolio is exposed to the profitability and investment factors.

An overall conclusion of this thesis would be that the ESG rating is affecting the stock's performance positively as high ESG rated stock perform better than the market measured by average excess return and Sharpe ratio. Specifically, the high rated stocks perform better than the market measured by Sharpe ratio while the low rated stocks perform better than the market measured by excess return. Furthermore, the low rated stocks perform better than the high rated stocks measured by excess return but not by Sharpe ratio. This finding is surprising as it is contrary to the research results achieved by NYU Stern Center for sustainable Business, Lu et al., Akben-Selçuk and Clark et. al. (NYU Stern Center for Sustainable Business. 2020; Lu et. al. 2016; Akben-Selçuk. 2019; Clark et. al. 2014). A further conclusion of this thesis is that the ESG controversies rating is affecting the stock's performance positively as highly ESG controversies rated stock perform better than the market measured by average excess return and Sharpe ratio. Furthermore, the highly rated stocks perform better than the low rated stocks measured by excess return and Sharpe ratio. The results achieved in this thesis research is in line

with the research conducted by Borgers et. al. as well as the research conducted by Halbritter et. al. A practical implication of the outcome of this thesis is that SRI related analysis of potential investment objects are recommended to consider both the ESG and the Controversy ratings. These two ratings are complementary and would help the investor discover a richer picture of the potential investment object. (Borgers et. al. 2013; Halbritter et. al. 2015)

6.2 Discussion

This thesis is undertaking to research the performance of created portfolios based on ESG rating. The goal was to study how the ESG rating affect the stock's performance. The reached research outcome are limited by the research scoping decisions made early in the research process. The introduced limitations have supported the decrease of the research landscape towards an area that seemed mostly relevant to the undertaken research. It is at this stage, interesting to reflect back and wonder how the thesis outcome could have been if those limitations were not introduced. It is thus interesting to visit other methods and choices that could have been made and how these would have affecting the thesis outcome. Decision was made to concentrate on a certain asset class and market and to concentrate on only a part of the selected market with regards to the sample data collection. It would be useful to compare this thesis result with results that would have been achieved in concentrating on other markets and other assets. An example of choice would be to look at the UK market, as ESG has an advanced implementation of ESG reporting. This is supported by the research conducted by Brzeszczyski et. al. that indicate that portfolios created based on British ESG ratings perform better than the overall UK stock market (Brzeszczyski. 2014). Some market such as emerging markets would have given an opposite problem as there is less ESG reporting happening in that geographical region. As an example, Refinitiv Thomson Reuters Eikon has only started covering the stock index MSCI Emerging Market in 2011 (Refinitiv Thomson Reuters Eikon. 2021). The research of the emerging market would be probably be very interesting project and render interesting results.

The limitation to concentrate on researching the stock as an asset represents in itself an exclusion of many ethical and sustainable investment objects that in turn also has affected this thesis's result. It would have been possible to look at the so-called green bonds, sustainable real estate, renewable energy project. These assets represent diversifying additions to any created portfolio and would potentially result into an improved Sharpe ratio. By adding other us stock market based indexes to the studied S&P 500 index, the thesis would benefit with a larger data sample and limit the bigger company bias that the present research result contains. The Fama and French six factors model is based on both small and large corporation's data from all the US based stock markets. This could potentially affected the conclusion of this thesis. Unfortunately, the Refinitiv Thomson Reuters Eikon database has only introduced more US based indexes in the last 10 years.

The decision to use of Refinitiv Thomson Reuters Eikon database has also excluded other ESG rating providers. According to the research conducted by Halbritter et. al., the discovered alphas resulting from high ESG rated portfolios are different depending on the ESG rating service provider. This has the potential of drawing different conclusions depending on the chosen ESG rating service provider. Finally, the Fama and French's six factors model was used a reference asset pricing model with the goal of testing for the profitability and investment factors. Alternative results might have been reached if the other asset pricing models such as Carhart's four factor model or Fama and French's three factors model were used. (Halbritter et. al. 2015)

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Appendices

Appendix 1. Category Scores details

Score	Definition
Resource Use	The Resource Use Score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management
Emissions	The Emission Reduction Score measures a company's commitment and effectiveness towards reducing environmental emissions in the production and operational processes.
Innovation	The Innovation Score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.
Workforce	The Workforce Score measures a company's effectiveness towards job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.
Human rights	The Human Rights Score measures a company's effectiveness towards respecting the fundamental human rights conventions.
Community	The Community Score measures the company's commitment towards being a good citizen, protecting public health and respecting business ethics.
Product Responsibility	The Product Responsibility Score reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy.
Management	The Management Score measures a company's commitment and effectiveness towards following best practice corporate governance principles.

Shareholders	The Shareholders Score measures a company's effectiveness towards equal treatment of shareholders and the use of antitakeover devices.
CSR strategy	The CSR Strategy Score reflects a company's practices to communicate that it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes.

Appendix 2. Controversy scores details

Controversy	description
Anti-Competition	Number of controversies published in the media linked to anticompetitive behavior (e.g., antitrust and monopoly), price-fixing or kickbacks
Business Ethics	Number of controversies published in the media linked to business ethics in general, political contributions or bribery and corruption
Intellectual Property	Number of controversies published in the media linked to patents and intellectual property infringements
Critical Countries	Number of controversies published in the media linked to activities in critical, undemocratic countries that do not respect fundamental human rights principles
Public Health	Number of controversies published in the media linked to public health or industrial accidents harming the health and safety of third parties
Tax Fraud	Number of controversies published in the media linked to tax fraud, parallel imports or money laundering
Child Labor	Number of controversies published in the media linked to use of child labor issues
Human Rights	Number of controversies published in the media linked to human rights issues
Mgt Compensation	Number of controversies published in the media linked to high executive or board compensation
Consumer	Number of controversies published in the media linked to consumer complaints or dissatisfaction directly linked to the company's products or services

Customer Health & Safety	Number of controversies published in the media linked to customer Health & Safety health and safety
Privacy	Number of controversies published in the media linked to employee or customer privacy and integrity
Product Access	Number of controversies published in the media linked to product access
Responsible Marketing	Number of controversies published in the media linked to the company's marketing practices, such as over-marketing of unhealthy food to vulnerable consumers
Responsible R&D	Number of controversies published in the media linked to responsible R&D
Environmental	Number of controversies related to the environmental impact of the company's operations on natural resources or local communities
Accounting	Number of controversies published in the media linked to aggressive or nontransparent accounting issues
Insider Dealings	Number of controversies published in the media linked to insider dealings and other share price manipulations
Shareholder Rights	Number of controversies published in the media linked to shareholder rights infringements
Diversity and Opportunity	Number of controversies published in the media linked to workforce diversity and opportunity
Employee Health & Safety	Number of controversies published in the media linked to workforce health and safety
Wages or Working Condition	Number of controversies published in the media linked to the company's relations with employees or relating to wages or wage disputes

Manage-ment De-partures	Has an important executive management team member or a key team member announced a voluntary departure (other than for retirement) or been ousted?

Appendix 3. Details of the factors of the asset pricing model

To increase the reader's understanding of the sorting process, The factors and their components, resulting of the 2x3 sorting, are given in more details below.

According to the research conducted by Fama and French, the asset pricing model factors other than the market factor can be created in at least three different ways. The first one is to use a 2x2 sorting, where each of the factors are distributed according to the NYSE median as a breakpoint. The second is to use a 2x3 sorting, where the size factor is distributed according to the NYSE median as a breakpoint and the value, profitability, investment, and momentum factors are put into three groups according to 30th and 70th NYSE percentiles as breakpoints. The final one is to use a 2x2x2x2 sorting, where the shares are distributed according to the NYSE median as a breakpoint into two size-based groups, two value-based groups, two profitability-based groups, two investment-based groups, and two momentum-based groups. Research finds that the 2x3 sorting yields as good result as the 2x2 and 2x2x2x2 sorting. (Fama et. al. 2015) (Fama et. al. 2018)

The size factor is given by the average return of nine small portfolios minus the by the average return of nine big portfolios. It can be calculated using the following formulas:

$$smb_{value} = \frac{small\ high + small\ neutral + small\ low}{3} - \frac{big\ high + big\ neutral + big\ low}{3}$$

$$smb_{profitability} = \frac{small\ robust + small\ neutral + small\ weak}{3} - \frac{big\ robust + big\ neutral + big\ weak}{3}$$

$$smb_{investment} = \frac{small\ conservative + small\ neutral + small\ agressive}{3} - \frac{big\ agressive + big\ neutral + big\ agressive}{3}$$

$$smb_{momentum} = \frac{small\ losers + small\ neutral + small\ winners}{3} - \frac{big\ losers + big\ neutral + big\ winners}{3}$$

$$smb = \frac{smb_{value} + smb_{profitability} + smb_{investment} + smb_{momentum}}{3}$$

The value factor is given by the average return of two high portfolios minus the average return of two low portfolios. It can be calculated using the following formulas:

$$hml = \frac{small\ high + big\ high}{2} - \frac{small\ low + big\ low}{2}$$

The profitability factor is given by the average return of two robust portfolios minus the average return of two weak portfolios. It can be calculated using the following formulas:

$$rmw = \frac{small\ robut + big\ robust}{2} - \frac{small\ weak + big\ weak}{2}$$

The investment factor is given by the average return of two conservative portfolios minus the average return of two aggressive portfolios. It can be calculated using the following formulas:

$$cma = \frac{small\ conservative + big\ conservative}{2} - \frac{small\ aggressive\ + big\ aggressive}{2}$$

The momentum factor is given by the average return of two winner portfolios minus the average return of two looser portfolios. It can be calculated using the following formulas:

$$wml = \frac{small\ winner + big\ winner}{2} - \frac{small\ looser\ + big\ looser}{2}$$

(Fama et. al. 2015) (Fama et. al. 2018)

Appendix 4. Details of the portfolio return data and standard deviation

The dataset available for the work conducted in this thesis contains daily stock prices of each of the corporations included in the dataset is detailed below.

The company's daily return is obtained by the following formula:

$$daily\ return = \frac{stock\ price\ at\ time\ t + 1 - stock\ price\ at\ time\ t}{stock\ price\ at\ time\ t}$$

The collected factors from the Kenneth French's database are based on a monthly time frame. This makes it necessary to determine the corporation's return on a monthly basis as well. The company's monthly return is obtained by the following formula:

$$monthly\ return = (1 + \ daily\ return)^{number\ of\ monthly\ trading\ days} - 1$$

The number of trading can be determined through logical calculations. There are 365 days on average per year, 5/7 working days per week, 6 weekdays holidays, 3 fixed date holidays. (NYSE holidays. 2021)

The yearly average number of trading days is thus given by the following formula:

$$yearly\ trading\ days = 365 \times {}^{5}/_{7} - 6 - 3 \times {}^{5}/_{7} = 252$$

And the average monthly trading days is then estimated to be 21 days.

The value-weighted portfolio's average monthly return is determined by the sum of the value-weighted return of each stock in the portfolio. The corresponding formula is given below:

$$portfolio\ return = \sum stock\ weight \times stock\ return$$

In the case that a company does not have a return because it is traded only part of the studied time-period, it will not have an impact on the portfolio's return.

In order to determine the portfolio's Sharpe ratio, it is necessary to discover the portfolio's standard deviation. The standard deviation of the portfolio is estimated with the support of the sample dataset's covariance matrix. The covariance matrix C contains the information of the covariance between the stocks contained in the portfolio. Assuming that there are N observation of a vector $X = (X_1, X_2, \dots, X_P)^T$, then the sample covariance is defined as follows:

$$C = \frac{1}{N-1}\sum_{t=1}^{N}(X_t - \bar{X}) \times (X_t - \bar{X})^T$$

where $\bar{X} = \frac{1}{N}\sum_{t=1}^{N} X_t$

There is a challenge with estimating the covariance matrix C as some stock data is not available for the whole study time-period.

A possible solution to this challenge could be to shorten the measured time-period to be equal to the period of the stock with the shortest time-period. This solution poses the challenge that a lot of valuable data would be excluded from this research. An alternative solution would be to estimate the average return based on the available dataset information and use that in all the datapoints where returns are missing. The resulting covariance matrix would be at risk of being weakened and unsatisfactory for the purpose of this thesis research. This is because there is a risk of introducing additional bias when extra return data is added for a stock at a certain point in time where the stock does not really exhibit any return. (Little et. al. 2002)

In order to minimize any possible introduced bias, the portfolio's average return for the measured month is used where stock return data is missing instead of the average return based on the available dataset information. The logic for this action is that whether the particular stock data is added or not, the portfolio will continue to exhibit that same return. The result of this activity is that the standard deviation for the period where the stock does not have a return would be considered zero. Furthermore, the added return data is not increasing or decreasing the portfolio's return. This method risks of introducing a bias in the discovered Sharpe ratios as the estimated portfolio standard deviation has the risk of ending up lower than the actual one due to these above-described additions. This would result into a Sharpe ratio that is slightly higher than the expected value. (Little et. al. 2002)

The daily covariance matrix is estimated using the daily stock return and the formula defined above. The portfolio's daily variance is given by the following formula:

$$\sigma^2_{portfolio,daily} = w\Sigma w^T$$

where w is the vector of stock weights in the portfolio and Σ is the covariance matrix of the daily stock returns.

The yearly and monthly standard deviation is then estimated as follows:

$$\sigma_{Portfoiio,monthly} = \sqrt{\sigma^2_{portfolio,daily}} \times \sqrt{21}$$

and

$$\sigma_{Portfoiio,yearly} = \sqrt{\sigma^2_{portfolio,daily}} \times \sqrt{252}$$

or

$$\sigma_{Portfoiio,yearly} = \sqrt{\sigma^2_{portfolio,monthly}} \times \sqrt{12}$$

Appendix 5: Data testing methodology details

The data testing is done using the time series regression model given earlier by the following formula described below:

$$R_{it} - R_{ft} = \alpha_i + \beta_i Mkt_t + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + m_i WML_t + e_{it}$$

The OLS regression and the Gauss-Markov assumptions

The OLS regression analysis helps estimate the coefficients α_i, β_i, s_i, h_i, r_i, c_i, m_i and the error term e_{it}. The OLS regression analysis method is seeking to minimize the sum of the squared difference between the observed and the expected value. Or in other words, seeks to minimize the error term of the regression analysis. The OLS regression method is one of the most used regression analysis method within the economical science research community. This thesis is using OLS regression analysis as a tool to test

the estimated portfolio's returns. The parameter results of the OLS regression model are considered unbiased, efficient, consistent, and normally distributed when the Gauss-Markov assumptions are fulfilled. The Gauss-Markov assumptions are linearity, no perfect collinearity, zero conditional mean, Homoskedasticity, no serial collinearity. These assumptions are covered in more details below. (Wooldridge. 2016)

Linearity

Linearity means that there is a linear relationship between the dependent and independents variables. No perfect collinearity means that in the dataset, none of the independent variables is constant and there is no exact linear relationship between the independent variables. Zero conditional mean means that the error terms have an expected value of zero. Homoskedasticity means that the variance of the error terms are homoskedastic or the variance is constant over many different observations. No serial collinearity means that the errors in two different time periods are uncorrelated. (Wooldridge. 2016)

In this thesis, the dependent variables the portfolios' returns as well as the independent variables need to be tested against the Gauss-Markov assumptions. The fulfillment of the assumptions is increasing the robustness of the results of the conducted OLS regression analysis. The conducted regression tests are evaluated at a five percent significance level, as this is one of the most used significance level in the financial research. In the following text below, each assumption related test is described in more details.

Linearity means that there is a linear relationship between the dependent and independents variables. This assumption is tested by using the Line Fit plotting. Through observation of the plots, it is possible to assess if there is a linear relationship between the dependent variable and each of the independent variables. (Wooldridge. 2016)

No perfect collinearity

No perfect collinearity means that in the dataset, none of the independent variables are constant and there is no exact linear relationship between the independent variables.

The presence of perfect collinearity tends to result into relatively large standard errors for the estimated regression coefficients. It is thus necessary to discover the pair wise correlation between the independent variables. A further analysis of the collinearity can be done by determining the Variance Inflation Factor (VIF). The VIF can take values from 1 up to a large number. In the case of no correlation, the VIF takes the value of 1. The threshold of VIF equal to 10 is considered critical and any value of VIF above 10 indicates that multicollinearity should be considered a problem with the present set of specification and data. (Wooldridge. 2016)

Zero conditional mean

Zero conditional mean means that the error term has an expected value of zero. This assumption is tested by using the residual values against the fitted values plotting. Through observation of the plotting, it is possible to assess the residuals plotting and determine whether the residual plotting is close to the value of zero. If the plotting is close to zero, it can be assumed that the average value of the residual is zero and that the zero conditional assumption is fulfilled. Determining the mean of the residuals is a complementary method to support the assessment of whether the residuals are close to the value of zero. (Wooldridge. 2016)

Homoskedasticity

Homoskedasticity means that the variance of the error term is homoskedastic or the variance is constant over different observations. This assumption is tested by using the residual values up against the independent variables plotting. If the variance of the error term is constant, the observed plotting would be close to the middle line. This would give an indication that the distribution of the residual is constant over time and not increasing with the increase of the independent variables. Identifying the presence of heteroskedasticity by observing plots can be difficult and the use of statistical testing can be helpful. The Breusch-Pagan test is used to test whether the error term exhibit heteroskedasticity. The null hypothesis of the Breusch-Pagan test is that the variance of the error term is constant, and the test is conducted with a five percent significance level. If the

null hypothesis is rejected, then it cannot be rejected that error term exhibits heteroskedasticity. If the Breusch-Pagan test indicates that the error term might exhibit heteroskedasticity, then that indicates a potential harmful bias and inconsistency in the standard errors of the estimated parameters. To mitigate the harmful effect of the presence of heteroskedasticity, it is recommended to use a standard error estimator that is robust to heteroskedasticity when using regression analysis models. The heteroskedastic robust standard errors are used to estimate new t-statistics and the corresponding p-value. It is important to remember that the presence of heteroskedasticity only affect the standard errors, the OLS estimators of the population parameters remain unbiased and consistent. (Wooldridge. 2016)

No serial collinearity

No serial collinearity means that the error terms in two different time periods are uncorrelated. In the case of serial collinearity, the standard errors become biased. The bias typically affects the statistical significance testing. One common test for detecting serial collinearity in the error terms is the Breusch-Godfrey test (BG test). The null hypothesis of the BG test is that there is no serial collinearity, and the result is typically measured at a five percent significance level. If the null hypothesis is rejected, then it cannot be rejected that there is serial collinearity in the error terms. (Wooldridge. 2016)

Newey et. al. has developed a method that makes it possible to use OLS regression model and then correct the standard error for serial collinearity by using serial correlation-robust standard errors. These serial correlation-robust standard errors are also called Heteroskedasticity and Auto correlation Consistent standard errors (HAC standard errors). This thesis is using the method developed by Newey et. al. to mitigate the challenge introduced by any identified risk of serial collinearity and HAC standard errors are used when discovering potential serial collinearity risks. (Newey et. al. 1987) (Wooldridge. 2016)

Normally distributed error term

The use of OLS based regression does not need the error term to be normally distributed to produce unbiased estimates when the data sample used is adequately large. As there

are no clear breakpoint when a small sample size becomes a big sample, this thesis checks whether the error terms are normally distribution. Furthermore, if the error terms are normally distributed, the exact calculation of the t-test and F-test values is easier. (Wooldridge. 2016)

The check error term normality is done by comparing the error term distributions against a normal distribution using a Quantile-Quantile plot (QQ plotting). If the error term distribution is normal, then the points of the QQ plot should approximately lie on a straight line. (Hocking. 2013)

It is also possible to execute a statistical significance test to discover whether the error term distributions are considered normal. Shapiro-Wilk test (WK test) is considered one of the best performing normality tests (Le Boedec. 2016). The null hypothesis of the WK test is that the error term distributions are normal. The null hypothesis is rejected if the p-value is below the significance level of 5 percent and the error term distributions cannot be considered normal.

The coefficient of determination R2

In this research, the coefficient of determination R^2 of the regressions are determined. The R^2, that is a number between 0 and 1, informs of the level the variation of the independent variables are able to explain the variation of the dependent variable. In other words, the R^2 indicates how well the model fit the dataset available. (Wooldridge. 2016)

Appendix 6. ESG and sub-categories analysis details

In the tables below, the amount of biggest companies in the portfolio and the percentage of the total group of biggest companies is documented.

ESG top 10	ESG top 20	Resource top 10	Resource top 20	Emission top 10	Emission top 20
16 companies	23 companies	13 companies	23 companies	12 companies	18 companies

16 out of 32 = 50%	23 out of 32 = 72%	13 out of 32 = 40%	23 out of 32 = 72%	12 out of 32 = 38%	18 out of 32 = 57%

The amount and percentage of biggest companies in the portfolio (part 1)

Innovation top 10	Innovation top 20	Workforce top 10	Workforce top 20	Human rights top 10	Human rights top 20
7 companies	18 companies	11 companies	21 companies	13 companies	19 companies
7 out of 32 = 22%	18 out of 32 = 57%	11 out of 32 = 35%	21 out of 32 = 66%	13 out of 32 = 40%	19 out of 32 = 60%

The amount and percentage of biggest companies in the portfolio (part 2)

Community top 10	Community top 20	Product top 10	Product top 20	Manage-ment top 10	Manage-ment top 20
9 companies	15 companies	10 companies	15 companies	7 companies	12 companies
9 out of 32 = 28%	15 out of 32 = 47%	10 out of 32 = 32%	15 out of 32 = 47%	7 out of 32 = 22%	12 out of 32 = 38%

The amount and percentage of biggest companies in the portfolio (part 3)

Shareholder top 10	Shareholder top 20	Strategy top 10	Strategy top 20
5 companies	10 companies	12 companies	19 companies
5 out of 32 = 16%	10 out of 32 =32%	12 out of 32 = 38%	19 out of 32 = 60%

The amount and percentage of biggest companies in the portfolio (part 4)

The resource, emission, innovation, workforce, human rights and strategy based portfolios are containing considerable amount of the biggest companies. The community and product based portfolios are containing relatively many of the biggest companies. The management and shareholder portfolios can be considered to contain a lesser amount of the biggest companies.

Appendix 7. ESG and sub-categories portfolios descriptive details

The descriptive statistics of the full set of created portfolios are documented in the tables below. The data calculated is the average return, the average excess return, the variance, the standard deviation, the Sharpe ratio, the skewness and the kurtosis that these portfolios represent on an average yearly basis.

	S&P500 yearly	ESG top 10 yearly	resource top 10 yearly	emissions top 10 yearly	innovations top 10 yearly	workforce top 10 yearly	human rights top 10 yearly	community top 10 yearly	product top 10 yearly	management top 10 yearly	shareholders top 10 yearly	strategy top 10 yearly
portfolio return	0.1138	0.0916	0.13016	0.106862	0.0891477	0.10411	0.094998203	0.1176443	0.1016	0.108182672	0.169635342	0.08776
portfolio excess return	0.1026	0.0804	0.11894	0.095642	0.0779277	0.09289	0.083778203	0.1064243	0.0904	0.096962672	0.158415342	0.07654
variance	0.0394	0.0174	0.01847	0.020493	0.02712965	0.013147	0.014080784	0.0265828	0.0157	0.018808855	0.023293297	0.01685
standard deviation	0.1766	0.1321	0.13592	0.143155	0.16471081	0.114659	0.11866248	0.1630423	0.1252	0.13714538	0.152621416	0.12981
kurtosis	2.7875	2.8115	4.42471	2.295619	1.9787547	3.481925	3.473574896	1.8308848	2.6925	2.630687423	2.162170846	2.92505
skewness	-0.2530	-1.0323	-1.5957	-1.050467	-0.4829375	-1.453586	-1.38734309	-0.9298503	-1.0594	-1.474326217	-1.07257957	-1.139
Sharpe ratio	0.5809	0.6085	0.87507	0.668103	0.47311834	0.810136	0.706020998	0.6527404	0.7222	0.70700648	1.037962735	0.58961

Descriptive statistics of the top 10 based portfolios

	S&P500 yearly	ESG top 20 yearly	resource top 20 yearly	emissions top 20 yearly	innovations top 20 yearly	workforce top 20 yearly	human rights top 20 yearly	community top 20 yearly	product top 20 yearly	management top 20 yearly	shareholders top 20 yearly	strategy top 20 yearly
portfolio return	0.1138	0.1002	0.12009	0.109603	0.10732367	0.109362	0.122190647	0.1085618	0.1022	0.105372426	0.169738149	0.09398
portfolio excess return	0.1026	0.0890	0.10887	0.098383	0.09610367	0.098142	0.110970647	0.0973418	0.091	0.094152426	0.158518149	0.08276
variance	0.0394	0.0178	0.01824	0.021559	0.0208391	0.015969	0.016220905	0.0243589	0.0186	0.018491107	0.02166786	0.0161
standard deviation	0.1766	0.1334	0.13507	0.14683	0.14435755	0.126368	0.127361317	0.1560735	0.1362	0.135982011	0.147200066	0.1269
kurtosis	2.7875	2.2765	3.81392	2.350128	2.5541253	3.732213	3.798149876	1.4381487	2.5367	3.164639779	2.391152775	3.51721
skewness	-0.2530	-1.0528	-1.5174	-1.053442	-0.9562708	-1.433415	-1.48246414	-0.8899665	-1.0456	-1.447746457	-1.1169284	-1.3111
Sharpe ratio	0.5809	0.6671	0.806	0.670047	0.6657336	0.776637	0.871305746	0.623692	0.6679	0.692388828	1.076889113	0.65215

Descriptive statistics of the top 20 based portfolios

Analysis of the sub-category generated portfolios

During the analyzed period of 2006 to 2020, an investment in the S&P 500 would have generated an average yearly excess return of 10.26 percent with a standard deviation of 17.66 percent. In comparison, the ESG portfolio with top 10 percent and top 20 percent would have respectively generated a lower yearly excess return of 8.04 and 8.09 percent with lower standard deviations of 13.21 and 13.34 percent. This would have a resulted in a higher average Sharpe ratio of 0.6085 and 0.6671 for the ESG portfolio with top 10 percent and top 20 percent compared to the S&P 500 with 0.5809. Increasing the selection to top 20 percent, seems to increase the excess return with 10 percent and the standard deviation with 1 percent. This can increase can also be observed with the 9 percent improvement of the Sharpe ratio from 0.6085 to 0.6671.

The analysis of the sub-category generated portfolios seems to be in line with the above findings. All the sub-category generated portfolios, except for the shareholders top 10, shareholders top 20 and community top 10 would have delivered less excess return than the S&P500 index based portfolio. The top three worst performing portfolios measured by excess return are the strategy top 10 with 7.65 percent, the innovations top 10 with 7.78 percent and the human rights top 10 with 8.38 percent. When the Sharpe ratio is considered, top three worst performing portfolios are the innovations top 10 with 0.4731, the strategy top 10 with 0.5896 and the community top 10 with 0.6527. The worst three portfolios based on excess return and the worst three portfolios based on Sharpe ratio are different because the innovations top 10 portfolio's standard deviation decreases with 13% while the excess return decreases with 32% compared with the S&P500 index based portfolio. This is in contrast to the strategy top 10 based portfolio's standard deviation decrease with 36% while the excess return decrease with 34%. Measured by Sharpe ratio, only the innovations top 10 with 0.47 would have performed worse than a S&P500 index based portfolio with 0.58. This seems to indicate that except for the innovations top 10 percent based portfolio, that the S&P500 index generate a worse risk-adjusted return.

The discovered skewness measured on the average monthly excess return of each portfolio. The most symmetric of the created portfolios is the innovations top 10 with -0.4829. The S&P500 index based portfolio has a skewness of -0.253 and thus the most symmetric of all. All the created portfolios have a negative skewness ranging from -0.4829 to -1.5957. This indicates that investors would incur frequent small positive returns and a few large negative returns if investing in these portfolios.

The measured kurtosis is between 4.4247 for the resource top 10 portfolio and 1.4381 for the community top 20 based portfolio and indicate that all there are portfolios with a negative excess as well as positive excess kurtosis. The majority of the portfolios have a negative excess kurtosis. This is an indication that the distribution of the portfolios are having thinner tails on either side. These thinner tails indicate small outliers in the portfolio's excess return distribution. This indicate that there are smaller chances that the

portfolios would experience extreme returns and is thus considered less risky. The portfolios with positive excess kurtosis are the resource top 10, the workforce top 10 & top 20, human rights top 10 & top 20 and the management top 20. These portfolios are in contrast considered risky as the distribution of the thicker tails and indicate larger outliers.

When increasing from top 10 percent to top 20 percent, it can be observed that the majority of the portfolios would experience an increase in the excess return except for the resource, community, management and shareholders based portfolios. When increasing from top 10 percent to top 20 percent, four of the portfolios' Sharpe ratio see an improvement. The improvement is especially valid with for innovations with an increase of 29% from 0.4731 to 0.6657 and for human rights with an increase of 19% from 0.7026 to 0.8713. The worst decrease of the Sharpe ratios is of 9%, where the resource based portfolio experience a fall from 0.8751 to 0.806.

Appendix 8. Factors' descriptive statistics details

In the table below are depicted the discovered pairwise correlations of the factors of the used asset pricing model.

	Mkt_RF	SMB	HML	RMW	CMA	WML
Mkt_RF	1	0.47	0.15	-0.25	-0.12	-0.28
SMB	0.47	1	0.27	-0.36	0.04	-0.26
HML	0.15	0.27	1	-0.29	0.64	-0.49
RMW	-0.25	-0.36	-0.29	1	-0.15	0.25
CMA	-0.12	0.04	0.64	-0.15	1	-0.21
WML	-0.28	-0.26	-0.49	0.25	-0.21	1

Factors' pairwise correlations

The pairwise correlations are based on the whole analysis period of 2006-2020. The highest correlation level of 0.64 is found between HML and CMA. This is fits into the understanding reviewed in the theoretical review chapter, that corporations with high book-to-market ratio also referred to as value stocks tend to have low investment levels. The profitability factor RMW is negatively correlated with the market, size, value and

investment factors. This indicates that corporations with low profitability have a higher beta, meaning that it carries a higher systematic risk than the market as a whole, that bigger companies are more profitable, that corporations with high profitability are considered growth stocks and that profitable companies have a conservative investment level. All the correlation levels, except the 0.64 between HML and CMA, are in fact below the magnitude level of 0.5 and any related conclusions will need to be considered carefully. It is a positive aspect that the correlations are low, as it limits any possible introduced bias, through any relationship between the independent variables, in the conducted regression analysis research.

Appendix 9: ESG and sub-categories portfolios regression analysis details

In the paragraphs below, a review of the conducted regression analysis of each constructed portfolio is documented.

ESG related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
ESG top 10%	0.0019251 (0.012549)**	0.9374152 (< 2e-16)***	-0.2289691 (4.51e-09)***	0.0672519 (0.126601)	-0.1157629 (0.034976)**	0.3165670 (1.10e-06)***	-0.0788959 (0.000584)***	0.952
ESG top 20%	0.0015478 (0.120390)	0.9522096 (< 2e-16)***	-0.2967068 (4.93e-09)***	0.1413410 (0.013994)**	-0.1468244 (0.039521)**	0.2900065 (0.000476)***	-0.0967011 (0.001155)***	0.9248

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the ESG related regression analysis

The ESG top 10% contains the 10 percent highest ESG scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 94 billion dollars. The three biggest constituents of the ESG top 10% are Microsoft, Exxon Mobil, Johnson & Johnson that together represent nearly 23 percent of the portfolio's market value. 16 of the largest corporations are represented in the ESG top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high ESG scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the ESG top 10% generates a positive and at 5% significant alpha. This represent a monthly return of 0.19% that cannot be explained by the FF6F model. The coefficient of determination of 0.952, shows that 95.2% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.94 indicates that the portfolio is slightly less volatile than the market portfolio and is thus less exposed to systematic risk. The ESG top 10% portfolio is significantly and negatively exposed to the size factor which support the assumption of overweight of larger companies in the portfolio. This is in line with the fact that all the companies stem from the S&P500 index. The profitability and momentum factors are negative and significant and the investment factor is positive and significant. This indicates an overweight of less profitable companies, companies less associated to winner stocks and investment conservative companies. It seems that the portfolio is not significantly exposed to the value factor and it is not possible to conclude that this factor is able to explain the excess return of the portfolio.
As the ESG top 10% portfolio is significantly exposed to the profitability and investment factors, we are not able to reject the hypothesis 2.

The ESG top 20% is based on the 20 percent highest ESG scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 70 billion dollars and lower than the ESG top 10% based portfolio. The three biggest constituents are still Microsoft, Exxon Mobil, Johnson & Johnson that together represent a little over 15 percent of the portfolio's market value. 23 of the largest corporations are represented in the ESG top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high ESG scoring are some of the largest companies of the S&P500 index.

For the executed regression analysis test results, the robust standard errors are used as per the findings in the Serial correlation paragraph that there is a potential problem and

that it is better to use the robust standard errors for reaching our conclusions from the regression analysis. The obtained robust standard errors are thus used for the ESG top 20 portfolio. As a result the regression analysis summary becomes as documented in the table below

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
ESG top 10%	0.0019251 (0.012549)**	0.9374152 (< 2e-16)***	-0.2289691 (4.51e-09)***	0.0672519 (0.126601)	-0.1157629 (0.034976)**	0.3165670 (1.10e-06)***	-0.0788959 (0.000584)***	0.952
ESG top 20%	0.0015478 (0.0196402)**	0.9522096 (< 2.2e-16)***	-0.2967068 (8.47e-07)***	0.1413410 (0.1783892)	-0.1468244 (0.0392061)**	0.2900065 (0.0002204)***	-0.0967011 (2.15e-05)***	0.9248

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the ESG related regression analysis with robust standard errors

The regression analysis shows that the ESG top 20% does generate a positive and at 5% significant alpha. This represent a monthly return of 0.15% that cannot be explained by the FF6F model. The coefficient of determination of 0.9248, shows that 92.48% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.95 indicates that the portfolio is slightly less volatile than the market portfolio and is thus less exposed to systematic risk. The ESG top 20% portfolio is significantly and negatively exposed to the size factor, the profitability factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the ESG top 20% portfolio has an overweight of companies that are large, less profitable, are associated to a loser stock and are conservatively investing. As the ESG top 20% portfolio is significantly exposed to the profitability and investment factors, we are not able to reject the hypothesis 2.

It seems that increasing the portfolio from top 10% to top 20%, does not alter the explanation power of the selected asset pricing model FF6F significantly. And the hypothesis 2 remains not rejected.

Resource related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Resource top 10%	0.002064 (0.0457)**	0.982903 (< 2e-16)***	-0.253154 (9.56e-07)***	-0.017407 (0.7678)	0.185530 (0.0121)**	0.094753 (0.2620)	-0.052015 (0.0874)*	0.917
Resource top 20%	0.0019810 (0.00802)***	0.9549635 (< 2e-16)***	-0.2360029 (5.39e-10)***	-0.0005046 (0.990518)	0.0981382 (0.064330)*	0.2218173 (0.000337)***	-0.0479694 (0.029034)**	0.953

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the resource related regression analysis

The resource top 10% contains the 10 percent highest resource scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 88 billion dollars. The three biggest constituents of the resource top 10% are Apple, Microsoft and Exxon Mobil that together represent more than 30 percent of the portfolio's market value. 13 of the largest corporations are represented in the resource top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high ESG scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the resource top 10% generates a positive and significant alpha. This represent a monthly return of 0.2% that cannot be explained by the FF6F model. The coefficient of determination of 0.917, shows that 91.7% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.98 indicates that the portfolio is slightly less volatile than the market portfolio and is thus less exposed to systematic risk. The resource top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the profitability factor. This support that the resource top 10% portfolio has an overweight of companies that are large, more profitable. As the resource top 10% portfolio is not significantly exposed to the investment factor, the hypothesis 2 is partially rejected.

The resource top 20% is based on the 20 percent highest resource scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 74 billion dollars and lower than the resource top 10% based portfolio. The three biggest constituents are still Apple, Microsoft and Exxon Mobil that together represent a little over 18 percent of the portfolio's market value. 23 of the largest corporations are represented in the ESG top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high ESG scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the resource top 20% does also generate a positive and significant alpha. This represent a monthly return of 0.2% that cannot be explained by the FF6F model. The coefficient of determination of 0.953, shows that 95.3% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.95 indicates that the portfolio is slightly less volatile than the market portfolio and is thus less exposed to systematic risk. The resource top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the ESG top 20% portfolio has an overweight of companies that are large, are associated to a loser stock and are conservatively investing. As the resource top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, does not change significant the explanation power of the selected asset pricing model FF6F. The value factor remain insignificant, the profitability factor becomes insignificant and the investment and momentum becomes significant. And the hypothesis 2 remains partially rejected with a change in factor significance.

Emissions related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Emissions top 10%	0.0011514 (0.2185)	1.0060702 (< 2e-16)***	-0.2106082 (6.53e-06)***	0.0459675 (0.3916)	0.0135130 (0.8393)	0.1804469 (0.0195)**	-0.0385584 (0.1628)	0.9361
Emissions top 20%	0.0019242 (0.01216)**	0.9968775 (< 2e-16)***	-0.2018487 (1.53e-07)***	0.0666225 (0.12826)	-0.0942205 (0.08390)*	0.1700328 (0.00704)***	-0.0682024 (0.00270)***	0.9578

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the emissions related regression analysis

The emissions top 10% contains the 10 percent highest emissions scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 78 billion dollars. The three biggest constituents of the emissions top 10% are Microsoft and Exxon Mobil and Johnson & Johnson that together represent more than 27 percent of the portfolio's market value. 12 of the largest corporations are represented in the emissions top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high emissions scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the emissions top 10% generates does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9361, shows that 93.61% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 1 indicates that the portfolio is equally volatile as the market portfolio and is thus similarly exposed to systematic risk. The emissions top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the investment factor. This support that the emissions top 10% portfolio has an overweight of companies that are large and conservatively

investing. As the emissions top 10% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

The emissions top 20% is based on the 20 percent highest emissions scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 63 billion dollars and lower than the emissions top 10% based portfolio. The three biggest constituents are still Microsoft and Exxon Mobil and Johnson & Johnson that together represent a little over 17 percent of the portfolio's market value. 18 of the largest corporations are represented in the ESG top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high emissions scoring are some of the largest companies of the S&P500 index.
The regression analysis shows that the emissions top 20% generates a positive and significant alpha. This represent a monthly return of 0.2% that cannot be explained by the FF6F model. The coefficient of determination of 0.9578, shows that 95.78% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 1 indicates that the portfolio is equally volatile as the market portfolio and is thus similarly exposed to systematic risk. The emissions top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the emissions top 20% portfolio has an overweight of companies that are large, are associated to a loser stock and are conservatively investing. As the emissions top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.2%. The value and profitability factors remain insignificant and the momentum factor

becomes significant. And the hypothesis 2 remains partially rejected with only investment factor remaining significant.

Innovations related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Innovations top 10%	0.001617 (0.17586)	0.978201 (< 2e-16)***	-0.159693 (0.00632)***	0.112485 (0.10129)	-0.234351 (0.00639)***	0.231769 (0.01872)**	-0.166659 (4.27e-06)***	0.9101
Innovations top 20%	0.0024047 (0.00375)***	0.9655943 (< 2e-16)***	-0.1930679 (2.64e-06)***	0.1189677 (0.01222)**	-0.0920905 (0.11668)	0.1842165 (0.00675)***	-0.1054434 (2.16e-05)***	0.9503

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the innovations related regression analysis

The innovations top 10% contains the 10 percent highest innovations scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 58 billion dollars. The three biggest constituents of the innovations top 10% are Walmart, General Electric and Procter & Gamble that together represent more than 23 percent of the portfolio's market value. 7 of the largest corporations are represented in the emissions top 10% portfolio. The moderately high market capitalization of the portfolio seems to be because some of the high innovations scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the innovations top 10% does not generate a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9101, shows that 91.01% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.98 indicates that the portfolio is nearly as volatile as the market portfolio and is thus similarly exposed to systematic risk. The innovations top 10% portfolio is significantly and negatively exposed to the size, profitability and momentum factor. It is also positively and significantly exposed to the investment factor.

This support that the innovations top 10% portfolio has an overweight of companies that are large, lower profitability, associated with a loser stock and conservatively investing. As the innovations top 10% portfolio is significantly exposed to the profitability and the investment factors, the hypothesis 2 is not rejected.

The innovations top 20% is based on the 20 percent highest innovations scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 60 billion dollars and higher than the innovations top 10% based portfolio. The three biggest constituents are still Microsoft, Johnson & Johnson and Walmart that together represent a little over 16 percent of the portfolio's market value. 18 of the largest corporations are represented in the ESG top 20% portfolio. The slightly higher market capitalization of the portfolio seems to be because many of the high ESG scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the innovations top 20% generates a positive and significant alpha. This represent a monthly return of 0.2% that cannot be explained by the FF6F model. The coefficient of determination of 0.9503, shows that 95.03% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.96 indicates that the portfolio is nearly equally as volatile as the market portfolio and is thus similarly exposed to systematic risk. The innovations top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the value and investment factor. This support that the innovations top 20% portfolio has an overweight of companies that are large, are associated to a loser stock, have a high book to market ratio and are conservatively investing. As the innovations top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.2%. The profitability factor becomes insignificant and the value factor becomes significant. And the hypothesis 2 becomes partially rejected with only investment factor remaining significant.

Workforce related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Workforce top 10%	0.0012610 (0.1628)	0.8887099 (< 2e-16)***	-0.2372926 (1.88e-07)***	-0.0697580 (0.1786)	0.1301262 (0.0443)**	0.3803526 (7.07e-07)***	-0.0440680 (0.0987)*	0.9194
Workforce top 20%	0.0016489 (0.0212)**	0.9164303 (< 2e-16)***	-0.2165581 (2.54e-09)***	-0.0098488 (0.8091)	0.1076328 (0.0349)**	0.3302426 (5.83e-08)***	-0.0306016 (0.1454)	0.9524

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the workforce related regression analysis

The workforce top 10% contains the 10 percent highest workforce scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 75 billion dollars. The three biggest constituents of the workforce top 10% are Microsoft and Exxon Mobil and Johnson & Johnson that together represent nearly 29 percent of the portfolio's market value. 11 of the largest corporations are represented in the workforce top 10% portfolio. The high market capitalization of the portfolio seems to be because many of the high workforce scoring are some of the largest companies of the S&P500 index.
The regression analysis shows that the workforce top 10% generates does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9194, shows that 91.94% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.88 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The

workforce top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the profitability and investment factor. This support that the workforce top 10% portfolio has an overweight of companies that are large, highly profitable and conservatively investing. As the workforce top 10% portfolio is significantly exposed to the profitability and the investment factors, the hypothesis 2 is not rejected.

The workforce top 20% is based on the 20 percent highest workforce scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 66 billion dollars and lower than the workforce top 10% based portfolio. The three biggest constituents are still Microsoft and Exxon Mobil and Johnson & Johnson that together represent a little less than 17 percent of the portfolio's market value. 21 of the largest corporations are represented in the workforce top 20% portfolio. The high market capitalization of the portfolio seems to be because many of the high workforce scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the workforce top 20% generates a positive and significant alpha. This represent a monthly return of 0.16% that cannot be explained by the FF6F model. The coefficient of determination of 0.9524, shows that 95.24% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.91 indicates that the portfolio is slightly less volatile than the market portfolio and is thus slightly less exposed to systematic risk. The workforce top 20% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the profitability and investment factors. This support that the workforce top 20% portfolio has an overweight of companies that are large, highly profitable and are conservatively investing. As the workforce top 20% portfolio is significantly exposed to the profitability and the investment factors, the hypothesis 2 is not rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.16%. The value and momentum factors remain insignificant with the increase. And the hypothesis 2 remains not rejected.

Human rights related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Human top 10%	0.0015211 (0.11450)	0.9079012 (< 2e-16)***	-0.2575739 (1.16e-07)***	0.0790115 (0.15301)	0.0163097 (0.81192)	0.2627105 (0.00104)***	-0.0727033 (0.01102)**	0.9187
Human top 20%	0.0025075 (0.00286)***	0.9264723 (< 2e-16)***	-0.2556785 (1.8e-09)***	-0.0020408 (0.96583)	0.0741159 (0.21183)	0.1795981 (0.00906)***	-0.0678529 (0.00612)***	0.9385

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the human rights related regression analysis

The human rights top 10% contains the 10 percent highest human rights scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 78 billion dollars. The three biggest constituents of the human rights top 10% are Microsoft and Exxon Mobil and Johnson & Johnson that together represent more than 27 percent of the portfolio's market value. 13 of the largest corporations are represented in the human rights top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high human rights scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the human rights top 10% generates does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9187, shows that 91.87% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.9 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk.

The human rights top 10% portfolio is significantly and negatively exposed to the size and momentum factors. It is also positively and significantly exposed to the investment factor. This support that the human rights top 10% portfolio has an overweight of companies that are large, associated to a loser stock and conservatively investing. As the human rights top 10% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

The human rights top 20% is based on the 20 percent human rights emissions scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 65 billion dollars and lower than the emissions top 10% based portfolio. The three biggest constituents are Apple, Microsoft and Exxon Mobil that together represent a little less than 21 percent of the portfolio's market value. 21 of the largest corporations are represented in the human rights top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high human rights scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the human rights top 20% generates a positive and significant alpha. This represent a monthly return of 0.25% that cannot be explained by the FF6F model. The coefficient of determination of 0.9385, shows that 93.85% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 0.92 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The human rights top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the human rights top 20% portfolio has an overweight of companies that are large, are associated to a loser stock and are conservatively investing. As the human rights top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.25%. The value and profitability factors remain insignificant. And the hypothesis 2 remains partially rejected with only investment factor remaining significant.

Community related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Community top 10%	0.003039 (0.003860)**	1.046179 (< 2e-16)***	-0.184120 (0.000342)***	0.116245 (0.052617)	-0.237194 (0.001620)*	0.090047 (0.292004)	-0.108605 (0.000501)***	0.9351
Community top 20%	0.0024109 (0.00629)***	1.0134412 (< 2e-16)***	-0.1500645 (0.000505)***	0.1082315 (0.031914)**	-0.1962208 (0.001898)***	0.2173549 (0.002758)***	-0.1312431 (8.72e-07)***	0.9513

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the community related regression analysis

The community top 10% contains the 10 percent highest community scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 66 billion dollars. The three biggest constituents of the community top 10% are Microsoft and JP Morgan Chase and Bank of America that together represent more than 26 percent of the portfolio's market value. 9 of the largest corporations are represented in the community top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high community scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the community top 10% generates a positive and significant alpha. This represent a monthly return of 0.3% that cannot be explained by the FF6F model. The coefficient of determination of 0.9351, shows that 93.51% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.88 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk.

The community top 10% portfolio is significantly and negatively exposed to the size and momentum factors. This support that the community top 10% portfolio has an overweight of companies that are large and are associated to a loser stock. As the community top 10% portfolio is not significantly exposed to the profitability and investment factors, the hypothesis 2 is rejected.

The community top 20% is based on the 20 percent highest community scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 56 billion dollars and lower than the community top 10% based portfolio. The three biggest constituents are Microsoft and Exxon Mobil and JP Morgan Chase that together represent a over 18 percent of the portfolio's market value. 15 of the largest corporations are represented in the community top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high community scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the community top 20% generates a positive and significant alpha. This represent a monthly return of 0.24% that cannot be explained by the FF6F model. The coefficient of determination of 0.9513, shows that 95.13% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 1.01 indicates that the portfolio is little more volatile than the market portfolio and is thus a little more exposed to systematic risk. The community top 20% portfolio is significantly and negatively exposed to the size, profitability and momentum factors. It is also positively and significantly exposed to the value and investment factors. This support that the community top 20% portfolio has an overweight of companies that are large, highly profitable, are associated to a loser stock, have high to book to market ratio and are conservatively investing. As the community top 20% portfolio is significantly exposed to the profitability and the investment factors, the hypothesis 2 is not rejected.

It seems that increasing the portfolio from top 10% to top 20%, does not alter the explanation power of the selected asset pricing model FF6F significantly. The value, profitability and investment factors become significant. And the hypothesis 2 becomes not rejected.

Product responsibility related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Product responsibility top 10%	0.0012334 (0.1984)	0.8862918 (< 2e-16)***	-0.2291070 (1.85e-06)***	-0.0241556 (0.6602)	0.1308822 (0.0566)*	0.3314614 (3.85e-05)***	-0.0507306 (0.0736)*	0.9113
Product responsibility top 20%	0.0018596 (0.01295)**	0.9253513 (< 2e-16)***	-0.1844887 (7.73e-07)***	0.0456749 (0.28418)	-0.0477032 (0.36805)	0.2955383 (2.62e-06)***	-0.0710468 (0.00138)***	0.9532

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the product responsibility related regression analysis

The product responsibility top 10% contains the 10 percent highest product responsibility scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 67 billion dollars. The three biggest constituents of the product responsibility top 10% are Microsoft and Exxon Mobil and Johnson & Johnson that together represent more than 32 percent of the portfolio's market value. 10 of the largest corporations are represented in the product responsibility top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high product responsibility scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the product responsibility top 10% generates does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9113, shows that 91.13% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the

S&P500 index, a proxy for the market portfolio. The beta of 0.88 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The product responsibility top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the investment factor. This support that the product responsibility top 10% portfolio has an overweight of companies that are large and conservatively investing. As the product responsibility top 10% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

The product responsibility top 20% is based on the 20 percent highest product responsibility scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 55 billion dollars and lower than the product responsibility top 10% based portfolio. The three biggest constituents are still Microsoft and Exxon Mobil and Johnson & Johnson that together represent a little over 19 percent of the portfolio's market value. 15 of the largest corporations are represented in the ESG top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high product responsibility scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the product responsibility top 20% generates a positive and significant alpha. This represent a monthly return of 0.18% that cannot be explained by the FF6F model. The coefficient of determination of 0.9532, shows that 95.32% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 0.92 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The product responsibility top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the product responsibility top 20% portfolio has an overweight of companies that are large, are associated

to a loser stock and are conservatively investing. As the product responsibility top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.18%. The value and profitability factors remain insignificant and the momentum factor becomes significant. And the hypothesis 2 remains partially rejected with only investment factor remaining significant.

Management related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Management top 10%	0.002073 (0.121794)	0.931099 (< 2e-16)***	-0.186373 (0.004491)**	-0.090481 (0.238651)	-0.142482 (0.136028)	0.251048 (0.022995)**	-0.150620 (0.000179)***	0.8683
Management top 20%	0.0017375 (0.048354)**	0.9420873 (< 2e-16)***	-0.1832448 (2.65e-05)***	0.0428508 (0.394189)	-0.0359577 (0.565001)	0.2753151 (0.000174)***	-0.0813180 (0.001899)***	0.9384

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the management related regression analysis

The management top 10% contains the 10 percent highest management scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 44 billion dollars. The three biggest constituents of the management top 10% are Microsoft and General Electric and Wells Fargo that together represent more than 39 percent of the portfolio's market value. 7 of the largest corporations are represented in the management top 10% portfolio. The little high market capitalization of the portfolio seems to be because many of the high management scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the management top 10% generates does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.8683, shows that 86.83% of the

variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a relatively high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.93 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The management top 10% portfolio is significantly and negatively exposed to the size and momentum factors. It is also positively and significantly exposed to the investment factor. This support that the management top 10% portfolio has an overweight of companies that are large, associated to a loser stock and conservatively investing. As the management top 10% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

The management top 20% is based on the 20 percent highest management scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 43 billion dollars and nearly equal to the management top 10% based portfolio. The three biggest constituents are Microsoft, Johnson & Johnson and Walmart that together represent over 22 percent of the portfolio's market value. 12 of the largest corporations are represented in the ESG top 20% portfolio. The still relatively little high market capitalization of the portfolio seems to be because many of the high management scoring are some of the largest companies of the S&P500 index.

For the executed regression analysis test results, the robust standard errors are used as per the findings in the serial correlation paragraph that there is a potential problem and that it is better to use the robust standard errors for reaching our conclusions from the regression analysis. The obtained robust standard errors are thus used for the management top 20% portfolio. As a result the regression analysis summary becomes as documented in the table below.

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2

Management top 10%	0.002073 (0.121794)	0.931099 (< 2e-16)***	-0.186373 (0.004491)**	-0.090481 (0.238651)	-0.142482 (0.136028)	0.251048 (0.022995)**	-0.150620 (0.000179)***	0.8683
Management top 20%	0.0017375 (0.047526) **	0.9420873 (< 2.2e-16)***	-0.1832448 (0.0003541)***	0.0428508 (0.5161215)	-0.0359577 (0.4830778)	0.2753151 (0.0043711)***	-0.0813180 (0.0050756)***	0.9384

***, **, * are indicating significance levels at 1%, 5%, 10%

The management related regression analysis with robust standard errors

The regression analysis shows that the management top 20% generates a positive and significant alpha. This represent a monthly return of 0.17% that cannot be explained by the FF6F model. The coefficient of determination of 0.9384, shows that 93.84% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 0.94 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The management top 20% portfolio is significantly and negatively exposed to the size factor and the momentum factor. It is also positively and significantly exposed to the investment factor. This support that the management top 20% portfolio has an overweight of companies that are large, are associated to a loser stock and are conservatively investing. As the management top 20% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, decrease the explanation power of the selected asset pricing model FF6F and generate an unexplained alpha of 0.17%. The value and profitability factors remain insignificant. And the hypothesis 2 remains partially rejected with only investment factor remaining significant.

Shareholders related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Shareholders top 10%	0.003793 (0.01196)**	0.979491 (< 2e-16)***	-0.191619 (0.00899)**	-0.097851 (0.25528)	0.429763 (8.27e-05)***	-0.184321 (0.13458)	-0.083511 (0.05971)*	0.8446

Shareholders top 20%	0.004012 (0.00018)***	0.956137 (< 2e-16)***	-0.122178 (0.017461)**	-0.180312 (0.003136)***	0.348306 (6.41e-06)***	-0.027380 (0.750779)	-0.065459 (0.035740)**	0.9125

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the shareholders related regression analysis

The shareholders top 10% contains the 10 percent highest shareholders scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 49 billion dollars. The three biggest constituents of the emissions top 10% are Apple, Microsoft and Chevron that together represent more than 47 percent of the portfolio's market value. 5 of the largest corporations are represented in the shareholders top 10% portfolio. The little high market capitalization of the portfolio seems to be because many of the high shareholders scoring are some of the largest companies of the S&P500 index. The regression analysis shows that the shareholders top 10% generates a positive and significant alpha. This represent a monthly return of 0.37% that cannot be explained by the FF6F model. The coefficient of determination of 0.8446, shows that 84.46% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.97 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The shareholders top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the profitability factor. This support that the shareholders top 10% portfolio has an overweight of companies that are large and highly profitable. As the shareholders top 10% portfolio is not significantly exposed to the investment factor, the hypothesis 2 is partially rejected.

The shareholders top 20% is based on the 20 percent highest shareholders scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 41 billion dollars and slightly lower than the shareholders top 10% based portfolio. The three biggest constituents are Apple, Microsoft and Amazon that together represent a little over 31 percent of the portfolio's market value. 10 of the largest corporations are

represented in the shareholders top 20% portfolio. The still relatively high market capitalization of the portfolio seems to be because many of the high shareholders scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the shareholders top 20% generates a positive and significant alpha. This represent a monthly return of 0.4% that cannot be explained by the FF6F model. The coefficient of determination of 0.9125, shows that 91.25% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 0.95 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The shareholders top 20% portfolio is significantly and negatively exposed to the size, value and momentum factors. It is also positively and significantly exposed to the profitability factor. This support that the shareholders top 20% portfolio has an overweight of companies that are large, have a low book to market ratio, are associated to a loser stock and are highly profitable. As the shareholders top 20% portfolio is not significantly exposed to the investment factor, the hypothesis 2 is partially rejected.

It seems that increasing the portfolio from top 10% to top 20%, makes the investment factor remain insignificant and the value and momentum factor becomes significant. And the hypothesis 2 remains partially rejected with only profitability factor remaining significant.

Strategy related portfolios

FF6F model	alpha	Market factor	Size factor	Value factor	Profitability factor	Investment factor	Momentum factor	R^2
Strategy top 10%	0.0005505 (0.578649)	0.9200753 (< 2e-16)***	-0.2489581 (6.08e-07)***	0.0652952 (0.251871)	-0.0008146 (0.990809)	0.2798636 (0.000716)***	-0.0346597 (0.236696)	0.9143
Strategy top 20%	0.0011069 (0.155)	0.8889995 (< 2e-16)***	-0.2111591 (7.66e-08)***	0.0300676 (0.500)	0.0397034 (0.039521)**	0.3722095 (2.34e-08)***	-0.0371559 (0.106)	0.942

***, **, * are indicating significance levels at 1%, 5%, 10%

Results of the strategy related regression analysis

The strategy top 10% contains the 10 percent highest strategy scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 78 billion dollars. The three biggest constituents of the strategy top 10% are Microsoft and Exxon Mobil and Johnson & Johnson that together represent more than 27 percent of the portfolio's market value. 12 of the largest corporations are represented in the strategy top 10% portfolio. The relatively high market capitalization of the portfolio seems to be because many of the high strategy scoring are some of the largest companies of the S&P500 index. The regression analysis shows that the resource top 10% does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.9143, shows that 91.43% of the variation of the portfolio can be explained by the variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of 0.92 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The strategy top 10% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the investment factor. This support that the strategy top 10% portfolio has an overweight of companies that are large and conservatively investing. As the strategy top 10% portfolio is not significantly exposed to the profitability factor, the hypothesis 2 is partially rejected.

The strategy top 20% is based on the 20 percent highest strategy scoring corporations of the S&P500 index. The average market capitalization of this portfolio is of 63 billion dollars and lower than the strategy top 10% based portfolio. The three biggest constituents are still Microsoft and Exxon Mobil and Johnson & Johnson that together represent a little over 16 percent of the portfolio's market value. 19 of the largest corporations are represented in the strategy top 20% portfolio. The still relatively high market

capitalization of the portfolio seems to be because many of the high emissions scoring are some of the largest companies of the S&P500 index.

The regression analysis shows that the strategy top 20% does not generates a significant alpha and it seems that all the portfolio's return is explained by the FF6F model. The coefficient of determination of 0.942, shows that 94.2% of the variation of the portfolio can be explained by the independent variables of the FF6F model. The FF6F model can be said to have a high power of explanation. The market factor exposure is highly significant and positive, as the portfolio constituents are also constituents of the S&P500 index, a proxy for the market portfolio. The beta of nearly 0.88 indicates that the portfolio is less volatile than the market portfolio and is thus less exposed to systematic risk. The strategy top 20% portfolio is significantly and negatively exposed to the size factor. It is also positively and significantly exposed to the profitability and investment factor. This support that the strategy top 20% portfolio has an overweight of companies that are large, highly profitable and are conservatively investing. As the strategy top 10% portfolio is significantly exposed to the profitability and investment factors, the hypothesis 2 is not rejected.

It seems that increasing the portfolio from top 10% to top 20% makes the value and momentum factors remain insignificant and the profitability factor becomes significant. And the hypothesis 2 becomes not rejected.

Appendix 10. ESG portfolio's descriptive statistics details

Summary for the full period of 2006 to 2020

The table below details an overview of all the created portfolios over the full measured period of 2006 to 2020. The data in the table are yearly average data over the period of 2016 to 2020.

full period of 2006-2020					
Yearly average	excess return	standard deviation	kurtosis	skewness	Sharpe ratio
S&P500	0.10257	0.17656	2.78754	-0.25299	0.58095
ESG top 10	0.09232	0.17932	2.52283	-0.16165	0.51483
ESG top 20	0.09452	0.17905	2.55587	-0.19458	0.52789
ESG bottom 10	0.22737	0.20165	2.07929	-0.21192	1.12757
ESG bottom 20	0.22046	0.20524	2.35591	-0.17307	1.07414

Average yearly data over the full period of 2006 to 2020

The top 10 percent and top 20 percent based portfolios are underperforming the S&P 500 index with respectively 10% and 8%. While the bottom 10 percent and bottom 20 percent overperform the S&P 500 index with respectively 122% and 115%. This is an above double performance.

The standard deviation of the top 10 percent and top 20 percent based portfolios are very close to the S&P 500 index's standard deviation. While the standard deviation of bottom 10 percent and bottom 20 percent are bigger than the S&P 500 index standard deviation. This indicate that the top 10 percent and top 20 percent based portfolios exhibit similar risk as the market for which the S&P 500 index act as a proxy. While the standard deviation of bottom 10 percent and bottom 20 percent portfolios are respectively 14% and 16% bigger than the market. The kurtosis and skewness of all four created portfolios are in a similar range as the S&P 500 index and are thus not worth analyzing any further.

The Sharpe clarify that the two bottom percent based portfolios perform much better risk adjusted return than the two top based portfolio and the S&P 500 index. The two top based portfolio and the S&P 500 index exhibit a very similar level of risk adjusted return.

Review of the top and bottom 10 percent ESG based portfolios

In the table below, the key return data of the top and bottom 10 percent ESG based portfolios over the period of 2006 to 2020 is detailed.

	S&P500			ESG top 10			ESG bottom 10		
Year	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio
2006	0.10994	0.09869	1.11405	0.04853	0.09838	0.4933	0.15328	0.12173	1.25922
2007	0.00834	0.15684	0.05316	0.19655	0.15453	1.27191	0.37997	0.16683	2.27763
2008	-0.38598	0.40255	-0.95883	-0.02397	0.39615	-0.06052	0.21008	0.42214	0.49765
2009	0.26364	0.26801	0.98372	-0.24339	0.28242	-0.86182	-0.2451	0.32129	-0.76287
2010	0.14943	0.17746	0.84206	0.18985	0.16479	1.15205	0.37051	0.19768	1.87431
2011	0.02072	0.2214	0.09358	0.1856	0.21335	0.86993	0.48791	0.25943	1.8807
2012	0.15943	0.12795	1.24606	0.00962	0.12407	0.07752	0.03453	0.15773	0.21893
2013	0.32368	0.10885	2.9736	0.25396	0.10421	2.43691	0.68759	0.14667	4.68787
2014	0.13668	0.11184	1.22209	0.16436	0.1056	1.55641	0.27062	0.14252	1.89886
2015	0.01364	0.15223	0.08959	0.12397	0.16021	0.77375	0.24585	0.16321	1.50639
2016	0.1176	0.12869	0.91382	0.05065	0.14038	0.36079	0.02732	0.16218	0.16845
2017	0.21032	0.06566	3.20319	0.20092	0.07084	2.83645	0.24173	0.08167	2.95979
2018	-0.06194	0.16732	-0.37021	0.13304	0.16902	0.78712	0.25584	0.19647	1.30216
2019	0.29346	0.12252	2.39522	0.00733	0.13578	0.05398	0.08568	0.14129	0.60644
2020	0.17959	0.33837	0.53074	0.11307	0.37113	0.30466	0.13429	0.33855	0.39666

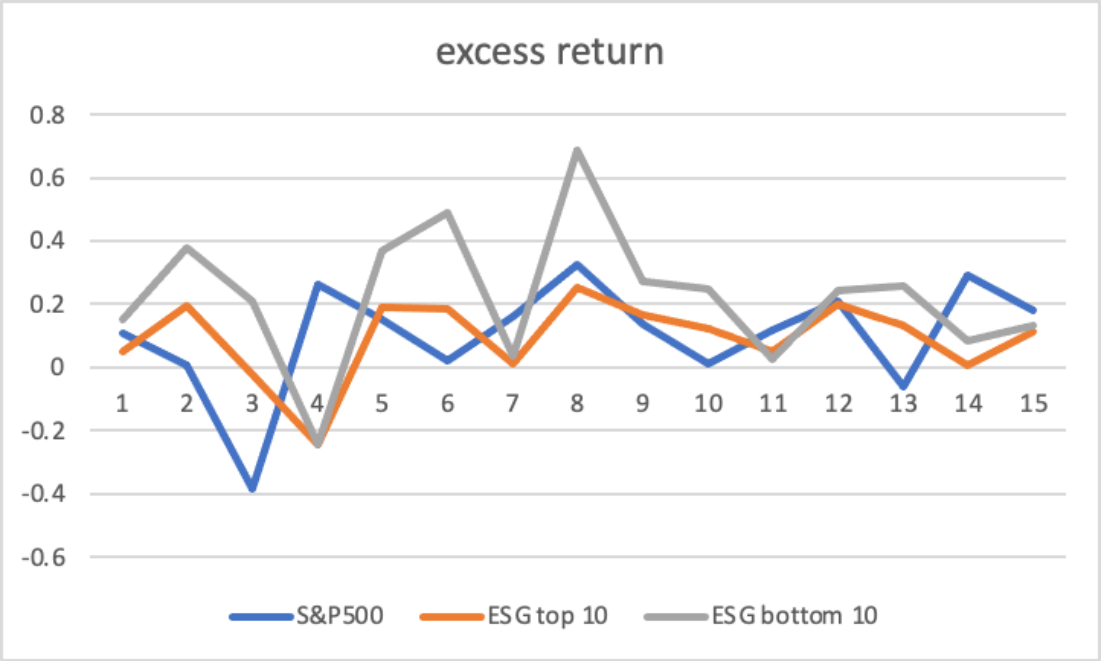
Data of the top and bottom 10 percent ESG based portfolios

The ESG bottom 10 percent based portfolio is producing the higher average excess return in 13 out of the 15 years of the period 2006 to 2020 compared to the ESG top 10 percent based portfolio.

The ESG bottom 10 and top 10 percent based portfolios are producing the higher average excess return in respective 10 and 8 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index.

In 4 out of the 15 years' period, the S&P 500 index is producing a higher excess return than both the bottom and top 10 percent based portfolios. On top of these four periods, the S&P 500 index is producing a higher excess return than the top 10 percent based portfolio but not the top 10 percent based portfolio during 2 periods.

The three excess return time series are depicted in the figure below.



S&P 500, ESG top 10 and bottom 10 excess return

As can be observed, the bear dips and bull highs in the excess returns of the created portfolios seem to occur with a year's delay compared with the S&P 500 index.

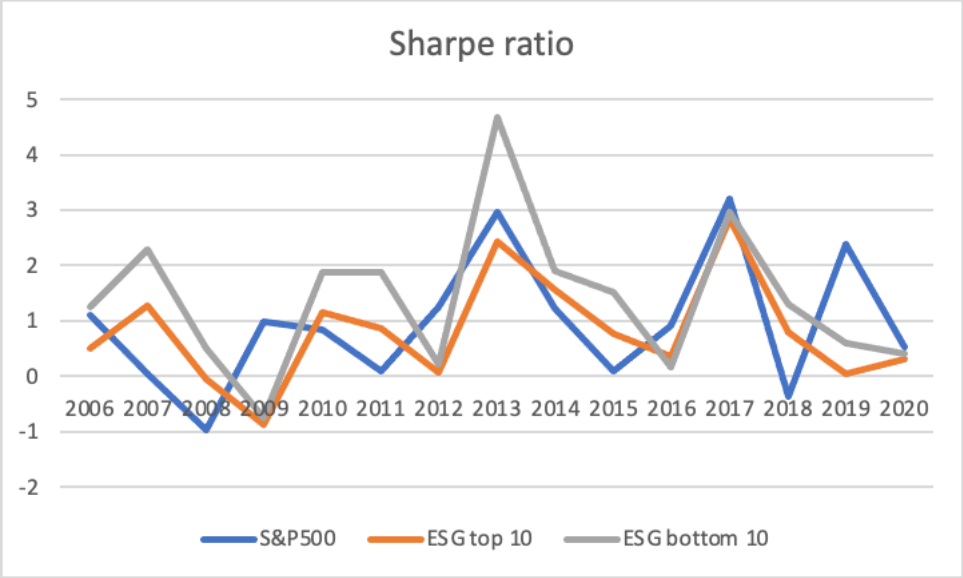
The standard deviation of the top 10 percent based portfolio is lower than the bottom 10 percent based portfolio in 14 out 15 years. Furthermore, the top 10 percent based portfolio has a smaller standard deviation than the S&P 500 index in 6 out of the 15 years.

Measured by the Sharpe ratio, The bottom 10 based portfolio has the higher Sharpe ratio 14 out of 15 times compared to the top 10 based portfolio. But the bottom 10 based portfolio only has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index. The top 10 based portfolio has a higher Sharpe ratio 6 out of 15 times compared to the S&P 500 index.

In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 10 percent based portfolios. On top of that, the S&P 500 index has a higher Sharpe ratio than the ESG top 10 percent based portfolio but not the ESG bottom 10 percent based portfolio 3 years out of the 15 years period. In summary, The bottom

10 based portfolio, in line with the findings across the whole research time period of 2006 to 2020, can be said to be better performing than the top 10 percent based portfolio measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.



S&P 500, ESG top 10 and bottom 10 Shape ratio

Review of the top and bottom 20 percent based portfolios

In the table below, the key return data of the top and bottom 20 percent based portfolio over the period of 2006 to 2020 is detailed.

	S&P500			ESG top 20			ESG bottom 20		
Year	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio
2006	0.10994464	0.09868937	1.11404746	0.04491307	0.0970278	0.46288874	0.0485294	0.09837798	0.49329534
2007	0.00833726	0.15684148	0.05315726	0.21417251	0.15271274	1.40245349	0.40880742	0.18126907	2.2552519
2008	-0.3859761	0.40254786	-0.9588328	-0.0417419	0.41165743	-0.1013995	0.12066354	0.43731954	0.2759162
2009	0.26364232	0.2680063	0.98371689	-0.2616778	0.29813956	-0.8777024	-0.2598575	0.30819541	-0.8431583
2010	0.14943401	0.17746149	0.84206445	0.18800236	0.16460652	1.1421319	0.38844422	0.20190446	1.92390116
2011	0.0207182	0.22139501	0.09358025	0.21118308	0.21314816	0.9907807	0.41832811	0.26030907	1.60704397
2012	0.15943224	0.12794944	1.24605651	0.0154963	0.12272681	0.12626666	0.08878492	0.14324528	0.61981041
2013	0.32368478	0.1088529	2.97359802	0.310085	0.10572449	2.9329533	0.42310553	0.15135779	2.9329533
2014	0.13668363	0.11184384	1.22209352	0.164229	0.10523836	1.56054308	0.52623166	0.160262	3.28357096
2015	0.0136376	0.15222928	0.08958591	0.10380154	0.15692923	0.66145447	0.27307556	0.16261431	1.67928375
2016	0.11759912	0.12868953	0.9138204	0.05371512	0.13246403	0.40550725	0.09685907	0.16596967	0.58359502
2017	0.21031602	0.06565828	3.20319092	0.17488759	0.06477499	2.69992471	0.29076086	0.09256635	3.14110739
2018	-0.0619424	0.16731742	-0.370209	0.13778001	0.16313182	0.84459307	0.20724765	0.1870841	1.10777801
2019	0.29346371	0.12252074	2.39521658	0.01197079	0.12707239	0.09420453	0.03561004	0.14551362	0.24471964
2020	0.17958827	0.33837063	0.53074425	0.07553795	0.3636028	0.20774853	0.08247942	0.36077414	0.22861787

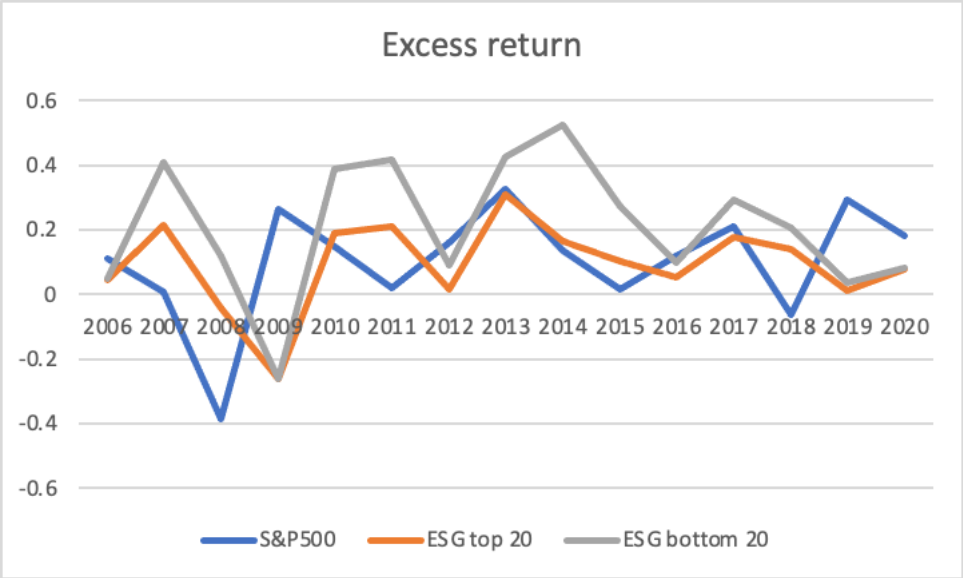
Data of the top and bottom 20 percent ESG based portfolios

The ESG bottom 20 percent based portfolio is producing the higher average excess return in 15 out of the 15 years of the period 2006 to 2020 compared to the ESG top 20 percent based portfolio.

The ESG bottom 20 and top 20 percent based portfolios are producing the higher average excess return in respective 9 and 7 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index.

In 5 out of the 15 years' period, the S&P 500 index is producing the higher excess return than both the bottom and top 20 percent based portfolios. On top of these four periods, the S&P 500 index is producing the higher excess return than the top 20 percent based portfolio but not the top 20 percent based portfolio during 2 periods.

The three excess return time series are depicted in the figure below.



S&P 500, ESG top 20 and bottom 20 excess return

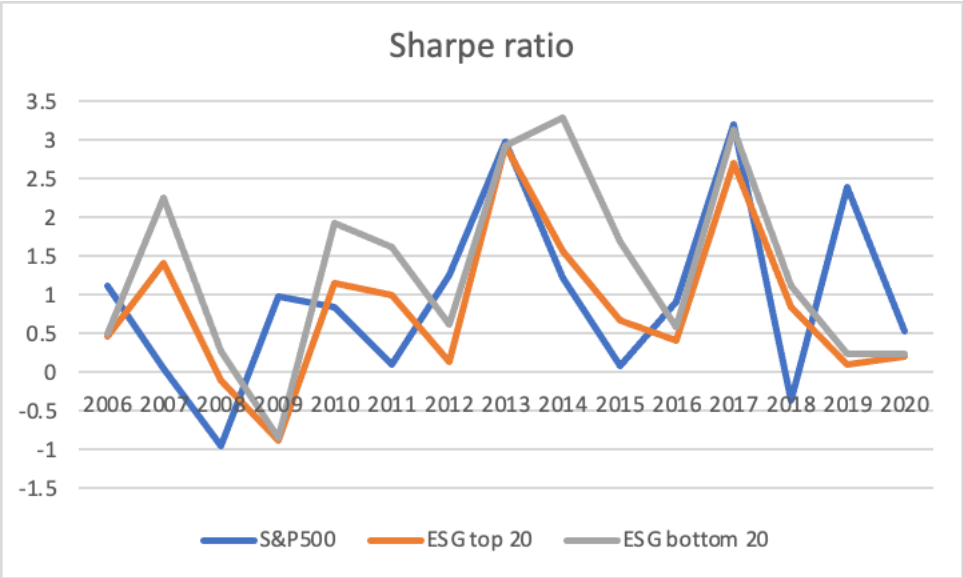
As can be observed, the bear dips and bull highs in the excess returns of the created portfolios seem to occur with a year's delay compared with the S&P 500 index.

The standard deviation of the top 20 percent based portfolio is lower than the bottom 20 percent based portfolio in 14 out 15 years. Furthermore, the top 20 percent based portfolio has a smaller standard deviation than the S&P 500 index in 6 out of the 15 years.

Measured by the Sharpe ratio, The bottom 20 based portfolio has the higher Sharpe ratio 14 out of 15 times compared to the top 20 based portfolio. But the bottom 20 based portfolio only has a higher Sharpe ratio 7 out of 15 times compared to the S&P 500 index. The top 20 based portfolio has a higher Sharpe ratio 7 out of 15 times compared to the S&P 500 index.

In fact, the S&P 500 index has a higher Sharpe ratio than both the bottom and top 20 percent based portfolios 6 out of 15 years. In summary, The bottom 20 based portfolio, in line with the findings across the whole research time period of 2006 to 2020, can be said to be better performing than the top 20 based portfolio measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.



S&P 500, ESG top 20 and bottom 20 Shape ratio

Appendix 11. ESG controversies portfolio's descriptive statistics details

Summary over the ESG controversies the full period of 2006 to 2020

The table below details an overview of all the created portfolios over the full measured period of 2006 to 2020. The data in the table are yearly average data over the period of 2016 to 2020.

full period of 2006-2020			
Yearly average	excess return	standard deviation	Sharpe ratio
S&P500	0.10257	0.17656	0.58095
ESG controversies top 10	0.19017	0.18667	1.01874
ESG controversies top 20	0.17491	0.18905	0.92521
ESG controversies bottom 10	0.12969	0.18324	0.70777
ESG controversies bottom 20	0.12776	0.18008	0.70947

Average yearly data over the full period of 2006 to 2020

All the created portfolios are overperforming the S&P 500 index with respectively 85%, 71%, 26% and 25% in terms of excess return. The top based portfolios also clearly over-perform the bottom based portfolios. The top 10 portfolio perform even better than the top 20 based portfolio measured in terms of excess return.

The standard deviation of all the created portfolios are not considerably different from the S&P 500 index's standard deviation. This indicate that all the created portfolios are carrying relatively similar risk as the market for which the S&P 500 index act as a proxy.

The Sharpe ratio clarify that the two top percent based portfolios perform much better risk adjusted return than the two bottom based portfolio and the S&P 500 index. The top 10 portfolio perform even better than the top 20 based portfolio measured in terms of risk adjusted return.

Detailed review of the top and bottom 10 percent based portfolios

In the table below, the key return data of the top and bottom 10 percent based portfolio over the period of 2006 to 2020 is detailed.

	S&P500			ESG controversies top 10			ESG controversies bottom 10		
Year	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio
2006	0.10994	0.09869	1.11405	0.05509	0.12369	0.44543	0.06581	0.09912	0.66393
2007	0.00834	0.15684	0.05316	0.28811	0.14448	1.99417	0.34152	0.11679	2.9243
2008	-0.38598	0.40255	-0.95883	0.17013	0.38939	0.43692	-0.00341	0.40568	-0.0084
2009	0.26364	0.26801	0.98372	-0.23721	0.28415	-0.83481	-0.28504	0.32572	-0.8751
2010	0.14943	0.17746	0.84206	0.32652	0.18087	1.8053	0.25962	0.17549	1.47937
2011	0.02072	0.2214	0.09358	0.33365	0.25476	1.30969	0.20688	0.22081	0.93691
2012	0.15943	0.12795	1.24606	0.05601	0.14336	0.39069	0.08106	0.13052	0.62104
2013	0.32368	0.10885	2.9736	0.42405	0.12149	3.49043	0.29959	0.11298	2.65177
2014	0.13668	0.11184	1.22209	0.27708	0.12689	2.18355	0.19484	0.1097	1.77616
2015	0.01364	0.15223	0.08959	0.24819	0.15896	1.56133	0.16885	0.16415	1.0286
2016	0.1176	0.12869	0.91382	0.06036	0.1437	0.42004	0.07949	0.13401	0.59316
2017	0.21032	0.06566	3.20319	0.30031	0.07489	4.01033	0.22384	0.07967	2.80961
2018	-0.06194	0.16732	-0.37021	0.23478	0.17712	1.32556	0.16268	0.17762	0.91589
2019	0.29346	0.12252	2.39522	0.0868	0.12587	0.68964	-0.00042	0.14018	-0.00298
2020	0.17959	0.33837	0.53074	0.2286	0.35039	0.65242	0.15003	0.35611	0.4213

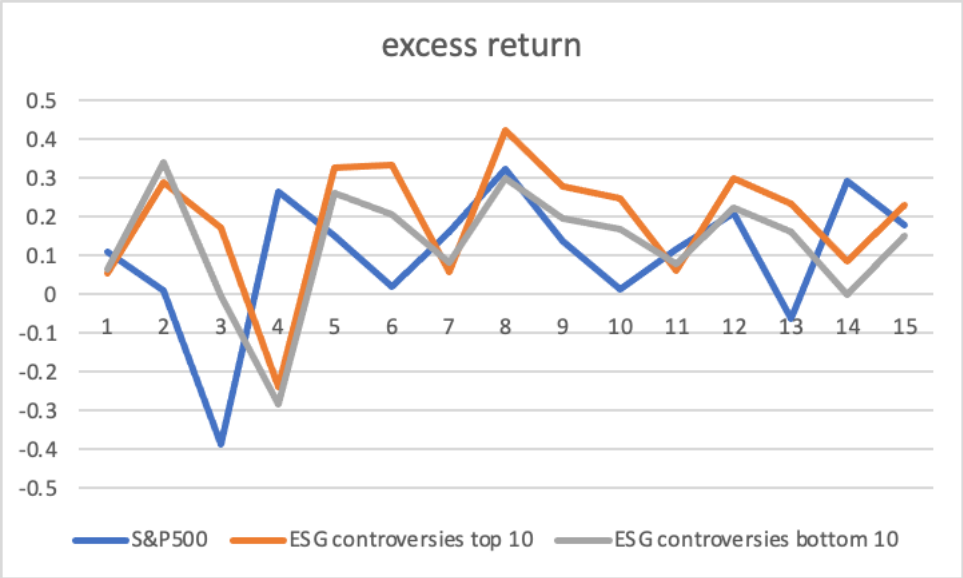
Data of the top and bottom 10 percent ESG controversies based portfolios

The ESG controversies top 10 percent based portfolio is producing the higher average excess return in 11 out of the 15 years of the period 2006 to 2020 compared to the ESG bottom 10 percent based portfolio.

The ESG controversies top 10 and bottom 10 percent based portfolios are producing the higher average excess return in respective 10 and 8 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index.

In 5 out of the 15 years' period, the S&P 500 index is producing the higher excess return than both the bottom and top 10 percent based portfolios. On top of these five periods, the S&P 500 index is producing the higher excess return than the bottom 10 percent based portfolio but not the top 10 percent based portfolio during 2 periods.

The three excess return time series are depicted in the figure below.



S&P 500, ESG controversies top 10 and bottom 10 excess return

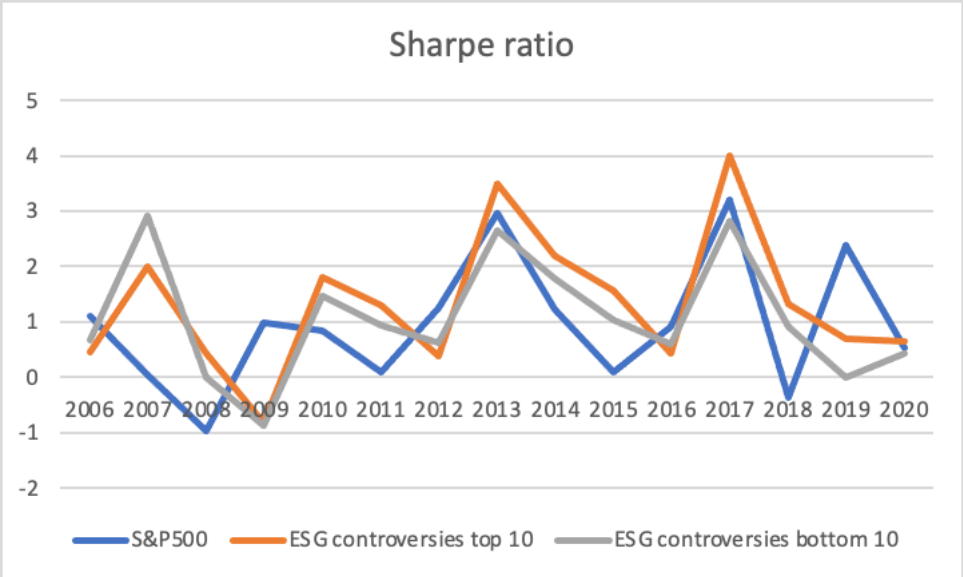
As can be observed, the bear dips and bull highs in the excess returns of the created portfolios seem to occur with a year's delay compared with the S&P 500 index.

The standard deviation of the top 10 percent based portfolio is higher than the bottom 10 percent based portfolio in 9 out 15 years. Furthermore, the top 10 percent based portfolio has a higher standard deviation than the S&P 500 index in 13 out of the 15 years.

Measured by the Sharpe ratio, The top 10 based portfolio has the higher Sharpe ratio 11 out of 15 times compared to the bottom 10 based portfolio. But the top 10 based portfolio only has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index. The bottom 10 based portfolio has a higher Sharpe ratio 6 out of 15 times compared to the S&P 500 index.

In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 10 percent based portfolios. On top of that, the S&P 500 index has a higher Sharpe ratio than the ESG top 10 percent based portfolio but not the ESG bottom 10 percent based portfolio 3 years out of the 15 years period. In summary, The top 10 based portfolio can be said to be better performing measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.



S&P 500, ESG controversies top 10 and bottom 10 Sharpe ratio

Detailed review of the top and bottom 20 percent based portfolios

In the table below, the key return data of the top and bottom 20 percent based portfolio over the period of 2006 to 2020 is detailed.

Year	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio	excess return	standard deviation	Sharpe ratio
2006	0.10994464	0.09868937	1.11404746	0.09119435	0.12089092	0.7543524	0.0622552	0.09528361	0.65336735
2007	0.00833726	0.15684148	0.05315726	0.2703163	0.14138137	1.91196546	0.30346036	0.12714032	2.38681453
2008	-0.3859761	0.40254786	-0.9588328	0.11767824	0.41679917	0.28233799	-0.0258531	0.40828879	-0.0633207
2009	0.26364232	0.2680063	0.98371689	-0.2545384	0.30920273	-0.8232089	-0.2616778	0.29813956	-0.8777024
2010	0.14943401	0.17746149	0.84206445	0.35836442	0.18913353	1.89476931	0.26199592	0.17398272	1.50587322
2011	0.0207182	0.22139501	0.09358025	0.37003046	0.25189993	1.46895816	0.24493072	0.22473897	1.08984534
2012	0.15943224	0.12794944	1.24605651	0.05287489	0.14260473	0.37077937	0.06780113	0.12809749	0.52929315
2013	0.32368478	0.1088529	2.97359802	0.39313107	0.12184509	3.22648255	0.29890621	0.10991345	2.71946886
2014	0.13668363	0.11184384	1.22209352	0.26390157	0.12342448	2.13816233	0.24809094	0.11414167	2.17353516
2015	0.0136376	0.15222928	0.08958591	0.22690881	0.15725633	1.44292321	0.15120412	0.15969234	0.94684644
2016	0.11759912	0.12868953	0.9138204	0.05964793	0.13734715	0.43428589	0.06276943	0.13103799	0.47901701
2017	0.21031602	0.06565828	3.20319092	0.26730183	0.07110003	3.75951773	0.21893965	0.071959	3.04256087
2018	-0.0619424	0.16731742	-0.370209	0.19504094	0.16598652	1.17504082	0.12398781	0.17050987	0.72715915
2019	0.29346371	0.12252074	2.39521658	0.05097918	0.12319597	0.41380558	0.02531449	0.13195482	0.19184212
2020	0.17958827	0.33837063	0.53074425	0.16078722	0.36362919	0.44217359	0.13426524	0.35626308	0.37687104

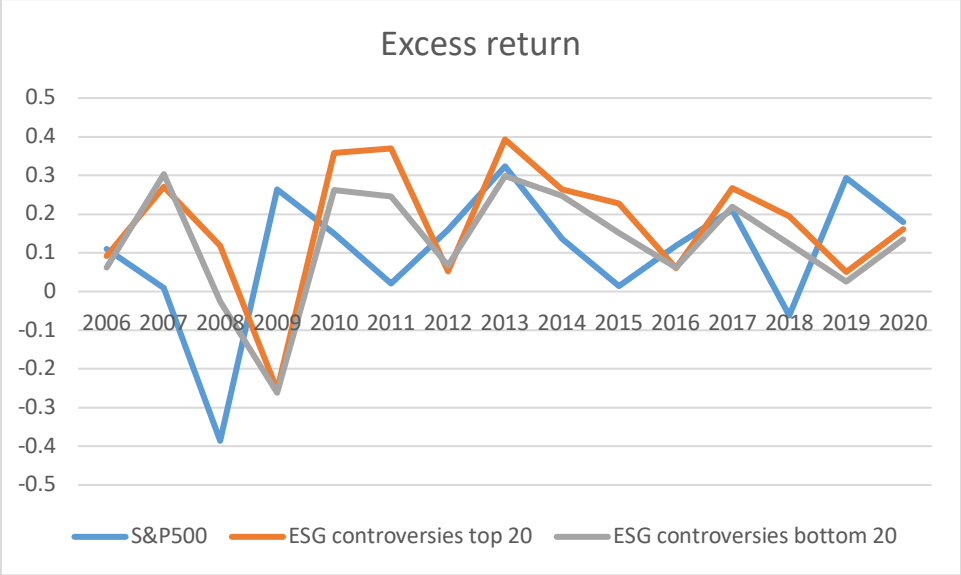
Data of the top and bottom 20 percent ESG controversies based portfolios

The ESG controversies top 20 percent based portfolio is producing a higher average excess return in 11 out of the 15 years of the period 2006 to 2020 compared to the ESG controversies bottom 20 percent based portfolio.

The ESG controversies bottom 20 and top 20 percent based portfolios are producing the higher average excess return in respective 8 and 7 out of the 15 years of the period 2006 to 2020 compared to the S&P 500 index.

In 7 out of the 15 years' period, the S&P 500 index is producing a higher excess return than both the bottom and top 20 percent based portfolios. On top of these 7 periods, the S&P 500 index is producing a higher excess return than the bottom 20 percent based portfolio but not the top 20 percent based portfolio during 1 period.

The three excess return time series are depicted in the figure below.



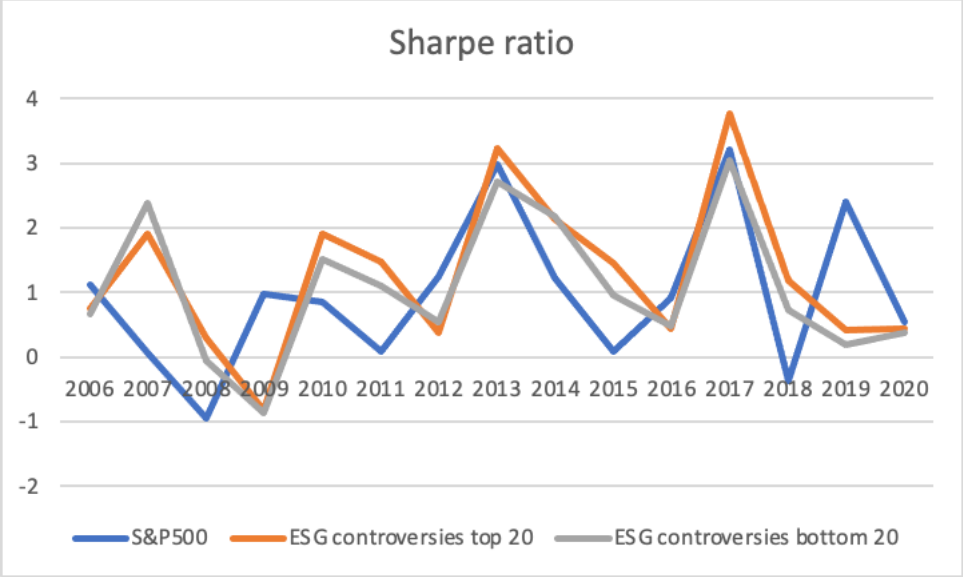
S&P 500, ESG controversies top 20 and bottom 20 excess return

As can be observed, the bear dips and bull highs in the excess returns of the created portfolios seem to occur with a year's delay compared with the S&P 500 index.

Measured by the Sharpe ratio, the top 20 based portfolio has the higher Sharpe ratio 10 out of 15 times compared to the bottom 20 based portfolio. But the top 20 based portfolio only has a higher Sharpe ratio 9 out of 15 times compared to the S&P 500 index. The top 20 based portfolio has a higher Sharpe ratio 7 out of 15 times compared to the S&P 500 index.

In fact, the S&P 500 index has a higher Sharpe ratio 6 out of 15 years than both the bottom and top 20 percent based portfolios. In summary, The top 20 based portfolio can be said to be better performing measured by the Sharpe ratio.

The three Sharpe ratios time series can be observed in the figure below.



S&P 500, ESG controversies top 20 and bottom 20 Sharpe ratio