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Sustainable Investments

Does it payoff to be socially responsible?

Author:
Märta Sandberg

Supervisor:
Olga Balakina

Abstract:

This paper investigates the relationship between financial performance and sustainable performance. More specifically, it investigates whether sustainable firms outperform less sustainable firms. The sustainable performance is based on companies received ESG score. The ESG rating system is based on three equally weighted pillars, environmental, social and governance. The study is based on stocks in the NYSE for the estimated period, January 1st 2004 - December 31st 2017. I deploy the study by constructing three types of portfolios; the first one for high rated stocks, the second one for low rated stocks and the third one is a difference portfolio. The absolute return, average monthly excess return, volatility, Sharpe Ratio and three types of regressions, the CAPM, Fama-French three-factor model and Fama-French five-factor model measure the firm performance. The results found are for most part inconclusive because of insignificant estimators. However, a great part of the result suggests a positive relationship between sustainability and financial performance.

A long-short portfolio is constructed in order to measure whether the high ESG stock have a greater performance than the low ESG stocks. The alpha found for most of the long-short portfolios are positive meaning that the difference portfolios make positive abnormal returns. The long-short strategy is therefore even good enough to beat the market. The result is insignificant which means that the abnormal return is not statistically reliable.

The behavioural finance theory could explain the increasing trend as a result of shifting personal preferences or misguiding information. The traditional finance theory would argue for a greater financial performance for the high rated stocks.

Key words: Sustainable investments, financial performance, ESG rating, Fama-French three-factor model, Fama-French five-factor model, CAPM

1. Introduction

"We're in the middle of a 30 trillion intergenerational wealth transfer from baby boomers to their children. And those kids – not really millennials only, but people form 25 to 40 years old – simply think about their investment decisions differently"
-Dave Nading, CEO of ETF.com

MSCI (n.d.) states that investment patterns are changing and ESG investing has been rising during the last years. Investors consider ESG scores before making investment decisions. The scores measures the company's level of sustainability based on three equally weighted pillars: environmental, social and governance. The Global investor (2013) expects the demand for social responsible investments to increase in the future. Evaluating ESG is a great part of the stock picking process because of several reasons. A greater majority approves the rating system and a bigger part of all investors believes that ESG factors are fundamental tools for successful investments.

The practice of social responsible investments began in the 1960s. Investors started to consider firm activities before making investments. Activities such as tobacco and involvement in South African apartheid regime were two important topics. Social responsible investments have been part of the human history for a long time, however the recent growth is due to three reasons. First, the changing world, with climate change and global warming threatens the global sustainability. Second, the new investors are also a contributing factor, women and millennial generation asks for sustainable investments. Lastly, the data received from companies and analytics capabilities enhances which improves the ESG investment process (MSCI, n.d.).

A common debate revolves around the relationship between sustainability and financial performance. One side argues that sustainability work will always be hurting financial performance while the other side states that a sustainable business comes with lower costs and higher financial returns. MSCI (n.d.) found higher profitability, lower tail risk with lower idiosyncratic risk and lower systematic risk for companies with high ESG score. Milton Friedman (1970), Nobel Prize winner, argues for the opposite, social and environmental responsibility will always damage the economy. The great cost of implementing sustainable strategies will reduce competitiveness and lower financial returns.

Sustainable investments is getting more imprinted in the world of today. The increasing trend and the movements with its characteristics have been analysed by a great many. This paper aims to find the reasons for why investors make sustainable investments by comparing the traditional finance theory and the behavioural finance theory. The traditional theory argues for a higher risk-adjusted return while the new behavioural school argues for an irrational world affected by personal preferences combined with an inefficient market. The study examines the financial performance of sustainable and non-sustainable companies in the US. Three types of portfolios are constructed based on companies' sustainable rating.

The portfolio performance is measured by different methods in order to get a wide picture of how the sustainable and non-sustainable portfolios perform. The result is analysed by comparing different types of financial measures, time periods and by using both the traditional theory and the behavioural theory. The conclusion has it roots in the theoretical framework, however mostly from the result and the analysis of the data.

1.1 Purpose

The purpose of this thesis is to compare the financial performance of portfolios that differ in ESG rating and investigate whether any of these portfolios have shown any significant risk-adjusted excess returns. In a broader perspective, get a better understanding for the reasons behind the increasing trend, sustainable investments.

2. Literature Review

The relationship between sustainability and firm performance have been investigated several times before. Previous studies use different rating systems to measure sustainability, methods to calculate and compare financial performance, time periods and geographic regions. Some studies found a positive correlation between the two factors while others found a negative relationship.

Eccles et al. (2014) present a study about the impact of sustainability in organizations processes and achievements. The authors compare different levels of sustainability and suggest that sustainability is based on long-term thinking and it will benefit the companies' financial performance in the long run. The study is based on data received form 180 American companies that use sustainability strategies. The authors compare different key ratios including the excess return and risk-adjusted return for the companies. The findings are clear, when comparing the financial performance between different kinds of sustainable companies. The firms that were trying to use sustainability strategies in order to achieve a competitive advantage in the short run were likely to fail. In contrast to the companies that created sustainable strategies over a long period of time, leading to an increasing financial performance. The findings suggest that companies have to rearrange the whole business and make it sustainable. It is not enough with additional sustainable work in extent to the core business in order to fulfil the advantages of acting as a sustainable firm.

A study by Richey (2017) investigated the performance of sin stocks. Sin stocks can be bought in companies involved with activities such as tobacco, gaming services and alcohol. The author investigates the return on a portfolio with sin stocks in the US. The return of the portfolio is calculated on a daily basis between the years of 1987-2016. The author investigates the whole period and shorter periods during bull and bear markets. The abnormal return of the portfolio is calculated and compared by four different types of regression models. The CAPM, Fama-French three-factor model and Carhart four-factor model provides a positive and significant abnormal return for the vice stocks. The Fama-French five-factor model on the other hand provides an insignificant result. The author uses regression models on a daily basis and finds a mixed result with a tendency towards a positive abnormal return for the sin stocks. A similarly study, Hong and Kacperczyk (2009) investigated sin stocks in the US during the times of 1962-2003. The authors' state that sin stocks behave like value stocks and by going through the history, it is not uncommon to see that sin stocks preform greater than the market. By using the Carhart four-factor model the authors found higher return of portfolios with sin stocks than the market. Sin stocks do not only perform better than the market, big institutions also face big costs in order to shun sin stocks. The authors make the conclusion that the recent trend is not consistent with traditional finance theory. Investors are not always rational, social norms affect investors' stock picking process. Their result reveals that social responsible investing is done because of other reasons than reduced costs and higher returns. Another study with partly similar conclusion is a paper by Climent & Sorianos (2011). The authors found similar evidence when they compared mutual funds in the US. The authors based their study on the capital asset pricing model and found that environmental funds had a lower performance than conventional funds. The relationship was accurate between the years of 1987-2009 and fades away when investigation a more recent time period, 2001-2009.

Further studies found evidence for a positive link between sustainability and well performing stocks. Both studies based their investigation of constructed portfolios. Derwall et al. (2005) found evidence that eco- efficient large cap companies outperformed less eco-efficient companies. The authors construct two portfolios based on eco-efficient ratings from the Innovest database. The authors compare Jensen's alpha between two portfolios and finds that the eco-efficient portfolio

yields a higher risk-adjusted return. The author proves that the result is not a result of market sensitivity, investment style or industry-specific factors; it is a pure result from the eco-efficient premium. Another similar study made by Kempf & Osthoff (2007) found comparable evidence using the Carhart four-factor model. The authors use SRI ratings from KLD research & analytics in order to construct portfolios. The performance is measured between 1992-2004 and the high-rated portfolio performs better than the low rated portfolio. The authors construct a long-short portfolio and the strategy yields a positive alpha with an abnormal return of up to 8,7% per year. The long-short strategy is based on buying high ranked SRI stocks and shorting low ranked.

Belghitar et al. (2014) made an investigation from a different angle and compared different indexes in contrary to other authors that compared constructed portfolios. The authors make the conclusion that ethical investors pay a price for socially responsible investments. The authors compare the performance of the market portfolio and the FTSE4Good index. The FTSE4Good index measures the performance of companies with high ESG rating. A total amount of 488 observations is gathered from Datastream, starting in July 2001 and ending in November 2010. The FTSE4Good index is available in four different markets, US, UK, Europe and global. The authors compare the FTSE4Good index in all 4 regions with the market index in all regions. The authors find evidence that the FTSE4Good index underperform the market with lower return and higher risk in all geographic regions. On the contrary, Yamashita et al. (1999) made an investigating and found the opposite, higher return and lower volatility for sustainable stocks. The study was made in the US market in 1986-1995 and examined the relationship between EC-score and firm performance. The EC-score tries to capture a firm's environmental conscientiousness. The authors studied how stock prices change when releasing new information about a firm's environmental conscientiousness. The result proves a positive relationship but insignificant. The relation between EC score and stock return proves to be positive and a highly correlation between badly performing stocks and low EC rating is found. The result suggests that poor results can be avoided by excluding stocks with low EC-score. The relationship gets stronger with time, a finding consistent with the results of Eccles et al. (2014).

Giese et al. (2017) states that high ESG rating is consistent with higher firm performance. The report does not study the correlation between the two, it focus on how ESG characteristic can lead to financially significant effects. The report states that high ESG-rated companies have higher profitability making abnormal returns. The companies are less likely to be a part of incidents because the companies are better at managing firm specific risk. The companies are also less exposed to systematic risk meaning a less volatile performance.

Lastly, I will present two studies using ESG rating as a measure of sustainable performance. De & Claymen (2015) made a study where they constructed portfolios based on companies ESG score. The performance of the stocks in the top was compared to the stocks in the bottom. A positive but insignificant correlation between ESG rating and risk-adjusted returns was found. However, the authors found one significant result, a negative correlation between ESG score and volatility. The result in the study shows that the portfolio performance can enhance by adding stocks with high ESG stocks and excluding the ones with low rating. The study of De and Claymen (2015) is not the only one using ESG rating as a measure of sustainability. The relationship is further analysed by Statman & Glushkov (2016). The authors studied the correlation between sustainability and financial return by constructing a factor model, an extended version of the classic Carhart four-factor model. The authors add two new factors; the first factor is based on the companies' ESG ratings; the second one is the accepted-shunned factor, which is the difference in selling sin stocks and buying commonly accepted stocks. The extended factor model should be viewed as a tool for

classifying and measuring the performance of assets. The authors found a varied result with findings supporting both better performance for the sustainable stocks and non-sustainable stocks.

3. Theoretic Framework

3.1 Traditional Finance Theory

The traditional finance theory assumes a perfect world where the optimal outcome is received. The theory is built upon a few important assumptions as follows in *table 1*. These assumptions enable researchers to build mathematical financial framework. All investors are rational, mean-variance optimizers with homogenous expectations. Investment decisions are based on rate of return and volatility. All decisions will be next into identical since expectations are homogenous and all information is publicly available in the market. This leads to correct stock prices in the financial market (Bodie, Kane & Marcus, 2014).

Assumptions

Individual Behaviour	Market Structure
Investors are rational, mean-variance optimizers	All assets are publicly held, trade on public exchange and short positions are allowed
Investors have homogeneous expectations	All information is publicly available and investors can borrow and lend at a common risk-free rate
Their planning horizon is a single period	No taxes and no transaction costs

Table 1: Assumptions in the traditional finance theory (Bodie, Kane & Marcus, 2014)

3.1.1The Efficient Market Hypothesis

Fama (1970) is the proposer of the efficient market hypothesis. The efficient market hypothesis states that all available information is reflected in stock prices. This implies that it is impossible to beat the market in the long run. Higher return comes with higher risk; an investor cannot outperform the market.

There are three different versions of the efficient market hypothesis, weak form, semi strong form and the strong form. The three levels demonstrate three different degrees of information reflected in stock prices. The weak form asserts that information from examining past prices and returns are reflected in stock prices. The semi strong form expands the information level to all publicly available information. Finally, the strong form states that all information, including insider information is reflected in stock prices (Fama, 1970).

3.2 Behavioural Finance

Behavioural finance, a relatively new field of finance, argues that traditional finance theory has missed a huge and important part about the market. The behavioural theory states that investors are not rational. Meaning that existing mispricing in the market will not automatically be corrected. The efficient market assumes that arbitrageurs looking for arbitrage opportunities will correct all

mispricing. Behavioural finance states that the market is inefficient meaning that pricing will not be correctly set and the world faces overvalued and undervalued stocks (Bodie, Kane & Marcus, 2014).

The relatively new school states that irrationalities originate in two critiques. The first states that investor does not always process information correctly. This generates incorrect probability distributions of future returns and firm performance. Second of all, investors make suboptimal decisions even when given the correct probability distributions. Investors have behavioural biases affecting their investment decisions (Bodie, Kane & Marcus, 2014).

Investors can misestimate the true probabilities due to errors in information processing. The errors can occur due to forecasting errors and representativeness biases. The forecasting error indicates that too much weight is placed on recent experience when making forecasts. Investors tend to overestimate the probability distribution for future outcome with too extreme estimations. The representativeness bias occurs when investors make conclusion based on a small sample. The small sample represents the whole population leading to biased estimation. Patterns are quickly adopted and used to forecast future trends leading to errors in information processing generating incorrect probability distributions of return (Bodie, Kane & Marcus, 2014).

Behavioural biases arise with mental accounting and affect. Mental accounting occurs when investors separate certain investment decisions. Traditional finance theory makes decisions for the whole period meaning that all investments have the same risk-adjusted return. Behavioural finance points out that investors want to assign different portfolios with different degrees of risk depending on the purpose and goal of the portfolio. The conventional theory focuses on utility as a relationship between risk and return. Behavioural finance expands the relationship with one more factor, affect. Affect is a feeling that investors add to their decision-making. Investors might purchase stocks because of the feeling of "making good" rather than maximizing their risk adjusted return. Meaning that mispricing will occur due to overpriced good affect stocks (Bodie, Kane & Marcus, 2014).

3.3 Theoretical Models

3.3.1 The Sharpe Ratio

Sharpe (1994) introduced a widely used reward to volatility measure, the Sharpe Ratio, as displayed in *formula (1)*. The measure calculates the average return of a portfolio and subtracts the risk free rate. The excess return is divided by the standard deviation of the portfolio. The ratio puts the excess return of a portfolio in relation to the volatility of the portfolio. The excess return is the premium earned by replacing the risk free asset with a risky portfolio.

$$SR_i = \frac{\bar{r}_p - \bar{r}_f}{\sigma_p} \quad (1)$$

SR_i= Sharpe ratio
$\bar{r}_p$= Expected return of portfolio
$\bar{r}_f$ =Expected risk-free rate
σ_p= Standard deviation of portfolio

3.3.2 The Capital Asset Pricing Model

Treynor (1961), Sharpe (1964), Lintner (1965) & Mossin (1966) developed the Capital Asset Pricing Model, one of the most accepted financial models. The model gives a precise prediction of the relationship between the systematic risk and the expected return. The creators argued that a well-diversified portfolio would eliminate the firm-specific risk and should therefore not get compensated for. Systematic risk on the other hand cannot be reduced by holding a diversified portfolio and should therefore be compensated for.

Individuals will construct a portfolio by combining the risk free asset with risky assets. The CAPM is built on a few important assumptions regarding individuals and the market as seen in *table 1*. These assumptions will make all investors choose the same weights for each risky assets and this creates the market portfolio. Individuals will construct their portfolio by combining the market portfolio and the risk free asset. The expected return of a portfolio can be calculated with the CAPM as displayed in *formula (2)*.

$$E(r_a) = r_f + \beta_a(E(r_m) - r_f) \quad (2)$$

$E(r_a)$ =The expected return of stock a
r_f = The risk-free rate
β_a = Beta of stock a
$E(r_m)$= The expected reurn of the market portfolio

The CAPM calculates the expected return of an asset as the sum of the risk free rate and the market premium. The risk premium for the asset is depending on the risk premium for the market and the Beta value.

Beta measures a stocks sensibility of returns when market movements occur and can be viewed in *formula (3*).

$$\beta_a = \frac{Cov(r_a, r_M)}{Var(r_M)} \quad (3)$$

($\beta > 1$) = The stock will have larger movements than the market
($\beta < 1$) = The stock will have smaller movements than the market
($\beta = 1$) = The stock is perfectly correlated with the market

3.3.3 Fama-French Three-Factor Model

Fama & French (1993) extended the capital asset pricing model by two more factors, value and size as displayed in *formula (4*). Fama & French found that value stocks outperformed growth stocks and small companies outperformed large companies. The result is consistent over time, in markets all over the world. The CAPM could therefore be improved by including the two factors.

$$R_{it} = \alpha_i + \beta_{iM}R_{Mt} + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + e_{it} \quad (4)$$

β_{iSMB} = Exposure to size
SMB_t= Excess return of small cap companies over large cap companies
β_{iHML} = Exposure to value
HML_t= Excess return of high book to market ratio companies over low book to market ratio

Fama & French (1993) explain the market risk premium in the same way as Treynor (1961), Sharpe (1964), Lintner (1965) & Mossin (1966) explained it in the CAPM. It is the difference between the expected return of the market and the risk- free rate.

The SMB factor captures the spread in returns between small cap stocks and large cap stocks. Fama & French proved that small cap stocks outperformed large cap stocks in the long run.

The HMLfactor measures the value effect on the excess return of companies with high book to market ratio over low book to market ratio. Fama & French proved that value companies outperformed growth companies in the long run.

3.3.4 Fama-French Five-Factor Model

Formula (5), Fama & French (2014) presented an extension of the three-factor model.

$$R_{it} = \alpha_i + \beta_{iM}R_{Mt} + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iRMW}RMW_t + \beta_{iCMA}CMA_t + e_{it} \qquad (5)$$

β_{iRMW} = Exposure to profitability
RMW_t = Excess return of portfolio with robust profitability over weak profitability
β_{iCMA} =Exposure to investment
CMA_t = Excess return of portfolio with conservative investment level over aggressive level

The two factors, RMW, robust minus weak profitability and CMA, conservative minus aggressive investment, improved the performance of the factor model by Fama & French. The extended version captures the stock return more successfully. The RMW factor captures that companies with robust profitability outperform companies with weak profitability. CMA captures the differences between companies that have conservative investment strategies compared to the ones that invest aggressively (Fama & French, 2014).

4. Data & Method

4.1 Data

A set of data is required in order to compare the performance of stocks with different levels of achieved ESG score. The data was gathered from Thomson Reuters Datastream, one of the most comprehensive databases for financial time series. The analysis is done for large cap, mid cap and small cap stocks traded on the New York Stock Exchange from 1st of January 2004 to the 31st of December 2017. Datastream reported ESG data in 2001 with a small number of companies rated. The amount of data increased in the following years and a bigger part of the listed companies in the US had a score in 2004. ESG data is available for the majority of the companies in the US and therefore the search is based on the US market.

Thomson Reuters ESG score is equally weighted among three pillars, environmental, social and governance. The overall score is a product of the data received from different ESG categories and the debates captured in the global media. The data is gathered from 10 subcategories, resource use, emissions, innovation, management, shareholders, CSR strategy, workforce, human rights, community and product responsibility. 178 relevant data points are selected to measure the overall sustainable performance. Thomson Reuters combines the data received with a controversies category. This category captures scandals and big events from social media and covers the overall global appearance. The overall ESG score lies between 0-100, from low to high rating (Thomson Reuters, 2018). *Table 2* displays the criteria that form the basis of the ESG rating.

Score Structure

Pillars	Category	Weights
Environmental	Resource Use	11%
	Emissions	12%
	Innovation	11%
Social	Workforce	16%
	Human Rights	4,50%
	Community	8%
	Product Responsibility	7%
Governance	Mangement	19%
	Shareholder	7%
	CSR Strategy	4,50%
Total		100%

Table 2: Extract from a number of criteria that form the basis of Thomson Reuters ESG rating (Thomson Reuters, 2018)

Datastream provides lists of current constituents of each index, which means that companies filling in for bankruptcy will be delisted from the lists. This could present a possible survivorship bias

where my investigation could include systematic errors leading to a biased result. Survivorship bias is a state where only the companies that "survived" are present in the result. The result from the selected companies does not comply with the target population (Körner & Wahlgren, 2012). This has to be considered when analysing the results in this study.

760 active stocks are found in the New York Stock Exchange in Datastream for the estimated time period. Lists are made for each year, constituting a total of 14 lists. Each list includes ESG score, monthly return and market value of all companies. All data regarding the stocks is obtained from Thomson Reuters Datastream.

The benchmark performance of each portfolio is measured with the CAPM, Fama-French three-factor model and Fama-French five-factor model. The five factors are gathered in order to calculate the regression models. Estimates of Mkt-Rf, SMB, HML, RMW, CMA and RF are collected from Kenneth French's website. Kenneth French (2018) provides a continuously updated database for the estimates used in the Fama-French multifactor regression models. All factors are gathered on a monthly basis for the whole estimated time period. The collected risk-free rate from Kenneth French's website is the 1-month T-bill rate for the period from 1st of January 2004 to the 31st of December 2017

4.2 Method

4.2.1 Portfolio Construction

This study investigates the relationship between financial performance and environmental, social and governance performance. The gathered data is ranked based on the received ESG score from Thomson Reuters Datastream. The ESG rating from Thomson Reuters Datastream is a multidimensional measure and not only based on belonging industry. The score is chosen in order to measure the sustainable performance and at a same time not inhibit the possibility of diversification. Bodie, Kane & Marcus (2014) describes how diversification is an important part in the decision making of an investor since it reduces the firm-specific risk and should therefore be considered in the investigation.

The stocks gathered are divided into 14 lists, one for each year. The lists are structured based on the companies' ESG rating with the highest in the top and the lowest in the bottom. The study examines constructed portfolios that differ in ESG rating. The top 10% in the list is selected for the top portfolio and the 10% in the bottom is chosen for the bottom portfolio. The portfolio construction in 2004 is showed in *table 3*.

Portfolio Construction

Top portfolio		Bottom portfolio	
Company	**ESG score**	**Company**	**ESG score**
HP	98,17	CROWN CASTLE INTL.	19,79
TARGET	98,16	TRAVELERS COS.	19,67
MARATHON OIL	98,02	DIAMOND OFFS.DRL.	19,56
JOHNSON & JOHNSON	97,98	LINCOLN NATIONAL	19,44
CHEVRON	97,93	MARSH & MCLENNAN	18,93
AVON PRODUCTS	97,76	EVEREST RE GP.	18,91
BRISTOL MYERS SQUIBB	97,68	ESTEE LAUDER COS.'A'	18,37
3M	97,64	BROWN & BROWN	18,28

MOTOROLA SOLUTIONS	97,4	DUN & BRADSTREET DEL.	18,26
MERCK & COMPANY	97,3	AMERICAN TOWER	18,17
SOUTHERN	97,3	UNITED STATES STEEL	18,13
BOEING	97,14	NATIONAL OILWELL VARCO	17,48
MCDONALDS	97,11	PROLOGIS	17,4
GENERAL MILLS	97,08	W R BERKLEY	16,2
CONOCOPHILLIPS	97,06	KB HOME	15,5
EATON	96,89	OSHKOSH	15,43
INTERNATIONAL BUS.MCHS.	96,81	ARCHROCK	15,02
EMERSON ELECTRIC	96,77	CONSTELLATION BRANDS 'A'	14,66
HONEYWELL INTL.	96,77	CONSTELLATION BRANDS 'B'	14,66
BAXTER INTL.	96,7	TOLL BROTHERS	14,47
OCCIDENTAL PTL.	96,63	FEDERATED INVRS.'B'	13,9
EXELON	96,6	CHESAPEAKE ENERGY	13,83
PINNACLE WEST CAP.	96,4	NVR	13,68
UNITED PARCEL SER.'B'	96,4	SL GREEN REALTY	12,19
UNITED TECHNOLOGIES	95,82	FOREST CITY REAL.TST.'A'	11,62
ASHLAND GLOBAL HDG.	95,09	MOLSON COORS BREWING 'B'	10,1
JOHNSON CONTROLS INTL.	95,08	ALLERGAN	9,64
PROCTER & GAMBLE	94,78	DILLARDS 'A'	6,72
OLIN	94,61	ROWAN COMPANIES CL.A	5,96

Table 3: Portfolio construction
Companies selected for the top and bottom portfolios in 2004 based on ESG-score.

The score is changing on a yearly basis hence the same requirements and selection process follows the years to come.

The ESG ratings change yearly leading to yearly portfolio rebalancing. The yearly rebalancing is done because the study aims to examine and compare the performance of the stocks with the highest rating and lowest rating. In order to make this possible, the portfolios have to be rebalanced. The portfolios could otherwise show a biased result based on scores that does not have to be accurate to the sustainable performance of the business.

The companies chosen for the portfolios each year are later on weighted. The portfolio weights are based on two different methods, equal weights and market value weights. The portfolio that consistent of equal weights divides each company by the sum of all companies leading to equal weights among all companies in the portfolio. The market value weighted portfolios are constructed by dividing each company's market value by the sum of the whole portfolio's market value.

Market value weighted portfolios is presented in *formula (6)*.

$$W_i = {MV_i}\Big/{MV_p} \tag{6}$$

MV_i = Market value of company i
$MV_p = \sum_{i=1}^{n} MV_i$ = Market value of portfolio

A difference portfolio is constructed according to the long-short strategy in order to evaluate and compare the performance of the stocks with high ESG score and low ESG score. The long-short strategy is issued by taking a long position in stocks that are expected to increase in value and a short position in stocks that are expected to decrease. The predicted future trend for sustainable

investment is the reason for picking the top ESG stocks as the long portfolio and the low ESG stocks are collected to the bottom portfolio.

4.2.2 Time period

The timeframe ranges from January 1st 2004 to December 31st 2017, a period of 14 years. The starting year of 2004 was chosen because of the big lack of rated companies in the earlier years. Recent studies showed a significant relationship in the long run such as the two studies of Eccles et al. (2014) and Yamashita et al. (1999). The length of the investigation was chosen in order to measure the connection between financial performance and sustainable performance in the long run. The period is divided into two sub periods in addition to the long run investigation. The two short periods examine how the portfolios change over time and the influence during various phases of the business cycle. The first period covers the years before, during and the time right after the financial crisis. The second period measures the later recovery years.

Whole Period: January 1st 2004 – December 31st 2017
First Period: January 1st 2004 – December 31st 2010
Second Period: January 1st 2011 – December 31st 2017

4.2.3 Investigation

4.2.3.1 Return and Volatility

The starting point to measure the firm performance is to calculate the rate of return, as displayed in *formula (7)*. The contribution of each stock is given by taking the monthly return for each of them multiplied with its weight given as showed in *formula (8*). The same procedure is done for the next month, which generates the monthly rate of return for the whole portfolio. The first section of the result shows the absolute returns for the top and bottom portfolio. The absolute return shows the development of an investment of 100$ in the beginning of the period to the maturity in the end of the period.

The second part of the result measures the average monthly excess return, volatility and Sharpe Ratio for the long, short and long-short portfolio during different time periods and by using different weighting strategies. The long-short portfolio is calculated by taking the difference between the financial performances of the long portfolio and subtracts the performance of the short portfolio. The risk-adjusted returns are measured with the Sharpe Ratio by dividing the excess return with the standard deviation of the portfolio. The arithmetic mean is calculated with the AVERAGE function in excel. The monthly risk-free rate is gathered form Kenneth French's website and is subtracted from the arithmetic mean in order to calculate the excess return. The volatility of the portfolios is calculated in excel using the excel function, STEDV.S. The equation for the Standard Deviation can be viewed in *formula (9*). The Sharpe Ratio is calculated in excel by dividing the excess return of the portfolio with the standard deviation.

$$R = \frac{P_t - P_{t-1}}{P_{t-1}} = \text{Return} \quad (7)$$

$$R_i = w_i * R_i = \text{Portfolio Return} \quad (8)$$

$$\sigma = \sqrt{\frac{\sum(r-\bar{r})^2}{n-1}} = \text{Standard Deviation} \quad (9)$$

4.2.3.2 Regression

The excess returns of each portfolio are further analysed with three types of regressions using StatPlus. The CAPM is the first regression followed by the Fama-French three-factor model and lastly the Fama-French five-factor model. Data for the independent factor are gathered from Kenneth French's website.

The five gathered estimates are SMB, HML, RMW, CMA and Mkt-Rf. The database, Kenneth French (2018), provides a brief description of the construction of the factors, which can be seen in *formulas (10*) to *(13).*

SMB is calculated as the average return on nine small stock portfolios minus the average return on nine portfolios with big stocks. These portfolios are divided into three different categories, the first one is size and book-to-market value, the other one is formed on size and operating profitability and the last one is size and investments.

$$\mathbf{SMB} = \mathbf{1/3}\ (\boldsymbol{SMB}_{\left(\frac{B}{M}\right)} + \boldsymbol{SMB}_{(OP)} + \boldsymbol{SMB}_{(INV)}) \quad (10)$$

The second estimate is calculated as the average return of two value portfolios minus the average return on two growth portfolios.

$$\mathbf{HML = 1/2(Small\ Value + Big\ Value) - 1/2(Small\ Growth + Big\ Growth)} \quad (11)$$

Robust Minus Weak is computed as the average return of two robust operating profitability portfolios minus the average return of two weak operating profitability portfolios.

$$\mathbf{RMW= 1/2(Small\ Robust + Big\ Robust) - 1/2(Small\ Weak + Big\ Weak)} \quad (12)$$

The factor CMA is the average of two conservative investments portfolios minus the average of two aggressive investment portfolios.

$$\mathbf{CMA = 1/2(Small\ Conservative + Big\ Conservative) - 1/2(Small\ Aggressive + Big\ Aggressive)} \quad (13)$$

The last estimate, the excess return of the market, is calculated as the excess return on selected stocks in the US.

These estimates are imported to StatPlus together with the monthly excess return for each portfolio. The portfolio performance is regressed with the three types of regressions. The regressions estimate alpha values and factor loadings. The regressions are made for both the portfolios with equal weights and the market value weighted portfolios. The regressions are made for the whole time period and the two shorter periods.

4.2.4 Statistical Reliability

A few tests on the data have to be conducted before analysing the financial performance of the portfolios with the linear regression model. The tests are done in order to determine whether the linear relationship is appropriate to the collected data and if the data fulfils the assumptions for a multiple regression. The statistical software, EViews is used to determine the statistical reliability of the data. The conducted tests can be found in the Appendix.

4.2.4.1 Normal Distributed Errors

Residuals of the regression should follow a normal distribution. The Jarque-Bera test has a null hypothesis of normal distribution. As n goes to infinity the t-statistics will converge to a standard normal distribution even though the standard errors do not follow a normal distribution. This means that a large sample will have approximately correct values even if the standard errors are not normal distributed (Ciuiu, 2008).

4.2.4.2 Homoscedasticity

Homoscedasticity is a desired state and occurs when all error terms have the same variance. The opposite is called heteroscedasticity and occurs when the variance of the residuals are not constant. The parameter estimates will still be unbiased when heteroscedasticity occurs, however the standard errors are biased leading to biased test statistics. The White test and Breusch-Pagan test can be used to detect heteroscedatsticity. The White test is an auxiliary regression where the null hypothesis is that the error terms are homoscedastic. The null hypothesis in the Breusch-Pagan test states that the error variance is equal. If heteroscedasticity is present in the data set, robust standard errors will be used while testing the hypothesis (Williams, 2015).

4.2.4.3 Autocorrelation

Autocorrelation occurs when present value are affected by previous values. The covariance between the errors terms is not equal to zero with autocorrelation. The phenomenon affects the model and the effectiveness of the model. The Breusch-Godfrey test is of great use in order to detect autocorrelation. The null hypothesis states that there is no autocorrelation in the error terms (Brooks, 2014).

4.2.4.4 Multicolinearity

A model suffers form multicolinearity if one explanatory variable is close to be equal to a linear combination of the rest of the explanatory variables. The model suffers from perfect multicolinearity if one of the explanatory variables is an exact linear combination of the rest of the explanatory variables. A correlation close to 1 or -1 between two variables is a sign of multicolinearity, which can lead to unreliable estimates. A correlation matrix can be analysed to test for multicolinearity and values should not exceed 0,7 or -0,7 (Brooks, 2014).

4.2.4.5 Significance Level

Körner & Wahlgren (2006) states that a significance level must be set when a study examines hypotheses. Type I error occurs when rejecting a hypothesis that should have been accepted. The opposite is called type II error and appears when we fail to reject a false hypothesis. The significance level is the risk that the null hypothesis will be rejected when it should have been accepted. The probability of committing a type I error is called the level of significance. The authors suggests that the level of significance should be 0,1 %, 1%, 5% or 10%. I will analyse the result with the 1%, 5% and 10% significance level.

4.2.4.6 T-Test

The T-test is used to determine if there is a significant difference between the means of two groups. The null-hypothesis states that there is no difference between the mean of the two groups. The T-test is used to determine whether an assumption is applicable to a population. If the P-value exceeds the level of significance we will accept the null hypothesis, if it is less than the level of significance we will do the opposite, reject it (Brooks, 2014).

4.2.4.7 R-Square

R-square is a statistical measure that tells us how close the data is to the fitted regression line. It is a measure of how well the regression predicts the real data points. In other words, to what degree the model can explain the variability around the mean. An R-square of 1 indicates that the model's prediction perfectly fit the real data. A low value means that the variability in data is explained by something more or something else than the model (Körner & Wahlgren, 2006).

Regressions with the CAPM, Fama-French Three-Factor model and Fama-French Five-Factor model are made after having considered and tested for all the assumptions that must hold for unbiased multiple regression.

5. Results

5.1 Absolute Return

The first section of the result investigates the absolute return of the high and low ESG stocks. Two different weighting methods are analysed to examine the portfolio performance. The first assigns market value weights while the second strategy assigns equal portfolio weights to all individual stocks. The two different strategies affect the overall portfolio performance. The absolute returns of the long portfolio and short portfolio are displayed in *figure 1* and *figure 2*. *Figure 1* displays the market value weighted portfolios and *figure 2* demonstrates the one with equal weights. As is evident, the absolute return of both the equally weighted portfolio and the market value weighted portfolio increased over time and the long portfolio is superior to the short portfolio. The long portfolio have a total return of 133,2% for the market value weighted portfolio and 242,7% for the equally weighted portfolio. Likewise, a 100$ investment in the short portfolio would appreciate to 183,6$ for the market value weighted portfolio and 245,7$ for the equally weighted. A total increase in return of 83,6% for the market value weighted portfolio and 145,7% for the equally weighted from January 2004 to December 2017. As exhibited, both portfolios for both weighting strategies follow the same pattern of movement with suffering years of poor outcome during the financial crisis and a rapid growth in the years that follows.

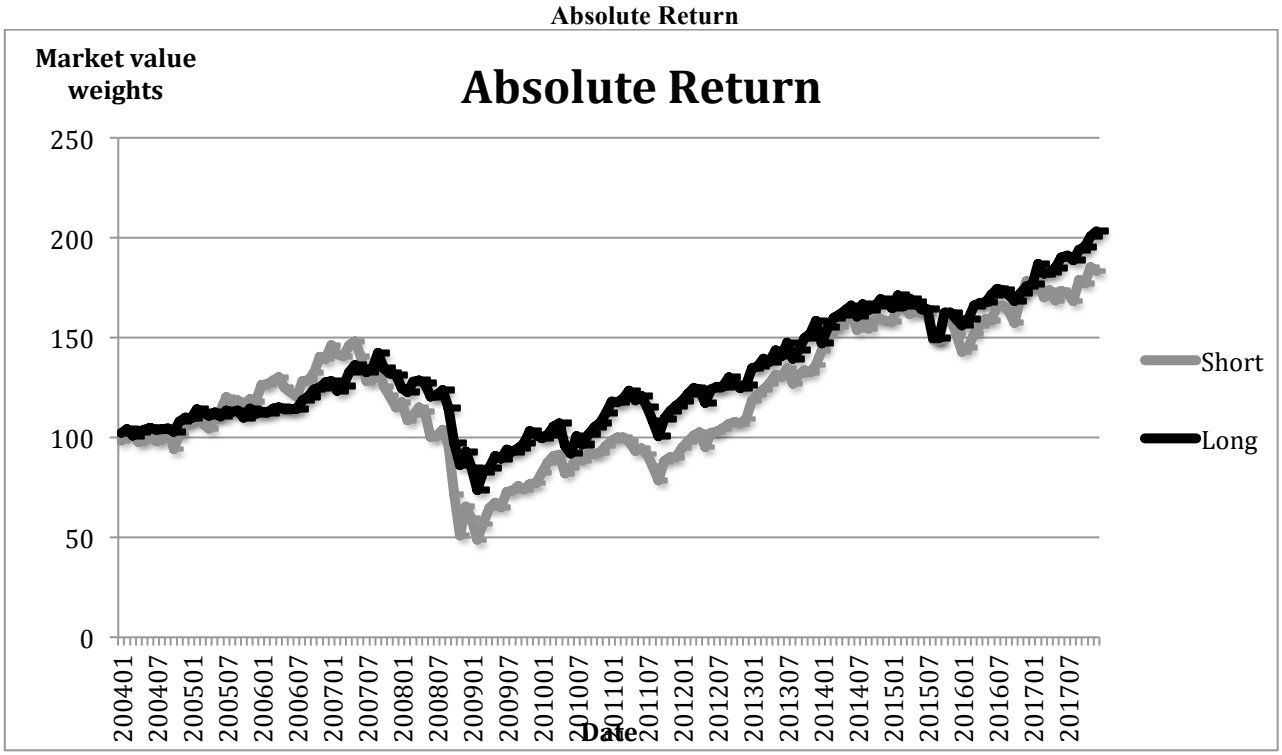

Figure 1: Absolute return, Market value weighted portfolios

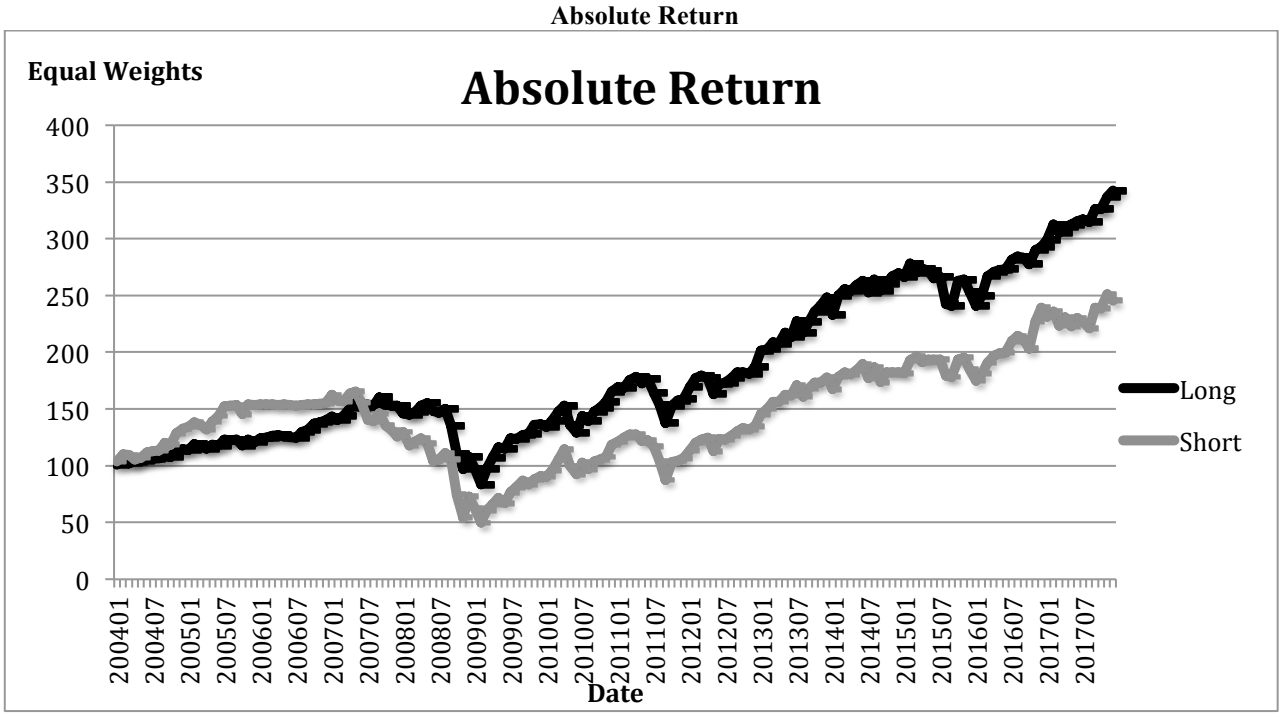

Figure 2: Absolute return, Equally weighted portfolios

5.2 Average Monthly Excess Return

A total of 18 portfolios are constructed to measure the performance of the long portfolio, short portfolio and the long-short portfolio. As seen in the result, the portfolio performance differs for different time settings and different weighting strategies. The average excess return fluctuates and the major disparity comes from the weighting strategies.

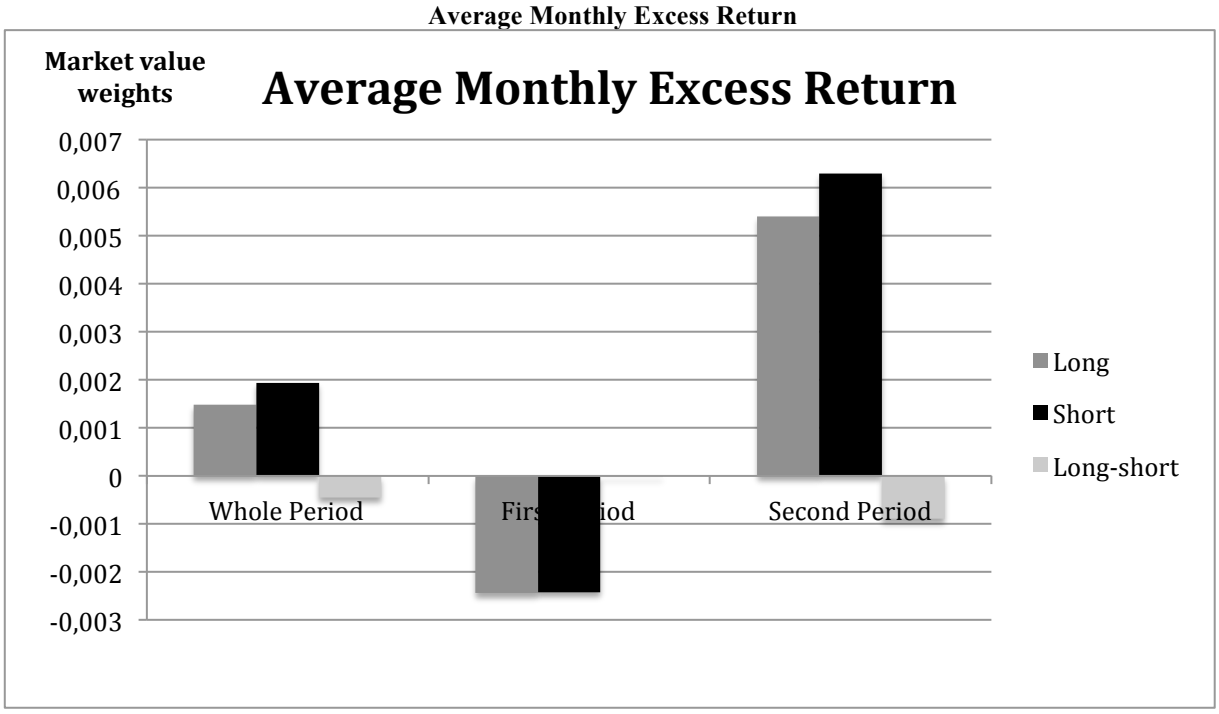

Figure 3: Average monthly excess return, Market value weighted portfolios

The average monthly excess return fluctuates over time for the market value weighted portfolios as seen in *figure 3*. The average monthly excess return for the low ESG stocks is always higher than the high ESG stocks. Both portfolios differ drastically from the first time period to the second. The monthly average excess return is -0,00244 for the high ESG stocks and -0,00242 for the low ESG stocks during the first time period. The negative excess return is a result of both low to negative monthly return and a risk-free rate that exceeds the monthly return. The outcome changes and the average monthly excess return is 0,00541 for the long portfolio and 0,0063 for the short portfolio during the second time period. The difference portfolio is left with a negative excess return for all estimated time periods. The market value weighted portfolios have a fluctuating average monthly excess return with even a negative outcome for all portfolios in the first period.

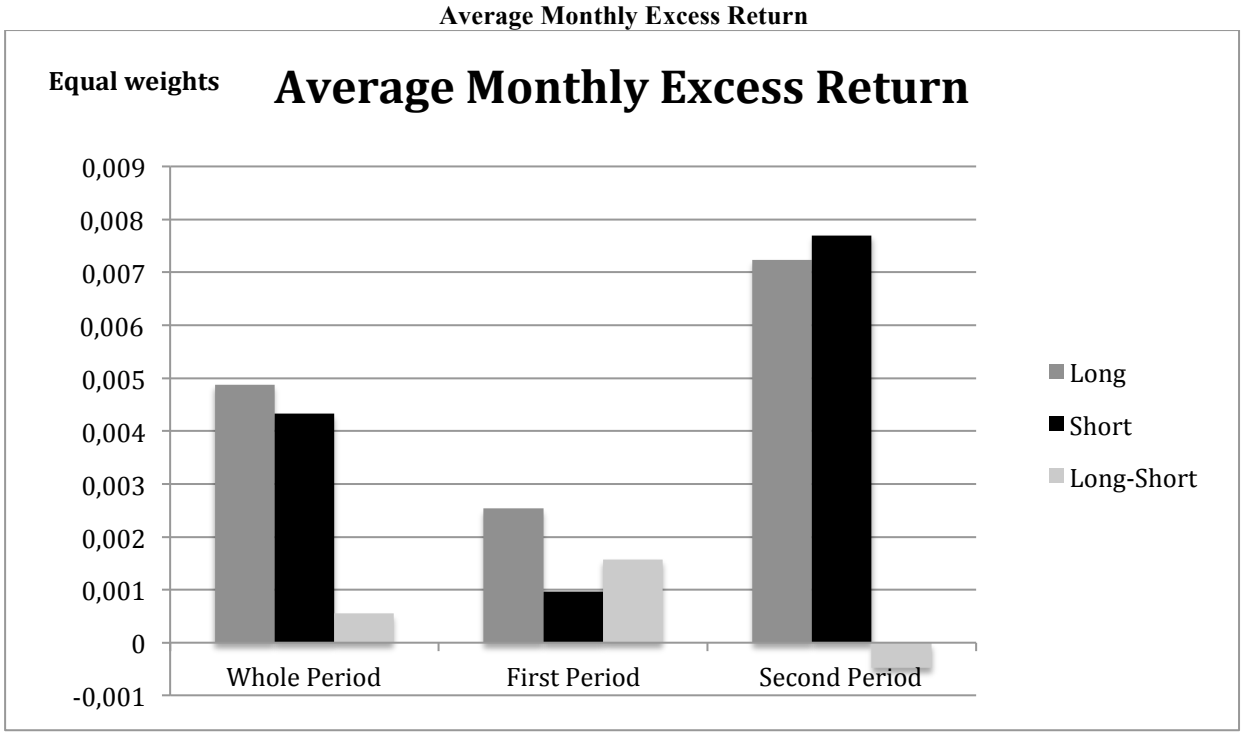

Figure 4: Average monthly excess return, Equally weighted portfolios

The outcome gets more consistent when constructing equally weighted portfolios as seen in *figure 4*. Both the long portfolio and short portfolio have a positive average monthly excess return for all equally weighted portfolios. The long portfolio has a higher average monthly excess return for the first period and the whole period. The outcome is reflected in the long-short portfolio, with a positive average monthly excess return during the same time. The equally weighted portfolios follow the same movement as the market value weighted portfolios with a positive development from the first time period to the other. The long portfolio has an average of 0,00254 and the short portfolio of 0,00097 for the first time period. The average monthly excess return is increasing and the short portfolio takes the lead at 0,0077 followed by the long portfolio at 0,00723.

5.3 Volatility

A high return does not directly imply a better financial performance. A higher return could be a result from increasing risk and therefore volatility has to be counted for.

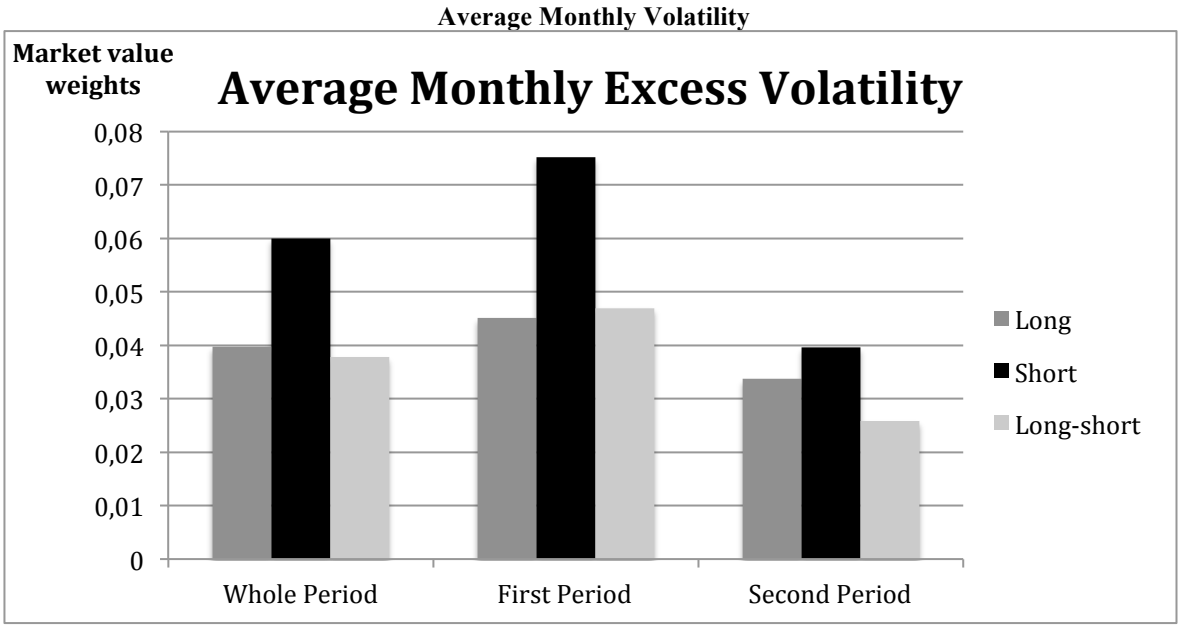

Figure 5: Standard deviation of monthly excess return, Market value weighted portfolios

The reflected volatility in *figure 5* is measured by the standard deviation of the monthly excess return of the portfolios. The short portfolio is experiencing a volatility peak of 0,07515 in the first period followed by a decreasing average of 0,03964 in the later years and a total of 0,05997 is calculated for the whole period. The long portfolio is also experiencing a decreasing volatility from the first time period to the second with an average of 0,03978 for the whole period. The short portfolio is experiencing a higher volatility than the long portfolio and the biggest difference is found in the first period. The long-short portfolio has a relative low volatility with an average of 0,0378 for the whole period.

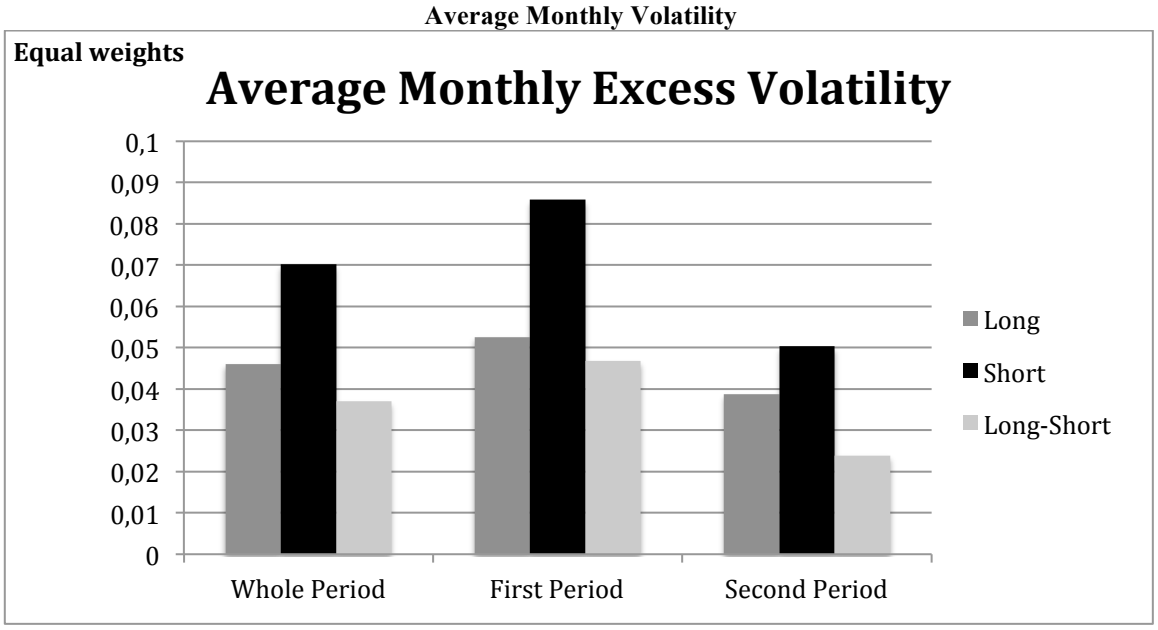

Figure 6: Standard deviation of monthly excess return, Equally weighted portfolios

The standard deviations for all long portfolios are vastly superior to the short portfolios as showed in *figure 6*. The portfolios follow consistent ranking with the short portfolio in the top, followed by the long portfolio and the long-short portfolio in the bottom. The portfolio of low ranked ESG stocks comes with great risk while the high ranked stocks have lower average monthly standard deviation. The short portfolio reaches the peak in the first time period, with a standard deviation of 0,08587 while the bottom is reached by long-short portfolio in in the second period with a volatility of 0,02393. The short portfolio has an average of 0,07019 for the whole period followed by the long portfolio with an average of 0,04607 and the long-short portfolio has an average of 0,03707.

5.4 Sharpe Ratio

The volatility and return are compared with the purpose of finding the risk-adjusted return. The Sharpe Ratio measures how much a financial asset yields per unit of risk.

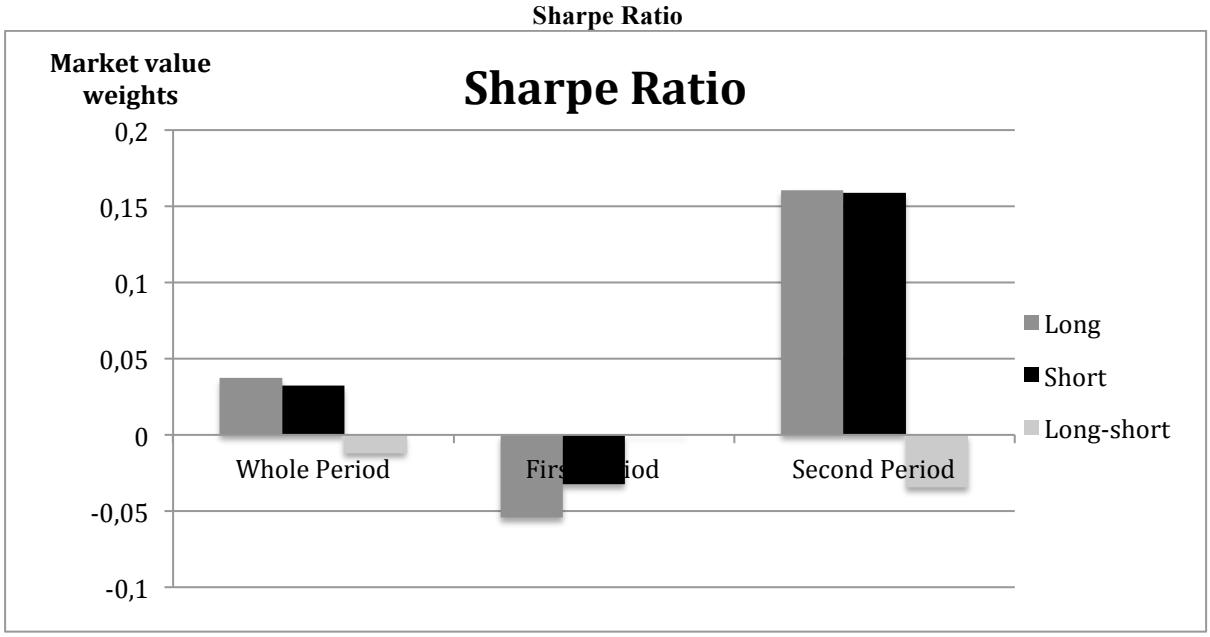

Figure 7: Sharpe Ratio, Market value weighted portfolios

The estimated Sharpe Ratio for the whole period is superior to the long market value weighted portfolio at 0,03734 as showed in *figure 7*. The short portfolio follows with an average of 0,03232 and lastly the long-short portfolio with a negative Sharpe Ratio. The long-short portfolio is experiencing a negative Sharpe Ratio for all tested time periods. The negative value is a result from a negative or low monthly return and a risk-free rate that exceeds the rate of return. The Sharpe Ratio increases over time for the long portfolio and short portfolio, a result from increasing rate of return and decreasing volatility. Negative values are found for all portfolios during the first time period. A Sharpe Ratio of 0,16063 for the long portfolio and an average of 0,15897 for the short portfolio follow in the second time period.

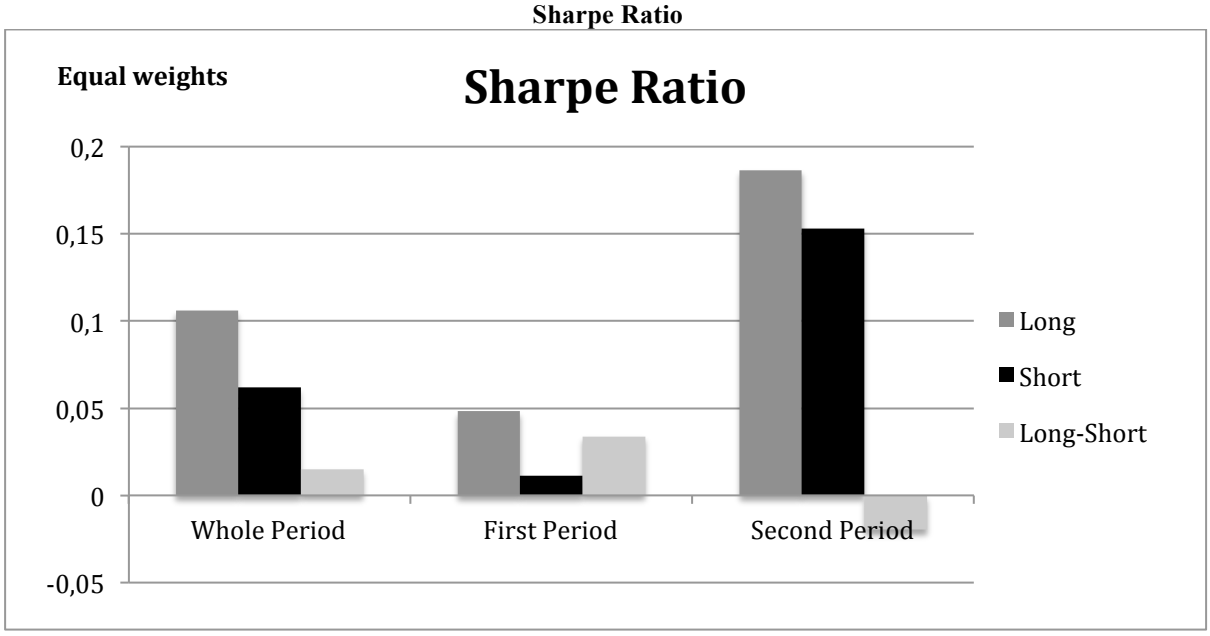

Figure 8: Sharpe Ratio, Equally weighted portfolios

As is evident in *figure 8*, the Sharpe ratio for the long equally weighted portfolio is higher than the short portfolio. This is largely attributed to the low standard deviation of the long portfolio. The Sharpe Ratio is low for all portfolios in the first period. The long portfolio has a value of 0,04834 while the short portfolio has an average of 0,01127 and 0,03361 is found for the long-short portfolio. Time changes and so does the risk-adjusted return, the long portfolio has an average of 0,18627 and the short portfolio has an average of 0,15307 in the second time period. The long-short portfolio is experiencing a negative risk-adjusted return during this time.

5.5 Capital Asset Pricing Model

The capital asset pricing model estimates the expected alpha value and market exposure for the portfolios. The excess return of the portfolio could be a result from high exposure to systematic risk and therefore the portfolio is analysed by the well-established model.

The regression made is based on 168 observations and has an R-square value between 0,71-0,8 as seen in *table 4*. This is the models ability to predict the data. All long portfolios generate negative alpha values according to the capital asset pricing model seen through the negative intercept. This is an indicator of that the portfolios are performing worse than the market. The result is significant at different levels and some parts are insignificant. The Beta values are significant positive at a 1% level during the whole estimated period for both weighing strategies. The equally weighted portfolios have higher factor exposure than the market value weighted portfolios. However, all Beta values are estimated around 1, the portfolios moves like the market.

One-Factor Regression Long Portfolio

Long	**Intercept**	**Mkt-RF**	R^2
Whole Period			
Market	-0,00462 (0,00644)***	0,85798 (0,00001)***	0,72002
Equal	-0,00257 (0,11223)	1,048 (0,0001)***	0,80576
First Period			
Market	-0,00502 (0,0641)*	0,82882 (0,00001)***	0,71061
Equal	-0,00064 (0,80536)	1,02086 (0,0001)***	0,79861
Second Period			
Market	-0,00474 (0,02389)**	0,91369 (0,00001)***	0,73362
Equal	-0,00519 (0,0084)***	1,11786 (0,00001)***	0,80576

Table 4: The Capital Asset Pricing Model for the long portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level, ***Significant at the 1 percent level
P-values found (in parentheses)

As exhibited in *table 5*, the short portfolio is preforming worse than the market, seen through the negative alpha value. The alpha is negative during the whole estimated time and for both weighting strategies. The result is significant for the later time period and the whole period. The estimated alpha values are not significant in the first time period. The Beta values are significant positive at a 1% level during the whole estimated period and for both weighing strategies. The equally weighted

portfolios have a greater exposure to the systematic risk than the market value weighted portfolios. Although, all Beta values lie between 1-1,45, which means that the portfolios have bigger movements than the market index. The short portfolios are exposed to more systematic risk than the market.

One-Factor Regression Short Portfolio

Short	**Intercept**	**Mkt-RF**	R^2
Whole Period			
Market	-0,00618 (0,04985)**	1,14098 (0,0001)***	0,56563
Equal	-0,00573 (0,08864)*	1,41512 (0,0001)***	0,63622
First Period			
Market	-0,00618 (0,27288)	1,20391 (0,00001)***	0,54242
Equal	-0,00356 (0,55162)	1,45136 (0,00001)***	0,60392
Second Period			
Market	-0,00496 (0,07751)*	1,01389 (0,00001)***	0,65108
Equal	-0,00739 (0,01885)**	1,35894 (0,00001)***	0,73047

Table 5: The Capital Asset Pricing Model for the short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level, ***Significant at the 1 percent level
P-values found (in parentheses)

As displayed in the *table 6*, all alpha values found are insignificant and positive. The positive alpha value means that the strategy makes abnormal return. The alpha is positive for both weighting strategies and during the whole time period. The alpha value lies between 0,00022-0,00316 for all long-short portfolios and the peak is reached with the equally weighted portfolio that covers the whole time period. All long-short portfolios have negative Beta values, which means that the portfolios are negatively correlated with the market. The Beta values are low which means that the market movements do not heavily affect the excess return of the portfolios.

The model explains the result with some significance. The equally weighted portfolios have higher R-square than the market value weighted, although all found R-square values are low for the long-short portfolios. All alpha values found are insignificant according to the reported p-statistics, the predicted abnormal return is therefore not statistically reliable. Five out of six portfolios have a significant factor loading to the market exposure. The most important finding is that the alpha value is positive with a negative exposure to the market. The long-short portfolio is predicted to perform better than the market with a lower systematic risk.

One-Factor Regression Long-Short Portfolio

Long- Short	**Intercept**	**Mkt-RF**	R^2
Whole Period			
Market	0,00156 (0,58308)	-0,28299 (0,00009)***	0,08868
Equal	0,00316 (0,23959)	-0,36713 (1,27E-07)***	0,15516

First Period			
Market	0,00115 (0,81098)	-0,37508 (0,00059)***	0,13487
Equal	0,00291 (0,53393)	-0,4305 (0,00006)***	0,17901
Second Period			
Market	0,00022 (0,94043)	-0,10021 (0,25795)	0,01558
Equal	0,00221 (0,4041)	-0,24108 (0,00263)***	0,10507

Table 6: The Capital Asset Pricing Model for the long-short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

5.6 Fama-French Three-Factor Model

As evident, the predictions improved by extending the model by two factors, which is seen through the increasing R-square.

Three-Factor Regression Long Portfolio

Long	**Intercept**	**Mkt-RF**	**SMB**	**HML**	R^2
Whole Period					
Market	-0,00463 (0,004)***	0,90857 (0,00001)***	-0,31704 (0,00003)***	0,16486 (0,01377)**	0,75153
Equal	-0,00247 (0,12185)	1,04291 (0,00001)***	-0,09106 (0,2233)	0,16054 (0,01657)**	0,81304
First Period					
Market	-0,00406 (0,11434)	0,89857 (0,0001)***	-0,39757 (0,00131)***	0,14448 (0,13975)	0,7482
Equal	-0,00011 (0,96442)	1,04352 (0,0001)***	-0,22651 (0,06306)*	0,15624 (0,11307)	0,81095
Second Period					
Market	-0,00539 (0,008)***	0,96138 (0,0001)***	-0,2461 (0,0082)***	0,22419 (0,01572)**	0,76519
Equal	-0,00492 (0,01174)**	1,10081 (0,00001)***	0,01781 (0,83895)	0,19025 (0,03249)**	0,83649

Table 7: Fama-French Three-Factor Model for the long portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

The intercept is still negative, no abnormal return is found for the high ESG portfolios as displayed in *table 7*. Most of the alpha values found in the three factor models provide insignificant results, except the portfolios in the second time period. The portfolios are still significantly positive correlated to the market at a 1% level. The two new factors improved the predictions in the regressions. The market value weighted portfolios have a significant negative factor loading to SMB at a 1% level. Suggesting a great exposure toward big capitalization stocks. The equally weighted portfolios are not as statistically reliable with higher p-values and a mixed outcome. HML is significant positive for both weighting strategies in the second time period suggesting a high exposure towards value stocks. The first time period follows positive factor loadings but insignificant.

Three-Factor Regression Short Portfolio

Short	Intercept	Mkt-RF	SMB	HML	R^2
Whole Period					
Market	-0,00566 (0,05964)*	1,00209 (0,00001)***	0,27023 (0,05527)*	0,41211 (0,00116)***	0,60902
Equal	-0,00494 (0,10106)	1,22139 (0,0001)***	0,28171 (0,04655)**	0,71206 (5,57696E-8)***	0,71215
First Period					
Market	-0,00692 (0,2097)	1,03313 (1,44575E-10)***	0,24615 (0,34071)	0,46274 (0,02923)**	0,5783
Equal	-0,00395 (0,47277)	1,23599 (0,00001)***	0,06131 (0,81187)	0,86319 (0,00008)***	0,67708
Second Period					
Market	-0,00345 (0,18093)	0,91097 (0,00001)***	0,32789 (0,00638)***	0,29939 (0,01248)**	0,71861
Equal	-0,00496 (0,04712)**	1,19307 (0,0001)***	0,53345 (9,35777E-6)***	0,46328 (0,0001)***	0,83715

Table 8: Fama-French Three-Factor Model for the short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

The low ESG portfolios are still experiencing negative alpha values as showed in *table 8.* The values are for most part insignificant except the equally weighted portfolio in the second time period that is significant at a 5% level. The market exposure is still significantly negative at a 1% level. The SMB coefficients are positive but low. The short portfolios are therefore more exposed to small capitalization stocks rather than big capitalization stocks. The values found in the second period are significant at a 1% level while the estimates for the earlier time period are insignificant. The short portfolios have a significant positive relationship towards the HML coefficient at a 1%-5% level; the portfolios are therefore exposed to value stocks.

Three-Factor Regression Long-Short Portfolio

Long-short	Intercept	Mkt-RF	SMB	HML	R^2
Whole Period					
Market	0,00103 (0,69143)	-0,09352 (0,19526)	-0,58727 (3,11E-06)***	-0,24724 (0,02363)**	0,24823
Equal	0,00247 (0,29242)	-0,17848 (0,00657)***	-0,37277 (0,00084)***	-0,55151 (6,87E-08)***	0,36478
First Period					
Market	0,00286 (0,52576)	-0,13456 (0,24602)	-0,64372 (0,00304)***	-0,31826 (0,06624)*	0,27363
Equal	0,00383 (0,35746)	-0,19247 (0,07379)*	-0,28783 (0,14246)	-0,70695 (0,00002)***	0,37692
Second Period					
Market	-0,00194 (0,46694)	0,05041 (0,54552)	-0,574 (9,98E-06)***	-0,07521 (0,53855)	0,25515
Equal	0,00004 (0,98474)	-0,09226 (0,17541)	-0,51563 (1,41E-06)***	-0,27302 (0,00719)***	0,4267

Table 9: Fama-French Three-Factor Model for the long-short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

As exhibited in *table 9,* the result for the long-short portfolio is not as clear as calculations made with the capital asset pricing model. The equally weighted portfolio in the first period reaches the highest alpha value of 0,00383. The majority yields a positive alpha except the market value weighted portfolio in the second period. This portfolio is also the only one that is positively correlated to the market. All other portfolios are negatively correlated to the market. The values are for most part insignificant except the equally weighted portfolio measured for the first period and the whole period. Almost all SMB estimates are significant negative at a 1% level, which means a great exposure towards large cap stocks. The only exception is the equally weighted portfolio in the first period that is insignificant. All HML estimates are negative and the majority are significant. This suggests that the portfolio is more exposed to growth stocks. The equally weighted portfolios are significant at a 1% level while the market value weighted portfolios are significant at different levels and even insignificant to some parts.

5.7 Fama-French Five-Factor Model

As exhibited, the predictions improved further by including RMW and CMA.

Five-Factor Regression Long Portfolio

Long	**Intercept**	**Mkt-RF**	**SMB**	**HML**	**RMW**	**CMA**	R^2
Whole Period							
Market	-0,00534 (0,00232)***	0,92885 (0,00001)***	-0,28515 (0,05198)*	0,18538 (0,52681)	0,16818 (0,11734)	-0,0685 (0,02825)**	0,75546
Equal	-0,00335 (0,00554)***	1,0576 (0,0001)***	-0,04325 (0,47909)	0,23574 (0,36332)	0,21252 (0,19469)	-0,26292 (0,19004)	0,82218
First Period							
Market	-0,00432 (0,10694)	0,88287 (0,00001)***	-0,36209 (0,00308)***	0,22888 (0,02831)**	0,0362 (0,84059)	-0,42636 (0,03106)**	0,76418
Equal	-0,001 (0,6968)	1,0388 (0,00001)***	-0,16699 (0,14719)	0,27624 (0,00639)***	0,15501 (0,37194)	-0,60639 (0,00173)***	0,83825
Second Period							
Market	-0,00609 (0,00232)***	1,00855 (0,0001)***	-0,18618 (0,05198)*	0,0713 (0,52681)	0,21326 (0,11734)	0,38034 (0,02825)**	0,79009
Equal	-0,00547 (0,00554)***	1,13396 (0,00001)***	0,06648 (0,47909)	0,10162 (0,36332)	0,17456 (0,19469)	0,22288 (0,19004)	0,84505

Table 10: Fama-French Five-Factor Model for the long portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

As showed in *table 10,* the intercept for the long portfolio is still negative and four out of six portfolios display a significant result at a 1% level. The market exposure is positive and significant at a 1% level with values close to 1 for all portfolios. Most portfolios still have a negative factor exposure to SMB except the equally weighted portfolio in the second period. HML is still positive for all portfolios, however this time the result is significant for the first time period and insignificant for the other estimated period. All portfolios are positively correlated to the RMW factor, however all are insignificant. The positive value means that the portfolio is exposed towards high profitability stocks. The factor loadings to the CMA coefficient are negative for the first time period and positive for the later time period. This means a change from exposure towards stocks that are investing aggressively towards stocks that investing conservatively. All market value weighted

portfolios are significant at a 5% level while the equally weighted portfolios are not as statistically reliable.

Five-Factor Regression Short Portfolio

Short	**Intercept**	**Mkt-RF**	**SMB**	**HML**	**RMW**	**CMA**	R^2
Whole Period							
Market	-0,00442 (0,14087)	0,90535 (0,001)***	0,66299 (2,49E-06)***	-0,27752 (0,17113)	-0,90622 (0,00014)***	0,26111 (0,06168)*	0,64578
Equal	-0,00491 (0,11321)	1,18275 (0,0001)***	0,30937 (0,03225)**	0,88867 (2,18E-09)***	0,00406 (0,98449)	-0,63208 (0,00912)***	0,72404
First Period							
Market	-0,00399 (0,45149)	0,8384 (1,29E-07)***	0,31527 (0,1856)	0,791 (0,00022)***	-0,6453 (0,07473)*	-1,65672 (0,00005)***	0,66161
Equal	-0,00261 (0,6443)	1,12761 (1,98E-10)***	0,11769 (0,64207)	1,08058 (4,06E-06)***	-0,30632 (0,42469)	-1,09737 (0,00958)***	0,70408
Second Period							
Market	-0,00298 (0,2584)	0,89482 (0,00001)***	0,28067 (0,0312)**	0,27495 (0,07446)*	-0,17362 (0,34466)	0,05106 (0,82542)	0,72184
Equal	-0,00557 (0,02945)**	1,22055 (0,0001)***	0,59182 (6,63E-06)***	0,44165 (0,00329)***	0,21263 (0,2276)	0,06237 (0,77843)	0,84075

Table 11: Fama-French Five-Factor Model for the short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

The short portfolios are also experiencing negative alpha values as seen in *table 11*, however there is only one significant result found. The low ESG stocks are still positively exposed to the market at a 1% level. The factor loadings towards SMB and HML have not changed much since the three-factor model with mostly positive factor loadings. The two new factors increase the likelihood of correct estimates of future excess return. The market value weighted portfolios have a significant negative factor loading towards the RMW factor when estimating the whole period and the first period. The estimates show a significant exposure to weak profitability stocks during these time periods. CMA follows the same movement as the long portfolio did with negative values in the first estimated period and positive in the second. The values indicate that the portfolio first is exposed to aggressive investment stocks and conservative investment stocks in later period. The values are significant at a 1% level in the first years and insignificant in later years.

Five-Factor Regression Long-Short Portfolio

Long-short	**Intercept**	**Mkt-RF**	**SMB**	**HML**	**RMW**	**CMA**	R^2
Whole Period							
Market	-0,00092 (0,71767)	0,0235 (0,74862)	-0,54626 (7,71E-06)***	-0,47761 (0,00006)***	0,44571 (0,0104)**	0,83772 (0,00004)***	0,34523
Equal	0,00156 (0,51971)	-0,12515 (0,07395)*	-0,35262 (0,00201)***	-0,65293 (1,68E-08)***	0,20847 (0,2039)	0,36916 (0,05105)*	0,38502
First Period							
Market	-0,00033 (0,94043)	0,04447 (0,7112)	-0,67735 (0,00088)***	-0,56211 (0,00136)***	0,6815 (0,02411)**	1,23036 (0,00025)***	0,40386

Equal	0,00162 (0,71111)	-0,08881 (0,45729)	-0,28468 (0,14727)	-0,80434 (7,91E-06)***	0,46132 (0,12107)	0,49098 (0,1273)	0,40723
Second Period							
Market	-0,0031 (0,23758)	0,11372 (0,17495)	-0,46685 (0,00045)***	-0,20365 (0,18229)	0,38688 (0,03641)**	0,32927 (0,15549)	0,32527
Equal	0,0001 (0,96357)	-0,08659 (0,2239)	-0,52534 (6,09E-06)***	-0,34003 (0,00994)***	-0,03807 (0,806)	0,16051 (0,4134)	0,43169

Table 12: Fama-French Five-Factor Model for the long-short portfolio with 168 observations
Note: * Significant at the 10 percent level, ** Significant at the 5 percent level,
*****Significant at the 1 percent level**
P-values found (in parentheses)

As displayed in *table 12*, the R-square improved further for the long-short portfolios with the five-factor model.

The result reveals a great mixture for both alpha and Beta values. All equally weighted portfolios have positive alpha values while the market value weighted portfolios have negative alpha values. The portfolio has the greatest appearance in in the first years with an alpha of 0,00162. The market value weighted portfolio is negative for all time periods, with the lowest value of -0,0031 in the second time period. None of the results found are significant at any levels.

The stocks with a positive alpha have a negative market exposure, while the negative alpha stocks are positively correlated with the market. The estimated SMB factors are negative for all 6 portfolios, indicating that all portfolios consist of large cap stocks to a greater extent. The result is statistical significant for all portfolios except the equally weighted portfolio in the first years. The third factor, HML, is significant negative for almost all portfolios. The portfolios consist of low value stocks also called growth stocks. The fourth factor, RMW, is positive, an indicator of portfolios being more exposed to robust profitability stocks rather than weak. The market value weighted portfolios are more exposed the RMW factor. The equally weighted portfolio is not as strong correlated with RMW and even negatively exposed in the later time period. The coefficient of the last factor, CMA, is positive. The portfolios are exposed to conservative investment stocks and two of the market value weighted portfolios show a significant result.

5.7 Reliability

Jarque-Bera: The test finds evidence that does not support a normal distribution meaning the standard errors are not following the normal distribution. The evidence supports the idea of rejecting the null hypothesis. The sample is viewed as big with 168 observations for each portfolio. This means that the t-statistics converges to a standard normal distribution, which was the requirement for the multiple regressions.

White test and Breusch-Pagan: Both tests support homoscedasticity for the gathered data. The smallest value of 0,15 is found with the White test for the long portfolio. The value accepts the null hypothesis even at a 10% significance level. Robust standard errors are not needed for the sample.

Breusch-Godfrey: The null hypothesis is accepted for the bottom and difference portfolio. The two portfolios show no sign of autocorrelation. The long portfolio has a value of 0,00014 which means that the null hypothesis is accepted at a 0,01% level but it is not even significant at 0,1%

significance level. The result of the long portfolio shows signs of autocorrelation, which should be considered when analysing the result.

Correlation Matrix: The correlation matrix finds that no value exceeds 0,7 and -0,7. This means that the gathered data shows no signs of multicolinearity. The most extreme value is found between HML and CMA at 0,47.

T-test: The estimated parameters in the result are significant at different levels to some extent and insignificant for other samples. The statistical ensure can be found for some parts of the result while other lack significance.

6. Analysis

The result is analysed and compared in order to understand the performance of the high ESG stocks versus the low ESG stocks. The findings illustrate different outcomes from different methods. The results differ for the different weighting strategies and different time periods. The absolute return, the Sharpe Ratio and the regressions find a varied outcome, some periods more diverse than others. The findings are later on analysed from two different angles, the traditional finance theory and the behavioural finance theory.

6.1 Regressions

The regressions improve with the multifactor models, which is consistent with the arguments by Fama & French (2014). This means that the extended models have better predictions of the portfolio performance than the CAPM has. The Fama-French five-factor model has better predictions for future outcome and is therefore used to analyse the financial performance of the portfolios.

The regression models bring different results and some are significant while others are insignificant. The P-values found for the estimates are higher for the extended factor models meaning the estimates get weaker. Several studies in the litterateur review found significant results, Derwall et al. (2005) and Kempf & Osthoff (2007) are two of them. By using the Fama-French three-factor model and the Carhart four-factor model the studies found significant positive alpha values. The findings in this study suggest that Derwall et al. (2005) and Kempf & Osthoff (2007) might have found a biased result. The significant abnormal return could have been a pure result from excluding RMW and CMA in the explanatory variables. The performance of the five-factor model should therefore be carefully examined when calculating the financial performance of the portfolios.

6.1.1 Alpha

Both the long and short portfolio has increasing absolute return as seen in *figure 1* and *figure 2*. The result makes it easy to believe that the portfolios have a high financial performance, however the absolute return is not compared to any risks, the market performance or the risk-free rate. The regressions calculate the excess return and compare it to the market index. The multifactor regressions make adjustments for several factors when making the predictions. Fama & French (2014) found evidence for small businesses to outperform bigger businesses, value companies to have a greater performance than growth companies, robust profitability stocks have a higher performance the low profitability stocks and lastly the conservative investment stocks have a greater financial performance than aggressive investing stocks. Theses factors are adjusted in the regressions, meaning a significant alpha value cannot be a result of these factors. Both the long portfolio and short portfolio have negative intercept for all regressions made. This means that both the portfolios preform worse than the market. The result suggests that it is better to hold the market index than to hold any of these two portfolios. The result is not statistically reliable for any of the short portfolios and the long portfolio has one significant value found in the second time period. The insignificant alpha values leads to statistically unreliable results and no conclusion can me made. The superior absolute return of the long portfolio is not shown in the regressions. The result suggests that the high absolute return is explained by the factors in the regressions and therefore not showed in the estimated alpha value.

A long-short portfolio is analysed in order to investigate the relationship between the long and short portfolio at a more precise level. The same method is used by Derwall et al. (2005) in order to capture the relationship between low and high rated stocks. The five-factor model finds positive values for all equally weighted portfolios and negative values for all market value weighted portfolios. The result suggests that the high ESG stocks have a better performance than the low ESG stocks when all stocks are equally weighted. Although, the low ESG stocks perform better when the companies are weighted based on market value. However, the general result from all regression models suggests that the high ESG stocks preform better with 14/18 positive alpha values. Even though both the long portfolio and the short portfolio have negative alpha values, the difference between them is positive leading to a rewarding strategy. The result does not only propose that high ESG stocks beat the low ESG stocks. The result furthermore suggests that the long-short strategy even beats the market. The financial difference between the low and high ESG stocks is big enough to make an abnormal return. None of the alpha values are significant meaning the result is not statistically reliable and no trustworthy conclusion can be made out of the result. However, the result shows tendencies towards a greater performance of the high ESG stocks. The result is consistent with the findings of Derwall et al. (2005). The authors found a positive alpha value for the difference portfolio and even a significant result. The result they found is relatively robust and proves that a sustainable premium exists.

The long-short portfolio reaches its highest R-square value at 0,43 in the equally weighted portfolio in the second time period. The portfolio has a positive alpha value, suggesting abnormal return. The excess return is to some extent explained by the independent factors, however as is obvious the regression does not fully explain the performance of the portfolio. The portfolio performance is furthermore explained by something else, which could be the sustainable performance. The received ESG score could be one important factor to explain the excess return of a company.

6.1.2 Market Factor, Size Factor, Value Factor

The next factor, the market exposure, is consistent for all long and short portfolios made. The market exposure is positive for all long and short portfolios. The stocks are positively correlated with the market where most of the short portfolios have a higher factor loading than the long portfolios. The low ESG stocks are therefore more exposed to systematic risk than the high ESG stocks. This could explain the higher monthly average excess return of the short portfolio when the market performs well as seen in *figure 3* and *figure 4*. The opposite will happen when the market is going through suffering years as seen in *figure 1* and *figure 2*. The result has similarities with findings in a report of Giese et al. (2017) who found a higher market exposure and systematic risk for low ESG stocks. Richey (2017) found a comparable result with a high, positive market exposure for vice stocks. This is similar to my result where the short portfolio experiences a market exposure that is around 1 and upward. This advocates that the portfolio is more exposed to systematic risk than the market index itself. Both the long and the short portfolios have significant reliable values at a 1% level for all regression models. The result is therefore statistically reliable and the market exposure has a great influence on excess return of the portfolios.

The estimated Beta values are the opposite for the long-short portfolio; it is insignificant negatively correlated with the market. This is probably a result from shorting stocks that are highly exposed to the market risk leading to a negative difference between the long and short portfolio, which reveals a negative market exposure. No conclusions can be made with insignificant factor, however, Kempf & Osthopp (2007) found a similar result where the long-short portfolio is negatively correlated with

the market. The result suggests that the long-short portfolio is an insurance against market fluctuations.

The long and short portfolio shows different factor loading to the SMB factor. The short portfolio has a positive factor estimate, suggesting that the portfolio is consistent of small capitalization stocks. The long portfolio on the other hand has a negative exposure, which suggests that the portfolio is filled with large capitalization stocks. The results are significant to some extent and others are insignificant. Kempf & Osthoff (2007) found a similar result with a long portfolio that had a negative exposure towards the SMB factor meaning a great exposure towards large cap stocks. The long-short portfolio has significant negative SMB estimates, which means that the portfolio is consistent of large capitalization stocks. The result suggests that large cap companies are working more sustainable resulting in higher ESG scores.

One other finding in the result is the evidence of growth stocks for the high ESG portfolio and value stocks for the low ESG portfolio. The result is consistent with the findings of Kempf & Osthoff (2007). Value stocks often pay out their earnings in dividends while growth stocks reinvest the earnings in order to accelerate growth. This means that companies with high ESG score probably reinvest a huge part of the earnings made. The study of Eccles et al. (2014) found that sustainable firms that made success were the ones that changed the core business and used sustainability as a long-term investment. This could be consistent with the result in this study. The companies with high ESG rating reinvest earnings in order to accelerate growth. The long-short portfolio has a positive alpha with a long position in high ESG stocks and a negative relation to the HML coefficient. The result suggests that the sustainable firms that reinvest a huge part of their earnings also are likely to succeed seen through the positive alpha value. The result is therefore similar to the study of Eccles et al. (2014). Although, my alpha values for the long-short portfolio is insignificant and therefore is the result not statistically reliable.

6.1.3 Profitability Factor, Investment Factor

RMW captures the portfolios exposure to robust profitable stocks or weak profitable stocks. The long-short portfolio has a higher factor loading during the first time period, the suffering years. The later period is followed by a positive but lower exposure. This means that the portfolio is more exposed to profitable stocks when the market suffers. This is a result from the short portfolio changing a lot between the two time periods, form negative exposure to positive in the second time period. The factor exposures are insignificant for all long and short portfolios and the only significant values are found for the market value weighted long-short portfolios. However, similarities are found with the findings of Richey (2017). The author compared bull and bear markets and found that RMW differed enormously for vice stocks during different time periods. The vice portfolio showed a great exposure towards high profitability stocks in bull markets while the opposite in bear markets. The long-short portfolio moves in the opposite direction from the vice stocks of Richey (2017) who found robust profitability stocks in good days and weak profitability in bad days. The result suggests that the companies with low ESG rating were more affected by rate of profitability during the crisis compared to the companies with high ESG rating.

The last factor, CMA, is negative in the first years for both the high and low ESG stocks. Time changes and it turns positive in the second time period. The difference portfolio shows a positive factor loading during the whole estimated time period. The positive difference is a result from higher estimates for the high ESG stocks during the whole estimated period. High ESG portfolios are more exposed to conservative investment stocks than the low ESG portfolios. This factor finds many insignificant values meaning it does not have a huge effect on the result found.

6.2 Sharpe Ratio

To check the robustness of the result I confirm the firm performance by measuring the Sharpe Ratio. The outcome points to the same direction as the regressions, the Sharpe Ratio is always higher for the long portfolio meaning, the reward to volatility is higher for the high ESG stocks. The result is mostly due to the low volatility associated with high ESG stocks. The Sharpe Ratio indicates that the high ESG stocks have a greater performance than the low ESG stocks. The result is not as clear when comparing the outcome from the long-short portfolio.

The measure does not fully work for the long-short portfolio due to the negative Sharpe Ratio. As exhibited in the result, the gained Sharpe Ratio does not correspond to the rate of return and volatility. The phenomenon is discussed by, Grable et al. (2017). The authors made the conclusion that the Sharpe Ratio should not be used when the ratio consist of negative numbers. The negative Sharpe Ratio is a result from a higher rate of return for the short portfolio compared to the long portfolio. It could also be a result from a minuscule excess return of the long portfolio that later is swallowed by the risk-free rate.

The negative Sharpe Ratio could be avoided when the risk-free rate is omitted. De & Claymen (2015) made an investigation where they decided to set the risk-free rate as zero. If the same assumption was made for this thesis the risk-adjusted return could have been positive for the long-short portfolio and therefore be compared to the other two portfolios. This could improve the comparison between the different assets but I considered the risk-free rate as high enough to be counted for. The intention with this thesis was to analyse the difference between the low and high ESG stocks. If the risk-free rate is low but still higher than the difference return it should be counted for. The result gets biased with a tendency towards higher estimates than the reality otherwise. No rational investor will make an investment where the asset rate of return is lower than the risk-free rate.

6.3 Time Periods

The two periods chosen describes the portfolio characteristics in different times, the first one influenced by the financial crisis and the first recovery years, a period when the market suffered. The other period chosen is the later recovery phase where the market trend turned and left the crisis behind. The long-short portfolio has a better appearance during the financial crisis as seen through the outcome from the regressions. The difference between the long and the short portfolio is positive combined with a market that preform badly which generate an high abnormal return for the long-short portfolio.

The Sharpe Ratio confirms the result once more. The low Sharpe Ratio in the first years reflects the financial concerns in America during the financial crisis. By comparing the Sharpe Ratio for the low ESG stocks with the high ESG stocks it is clear that the low ESG stocks were more affected by the crisis. By comparing the findings to the absolute return it gets even clearer. The absolute return was greater for the low ESG stocks before the financial crisis with a fast growing return. The drift congested and the low ESG stocks reached a lower bottom than the high ESG stocks during the suffering years followed by years of poor outcome and a slow recovery. The crisis was harsher to the low ESG stocks compared to the high ESG stocks. The findings suggest that the low ESG

stocks are more affected by suffering years than high ESG stocks, the long portfolio has a better recovery phase.

6.4 Traditional Finance Theory & Behavioural Finance Theory

The two different scholars would explain the popular trend among investors, sustainable investments, differently. The traditional finance theory would argue for a recent increase due to higher financial performance. The behavioural theory argues for a world with irrational investors. The reason for the increasing trend doesn't have to be connected to a greater financial performance. The increasing trend, sustainable investments, could be a result from personal preferences.

The result finds a high Sharpe Ratio for the high ESG stocks and the long-short strategy even finds an abnormal return through the regressions. The abnormal return is the reason for why sustainable investments are a popular investment strategy according to the traditional school. The regression confirms the abnormal return and proves a successful strategy. Rational investors are looking for arbitrage opportunities and this strategy beats the market. The recent trend could be a result from investors valuing other things than higher risk-adjusted return according to the behavioural school. The market value weighted long-short strategy with the Fama French five factor model suggest a negative alpha. The strategy preforms worse than the market. The behavioural school could argue that the increasing trend is a result from different reasons than risk-adjusted return. Investors think differently, some base their investments decisions based on higher financial performance while others do it because of increasing utility from other things. The behavioural school would see the mixed result as a proof for investors believing in different things and not an efficient market where everybody shares the same information. The irrational choices are made first by information leakage and secondly because utility is received from other thing than financial performance. The sustainable investment trend could be an increasing trend because more people receive utility from "making good". Also because investors only share one side of the coin, the information about the upswing for high ESG stocks. The market is not effective enough to promote all with the same information. A great many of studies have been made and the findings differ from each other. The information spread is huge which could mislead investors when making conclusions out of a small sample.

The behavioural school would see the result from the regressions as investors facing representativeness bias and forecasting errors. Investors are exposed to different findings with different proves, misguiding to different investment strategies. The forecasting error combined with representativeness bias makes investors believe in different outcomes for the strategies used. An investor exposed to the result of the Sharpe Ratio would probably characterise sustainable stocks in a different way than an investor exposed to the regressions. The information leakage is combined with suboptimal decisions through affect. The sustainable investment trend could be a result for people valuing affect when investing. Affect, a feeling, is including in the utility received form an investment; the feeling of "making good" could increase utility for investors. The increasing awareness of climate change and a non-sustainable society from social media make a bigger majority committed to have a more sustainable lifestyle. The sustainable lifestyle includes investment decisions where utility increases with sustainability scores received.

7. Conclusion

The purpose of this paper has been to analyse the reason behind the sudden increasing trend for sustainable investments. The aim has also been to analyse constructed portfolios based on received ESG score in order to measure and compare financial performance between low and high ESG stocks. The result has been analysed form two perspectives, the traditional finance theory and the new behavioural finance theory. Most of the findings suggest that high ESG stocks preform better than low ESG stocks. Both the absolute return and the calculated Sharpe Ratio suggest that the high ESG outperform the low ESG stocks. The Fama-French (2014) model makes adjustments for the market effect, size effect, value effect, profitability effect and investment effect when regressing future performance. The constructed difference portfolio finds for most part positive but insignificant values. The result shows tendencies towards a great performance of the high ESG stocks, however the result is not significantly reliable. The traditional finance theory would see the greater financial performance as proof for why the sudden trend. The behavioural approach would see the mixed and insignificant outcome as proof of an inefficient market where investors don't share the same information and personal preferences leading to different investment decisions are made. Most of the findings suggest that the low ESG stocks are more affected when the market suffers. This is confirmed by the regressions where the low ESG stocks have a higher market exposure for most of the samples. This means that the long-short strategy is rewarding when the market has a low performance.

8. Further Research

Many studies investigating the relationship between sustainable performance and financial performance have been made. A suggestion for future research would be to extend the Fama-French five-factor model by one more factor covering the sustainable performance. One such suggestion would be to include one factor based on the received ESG score. It would be interesting to compare the received R-square value on the new extended model to the value found with the five-factor model. A higher R-square would suggest that ESG rating is a contributing factor to the received excess return of a portfolio.

It would furthermore be interesting to investigate household data. This would enable researchers to find important patterns behind the increasing trend. The research would first of all ascertain if the increasing trend is attributed by a great many or a smaller part of the population. The investigation would find the person behind the increasing trend.

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10. Appendix

Appendix 1:

Financial performance measured for all portfolio constellations

Whole Period (M)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,15801	-0,29029	-0,19683
Maximum	0,11655	0,27039	0,1694
Mean	0,00149	0,00194	-0,00045
Standard deviation	0,03978	0,05997	0,0378
Sharpe ratio	0,03734	0,03232	-0,01198

Whole Period (E)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,19117	-0,29869	-0,23937
Maximum	0,16291	0,33994	0,1583
Mean	0,00488	0,00433	0,00055
Standard deviation	0,04607	0,07019	0,03707
Sharpe ratio	0,10603	0,06175	0,01485

First Period (M)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,15801	-0,29029	-0,19683
Maximum	0,11655	0,27039	0,1694
Mean	-0,00244	-0,00242	-0,00002
Standard deviation	0,04511	0,07515	0,04698
Sharpe ratio	-0,0541	-0,03227	-0,00033

First Period (E)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,19117	-0,29869	-0,23937
Maximum	0,16291	0,33994	0,1583
Mean	0,00254	0,00097	0,00157
Standard deviation	0,05255	0,08587	0,0468
Sharpe ratio	0,04834	0,01127	0,03361

Second Period(M)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,08927	-0,09165	-0,12322
Maximum	0,08525	0,11978	0,0564
Mean	0,00541	0,0063	-0,00089
Standard deviation	0,03369	0,03964	0,02583
Sharpe ratio	0,16063	0,15897	-0,03445

Second Period (E)	Long portfolio	Short portfolio	Long-Short portfolio
Minimum	-0,11301	-0,16778	-0,07503
Maximum	0,10952	0,17782	0,05476
Mean	0,00723	0,0077	-0,00047
Standard deviation	0,03881	0,05031	0,02393
Sharpe ratio	0,18627	0,15307	-0,01972

Appendix 2:

Breusch-Pagan and White

Variables	Top	Bottom	Difference
Breusch-Pagan	0,725	0,49	0,196
White	0,15	0,737	0,323

The tests show no sign of heteroscedacity. The null hypotheis is accepted as seen through the high numbers.

Appendix 3:

Breusch-Godfrey

Variables	Top	Bottom	Difference
Breusch-Godfrey	0,00015	0,101	0,259

The test shows no sign of autocorrelation for the bottom and difference portfolio. The top portfolio rejects the null hypothesis at any level greater than 0,01%.

Appendix 4:

Correlation Matrix

Variables	Mkt-RF	SMB	HML	RMW	CMA
Mkt-RF	1				
SMB	0,418705867	1			
HML	0,273970092	0,300255273	1		
RMW	-0,46325818	-0,402471612	-0,184996195	1	
CMA	-0,008505337	0,148709773	0,473905459	-0,064604472	1

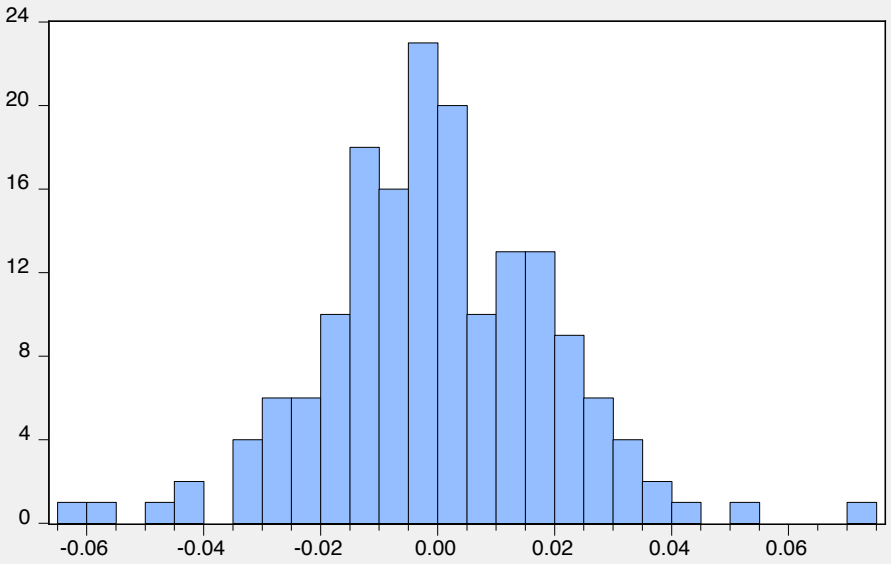
The tests shows no sign of multicolinearity since no correlation exceeds the value of 0,7 and -0,7.

Appendix 5:

Jarque-Bera

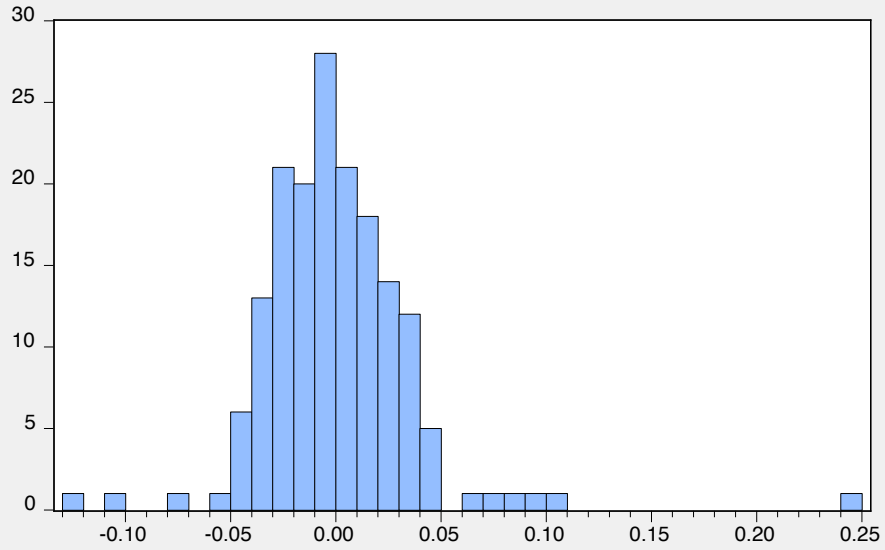
The test shows sign of not normally distributed error terms. The null hypothesis that assumes normal distribution is rejected. This is seen through the low probability of 0 for the bottom and difference portfolio and 0,0016 for the long portfolio.

Long Portfolio



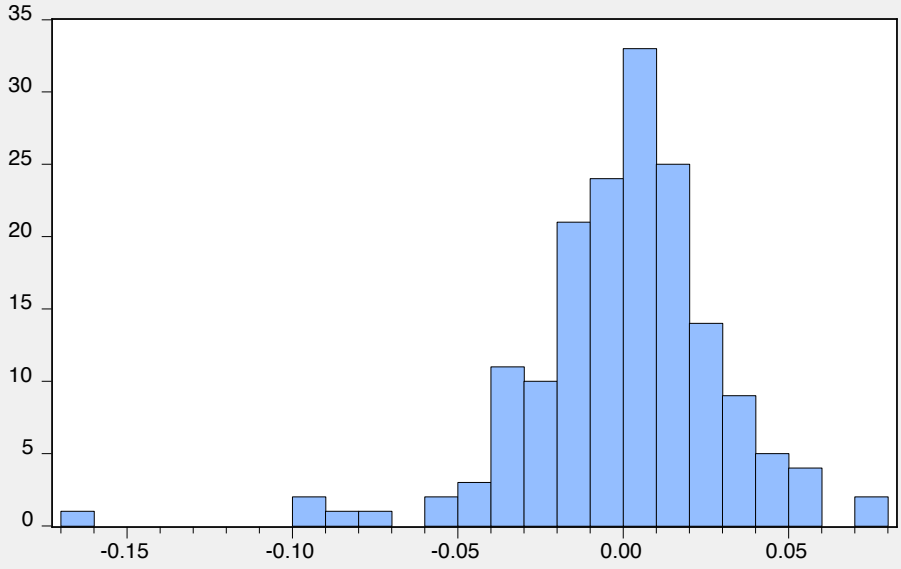
Series: Residuals	
Sample 1 168	
Observations 168	
Mean	3.51e-18
Median	-0.000533
Maximum	0.074846
Minimum	-0.064904
Std. Dev.	0.019704
Skewness	0.037046
Kurtosis	4.360369
Jarque-Bera	12.99266
Probability	0.001509

Short Portfolio



Series: Residuals	
Sample 1 168	
Observations 168	
Mean	2.50e-18
Median	-0.001708
Maximum	0.241827
Minimum	-0.127123
Std. Dev.	0.035899
Skewness	1.778737
Kurtosis	15.44431
Jarque-Bera	1172.614
Probability	0.000000

Long-short Portfolio



Series: Residuals	
Sample 1 168	
Observations 168	
Mean	1.49e-18
Median	0.002652
Maximum	0.078477
Minimum	-0.166981
Std. Dev.	0.030585
Skewness	-1.285186
Kurtosis	8.514087
Jarque-Bera	259.0838
Probability	0.000000