CHASING SUSTAINABLE STOCKS: A SUPERIOR INVESTMENT DECISION?

AN ESG INVESTMENT STUDY

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Abstract:
Sustainable investing is trending, amounting to $30 trillion in assets under management worldwide in 2018 and it is predicted to grow even larger in the years to come. This thesis studies ESG portfolio performance of three comparable portfolios, a Sustainable, a Good Enough and an Unsustainable portfolio constructed using ESG-score in relation to their Global Industrial Classification Standard (GICS), between 2004 – 2018 in the U.S market. The annual beta coefficients are examined between 2004-2013 to observe differences in exposure to systematic risk. Based on the observations, six trading strategies are constructed for the period 2014 – 2018 by combining the three portfolios in times of high and low market volatility. The market volatility level is determined using a relative measure of the CBOE VIX index. Focusing solely on ESG and comparing three portfolios based on GICS and ESG-scores as opposed to only comparing the two extremes, sustainable against unsustainable stocks, distances this study from previous research, thereby contributing with new testing methodology to this field. Furthermore, using an augmented version of the Fama-French five factor model and extending it with the Carhart (1997) momentum factor and later adding two liquidity factors from Pástor and Stambaugh (2003), contrasts this thesis from previous research. The results show that the Unsustainable portfolio generates the highest significant abnormal return of 8.26 % annually, followed by the Good Enough portfolio with 5.51 % and the Sustainable portfolio with 5.17 % in annual abnormal returns, over the period 2004-2018. This finding contradicts the belief that sustainable companies generate superior returns. Nonetheless, the Sustainable portfolio is a profitable investment as it generates positive abnormal returns. Further, using Trading Strategy 1, combining the Sustainable and Good Enough portfolio between 2014-2018, investors can generate significant yearly abnormal return of 3.4% while conforming to their sustainability preferences.

Keywords: ESG, Socially Responsible Investing, Trading Strategy, Portfolio Performance

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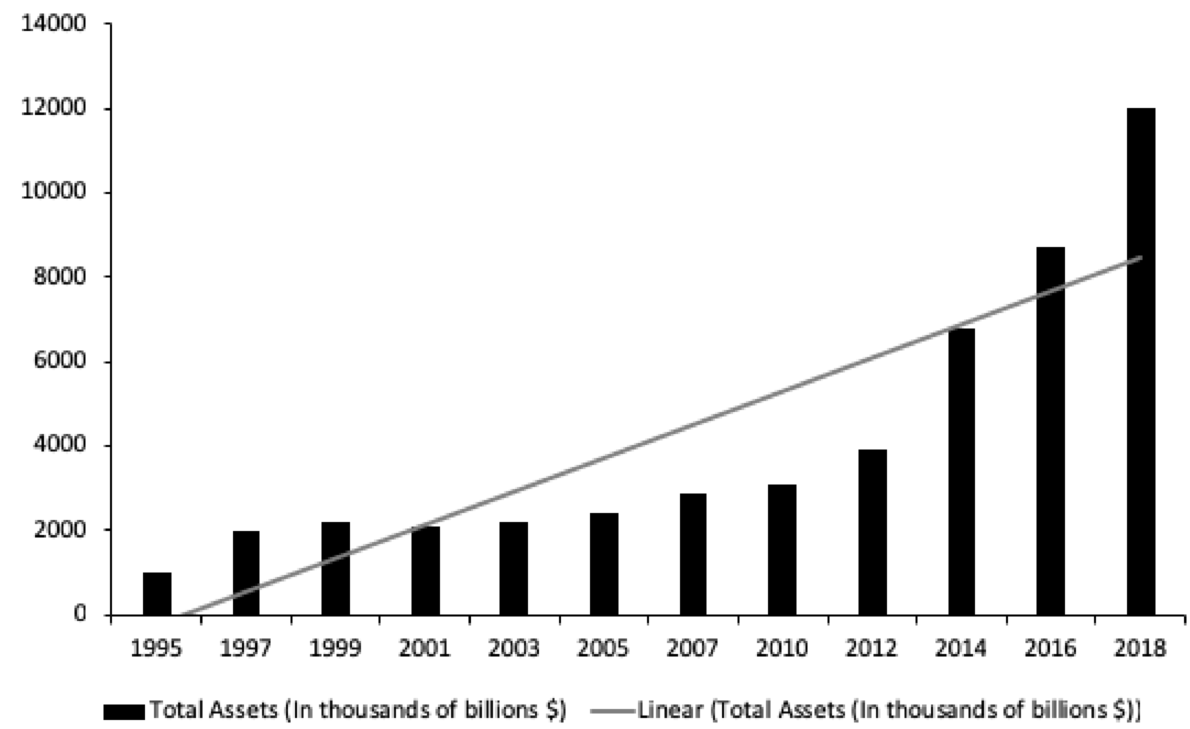
1. Introduction

Draughts, floods and social crises such as wars on a regional and civil level have a correlation with climate change according to Johan Rockström, professor in environmental science with emphasis on water resources and global sustainability at Stockholm University. However, the threat of climate change is not a new phenomenon. In fact, as far back as in 1896 the Swedish scientist Svante Arrhenius discovered the climate effects of burning coal (National Geographic, 2018). Also, the article "Warmer Climate in the Earth May Be Due To More Carbon Dioxide in the Air" by Waldemar Kaempffert (1956) in the New York Times discussed the effects of carbon dioxide on the climate. But it took until 2015 until the world could reach a consensus with the Paris Agreement about that we have to do something now before a state of climate irreversibility kicks in. The world is at a tipping point and the focus on climate and social causes fortunately enough was incorporated into financial investors' minds before world leaders reached an agreement. There has been a tremendous increase in sustainable investing over the years, which amounted to $30 trillion dollars in 2018. The biggest market is Europe in 2018 with $14.1 trillion in assets under management followed by the US with $12 trillion (Greenbiz, 2018).

Figure 1: Sustainable and Responsible Investing in the United States between 1995 - 2018



Source: US SIF Foundation

It is interesting to see an upgoing trend driven by the belief that Sustainable Investing is profitable from a long-term perspective (Deutsche Bank, 2012). Investors stick with the belief that sustainable investing is superior to conventional even when there is no consensus in academia. Previous studies are subject to methodological differences, geographical differences, sorting procedures, different regression models and time horizons. Nevertheless, it is important to note that there are differences between the US and the European market. In the EU there exists mandatory sustainability reporting rules whereas it is absent in the US market (European Union, 2014), (CPA Journal, 2018). In the US it is optional to conform to these standards. This could explain why US is far behind in terms of assets under management. Hence, because of the differences between markets and studies it is interesting to investigate how ESG (Environmental, Social, Governance) affects the US financial market. To the best of our knowledge no study has focused on aggregate ESG in the US market, only on the separate factors in isolation. Perhaps there does not exist any mandatory regulation for a reason. The Americans might not share the common belief that ESG is positively correlated with stock performance as suggested by Statman & Glushkov (2009) and Kempf & Osthoff (2007). Based on their research within the area of socially responsible investments we have formed the following hypothesis: *Companies with high ESG ratings deliver higher value and generate higher stock returns for shareholders as opposed to comparable companies with low or average ESG ratings, thereby impacting the intrinsic value of the stock. This creates divergence in stock performance characteristics between sustainable, good enough and unsustainable companies across industries and over time, allowing investors to exploit abnormal returns using thematic investing.* To test the hypothesis the following research questions have been formulated:

1) *Do Sustainable portfolios outperform Good Enough and Unsustainable portfolios?*
2) *Are there portfolio characteristics that allow investors to obtain abnormal returns through trading strategies in times of low and high market volatility?*

In order to test the research questions and hypothesis, we have conducted a performance study using an augmented version of the Fama-French five factor model not previously used in sustainability literature, the model adds the Carhart momentum factor to the traditional Fama-French five factor model. A common methodology is to benchmark best in class stocks in terms of ESG performance against the underperformers. However, research has not paid any attention to the average "good enough" stocks in terms of ESG performance, only to the two extremes.

Thus, we add an additional Good Enough portfolio when comparing the performance of three portfolios with different ESG scores, distancing us from the binary testing of Sustainable portfolios against Unsustainable portfolios. The portfolios used in this study are divided based on their ESG scores in relation to their Global Industrial Classification Standard (GICS) category, resulting in a Sustainable, a Good Enough and an Unsustainable portfolio diversified across industries. The results indicate that the Unsustainable portfolio generates the highest abnormal return of 8.26 % annually, significant at the 1 % level, which contrasts the belief and the trend of investing in sustainable stocks to achieve higher returns. However, after studying the portfolio characteristics we noticed interesting differences between the portfolios' sensitivity to market fluctuations, expressed by their market betas. The Sustainable and Good Enough stocks have higher exposure to systematic risk than the Unsustainable stocks. Furthermore, there exists a demand for sustainable investing, therefore by taking advantage of the demand and the correlation of the Sustainable, Good Enough and Unsustainable stocks with the market, trading strategies exploiting these characteristics are constructed. Consequently, six trading strategies are formed by combining the three portfolios in times of high and low market volatility. The strategies use the VIX index as a proxy for the market sentiment and as a trigger for switching portfolios in times of high and low volatility in order to exploit the portfolios' exposure to the market. Interestingly, the best thing for an investor to do during the period 2014-2018 is to refrain from using any of the trading strategies and instead only hold the Unsustainable portfolio. However, investors wanting to make sustainable investments for ethical reasons can generate higher abnormal returns from combining the Sustainable and Good Enough portfolio, than holding any of these portfolios in isolation. Trading strategy 1, which involves longing the Sustainable portfolio in times of low volatility and longing the Good Enough portfolio in times of high volatility generates 3.4% in annual abnormal return.

In the final result section, the robustness of the result is tested using model variation tests and time frequency sensitivity. This section uses monthly data instead of daily data and adds the traded liquidity factor and innovations in aggregate liquidity non-traded factor from Pástor and Stambaugh (2003). The tests show that the traded liquidity factor is significant at the 1 % level for the Sustainable portfolios while it remains insignificant for the other two portfolios. In addition, the innovations in aggregate liquidity non-traded factor is significant at the 10 % level for the Sustainable portfolio, but not for the other portfolios. This indicates that Sustainable stocks have higher than average liquidity, therefore reducing the expected returns of the Sustainable portfolio compared to the other two portfolios.

In conclusion, against the common belief that Sustainable portfolios contain the best performing stocks, our study shows that the Unsustainable portfolio outperforms its Sustainable and Good Enough peers. Nonetheless, investors seeking to make sustainable investments can still generate significant abnormal returns while conforming to their sustainability preferences by using Trading Strategy 1.

2. Related Literature

2.1 Corporate Social Responsibility and ESG

Bénabou and Tirole (2009) try to disentangle the highly contested concept of Corporate Social Responsibility. In their paper, they lay out the common perception of the definition of CSR. Defined by a regular person, CSR captures all kinds of activities, for instance firms' willingness to take care of their employees and a company's contribution to solving environmental issues by reducing its environmental footprint. CSR also urges companies to be ethical towards the community by funding good causes. CSR was perceived to entail profit sacrificing. In an effort to clarify the concept they discuss three visions of CSR:

1) "Win-win vision". The vision tackles the problem of short-termism, inferring that the short-term way is not necessarily the most profitable one e.g. if a company cuts wages in order to reduce costs it might have problems recruiting ambitious talent in the future. Instead, companies should focus on long term activities because they benefit the society and simultaneously enhance the company's competitive position.
2) "Delegated philanthropy". Companies work as an extension of consumer demand and wishes. People want to engage in philanthropic activities but for varying reasons are unable to do so. Thus, companies should engage in philanthropic activities on behalf of the customers, for instance, by providing decent working conditions or stop polluting the environment. Firms can engage in "profit sacrificing" activates by taking sometimes costly actions, but they will recoup the costs by passing them through to the costumers or by increasing the demand of their products. For example, Starbucks increased the demand for their products by buying fair trade coffee and tea.
3) Insider-initiated corporate philanthropy. From this perspective companies' social commitments do not stem from consumers demand, instead they emerge from the managers or board members wishes to engage in such activities. For example, companies often donate to good causes, as a consequence, sacrificing profit to positively impact the society.

CSR has been a widely contested concept, especially the third vison has met severe critique. The famous quote "The social responsibility of business is to increase its profits" by Milton Freidman represents another view of CSR (Friedman, 1970). The bottom line is that corporate managers should only maximize profits and refrain from donating to charitable causes, because these activities drain the shareholders' money. Spending money on these causes is equivalent to spending shareholders' money on activities not demanded by them. The CEO should only care about the owners' interest and neglect other stakeholders' demand. If managers desire to engage in CSR activities, they should do so in their private time using their own money.

However, fast-forwarding ten years, the institutional landscape has a different perspective on social activities. It is more or less expected that corporations take their responsibility. The corporate responsibility has become so important that there exist rating institutes scoring companies sustainability commitments. Today CSR is a clearer concept, consisting of Environmental (E), Social (S), and Governance (G) factors. Bundled together, ESG define corporations' sustainable activities. E-factors include activities aiming to tackle climate change through reduced gas emissions and increased energy efficiency. S-factors refer to guaranteeing human and labor rights, workplace health and safety and community engagement. The G-factors cover the rules and principles regulating the corporate activities, including board independence and internal auditing (Shrivastava and Addas, 2014). In other words, the G-factors determine how successful a company will be in fulfilling its environmental and social commitments and in its obligation to meet stakeholders' demands through the implementation of these ideas in its business.

2.2 Corporate Social Responsibility and Stock Performance

In the wake of the highly discussed concept of CSR, nowadays ESG, a lot of papers have attempted to assess the impact of sustainability on stock performance. However, the results remain inconclusive as studies conducted in this area have mixed results and different methodological approaches. Researchers have tried to desiccate if engaging in ESG has a neutral, positive or negative impact on stock performance.

In a paper by Bauer et al. (2005), the authors try to clarify if ethical and social portfolios deliver lower, neutral or higher risk-adjusted returns than conventional portfolios. The study examines 103 German, UK and US ethical funds screened through Morningstar (US), EIRIS (UK) and Ecoreporter (Germany). The study matches ethical funds against funds with no ethical criteria. The authors use the Carhart four factor model as the regression model for portfolio performance. Their findings indicate no significant discrepancies in risk-adjusted returns between ethical and conventional mutual funds during the period 1990 to 2001.

In another study by Kempf and Osthoff (2007) they test if incorporating socially responsible screens increases the performance of their stock portfolio. Three different portfolios are formed: a portfolio excluding companies engaging in tobacco, gambling and fire arms. Portfolio two which does not exclude such companies but instead rate them on factors such as diversity, environment and human rights. Finally, a third portfolio using best in class screening which follows the same criteria as the second portfolio but is diversified across industries. In order to test the performance, the authors form a trading strategy based on ratings from KLD Research & Analytics. The trading strategy involves longing stocks with high social responsibility ratings and shorting stocks with low social responsibility ratings. This study finds a positive abnormal return of 8.7 % per annum using the Carhart four factor model, the highest returns are obtained when investing in stocks that have best in class ratings.

Additionally, Ibikunle and Steffen (2015) conducted a comparative analysis of the performance of green, black and conventional European mutual funds, where the black fund is defined as a fund that invests in carbon intensive activities and exploitation of natural resources. By using a dataset consisting of 175 green, 259 black and 976 conventional mutual funds between 1991 and 2015, using the CAPM and Carhart four factor model they found that green mutual funds significantly underperformed relative to conventional funds, whereas no significant risk-adjusted performance existed between green and black mutual funds. However, they find that green funds succeeded to catch up against conventional mutual funds to that extent that no significant difference in performance could be identified during 2012-2014. On top of that, the green funds outperformed the black ones during the time period 2012-2014.

Focusing on ESG, a recent report by Nordea Equity Research (2017) investigated the relative performance of top and bottom ESG score performers during the period 2012 to 2015. They found that ESG has an impact on operational metrics, since companies with top ESG scores have higher ROE, ROCE and lower Net Debt to EBITDA than the market average. ESG affects stock performance as well, they identified a relative performance difference for European stocks of 40% between those having top and bottom ESG scores during 2012-2015.

In similar fashion, Shrivastava and Addas (2014) investigate what affects sustainability scores by looking at the relationship between corporate governance and sustainability using the Bloomberg Environmental, Social and Governance database. They find that environmental disclosure scores and ESG scores are strongly influenced by governance disclosure scores.

Important governance factors influencing the score and sustainability performance are, for instance, board meeting attendance percentage. Furthermore, boards with higher share of independent directors also have higher disclosure scores and are more prone to have imposed a climate change and environmental supply chain policy.

The sustainability research gives mixed results; thus, researchers have tried to aggregate several studies, in order to disentangle the facts we know to date. Revelli and Viviani (2015) try to determine whether or not including social responsibility criteria into portfolio selection enhances or decreases the performance of the portfolio. The study is conducted by aggregating 190 international experiments. They find that on a global level there are no costs or benefits to engage in socially responsible investing (SRI), rather the performance of the portfolios depends on the methods used by researchers when assessing SRI fund managers' ability to generate returns. In addition, Sjöström (2015) conducted a compiled study on the performance of SRI funds and indices and compared them to conventional funds or indices. Sjöström found that out of 21 reports, seven showed neutral results, five studies indicate that SRI funds outperform their conventional counterparts. Moreover, two studies claimed that SRI funds underperformed, whereas seven reports displayed mixed results. Hence, there is still ambiguity surrounding the impact SRI on stock, fund and portfolio performance.

2.3 Efficient Market Hypothesis

The fundamental theory underpinning financial frameworks and asset pricing models is the Efficient Market Hypothesis (EMH) developed by Eugene Fama (1970). A market is considered efficient when asset prices fully reflect all currently available information, as such, the market absorbs new information into asset prices instantly. Hence, the asset will always trade at its fair value. As a result, there would be no arbitrage opportunities and impossible to outperform the market portfolio.

The efficient market is based on three conditions that have to hold in order to fulfill such a claim, namely a market where:

1) there are no market frictions i.e. no transaction costs or taxes,
2) all available information is costlessly available to all market participants,
3) all market participants homogeneously interpret the implications of available information, leading to identical expectations about the security's future price and performance.

In such a setting, the prevailing price of an asset is the fair price, which undoubtedly reflects all available information, both public and private. Consequently, an investor would not have any informational advantage and is therefore unable to generate abnormal returns from trading.

Fama (1970) identifies three market efficiency settings, weak, semi-strong and strong form. In the weak version of the EMH, historical prices reflect all information, which should not be predictive of future performance according to the random walk research. When this finding gained general confirmation, new settings were studied. In the semi-strong version, the research is primarily concerned with the speed of price adjustments to new publicly available information, for example, annual reports and stock splits. Lastly, the strong setting aims to determine if prices reflect that investors or groups of investors have access not only to publicly available information, but also private information. In other words, if inside information as well as publicly available information is incorporated into the asset price. Regarding ESG, the efficient market hypothesis still holds. In the weak and strong setting all information about ESG engagements should be reflected by the trading prices. The stock should not experience abnormal return in this setting either. The semi-strong setting is also unchanged, for example if a company enhances its governance activates it would on the one hand follow that the companies would perhaps become more transparent which would reflect the intrinsic value of the stock to a larger extent, but this G-factors effect would instantly adjust in prices, eliminating any abnormal returns.

2.4 Contribution

The research field of sustainability's impact on stock performance is mixed, and most studies concentrate on the "old" ambiguous CSR framework. To the best of our knowledge, a study focusing on ESG and stock performance including a trading strategy in the US market has not yet been made. The only time ESG has been used in this context is in the Nordea report looking at the European market, a report which has not been through a peer review process, which in addition, is using a binary testing methodology. Many studies have a binary testing method, comparing sustainable against unsustainable, top performers against underperformers. Thus, it would be interesting to examine how Good Enough portfolios using well-established ESG scores would perform against best in class and below average rated stocks. We are contributing to this research field in at least four ways. Firstly, a clear focus on ESG distinguishes this study from the ambiguous CSR framework. Secondly, trading strategies using a relative CBOE volatility index for market sentiments outlined in section 4.5, equation 7 with respect to ESG investing. Thirdly, constructing three portfolios consisting of stocks with Thomson Reuters' ESG score, and then matching the stocks with their peers based on GICS (Global Industry Classification Standard) distances us from the binary testing method and contributes to a new testing methodology. Lastly, using a more accurate model for estimating predicted returns by extending the Carhart four-factor model to include two more variables from the Fama-French five-factor model, and later adding two liquidity factors from Pástor and Stambaugh (2003) contrasts our research from previous research in the field. These model specifications have not been used in previous ESG literature.

3. Data

3.1 Initial Data and Screening

Our sample data are collected from Thomson Reuters Eikon, CRSP, WRDS, CBOE and the Kenneth French Data Library. This study examines the portfolio performance of Sustainable, Good Enough and Unsustainable portfolios between Jan 2004 and Dec 2018 on the NYSE and NASDAQ exchange. Limiting the study to these two exchanges causes a focus on liquid stocks where investors are free to reallocate their capital. The VIX index used to construct the relative market volatility in equation 7, section 4.5, is obtained from CBOE.

We gathered company names, tickers, Global Industry Classification Standard (GICS) codes and the most recently available ESG score from Thomson Reuters Eikon.

The Thomson Reuters ESG rating is an updated version of the ASSET4 rating, instead of the previous equally weighted category rating, the new enhanced rating used in this thesis is a category weighted measure with respect to three areas: environmental, social and governance factors[3]. Category weighted means that issues are grouped according to their material impact on the company, categories with more issues have more weight. The new rating is built upon 400 KPI measures and datapoints. The rating later utilizes the 178 most relevant KPI data for each industry before grouping the KPIs into 10 categories and used to compute the final company aggregate ESG score, which assumes a value between 0 and 100 (Thomson Reuters, 2017).

Furthermore, daily stock returns, numbers of shares outstanding, ticker, close price, exchange code and permanent security identification number (PERMNO) for the period 2004-2018 are collected from CRSP Daily Stock File.

The Kenneth French Data Library contains U.S firm data for the Fama-French five-factor model, including the momentum variable on a daily and monthly basis from 1926 to the end of 2018.

The Pástor and Stambaugh (2003) liquidity factors are fetched from WRDS' Fama-French Portfolios and Factors under the Pástor-Stambaugh section, the non-traded innovations in aggregate liquidity variable and traded liquidity variable are collected from this source.

We do not limit the study by excluding companies that have been recently listed as these companies are assigned to our portfolio over time, thereby giving a more representative picture

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[3] Examples of Environmental Factors include: Resource Usage & Emissions, Social Factors include: Workforce & Human Rights, and Governance Factors include: Management & Shareholders (Thomson Reuters, 2017).

of the development in the industry. Also, we do not exclude companies that have gone bankrupt or been delisted from our sample if they have an ESG rating. Including these companies in the sample prohibits survivorship bias, thereby mitigating sample selection bias and ensuring that the results are not skewed by only including successful companies in the sample.

To be assigned to a portfolio the companies are required to have an active ESG rating, therefore companies without ESG ratings are excluded from the sample. The initial data sample contained 3170 companies with ESG ratings, missing values were set to 0 before eliminating them from our sample, leading to 2386 eligible companies with active ESG ratings, after sorting the stock into portfolios based on their ESG quintile, there are 1430 companies left that are used in this study. The initial stock data contained all available data in the U.S from Jan 2004 to Dec 2018, after cleaning the data for missing values and negative stock prices, there are 4,469,738 daily stock return observations in the final sample.

3.2 Portfolio Construction

Three equally weighted portfolios are constructed based on the Thomson Reuters combined ESG score, an equally weighted portfolio approach causes the returns of the portfolios to be equal to the mean of the returns of the stocks that belong to that portfolio on a certain date. This ensure that stocks with large market caps do not disproportionately influence the returns of the portfolio, which would be the case if we had used a value-weighted portfolio. Further, the ESG score is compared to the peer group of companies within the same Global Industry Classification Standard (GICS) group, this ensures that the relative ESG performance of each industry is compared within the same industry, giving an apples-to-apples comparison of ESG performance. This ensures that the three portfolios are diversified across GICS industries.

After cleaning the data, the companies are assigned into an ESG quintile based on their performance in relation to their GICS group. Thereafter, the companies are sorted into portfolios formed using the quintile scores (1-5) they were assigned. The Sustainable portfolio contains the companies with top 20 % highest ESG score in relation to their respective industry group (quintile 5), the Good Enough portfolio consists of companies hoovering around the average rating in the industry (40 % - 60 % ESG score in relation to peers; quintile 3), and the Unsustainable portfolio consists of the companies with the lowest 20 % ESG score in their industry group (quintile 1). The Sustainable portfolio includes 473 companies, the Good Enough portfolio comprises 476 companies and the Unsustainable portfolio contains 481 companies.

3.3 Sample Selection Bias and Data Limitations

Since the study is limited by the availability of ESG data on the Thomson Reuters Eikon platform, there is the issue of sample selection bias, as it cannot be regarded as a randomized sample. Usually, the largest companies in each exchange have active ESG ratings, thereby skewing the sample toward large cap stocks which are more actively covered by analysts and to a larger degree, exposed to ESG coverage. Nonetheless, the study uses 1,430 companies out of the total population of 6,530 firms listed on the NYSE and NASDAQ. Approximately 22 % of the total population is obtained using the available ESG data provided by Thomson Reuters. Using another database such as Sustainalytics would have allowed a larger sample, however, the database was not available for this study. Cash (2019) expresses concerns about heterogeneity amongst sustainability ratings due to the reliance on divergent criteria when assessing ESG performance. This has been observed when scrutinizing how the indices are calculated when conducting this study, for reference, the Thomson Reuters ESG index relies on different criteria than the Sustainalytics and Morningstar indices, as they are free to define the rating scales and inclusion criteria themselves. Also, Cash (2019) points towards agency conflicts that arises when investors pays the rating agencies generously to obtain favourable rankings, thereby distorting the actual ESG efforts of the companies through the misalignment of economic incentives in rating agencies and the financial markets addiction to different types of ratings. As a result, investors relying on another index would obtain different results than this study.

Another issue with the sample is that in the results section, all the portfolios generate positive alpha, the sample does not reflect the fact that alpha should be a zero-sum game where some investors hold positive alpha portfolios and others hold negative alpha portfolios. Hence, this thesis compares the relative differences between portfolio characteristics to provide valid insight into the topic of sustainable investing.

4. Methodology

4.1 Overview

This thesis is a performance study which objective is to study the performance of portfolios with different ESG characteristics, constructed using stocks listed on NYSE and Nasdaq. In this case, the stock's performance is evaluated and sorted into portfolios based on its current ESG score. This study aims to assess the performance of Sustainable, Good Enough, and Unsustainable portfolios in the United States on the NYSE and Nasdaq exchange between 2004 and 2018. The study commences in 2004 in order to eliminate the macroeconomic influence of the "dot-com bubble" (i.e Information Technology bubble), another reason for starting the study in 2004 is to cope with the change in the measurement of the CBOE Volatility Index (VIX)[4]. The study is divided into four parts:

(1) We regress the portfolios performance based on daily data during the entire time horizon, thereby acquiring total portfolio performance and characteristics over the time period 2004-2018.

(2) We compare the annual performance and the regression variables of our portfolios during 2004-2013, thereby enabling us to evaluate the performance of our portfolios during the financial crisis and over time for each individual year.

(3) As we have three portfolios, we are able to construct six trading strategies where we can only go long in the portfolios; we do not allow shorting in our strategies due to market limitations to shorting. Another motivation for only going long is the potential co-movement between portfolios due to similarities in portfolio characteristics, hence going short in one portfolio would likely reduce the returns of the trading strategies. To decide whether or not we should exit one portfolio and enter another we use a relative measure of CBOE Volatility Index (VIX), the VIX index is frequently used as the stock market's expected implied volatility derived from the S&P 500 index options (CBOE, n.d). The relative measure will assume a value greater than one during periods of high market volatility and lower than one in times of lower volatility, which are the triggers for switching between portfolios. The performance of the trading strategies and portfolios are examined during the period 2014-2018 to see if any of these investment strategies generate positive or negative abnormal returns.

[4] VIX prior to 2004 is calculated using the 30-day volatility implied by at-the-money S&P 100 Index option prices. After 2004, it is calculated using the midpoints of S&P 500 Index option bid/ask quotes (CBOE, n.d.)

(4) We regress the total portfolio performance in section 5.4 during the entire time horizon (2004-2018), using monthly data instead of daily data. Thereafter, we reduce the measurement horizon to 2004-2017 to match the portfolio monthly return data with Pástor and Stambaugh's (2003) liquidity factors, for which monthly data is only available until the end of 2017. Then, we regress the portfolio performance during the period 2004-2017, once without Pástor and Stambaugh's traded liquidity factor and innovations in aggregate liquidity non-traded factor, and once including these variables to assess the impact of liquidity on the portfolio returns. This is done to check the robustness of our results by adding more variables to the regression, a model variation test. Furthermore, the results are tested for sensitivity in measurement horizon and measurement frequency.

4.2 Regression Specifications

To assess and explain portfolio performance it is necessary to use a regression model to determine the portfolio characteristics that are driving the results. The most basic model used for this purpose is the capital asset pricing model (CAPM) (Sharpe, 1964). CAPM measures the return of a security ($r_{i,t}$) based on the risk-free rate (r_f), and the stocks responsiveness to the market measured by (β_{MKTRF}). The risk premium is defined as the excess market return, which is computed as $\left(r_{mkt} - r_f\right)$. The residual variable (ε_i) has the same function in the extended versions of the CAPM model as for the CAPM model itself, the residual captures the model's shortcoming when measuring the relationship between the independent variables and the dependent variable. The CAPM regression specification for excess stock returns is:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}\left(r_{mkt} - r_f\right) + \varepsilon_i \qquad (1)$$

However, in the light of Bernard and Thomas' (1989) critique against the CAPM model's failure to properly adjust for risk, alternative augmented versions of the CAPM model have been introduced to incorporate differences in risk and reduce the likelihood of observing significant results due to misspecifications of the CAPM model. One of these models is the Fama-French three-factor model which adds two variables to the traditional CAPM model, the High Minus Low (HML) variable and the Small Minus Big (SMB) variable. Fama-French (1992) regress the excess market returns using to the follow specification:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}\left(r_{mkt} - r_f\right) + \beta_{HML,i}HML + \beta_{SMB,i}SMB + \varepsilon_i \qquad (2)$$

HML captures the historical excess returns of stocks with high-book-to-price ratio over low book-to-price ratio. ($\beta_{HML,i}$) measures the correlation between the specific firm and the HML factor. SMB measures the historical excess returns of small companies over large companies.($\beta_{SMB,i}$) measures the relationship between the specific firm and the SMB factor.

Carhart (1997) extended the traditional Fama-French three factor model by introducing a momentum variable (UMD) that is constructed using the equally weighted average returns of the two highest performing portfolios subtracted by the equally weighted average returns of the two lowest performing portfolios, lagged by one month (Carhart, 1997). ($\beta_{UMD,i}$) explains the interaction between a specific firm and the UMD factor. The Carhart four factor model is presented below:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}(r_{mkt} - r_f) + \beta_{HML,i}HML + \beta_{SMB,i}SMB + \beta_{UMD,i}UMD + \varepsilon_i \quad (3)$$

In 2015, Fama-French extended their three-factor model by adding two new factors, namely the Robust Minus Weak (RMW) and Conservative Minus Aggressive (CMA) variables. RMW illustrates the difference in returns of diversified stock portfolios with strong and weak profitability. ($\beta_{RMW,i}$) shows the relationship between the specific firm and the RMW factor. The CMA factor depicts the returns on diversified portfolios of firms that invests carefully minus firms that invest heavily. ($\beta_{CMA,i}$) shows the interrelationship between the specific firm and the CMA factor. The Fama-French five factor model is presented below:

$$\begin{gathered} r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}(r_{mkt} - r_f) + \beta_{HML,i}HML + \beta_{SMB,i}SMB + \beta_{RMW,i}RMW \\ +\beta_{CMA,i}\, CMA + \varepsilon_i \end{gathered} \quad (4)$$

In this thesis, however, in order to mitigate the issue of model misspecifications and to enhance the precision of regression results, an augmented version of the Fama-French five-factor model (Fama and French, 2015) is used. The augmented Fama-French five-factor model adds Carhart's (1997) momentum variable to increase the explanatory effect of the regression, which produces more accurate results and provide implications for the drivers of the results. Hence, the following regression specification used in this thesis:

$$\begin{gathered} r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}(r_{mkt} - r_f) + \beta_{HML,i}HML + \beta_{SMB,i}SMB + \beta_{RMW,i}RMW + \\ \beta_{CMA,i}\, CMA + \beta_{UMD,i}UMD + \varepsilon_i \end{gathered} \quad (5)$$

The market excess return coefficient (β_{MKTRF}) captures the security's exposure to systematic risk, in conjunction to the market risk premium, a larger beta implies that the security generates larger expected excess return due to its exposure to market risk.

As previously mentioned, Fama-French (1992) introduced two additional variables to the CAPM equation. The HML (high book-to-market) factor distinguishes between high-value (high book-to-market) stocks and growth (low-book-to-market) stocks, the historical trend is that value stocks outperform growth stocks. In instances where the HML coefficient (β_{HML}) is greater than zero ($\beta_{HML} > 0$), the security or the portfolio is characterized as a value stock/value portfolio, whereas a HML coefficient below zero ($\beta_{HML} < 0$) implies that the stock or portfolio is a growth stock/growth portfolio.

The additional variable in the Fama-French three factor model (1992) is the SMB (small minus big) factor. Fama-French (1992) found that large-cap stocks are outperformed by small-cap stocks, this finding indicates that stocks or portfolios with a SMB coefficient (β_{SMB}) greater than zero ($\beta_{SMB} > 0$) have similar characteristics to small-cap stocks or portfolios, if the SMB coefficient is smaller than zero ($\beta_{SMB} < 0$) the stock or portfolio resembles large-cap stocks or portfolios.

Regarding the (β_{UMD}), if it is greater than zero ($\beta_{UMD} > 0$), the returns of the two equally top performing portfolios performance are positively related to prior returns. On the other hand, if it is below zero ($\beta_{UMD} < 0$), the returns are negatively correlated with prior returns.

The coefficient (β_{RMW}) captures the difference in operating profitability of highly and weakly profitable firms. That is, if the β_{RMW} > 0 the portfolio consists of more exceptionally profitable firms than weakly profitable firms. If β_{RMW} < 0, the reverse is true.

Concerning the (β_{CMA}) coefficient, it illustrates the difference in investment behaviour of firms. If β_{CMA} > 0, the portfolio consists of more conservatively investing firms than firms that invest aggressively. Hence, if β_{CMA} < 0 the opposite is true.

The difference between the actual returns of a stock and the estimated returns of a stock is referred to as abnormal returns. Abnormal returns can be zero, positive or negative, it is a measure of how the actual returns compare to the returns predicted by the augmented Fama-French five factor model. Under the efficient market hypothesis (Fama, 1970), all market information should be reflected in the prices and the expected value of abnormal returns should be zero as the estimation model correctly predicts the actual outcome. The constant alpha (α_i) captures deviations from the returns explained by the augmented Fama-French regression model, therefore, alpha is abnormal returns that should not appear in an efficient market.

Lastly, to assess the impact of liquidity on the portfolio performance, we add two additional liquidity variables to the augmented Fama-French five factor model. The Traded Liquidity Factor (TLF/TRADEDLIQ) and Innovations in Aggregate Liquidity Factor (ILF/INNOVLIQ) are obtained from Pástor and Stambaugh (2003). TLF captures the historical excess returns of stocks with high liquidity (top decile) over low liquidity (bottom decile) using decile portfolios ranked according to stock liquidity. $(\beta_{TLF,i})$ measures the correlation between an individual stock and the TLF factor. The other factor ILF, captures a stocks sensitivity to innovations in aggregate liquidity which is a non-traded factor, it measures whether there exists a liquidity premium for a given stock. As such, $(\beta_{ILF,i})$ measures the correlation between stock returns of a specific firm and the innovations in aggregate market liquidity factor.

If $\beta_{TLF,i} > 0$ the portfolio contains liquid stocks, while $\beta_{TLF,i} < 0$ implies that the portfolio is constructed using illiquid stocks. If the innovations in aggregate liquidity factor $\beta_{ILF,i}$ assumes a value greater than 0 $(\beta_{ILF,i} > 0)$, the asset has positive co-movement with innovations in aggregate liquidity, which indicates the presence of a liquidity risk premium. Stocks exhibiting positive significant $\beta_{ILF,i}$ have higher expected returns to compensate for liquidity risk. On the other hand, if the stock has negative co-movement with innovations in aggregate liquidity, that is a $\beta_{ILF,i}$ less than 0 $(\beta_{ILF,i} < 0)$, the stock has lower expected returns because the stock can be traded quickly without assuming any liquidity risk. In other words, investors holding stocks with negative innovations in aggregate liquidity betas are willing to forego expected returns in favour of holding stocks that can be traded quickly. All the previous regression variables together with the new liquidity variables lead to the following regression specification:

$$\begin{aligned} r_{i,t} - r_{f,t} = \alpha_i + \beta_{MKTRF,i}\left(r_{mkt} - r_f\right) + \beta_{HML,i}HML + \beta_{SMB,i}SMB + \beta_{RMW,i}RMW \\ + \beta_{CMA,i}\,CMA + \beta_{UMD,i}UMD + \beta_{TLF,i}TLF + \beta_{ILF,i}\mathrm{ILF} + \varepsilon_i \end{aligned} \tag{6}$$

4.3 Heteroskedasticity

The main regression used in this thesis, the augmented Fama-French five factor model, is applied to three separate portfolios. To control for the presence of heteroskedasticity, meaning that the variance of the error term is not constant over time; which would result in inaccurate results due to biased coefficients, a Breusch-Pagan/Cook-Weisberg (B-P/C-W) test for heteroskedasticity is performed. Under the null hypothesis of the B-P/C-W test, the variance of the error terms are equal and constant over time, which means that the model is homoskedastic. Under the alternative hypothesis, the error term's variance is a dependent function of the regression variables and not constant over time (Wooldridge, 2013). The B-P/C-W test for heteroskedasticity is run on the regression for the three separate portfolios for each individual year over the time horizon 2004-2018. The results of the test, presented in Table A1 in Appendix, displays the presence of heteroskedasticity for multiple years as the null hypothesis of constant error terms over time can be rejected for multiple years. With respect to this finding, we employ robust regressions for all results presented in this thesis. This prevents the results from being influenced by biased standard errors for the coefficients and ensures compatibility with the Ordinary Least Square (OLS) regression assumptions.

4.4 Multicollinearity and Normality

Multicollinearity occurs when there are simultaneous changes in the independent variables in a multiple regression model, indicating that the independent variables are closely correlated with each other. This means that the predictors in the model can be linearly predicted using the independent variables in the regression model. In other words, the independent variables can be used to explain one another, thereby distorting the results. Multicollinearity makes it impossible to isolate the effect of a separate independent variable on the dependent variable (Newbold et al, 2013). To assess if the augmented Fama-French five factor model experiences multicollinearity, we use the Variance Inflation Factor (VIF). A common rule of thumb used by researchers in this context is the rule of 10, if the independent regression variables have a VIF below 10, multicollinearity is not an issue (O'Brien, 2007). The VIF test shows that the augmented Fama-French five factor model does not exhibit multicollinearity as all independent variables have a VIF below 2, for results, see Appendix Table A2.

An additional assumption of a multivariate regression model is that the residuals of the regression models are normally distributed. The assumption of normality is graphically examined for the Sustainable, Good Enough and Unsustainable portfolio in Appendix Figure A2, A3 and A4, respectively. The results indicate that the residuals are normally distributed for all portfolios. Able 5

4.5 Methodological Procedure for the Result Sections

Part 1 of the study outlined in section 4.1 compares the annual performance of Unsustainable, Good Enough and Sustainable portfolios, thereby acquiring the average characteristics of the different portfolios over the time frame 2004-2018. The portfolios are equally weighted, which means that the portfolio return is the mean return of all stocks belonging to that portfolio on that particular day, without respect to market capitalization. The daily excess portfolio returns are used to compute the total average daily performance of the portfolio over the entire period (2004-2018). The regression coefficients are obtained using the augmented Fama-French five factor model introduced in section 4.2, equation 5. Furthermore, we test for the difference of the monthly regression coefficients being equal against being unequal using a Kruskal-Wallis test for equality of medians between three population.

In the second part of the study, the three portfolios are regressed on an annual basis from 2004 to 2013 to assess the performance of the portfolios during the financial crisis and before formulating the trading strategies. After obtaining the annual regression coefficients, they are examined to see the behaviour of the Sustainable, Good Enough and Unsustainable portfolios over time. Comparing the annual performance enables the examination of the development in the three portfolios characteristics, which lays the foundation for the trading strategies introduced in the third section.

In the third part of the study, six trading strategies are constructed using the three portfolios. The performance of these strategies is tested in conjunction to the individual portfolios during the five-year investment horizon, 2014-2018. The strategies are used to assess whether or not the different characteristics in portfolio can be combined in times of high and low market volatility to maximize an investor's returns, as opposed to only holding one portfolio during the entire time horizon (2014-2018). If a combination of portfolio investments (strategies) generates larger abnormal returns than only holding a portfolio in isolation, the results would imply that investors can exploit abnormal returns in the stock market through the usage of thematic investing. The strategies are presented in the results section 5.3.

The augmented Fama-French five factor model is chosen to explain as much of the variation in portfolio returns as possible for all parts of the study, in order to explain portfolio performance and characteristics as exhaustively as possible.

The relative volatility index mentioned in section 4.1 which assumes a value greater than

1 in times of high volatility and lower than 1 in times of low volatility is constructed using the closing price of yesterday's VIX index (VIX_{t-1}) divided by the average volatility level over the last three years, with 252 trading days per year ($\frac{\sum_{t-1-252\times3}^{t-2} VIX_t}{252\times3}$). The rationale for using a three-year average is that short-run macroeconomic shocks are expected to last for a minimum of two years. Macroeconomic shocks cause deviations from expected long-run growth and cause different expectations about the development of macroeconomic variables and causes stickiness in factor adjustments, hence market expectation will be influenced by recent developments (Jones, 2018). The expression for the relative measure is expressed mathematically as:

$$Relative\ CBOE\ VIX\ Index\ (RVIX) = \frac{VIX_{t-1}}{\left(\frac{\sum_{i\,=\,t-1-252\times3}^{t-2} VIX_i}{252 \times 3}\right)} \tag{7}$$

If VIX_{t-1} is greater than ($\frac{\sum_{t-1-252\times3}^{t-2} VIX_t}{252\times3}$), the relative measure has a value greater than 1, meaning high volatility levels. In cases where VIX_{t-1} is smaller, the relative measure has a value below 1, indicating low volatility levels. As previously mentioned, these are the triggers for going long and exiting portfolios during the trading strategies during the time period 2014-2018. A visual representation of the relative volatility index (RVIX) is presented in Appendix figure 1 for the time period 2007-2019.

In the fourth and final section, the augmented Fama-French model is regressed using monthly data for the time period 2004-2018 to examine if monthly frequencies would alter the results, note that the regression will produce a monthly alpha, instead of a daily alpha. Thereafter, as explained in section 4.1, the measurement horizon is reduced to 2004-2017, whereby the augmented Fama-French five factor model is regressed, first excluding the liquidity factors and then including the liquidity factors.

5. Empirical Results

5.1 Portfolios Characteristics Between 2004 - 2018

The equally weighted portfolio returns are regressed from 2004-2018 using the augmented Fama-French five factor model, during this timeframe there are 3775 trading days and observations used to generate the following portfolio characteristics.

Table 1: Daily Descriptive Characteristics of the Three Thematic Portfolios between 2004 - 2018

Portfolios	Sustainable Portfolio	Good Enough Portfolio	Unsustainable Portfolio
Variables	ret	ret	ret
MKTRF	1.060***	1.047***	0.990***
	(0.00553)	(0.00727)	(0.00546)
SMB	0.422***	0.570***	0.727***
	(0.00979)	(0.00990)	(0.00857)
HML	0.148***	0.194***	0.172***
	(0.0116)	(0.0135)	(0.0102)
UMD	-0.118***	-0.103***	-0.0805***
	(0.00642)	(0.00595)	(0.00599)
RMW	-0.0284**	-0.00573	-0.0413***
	(0.0139)	(0.0127)	(0.0122)
CMA	-0.0469**	-0.0836***	-0.120***
	(0.0187)	(0.0216)	(0.0150)
CONSTANT	0.0200***	0.0213***	0.0315***
	(0.00313)	(0.00274)	(0.00302)
Observations	3,775	3,775	3,775
R-squared	0.981	0.985	0.982
Adjusted R-squared	0.981	0.985	0.982

Note: ***, **, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted daily portfolio returns for the Sustainable portfolio, the Good Enough portfolio and the Unsustainable portfolio, over the entire sample period 2004-2018. The dependent variable is daily portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the number of trading days between 2004 and 2018. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

The results showcase that the MKTRF, SMB, HML, UMD and the CONSTANT variables are significant at the 1 % level for all three portfolios. The RMW variable does not exhibit significant results for the Good Enough portfolio, therefore, the variable is not meaningful in explaining the regression results for that portfolio. The Sustainable portfolio has a CMA variable that is significant at the 5 % level compared to the other portfolios that have a significant CMA at the 1 % level. This indicates that the variables have divergent explanatory power for the different portfolios. The adjusted R-squared explains over 98 % of the returns of all portfolios. Interestingly, the Unsustainable portfolio has a MKTRF below 1, making it less exposed to systematic risk than the other portfolios. Also, the Unsustainable portfolio consists of a larger portion of shares with small stock characteristics (SMB) with lower operating profitability (RMW) than the two other portfolios. The HML variable shows that Good Enough portfolio consists of more high book-to-market stocks than the Unsustainable and Sustainable portfolio. It entails that the Good Enough portfolio contains more value stocks than growth stocks. A significantly larger negative CMA variable indicates that the firms in the Unsustainable portfolio have more aggressive investing strategies than the firms in the other portfolios. The difference between the actual and predicted return by the model gives the alpha (CONSTANT) which is the abnormal return. Noteworthy, is how the Unsustainable portfolio has an abnormal daily return of 0.0315% per day[5], resulting in a yearly abnormal return of about 8.26%[6]. However, it is insufficient to observe a beta coefficient's value to say that the portfolio characteristics differ from each other. To ensure that there are significant differences in portfolio characteristics, a Kruskal-Wallis test for equality of medians between the three portfolio betas is employed using monthly regression variables. The results displayed in Table 2 shows that there is a significance difference between the Sustainable-, Good Enough- and Unsustainable portfolio for MKTRF, SMB, HML and CMA. MKTRF, SMB, HML, and CMA are significant at the 1 % level, while CONSTANT (CONS) is significant at the 5 % level. The differences in alpha between portfolios is rejected at the 5 % level, consequently, there is a significant difference in abnormal returns between the portfolios. In addition, the RMW and UMD variables are not rejected, thus, the three portfolios have similar profitability and the prior year's returns have similar impact on the portfolio performance over time.

[5] The CONSTANTS are expressed in percentages.
[6] The daily abnormal returns compounded by 252 trading days generate annual abnormal returns.

Table 2: Kruskal-Wallis Test of Equality of Medians between Portfolios

VAR	χ2 (2)	Obs	Prob.>
CONS	6.111	180	0.0471
MKTRF	26.755	180	0.0001
SMB	351.17	180	0.0001
HML	31.377	180	0.0001
UMD	2.286	180	0.3189
RMW	1.418	180	0.4921
CMA	24.878	180	0.0001

Note: A Kruskal-Wallis test is performed for median monthly coefficient differences between the Sustainable, Good Enough and Unsustainable portfolio. The null hypothesis of equality of median beta coefficients between portfolio is tested against the alternative hypothesis of unequal beta coefficients. The χ2 (2) test statistic implies that the test uses two degrees of freedom, since there are three groups tested. Obs is the number of monthly coefficient observations within each portfolio between 2004-2018. Prob>0.10, Prob>0.05, and Prob>0.01 indicates statistical significance at the 10 %, 5 % and 1 % level, respectively.

As there are differences between portfolio medians for several factors, it is interesting to examine which of the portfolios that have dissimilar characteristics. The Kruskal-Wallis test fails to explain which of the medians diverge from each other, thus, a Dunn's test with Bonferroni correction is conducted to see for which pairwise comparison the null hypothesis of equality of medians is rejected.

Table 3: Dunn's Test with Bonferroni Corrections for Pairwise Comparison

COMB	S & G		S & U		G & U	
VAR	Z	Prob.>	Z	Prob.>	Z	Prob.>
CONS	0.84	0.6002	2.43	0.0224	1.59	0.1670
MKTRF	-1.43	0.2283	-5.02	0.0000	-3.59	0.0005
SMB	9.63	0.0000	18.74	0.0000	9.10	0.0000
HML	4.70	0.0000	4.99	0.0000	0.28	1.0000
UMD	0.46	0.9653	1.48	0.2092	1.02	0.4651
RMW	1.07	0.4275	0.08	1.0000	-0.99	0.4840
CMA	-2.99	0.0042	-4.95	0.0000	-1.97	0.0737

Note: A Dunn's test with Bonferroni correction is used as post-hoc analysis to the Kruskal-Wallis test in order to reduce the family-wise error rate for multiple hypotheses tests. Dunn's post-hoc test identifies which medians significantly differ from each other under the Kruskal-Wallis test. The augmented Fama-French beta coefficients are compared in pairwise portfolio combinations, Sustainable and Good Enough (S&G), Sustainable and Unsustainable (S&U), Good Enough and Unsustainable (G&U). The Z-statistic and the significance level Prob.> is displayed for each pairwise comparison of monthly beta coefficients. Prob>0.10, Prob>0.05, and Prob>0.01 indicates statistical significance at the 10 %, 5 % and 1 % level, respectively.

The post-hoc test shows that the null hypothesis of equality of medians for MKTRF is rejected for the combination Sustainable and Unsustainable portfolio at the 1 % level. MKTRF is also significant for the Good Enough and Unsustainable portfolio at the 1 % level. The SMB factor is rejected at the 1 % level for each portfolio comparison. The null hypothesis is accepted for the HML factor for the Good Enough and Unsustainable portfolio, the remaining combinations are accepted at the 1 % level, implying differences in value and growth stock in the portfolio composition. The null hypothesis for the CMA variable is rejected for all combination of portfolio combinations, the Good Enough and Unsustainable portfolio is statistically significant at the 10 % level, while the other two combinations are significant at the 1 % level. The null hypothesis of equal medians for alpha is rejected for the combination Sustainable and Unsustainable at the 5 % level, consequently, there is a difference in abnormal returns between the Sustainable and the Good Enough portfolio, implying that the Unsustainable portfolio outperforms the Sustainable portfolio. The remaining factors, UMD and RMW remain insignificant when conducting multiple pairwise comparisons. For the variables that are not significant at the 10%, 5% or 1% significance level, it is infeasible to conclude with statistical methods if the variables contrast each other.

However, as the augmented Fama-French five factor model demonstrate, a majority of the variables are significant on a daily basis, and the percentage difference is even larger on a yearly basis. For instance, the annual abnormal return is 5.17%, 5.51% and 8.26% for the Sustainable, Good Enough and Unsustainable portfolio respectively, whereas on a daily basis it is 0.020%, 0.0213% and 0.0315%, respectively during the period 2004 to 2018.

5.2 Portfolio Performance between 2004 - 2013

By looking at Table 4, Table 5 and Table 6 and Figure 2 below it is evident that the portfolio betas changes over time. All portfolios' HML, UMD, RMW and CMA variables experience changes in significance ranging from 1%, 5% to 10% over time. The MKTRF and SMB variables remain significant at the 1 % level for all portfolios during the whole period between 2004 – 2013. The Sustainable and Good Enough portfolio are exposed to more systematic risk in relation to the Unsustainable portfolio, displayed by higher MKTRF. More interesting is how the portfolios react differently during the Great Recession. The Sustainable portfolio's MKTRF jumps from a level below one to 1.057 in 2007 and has since then remained above one. However, it dips to 1.053 in 2008 compared to 1.057 in 2007 and 1.098 in 2009. The Good Enough portfolio's MKTRF rises following the crisis and it also remains above one. In contrast to the Sustainable portfolio's MKTRF, which slumps in 2008, the Good Enough portfolio's spikes, reaching 1.089 compared to 1.045 in 2007 and 1.072 in 2009. The Unsustainable portfolio's pattern is similar to the Sustainable portfolio during the crises. It also bounces from a MKTRF level below one in 2006 to above one on average in the recession. It also declines in 2008 to 0.981 compared to 1.035 in 2007 and 1.022 in 2009. In contrast to the other portfolios, the MKTRF returns to a level below one once the crisis settles. It implies that the Unsustainable portfolio during normal market conditions is less affected by systematic risk. Additionally, the abnormal returns differ across the portfolios. All portfolios' CONSTANT (alpha) dips in the crisis. In spite of that, the abnormal return is higher during 2008 for all portfolios. It implies that the actual return is greater than predicted returns by the augmented Fama-French model. Noteworthy is how the Sustainable portfolio does not experience a jump as large as the Good Enough and Unsustainable portfolio during 2008. The Sustainable portfolio's alpha goes from 0.0233 in 2007 to 0.0504 in 2008 and 0.0376 in 2009. The Unsustainable portfolio's alpha reaches 0.0680 in 2008 compared to 0.0331 in 2007 and 0.0497 in 2009. The Good Enough portfolio has the largest increase in alpha, from 0.0232 in 2007 to 0.0750 in 2008 and down to 0.0478 in 2009. This pattern of jumps and slumps is more severe for the Sustainable and Good Enough portfolio since the alpha goes from a level of 0.03 to hover around 0.017 on average after the crises. As for the Unsustainable portfolio, the alpha drops after the crises from an average level of 0.038 to an average level of 0.033. In short, the crisis strongly affects the yearly abnormal returns for all portfolios.

Table 4: Portfolio Performance of the Sustainable Portfolio between 2004 - 2013

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Variables	ret	ret	ret	ret	ret	ret	ret	ret	ret	ret
MKTRF	0.963***	0.971***	0.981***	1.057***	1.053***	1.098***	1.012***	1.053***	1.029***	1.047***
	(0.0162)	(0.0148)	(0.0194)	(0.0112)	(0.0192)	(0.0174)	(0.0122)	(0.0142)	(0.0137)	(0.0153)
SMB	0.450***	0.424***	0.426***	0.379***	0.431***	0.434***	0.371***	0.401***	0.371***	0.383***
	(0.0290)	(0.0247)	(0.0247)	(0.0291)	(0.0362)	(0.0240)	(0.0198)	(0.0234)	(0.0218)	(0.0193)
HML	0.208***	0.162***	0.00976	0.172***	0.0278	0.150***	0.118***	0.0118	-0.0800**	0.0222
	(0.0401)	(0.0422)	(0.0454)	(0.0540)	(0.0332)	(0.0240)	(0.0257)	(0.0422)	(0.0344)	(0.0344)
UMD	-0.0364	0.0743***	0.0888***	0.0558**	-0.164***	-0.168***	0.0646***	-0.0904***	-0.146***	-0.0988***
	(0.0240)	(0.0220)	(0.0230)	(0.0281)	(0.0296)	(0.0169)	(0.0207)	(0.0223)	(0.0191)	(0.0235)
RMW	-0.00166	-0.101***	-0.0729	-0.106**	-0.0611	-0.0412	-0.0599*	-0.104**	-0.109**	-0.132***
	(0.0455)	(0.0362)	(0.0451)	(0.0456)	(0.0723)	(0.0499)	(0.0335)	(0.0453)	(0.0459)	(0.0388)
CMA	0.0202	0.0942	-0.0410	-0.0492	-0.261***	-0.0374	0.0738*	-0.0709	0.160***	0.165***
	(0.0593)	(0.0632)	(0.0485)	(0.0478)	(0.0801)	(0.0503)	(0.0416)	(0.0469)	(0.0498)	(0.0426)
CONSTANT	0.0369***	0.0273***	0.0365***	0.0233**	0.0504**	0.0376**	0.0155*	0.00304	0.0163*	-0.00599
	(0.0104)	(0.00847)	(0.00895)	(0.0113)	(0.0205)	(0.0153)	(0.00879)	(0.00996)	(0.00866)	(0.00727)
Observations	252	252	251	251	253	252	252	252	250	252
R-squared	0.966	0.972	0.975	0.981	0.987	0.990	0.991	0.993	0.982	0.980
Adjusted R-squared	0.965	0.971	0.974	0.980	0.987	0.990	0.991	0.993	0.981	0.980

Note: ***,**, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted daily portfolio returns for the Sustainable portfolio, for each year between 2004 and 2013. The dependent variable is daily portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the number of trading days for each individual year between 2004 and 2013. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

Table 5: Portfolio Performance of the Good Enough Portfolio between 2004 - 2013

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Variables	ret	ret	ret	ret	ret	ret	ret	ret	ret	ret
MKTRF	0.935***	0.948***	0.939***	1.045***	1.089***	1.072***	1.018***	1.038***	1.023***	1.021***
	(0.0178)	(0.0147)	(0.0160)	(0.00802)	(0.0193)	(0.0172)	(0.0110)	(0.00915)	(0.0105)	(0.0141)
SMB	0.561***	0.503***	0.527***	0.599***	0.597***	0.589***	0.563***	0.587***	0.579***	0.558***
	(0.0275)	(0.0235)	(0.0215)	(0.0199)	(0.0295)	(0.0247)	(0.0149)	(0.0177)	(0.0186)	(0.0179)
HML	0.221***	0.169***	0.121***	0.222***	0.0512	0.220***	0.175***	0.201***	0.114***	0.0367
	(0.0371)	(0.0348)	(0.0390)	(0.0318)	(0.0365)	(0.0259)	(0.0222)	(0.0336)	(0.0265)	(0.0339)
UMD	-0.00263	0.0586***	0.0535***	0.0208	-0.112***	-0.0941***	-0.0573***	-0.0557**	-0.0627***	-0.0615**
	(0.0254)	(0.0194)	(0.0198)	(0.0166)	(0.0272)	(0.0161)	(0.0189)	(0.0231)	(0.0169)	(0.0242)
RMW	0.0947**	-0.0612*	0.0393	0.0367	-0.153***	-0.101**	-0.0458	-0.00246	-0.0941***	-0.105***
	(0.0430)	(0.0312)	(0.0418)	(0.0379)	(0.0565)	(0.0502)	(0.0297)	(0.0472)	(0.0340)	(0.0378)
CMA	-0.0223	-0.0310	-0.127***	-0.0404	-0.178*	-0.197***	-0.00893	-0.0776*	0.0564	0.103***
	(0.0485)	(0.0529)	(0.0422)	(0.0356)	(0.0906)	(0.0605)	(0.0331)	(0.0426)	(0.0376)	(0.0361)
CONSTANT	0.0298***	0.0273***	0.0343***	0.0232***	0.0750***	0.0478***	0.0166**	0.0144*	0.0220***	0.0119*
	(0.00978)	(0.00714)	(0.00755)	(0.00778)	(0.0206)	(0.0156)	(0.00715)	(0.00862)	(0.00731)	(0.00675)
Observations	252	252	251	251	253	252	252	252	250	252
R-squared	0.970	0.980	0.981	0.990	0.990	0.990	0.994	0.996	0.988	0.985
Adjusted R-squared	0.969	0.979	0.981	0.989	0.990	0.989	0.994	0.996	0.988	0.984

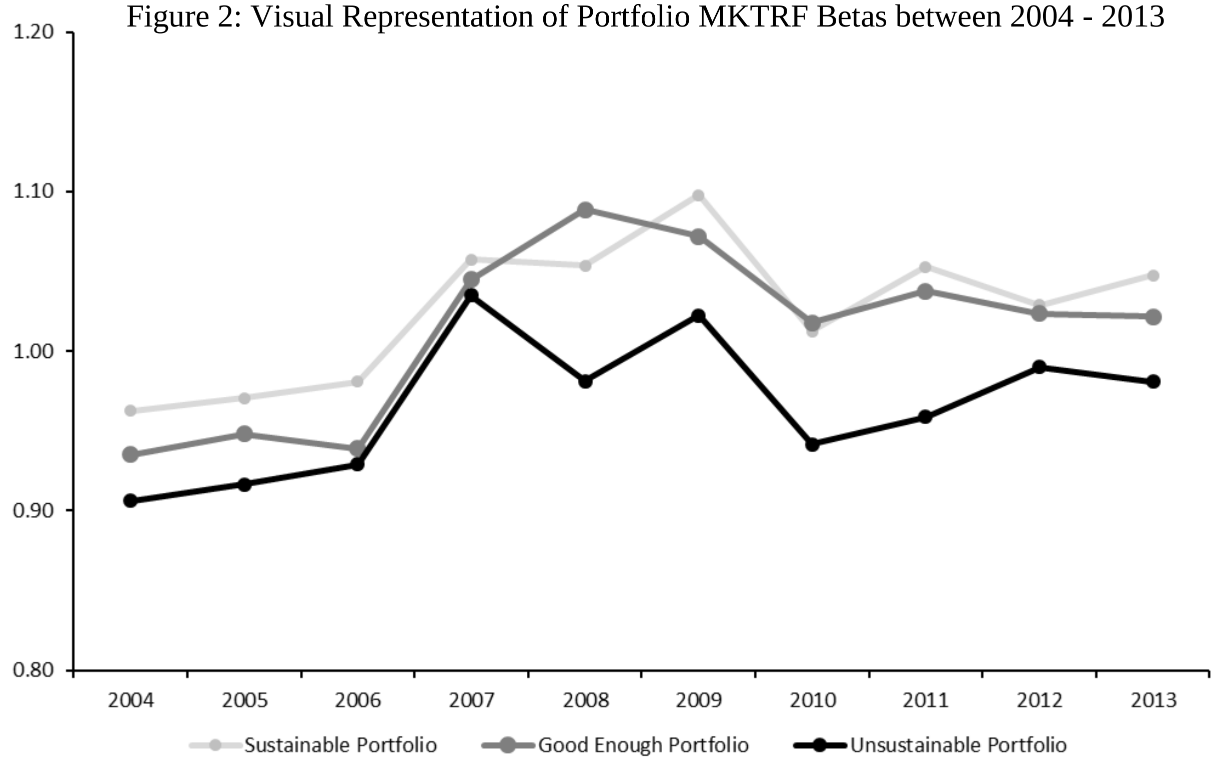
Note: ***,**, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted daily portfolio returns for the Good Enough portfolio, for each year between 2004 and 2013. The dependent variable is daily portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the number of trading days for each individual year between 2004 and 2013. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

Table 6: Portfolio Performance of the Unsustainable Portfolio between 2004 - 2013

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Variables	ret	ret	ret	ret	ret	ret	ret	ret	ret	ret
MKTRF	0.906***	0.917***	0.929***	1.035***	0.981***	1.022***	0.942***	0.959***	0.990***	0.981***
	(0.0185)	(0.0166)	(0.0340)	(0.0110)	(0.0138)	(0.0194)	(0.0158)	(0.0116)	(0.0155)	(0.0137)
SMB	0.711***	0.709***	0.692***	0.769***	0.713***	0.726***	0.728***	0.769***	0.734***	0.734***
	(0.0360)	(0.0288)	(0.0377)	(0.0252)	(0.0249)	(0.0291)	(0.0229)	(0.0230)	(0.0285)	(0.0215)
HML	0.284***	0.232***	0.160***	0.201***	0.0636**	0.154***	0.201***	0.216***	0.108***	0.136***
	(0.0441)	(0.0523)	(0.0538)	(0.0396)	(0.0285)	(0.0283)	(0.0278)	(0.0390)	(0.0319)	(0.0323)
UMD	0.00729	-0.000860	0.0198	0.0647***	-0.122***	-0.0873***	-0.0343	-0.0443	-0.0141	-0.00743
	(0.0274)	(0.0316)	(0.0301)	(0.0206)	(0.0263)	(0.0151)	(0.0227)	(0.0287)	(0.0271)	(0.0258)
RMW	0.0333	-0.0549	-0.0359	-0.0604	-0.128**	-0.100*	-0.0911**	-0.0440	-0.158***	-0.0776
	(0.0498)	(0.0454)	(0.0581)	(0.0644)	(0.0562)	(0.0575)	(0.0435)	(0.0553)	(0.0606)	(0.0472)
CMA	-0.113*	-0.0365	-0.234***	-0.0170	-0.210***	-0.140**	-0.145***	-0.166***	0.0934*	-0.0142
	(0.0679)	(0.0781)	(0.0646)	(0.0492)	(0.0622)	(0.0564)	(0.0528)	(0.0559)	(0.0520)	(0.0392)
CONSTANT	0.0458***	0.0269**	0.0445***	0.0331***	0.0680***	0.0497***	0.0299***	0.0273**	0.0245**	0.0358***
	(0.0115)	(0.0104)	(0.0116)	(0.00999)	(0.0180)	(0.0177)	(0.00985)	(0.0106)	(0.00973)	(0.00767)
Observations	252	252	251	251	253	252	252	252	250	252
R-squared	0.961	0.961	0.961	0.982	0.989	0.985	0.989	0.993	0.978	0.981
Adjusted R-squared	0.960	0.960	0.960	0.981	0.989	0.984	0.989	0.993	0.977	0.980

Note: ***,**, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted daily portfolio returns for the Unsustainable portfolio, for each year between 2004 and 2013. The dependent variable is daily portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the number of trading days for each individual year between 2004 and 2013. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

Figure 2: Visual Representation of Portfolio MKTRF Betas between 2004 - 2013



5.3 Trading Strategies between 2014 - 2018

Based on the interesting findings regarding MKTRF betas (the market betas) in section 5.2, displayed in Figure 2, it is possible to construct a trading strategy. The Sustainable and Good Enough portfolio experience higher exposure to systematic risk than the Unsustainable portfolio as their market betas are higher in recession. Furthermore, the Sustainable and Good Enough portfolio went from a level below one to a stable level above one after the crisis. It is also important to mention that the beta for the Good Enough portfolio increased when the crises was the most striking. The Sustainable and Unsustainable portfolio on the other hand demonstrated another behaviour in relation to the market. Their betas also jumped to a level above one around the crisis but when the crisis was at its worst, their betas declined. On top of that, once the crisis had calmed down the MKTRF for the Unsustainable portfolio was once again on its normal levels below one. The Sustainable and Good Enough portfolios' market beta and the Unsustainable portfolio's market beta display different behaviour. For that reason, we will construct a trading strategy based on the behaviour with respect to the market sentiments. The CBOE Volatility Index (VIX) will be used as a proxy for the market sentiment. It is often used as the stock markets expected implied volatility. In other words, it can be regarded as an indicator of forward-looking systematic risk. It is based on the implied volatility of 30-day options on the

S&P 500. As outlined in section 4.5, equation 7, a relative measure of the VIX index (RVIX) will be used, based on the current level of volatility in relation to the average of the past three years. The relative measure will assume a value above one in times of high market volatility and a value below one in periods of lower volatility. This measure will work as trigger for switching between portfolios.

Based on the three portfolios, the following six trading strategies can be created:

1. Trading strategy 1 involves going long in the Sustainable portfolio in times of low market volatility i.e. when the relative VIX is below one (RVIX < 1) and go long in the Good Enough portfolio in times of high market volatility (RVIX > 1).
2. Trading Strategy 2 involves going long in the Sustainable portfolio in times of high market volatility (RVIX>1) and long in the Good Enough portfolio in times of low market volatility (RVIX<1).
3. Trading Strategy 3 involves going long in the Sustainable portfolio in times of high market volatility (RVIX>1) and long in the Unsustainable portfolio in times of low market volatility (RVIX<1).
4. Trading Strategy 4 involves going long in the Sustainable portfolio in times of low market volatility (RVIX<1) and long in the Unsustainable portfolio in times of high market volatility (RVIX>1).
5. Trading Strategy 5 involves going long in the Good Enough portfolio in times of high market volatility (RVIX>1) and long in the Unsustainable portfolio in times of low market volatility (RVIX<1).
6. Trading Strategy 6 involves going long in the Good Enough portfolio in times of low market volatility (RVIX<1) and long in the Unsustainable portfolio in times of high market volatility (RVIX>1).

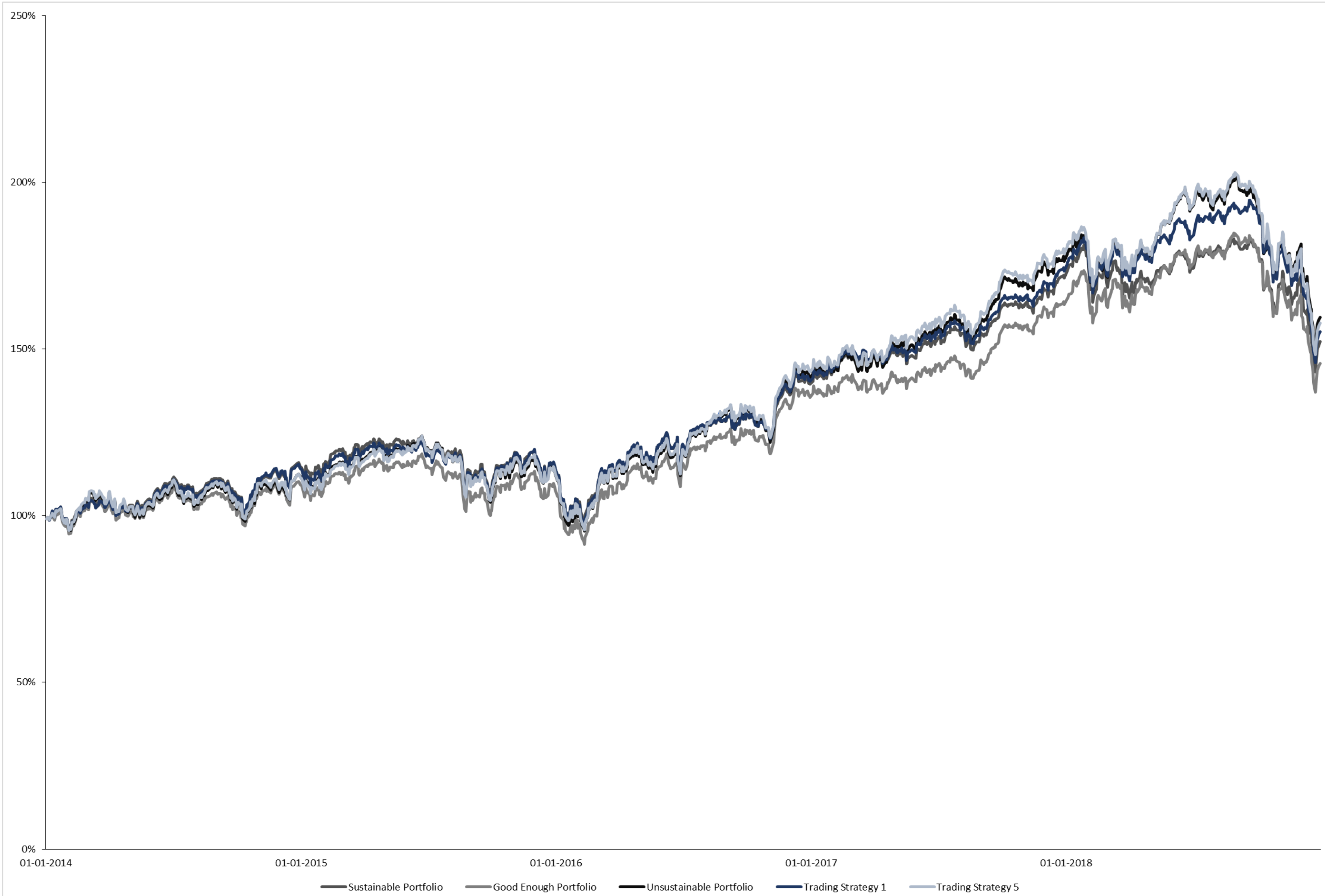
Applying these trading strategies over the period 2014-2018 generates the output in Table 7 below. The MKTRF, SMB, HML, UMD and RMW variables are all significant at the 1% level for all portfolios and trading strategies. The CMA variable is insignificant for Trading Strategy 3 and 5 and for the Unsustainable portfolio. The trading strategies' CONSTANT are significant at the 1% level except for Trading Strategy 2 which is insignificant. Over the period, the yearly abnormal returns are 2.7%, 2.4% and 4.6% for the Sustainable, Good Enough and Unsustainable portfolio, respectively. Of the trading strategies, strategy 5, generates the highest annual abnormal return of 4.1%. The results indicate that a profit maximizing investor should hold the Unsustainable portfolio and disregard any of the trading strategies. Investors nowadays, however, invest more frequently based on values than solely on returns, i.e. they are willing to sacrifice returns for holding sustainable portfolios (Riedl and Smeets, 2017). Hence, investors seeking to limit their exposure towards Unsustainable stocks can combine it with Good Enough stocks and still generate annual abnormal returns of 4.1%. Furthermore, investors that have stronger preferences for sustainability could use Trading Strategy 1, focusing solely on Sustainable and Good Enough stocks and obtain an abnormal return of 3.4% per year. This is higher than holding the Sustainable or Good Enough portfolio in isolation as the portfolios generate an alpha of 2.7%, and 2.4%, respectively. To summarize, there are abnormal returns to collect using the devised trading strategies, regardless of investors' sustainability preferences.

Table 7: Descriptive Statistics of Trading Strategies between 2014 - 2018

Strategy from 2014-2018	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Strategy 5	Strategy 6	Sustainable Portfolio	Good Enough Portfolio	Unsustainable Portfolio
Variables	ret	ret	ret	ret	ret	ret	ret	ret	ret
MKTRF	1.005***	1.020***	1.022***	0.989***	1.011***	0.993***	1.016***	1.009***	0.995***
	(0.00565)	(0.00687)	(0.00783)	(0.00725)	(0.00538)	(0.00655)	(0.00660)	(0.00507)	(0.00637)
SMB	0.475***	0.514***	0.615***	0.531***	0.685***	0.640***	0.405***	0.584***	0.741***
	(0.00980)	(0.0104)	(0.0133)	(0.0124)	(0.00935)	(0.00977)	(0.00959)	(0.00819)	(0.00900)
HML	0.0567***	0.101***	0.0962***	0.0448***	0.106***	0.0990***	0.0471***	0.111***	0.0938***
	(0.0119)	(0.0131)	(0.0142)	(0.0140)	(0.0120)	(0.0129)	(0.0127)	(0.0117)	(0.0119)
UMD	-0.124***	-0.0897***	-0.0740***	-0.134***	-0.0833***	-0.109***	-0.115***	-0.0989***	-0.0937***
	(0.00703)	(0.00808)	(0.00883)	(0.00861)	(0.00712)	(0.00766)	(0.00788)	(0.00665)	(0.00737)
RMW	-0.0724***	-0.0592***	-0.0757***	-0.0709***	-0.0783***	-0.0603***	-0.0698***	-0.0618***	-0.0768***
	(0.0145)	(0.0169)	(0.0190)	(0.0156)	(0.0157)	(0.0146)	(0.0159)	(0.0143)	(0.0152)
CMA	0.0931***	0.0838***	0.0382	0.0720***	0.0228	0.0472**	0.109***	0.0684***	0.00164
	(0.0190)	(0.0207)	(0.0239)	(0.0212)	(0.0196)	(0.0195)	(0.0200)	(0.0178)	(0.0201)
CONSTANT	0.0134***	0.00655	0.0134***	0.0152***	0.0161***	0.0112***	0.0106**	0.00934**	0.0180***
	(0.00411)	(0.00424)	(0.00492)	(0.00475)	(0.00414)	(0.00420)	(0.00424)	(0.00375)	(0.00424)
Observations	1,258	1,258	1,258	1,258	1,258	1,258	1,258	1,258	1,258
R-squared	0.976	0.976	0.970	0.969	0.978	0.977	0.975	0.981	0.978
Adjusted R-squared	0.976	0.976	0.970	0.969	0.978	0.977	0.975	0.981	0.978

Note: ***,**, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted daily portfolio returns for the Unsustainable portfolio, Good Enough portfolio and Sustainable portfolio aggregated for the time period 2014 to 2018. In additional, the six trading strategies are combinations of the three portfolios during times of high and low market volatility are presented in the same manner as the portfolios and are presented on page 34. High market volatility is defined as a relative VIX>1 and low market volatility is VIX<1, see equation 7. The dependent variable is daily portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the total number of trading days between 2014 and 2018. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

Figure 3: Raw Returns of Portfolios and Trading Strategies between 2014 - 2018



As a sanity check, Figure 3 demonstrates the raw returns of buy and hold strategies for the different portfolios and for Trading Strategy 1 and 5. It supports the regressions results, i.e. that the Unsustainable portfolio performs best. It also shows that Trading Strategy 5, containing the Unsustainable and Good Enough stocks performs better than Trading strategy 1, including Sustainable and Good Enough stocks.

5.4 Portfolio Characteristics on a Monthly Basis and Including Liquidity Factors

As opposed to the previous sections, this section uses monthly data instead of daily data to make the data compatible with the Pástor and Stambaugh (2003) liquidity factors. The same portfolio characteristics as in section 5.1 are regressed on a monthly basis between 2004-2018, instead of on a daily basis. During this time horizon, the following characteristics are observed.

Table 8: Monthly Descriptive Characteristics of the Three Thematic Portfolios between 2004 - 2018

Portfolios	Sustainable Portfolio	Good Enough Portfolio	Unsustainable Portfolio
Variables	ret	ret	ret
MKTRF	1.059***	1.046***	0.959***
	(0.0215)	(0.0118)	(0.0177)
SMB	0.495***	0.567***	0.744***
	(0.0462)	(0.0238)	(0.0342)
HML	0.0603*	0.124***	0.0586*
	(0.0343)	(0.0309)	(0.0334)
UMD	-0.184***	-0.112***	-0.101***
	(0.0543)	(0.0155)	(0.0185)
RMW	-0.0346	-0.0709*	-0.124***
	(0.0623)	(0.0376)	(0.0474)
CMA	-0.0658	-0.121**	-0.184***
	(0.0607)	(0.0530)	(0.0579)
CONSTANT	0.356***	0.388***	0.611***
	(0.0770)	(0.0484)	(0.0620)
Observations	180	180	180
R-squared	0.968	0.985	0.977
Adjusted R-squared	0.967	0.984	0.976

Note: ***, **, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted monthly portfolio returns for the sustainable portfolio, the good enough portfolio and the unsustainable portfolio, over the entire sample period 2004-2018. The dependent variable is monthly portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5. Observations are the number of months between 2004 and 2018. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

The MKTRF and SMB variables exhibit similar statistics to Table 1 in Section 5.1, which is regressed using daily data. However, the monthly HML variables decrease for all portfolios and drop in significance levels for the Sustainable and Unsustainable portfolio but remain on the same significance level for the Good Enough portfolio.

The UMD monthly variable is similar to the daily UMD variable for the Unsustainable and the Good Enough portfolio, but for the Sustainable portfolio, there is almost a 0.06 difference between the daily data and the monthly data. The monthly data indicates a smaller negative impact of the UMD variable on portfolio returns. The monthly RMW variables becomes significant for the Good Enough and insignificant for the Sustainable portfolio. Moreover, the monthly CMA variable becomes insignificant for the Sustainable and drops in significance to the 5% level for the Good Enough portfolio.

In short, due to compounding frequency and number of observations, the regression results differ, which is not unique to this study. For instance, Yan (2008) found differences in returns for SMB portfolios based on the measurement frequency of the Fama-French factors. This points towards the results being sensitive to the time horizon and number of observations.

Now, we reduce the span of the regression from 2004-2018 to 2004-2017, in order to make the Pástor and Stambaugh (2003) liquidity data compatible with our findings, since the Pástor and Stambaugh data on WRDS has not been updated to include the liquidity variables for 2018. Looking at the findings in Table 8, compared to the 2004-2017 regression without the liquidity factors in Table 9, omitting the final year 2018 from the regression, slightly alters the results with respect to the HML factor for the sustainable portfolio which is not significant at the 10 % level for the 2004-2017 regression, but is significant at this level for the 2004-2018 regression. Overall, the years exhibit similar portfolio characteristics, therefore, the impact of the liquidity factor should be the same regardless of whether 2018 is included in the regression or not. The innovations in aggregate liquidity non-traded factor (INNOVLIQ) is statistically negatively significant at the 10 % level only for the sustainable portfolio. This means that the equities composing the Sustainable portfolio have negative liquidity betas, implying that the stocks have above average liquidity, thereby reducing the expected returns of the portfolio. Simultaneously, the traded liquidity factor (TRADEDLIQ) is significantly positive at the 1 % level, meaning that the portfolio is constructed using more liquid stocks than illiquid stocks, as opposed to the other portfolios which do not have significant liquidity variables on any level.

This finding suggests that the Sustainable portfolio has lower expected returns and higher liquidity compared to the Good Enough and Unsustainable portfolios, therefore, liquidity serves a role in explaining why the Sustainable portfolio generates lower abnormal returns compared to the other portfolios.

Table 9: Monthly Descriptive Characteristics of the Three Thematic Portfolios between 2004 - 2017

Portfolios	Sustainable Portfolio	Good Enough Portfolio	Unsustainable Portfolio	Sustainable Portfolio	Good Enough Portfolio	Unsustainable Portfolio
Variables	ret	ret	ret	ret	ret	ret
MKTRF	1.065***	1.049***	0.966***	1.068***	1.055***	0.975***
	(0.0227)	(0.0126)	(0.0179)	(0.0222)	(0.0138)	(0.0176)
SMB	0.523***	0.564***	0.723***	0.501***	0.562***	0.728***
	(0.0476)	(0.0249)	(0.0353)	(0.0454)	(0.0256)	(0.0348)
HML	0.0382	0.115***	0.0585*	0.0491	0.116***	0.0539
	(0.0345)	(0.0308)	(0.0339)	(0.0394)	(0.0330)	(0.0347)
UMD	-0.178***	-0.112***	-0.0969***	-0.185***	-0.111***	-0.0916***
	(0.0559)	(0.0156)	(0.0181)	(0.0543)	(0.0152)	(0.0185)
RMW	-0.0407	-0.0755*	-0.129***	-0.0424	-0.0736*	-0.124**
	(0.0647)	(0.0383)	(0.0479)	(0.0634)	(0.0390)	(0.0476)
CMA	-0.0870	-0.120**	-0.185***	-0.0544	-0.118**	-0.198***
	(0.0624)	(0.0550)	(0.0575)	(0.0673)	(0.0559)	(0.0566)
TRADEDLIQ				0.0597**	0.00128	-0.0267
				(0.0233)	(0.0200)	(0.0212)
INNOVLIQ				-0.0264*	-0.0126	-0.0135
				(0.0159)	(0.0136)	(0.0150)
CONSTANT	0.385***	0.414***	0.647***	0.393***	0.418***	0.652***
	(0.0768)	(0.0490)	(0.0641)	(0.0770)	(0.0488)	(0.0640)
Observations	168	168	168	168	168	168
R-squared	0.970	0.985	0.978	0.972	0.985	0.978
Adjusted R-squared	0.969	0.985	0.977	0.970	0.985	0.977

Note: ***, **, and * indicates statistical significance at the 1 %, 5 % and 10 % level, respectively. Robust standard errors are reported in parentheses. The table displays the robust regression results for equally weighted monthly portfolio returns for the Sustainable portfolio, the Good Enough portfolio and the Unsustainable portfolio, over the sample period 2004-2017. The dependent variable is monthly portfolio returns. The independent variables are fetched from the augmented Fama-French five factor model presented in equation 5, and the independent variables for the statistics including the liquidity factors are presented in equation 6. Observations are the number of months between 2004 and 2017. The regression uses robust standard errors, since the Breusch-Pagan/Cook-Weisberg test rejected the null hypothesis of homoskedasticity for several years, hence the regressions are adjusted for heteroskedasticity.

6. Discussion

The result section finds that the Unsustainable portfolio generates the highest yearly abnormal returns of 8.26% over the period 2004-2018. In second place is the Good Enough portfolio with abnormal returns of 5.51% and last is the Sustainable portfolio with 5.17%. Trading Strategy 5, which includes the Good Enough and Unsustainable portfolio delivers the highest abnormal returns amongst the trading strategies, with an annual abnormal return of 4.1%. Nevertheless, all portfolios and trading strategies produce positive abnormal returns. Regarding portfolio characteristics, there is a spread between the portfolio characteristics over time that is supported both by section 5.1 and section 5.2. The annual regression coefficients for the Unsustainable portfolio bear smaller resemblance to the Sustainable and the Good Enough portfolio. The Good Enough portfolio has similar regression characteristics compared to the Sustainable portfolio.

This thesis adds to the existing literature through the finding that liquidity plays a role in explaining the returns of the Sustainable portfolio. The innovation in aggregate liquidity variable is significant at the 10 % level and the traded liquidity factor is significant at the 1 % level for the Sustainable portfolio, but not for the other two portfolios. Although the results in this thesis indicates that Unsustainable stocks and portfolios outperform Good Enough and Sustainable portfolios, there is no consensus in SRI literature.

Previous studies are subject to methodological differences, geographical differences, sorting procedures, regression models and time horizons. Because of these differences, specifically in relation to portfolio composition and construction, the results of the studies differ. The portfolios used in this study are based on GICS codes as opposed to other studies that compare established ethical/sustainable funds against conventional funds. In addition, measurement horizons and number of observations cause divergent results, addressing this issue would be of interest for future research. Moreover, the focus on the US market which has less sustainability regulation than the European market might explain why the Unsustainable portfolio in the US market delivers the highest abnormal returns. In another capital market setting, the Sustainable portfolio might deliver higher returns as observed in Europe by Nordea Equity Research in 2017.

Another reason to why the Unsustainable portfolio outperforms the Good Enough and Sustainable portfolio might be attributable to the ESG score system itself. Perhaps the ESG index promotes the wrong efforts, thus firms that are perceived as sustainable are anticipated to generate higher returns and fail to meet analyst consensus, because they are in fact only Sustainable due to a malfunctioning ESG score. The bottom line is that the firms that are perceived as Unsustainable according to the Thomson Reuters index might be Good Enough or Sustainable according to Sustainalytics, thus the hypothesis that Sustainable and Good Enough firms generate higher returns will be fulfilled using the “correct” index. This issue regarding heterogenous rating indices has been expressed by Cash (2019).

Moreover, potential issue with previous results is reverse causality, that already profitable, financially healthy companies engage in ESG activities and generate higher results. This study finds that the Sustainable portfolio underperforms the Good Enough portfolio, these results might be driven by overinvestment in ESG activities by the Sustainable companies, thereby deteriorating profits. This is consistent with the idea of insider-initiated corporate philanthropy (Bénabaou and Tirole, 2009).

As we are able to generate positive alpha the assumption of market efficiency is not true. Because in a perfect capital market setting the stock’s value is the true value and no abnormal returns should exist, hence alpha should be zero (Eugene Fama, 1970). However, given that the stock market is inefficient then companies’ different activities affect the stock price and, in the end, abnormal return. Consequently, the reason why the Unsustainable portfolio outperforms Sustainable and Good Enough portfolios might be because of governance and corporate governance factors. Shrivastava and Addas (2014) found that governance factors such as board meeting attendance percentage influences sustainability policies. Therefore, the case might be that the Sustainable and Good Enough firms might have boards that conform to structures that result in more ESG activities. On the other hand their boards fail to correlate it with stock performance. On the contrary, Unsustainable firms’ board might have different attitudes toward ESG commitments but manage to convert existing resources to a higher stock price. Maybe this is because they are better in working with operational metrics such as ROE and ROCE, which are correlated with the stock price and in the end abnormal return.

Another reason for why the Unsustainable portfolio outperforms Sustainable and Good Enough portfolios might be because of the preferences and mind sets of investors. The US market might lack sustainability regulation for a reason. It might be the case that the CSR heritage, that CSR entails wasting money, has affected a lot of investors (Bénabaou and Tirole, 2009). Therefore, they might shy away from Sustainable and Good Enough stocks to a greater extent in times of low volatility i.e. stable markets. Instead they trade Unsustainable stocks that do not engage in this "wasteful" behaviour. As demand increases it leads to higher trading volume and higher stock return. That might explain why Trading Strategy 5, which means longing Good Enough Stocks during high volatility and longing Unsustainable stocks during low volatility delivers the highest abnormal return amongst the trading strategies. And when doing the reverse, when holding Trading Strategy 6, that longs Unsustainable in times of high market volatility and longs Good Enough in periods of low market volatility the abnormal return is the second lowest amongst the trading strategies.

Lately capital allocation towards sustainable investments has been on the rise. In 2018 $30 trillion in assets where managed around the world (Greenbiz, 2018). This is interesting since there does not exist consensus in academia that sustainable stocks are superior. Perhaps, herding behaviour towards ESG investments might increase the demand for sustainable stocks or as suggested by Reidl and Smeets (2017), people invest in sustainable stocks for social reasons. This might be the case for markets which has come further in their sustainability development

However, the price of the company and the stock return is then driven by increase in demand resulting from shift in capital allocation rather than reflecting an increased intrinsic value of the stock as consequence of operational performance. The US market might be more efficient in impounding this fact into prices. Thus, the Unsustainable portfolio might deliver higher return than the Sustainable and Good Enough portfolios. This also leads to the question of endogeneity. Performance could be driven by something else rather than ESG or capital allocation. That might explain why Unsustainable firms perform the best, because their lack of ESG activities is not the sole determinant for their stock performance.

Finally, a crucial event to comment on is the existence of positive alphas only for all portfolios, which according to theory should not exist because alpha is assumed to net to zero. This because all investors make up the universe, and for someone to win there must be someone that loses (Sharpe, 1991). However, as our study is limited by the availability of ESG data on the Thomson Reuters Eikon index there is the issue of sample selection bias. In this study there might be the case that all stocks in our sample simply have positive alpha. Usually, the largest companies in each exchange have active ESG ratings, thereby skewing the sample towards large cap stocks which have greater exposure to ESG coverage. Using another database such as Sustainalytics would have allowed a larger sample, however, as mentioned in the Data

Chapter the database was not available for this study. Nonetheless, it is still interesting to focus on, as we have done, on the relative differences across portfolios. It is undoubtedly interesting to note that in these times of sustainability focus, the stocks generating the highest abnormal returns are the unsustainable ones. The reason for this can be explained by Frazzini and Pedersen (2013). They present a model with leverage and margin limitations explaining that constrained investors chase high-beta assets in order to find positive alphas. A result of all investors wanting high-beta assets is that the alpha is lower for those assets. On the other hand, as low-beta assets get neglected they experience higher alphas. This behaviour of betting against beta could explain why the Unsustainable portfolio has the highest alpha. Since, the trend today is to invest in Sustainable stocks, because the belief is that they generate higher returns. Consequently, as everyone is chasing Sustainable stocks it simultaneously benefits Unsustainable stocks since they become the new low-beta assets with higher alphas.

7. Conclusion and Implications for Future Research

7.1 Conclusion

Sustainable investing is on an all-time high, amounting $30 trillion dollars in 2018. The topic is highly relevant in today's market environment with shifting capital allocation and increased demand for sustainable funds. The data indicates that investors perceive sustainable investing as a superior alternative to conventional investing even though there is no consensus in academia. However, this thesis finds that investing in sustainable stocks might not justify this increase in sustainable investing as the Unsustainable portfolio outperforms the Sustainable portfolio, which points towards market irrationality. One explanation is that investors are willing to forego returns in favour of holding stocks that are aligned with their social values, as suggested by Reidl and Smeets (2017). Another explanation is that the increased demand for sustainable stocks causes lower alphas (Frazzini and Pedersen, 2013). What distinguishes this thesis from previous studies in the field of ESG investing is our methodology and sorting procedure through portfolio construction by using GICS and ESG score. We stand out from previous research since none has paid any attention to Good Enough stocks in terms of ESG activity, only to the two extremes. Thus, we are comparing the performance of three portfolios with different ESG scores, distancing us from the binary testing of Sustainable portfolios against Unsustainable portfolios.

Connecting the results to the hypothesis, the study finds differences in portfolio characteristics that can be used to devise trading strategies over the period 2014-2018. Trading Strategy 1, solely focusing on Sustainable and Good Enough stocks generates annual abnormal returns of 3.4%, which is larger than holding the Sustainable portfolio or Good Enough in isolation which generates 2.7% and 2.4% annual abnormal returns, respectively. Thereby, the study confirms the hypothesis that investors can use thematic portfolio characteristics to generate abnormal returns. Nonetheless, for profit maximizing investors the best thing is to refrain from using any of the trading strategies and instead only hold the Unsustainable portfolio. In contrast to the hypothesis that the Sustainable portfolio will outperform the Good Enough and Unsustainable portfolios, this thesis finds that the Unsustainable portfolio delivers higher returns over the period 2004 to 2018. The results show that the Unsustainable portfolio generates the highest abnormal return of 8.26 % annually, followed by the Good Enough portfolio with 5.51 % and the Sustainable portfolio with 5.17 % in annual abnormal returns.

To summarize, against the common belief that Sustainable portfolios include the best performing stocks, our study shows that the Unsustainable portfolio outperforms its Sustainable and Good Enough peers. Nevertheless, investors wanting to make sustainable investments can still generate significant abnormal returns while conforming to their ethical preferences by using Trading Strategy 1.

7.2. Implications for Future Research

This study contributes to the field of ESG investing by shedding light on the performance of portfolios with divergent ESG characteristics over time and addresses how portfolio characteristics can be used to construct trading strategies with respect to volatility levels. This was achieved through the study's unique portfolio construction, benchmarking model and different capital market setting in an ESG context.

However, this study has just scratched the surface of ESG investing and acknowledges its limitations. Future studies within the field of ESG investing could extend the scope of this study by examining the role of corporate finance variables in relation to ESG performance. It could be the case that companies within the ESG portfolios have different attitudes towards financial leverage and R&D activity that could help the companies compete for efficiently. Therefore, it would be interesting to examine the role of innovation and leverage with respect to ESG performance.

Another interesting topic to study would be analysts' performance expectations on the companies within the ESG portfolios. For instance, an analyst might have lower expectations on companies with limited ESG commitment and bad ESG scores. This causes the unsustainable firms to beat consensus estimates more regularly than sustainable firms for whom analysts have higher expectations.

As explained in the data and discussion section, there is no standardized ESG screening process due to heterogeneity in index construction. Nevertheless, using another sustainability index together with a more data and dynamically rebalance the ESG portfolios based on ESG downgrades and upgrades would enable future studies to enhance our understanding about the performance of actively managed ESG portfolios. In this context, it would be interesting to examine the social preferences of fund managers and investors, as examined by Reidl and Smeets (2017).

Also, it would be interesting to examine if fund managers are constrained in their investing and include a variable to measure assets under management to see if the demand for sustainable funds/portfolios has increased and consequently capital allocation. Tying back to our results, the Unsustainable portfolio generates higher alpha than the Sustainable portfolio, this could be a function of fund managers chasing Sustainable stocks, driving down abnormal returns. The theoretical foundation for the lower alpha following higher demand is outlined by Frazzini and Pedersen (2013) in the article “Betting against beta”. Hence, future research should examine ESG investing with respect to capital allocation and investor sentiments.

Lastly, due to data limitations, this study has focused on the relative differences in ESG portfolio characteristics, more data would allow for further digging into the topic and determine the magnitude of ESG’s impact on portfolio performance. The suggestions for future research would allow us to decipher the source of ESG portfolio performance and draw more general conclusions about ESG investing.

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Appendix

Table A1: Breusch-Pagan/Cook-Weisberg Heteroskedasticity Test

	Sustainable Portfolio		Good Enough Portfolio		Unsustainable Portfolio	
Year	$\chi 2$ (6)	Prob.>	$\chi 2$ (6)	Prob.>	$\chi 2$ (6)	Prob.>
2004	9.63	0.1411	6.55	0.3648	4.13	0.6587
2005	6.79	0.3403	4.62	0.5934	14.44	0.0251
2006	6.63	0.1956	5.33	0.5017	7.24	0.2994
2007	20.83	0.0020	13.01	0.0429	10.07	0.1216
2008	77.10	0.0000	135.31	0.0000	42.09	0.0000
2009	10.53	0.104	16.85	0.0098	6.28	0.3929
2010	8.24	0.2209	7.56	0.2721	10.41	0.1083
2011	42.92	0.0000	80.62	0.0000	96.16	0.0000
2012	3.58	0.7335	4.57	0.6005	7.44	0.2824
2013	2.78	0.8357	1.10	0.9815	2.53	0.8656
2014	8.85	0.1821	4.46	0.6151	12.53	0.0511
2015	3.98	0.6796	5.81	0.4453	1.76	0.9401
2016	6.40	0.3801	13.72	0.0329	1.95	0.9245
2017	5.30	0.5057	3.19	0.7850	6.47	0.3727
2018	36.32	0.0000	9.76	0.1352	3.32	0.7680

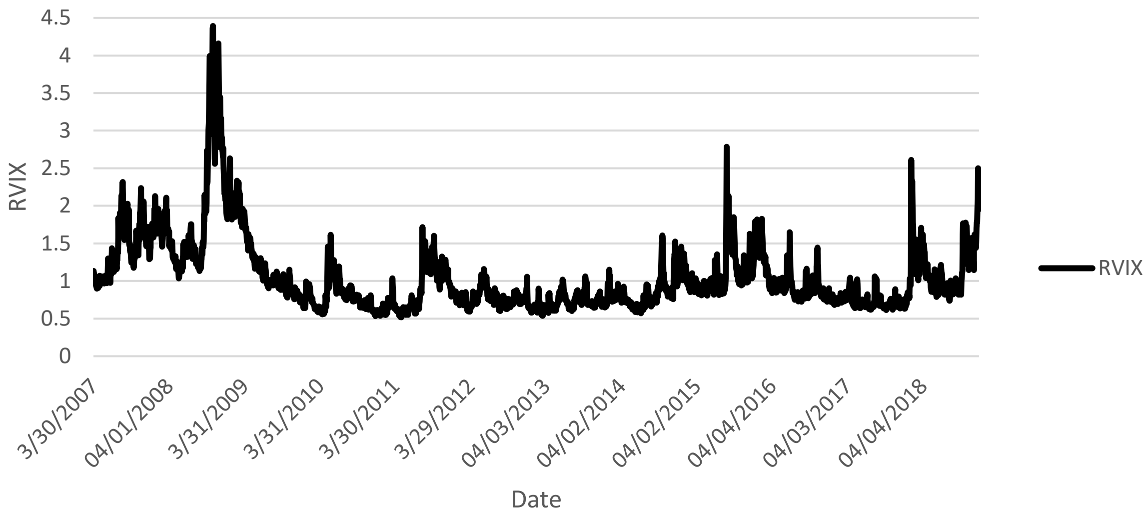
Note: A Breusch-Pagan/Cook-Weisberg (B-P/C-W) heteroskedasticity test is performed for all portfolios for each individual year during the time horizon 2004-2018. The null hypothesis of equal error variances (homoskedasticity) is tested against the alternative hypothesis of unequal error variances (heteroskedasticity). The $\chi 2$ (6) test statistic means that the test uses six degrees of freedom, which are attributable to the number of independent variables in the non-robust augmented Fama-French five factor model (equation 5). Prob. shows the significance level for the B-P/C-W test for each individual year and portfolio over the sample period 2004-2018. Prob>0.1 indicates statistical significance at the 10 % level, Prob>0.05 at the 5 % level, and Prob>0.01 at the 1 % level.

Table A2: Multicollinearity Test Using VIF

Variable	VIF	1/VIF
mktrf	1.37	0.73
hml	1.82	0.55
smb	1.17	0.86
umd	1.47	0.68
rmw	1.36	0.74
cma	1.20	0.84
Mean VIF	1.40	

Note: Multicollinearity test using variance influence factor (VIF) for the augmented Fama-French five factor model, if VIF is below 10, the rule of thumb states that there is no presence of multicollinearity.

Figure A1: Relative CBOE Index Over Time



Note: Figure 1 shows the development of the relative CBOE volatility index introduced in equation 7, over time during the time horizon 2007 – 2019. The relative index volatility index (RVIX) displayed on the y-axis is only available for this time period as constructing the measure requires the three-year average for the CBOE volatility index. The x-axis displays the date in MM/DD/YY format.

Figure A2: Distributional Graph of Residuals for the Sustainable Portfolio

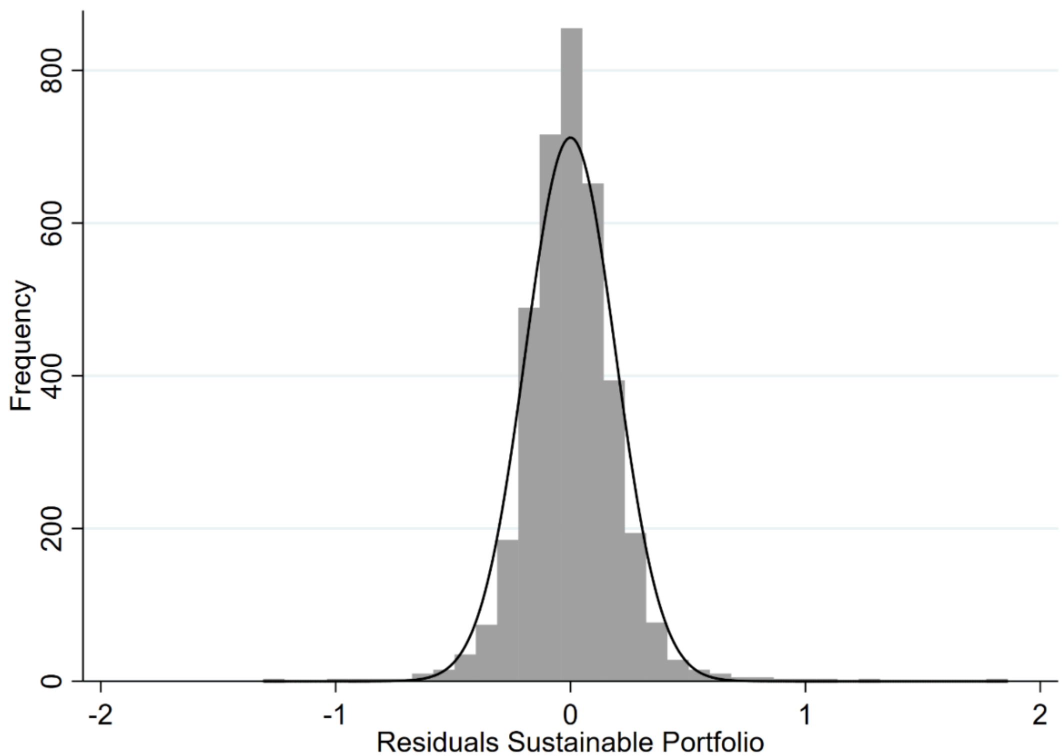


Figure A3: Distributional Graph of Residuals for the Good Enough Portfolio

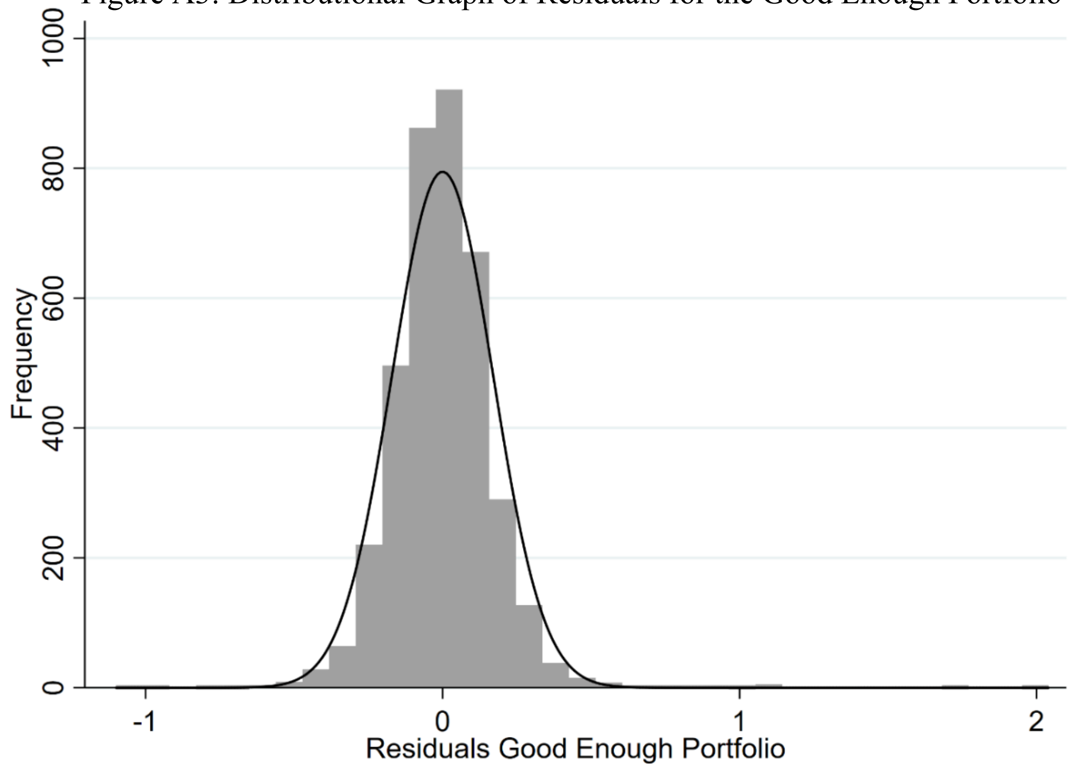


Figure A4: Distributional Graph of Residuals for the Unsustainable Portfolio