

At the Department of Economics



UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Performance Evaluation of European Green Mutual Funds

Is There an Economic Trade-Off?

Bachelor's Thesis - 15 ECTS

By

Emil Andreasson and Mats Kronborg

Spring 2017

Supervisor: Charles Nadeau

Abstract

In this thesis, we investigate the financial performance of European green and conventional mutual equity funds over the 2007 – 2017 period. We applied the Carhart (1997) four-factor model over three different periods, and find evidence that the risk-adjusted alphas are not statistically different. Furthermore, we computed two-sided t-test with Sharpe ratios adjusted for asymmetrical return distributions and find that the results are consistent. In respect to green funds' investment styles, we find that the funds in our sample are less exposed to small market capitalisation, potentially uncovering different investment styles for various green fund classes. Lastly, we find that there is no statistical difference regarding investment styles for the book-to-market and momentum factors.

JEL Classification: G11, G12

Keywords: Green Funds, Conventional Funds, Performance Evaluation, European Focus, Risk-Adjusted Returns, Sharpe Ratio

Abbreviations

ECB – European Central Bank
ESG – Environmental, Social and Governance
IID – Independent and Identically Distributed
SRI – Socially Responsible Investments
US SIF – United States Investment Forum

Acknowledgements: We are grateful to our supervisor Charles Nadeau who gave us valuable advice throughout the writing process. Additionally, we would like to thank Kenneth R. French for providing us with data for the analysis. Thanks are also due to the people at the Finance Department at The School of Business, Economics and Law at Gothenburg University for granting us access to Bloomberg and other software needed to make this study.

Authors Contact Details

Emil Andreasson: E-mail: emil.andreasson@me.com , Phone: +46762019858
Mats Kronborg: E-mail: mats_kronborg@hotmail.com , Phone: +46733200749

Table of Contents

1 Introduction	- 2 -
1.1 Background	- 2 -
1.2 Research Questions	- 3 -
1.3 Contributions and Purpose	- 3 -
1.4 Delimitations	- 4 -
1.5 Results	- 4 -
1.6 Thesis Organisation	- 4 -
2 Literature Review	- 5 -
3 Theory Review	- 9 -
3.1 Modern Portfolio Theory and Expected Alphas	- 9 -
3.2 Determining the Statistical Significance of the Sharpe Ratio	- 9 -
3.3 Carhart's Four-Factor Model	- 11 -
4 Data	- 13 -
4.1 Mutual Funds Screening	- 13 -
4.2 Kenneth R. French Database from Tuck School of Business at Dartmouth	- 14 -
4.3 Outliers and Anomalies in the Dataset	- 15 -
4.4 Fund Expenses and Management Fees	- 15 -
5 Methodology	- 16 -
5.1 Econometric Analysis	- 16 -
5.2 Sharpe Ratio Computations	- 17 -
5.3 Statistical Tests and Robustness	- 17 -
6 Empirical Results	- 19 -
6.1 Descriptive Statistics	- 19 -
6.2 Hypothesis 1 – Are the Risk-Adjusted Alphas Statistically Different?	- 21 -
6.3 Hypothesis 2 – Do Green and Conventional Funds Have Different Investment Styles?	- 23 -
6.4 Hypothesis 3 – Are the Sharpe Ratios Statistically Different?	- 25 -
6.5 Critical Evaluation of Empirical Results	- 26 -
7 Conclusion	- 27 -
8 Appendix	- 29 -
8.1 Test of the OLS Assumptions	- 29 -
8.2 Statistical and Robustness Tests	- 29 -
8.3 List of Funds	- 34 -
9 References	- 35 -

Table of Tables

Table I – Descriptive Statistics	- 19 -
Table II – Carhart's Model	- 21 -
Table III – Performance over Time	- 22 -
Table IV – Distribution and Sharpe Ratio Statistics	- 25 -

Appendix

Table I – Heteroscedasticity and Serial Correlation	- 29 -
Table II – Correlation Matrix	- 29 -
Table III – Time Significance and Seasonality	- 29 -
Table IV – Adjusted for Seasonality	- 30 -
Table V – Inactive Fund Bias	- 30 -
Table VI – Libor as Risk-Free Rate	- 31 -
Table VII – Adjusted for Management Fees	- 31 -
Table VIII – Different Benchmarks	- 32 -
Table IX – Model Specifications	- 33 -

1 Introduction

1.1 Background

The past decades have seen an increasing awareness of climate change and the threats it poses. This has inevitably led to policy changes in society and corporations have seen an increasing responsibility to enforce sustainable and environmentally friendly practices in their businesses. This effect has reverberated into the financial markets where the demand for green and socially responsible investments has surged over the last decade. In 2016 the investments in sustainable, responsible and impact investment reached more than eight trillion US dollar only in the United States, as shown in US SIF's 2016 trend report. The number represents a 14-fold increase since 1995. Bourghelle, Jemel and Louche (2009) describe it as micro-level actions of individuals pushing the emerging trend of integration of ESG into conventional investment processes. Hence, investors nowadays do not only have to account for financial performance in their analysis when taking investment decisions but as well consider the carbon footprint and potential environmental liabilities that are associated with the enterprise.

When considering the gravity of tackling climate change, there is an interesting belief regarding the financial performance of green investment vehicles. Some early critic such as Friedman (1970) argues that implementing environmental controls impose substantial direct and indirect costs that may erode a firm's competitiveness and undermine its resources. Investors seem today, more than forty years later, to still be questioning environmental practices and related financial performance. This was identified when Morgan Stanley conducted a study named *Sustainable Signals* in 2015 to explore the sentiment surrounding green investing and found that a majority of investors associated "green" with an economic trade-off. However, the opinions are not one-sided as there are numerous of examples that advocate the benefits of green investing. For example, Heinkel, Kraus and Zenchner (2001) argue that if a company does not undertake an environmental and sustainable framework their stock will get excluded in screening processes and consequently raise their cost of capital.

1.2 Research Questions

Previous studies on sustainability and fund performance have predominantly focused on the United States and global mutual funds. Consequently, the literature covering European equity funds that invest in Europe is less exhaustive. The hypotheses posed in this thesis seek to supplement this area of study while simultaneously addressing the uncertainties regarding the financial performance of green investing. The null hypotheses we investigate in this thesis are:

1. The risk-adjusted alphas are not statistically different between European green and conventional mutual equity funds.
2. The investment styles are not statistically different between European green and conventional mutual equity funds.
3. The Sharpe ratios are not statistically different between European green and conventional mutual equity funds.

The first hypothesis tested in this thesis is that the risk-adjusted return of green mutual funds is not statistically different when compared to conventional funds. We investigate this assumption by using Carhart's (1997) model to obtain risk-adjusted alphas. Our choice of model allows us to observe the portfolio's sensitivity to market, size, book-to-market and momentum factors. The sensitivity to these factors can be interpreted as investment styles and this leads us to our second hypothesis that the investment styles of green and conventional funds are not statistically different. Sharpe ratios are used in addition to the econometric analysis. Therefore, the third hypothesis is that the Sharpe ratios are not statistically different between green and conventional funds.

1.3 Contributions and Purpose

The contribution of this thesis is three-fold. Firstly, we contribute to an area of modest literature by examining green funds in Europe with a focus on European equities. Secondly, investors still seem to be wary of green investments, and we contribute by finding risk-adjusted alphas to test if this belief is warranted based on historical performance. Lastly, we contribute by taking a new look at green funds' performance using a contemporary dataset, i.e. from January 2007 to January 2017.

1.4 Delimitations

A number of delimitations are made in this thesis. We adjust for most of the factors Chegut, Schenk and Scholtens (2011) find to be most important when assessing SRI performance. These are dividends yields, fees, testing with different benchmarks, fund composition and management influences. We test for all factors mentioned except management influences. The sampling of conventional funds is limited to 100 funds due to a large resulting sample universe and not enough time to include them all. We use a matched sampling procedure and we adjust for size and age, where size is given a higher priority. In this process, we do not account for currency-rate fluctuations or changes in assets under management. In this thesis, we define green funds as funds that state a sustainable or environmental investment philosophy.

1.5 Results

We find that there is no statistical difference regarding the risk-adjusted alpha when constructing two portfolios of green and conventional funds. Furthermore, both portfolios have negative alphas and underperform our market benchmarks as found by prior studies on mutual funds. A difference in investment style is observed where green funds are less exposed to small market capitalisation, and we suggest this contrast to other studies could be due to different fund classes. Moreover, the results using Sharpe ratios are consistent with the econometric analysis, showing no statistical difference between the portfolios.

1.6 Thesis Organisation

This thesis is organised as follows: in the next section, a literature review of previous research on green investing and mutual fund studies is given. The literature review is followed by a theory review explaining the model we use to test our hypotheses. The sections of data and methodology are then covered before presenting our findings in the results section that is followed by a conclusion.

2 Literature Review

In previous research on sustainability and financial performance, there is a strand of literature that supports the idea that environmental practices increase firm performance. Derwall et al. (2005) find that enterprises with superior environmental practices have higher stock returns. The findings of Derwall et al. are analogous with previous literature where Klassen and McLaughlin (1996) find there to be positive abnormal stock returns associated with corporations that received environmental performance awards. These findings are also reaffirmed by contemporary studies where Gupta (2015) asserts that cost of capital is reduced by implementing environmental practices, where the reduction of emissions and minimising wastage of resources are key drivers.

A potential reason for the investors' caution is that there are numerous of different categories with similar traits making it difficult to form a holistic understanding of the sector. SRI, ESG, ethical, environmental and sustainable investing are just a few definitions which are subject to the fund managers' interpretation. The interpretation has consequences as it has been shown that screening practices matter when it comes to returns. For example, Capelle-Blancard and Monjon (2014) evaluate the French SRI market and identify that screening processes such as excluding sectors and best in class significantly affect fund performance. Likewise, Lesser, Rößle and Walkshäusl (2016) find that performance is heterogeneous when comparing 200 international funds of different sustainable categories.

Adding to that, the results from prior studies are not homogenous, and several examples present evidence for green funds having underperformed historically. For example, Climent and Soriano (2011) examine environmental and conventional funds with similar characteristics during 1987 – 2009 using the capital asset pricing model (CAPM) and find that environmental funds underperformed on a risk-adjusted basis compared to conventional funds. Furthermore, Climent and Soriano investigate periodical differences and conclude that the environmental funds' alpha progressively increase in their study until no difference could be discerned. Climent

and Soriano explain the lower returns by suggesting it is due to a smaller investment universe and inexperienced green fund managers.

However, single-factor models such as CAPM to measure and compare funds and other investment options have their limitations and have been criticised for its failures to capture the true element of risk and missing cross-sectional differences (Fama and French, 1992, 1993, 1994 and 1996). It was through this criticism that more factors were added to account for differences in market capitalisation and book-to-market in Fama and French's three-factor model. This was later accompanied by a factor describing momentum by Jegadeesh and Titman (1993) summarised as Carhart's four-factor model which became thoroughly used in comparative fund analysis.

Bauer, Koedijk and Otten (2005) used Carhart's model to study ethical mutual funds in the United States, German and UK funds over the 1990 – 2001 period. The results of their study show similar to Climent and Soriano's (2011) findings that green funds appear to have gone through a catch-up phase to achieve similar returns to those of conventional funds. Furthermore, Bauer, Koedijk and Otten find that the investment style of the funds differs depending on the region. In the United States, green funds are less exposed toward small market capitalisation stocks than conventional ones whereas the opposite is true for green funds in the United Kingdom and Germany. Furthermore, Bauer, Koedijk and Otten discover that green funds are more invested in growth stocks or less value stocks than their conventional peers. In the study, the momentum factor fails to reach significance across all regions.

In another paper, Cortez, Silva and Areal (2012) evaluate the performance of socially responsible funds in global markets between the years of 1996 – 2008. Focusing on European and US funds Cortez, Silva and Areal utilise different multi-factor specifications to find time-varying betas but not alphas for socially responsible funds. Their funds perform well in bear markets and Cortez, Silva and Areal propose that good reputation could protect green stocks from price declines. Similar to Bauer, Koedijk and Otten (2005), Cortez, Silva and Areal also find indications that socially responsible funds are more exposed to both small market

capitalisation stocks and growth stocks. The authors find this peculiar as their sample consists mostly of large market capitalisation funds. In addition, their results show socially responsible funds to be skewed towards growth stocks. This contradicts the classifications of some the funds' descriptions of pursuing value strategies. The authors conclude that there may be misclassification issues in the sector. Regarding performance, Cortez, Silva and Areal find that global socially responsible funds perform neutral to its conventional counterparts.

A year later Areal, Cortez and Silva (2013) published a study exclusively focusing on the US market evaluating performance conditional on market regimes. The findings support that socially responsible funds perform better under high volatility markets when compared to an unethical fund. Areal, Cortez and Silva write that socially responsible funds outperforming during periods of crisis are consistent with previous literature such as Jones et al. (2000) and Schnietz and Epstein (2005).

Another study that similarly uses comparisons with worst in class is one by Ibikunle and Steffen (2015). Ibikunle and Steffen evaluate fund performance and investment style in a matched pair analysis using Carhart's four-factor model on three different fund classes: green, conventional and black, where black ones represent fossil energy and natural resources. Ibikunle and Steffen find, similar to Bauer, Koedijk and Otten (2005), a trend of steadily increasing risk-adjusted returns for green funds over the years 1991 – 2014. Adding to Bauer, Koedijk and Otten (2005) and Cortez, Silva and Areal's (2012) findings, Ibikunle and Steffen's results indicate that green funds start to outperform black funds at the end of the period significantly. Ibikunle and Steffen find similar to previous studies that the green funds investment style is more exposed toward small market capitalisation and growth stocks than conventional funds. Lastly, the momentum factor fails to reach statistical significance in either portfolio.

On the other hand, some studies show contrasting results regarding the investment styles found by authors mentioned above. Muñoz, Vargas and Marco (2014) find that different fund classes have different investment styles and that it changed conditional on crisis periods in the market. Muñoz, Vargas and Marco study green domestic and global funds in Europe and the United States and find that the

manager's ability to capture the benefits from investment style is poor in periods of market crisis, where most factors are insignificant. In non-crisis periods only the global green portfolio has a significant size factor, and both portfolios capture the book-to-market style, but the momentum factor remains insignificant.

In this thesis, we use Sharpe ratios to support our econometric model. Mallin, Saadouni and Briston (1995) also use Sharpe ratios in their analysis of ethical funds in the United Kingdom. They find indications of the ethical funds outperforming the conventional ones. However, the difference is not statistically significant. Using Mallin, Saadouni and Briston's methodology, Kreander et al. (2005) extend their geographic scope and examine ethical funds from a European perspective. Similar to Mallin, Saadouni and Briston, Kreander et al. find no statistical difference for the Sharpe ratio between the ethical and non-ethical funds in their sample.

To summarise, there appears to be a positive correlation between sustainable practices and financial performance. However, green fund performance is less clear cut. Previous studies advocate that there has been a trend change in risk-adjusted returns of green funds, from underperforming to performing on par with conventional ones and outperforming worst in class ones. Moreover, green funds are suggested to be more stable during periods of crisis. Concerning investment style, green funds tend to be more exposed toward small market capitalisation though some researchers have found discrepancies with the funds' classifications. The momentum factor is poor at explaining the green funds' returns and is not significant in several studies. Furthermore, green funds tend to be more growth oriented than value focused. Lastly, the studies using Sharpe ratios are consistent with the factor models, resulting in no statistical difference between the two groups.

3 Theory Review

3.1 Modern Portfolio Theory and Expected Alphas

It is well established that funds do not beat the market on average and report negative risk-adjusted alphas. This is consistent with the efficient market hypothesis introduced by Fama (1970). The hypothesis implies that securities are correctly priced in the market. Based on that premise, coupled with the law of averages, and introducing management fees it is not surprising that funds on average generate lower returns than their benchmarks. Furthermore, the hypothesis proposes that there is a trade-off between risk and reward. Modern portfolio theory manages idiosyncratic risk through diversification building on Markowitz's (1952, 1959) mean-variance theory. The consequence for green funds is that by having stricter screening criteria, the possibilities for diversification get smaller, thus, inducing idiosyncratic risk to their portfolios as Rudd (1981) demonstrates. To put it another way, it is important to set the realised return in perspective to the risk the manager takes. In the wake of the introduction of the CAPM developed by Sharpe (1964), Lintner (1965a,b), Treynor (1961) and Mossin (1966), the predominantly used model historically for measuring and comparing fund performance, risk-to-reward ratios were recognised as necessary extensions.

3.2 Determining the Statistical Significance of the Sharpe Ratio

Most readers of this thesis will be familiar with the Sharpe ratio as a risk-to-reward ratio from previous finance classes. This section addresses the implications of determining statistical significance when introducing non-normal return distributions. The following condition was previously assumed:

$$r_p - r_f \sim N(\mu, \sigma^2) \quad (1)$$

In formula (1), we have the excess return ($r_p - r_f$) that is normally distributed (N) with a mean of (μ) and a variance of (σ^2). As the population data for the variables are unbeknownst to us, estimations are required and indicated by hats over the variables in the following formulas.

The Sharpe ratio as defined by Sharpe in 1994 can be seen in formula (2) where (r_p) is the average portfolio return, (r_f) is the average risk-free rate and (σ) the standard deviation of the portfolio's excess return. When determining the statistical significance of the Sharpe ratio it is intuitive that we should consider the underlying return distribution.

$$\text{Sharpe ratio} = SR = \frac{r_p - r_f}{\sigma} \quad (2)$$

Christie (2005) proposes a method of calculating standard errors that are valid under time-varying conditional volatilities, non-IID returns and serial correlation. Hence, reflecting reality better than models derived under the normality assumption. The drawback is that Christie's specification is long and cumbersome to implement. However, Opdyke (2007) shows that the model can be derived to another model and simplified. We use Opdyke's standard error that is applicable to what we observe in the financial markets.

$$SE(\widehat{SR}) = \sqrt{\frac{1 - \widehat{\gamma}_3 \widehat{SR} \frac{\widehat{\gamma}_4 - 1}{4} \widehat{SR}^2}{n-1}} \quad \text{where } \gamma_3 = \frac{\mu_3}{\sigma^3} \text{ and } \gamma_4 = \frac{\mu_4}{\sigma^4} \quad (3)$$

In formula (3) we can see the estimation of the standard deviation under asymmetric distribution, i.e. not perfectly normal. ($\widehat{\gamma}_3$) is the estimated skewness of the distribution and ($\widehat{\gamma}_4$) the estimated kurtosis of the distribution. Lastly (n) refers to the number of observations. For more information about the derivation see Opdyke's paper.

$$\text{Prob} \left[SR \in \left(\widehat{SR} - t_{\frac{\alpha}{2}} SE(\widehat{SR}), \widehat{SR} + t_{\frac{\alpha}{2}} SE(\widehat{SR}) \right) \right] = 1 - \alpha \quad (4)$$

Supposedly, the true Sharpe ratio should be within the confidence interval provided in formula (4) for a given significance of α .

3.3 Carhart's Four-Factor Model

The main model for our analysis is the Carhart four-factor model. It is an extension of CAPM where three more factors have been added to the original model. The first two were proposed by Fama and French (1992). Fama and French found that size and book-to-market factors could help isolate the risk-adjusted alpha further. The third factor added was the short-term momentum factor courtesy of Jegadeesh and Titman (1993). Jegadeesh and Titman find performance persistence among winning and losing securities that can help explain returns. Carhart (1997) concludes that this model outperforms both CAPM and Fama and French's three-factor model in terms of accuracy. The model can be seen in formula (5).

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t} \quad (5)$$

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

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

α_i = Four-factor alpha – the risk-adjusted return for portfolio i .

$r_{m,t} - r_{f,t}$ = Excess return of the market at time t .

$r_{SMB,t}$ = Fama-French's risk premium capturing size effects at time t .

$r_{HML,t}$ = Fama-French's risk premium capturing book-to-market effects at time t .

$r_{MOM,t}$ = Jegadeesh and Titman's risk premium capturing momentum effects at time t .

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

The intercept in the model is the four-factor alpha capturing the risk-adjusted return of the portfolio. A positive value indicates that the portfolio outperforms the market while a negative value indicates underperformance. The first variable is the market excess return where the coefficient is interpreted as the beta, i.e. sensitivity to market risk. A beta higher than one implies that the manager's portfolio inhibits more risk compared to the market.

The second variable came to be after Fama and French (1992, 1993) found a negative correlation between the size and the return of the stock. In other words, their findings suggest that smaller firms are more sensitive to market movements than larger ones. The small minus big (SMB) variable in Fama and French's model accounts for the return spread between small and large corporations, where the size is determined by market capitalisation. A positive coefficient for the SMB variable suggests that the manager has invested in stocks with small market capitalisation.

Similarly, a negative SMB coefficient would indicate that the manager invests more in large market capitalisation stocks.

The third variable in the four-factor model is the high book-to-market minus low book-to-market (HML) variable. Fama and French find a positive correlation between the average return of a company and their book-to-market ratio (B/M). The idea is that corporations with a high B/M (value stocks) outperform those with low B/M (growth stocks). Fama and French argue that if the pricing is rational, book-to-market would be a good indicator of the relative prospects of the enterprise. Hence, corporations with high book-to-market ratios, indicating financial distress, should have lower returns on assets in general, and should thereby represent more risk (Fama and French 1995, 1998). Therefore, a positive coefficient indicates investment in value stocks and a negative one growth stocks.

The fourth variable is the momentum variable (MOM) by Jegadeesh and Titman (1993). Jegadeesh and Titman find that winners tend to continue to perform well and losers to underperform. This variable isolates this short-term momentum effect that securities may experience in the market. The factor can be interpreted as an investment style where a positive factor indicates a momentum strategy investment style of buying winners and selling losers while a negative value suggests a contrarian strategy of moving against the market, selling winners and buying losing stocks.

Lastly, there is the error term. As the exposure to systematic risk has already been accounted for in the model, the remaining risk component, the idiosyncratic risk, is captured by this term. The error term does not receive a risk premium as idiosyncratic risk can be removed by diversification (Berk and DeMarzo, 2012, p.332). This term is expected to have zero correlation with the other variables and a zero conditional mean under the Gauss-Markov assumptions (Wooldridge, 2012, p.105).

4 Data

4.1 Mutual Funds Screening

The return data of the funds used in this thesis is on a monthly basis and collected from the Bloomberg terminal. The fund selection process starts with screening for primary share, open-end mutual funds with an asset allocation focus on equity. Additionally, we screen for funds that explicitly stated a geographical emphasis on the Eurozone, European region or the European Union. Moreover, we decide to only include funds with the stated country of domicile being in either Eastern or Western Europe. To have return data over the whole period is not a requirement to be included in the sample, although many of our funds meet this criterion, as long as 12 months of data is available. The criteria chosen to screen for green funds are Climate Change, ESG, Environmentally Friendly, Socially Responsible and Clean Energy. These are categories we consider to be closely related to sustainability and environmental investing. We control for the funds categorised as only socially responsible in Bloomberg by reading their prospectus and see if they met the Morningstar Direct's sustainability mandate.

The screening for green funds results in a total sample of 28 active funds and 45 when including inactive ones. After reading the security description for each fund and removing those who are not deemed fit to be used in the study where the final number of green funds is 24 with 9 of them being inactive funds. The reasons for removing funds after the initial screening process were excessive investments outside of the European region (more than 50%) or not having at least 12 months of data within the desired period. Secondly, screening for conventional funds and excluding green traits results in 717 active funds and 1933 when including inactive ones. The conventional funds are then selected under a matched procedure using the green funds' size and age as factors where size was prioritised. A limitation to a sample size of 100 conventional funds is made, and of those 100 funds, 18 are inactive. Besides considering age and size, the selection of conventional funds is made sorting the ticker and using Microsoft Excel's randomise function. The reason for including inactive funds in the portfolios is to control for survivorship

bias. Brown (1992) describe that there would be an overestimation of performance as only funds that persisted through performance cuts would be included.

4.2 Kenneth R. French Database from Tuck School of Business at Dartmouth

All four factors for the Carhart specification (market excess return, SMB, HML, MOM) are monthly data and is collected from the Kenneth R. French database specific for European markets. As Kenneth R. French calculates these portfolios, all returns are in US dollars (USD), includes dividends and capital gains, and are not continuously compounded. Furthermore, Kenneth R. French uses the U.S. one month T-bill as the proxy for the risk-free rate. The market index is the value-weighted market portfolio including all stocks with market data from the 16 biggest European markets.

When assembling the SMB and HML variables, six different portfolios are constructed based on market capitalisation and B/M. Kenneth R. French distinguishes big stocks as the ones in the top 90 percent market capitalisation and small stocks as the ones in the bottom 10 percent. The stocks are then sorted on B/M where the lower 30 percent are growth stocks, 30 to 70 percent are neutral, and above 70 percent are value stocks. The formula for the SMB variable can be seen below.

$$SMB = \frac{Small\ Value + Small\ Neutral + Small\ Growth}{3} - \frac{(Big\ Value + Big\ Neutral + Big\ Growth)}{3} \quad (6)$$

Formula (6) states that SMB is the equally-weighted average of the returns on the three small stock portfolios subtracted by the mean of the returns on the three big ones. Subtracting can be interpreted as short selling in this context. Hence, the three factor portfolios described in this section are zero net investments.

$$HML = \frac{(Small\ Value + Big\ Value)}{2} - \frac{(Small\ Growth + Big\ Growth)}{2} \quad (7)$$

The HML factor is then constructed using the upper and lower bounds of the B/M ratios with small and big stocks. Formula (7) says that HML is the equally-

weighted average of the returns for the two high B/M portfolios that are subtracted by the two low B/M portfolios.

Lastly, there is the MOM factor that is based on size and lagged momentum. Kenneth R. French uses small and big stocks together with the upper and lower 30 percentiles of stock returns for respective portfolio. The result is a 12-month rolling momentum factor.

$$MOM = \frac{(Small\ High + Big\ High)}{2} - \frac{(Small\ Low + Big\ Low)}{2} \quad (8)$$

Formula (8) is the equally-weighted average of winners in small and big market capitalisation portfolios subtracted by the average of the two loser portfolios of respective sizes.

4.3 Outliers and Anomalies in the Dataset

We have identified a few outliers in our dataset, funds that outperform and underperform significantly different from the average over time, and monthly return anomalies. We deem that the deviations in the anomalies and outliers are not as significant that adjustment or correction is motivated. Furthermore, the standard deviation of the portfolios' size is considerably more than the resulting weighted size in the final portfolio. This is due to some of the inactive funds having limited size before closing. However, both the green and conventional sample share this characteristic.

4.4 Fund Expenses and Management Fees

When estimating the gross returns, the yearly expense ratios were gathered using Morningstar Direct while the Bloomberg terminal was used to get the front and back load fees. Those that were not available with these services were collected from the funds' websites. Despite these actions, we were unable to find some front and back-load data (23%) which may result in measurement error even though the proportion of missing values between the portfolios was similar.

5 Methodology

5.1 Econometric Analysis

After obtaining a total of 124 different funds following our screening in Bloomberg, we construct two merged equally-weighted portfolios, a green and a conventional one. Thereafter, the monthly returns of the portfolios are computed by averaging the portfolios' constituents' returns. The difference portfolio is then constructed to test for relative performance and is obtained by subtracting the green portfolio's return by the conventional one's. The returns collected from Bloomberg are calculated as the price change of the fund, plus dividends, divided by the starting price. The returns Bloomberg reports are adjusted for management fees, and we make the assumption that dividends are reinvested in the funds.

In this thesis, we run OLS regressions using Carhart's model (1997), see formula (9), for evaluating the portfolios' risk-adjusted return and investment style. For more information about the model see the theory section. The regressions are run over the whole sample period Jan 2007 – Jan 2017 and similar to Bauer, Koedijk and Otten (2005) we do a performance over time analysis by splitting the dataset in two periods, formally Jan 2007 – Dec 2011 and Jan 2012 – Jan 2017. We do this to identify potential trends. All regressions in this thesis are computed in Stata.

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t} \quad (9)$$

The factor-portfolios and the market excess return in formula (9) are obtained from Kenneth R. French database and are computed based on USD returns. Hence, we calculate our fund returns and benchmarks using USD returns for model consistency. The one-month T-bill is used when testing with different benchmarks for the same reason. Using the T-bill as proxy for the risk-free rate in Europe is not something novel. For example, this was done by Bauer, Koedijk and Otten (2005) and Ibikunle and Steffen (2015).

In the sample, the proportions of inactive funds for the portfolios differ distinctly. To ensure no new biases are introduced this is adjusted for in the post-analysis to observe if it changes the conclusions. The adjustment is made by randomly removing three out of nine inactive funds in three different combinations, resulting in the green portfolio to have approximately the same percentage of inactive funds. We use Microsoft Excel's randomise function between zero and one over the inactive funds for the selection and remove those generating the highest number.

5.2 Sharpe Ratio Computations

Sharpe ratios are computed for three different periods, namely, Jan 2007 – Jan 2017, Jan 2012 – Jan 2017 and Jan 2007 – Dec 2011. The Sharpe ratios are then calculated in Microsoft Excel using the average monthly excess return of the merged portfolios and then divided by the sample variance of the monthly excess returns. The proxy for the risk-free rate used is the monthly T-bill returns provided by Kenneth R. French. To estimate the significance of the Sharpe ratio we start by testing if the return distribution is normal by using the Shapiro-Wilk and Shapiro-Francia tests in Stata. The skewness and kurtosis is then computed in Stata for respective distribution and standard deviations are then obtained by using formula (3). The resulting data is used to test the hypothesis of no statistical difference in Sharpe ratio where the Student's two-sided t-test is used to determine if there is a statistical difference.

5.3 Statistical Tests and Robustness

To ensure our results are consistent, Breusch-Pagan and White tests for heteroscedasticity are conducted. Furthermore, the Breusch-Godfrey test is used to check for serial correlation. Newey-West standard errors are used if either serial correlation or heteroscedasticity is present in the dataset. Newey-West regressions are used with a lag of 12 as suggested by Wooldridge (2012, p.432). The last OLS assumption tested for is multicollinearity by generating a correlation matrix for the independent variables. The data collected is of cross-sectional time series characteristic; thus, a test if time is significant is conducted, and if so we include time as an explanatory variable to see if it changes the results from the Carhart specification. To perform this test, we run a regression using the adjusted portfolio

returns as the dependent variable and time as the independent variable. To test for seasonality in our sample, we construct dummy variables for our regressions in Stata to represent the months of the year from when the observations were taken. Following these results, we test for joint significance of the dummy variables to find out if seasonality is present in the sample.

To test the robustness of our findings we use different econometric model specifications (CAPM, Fama and French three-factor model and Carhart's four-factor model). We also use two different benchmarks to compare to the results using Kenneth R. French market index. First, we have the MSCI Europe index that focuses on 16 developed markets in Europe, capturing representation through mid and large market capitalisation securities. The 446 components are value weighted and cover approximately 85% of European free-float market capitalisation. Secondly, we use the STOXX Europe 600 index which is a subset of the STOXX 1800 global index that focuses on the 17 biggest financial markets in Europe. Throughout these markets, it consists of 600 securities representing large, mid, and small market capitalisation and weighting them according to free-float market capitalisation. Using STOXX 600 as a benchmark is in line with other European fund performance studies such as Ibikunle and Steffen (2015). Furthermore, we test if the results change by using the one-month Euro LIBOR as a proxy for the risk-free rate.

A robustness test for management fees is conducted by regressing on gross returns. The yearly management fees are assumed to be the annual expense ratios of the funds including the loading charges. The front and back load fees are annualised by dividing by seven which is considered to be the average holding period (Sirri and Tufano 1998). The yearly fee is then divided by 12 to get the monthly fee which is then added to the net returns of the portfolio. The variables in formula (10) are averages of the portfolio's holdings.

$$\text{Annualized management fee} = \text{expense ratio} + \frac{\text{front and back load}}{7} \quad (10)$$

6 Empirical Results

6.1 Descriptive Statistics

First, we provide summary statistics of our data. In Table I we can see the mean returns of the portfolios. Interestingly, the green portfolio displays a higher monthly average return than the conventional one. The green portfolio's standard deviation suggests it inherits more risk, in line with the risk-to-reward theories. However, both the green and conventional portfolio have lower average returns than the market, supporting the idea that they on average can not beat the market.

Table I – Descriptive Statistics

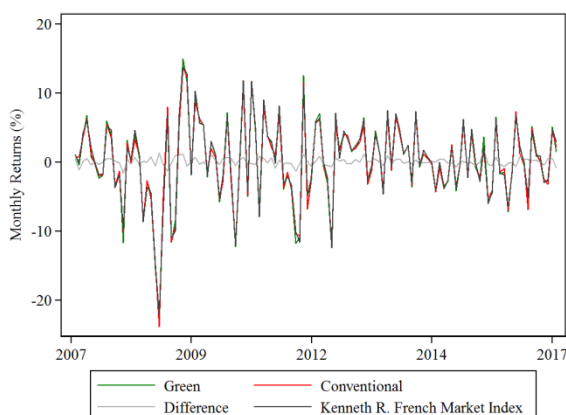
Variables	Green	Conventional	Difference	Market	SMB	HML	MOM
Mean	0.17	0.10	0.07	0.29	0.10	-0.13	0.79
Median	0.01	0.18	0.01	0.16	0.17	-0.28	1.16
St. Dev	6.01	5.83	0.57	5.91	1.98	2.47	4.19
Min	-22.51	-23.86	-1.62	-22.06	-4.79	-4.47	-26.20
Max	14.97	13.75	1.90	13.85	4.92	8.34	10.33
No. of funds	24	100					
Inactive funds	9	18					
Expense ratio	1.29	1.55					
Inception year	2004	2002					
Size	143	143					

Note to Table I: The inception year is calculated by taking the average starting date for the funds in respective equally-weighted portfolio. The average month of the inception year of both portfolios is November. The mean, median, St.Dev, min and max are all reported in percent. Size is reported in millions of euro. Market is the Kenneth R. French market index. St. Dev is the sample standard deviation of the portfolios return. The table is based on data for the Jan 2007 - Jan 2017 period for a total of 121 observations.

The green and conventional portfolios are of the same asset size after weighting their constitutions assets equally. There is a two-year difference for average age. For the different factor portfolios, the momentum portfolio appears to be the most successful strategy whereas the book-to-market portfolio has yielded an average negative return over the whole holding period. A remark regarding the sample data is that it demonstrates heteroscedasticity and serial correlation for several portfolios. Hence, we use Newey-West standard errors unless specified otherwise in the following section. Moreover, inactive fund bias from excessive inclusion of inactive funds or adjusting for management fees did not change the results significantly in the next section. These findings can be seen in the Appendix (Table I, V and VII).

In Figure I, the monthly merged equally-weighted portfolio returns in percent over time are displayed. The 2007 – 2012 period suffered from the financial crisis 2008 and the Eurozone crisis shortly after. This can explain the higher volatility as indicated by the broader spectrum of returns during this period. If we take these monthly returns and see what effect it has over time we get the result in Figure II.

Figure I - Monthly equally-weighted portfolio returns



In Figure II, we have visualised the cumulative performance over the sample period. The portfolios and indexes have been indexed to a starting value of 100. Figure II shows that both the green and conventional portfolio have underperformed relative to the Kenneth R. French market index. The figure indicates that the green portfolio performs better than the conventional one. By further examining the difference between the two portfolios we have subtracted the indexed green portfolio with the conventional one in Figure III. It appears that the green portfolio outperforms when the market rebounds after crisis periods.

Figure II - Indexed performance over time

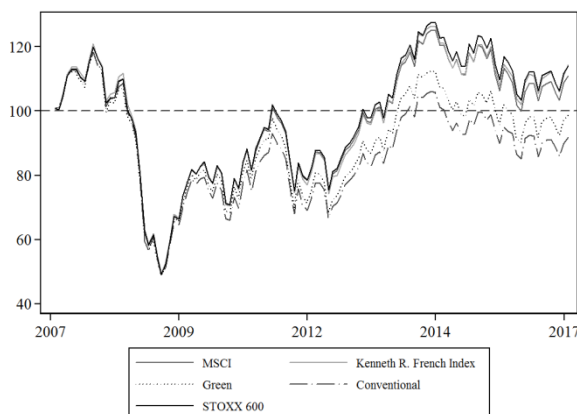
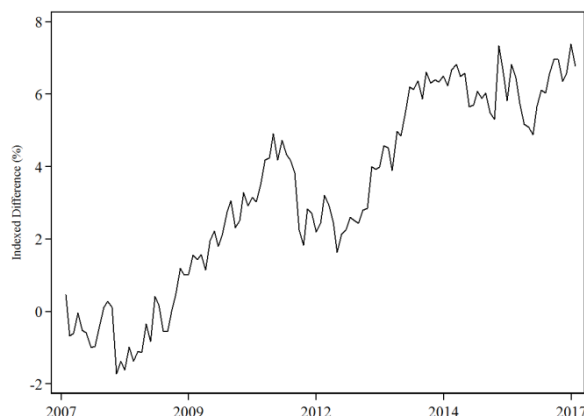


Figure III - Indexed portfolio difference



6.2 Hypothesis 1 – Are the Risk-Adjusted Alphas Statistically Different?

Table II: Carhart's Model

Variables	Green Portfolio	Conventional Portfolio	Difference Portfolio
4-factor alpha	-0.115*** (0.041)	-0.184*** (0.036)	0.068 (0.047)
Market	1.007*** (0.014)	0.979*** (0.010)	0.028 (0.018)
SMB	0.015 (0.029)	0.093*** (0.031)	-0.079*** (0.017)
HML	0.008 (0.025)	0.005 (0.020)	0.003 (0.017)
MOM	-0.003 (0.013)	-0.004 (0.010)	0.002 (0.016)
No. of observations	121	121	121

Note to Table II: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios over the Jan 2007 - Jan 2017 period. We use the Kenneth. R French market index and one month T-bill as proxies for the market and the risk-free rate. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

- * Significant at the 10% level
- ** Significant at the 5% level
- *** Significant at the 1% level

In Table II the results from running OLS regressions on the dataset using Carhart's model are presented. First, we can observe that both the green and conventional portfolios have significant negative four-factor alphas, indicating that both portfolios underperform relative to the market. Furthermore, the green portfolios four-factor alpha is less negative than the conventional portfolio, i.e. the green portfolio performs better than conventional portfolio on a risk-adjusted basis. However, that statement can not be supported statistically as the difference portfolio indicates that the difference is insignificant on a ten percent basis. Contrastingly, we get a ten percent significance level for the difference portfolio when changing the model specification to CAPM and Fama and French's three-factor model (Appendix Table IX). The results in our main regression IX model are similar to what Bauer, Koedijk and Otten (2005) and Cortez, Silva and Areal (2012) and Ibikunle (2015) find. Considering that they all reported the green funds going through a catch-up phase, these results weakly indicate that the trend of progressively increasing alphas has continued relative to their conventional peers.

Table III: Performance over Time

Variables	Green		Conventional		Difference	
	2007-2011	2012-2017	2007-2011	2012-2017	2007-2011	2012-2017
4-factor alpha	-0.106 (0.067)	-0.118*** (0.040)	-0.162*** (0.054)	-0.193*** (0.050)	0.056 (0.077)	0.075 (0.045)
Market	1.002*** (0.016)	1.015*** (0.016)	0.981*** (0.013)	0.965*** (0.020)	0.021 (0.022)	0.050*** (0.011)
SMB	0.023 (0.043)	0.009 (0.053)	0.080** (0.038)	0.117* (0.060)	-0.057*** (0.020)	-0.108*** (0.024)
HML	0.030 (0.044)	-0.012 (0.027)	0.033 (0.028)	-0.017 (0.024)	-0.004 (0.029)	0.004 (0.021)
MOM	0.002 (0.014)	-0.009 (0.031)	0.001 (0.014)	-0.011 (0.020)	0.001 (0.023)	0.001 (0.022)
No. of observations	60	61	60	61	60	61

Note to Table III: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios over the Jan 2007 - Jan 2017 period. We use the Kenneth. R French market index and one month T-bill as proxies for the market and the risk-free rate. Two periods are evaluated. Namely, Jan 2007 - Dec 2011 and Jan 2012 - Jan 2017. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

- * Significant at the 10% level
- ** Significant at the 5% level
- *** Significant at the 1% level

Further examining the discrepancy in alphas between the portfolios, Table III shows the regressions done on the two halves of the sample period. In the first period, affected by the financial crisis and Eurozone crisis, the green portfolio's alpha is not statistically different from zero on a ten percent level as opposed to the highly significant negative alpha of the conventional portfolio. Although not statistically significant, this result still weakly indicates that the green portfolio outperforms the conventional one during this crisis period. These findings are consistent with Jones, Jones and Little (2000) and Schnietz and Epstein (2005) that their good reputation could act as a cushion in market-wide stock declines. Looking back at the price movements visualised previously in Figure II, it appears that the spread is trending slightly below zero to experience a robust upward trend during the market rebound after the financial crisis. Similar patterns are seen around 2012 when the discrepancy first decreased slightly in the European crisis, before stabilising and start to rise again in 2012 after the increased ECB bond purchases. Thus, it seems like green funds achieve higher returns than the conventional funds in the ensuing bull markets after crisis periods.

6.3 Hypothesis 2 – Do Green and Conventional Funds Have Different Investment Styles?

Table II shows that both portfolios have a beta of approximately one with no statistically significant difference. Our findings are similar to Ibikunle and Steffen (2015) that reported slightly higher betas for green funds when comparing to conventional ones. According to the results from the difference portfolio, the difference does not appear to be significant. These results change as different benchmarks are used, where the difference becomes significant at a ten percent level (Appendix Table VIII). Likewise, we can see that the difference is highly significant in the latter period when splitting the dataset but only at a ten percent significance in the first period. The results indicate that the green portfolio is more sensitive to market risk. This is consistent with previous literature that suggest this is due to a smaller investment universe (Climent and Soriano, 2011).

Moving on to the other factors, we see that both the green and conventional portfolio display positive SMB factors, where only the latter reaches statistical significance. The positive factor implies that the conventional portfolio is more skewed towards small market capitalisation stocks than the green portfolio, which the difference portfolio also indicates. These results differ from several previous studies such as Bauer, Koedijk and Otten (2005) and Cortez, Silva and Areal (2011) and Ibikunle and Steffen (2015). However, the comparison differs as they mainly use global funds and we have excluded all global ones in our sample. Moreover, as Muñoz, Vargas and Marco (2014) finds in their study that only global funds in their sample display statistical significance for the SMB factor. Hence, we suggest that this disparity can be attributed to differences in fund classes.

The HML factors are approximately zero and a minuscule bias toward value stocks would be suggested for the green portfolio by the sign of the factor. Once again these results contradict studies such as Bauer, Koedijk and Otten (2005) who finds green funds to be skewed towards growth stocks. At the same time, the results are similar to the findings of as Muñoz, Vargas and Marco (2014). The motivation of green funds being skewed towards growth stocks has previously been that high book-to-market stocks have traditionally been found in the energy, chemical and

basic industries sectors commonly excluded in ethical fund screening. These results indicate that this may not be the case for green European mutual equity funds.

Lastly, both the green and conventional portfolio receives negative values close to zero for the momentum factor, implying that it explains the portfolios returns poorly. The interpretation of the negative sign would be that both portfolios appear to be more exposed to a contrarian investment style rather than following a momentum strategy. However, the factor does not achieve statistical significance for any of the three portfolios, hence, no style or difference can be determined. This finding is comparable to Cortez, Silva and Areal's (2011) conclusion that the momentum factor appears less significant than the SMB and HML factor and that they found no significant difference in the momentum factor between their portfolios.

Summarising the answer for our second hypothesis, in the sample green funds are less exposed towards small market capitalisation stocks than the conventional funds. The green funds indicate to be more sensitive to market risk and we find that the portfolios do not demonstrate any strong preference for the investment styles related to book-to-market and momentum factors.

6.4 Hypothesis 3 – Are the Sharpe Ratios Statistically Different?

Table IV – Distribution and Sharpe Ratio Statistics

Variables	Green			Conventional		
	2007-2017	2012-2017	2007-2011	2007-2017	2012-2017	2007-2011
Shapiro-Wilk	0.034	0.152	0.648	0.010	0.194	0.433
Shapiro-Francia	0.017	0.148	0.482	0.005	0.176	0.282
Skewness	0.020	0.203	0.232	0.005	0.171	0.123
Kurtosis	0.025	0.615	0.409	0.005	0.556	0.200
Sharpe ratio (SR)	0.019	0.146	-0.052	0.008	0.136	-0.062
St.Dev (SR)	0.091	0.129	0.130	0.091	0.129	0.130
No. of observations	121	61	60	121	61	60
t-statistic	0.937	0.428	0.421			
df	240	109	118			
p-value	0.257	0.363	0.364			

Note to Table IV: The reported values for the Shapiro tests are p-values with the null hypothesis of normal distribution. The t-statistic and the degrees of freedom are computed based on the formulas below. For more information about the formulas see Jaggia & Kelly (2013) in the references. The p-values are based on a two-sided t-test. See formula (3) in the theory review for the St.Dev computations.

$$t_{df} = \frac{(\bar{x}_1 - \bar{x}_2) - d_0}{\sqrt{\frac{s_1^2 + s_2^2}{n_1 + n_2}}} \quad \text{and} \quad df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{(n_1-1)} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{(n_2-1)}}$$

The \bar{x} are the point estimates, green and conventional respectively, the d_0 is the hypothesised difference, i.e. zero. s^2 are the estimated variances (squared standard deviations) and the n 's represent the number of observations. The Sharpe ratios are based on the equally-weighted portfolios.

After having tested our third hypothesis, we can see in Table IV that the returns are asymmetric for the whole period, but the null hypothesis can not be rejected for the other periods. However, this does not prevent us from using the standard errors discussed in the theory section. Moreover, the kurtosis and skewness estimates indicate fatter tails, skewed to the right, and a higher peak than the normal distribution. Furthermore, the table shows that the p-values for the reported two-sided t-tests are not significant on a ten percent significance level. The t-values are positive and indicate that it is more probable that the green portfolio performs better on a risk-adjusted basis although not enough to reject the null hypothesis of zero difference in a two-sided test. The results are similar to Mallin, Saadouni and Briston (1995) where they observe indications of outperformance but not enough to be statistically significant. Furthermore, the finding of insignificant Sharpe ratios is coherent with Kreander et al.'s (2005) results. The results in Table IV are also consistent with our econometric analysis, weakly indicating outperformance in all periods but not enough to be statistically significant. The negative Sharpe ratios in 2007 – 2011 can be attributed to the financial crisis 2008.

6.5 Critical Evaluation of Empirical Results

There are a few critical aspects worth pointing out in this thesis. Firstly, we do not test all the combinations of inactive fund biases as we compute three different combinations of the green portfolio out of a total of 84 combinations. If a bias based on Brown's (1992) findings is present, we would be underestimating the green portfolio's performance as it has a higher percentage of inactive funds. However, considering that there are no significant outliers in the dataset, the different combinations should be similar. Furthermore, we decide in this thesis to give size a higher priority when constructing our portfolios as we assumed that size is more important than age. This could potentially introduce an age bias in the results. Ferreira, Miguel and Ramos (2007) evaluates this subject and find in their paper that age and performance are negatively correlated. Hence, the two-year difference between the portfolios would suggest that the green portfolio has a positive bias and the conventional one a negative one.

Moreover, we were unable to find all the front and back load data, as previously mentioned, where approximately 23% is missing for both portfolios. This results in a potential measurement error which could be either positive or negative when comparing the two portfolios using gross returns. However, the results are based on approximately 77% of the funds which should give an adequate representation of the two groups. The main reason why we state weak indications of outperformance in previous sections is because the p-values are at times on the threshold of being significant, and these biases could potentially make the alphas significant at ten percent.

7 Conclusion

The thesis begins with describing the surge of green investments seen last decades and investors' belief of an economic trade-off associated with these investment vehicles. In this thesis, we address this question in the context of European green mutual equity funds. We run regressions accounting for market, size, book-to-market, and momentum using the Carhart (1997) four-factor model on a dataset of 24 green funds and 100 matched conventional ones over the Jan 2007 – Jan 2017 period. The results suggest that the belief of an economic trade-off is not warranted based on historical performance.

In our investigation, we find higher alphas for the green portfolio in all analysed timeframes. Nonetheless, the differences between the two portfolios are not significant at ten percent. Our findings of no financial penalty of investing in green funds are analogous to previous results from Bauer, Koedijk and Otten (2005) and Climent and Soriano (2011). However, the coherently higher alphas of the green portfolio do reach significance by changing the econometric model specification. Previous literature has described a trend of progressively increasing alphas for green funds relative to their conventional peers; our results coupled with the potential biases in this thesis indicate that this trend may have continued. It could give rise to a mispricing story in which green funds earn abnormal returns compared to conventional funds. This disparity would eventually be brought back to equilibrium by investors as they would want to be compensated for holding the riskier conventional funds. Furthermore, the results are consistent when using two-sided t-tests with Sharpe ratios adjusted for asymmetrical return distributions.

Subsequently, we investigate if there are different investment styles by interpreting the factors from Carhart's model. We find no difference between the two groups regarding the book-to-market and momentum factors. However, in contrast to earlier findings, we find that our green funds are less exposed to small market capitalisation. We believe Muñoz, Vargas and Marco's (2014) findings of differences between fund classes can explain our results as we omit global funds commonly used in the other papers. Additionally, we find weak indications that the

green portfolio is more exposed to the market factor. Although not statistically significant in the main regression, the higher beta can potentially be explained by a smaller investment universe as prior studies suggest. This is also indicated by the higher standard deviation of the green portfolio's returns as stated in the descriptive statistics. We kindly remind our readers that the results are limited to our sample and analysed timeframe.

This research has raised several questions that are in need of further investigation. Can green funds in terms of investment styles be treated as a homogenous group? Alternatively, are the investment styles different between fund classes as our results suggest? Moreover, future studies should target to address the potential outperformance of green funds identified in this thesis. In those studies, we propose that the research should be undertaken more broadly by using a less strict screening of green funds.

In conclusion, we think the thesis answers our primary research question we set out to answer. That when choosing between European green and conventional mutual equity funds, there is no economic trade-off in going green.

8 Appendix

8.1 Test of the OLS Assumptions

Table I: Tests for Heteroscedasticity and Serial Correlation

Variables	Green Portfolio	Conventional Portfolio	Difference Portfolio
Breusch-Pagan	0.149	0.047	0.039
White	0.075	0.067	0.060
Breusch-Godfrey	0.000	0.000	0.510

Note to Table I: Reported values are the p-values of the null hypothesis that the variance is constant. For the Breusch-Godfrey test the null hypothesis is that serial correlation is not present in the dataset. The reported Breusch-Godfrey test has a lag of 1. Furthermore, we tested higher levels of lag and the results also indicated serial correlation present in the samples.

Table II: Correlation Matrix

Variables	Market	SMB	HML	MOM
Market	1			
SMB	-0.062	1		
HML	0.537	-0.074	1	
MOM	-0.480	-0.031	-0.565	1

Note to Table II: This table reports the correlation matrix for the independent variables used in our main model. The Market is the Kenneth R. market index's monthly return adjusted for the risk-free rate (one month T-bill).

In Table I we can see that the homoscedasticity assumption is violated on a ten percent basis for several portfolios and that serial correlation is present. We use Newey-West standard errors correct for this in our thesis. The no-multicollinearity assumption appears to hold as no correlation between the independent variables is more than 0.9 in Table II. No time variable is included in our regressions as it was not significant when tested for. However, a test for seasonality is conducted as it is significant on a ten percent basis for the difference and conventional portfolio as can be seen in Table III.

8.2 Statistical and Robustness Tests

Table III: Time Significance and Seasonality

Variables	Green Portfolio	Conventional Portfolio	Difference Portfolio
Time	0.543	0.535	0.999
Seasonality	0.229	0.076	0.084

Note to Table III: Reported values are p-values where the null hypothesis is that time does not have statistical significance and for seasonality it is that there is no seasonality present.

Table IV: Adjusted for Seasonality

Variables	Green Portfolio	Conventional Portfolio	Difference Portfolio
4-factor alpha	-0.568** (0.232)	-0.571*** (0.171)	0.003 (0.194)
Market	1.000*** (0.015)	0.973*** (0.009)	0.026 (0.017)
SMB	0.054 (0.039)	0.124*** (0.039)	-0.070*** (0.017)
HML	0.016 (0.029)	0.010 (0.024)	0.006 (0.021)
MOM	-0.016 (0.014)	-0.020 (0.014)	0.004 (0.018)
Observations	121	121	121

Note to Table IV: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios, correcting for seasonality, using the Kenneth R. French index as market proxy, for the Jan 2007 - Jan 2017 period. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \beta_{6,i}Mar + \beta_{7,i}Apr + \beta_{8,i}May + \beta_{9,i}Jun + \beta_{10,i}Jul + \beta_{11,i}Aug + \beta_{12,i}Sep + \beta_{13,i}Oct + \beta_{14,i}Nov + \beta_{15,i}Dec + \varepsilon_{i,t}$$

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

Table V: Inactive Fund Bias

Variable	Green	Active Only	Adjusted 1	Adjusted 2	Adjusted 3
4-factor alpha	-0.115*** (0.041)	-0.108** (0.043)	-0.117*** (0.042)	-0.121** (0.047)	-0.101** (0.043)
Market	1.007*** (0.014)	0.990*** (0.017)	0.991*** (0.016)	0.995*** (0.017)	1.000*** (0.015)
SMB	0.015 (0.029)	-0.010 (0.030)	-0.031 (0.029)	-0.012 (0.030)	0.048 (0.035)
HML	0.008 (0.025)	0.024 (0.027)	0.019 (0.027)	0.011 (0.027)	0.015 (0.023)
MOM	-0.003 (0.013)	0.011 (0.012)	0.003 (0.011)	0.003 (0.014)	0.007 (0.013)
No. of funds	24	15	20	20	20

Note to table V: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios over the Jan 2007 - Jan 2017 period. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. The adjusted portfolios have been corrected to have the approximate same ratio of inactive funds as the conventional portfolio. The inactive funds included in each of the three portfolios were chosen randomly using Microsoft Excel's randomise function. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

* Significant at the 10% level

** Significant at the 5% level

*** Significant at the 1% level

Table VI: Libor as Risk-Free Rate

Variables	T-bill			Libor		
	Green	Conventional	Difference	Green	Conventional	Difference
4-factor alpha	-0.115*** (0.041)	-0.184*** (0.036)	0.068 (0.047)	-0.115*** (0.041)	-0.184*** (0.036)	0.069 (0.047)
Market	1.007*** (0.014)	0.979*** (0.010)	0.028 (0.018)	1.007*** (0.014)	0.979*** (0.010)	0.028 (0.018)
SMB	0.015 (0.029)	0.093*** (0.031)	-0.079*** (0.017)	0.015 (0.029)	0.094*** (0.031)	-0.079*** (0.017)
HML	0.008 (0.025)	0.005 (0.020)	0.003 (0.017)	0.008 (0.025)	0.005 (0.020)	0.003 (0.017)
MOM	-0.003 (0.013)	-0.004 (0.010)	0.002 (0.016)	-0.003 (0.013)	-0.005 (0.010)	0.001 (0.016)
Observations	121	121	121	121	121	121

Note to Table VI: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios, using the Kenneth R. French market index and one month T-bill, for the Jan 2007 - Jan 2017 period. The one month Euro LIBOR-rate is used in the LIBOR regressions. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

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

Table VII: Adjusted for Management Fees

Variables	Green Portfolio	Conventional Portfolio	Difference Portfolio
4-factor alpha	0.045 (0.041)	0.013 (0.036)	0.033 (0.047)
Market	1.007*** (0.014)	0.979*** (0.010)	0.028 (0.018)
SMB	0.015 (0.029)	0.093*** (0.031)	-0.079*** (0.017)
HML	0.008 (0.025)	0.005 (0.020)	0.003 (0.017)
MOM	-0.003 (0.013)	-0.004 (0.010)	0.002 (0.016)
Observations	121	121	121

Note to Table VII: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios, using the Kenneth R. French market index as market proxy, for the Jan 2007 - Jan 2017 period. Returns are gross returns accounting for management fees with an average holding period of seven years. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regression are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

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

Table VIII: Different Benchmarks

Variables	<u>Kenneth R. French</u>			<u>MSCI Europe</u>			<u>STOXX 600</u>		
	Green	Conventional	Difference	Green	Conventional	Difference	Green	Conventional	Difference
4-factor alpha	-0.115*** (0.041)	-0.184*** (0.036)	0.068 (0.047)	-0.118** (0.055)	-0.185*** (0.052)	0.067 (0.047)	-0.136*** (0.050)	-0.203*** (0.048)	0.067 (0.047)
Market	1.007*** (0.014)	0.979*** (0.010)	0.028 (0.018)	1.030*** (0.011)	0.999*** (0.010)	0.031* (0.018)	1.023*** (0.011)	0.992*** (0.011)	0.030* (0.018)
SMB	0.015 (0.029)	0.093*** (0.031)	-0.079*** (0.017)	0.169*** (0.026)	0.242*** (0.034)	-0.074*** (0.016)	0.134*** (0.022)	0.209*** (0.028)	-0.075*** (0.016)
HML	0.008 (0.025)	0.005 (0.020)	0.003 (0.017)	0.030 (0.018)	0.028** (0.014)	0.002 (0.017)	0.032* (0.018)	0.030* (0.016)	0.002 (0.017)
MOM	-0.003 (0.013)	-0.004 (0.010)	0.002 (0.016)	0.019 (0.013)	0.016* (0.009)	0.003 (0.016)	0.017 (0.013)	0.014 (0.009)	0.003 (0.016)
Observations	121	121	121	121	121	121	121	121	121

Note to table VIII: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios over the Jan 2007 - Jan 2017 period, using the one month T-bill with different index benchmarks. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following model:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}$$

- * Significant at the 10% level
- ** Significant at the 5% level
- *** Significant at the 1% level

Table IX: Model Specifications

Variables	<u>Green Portfolio</u>			<u>Conventional Portfolio</u>			<u>Difference Portfolio</u>		
	CAPM	Fama French	Carhart	CAPM	Fama French	Carhart	CAPM	Fama French	Carhart
4-factor alpha	-0.118*** (0.040)	-0.117*** (0.038)	-0.115*** (0.041)	-0.179*** (0.032)	-0.187*** (0.036)	-0.184*** (0.036)	0.061* (0.035)	0.070* (0.041)	0.068 (0.047)
Market	1.009*** (0.012)	1.007*** (0.014)	1.007*** (0.014)	0.979*** (0.010)	0.979*** (0.010)	0.979*** (0.010)	0.030* (0.016)	0.028* (0.016)	0.028 (0.018)
SMB		0.015 (0.031)	0.015 (0.029)		0.094*** (0.031)	0.093*** (0.031)		-0.079*** (0.018)	-0.079*** (0.017)
HML		0.010 (0.024)	0.008 (0.025)		0.008 (0.019)	0.005 (0.020)		0.002 (0.016)	0.003 (0.017)
MOM			-0.003 (0.013)			-0.004 (0.010)			0.002 (0.016)
Observations	121	121	121	121	121	121	121	121	121

Note to table IX: This table reports the estimates for the four factors and the alpha for equally-weighted portfolios, using CAPM, the Fama-French three-factor model and the Carhart four-factor model for the Jan 2007 - Jan 2017 period. Newey-West standard errors are in parentheses, correcting for serial correlation and heteroscedasticity. Regressions are made using OLS on the following models:

$$\begin{aligned}
 \text{(CAPM)} \quad & r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \varepsilon_{i,t} \\
 \text{(Fama French)} \quad & r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \varepsilon_{i,t} \\
 \text{(Carhart)} \quad & r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}r_{SMB,t} + \beta_{3,i}r_{HML,t} + \beta_{4,i}r_{MOM,t} + \varepsilon_{i,t}
 \end{aligned}$$

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

8.3 List of Funds

Green Funds

AXA World Funds - Framlington Eurozone RI – Luxembourg
Banco Euro Top 50 Etisk – Sweden
Banco Euro Top 50 Stockholm – Sweden
Danske Invest Europa Baeredygtig Indeks – Denmark
DD Property Fund NV – The Netherland
Delphi Europe – Norway
DNB Europa – Norway
DNB Europa II – Norway
Ecology Stock – Austria
Erste Responsible Stock Europe – Austria
Kempen SeNSe Fund – The Netherlands
KLP AksjeEuropa Indeks I – Norway
LBBW Nachhaltigkeit Aktien – Germany
Metropole Funds - Metropole Value SRI – France
Nordea - Institutionella Aktiefonden Europa – Sweden
Northern Trust UCITS Common Contractual Fund Europe
Custom ESG Equity Index – Ireland
Oddo Sustainability Fund – Germany
Ohman Etisk Index Europa – Sweden
SEB Cancerfonden – Sweden
SNS Duurzaam Aandelenfonds – The Netherlands
Sustainable Europe Index Fund – The Netherlands
UBI Pramerica Azionario Etico – Italy
UBS (Lux) Responsibility Fund, European Equities – Luxembourg
Vanguard Investment Series PLC - SRI European Stock Fund – Ireland

Conventional Funds

Acadian European Equity UCITS – Ireland
Acofi Gestion-Euro Select-Ic – France
Aktia Eurooppa – Finland
Alfred Berg - Aktiivinen Fokus – Finland
Allianz EuropaVision – Germany
Allianz Invest - Macquarie MS Equities Western Europe – Austria
Alm Brand Invest Europaeiske Aktier – Denmark
AMCFM Fund - European Select I – Liechtenstein
Amundi Europa Dividende Plus – Austria
Anima Geo Europa PMI – Italy
Arca Azioni Europa – Italy
Argonaut Pan European Alpha Fund – UK
Argonaut Pan Eur Dv-Eur I-A – Ireland
AXA Agipi Innovation – France
AXA Insurance Fund – Euro Value Equities EUR - Luxembourg
AXA Rosenberg Pan-European Equity Alpha Fund – Ireland
Bankinter Indice Europeo 50 FI – Spain
BBVA Bolsa Euro FI – Spain
Bel Air-Selection Europe-I – Luxembourg
Berenberg Equity Protect-R – Germany
Berenberg European Equity Se – Germany
Berenberg Osteuropa – Germany
BlackRock Active Selection Fund, EMU Index Sub Fund – UK
BMN RF Flexible FI – Spain
Caixagest Accoes Europa - Fundo de Investimento Mobiliario
Aberto de Accoes – Portugal
Caixabank Bolsa Gestion Euro FI – Spain
Caja Ingenieros Bolsa Euro Plus FI – Spain
Challenge Funds - European Equity Fund – Ireland
Danske Inverh Ak Højt U – Denmark
Danske Inv Erhverv Euro Ak E – Denmark
Danske Invest Europa Fokus – Denmark
Danske Invest-Europaindeks Fund – Denmark
Danske Invest European Small Cap – Denmark
Delta Lloyd Select Dividend Fonds NV – The Netherlands
Deutsche Quant Equity Europe SC – Germany
Dux Dividendo – Spain
Emi High Dividend I C – France
Erste Sparinvest - ESPA Stock Europe – Austria
Eurizon Azioni Europa – Italy
Evli Europe – Finland
eQ Eurooppa Kiinteisto – Finland
FBG Europe Equity – Switzerland
Ffii Europeiske Sm Cap Aktie – Denmark
First Private Dynamic Equity Allocation – Germany
First Private - First Private Europa Aktien ULM – Germany
FP Argonaut European Alpha Fund – UK
FT EuropaDynamik – Germany
Fourton Odysseus – Finland
Geam Euro Equity Fd-Ia – Ireland
Handelsinvest Europa – Denmark
Hidden Pearl Value-A – Austria
Invesco Continental European – Ireland
Janus Capital Funds PLC - Europe Fund – Ireland
Julius Meinl - Meinl Core Europe – Austria
Juno Selection Fund – The Netherlands
Jyske Invest Europaeiske Aktier – Denmark
Kutxabank Dividendo FI – Spain
Kuwait Investment Co - European Equity Fund – UK
L&G European Absolute-Ra – UK
LGT Select Equity Europe EUR – Liechtenstein
Liontrust European Abs Ret-R – UK
Melchior Selected Trust - European Opportunities Fund – Luxembourg
Millennium FIO - Subfundusz Akcji – Poland
MKB European Equity Investment Fund – Hungary
Montanaro European Income Fund – UK
Montbleu Etoiles – France
Montepio Acoes Europa – Portugal
Multi Manager Invest Europa – Denmark
NLB Skladi - Juzna srednja in vzhodna Evropa delniski – Slovenia
Nordea Invest Special Europaeiske Aktier – Denmark
Nuernberger Euroland – Germany
Optimix Europe Fund – The Netherlands
Piraeus Eurozone Equity Fund – Greece
Pioneer Akcji Europejskich F – Poland
PLUSS Europa Aksje – Norway
Premier Pan European PR-A-I – UK
Raiffeisen Index Fonds - Euro Stoxx 50 – Switzerland
Raiffeisen Kapitalanlage-Gesellschaft - GF 224 – Austria
Raiffeisen Salzburg Invest - Klassik Aktien Europa – Austria
Rinvest Alpha Fund – Liechtenstein
Santander Dividend Income Portfolio – UK
Scudo Azionario Europa – San Marino
SEB invest European Equity Fund – Denmark
SEB Invest - SEB EuroCompanies – Germany
SEB Invest - SEB Europafonds – Germany
Selectiva Europa FI – Spain
Siemens Euroinvest Aktien – Germany
Sparinvest Value Europa – Denmark
SPP Aktiefond Europa – Sweden
Swedbank Robur Indexd Europa – Sweden
Swedbank Robur Småbolag Euro – Sweden
Swisscanto CH Equity Fund Europe I – Switzerland
Swisscanto CH Equity Fund Europe II – Switzerland
Swissquote Quant Fund - European Equities EUR – Switzerland
Sydinvest Euroland – Denmark
UB European REIT Fund – Finland
Universal-Investment - Aktien Sudeuropa UI – Germany
Vegagest Azionario Area Eu-A – Italy
Wanger Eur Smaller Comps-Ei – Ireland
Warburg-D-Fonds Small&Midcaps Europa – Germany
3 Banken-Generali - GNLStock – Austria

9 References

- Areal, N., Cortez, M. and Silva, F., 2013, The conditional performance of US mutual funds over different market regimes: Do different types of ethical screens matter? *Financial Markets and Portfolio Management*, 27(4), 397-429.
- Bauer, R., Koedijk, K. and Otten, R., 2005, International evidence on ethical mutual fund performance and investment style, *Journal of Banking and Finance*, 29(7), 1751-1767.
- Berk, J. and DeMarzo, P., 2014, *Corporate Finance*. 3rd ed. England: Pearson Education, pp. 332.
- Bourghelle, D., Jemel, H. and Louche, C., 2009, The integration of ESG information into investment processes: Toward an emerging collective belief. *The Market Valuation of Non*.
- Brown, S. J., 1992, Survivorship bias in performance studies, *The Review of Financial Studies*, 5(4), 553-580.
- Capelle-Blancard, G. and Monjon, S., 2014, The Performance of Socially Responsible Funds: Does the Screening Process Matter?. *Eur Financial Management*, 20: 494–520.
- Carhart, M., 1997, On Persistence in Mutual Fund Performance, *Journal of Finance*, 52(1), 57-82.
- Chegut, A., Schenk, H. and Scholtens, B., 2011, Assessing SRI fund performance research: Best practices in empirical analysis. *Sustainable Development*, 19(2), 77-94.
- Christie, S., 2005, Is the Sharpe Ratio Useful in Asset Allocation?, *MAFC Research Papers No.31*, Applied Finance Centre, Macquarie University.
- Climent, F., Soriano, P., 2011, Green and Good? The Investment Performance of US Environmental Mutual Funds. *Journal of Business Ethics*, 103, pp. 275-287.
- Cortez, M. C., Silva, F. and Areal, N., 2012, Socially Responsible Investing in the Global Market: the Performance of US and European Funds, *Int. J. Fin. Econ.*, 17: 254–271.
- Derwall, J., Guenster, N., Bauer, R. and Koedijk, K., 2005, The Eco-Efficiency Premium Puzzle, *Financial Analysts Journal*, 61(2), 51-63.
- Eurosif - European SRI Study 2016, available at webpage: <http://www.eurosif.org/wp-content/uploads/2016/11/SRI-study-2016-HR.pdf> (last visited May 17, 2017).
- Fama, E. F. and French, K. R., 1992, The Cross-Section of Expected Stock Returns, *The Journal of Finance*, 47: pp. 427–465.
- Fama, E. F. and French, K. R., 1993, Common risk factors in the returns on stocks and bonds, *The Journal of Finance*, 33: 3-56
- Fama, E. F. and French, K. R., 1994, Multifactor explanations of asset pricing anomalies, Working paper (Graduate School of Business, University of Chicago, Chicago, IL).
- Fama, E. F. and French, K. R., 1995, Size and Book-to-Market Factors in Earnings and Returns, *The Journal of Finance*, 50: 131–155.
- Fama, E. F. and French, K. R., 1996, Multifactor Explanations of Asset Pricing Anomalies, *The Journal of Finance*, 51: 55–84.
- Fama, E. F., 1998, Market efficiency, long-term returns, and behavioral finance. *Journal of financial economics* 49.3: 283-306.
- Ferreira, M., Keswani, A., Miguel, A. and Ramos, S., 2013, The Determinants of Mutual Fund Performance: A Cross-Country Study. *Review of Finance*, 17(2), 483-525.

- Friedman, M., 1970, The social responsibility of business is to increase its profits, *New York Times Magazine*, September 13, 225–230.
- Gupta, K., 2015, Environmental Sustainability and Implied Cost of Equity: International Evidence, *Journal of Business Ethics*, Journal of Business Ethics, 12/1/2015.
- Heinkel, R., Kraus, A., and Zechner, J., 2001, The effect of green investment on corporate behaviour, *Journal of financial and quantitative analysis* 36.04: 431-449.
- Ibikunle, G. and Steffen, T., 2015, European Green Mutual Fund Performance: A Comparative Analysis with their Conventional and Black Peers, *Journal of Business Ethics*, Journal of Business Ethics, 7 September 2015.
- Jaggia, S. and Kelly, A., 2013, Business Statistics - Communicating with Numbers, USA, McGraw-Hill/Irwin, pp. 306-307.
- Jegadeesh, N. and Titman, S., 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *The Journal of Finance*, 48: 65–91.
- Jones, G.H., Jones, B.H. and Little, P., 2000, Reputation as a reservoir: buffering against loss in times of economic crisis. *Corp. Reput. Rev.* 3, 21–29
- Klassen, R.D. and McLaughlin, C.P., 1996, The Impact of Environmental Management on Firm Performance, *Management Science*, 42, 1199-1214.
- Kreander, N., Gray, R., Power, D. and Sinclair, C., 2005, Evaluating the Performance of Ethical and Non-ethical Funds: A Matched Pair Analysis. *Journal of Business Finance & Accounting*, 32(7-8), 1465-1493.
- Lesser, K., Rößle, F. and Walkshäusl, C., 2016, Socially responsible, green, and faith-based investment strategies: Screening activity matters!, *Finance Research Letters* 16: pp. 171-178.
- Lintner, J., 1965, Security prices, risk, and maximal gains from diversification, *The journal of finance* 20.4 (1965): 587-615.
- Lintner, J., 1965, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets, *The Review of Economics and Statistics*, vol. 47, no. 1, pp. 13–37.
- Luther, R. G., Matatko, J. and Corner, D.C., 1992, The Investment Performance of UK “Ethical” Unit Trusts, *Accounting, Auditing and Accountability Journal*, 5(4), 1992, Vol.5(4).
- Malkiel, B. and Fama, E., 1970, Efficient Capital Markets: A Review Of Theory And Empirical Work, *Journal of Finance*, 25(2), 383-417.
- Mallin, C., Saadouni, B. and Briston R., 1995, The Financial Performance of Ethical Investment Trusts, *Journal of Business Finance and Accounting*, 22 (4), 483-496.
- Markowitz, H., 1952, Portfolio Selection. *The Journal of Finance*, 7: 77–91.
- Markowitz, H. and Wiley J., 1959, Portfolio Selection, Efficient Diversification of Investments.
- Morgan Stanley Institute for Sustainable Investments - Sustainable Signals: The Individual Investor Perspective, available at webpage: https://www.morganstanley.com/sustainableinvesting/pdf/Sustainable_Signals.pdf (last visited May 17, 2017).
- MSCI Europe Index (USD), available at webpage: <https://www.msci.com/documents/10199/db217f4c-cc8c-4e21-9fac-60eb6a47faf0> (last visited May 17, 2017).
- Mossin, J., 1966, Equilibrium in a capital asset market, *Econometrica: Journal of the econometric society*: 768-783.
- Opdyke, J. D., 2007, Comparing Sharpe ratios: So where are the p-values?, *Journal of Asset Management*, 8(5), 308-336.

Rinblatt, M. and Titman, S., 1992, The Persistence of Mutual Fund Performance, *The Journal of Finance*, 47: 1977–1984.

Rudd, A., 1981, Social responsibility and portfolio performance, *California Management Review* 23, 55–61.

Schnietz, K. E. and Epstein, M. J., 2005, Exploring the financial value of a reputation for corporate social responsibility during a crisis, *Corp. Reput. Rev.* 7, 327–345

Sharpe, W. F., 1964, Capital Asset Prices: A Theory Of Market Equilibrium Under Conditions Of Risk, *Journal of Finance*, 19(3), 425-442.

Sharpe, W. F., 1966, Mutual Fund Performance, *The Journal of Business*, vol. 39, no. 1, pp. 119–138.

Sharpe, W. F., 1994, The Sharpe Ratio, *Journal of Portfolio Management*, Fall 49-58

Sirri, R. E. and Tufano, P., 1998, Costly Search and Mutual Fund Flows, *The Journal of Finance*, 53 (5), pp. 1589-1622.

Stoxx Index Methodology Guide (Portfolio Based Indices), available at webpage: https://www.stoxx.com/download/indices/rulebooks/stoxx_indexguide.pdf (last visited May 17, 2017).

Treynor, J. L., 1961, Market Value, Time, and Risk.

Treynor, J. L., 1966, How to rate management investment funds, *Harvard Business Review*, vol 43, no. 1 (January-February): 63-75.

US SIF 2016 Trends Report Highlights, available at webpage: <http://www.ussif.org/files/Trends/US%20SIF%202016%20Trends%20Overview.pdf> (last visited May 17, 2017).

Wooldridge, J. M., 2012, *Introductory Econometrics - A Modern Approach* 5th ed. USA: Centage Learning. pp. 105 and 432.

Databases:

Bloomberg – Bloomberg Professional service, available at the Bloomberg terminal (last visited: May 17, 2017)

French, Kenneth R. – Data Library, available at webpage: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html (last visited: March 15, 2015)

Morningstar. (2017) *Morningstar Direct*. (Online). Available at: Subscription Service (Accessed: 19 May 2017)