STOCKHOLM SCHOOL OF ECONOMICS
Department of Finance
649 Degree Project in Finance
Spring 2018

On the performance of sustainable funds during periods of crisis and non-crisis

A quantitative study of the performance of sustainable funds from 2005 to 2013 in Sweden.

Pia Lundkvist, 23741 Viktoria Nacksten, 23751

ABSTRACT

This thesis examines the financial performance of sustainable and conventional funds during the global financial crisis (2008/01-2010/12) and the time period before (2005/01-2007/12) and after (2011/01-2013/12) the crisis. Our hypothesis is that sustainable funds perform slightly worse than conventional funds in periods of non-crisis and slightly better than conventional funds in periods of crisis. To analyze the financial performance of the funds, we use the CAPM, the Fama-French three-factor model and Carhart's four-factor model. To assess the difference in financial return between sustainable and conventional funds, we include a dummy variable. The results indicate that there is no statistically significant difference in risk-adjusted return between sustainable and conventional funds before and during the global financial crisis. After the crisis, we conclude that conventional funds significantly outperform sustainable funds. This implies that during both pre-crisis and crisis periods, there is no evidence that investors suffer from investing in sustainable funds. During the post-crisis period, sustainable funds underperform financially. However, there might be other factors adding value such as improved and sustainable business practices needed for profitability in the long run. Our hypothesis regarding the three time periods is not accurate since we find no evidence that sustainable funds differ in financial performance compared to conventional funds in pre-crisis and crisis periods. We also do a sub-sample analysis of the two categories the funds invest in; Sweden and Sweden Small Cap. We find some small differences from the general result during the crisis and post-crisis period. Even though there are no large deviations, the size of the stocks the funds invest in may change the result slightly.

Key words: sustainability, sustainable funds, conventional funds, Sweden, financial performance

Supervisor: Riccardo Sabbatucci

Acknowledgements

First and foremost, we would like to thank our supervisor assistant professor Riccardo Sabbatucci at the Department of Finance, Stockholm School of Economics, for his commitment and for providing valuable insights and feedback. We would also like to thank associate professor Michael Halling for his help. Furthermore, we would like to thank family and friends for their support.

Table of Contents

1 Introduction

1.1 Background

The market for sustainable investments has undergone rapid growth during the last decade. There are several potential explanations of this, for example increased awareness about global challenges such as the global warming, and the growing interest for investors to contribute to advancements in social, environmental and governance practices (Ussif, no date). In a study conducted by Eurosif (2016) a common practice among Swedish institutional investors is to combine several sustainable investing strategies. They also argue that the most common strategy is exclusion followed by engagement and voting and norms-based screening. Swedish Investment Fund Association (2018) show in their study that sustainability is important for Swedes when choosing funds to invest in. They also state that every fourth saver in Sweden has chosen a fund because of its sustainability focus. According to a study performed by WWF (2015), 70 percent of the Swedish savers are interested in having their money in a portfolio of sustainable investments.

The definition of sustainability comprises a lot of different areas such as environmental issues, human rights and ethical issues. Sustainability is usually defined as a generation fulfilling their own needs without endangering future generations' possibilities to fulfill their needs (United Nations Commission on Sustainable Development, 2007). ESG is a common abbreviation for sustainable investments and stands for Environmental, Social and Governance. It means that the fund manager takes environmental, social and corporate governance issues into consideration.

There is a difference between ethical and sustainable investment strategies. Ethical investments often refer to the exclusion of companies that produce or distribute weapons, tobacco, alcohol, gambling or pornography. Sustainable investments identify risks and opportunities from a sustainability perspective and the investor chooses companies that handle these in a satisfying way. This means that there is a larger focus on how, rather than what, companies produce (Söderberg & Partners, 2017).

Eurosif (no date) has classified seven common sustainable investment strategies; integration, best-in-class, thematic investments, impact investing, exclusion, norms-based screening and finally engagement and active ownership. Integration means that fund managers integrate ESG opportunities and risks in their financial analyses. This means that sustainability

is quantitatively measured and included in the fundamental analysis. Best-in-class means that the best companies within each industry are chosen. An investor can also do thematic investments in for example water management or sustainable energy. Impact investing means that the asset manager tries to affect social or environmental issues and get a financial return at the same time. Exclusion and norms-based screening means that the asset manager chooses to not invest in certain companies. Exclusion means that the asset manager chooses to exclude some companies, industries or countries from their portfolio. This reduces the universe of firms a company can invest in. When an asset manager uses norms-based screening, the asset manager does not invest in companies that violates international norms and conventions from organizations, for example United Nations (UN) and UN organs such as UNICEF and UNHCR. The last strategy is engagement and active ownership which involves several strategies such as dialogue, voting on annual general meetings and collaborations.

A common discussion is whether or not savers need to refrain from financial return for the benefit of sustainability. Some people argue that sustainable investment strategies result in a lower return because the number of investment opportunities decreases, which would lead to lower diversification possibilities. Others argue that the benefits outweigh the consequences since companies not invested in are involved in unsustainable business practices that will make them less profitable. These arguments are mainly based on investments that use the exclusion strategy (Söderberg & Partners, 2017).

A lot of research has been conducted on the financial performance of sustainable investments. Hamilton, Hoje and Statman (1993) investigate the difference in the excess return of US sustainable funds compared to conventional funds in the time period 1981-1990. They find no significant difference between the funds and conclude that investors are neither worse off, nor better off, when investing sustainably. Another paper by Mallin, Saadouni and Briston (1995) confirms these results when analyzing sustainable funds compared to conventional funds in the UK in the time period 1986-1993. Friede, Bush and Bassen (2015) conducted a meta study that analyzed approximately 2200 academic studies. 90 percent of the studies found a neutral or positive relationship between ESG and a companies' financial result. However, there are not that many studies focusing on the performance of sustainable funds available on the Swedish market. Therefore, we are going to compare the financial performance of sustainable funds with conventional funds on the Swedish market during periods of crisis and non-crisis. This analysis contributes to the existing literature by further expanding the research of the performance of sustainable and conventional funds in Sweden during the global financial crisis of 2008.

1.2 Purpose

The purpose of this thesis is to explore if sustainable equity funds on the Swedish market perform better or worse than conventional equity funds on the Swedish market during a financial crisis and during periods of non-crisis. Furthermore, we will perform a sub-sample analysis where we divide the sample into their investment categories, Sweden and Sweden Small Cap, to make sure that there are no large differences that could affect the result.

2 Literature review

This section covers previous research on the financial performance of sustainable and conventional funds during periods of crisis and non-crisis. Secondly, we will briefly present studies on the performance of small-cap and large-cap stocks.

2.1 Performance of sustainable funds compared to conventional funds

Nofsinger and Varma (2014) conducted a study on the performance of 250 US socially responsible mutual funds and conventional mutual funds during the time period 2000-2011. They conclude that socially responsible funds outperform during periods of market crises due to lower downside risk. However, as a result of this, socially responsible mutual funds underperform during non-crisis periods. Moreover, they argue that this is caused by the sustainable attributes the socially responsible mutual funds have, and not by differences in fund portfolio management or the characteristics of the company holdings. The socially responsible mutual funds' outperformance in periods of crisis, is driven by their focus on shareholder advocacy and ESG issues. Furthermore, it is funds using positive screening rather than negative screening that tend to outperform.

Nakai, Yamaguchi and Takeuchi (2016) compare socially responsible funds and conventional funds on the Japanese market during the global financial crisis in 2008. They use the bankruptcy of Lehman Brothers and conduct an event study. They find that the bankruptcy positively affected the sustainable funds' financial performance while the conventional funds' performance suffered. The authors argue that a possible reason for this may be that companies targeting corporate social responsibility (CSR) have a sound long-term strategy. Therefore, the company might be more forward-looking than its competitors. Moreover, the CSR activity is believed to be a factor that can induce stable development for firms. Therefore, socially responsible funds should have been less sold than conventional funds during the day of the bankruptcy filing.

Muñoz, Vargas and Marco (2014) study US and European environmental mutual funds and their financial performance compared to conventional funds and other forms of socially responsible funds. The US socially responsible funds obtain statistically insignificant performance in periods of crisis but underperform compared to the market during normal periods. The European socially responsible funds obtain statistically insignificant performance

irrespective of crisis or normal periods. They also find that green funds in both the US and in Europe did not perform worse than any other socially responsible fund.

Leite and Cortez (2015) also conducted a study of socially responsible funds during crisis and non-crisis periods. They focus on French funds investing in Europe, and their results show that socially responsible investment funds significantly underperform conventional funds during periods of non-crisis. However, socially responsible investment funds matched the performance of conventional funds during crisis. They also find that socially responsible investment funds using positive screening, and not negative screening, perform similarly to conventional funds in periods of crisis and non-crisis. They argue that the significant underperformance of socially responsible investment funds during non-crisis periods is driven by funds that use negative screening. Moreover, socially responsible investment funds that does not use negative screens are more similar to conventional funds with regards to the investment styles.

Bredal and Negård (2015) evaluate the performance of socially responsible indices. By using an approach based on the Fama-French three factor model, they study the risk-adjusted performance of five socially responsible indices and their conventional benchmarks. They assume that socially responsible screening leads to more idiosyncratic risk and therefore, the risk-adjusted returns will be lower during market downturns. Moreover, they argue that socially responsible investors with a long investment horizon should not have worse financial returns.

Lastly, Christensson and Skagestad (2017) compare the performance of sustainable and conventional mutual funds in emerging markets. They compare performance and risk factor exposure of sustainable and conventional mutual funds in emerging markets from 2012-2017. Moreover, they study the funds during three different economic cycles: steady development, recession and recovery. They find no statistically significant difference in risk-adjusted returns between sustainable and conventional funds, but also that conventional funds outperform sustainable funds during periods of recovery.

2.2 Difference in performance between small cap and large cap stocks

Boström and Petersson (2011) study Swedish small and large-cap funds during crisis (2008-2010) and pre-crisis (2001-2007). They find that small-cap funds outperform large-cap funds in every time period in regard to the risk-adjusted return. This means that small cap funds seem to be a superior investment option, due to the evidence of size premium, despite the economic

downturn. The investor will get a lower return when investing in small-cap funds during the period of crisis compared to the pre-crisis period, but the return is still higher than the return from investing in large-cap funds.

Kilbert and Subramanian (2010) compare the performance of small-cap and large-cap stocks during the financial crisis 2007-2008. Furthermore, they capture the small-cap premium by investigating in active versus passive processes of investing. They find that small-cap stocks suffered more than large-cap stocks during the global financial crisis of 2007-2008. However, the small-cap stocks also rebounded faster. In addition, they conclude that small-cap stocks are often perceived as risky compared to large-cap stocks, but that small-cap stocks have other characteristics that creates possibilities for portfolio diversification and return enhancement.

3 Hypothesis

This section explains the hypothesis we explore in the thesis. It is mainly based on previous research but also on our own assessments and beliefs.

Hypothesis: Sustainable funds perform slightly worse than conventional funds in periods of non-crisis and slightly better than conventional funds in periods of crisis.

We expect sustainable funds to perform slightly better compared to conventional funds during periods of crisis. We believe that sustainable funds invest in companies that takes sustainability risks and opportunities into account, and therefore should these funds have lower downside risk. However, due to this, sustainable funds will perform worse than conventional funds during periods of non-crisis. This view is supported by Nofsinger and Varma (2014) who conclude that sustainable funds outperform conventional funds during periods of market crisis but underperform during periods of non-crisis. They also argue that companies taking sustainability into account make them less risky in market crisis periods, because these companies can successfully handle the challenges of the crisis. Nakai, Yamaguchi and Takeuchi (2016) also find that sustainable funds seem to outperform conventional funds during market crisis, but not under periods of non-crisis. Moreover, they find that a company targeting CSR would induce a more stable development, and subsequently kept them during the bankruptcy filing.

4 Data

The following section explains the collection of the dataset used in the thesis, as well as some critique. First, the data sources will be explained. Secondly, we will describe the Swedish Pension Agency's label and Swesif's Sustainability Declaration for Funds that is used to create our sample. After that, we explain how the sample is created and describe the data collected. Lastly, we discuss some potential data issues.

4.1 Data sources

The main data source is the analysis platform Morningstar Direct, which is an independent provider of investment research. Morningstar provides data and research insights on a wide range of investment offerings and is built to help investors make investment decisions and to reach their financial goals (Morningstar, no date). We use this platform to collect the return series, inception dates, fund identification numbers and categories. The Fama-French factors for the Swedish market are retrieved from Swedish House of Finance Research Data Center. We use The Swedish Pension Agency and Swesif's Sustainability Declaration for Funds to create the sample of sustainable funds.

4.2 The Swedish Pension Agency

The Swedish Pension Agency has a label, called M/E label, for funds that takes environmental and/or ethical consideration when investing. In order to get the label, funds need to inform about their work with sustainability at Swesif's Sustainability Declaration for Funds. Moreover, the fund manager need to have the following (Pensionsmyndigheten, no date):

- A well-defined process for investing with consideration for the environment and/or ethical issues.
- This sustainable orientation must be clearly specified in information and marketing.
- The fund company must monitor the sustainable orientation systematically and regularly.
- The fund company must follow the sustainable orientation when making investments.

4.3 Swesif's Sustainability Declaration for Funds

Swesif is an independent non-profit forum for organizations working with sustainable investments in Sweden. The purpose is to provide clear and easily accessible information regarding the sustainability work of funds. It is a standardized information leaflet for funds who state that they consider sustainability issues. Important to notice is that it is a self-declaration and that the information has not been reviewed or approved by Swesif. It is not a certification, label or quality stamp, but an information standard where fund companies can report how their funds take sustainability into account (Swesif, no date).

4.4 Creating the sample

To analyze the performance of sustainable and conventional equity funds on the Swedish market, the first criteria to be fulfilled is that the funds are available to Swedish savers. Funds investing in for example fixed income are excluded. Moreover, only funds that invest mainly in Swedish equities are included. The time period is limited from 2005-01-01 to 2013-12-31 in order to analyze how sustainable funds performed compared to conventional funds before, during and after the global financial crisis.

To create the sample, we use The Swedish Pension Agency's list of equity funds included in the premium pension system. Since the focus of this thesis is to analyze the funds' performance before, during and after the financial crisis, only funds with an inception date prior to 2005-01-01 is included in the sample. The inception dates are collected from Morningstar.

Some of the funds in the sample have the same FundID[1], meaning that the funds are invested in the exact same portfolio. These funds have different SecID[2], meaning that they represent different share classes of the same fund. To avoid including multiple funds that are invested in the same portfolios, giving the same return before expenses, only one FundID is kept. One fund[3] was excluded because it was missing monthly return for some months.

The sample of the sustainable funds is based on the Swedish Pension Agency M/E label. This label is described more thoroughly in section 4.2. Since many funds have received the M/E label, we want to reduce the sample of sustainable funds. Therefore, we use Swesif's Sustainability Declaration for Funds to identify sustainable funds with relatively similar

[1] Used by Morningstar to identify funds.
[2] Used by Morningstar to identify different share classes.
[3] Monyx Svenska Aktier.

investment strategies. Subsequently, we choose funds where the asset manager takes sustainability issues into account when making investments. This means that funds that do not have an M/E label, or have an M/E label but do not live up to this requirement, are assumed to be conventional. In total, our sample is based on16 sustainable and 17 conventional funds.

4.5 Data and variables

The funds' return series during the period 2005-01-01 to 2013-12-31 is downloaded from Morningstar Direct. The variable "Total Return" on a monthly basis in SEK is used, and it is calculated by taking the change in monthly net asset value, reinvesting all income and capital-gains distributions that occurred during the month, and dividing it with the starting NAV (Morningstar Direct, no date). Furthermore, the funds' category benchmark indices and their returns are retrieved from Morningstar Direct. The indices are MSCI Sweden NR SEK and MSCI Sweden Small Cap NR SEK.

When deciding the risk-free rate, the market that is examined needs to be considered. Since this thesis analyzes Swedish equity funds, the risk-free rate is the 1-month Swedish T-bill. The risk-free rate is retrieved from Swedish House of Finance Research Data Center. The market factor is the index MSCI Sweden NR SEK for funds investing in the category Sweden, and the index MSCI Sweden Small Cap NR SEK for funds investing in Sweden Small Cap. The returns for the indices was retrieved from Morningstar Direct. The Small Minus Big, High Minus Low and Momentum factor was extracted from Swedish House of Finance Research Data Center and are calculated over every Swedish stock.

4.6 Potential data issues

Funds that are closed or merged during the period of investigation are not included in the dataset. This means that the results of this thesis may suffer from survivorship bias. Consequently, the returns may be overestimated, and the conclusions may therefore differ from a sample where closed or merge funds are included (Rohleder, Scholz and Wilkens, 2007). However, since our sample is based on the Swedish Pension Agency's label and Swesif's Sustainability Declaration for Funds, it would be difficult to create a sample with closed or merged funds since they do not have a M/E label or a sustainability declaration at Swesif. Therefore, it would not be suitable for this thesis to include closed or merged funds.

Furthermore, it can be assumed that the closed or merged funds are divided equally between the sample of sustainable funds and conventional funds.

Swesif's sustainability declaration for funds is not reviewed by Swesif since it is a self-declaration, and it is therefore not a certification, label or quality stamp. This means that each fund company is responsible for the information. As a consequence, there is no independent actor reviewing the information. Since one of the criteria to get a M/E label at the Swedish Pension Agency's premium pension system is to report in accordance with Swesif's Sustainability Declaration for Funds, this label will also be affected by this weakness. Furthermore, there is no universal definition of sustainability, which we learned when creating our data sample. Depending on the label or certification used, the sample of funds will be different which may affect the outcome of the analysis.

Two other weaknesses with the dataset are that we assume that the funds are sustainable for the entire period and that we use monthly returns. In order to conduct this thesis, it is necessary to make the assumption that sustainable funds today also were sustainable in the time period studied. Previous similar studies also make this assumption. Monthly returns are chosen in order to avoid the noise resulting from daily data. However, the use of monthly returns gives relatively few observations which can potentially affect the result.

Another criticism towards our dataset is the small size of the sample. A small sample size can according to Deziel (2018) potentially limit the accuracy of the study and increase the error-margin. Furthermore, a small sample size also reduces the number of total observations in the research, which also reduces the confidence level of the study. In this study, we were constrained by the amount of sustainable and conventional funds available in Swedish Pension Agency premium pension system, that also have an inception date prior to 2005.

5 Method

5.1 Models

First, we use the Capital Asset Pricing Model (CAPM) to capture the performance of the sustainable and conventional funds. In addition, the risk factors from the Fama-French three-factor model and Carhart's four-factor model are added in order to make a more complete assessment of the risk-adjusted performance. The data is structured as panel data, meaning that we have multi-dimensional data measured over time. In order to be able to explore our hypothesis, a model with a dummy variable is created that measures the difference in return between sustainable and conventional funds. This model is presented in section 5.1.4. below.

When running the regressions with the CAPM, the Fama-French three-factor model and Carhart's four-factor model, the coefficient of largest interest is alpha which indicates if the funds outperform their factor benchmarks. The following hypothesis is used:

$H_0: \alpha = 0$
$H_1: \alpha \neq 0$

We will analyze and comment upon the other risk factors in a similar way. In general, the null hypothesis indicates that there is no relationship between the factor and the risk-adjusted return and the alternative hypothesis indicates that there is a relationship.

In order to test our hypothesis for this thesis, we need to run the regression with a dummy variable included. The coefficient of interest is the coefficient in front of the dummy variable. It indicates if there is a difference in risk-adjusted return between sustainable funds and conventional funds. The following hypothesis is used:

H_0: No difference in financial performance between sustainable and conventional funds ($\beta^{SUST} = 0$)
H_1: There is a difference in financial performance between sustainable and conventional funds ($\beta^{SUST} \neq 0$)

5.1.1 The Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) is commonly used when evaluating the performance of portfolios. The model measures the risk and explains the relationship between risk and the expected return. The total risk in a portfolio can be divided into two groups; systematic and unsystematic risk. The systematic risk concerns market risk and cannot be diversified away. Unsystematic risk is not correlated with the market and can therefore be diversified away. The beta coefficient shows the systematic risk and indicates to what extent an investor should be compensated for taking on additional risk. The unsystematic risk is measured by the residual standard deviation and it measures the accuracy of the expected return of the fund (Berk and DeMarzo, 2011).

The Capital Asset Pricing Model describes the funds' excess return by looking at the market. The alpha shows if the funds have outperformed or underperformed its benchmark. The model is presented below:

$$r_t - rf_t = \alpha + \beta^{rM} * (rM_t - rf_t) + u_t \quad (1)$$

Definition of variables:

$r_t - rf_t$ = Return at time t minus the risk-free rate at time t

α = Risk adjusted excess return

β^{rM} = Sensitivity to market fluctuations

rM_t = Market return at time t

rf_t = Risk-free rate at time t

u_t = Error term at time t

5.1.2 Fama-French three-factor model

Fama and French (1992) identify three stock-market factors in their study; the overall market factor and factors related to firm size and book-to-market equity. They find that during the period between 1963 and 1990, size and book-to-market equity capture the cross-sectional variation in average stock returns. They also find that the negative relation between size and average return is robust, even when including other variables. Moreover, the positive relation between book-to-market equity and average return also hold when including other variables. The book-to-market equity has a stronger role in explaining average returns compared to the

size effect. The two variables are presented by two portfolios, Small Minus Big (SMB) and High Minus Low (HML). By adding these factors, we get the following model:

$$r_t - rf_t = \alpha + \beta^{rM} * (rM_t - rf_t) + \beta^{SMB} * SMB_t + \beta^{HML} * HML_t + u_t \quad (2)$$

Definition of additional variables:

β^{SMB} = Exposure to size factor

SMB_t = Size factor at time t

β^{HML} = Exposure to book-to-market equity factor

HML_t = Book-to-market factor at time t

5.1.3 Carhart's four-factor model

To further interpret the funds' performance, we add the risk factor Momentum (MOM) to the model. This is in line with Carhart's four-factor model. The risk factor Momentum exhibits the likelihood of a continuing rise in the price of a company that recently experienced a rise and the tendency to continue declining in price if it recently went down. In most cases, being exposed to firms that recently experienced superior returns make it likely to achieve positive excess returns in the upcoming period (Carhart, 1997). The model with all four risk factors is presented below:

$$r_t - rf_t = \alpha + \beta^{rM} * (rM_t - rf_t) + \beta^{SMB} * SMB_t + \beta^{HML} * HML_t + \beta^{MOM} * MOM_t + u_t \quad (3)$$

Definition of additional variables:

β^{MOM} = Exposure to momentum factor

MOM = Momentum factor at time t

5.1.4 Dummy model

In order to compare the risk-adjusted performance of sustainable and conventional funds, and thereby test our hypothesis, one more model is used. In this model we create a dummy variable called "Sustainable" in order to compare the risk-adjusted performance between sustainable and conventional funds. The dummy variable is created in the following way:

$$Sustainable_i = \begin{cases} 1\ if\ sustainable\ fund \\ 0\ if\ conventional\ fund \end{cases}$$

This gives us the following model:

$$r_t - rf_t = \alpha + \beta^{rM} * (rM_t - rf_t) + \beta^{SMB} * SMB_t + \beta^{HML} * HML_t + \beta^{MOM} * MOM_t + \beta^{SUST} * Sustainable_i + u_t \quad (4)$$

Definition of variables not already defined:

β^{SUST} = The difference in risk-adjusted return for sustainable funds compared to conventional funds

$Sustainable_i$ = Dummy variable defined above

5.2 Model selection

When having a panel data set, it is important to choose the right model; fixed effects, random effects or pooled OLS model (Torres-Reyna, 2007). In order to decide which model to use, we conduct a Hausman test to find if the fixed effects model (FE) or the random effects model (RE) is most suitable. After that, we use the Breusch-Pagan Lagrange Multiplier test to decide between pooled OLS model (POLS) and RE. The Hausman test analyzes if the individual specific error terms are correlated with the regressors. If the random effects model is similar to the fixed effect model, random effects model will be chosen since it is a more efficient estimator. This means that individual specific error terms are uncorrelated with the regressors, making POLS consistent too. When conducting the Hausman test, the hypotheses are the following:

H_0: Difference in coefficients is not systematic and therefore, RE is the preferred model.

H_1: Difference in coefficients is systematic and therefore, FE is the preferred model.

We test the following:

$$W = \frac{\left(\widehat{\beta_{FE}} - \widehat{\beta_{RE}}\right)^2}{Var\left(\widehat{\beta_{FE}}\right) - Var\left(\widehat{\beta_{RE}}\right)} \sim \chi^2 \quad (5)$$

Since the Hausman test shows both RE and POLS to be consistent, we must test which model to use. If there are unobserved effects for every individual, or group of individuals, over a specified time, the panel data will suffer from serial correlation and therefore RE should be used. If not, POLS would be preferred. This can be tested with the Breusch-Pagan Lagrange Multiplier test (Torres-Reyna, 2007). The results from the tests show that POLS should be used. When conducting the Breusch-Pagan Lagrange Multiplier test, the hypothesis is the following:

H_0: Variances across entities is zero.
H_1: Variances across entities is not zero.

We test the following:

$$\lambda_{LM} = \frac{(n\bar{T})^2}{2}\left(\frac{A_1^2}{(\sum_i T_i^2) - n\bar{T}}\right) \sim \chi^2 \quad (6)$$

$$\text{Where } A_1 = 1 - \frac{\sum_{i=1}^{n}\left(\sum_{t=1}^{T_i} v_{it}\right)^2}{\sum_i \sum_t v_{it}^2} \quad (7)$$

5.3 Additional issues

To make sure that the results are valid, there are certain requirements that needs to be met. In this section we will describe the statistical tests performed.

5.3.1 Heteroscedasticity

Heteroscedasticity means that the variance in the error terms is not constant. This means that when the value of an independent variable increases, the unexplained variation in the dependent variable will increase or decrease. OLS requires the error terms to be as small as possible in order to give correct coefficients, meaning that the error terms need to be constant (homoscedastic). If this is not true, the standard errors for the coefficient will be larger or smaller than what they should be and therefore, the significance tests are not correct.

When the variance of the error term is not constant, heteroscedasticity is present. This can be tested with a Breusch-Pagan test. In order to solve the problem of heteroscedasticity, the regressions are performed with robust standard errors.

5.3.2 Multicollinearity

Multicollinearity means that some of the independent variables are highly correlated with each other. If multicollinearity is present, it will be hard to separate the effects of the two variables on the dependent variable. In order to test the presence of multicollinearity, we studied the Variance Inflation Factor (VIF). No multicollinearity was found.

5.3.3 Autocorrelation

Autocorrelation means that the error term of one variable correlates with another variable's error term, which implies that the covariance of the error terms is not zero. If autocorrelation is present, the results in the OLS will not be reliable. This is tested by using the Wooldridge test for autocorrelation in panel data. In some cases, autocorrelation was present and adjusted for in the regressions.

6 Summary Statistics

The sample consists of 16 sustainable funds and 17 conventional funds. Table 1 show summary statistics for the dependent variable, monthly excess return. The table is divided into the three different time periods and the conventional and sustainable funds.

Table 1: Summary statistics for sustainable and conventional funds

Table 1 shows descriptive statistics for sustainable and conventional funds during three different time periods, pre-crisis (2005/01-2007/12), crisis (2008/01-2010/12) and post-crisis (2011/01-2013/12). The table is based on the dependent variable describing monthly return minus the risk-free rate (excess return) of the funds. It illustrates the number of observations, the mean return, the standard deviation and the minimum and maximum monthly excess return in the sample.

	Count	***Mean***	***Sd***	***Min***	***Max***
Pre-crisis					
Sustainable	576	0.0139024	0.0391863	-0.1167503	0.1138493
Conventional	612	0.0132028	0.0411198	-0.1151935	0.1243957
Crisis					
Sustainable	576	0.0063761	0.0740632	-0.2168852	0.2623395
Conventional	612	0.0067854	0.074697	-0.2118067	0.3384908
Post-crisis					
Sustainable	576	0.005858	0.0446133	-0.1243719	0.1376749
Conventional	612	0.0068474	0.0438203	-0.131389	0.140842

As illustrated in the table above, the average monthly excess return is very similar between sustainable and conventional funds. Moreover, the minimum and maximum value is also similar between sustainable and conventional funds. The average return of sustainable and conventional funds during pre-crisis was around 1.3%, whereas it decreased to approximately 0.7% during the crisis and 0.6% and 0.7% respectively during the post-crisis period.

The interval in which the monthly excess return moves is from the minimum return of approximately -12% to the maximum return of around 12% both during the pre-crisis period and the post-crisis period. However, this interval increases during the global financial crisis with a minimum excess return of -20% for both sustainable and conventional funds, and a maximum excess return of 26% for the sustainable funds and 34% for the conventional funds.

7 Results

In this section we present the results from the analysis. First, we explore if sustainable equity funds perform better or worse than conventional equity funds during the global financial crisis and during periods of non-crisis. Furthermore, we conduct a sub-sample analysis since previous research show that small-cap stocks perform differently than large-cap stocks. We want to control if there is a difference in our results depending on which category the funds invest in. This is done in order to make sure that our results are not affected by the investment category.

The first four sections present the result to our hypothesis: sustainable funds perform slightly worse than conventional in periods of non-crisis and slightly better than conventional funds in periods of crisis. After that we present the sub-sample analysis of the categories Sweden and Sweden Small Cap.

7.1 Performance during the pre-crisis period

This section presents the performance of sustainable and conventional funds during the period before the global financial crisis (2005/01-2007/12). Table 2 reveals the results from the CAPM, the Fama-French three-factor model and Carhart's four-factor model. The alpha shows the performance of the funds compared to their factor benchmark. Table 3 present the difference in performance between sustainable and conventional funds through the dummy variable Sustainable. This is done in order to test our hypothesis.

Table 2: Sustainable and conventional funds during the pre-crisis period

This table shows the regression results from regressions based on the CAPM, the Fama-French three-factor model and Carhart's four-factor model in the period between 2005/01 to 2007/12. The regressions are performed for both sustainable and conventional funds. The regressions are carried out with robust standard errors. The dependent variable is the funds' return minus the risk-free rate (excess return), and the table reports the regression of the funds' excess return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is increasing slightly when adding risk factors, implying that the fit of the model is better.

	α	β(rM-rf)	βSMB	βHML	βMOM	R^2	OBS
CAPM							
Sustainable	0.00261***	0.862***				0.856	576
	(0.000312)	(0.0264)					
Conventional	0.00218***	0.877***				0.798	612
	(0.000436)	(0.0184)					
Fama-French							
Sustainable	0.00262***	0.859***	0.0217	0.000389		0.856	576
	(0.000308)	(0.0272)	(0.0177)	(0.00784)			
Conventional	0.00220***	0.870***	0.0594**	0.00740		0.802	612
	(0.000422)	(0.0202)	(0.0220)	(0.0241)			
Carhart							
Sustainable	0.00367***	0.874***	-0.0694***	-0.00436	-0.142***	0.862	576
	(0.000340)	(0.0252)	(0.0130)	(0.00885)	(0.0346)		
Conventional	0.00270***	0.876***	0.0172	0.00531	-0.0661	0.803	612
	(0.000340)	(0.0204)	(0.0292)	(0.0242)	(0.0412)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

Looking at the CAPM we see that sustainable funds have a statistically significant alpha of 0.261% and conventional funds have a significant alpha of 0.218%. This means that both sustainable and conventional funds tend to outperform their factor benchmark. We can also see that sustainable funds tend to have a larger alpha than conventional funds. However, we are not able to conclude if the difference in performance between sustainable and conventional funds is statistically significant. To test this, we will conduct a regression with the dummy model, shown in table 3. Moreover, we notice that both sustainable and conventional funds are significantly underexposed to the market portfolio with a beta below 1. This indicates that both the sustainable and the conventional funds are less volatile than the market.

By including more risk factors in form of SMB and HML through the Fama-French three-factor model, the alphas of both sustainable and conventional funds are still statistically significant. The alphas in this model are similar to the alphas from the CAPM model. Sustainable and conventional funds are still underexposed to the market portfolio. Conventional funds are significantly exposed, on a 5% significance level, to small capitalization

companies, while sustainable funds are insignificantly exposed to small capitalization firms. We also find that both sustainable and conventional funds are positively exposed to value companies, however the exposure is not statistically significant.

Carhart's four-factor model adds a fourth risk factor called Momentum (MOM) to the regression. Sustainable funds have a statistically significant alpha of 0.367%, while conventional funds have a statistically significant alpha of 0.270%. This means, similarly to the CAPM and the Fama-French three-factor model, that sustainable and conventional funds outperform the market during pre-crisis periods. Sustainable funds have a statistically significant exposure towards large capitalization firms. Moreover, sustainable funds have a significant negative exposure to the momentum strategy. The funds have no other statistically significant exposures to the other risk factors.

The result in the table above indicates that sustainable and conventional funds do not perform significantly different when adjusting for the risk factors exposure. However, to be able to capture the difference between sustainable funds and conventional funds with respect to financial performance, we create a dummy variable that is included in the regression with Carhart's four-factor model. This dummy represents the change from the conventional funds' alpha for sustainable funds.

Table 3: Dummy model during the pre-crisis period

This table shows the regression results from running the dummy model, based on Carhart's four-factor model and a dummy variable that takes the value 1 if the fund is sustainable, and zero if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2005/01-2007/12. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The r-squared (R^2) is 0,829 which indicates that the fit of the model is good.

	α	***β(rM-rf)***	***βSMB***	***βHML***	***βMOM***	***βSust.***	R^2	***OBS***
Dum	0.00306***	0.875***	-0.0248	0.00063	-0.103***	0.00023	0.829	1,188
	(0.000393)	(0.0159)	(0.0178)	(0.0130)	(0.0275)	(0.000622)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Dum = Dummy model

In the table above, we see that the dummy variable exhibits an insignificant value of 0.00023. This indicates that even though sustainable funds experience a higher risk-adjusted return than conventional funds, the result is not statistically significant. Hence, there is no statistically significant difference in financial performance between sustainable and conventional funds in the period before the global financial crisis.

7.2 Performance during the crisis period

This section presents the performance of sustainable and conventional funds during the global financial crisis (2008/01-2010/12). Table 4 shows the results from the CAPM, the Fama-French three-factor model and Carhart's four-factor model. The alpha indicates the performance of the funds compared to their factor benchmark. Table 5 shows the difference in performance between sustainable and conventional funds through the dummy variable Sustainable in order to test our hypothesis.

Table 4: Sustainable and conventional funds during the crisis

This table shows the regression results from regression based on the CAPM, the Fama-French three-factor model and Carhart's four-factor model in the period from 2008/01 to 2010/12. The regressions are performed for both sustainable and conventional funds. The regressions are carried out with robust standard errors. The dependent variable is the funds' return minus the risk-free rate (excess return), and the table reports the regression of the funds' excess return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is increasing slightly when adding risk factors, implying that the fit of the model is better.

	α	β(rM-rf)	βSMB	βHML	βMOM	R^2	OBS
CAPM							
Sustainable	0.00166***	0.909***				0.936	576
	(0.000521)	(0.0372)					
Conventional	0.00204***	0.919***				0.906	612
	(0.000687)	(0.0258)					
Fama-French							
Sustainable	0.00182***	0.910***	-0.00396	-0.0224		0.936	576
	(0.000511)	(0.0374)	(0.00684)	(0.0150)			
Conventional	0.00247***	0.924***	-0.0134	-0.0664***		0.906	612
	(0.000601)	(0.0262)	(0.00884)	(0.0148)			
Carhart							
Sustainable	0.00130***	0.912***	-0.000872	0.0369	0.0573**	0.937	576
	(0.000436)	(0.0373)	(0.00651)	(0.0280)	(0.0205)		
Conventional	0.00180***	0.926***	-0.00945	0.0100	0.0739*	0.908	612
	(0.000582)	(0.0255)	(0.00787)	(0.0355)	(0.0358)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

The CAPM reveals that both sustainable and conventional funds significantly outperform the market, with alphas of 0.166% and 0.204% respectively. However, the alphas are lower compared to the alphas during the pre-crisis period, indicating that the financial performance was lowered for both sustainable and conventional funds during the global financial crisis. Moreover, we can also see that conventional funds tend to have a higher alpha than sustainable

funds, which is the opposite compared to the pre-crisis period. Since we are not able to conclude if the difference in financial performance between sustainable and conventional funds are statistically significant, we need to do a second regression including a dummy variable. This is presented in table 5. Both sustainable and conventional funds are significantly underexposed to the market portfolio, indicating that the funds are less volatile than the market, similarly to the pre-crisis period.

When adding the risk factors SMB and HML in the Fama-French three factor model, we notice that the alphas are still positive and statistically significant for both sustainable and conventional funds. Both sustainable and conventional funds are insignificantly exposed to large capitalization firms during the period of the crisis. Moreover, the coefficients for the HML factor are negative for both the sustainable and conventional funds, indicating that they are more exposed to growth companies. This exposure is only significant for conventional funds.

Carhart's four-factor model shows that the alpha is still positive and statistically significant for both sustainable and conventional funds during the global financial crisis. The alpha is 0.130% for sustainable funds and 0.180% for conventional funds. This indicates that conventional funds tend to experience a higher risk-adjusted return than sustainable funds. Both sustainable and conventional funds seem to be more exposed to large capitalization firms, however the exposure is not statistically significant. They also seem to be exposed to value firms, but this is also not statistically significant. However, the momentum factor is positive for both sustainable and conventional funds. The exposure is significant on a 5% significance level for sustainable funds and on a 10% significance level for conventional funds.

To test our hypothesis regarding the difference in financial performance between sustainable and conventional funds, we include a dummy variable. The dummy represents the change from the conventional funds' alpha for sustainable funds.

Table 5: Dummy model during the crisis

This table shows the regression results from running the dummy model, based on Carhart's four-factor model and a dummy variable that takes the value 1 if the fund is sustainable, and zero if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2008/01-2010/12. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The r-squared (R^2) is 0,922 which indicates that the fit of the model is good.

	α	β(rM-rf)	βSMB	βHML	βMOM	βSust.	R^2	OBS
Dum	0.00177***	0.919***	-0.0053	0.023	0.0659***	-0.00044	0.922	1,188
	(0.000590)	(0.0222)	(0.00510)	(0.0225)	(0.0207)	(0.00076)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Dum = Dummy model

Carhart's four-factor model in table 4 show that the alpha for sustainable funds were smaller than for conventional funds, indicating that conventional funds perform better than return sustainable funds. Table 5 shows that the coefficient to the dummy variable is -0.00044, indicating that sustainable funds experience a lower return than conventional funds, but we cannot conclude any statistically significant difference in the financial performance.

7.3 Performance during the post-crisis period

This section presents the performance of sustainable and conventional funds during the period after the crisis (2011/01-2013/12). Table 6 shows the results from the CAPM, the Fama-French three-factor model and Carhart's four-factor model. The alpha indicates the performance of the funds compared to their factor benchmark. Table 7 shows the difference in performance between sustainable and conventional funds through the dummy variable Sustainable in order to test our hypothesis.

Table 6: Sustainable and conventional funds during the post-crisis period

This table shows the regression results from regression based on the CAPM, the Fama-French three-factor model and Carhart's four-factor model in the period between 2011/01 to 2013/12. The regressions are performed for both sustainable and conventional funds. The regressions are carried out with robust standard errors. The dependent variable is the funds' return minus the risk-free rate (excess return), and the table reports the regression of the funds' excess return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is high, implying that the fit of the model is good.

	α	$\beta(rM-rf)$	βSMB	βHML	βMOM	R^2	OBS
CAPM							
Sustainable	-0.000606	1.029***				0.932	576
	(0.000448)	(0.0160)					
Conventional	0.000867	0.994***				0.902	612
	(0.000555)	(0.0262)					
Fama-French							
Sustainable	-0.000671	1.031***	0.0160*	0.0172		0.932	576
	(0.000508)	(0.0156)	(0.00784)	(0.0106)			
Conventional	0.000616	0.996***	0.0343**	0.0224*		0.903	612
	(0.000521)	(0.0256)	(0.0139)	(0.0125)			
Carhart							
Sustainable	-0.000698	1.031***	0.0173*	0.0168	0.00243	0.932	576
	(0.000458)	(0.0157)	(0.00900)	(0.0106)	(0.00873)		
Conventional	0.000750	0.996***	0.0277**	0.0243*	-0.0122	0.903	612
	(0.000490)	(0.0257)	(0.0110)	(0.0126)	(0.0115)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses

Using the CAPM, the result shows that sustainable funds achieve a negative insignificant alpha of 0.0606%. This indicates that sustainable funds underperform their benchmark during the period after the global financial crisis. The conventional funds have a positive, but insignificant, alpha of 0.0867% which indicates that these funds tend to perform better than their benchmark factor. Furthermore, sustainable funds have a significant overexposure to the market factor, whereas conventional funds have significant underexposure to the market factor. This implies that sustainable funds are more volatile than the market, whereas conventional funds are less volatile than the market.

By adding the risk factors SMB and HML through the Fama-French three-factor model, the alpha of sustainable funds is -0.0671%. The alpha is negative, indicating that sustainable funds underperform their benchmark factor, but it is insignificant. Conventional funds have a positive, but insignificant alpha of 0.0616%. Sustainable funds have significant overexposure to the market factor and conventional funds have significant underexposure to the market factor, similar to the results from the CAPM model. The exposure to the SMB factor

is positive and significant on a 10% significance level for sustainable funds, and significant on a 5% significance level for conventional funds. This means that both sustainable and conventional funds are exposed to small capitalization firms. The coefficients for the HML factor are positive, indicating an exposure towards value firms, but it is only statistically significant on a 10% significance level for conventional funds.

By adding the fourth risk factor Momentum through Carhart's four-factor model, the results are very similar to the Fama-French three-factor model. Alpha is still statistically insignificant and negative for sustainable funds, and statistically insignificant and positive for conventional funds. As explained above, this indicates that sustainable funds tend to underperform their benchmark factor, while conventional funds outperform their benchmark factor. However, the results are not statistically significant. Regarding the risk factor exposure, we get similar results as with the Fama-French three-factor model. Furthermore, the sustainable funds are positively exposed to the momentum factor, but it is not significant. The conventional funds are negatively and insignificantly exposed to the momentum factor.

To test our hypothesis regarding the difference in financial performance between sustainable and conventional funds, we include a dummy variable. The dummy represents the change from the conventional funds' alpha for sustainable funds.

Table 7: Dummy model during the post-crisis period

This table shows the regression results from running the dummy model, based on Carhart's four-factor model and a dummy variable that takes the value 1 if the fund is sustainable, and zero if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2011/01-2013/12. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The r-squared (R^2) is 0,917 which indicates that the fit of the model is good.

	α	β(rM-rf)	βSMB	βHML	βMOM	βSust.	R^2	OBS
Dum.	0.000659	1.013***	0.0227***	0.0208**	-0.00515	-0.00125*	0.917	1,188
	(0.000487)	(0.0154)	(0.00712)	(0.00813)	(0.00727)	(0.000638)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Dum. = Dummy model

The table above presents a statistically significant, on the 10% significance level, difference in return between sustainable and conventional funds. The coefficient of the dummy variable takes the value -0.00125, indicating that sustainable funds' financial performance is slightly worse than conventional funds' financial performance.

7.4 Sub conclusion 1

The analysis shows that both sustainable and conventional funds tend to perform significantly better than their benchmark factor during the period before the global financial crisis and during the crisis. During the post-crisis period, sustainable funds perform worse than its benchmark factor while conventional funds perform better. These alphas, however, are not significant. In order to test our hypothesis, we include a dummy variable in Carhart's four-factor model. The result shows that during the pre-crisis period, sustainable funds seem to perform better than conventional funds. This is not in line with our hypothesis, but we cannot conclude any statistically significant difference in financial performance between the sustainable and conventional funds. Therefore, we cannot say that sustainable funds perform better or worse than conventional funds. During the crisis, sustainable funds seem to perform worse than conventional funds. This is also not in line with our hypothesis, which stated that sustainable funds should outperform conventional funds during a financial crisis. However, once again is the difference not statistically significant. Consequently, we conclude that there is no statistical evidence of conventional funds achieving higher risk-adjusted return compared to sustainable funds during the crisis. In the period after the global financial crisis, we find a statistically significant difference in financial performance on a 10% significance level, where sustainable funds on average perform slightly worse than the funds characterized as conventional. This is in line with our hypothesis.

7.5 Subsample analysis

Earlier research conducted by Kilbert and Subramanian (2010) shows that small-cap stocks suffered more than large-cap stocks during the global financial crisis, but that the small-cap stocks rebounded faster during the time period after the crisis. Boström and Petersson (2011) find that small-cap funds outperform large-cap funds during both pre-crisis and crisis periods. Since our sample contains funds investing in the categories Sweden and Sweden Small Cap, we need to analyze if there is a large difference, implied by previous research, that could affect the result above. In this section, we divide our sample into the two categories. By using Carhart's four-factor model together with the dummy variable, we check if there are any large deviations from the result above. The result for each time period is shown in the three tables below.

Table 8: Categories during the pre-crisis period

This table shows the result from the dummy model, based on Carhart's four-factor model and a dummy variable taking the value 1 if the fund is sustainable and 0 if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2005/01-2007/12. The two rows present the result for the two categories in our sample; Sweden and Sweden Small Cap. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The R-squared (R^2) is relatively high, implying that the fit of the model is good.

	α	***β(rM-rf)***	***βSMB***	***βHML***	***βMOM***	***βSust.***	R^2	***OBS***
Swe	0.00277***	0.892***	-0.0159	0.0166	-0.0320	0.00057	0.870	864
	(0.000327)	(0.0147)	(0.0230)	(0.0162)	(0.0232)	(0.00056)		
SSC	0.00333***	0.862***	-0.0578**	-0.0433***	-0.299***	2.77e-05	0.761	324
	(0.000937)	(0.0421)	(0.0203)	(0.00879)	(0.0280)	(0.00102)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Swe = Sweden
SSC = Sweden Small Cap

The table above shows an alpha of 0.277% for funds investing in Sweden and 0.333% for funds investing in Sweden Small Cap. This means that funds investing in Sweden and funds investing in Sweden Small Cap outperformed their benchmark factor significantly. The funds investing in Sweden Small Cap have a slightly higher alpha than the other funds, but only marginal. We cannot draw any conclusion regarding a major difference in financial performance between the two categories during the period before the global financial crisis.

The coefficient to the dummy variable Sustainable is 0.00057 for Sweden and 0.0000277 for Sweden Small Cap. This indicates that sustainable funds tend to perform slightly better than conventional funds in both categories, but these findings are not statistically significant. This is similar to the results in section 7.1 where the coefficient had an insignificant value of 0.00023, indicating that sustainable funds tend to perform slightly better than conventional funds during the pre-crisis period.

Table 9: Categories during the crisis

This table shows the result from the dummy model, based on Carhart's four-factor model and a dummy variable taking the value 1 if the fund is sustainable and 0 if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2008/01-2010/12. The two rows present the result for the two categories in our sample; Sweden and Sweden Small Cap. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The R-squared (R^2) is high, implying that the fit of the model is good.

	α	β(rM-rf)	βSMB	βHML	βMOM	βSust.	R^2	OBS
Swe	0.00140*	0.982***	0.00739**	-0.0122	0.0306	-0.00013	0.933	864
	(0.000712)	(0.0159)	(0.00353)	(0.0248)	(0.0213)	(0.000849)		
SSC	0.00307***	0.813***	-0.0354**	0.113**	0.167***	-0.0019*	0.925	324
	(0.000781)	(0.0344)	(0.0108)	(0.0353)	(0.0339)	(0.00100)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Swe = Sweden
SSC = Sweden Small Cap

Table 9 shows the result during the global financial crisis. The alpha for the funds investing in the category Sweden is significantly positive (0.140%) on the 10% significance level. Funds investing in the category Sweden Small Cap have a significant positive alpha of 0.307% on the 1% significance level. This indicates that funds in both categories tend to outperform their factor benchmark. The alpha for funds in Sweden Small Cap is larger compared to the alpha for funds in Sweden, but we cannot draw any conclusion regarding a major difference in financial performance between the two categories during the global financial crisis.

The dummy variable has a negative insignificant coefficient of -0.00013 for Sweden and a negative, but statistically significant, coefficient of -0.0019 for Sweden Small Cap. This indicates that sustainable funds tend to underperform conventional funds in both categories, but the result is only statistically significant for Sweden Small Cap. In the result in section 7.2, the difference in financial performance between sustainable funds and conventional funds was negative but insignificant. This means that we cannot find any significant underperformance of Swedish sustainable funds in general. However, it seems that sustainable funds investing in small capitalization stocks significantly underperformed the conventional funds during the global financial crisis.

Table 10: Categories during the post-crisis period

This table shows the result from the dummy model, based on Carhart's four-factor model and a dummy variable taking the value 1 if the fund is sustainable and 0 if the fund is conventional. The regression is carried out with robust standard errors. The period covered in this table is 2011/01-2013/12. The two rows present the result for the two categories in our sample; Sweden and Sweden Small Cap. βSust. is interpreted as the change from the conventional alpha for sustainable funds. The market factor, the risk factors and the alpha are calculated for the whole sample of funds, and not divided in sustainable and conventional funds. The R-squared (R^2) is high, implying that the fit of the model is good.

	α	$\beta(rM-rf)$	βSMB	βHML	βMOM	$\beta Sust.$	R^2	OBS
Swe	0.00156***	0.997***	0.0239**	0.0311***	-0.00232	-0.00149***	0.917	864
	(0.000336)	(0.0187)	(0.00918)	(0.00837)	(0.00798)	(0.000525)		
SSC	-0.00240**	1.063***	0.0156	-0.0134	-0.0111	5.25e-05	0.922	324
	(0.000896)	(0.0195)	(0.00868)	(0.0158)	(0.0166)	(0.00128)		

Significance level: *** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses
Swe = Sweden
SSC = Sweden Small Cap

Table 10 shows a significant alpha of 0.156% for funds investing in Sweden and a significant alpha of -0.240% for funds investing in Sweden Small Cap. This means that funds investing in the category Sweden outperformed their benchmark factor, whereas funds in the category Sweden Small Cap underperformed their benchmark factor. However, we cannot draw any conclusion regarding a major difference in financial performance between the two categories during the global financial crisis.

The general result in section 7.3 shows that sustainable funds significantly underperform conventional funds during the post-crisis period. When dividing the sample into the categories, sustainable funds investing in Sweden underperform conventional funds significantly, while sustainable funds investing in Sweden Small Cap outperform conventional funds insignificantly. However, it will not affect the result since outperformance is very small and not significant.

7.6 Sub conclusion 2

Our findings show that before the global financial crisis, sustainable funds performed slightly better than conventional funds in both categories, however the difference is insignificant. This is in line with the results from the whole sample, where sustainable funds tend to perform insignificantly better than conventional funds. During the financial crisis, sustainable funds investing in Sweden underperform conventional funds, but the difference is not significant. Sustainable funds investing in Sweden Small Cap seem to significantly underperform

conventional funds during the crisis period. This is not in line with the general result for the whole sample, where the difference in performance between sustainable and conventional funds was insignificant. However, it will not affect our results. The result from the time period after the financial crisis shows that sustainable funds investing in Sweden significantly underperform conventional funds, whereas sustainable funds investing in Sweden Small Cap perform insignificantly better than conventional funds. This is not in line with the result for the total sample which shows that sustainable funds significantly underperformed conventional funds during the post-crisis period. However, the outperformance of the sustainable funds in Sweden Small Cap is insignificant, meaning that there is no statistically significant difference in financial performance between sustainable and conventional funds in this period. The result will probably not be affected since the outperformance is very small and insignificant.

8 Discussion

When looking at the result from the pre-crisis period, it shows that there is no evidence of any significant difference in risk-adjusted return between sustainable and conventional funds. There are some indications that sustainable funds perform better than conventional funds, but the difference is not significant. This is not in line with our hypothesis, stating that sustainable funds should perform worse than conventional funds during the non-crisis periods. It indicates that investors do not have to suffer financially from investing in sustainable funds in the Swedish market. The result is surprising since a majority of the previous studies, such as Nofsinger and Varma (2014), find that sustainable funds underperform conventional funds during non-crisis periods.

The result indicates that the argument that negative screening would lead to smaller diversification benefits due to a smaller investment universe, and therefore give a lower risk-adjusted return than conventional funds, does not hold. A reason for this could be that even if the investment universe is smaller for sustainable funds, it is still large enough to avoid diversification losses. Moreover, many sustainable funds use other investment strategies than the negative screening strategy. Sustainable funds may invest in companies that handle sustainability risks and opportunities in a good way, and therefore perform better in the long run. This is supported by Leite and Cortez (2015) who find that socially responsible funds using other investment strategies than negative screening performed similarly to conventional funds in both non-crisis and crisis periods.

Since the sample of funds contains funds investing in different categories, we did a sub-sample analysis to see any potential differences that could affect the result. Sustainable funds investing in the category Sweden and Sweden Small Cap tend to perform slightly better than conventional funds during the pre-crisis period, but these findings are statistically insignificant. This is in line with the general result.

Moving to the global financial crisis, the result indicates that sustainable funds experience a lower risk-adjusted return compared to conventional funds, but the difference is statistically insignificant and close to zero. This means that there is no statistical evidence of conventional funds having higher risk-adjusted returns than sustainable funds. This indicates that investors do not suffer financially from investing in sustainable funds. The result is not in line with our hypothesis stating that sustainable funds should perform better than conventional funds during crisis periods. The finding is surprising, since a majority of studies conducted in

the field find that sustainable funds tend to outperform conventional funds during periods of crisis. However, our result is similar to the study of Muñoz, Vargas and Marco (2014), who find that European socially responsible funds perform statistically insignificant in both crisis and normal periods. It is also supported by Christensson and Skagestad (2017) who identify no statistical difference in risk-adjusted return between sustainable and conventional funds in recessions, but indications of sustainable funds experiencing lower risk-adjusted returns

There is no statistical evidence that sustainable funds underperform, however, by looking at the alpha, the result indicates that sustainable funds experience a slightly lower risk-adjusted return. A potential explanation for this result could be that the investment universe is smaller for sustainable funds during the crisis period. This makes the sustainable funds underperform conventional funds because of less profitable investment alternatives. This is supported by the study of Bredal and Negård (2015), in which they find that socially responsible screening lead to increased idiosyncratic risk from reduced investment universe and skewed sector tilts, translating to inferior risk-adjusted returns in periods of crisis.

The sub-sample analysis shows that sustainable funds investing in Sweden and Sweden Small Cap tend to underperform conventional funds, but the result was only statistically significant for Sweden Small Cap. This is not in line with the general result but could perhaps be explained by small-cap stocks suffering more than large-cap stocks during the global financial crisis. This is supported by Kilbert and Subramanian (2010).

Finally, the analysis after the global financial crisis shows that there is a statistically significant difference in risk-adjusted return between sustainable and conventional funds. Sustainable funds' financial performance is slightly worse than conventional funds. This supports our hypothesis stating that sustainable funds should underperform conventional funds during non-crisis periods. The result is in line with a lot of the previous research conducted, for example Nofsinger and Varma (2014) who find that sustainable funds underperform during non-crisis periods because of the lower downside risk during financial crises. Moreover, Christensson and Skagestad (2017) find that conventional funds outperform sustainable funds during periods of recovery.

An explanation for the sustainable funds' underperformance during the period after the market crisis could be the lower downside risk during crisis periods as described by Nofsinger and Varma (2014). One could also argue that negative screening makes sustainable funds' investment universe smaller, resulting in fewer profitable investments. Furthermore, the companies' focus on increasing profits to compensate for losses created under the global financial crisis could result in less focus on sustainability compared to more stable periods. This

might lead to fewer profitable investment opportunities for sustainable funds, both for funds using negative screening and funds using positive screening.

When studying the result from the sub-sample analysis, sustainable funds investing in the category Sweden tend to underperform conventional funds significantly, while sustainable funds investing in Sweden Small Cap tend to outperform conventional funds insignificantly. However, the outperformance is very small and might affect the general result.

To summarize the discussion, our hypothesis for this thesis is that sustainable funds perform slightly worse than conventional funds in periods of non-crisis and slightly better than conventional funds in periods of crisis. By studying the result for all three time periods, we have no evidence of difference in financial performance between sustainable and conventional funds during pre-crisis and crisis periods. This is not in line with our hypothesis. However, we identify a significant underperformance of sustainable funds during the post-crisis period in line with our hypothesis. Since the result was not statistically significant in pre-crisis and crisis periods, we cannot draw any conclusion regarding a difference in financial performance. However, it is interesting to find out why the results differ for pre-crisis and post-crisis periods. One explanation could perhaps be that before the crisis, sustainable investment strategies was not as widespread as after the crisis. According to Nofsinger & Varma (2014), the downside risk of sustainable funds is lower, making them underperform in periods of non-crisis. Sustainable funds in the pre-crisis period is perhaps not affected by this lower downside risk to the same extent as sustainable funds after the crisis, and therefore perform insignificantly better than conventional funds. Another explanation could be that it may be easier for sustainable funds to invest in profitable companies taking sustainability into account during the pre-crisis period, but harder during the post-crisis period due to a focus on covering losses from the crisis. With the available data and the models used, we find no evidence that sustainable funds differ in financial performance compared to conventional funds in pre-crisis and crisis periods. Therefore, we conclude that our hypothesis is not accurate.

Overall, we see that investors investing in sustainable funds during pre-crisis and crisis periods do not suffer financially. During the period after the global financial crisis, sustainable funds underperform conventional funds. However, even if investors might suffer financially during this time period, there might be other important factors to consider such as positive effects on society and the environment. In addition, the global challenges the world have creates a need that companies handle sustainability risks and opportunities in a satisfactory way in order to be competitive and profitable in the long run. If companies cannot handle these risks and opportunities, they will be less profitable in the long run.

9 Conclusion

The purpose of this study is to explore if sustainable equity funds on the Swedish market perform better or worse than conventional equity funds on the Swedish market during a financial crisis and periods of non-crisis. Our hypothesis is that sustainable funds perform slightly worse than conventional funds in periods of non-crisis and slightly better than conventional funds in periods of crisis. Furthermore, we did a sub-sample analysis to examine if there was any difference in the financial performance of the funds depending on the category they invest in; Sweden or Sweden Small Cap.

Based on our analysis, we find indications that sustainable funds perform better than conventional funds during the pre-crisis period. This is not in line with our hypothesis, but the difference in risk-adjusted return is not statistically significant, making it hard to find any statistical evidence of a difference in financial performance. Furthermore, we find that sustainable funds tend to underperform conventional funds during the financial crisis. This indicates that the second result cannot verify our hypothesis but since the result is not statistically significant, we cannot conclude any statistical difference between sustainable and conventional funds during the crisis. Moreover, the results from the pre-crisis and crisis period indicate that there is no financial loss for investors choosing to invest in sustainable funds. However, we find that sustainable funds significantly underperform funds characterized as conventional during the period of post-crisis. This is in line with our hypothesis regarding the post-crisis period. To summarize, the hypothesis regarding the three time periods cannot be verified since we find no evidence that sustainable funds differ in financial performance compared to conventional funds in pre-crisis and crisis periods.

In our sub-sample analysis, we find small deviations from our result described above. In the pre-crisis period, there is no evidence of a difference in performance between sustainable and conventional funds in any category. During the global financial crisis, there was a difference from the general result where sustainable funds investing in Sweden Small Cap significantly underperform conventional funds. After the financial crisis, Sweden Small Cap once again deviate from the general result, showing an insignificant difference in financial performance. This means, even though there are no large deviations, it is important to have in mind that the size of the stocks the funds invest in may change the result slightly.

To conclude, there are no statistically significant difference in risk-adjusted return between sustainable and conventional funds before and during the global financial crisis. After the crisis, we identify that conventional funds significantly outperform sustainable funds. This

implies that during both the pre-crisis and crisis periods, there are no statistically significant evidence that investors would experience any financial loss from investing in sustainable funds. In the period of the post-crisis, sustainable funds underperform conventional funds. However, there might be other values that are important to consider, for example sustainable business practices and good environmental performance needed for profitability in the long run.

A possible limitation of this study is the quality of the data. Our sample is created from funds available at the Swedish Pension Agency's premium pension system. The funds need to have an inception date prior to 2005 resulting in a limited number of funds in our sample. Additionally, we use monthly data which limit the number of observations in our sample. Moreover, our dataset might suffer from survivorship bias and consequently lead to an overestimation of the funds' performance. Another limitation is the assumption that the funds that are sustainable today are assumed to be sustainable in our analyzed time period. Furthermore, the interest in sustainable funds have increased during the last years and there is a larger focus on socially responsible investing today. This also means that the strategies used for socially responsible investing have evolved. Moreover, there is no universal definition of sustainability. This means that depending on which label or categorization of sustainable funds that is used, the result may be different.

Our thesis focus on the financial performance of sustainable and conventional funds. The financial performance of sustainable funds is often discussed, and a lot of studies have been conducted. Future studies might instead examine other performance indicators such as the environmental performance or social performance of sustainable funds. One could for example study if sustainable funds that focus on the environment have less environmental impact by measuring for example carbon dioxide footprints. It would also be of interest for future studies to examine the difference in performance depending on which sustainable investment strategy fund managers use, something that we did not focus on in this study. Moreover, it would be interesting to examine the effect the different investment strategies have and if sustainable investments make a difference.

10 References

Berk, Jonathan B. and DeMarzo, Peter M., 2014, Corporate Finance, 3. ed., global ed. Harlow, England: Pearson.

Boström, Anna-Lina and Petersson, Johanna, 2011, Does Cap-Size Matter; A study of ten Swedish Small and Large-Cap Funds, University of Gothenburg. Retrieved from: https://gupea.ub.gu.se/bitstream/2077/28997/1/gupea_2077_28997_1.pdf.

Carhart, Mark M., 1997, On Persistence in Mutual Fund performance, The Journal of Finance, Vol. 52 No. 1, 57-82.

Christensson, Lars S. B. and Skagestad, Ole J., 2017, Performance of Sustainable Investments; A comparison of sustainable and conventional mutual funds in emerging markets, Norwegian School of Economics. Retrieved from: https://brage.bibsys.no/xmlui/bitstream/handle/11250/2486956/master2017.PDF?sequence=1&isAllowed=y.

Deziel, Chris, 2018, The Effects of a Small Sample Size Limitation, Sciencing. Retrieved from: https://sciencing.com/effects-small-sample-size-limitation-8545371.html.

European Sustainable Investment Forum, 2016, European SRI Study 2016. Retrieved from: http://www.eurosif.org/wp-content/uploads/2016/11/SRI-study-2016-HR.pdf.

European Sustainable Investment Forum, Responsible Investment Strategies. Retrieved from: https://www.eurosif.org/responsible-investment-strategies/.

Fama, Eugene F. and French, Kenneth R., 1992, The Cross-Section of Expected Stock Returns, The Journal of Finance, Vol. 47, No. 2, 427-465.

Friede, Gunnar, Busch, Timo and Bassen, Alexander, 2015, ESG and financial performance; aggregated evidence from more than 2000 empirical studies, Journal of Sustainable Finance & Investment, Vol. 5, No. 4, 210-233.

Hamilton, Sally, Hoje, Jo and Statman, Meir, 1993, Doing Well While Doing Good? The Investment Performance of Socially Responsible Mutual Funds, Financial Analysts Journal, 49(6), 62-66.

Kilbert, Marc and Subramanian, A. Raman, 2010, Revisiting Global Small Caps, MSCI Index Research Group. Retrieved from: https://www.msci.com/documents/10199/3378e77e-556f-4c6a-8b47-421149cc3f4d.

Leite, Paulo and Cortez C., Maria, 2015, Performance of European socially responsible funds during market crises: Evidence from France, International Review of Financial Analysis vol. 40, issue C, 132-141.

Mallin, Christine, Saadouni, Brahim and Briston R.J., 1995, The Financial Performance of Ethical Investment Funds, Journal of Business Finance and Accounting, 22 (4), 483-496.

Morningstar, Inception dates and ISIN. Retrieved 2018-04-21 from: http://www.morningstar.se/Funds/Quickrank.aspx.

Morningstar, Total Return, Morningstar Direct. Retrieved from: http://www.morningstar.com/InvGlossary/total-return.aspx.

Morningstar, Who we are. Retrieved from: http://corporate.morningstar.com/us/asp/subject.aspx?xmlfile=177.xml.

Morningstar Direct Database, Return series for funds and indices, FundId, SecId. Accessed 2018-04-23.

Muñoz, Fernando, Vargas, Maria and Marco, Isabel, 2014, Environmental Mutual Funds: Financial Performance and Managerial Abilities, Journal of Business Ethics, Vol. 124, Iss. 4, 551-569.

Murray, Leigh, Nguyen, Hien, Lee, Yu-Feng, Remmenga, Marta D. and Smith, David W., 2012, Variance Inflation Factors in Regression Models with Dummy Variables, Annual Conference on Applied Statistics in Agriculture. Retrieved from: http://newprairiepress.org/cgi/viewcontent.cgi?article=1034&context=agstatconference.

Nakai, Miwa, Yamaguchi, Keiko and Takeuchi, Kenhi, 2016, Can SRI funds better resist global financial crisis? Evidence from Japan, International Review of Financial Analysis, Vol. 48, 12-20.

Nofsinger, John and Varma, Abhishek, 2014, Socially responsible funds and market crises, Journal of Banking & Finance, Vol. 48, 180-193.

Pensionsmyndigheten, För fondbolag – M/E-märkning. Retrieved from: https://www.pensionsmyndigheten.se/om-pensionsmyndigheten/kontakta-oss/for-fondbolag.

Pensionsmyndigheten, Sök och jämför fonder (Listing of funds in the premiumpension system). Retrieved 2018-04-21 from: https://www.pensionsmyndigheten.se/mina-tjanster/fondtorg/sok.

Rohleder, Martin, Scholz, Hendrik and Wilkens, Marco, 2007, Survivorship Bias and Mutual Fund Performance: Relevance, Significance and Methodical Differences, Ingolstadt School of Management. Retrieved from: https://www.researchgate.net/profile/Martin_Rohleder3/publication/227465255_Survivorship_Bias_and_Mutual_Fund_Performance_Relevance_Significance_and_Methodical_Differences/links/54d4bc710cf2970e4e638d5f/Survivorship-Bias-and-Mutual-Fund-Performance-Relevance-Significance-and-Methodical-Differences.pdf.

Swedish House of Finance Research Data Center, Fama and French factors for the Swedish market. Retrieved 2018-03-06 from: https://data.houseoffinance.se/otherDB/famaFrench.

Swedish Investment Fund Association, 2018, Var fjärde sparare har valt en hållbar fond - fortsatt störst intresse hos kvinnor. Retrieved from: http://www.fondbolagen.se/sv/Aktuellt/Pressmeddelanden/?release=F18AC023CC470280.

Swesif Sveriges Forum för Hållbara Investeringar, Hållbarhetsprofilen (Swesif's sustainability declaration for funds). Retrieved from: http://www.swesif.org/swesif/hallbarhetsprofilen-english/.

Swesif Sveriges Forum för Hållbara Investeringar, Hållbarhetsprofilen. Retrieved 2018-04-22 from: http://www.hallbarhetsprofilen.se/index.html.

Söderberg & Partners, 2017, Hållbara Investeringar. Retrieved from: https://user-bmxgpti.cld.bz/Soderberg-Partners-Hallbara-investeringar-2017/15/#zoom=z.

Torres-Reyna, Oscar, 2007, Panel Data Analysis Fixed and Random Effects using Stata (v.4.2), Princeton University, Retrieved from: https://www.princeton.edu/~otorres/Panel101.pdf.

United Nations Commission on Sustainable Development, 2007, Framing Sustainable Development: The Brundtland Report - 20 Years On. Retrieved from:http://www.un.org/esa/sustdev/csd/csd15/media/backgrounder_brundtland.pdf.

US SIF: The Forum for Sustainable and Responsible Investment, SRI Basics. Retrieved from: https://www.ussif.org/sribasics#Basics Top.

Världsnaturfonden WWF, 2015, Svenska sparare vill se mer hållbara investeringar. Retrieved from: http://www.wwf.se/press/pressrum/pressmeddelanden/1592518-svenska-sparare-vill-se-mer-hallbara-investeringar.

11 Appendix

11.1 Sample of sustainable and conventional funds

In the two tables below, the samples of sustainable funds and conventional funds are listed. The information given are identification codes, both the PPM number, ISIN and FundID. Moreover, the inception date for each fund is presented in the fourth column.

Table 11: Sustainable funds

The table below presents all funds that are included in our sample of sustainable funds. The funds' identification numbers are given, as well as their different inception dates.

Fund Name	PPM-number	ISIN	FundID	Inception Date
AMF Aktiefond Sverige	681783	SE0000739195	FSGBR0532Z	1998-12-30
Folksam LO Sverige	976928	SE0000540593	FSGBR0537Q	1999-03-18
Folksam LO Västfonden	905265	SE0000540619	FSGBR0537S	1999-03-18
Swedbank Robur Sverigefond Mega	789271	SE0000537771	FSGBR053P3	1995-11-30
Nordea Swedish Stars	203067	SE0000625238	FSGBR053UE	1999-10-26
SEB Sverige Expanderad	158261	SE0000984197	FSGBR053SL	1973-11-11
Skandia Sverige	690289	SE0000810913	FSGBR05BAM	1991-03-05
Lannebo Sverige	806869	SE0000740680	FSGBR053AU	2000-08-04
Aktie-Ansvar Sverige	344739	SE0000735789	FSGBR052VC	1992-01-01
Catella Sverige Aktiv Hållbarhet	220244	SE0000577322	FSGBR0533I	1998-02-16
Enter Sverige	170423	SE0000813917	FSGBR05AV4	1999-11-30
AMF Aktiefond Småbolag	269357	SE0001185000	FSGBR04YMM	2004-05-17
Swedbank Robur Småbolagsfond Sverige	856682	SE0000602302	FSGBR053OZ	1995-11-13
Skandia Småbolag Sverige	103606	SE0000810814	FSGBR05BQA	1998-12-09
Lannebo Småbolag	842690	SE0000740698	FSGBR053AV	2000-08-04
Catella Småbolagsfond SEK	184416	SE0000577330	FSGBR0533J	1998-02-16

Table 12: Conventional funds

The table below presents all funds that are included in our sample of conventional funds. The funds' identification numbers are given, as well as their different inception dates.

Fund Name	PPM-number	ISIN	Fund ID	Inception Date
SPP Aktiefond Sverige	212332	SE0000529992	FSGBR053TV	1998-12-23
Aktiespararna Topp Sverige	290072	SE0000924649	FSGBR0532Y	1999-11-25
Handelsbanken Sverigefond	916189	SE0000582033	FSGBR053A2	1988-04-25
Catella Sverige Index	838441	SE0000577272	FSGBR053AO	1998-10-02
Didner & Gerge Aktiefond	291906	SE0000428336	FSGBR05353	1994-10-21
Länsförsäkringar Sverige Aktiv	528133	SE0000837221	FSGBR053KQ	1990-12-10
Carnegie Sverigefond	393314	SE0000429789	FSGBR05CB3	1987-01-08
Öhman Sverige Smart Beta	928937	SE0000493512	FSGBR053Q2	1996-03-20
Öhman Sverige	569988	SE0001091018	FSGBR05AZS	2003-10-03
Odin Sverige	450981	NO0008000023	FSGBR05CR3	1994-10-31
Spiltan Aktiefond Stabil	339184	SE0001015348	FSGBR05AX6	2002-12-02
Spiltan Aktiefond Sverige	152181	SE0001015355	FSGBR05CDX	2002-12-02
Alfred Berg Sverige Plus	647487	SE0000709271	FSGBR0532W	2000-06-08
Handelsbanken Svenska Småbolagsfond	952010	SE0000356065	FSGBR053A6	1994-11-21
Länsförsäkringar Småbolag Sverige	515676	SE0000837239	FSGBR053KP	1997-09-01
Öhman Sweden Micro Cap	416867	SE0000432809	FSGBR0535T	1997-05-29
Öhman Småbolagsfond	694539	SE0000432775	FSGBR05BWX	1991-09-20

11.2 Summary statistics for Sweden and Sweden Small Cap

Table 13 shows summary statistics for the dependent variable monthly excess return based on the two categories, Sweden and Sweden Small Cap, during each time period. It is also divided in sustainable and conventional funds. We identify that there is a small difference in average monthly excess return and minimum and maximum excess returns between the categories.

Table 13: Summary statistics for sustainable and conventional funds per category

This table shows descriptive statistics for sustainable and conventional funds during three different time periods, pre-crisis (2005/01-2007/12), crisis (2008/01-2010/12) and post-crisis (2011/01-2013/12). The table is based on the dependent variable describing the monthly return of the funds minus the risk-free rate (excess return). It illustrates the number of observations, the mean return, the standard deviation and the minimum and maximum monthly return in the sample.

	Count	*Mean*	*Sd*	*Min*	*Max*
Sweden					
Pre-crisis					
Sustainable	396	.0128585	.0390552	-.1167503	.0836585
Conventional	468	.0122894	.0398897	-.1151935	.1243957
Crisis					
Sustainable	396	.005836	.0742604	-.2168852	.2572471
Conventional	468	.0059612	.0730055	-.201807	.3384908
Post-crisis					
Sustainable	396	.0053073	.0443287	-.1243719	.1376749
Conventional	468	.0067952	.0428554	-.131389	.1279499
Sweden Small Cap					
Pre-crisis					
Sustainable	180	.016199	.0394851	-.081711	.1138493
Conventional	144	.0161713	.0449055	-.1120251	.1232409
Crisis					
Sustainable	180	.0075644	.07382	-.1901046	.2623395
Conventional	144	.009464	.0801569	-.2118067	.2688007
Post-crisis					
Sustainable	180	.0070695	.0453339	-.1219701	.1289313
Conventional	144	.007017	.046976	-.1176228	.140842

11.3 Risk factors exposure for each fund

The table below shows the risk factor exposure for each fund in the sample using Carhart's four-factor model. The reason for this is that dummy model used for testing our hypothesis is based on Carhart's four-factor model. The first table shows the risk factor exposure for each fund during the pre-crisis period. Table 15 shows the risk factor exposure for each fund during the crisis period, and the last table shows the risk factor exposure for each fund during the post-crisis period.

Table 14: Risk factor exposure during the pre-crisis period

Table 14 shows the regression with Carharts' four-factor model for each fund in the sample during the time period 2005/01-2007/12. The regression is carried out with robust standard errors. The dependent variable is the funds' return minus the risk-free rate (excess return), and the table reports the regression of the funds' excess return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is high for some funds, indicating that the fit of the model is good.

Name	α	β*(rM-rf)*	β*SMB*	β*HML*	β*MOM*	R^2
AMF Aktiefond Småbolag	.003782	.9149302	-.0871033	-.0471008	-.3910736	.7943596
AMF Aktiefond Sverige	.0048516	.9228578	-.0978564	-.0299593	-.115297	.9275686
Aktie-Ansvar Sverige A	.0036562	.9466791	-.074898	.0384439	-.0779167	.9531002
Aktiespararna Topp Sverige (index)	.001738	.9119636	-.0418838	-.0202192	-.0548352	.979432
Alfred Berg Sverige Plus A	.0018264	.9068319	-.0781601	-.0296967	-.0596594	.9620273
Carnegie Sverigefond A	.003742	.9045576	.0366723	.0597436	-.0243951	.9153232
Catella Småbolag	.0035905	.6036802	.0158161	-.0145031	-.115901	.7928746
Catella Sverige Aktiv Hållbarhet	.0037279	.9397585	.0631915	.048426	.1222322	.8339292
Catella Sverige Index A	.0030459	.923369	-.0716105	-.0030035	-.0792548	.9661947
Didner & Gerge Aktiefond	.0023588	.8750646	.0300994	-.0014021	-.009714	.856523
Enter Sverige A	.0053846	.9038268	-.1176752	-.006099	-.182692	.8672511
Folksam LO Sverige	.0030214	.8964691	-.0538138	.028687	-.0275364	.9609651
Folksam LO Västfonden	.0034215	.9117403	-.0494273	.0305291	-.0291329	.9565083
Handelsbanken Svenska Småbolag	.0021236	.9201843	-.0625226	-.0633377	-.2671531	.9026743
Handelsbanken Sverigefond SEK	.0036266	.9146485	-.0658667	-.0070851	-.0353093	.9391733
Lannebo Småbolag	.0064444	.7150768	-.1539512	-.0089222	-.4050998	.6497386
Lannebo Sverige	.0005412	.8598978	-.054133	.0465397	-.0515606	.88581

Länsförsäkringar Småbolag Sverige A	.0013029	.9975594	.0434576	-.011329	-.3138552	.7910472
Länsförsäkringar Sverige Aktiv A	.0014241	.9251803	-.0839058	.008144	-.07354	.9554316
Nordea Swedish Stars icke-utd	.0020673	.9252647	-.0954824	-.0271951	-.0954536	.9524872
ODIN Sverige C	.0024311	.9162884	.1370457	-.0541453	.037331	.7922519
SEB Sverige Expanderad	.0028377	.8914602	-.0760565	-.0313678	-.0887985	.9535474
SPP Aktiefond Sverige A	.001672	.9170624	-.0682425	-.0539819	-.050542	.9652987
Skandia Småbolag Sverige	.0043256	.8825142	-.0903146	-.0497691	-.2868142	.8086669
Skandia Sverige	.0036513	.9264029	-.1246795	.0139539	-.1266517	.968015
Spiltan Aktiefond Stabil	.0043442	.6114764	.0253995	.307203	-.0176039	.6949137
Spiltan Aktiefond Sverige	.0057676	.7435887	.2243127	.1332711	.0022751	.6224781
Swedbank Robur Småbolagsfond Sverige	.0025656	.971168	-.0633496	-.0606246	-.2926143	.8887256
Swedbank Robur Sverigefond MEGA	.0048422	.9361409	-.0790426	.0226606	-.0892614	.9600579
Öhman Småbolagsfond A	.0046864	.8772324	-.0954859	-.050928	-.295384	.8023442
Öhman Sverige	.0007885	.8925032	.3415304	-.1227719	.4237674	.6524528
Öhman Sverige Smart Beta	.0019899	.9130374	-.0078412	.0477588	-.0634643	.9484267
Öhman Sweden Micro Cap	.0012759	.8742877	-.0267793	-.08361	-.3263748	.6141762

Table 15: Risk factor exposure during the crisis period

Table 15 shows the regression with Carharts' four-factor model for each fund in the sample during the time period of 2008/01-2010/12. The regression is carried out with robust standard errors. The dependent variable is the funds' return minus the risk-free rate (excess return), and the table reports the regression of the funds' excess return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is high for some funds, indicating that the fit of the model is good.

Name	α	β*(rM-rf)*	β*SMB*	β*HML*	β*MOM*	R^2
AMF Aktiefond Småbolag	-.0002941	.9012331	-.0517496	.1346666	.1545478	.9676726
AMF Aktiefond Sverige	.0020964	1.009768	.0039164	-.0176132	.0027752	.9762329
Aktie-Ansvar Sverige A	-.0020218	.9461838	-.0044098	.1020002	.0798716	.9791319
Aktiespararna Topp Sverige (index)	.0010939	.9554865	.0132795	-.0009875	-.0218907	.9921545
Alfred Berg Sverige Plus A	-.0026559	.9781761	-.0357069	-.2402907	-.0756479	.8816856
Carnegie Sverigefond A	.0017929	.9170525	.0152421	.0207411	-.0167994	.9705828

Catella Småbolag	.0016926	.5829083	.01571	.1582431	.0946728	.883344
Catella Sverige Aktiv Hållbarhet	-.0015891	1.044202	-.0005559	.0035836	.048321	.9640009
Catella Sverige Index A	.0016275	1.032035	.010508	-.0764706	-.0142166	.9781793
Didner & Gerge Aktiefond	.007859	1.103216	.014993	-.1764366	-.0256481	.8511714
Enter Sverige A	.0004693	.9681945	-.0126755	.0597888	.0855712	.9336879
Folksam LO Sverige	.0009115	1.05156	.007605	-.0247089	-.0068174	.9816273
Folksam LO Västfonden	.0023944	1.046334	.0181009	-.0611426	-.0280432	.9809642
Handelsbanken Svenska Småbolag	.0028403	.9034452	-.0321403	.0627844	.1143621	.9707883
Handelsbanken Sverigefond SEK	.0015756	1.024482	.0135482	-.0195622	.0354092	.9717935
Lannebo Småbolag	.0052831	.7437293	.0031658	.0565897	.2052215	.9487907
Lannebo Sverige	.0028618	.9910746	.0334652	.2094978	.1501975	.9303734
Länsförsäkringar Småbolag Sverige A	.000741	.8693966	-.0743543	.1133017	.2162107	.9309437
Länsförsäkringar Sverige Aktiv A	.0039409	.9620826	.0134147	-.145385	-.0523452	.970435
Nordea Swedish Stars icke-utd	.0006759	1.009155	.0268427	.0241379	.0401758	.9534548
ODIN Sverige C	.0035733	.9984723	-.001653	-.1109887	-.0422393	.8755031
SEB Sverige Expanderad	.0009942	.9499206	.0107753	-.2442558	-.1244063	.9638871
SPP Aktiefond Sverige A	.0018082	1.001059	.010133	-.0363563	.0185524	.9875557
Skandia Småbolag Sverige	.0016926	.8475177	-.0232583	.1416307	.1545008	.9661826
Skandia Sverige	.0021297	.9849343	.0297282	.0863461	.0496732	.9615774
Spiltan Aktiefond Stabil	.0017078	.6771933	.0044219	.2203622	.2887704	.8511358
Spiltan Aktiefond Sverige	-.0027526	.9481633	.0230259	.1723702	.3357902	.8904559
Swedbank Robur Småbolagsfond Sverige	.0014476	.8549212	-.0575597	-.0878597	.0229536	.9705085
Swedbank Robur Sverigefond MEGA	.0014133	1.026542	.0088096	.0250496	.0279572	.9708148
Öhman Småbolagsfond A	.0017857	.8493948	-.0239861	.127568	.1500581	.9653286
Öhman Sverige	.0005189	.9721512	-.0380145	-.039982	.0253873	.8621423
Öhman Sverige Smart Beta	.0018559	.9685351	.012518	-.0229961	-.0453152	.9933008
Öhman Sweden Micro Cap	.0029817	.7615072	-.074864	.3101843	.3866002	.8426279

Table 16: Risk factor exposure during the post-crisis period

Table 16 shows the regression with Carharts' four-factor model for each fund in the sample during the time period of 2011/01-2013/12. The regression is carried out with robust standard errors. The dependent variable is the funds' return, and the table reports the regression of the funds' return on the interaction of risk-adjusted performance compared to their factor benchmark (alpha) and the exposure to different risk factors. If the alpha is significant, the funds experience a positive or negative abnormal return on a monthly basis. The r-squared (R^2) is high for some funds, indicating that the fit of the model is good.

Name	α	β*(rM-rf)*	β*SMB*	β*HML*	β*MOM*	R^2
AMF Aktiefond Småbolag	-.0020225	1.09499	.000319	-.0752421	-.0014908	.9359991
AMF Aktiefond Sverige	.0013069	1.028303	.0004353	.0302863	.0072555	.9621107
Aktie-Ansvar Sverige A	.0019525	.948599	-.0267834	.069859	-.0174095	.9641424
Aktiespararna Topp Sverige (index)	.0018585	.9572653	-.018945	.0178945	.0138043	.9928495
Alfred Berg Sverige Plus A	.0031217	.9908164	.0513689	.0668094	.0633741	.8419097
Carnegie Sverigefond A	.0021237	.9032972	.0568402	.0571212	.0299604	.9588356
Catella Småbolag	-.0046896	.9956947	-.018454	-.0008917	-.0608028	.8704472
Catella Sverige Aktiv Hållbarhet	.0008552	1.0445	.0143599	.0420152	-.0063673	.9685995
Catella Sverige Index A	.0014658	.9756323	.0107529	.0491583	.0010895	.9807519
Didner & Gerge Aktiefond	.0024081	1.130288	-.0410545	-.113013	-.045164	.9061259
Enter Sverige A	-.0024877	1.042134	.0202288	.0437178	-.0464628	.9427972
Folksam LO Sverige	.0005166	1.062872	.0222864	.0553555	.0269274	.9604635
Folksam LO Västfonden	.0004865	1.0539	.0131744	.0455769	.0130083	.9561454
Handelsbanken Svenska Småbolag	-.0012538	1.134395	-.0080933	-.0264564	.0084258	.9688556
Handelsbanken Sverigefond SEK	.0005922	1.028954	.0184646	.0704829	.004174	.9621678
Lannebo Småbolag	-.0025428	1.079978	.0409741	-.0695879	-.0080145	.9515262
Lannebo Sverige	-.0008413	1.147439	-.0110376	.0373496	-.018254	.9042855
Länsförsäkringar Småbolag Sverige A	-.0048762	1.14906	-.0058053	.0645826	-.0871865	.8991709
Länsförsäkringar Sverige Aktiv A	-.0004041	1.012301	-.0156881	.0348352	-.0193389	.9372795
Nordea Swedish Stars icke-utd	-.0004147	.9458984	.1194725	.0065705	.0694	.8635445
ODIN Sverige C	.0035383	.9538497	.1262069	.0957826	-.102801	.7922494
SEB Sverige Expanderad	.0014256	.9046797	-.0021819	.0283258	.0533628	.9647699
SPP Aktiefond Sverige A	.0013518	.9996133	.0163673	.0092329	.0361818	.9690587
Skandia Småbolag Sverige	-.0020365	.9998747	.0213961	-.0360069	.0548842	.9563016
Skandia Sverige	-.0020402	1.022691	-.0086926	.0036379	-.0088934	.9559702

Spiltan Aktiefond Stabil	.0024369	.6808547	.0744331	.003671	-.0480797	.8720753
Spiltan Aktiefond Sverige	.0003969	1.036892	.1073992	-.0293301	-.0394306	.8519721
Swedbank Robur Småbolagsfond Sverige	-.0008583	1.061524	.0613168	.0313121	-.013463	.9396489
Swedbank Robur Sverigefond MEGA	-.0001643	1.088776	.0237337	.0499707	-.0026923	.9523361
Öhman Småbolagsfond A	-.0020238	.9956986	.025758	-.0323168	.05858	.9578032
Öhman Sverige	.0008775	.9875775	.0313565	.045417	-.0163564	.9479406
Öhman Sverige Smart Beta	.0007125	.9756324	-.0085953	.026121	-.002934	.9935874
Öhman Sweden Micro Cap	-.0010495	1.054356	.0234358	.0241807	-.0505789	.8916109

11.4 Tests performed

We conduct a model selection test called the Hausman test and the Breusch-Pagan Lagrange Multiplier test. Moreover, we test for heteroscedasticity, multicollinearity and autocorrelation. In this section, we give examples of the results from the test performed on the dummy model on pre-crisis periods, since the results are similar for all the regressions. We have adjusted for heteroscedasticity and autocorrelation for all regressions.

11.4.1 Model selection

The Hausman test in table 17 shows that both RE and POLS is consistent. Therefore, we run the Breusch-Pagan Lagrange Multiplier test to determine if we should use RE or POLS. The result shows that there are no individual specific variations in the model. Therefore, we cannot reject the null hypothesis which makes POLS the appropriate model.

Table 17: The Hausman test

The Hausman test tests if the difference in coefficients is systematic. The null hypothesis is that the difference is not systematic. The dependent variable is the funds' return minus the risk-free rate (excess return). The variable excessretu~x describes the excess return of the index. The result show that both RE and POLS is consistent.

	---- Coefficients ----			
	(b) fixed	(B) random	(b-B) Difference	Sqrt(diag(V_b-V_B)) S.E.
excessretu~x	.8771923	.8751075	.0020848	.0017304
SMB	-.0254959	-.0247698	-.000726	.0024113
HML	.0003393	.0006258	-.0002865	.0020247
MOM	-.1038849	-.103077	-.0008079	.0029149

b = consistent under H_0 and H_a; obtained from xtreg

B = inconsistent under H_a, efficient under H_0; obtained from xtreg

Test: H_0: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 1.45

Prob>chi2 = 0.8352

Table 18: The Breusch-Pagan Lagrange Multiplier test

This table presents the results from the Breusch-Pagan Lagrange Multiplier test. If there are unobserved effects for every individual, or group of individuals, the random effects model should be used. The dependent variable is the funds' return minus the risk-free rate (excess return). The variable excessretu~x describes the excess return of the index. The test shows that POLS should be used.

Breusch and Pagan Lagrangian multiplier test for random effects
excessreturn[fundID,t] = Xb + u[fundID] + e[fundID,t]

Estimated results:

	Var	sd = sqrt(Var)
excessretu~x	.0016143	.0401786
e	.0002808	.0167568
u	0	0

Test: Var(u) = 0
chibar2(01) = 0
Prob > chibar2 = 1.0000

11.4.2 Heteroscedasticity

We test our model for heteroscedasticity by performing the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. The result shows signs of heteroscedasticity and therefore we run the regressions with robust standard errors.

Table 19: Test for heteroscedasticity

This test tests if the variance in the estimated residuals is not constant, which implies heteroskedasticity. The dependent variable is the funds' return minus the risk-free rate (excess return). The null hypothesis is that there is a constant variance.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
H_0: Constant variance
Variables: fitted values of excessreturn

chi2(1)	4.41
Prob > chi2	0.0358

11.4.3 Multicollinearity

We test our models for multicollinearity by using the Variance Inflation Factor (VIF). Based on Murray et al (2012), who write that the typical cutoff values for VIFs is 5 or 10, we have decided that 5 is the critical value for our VIFs.

VIF is calculated in the following way: $VIF = \frac{1}{(1-R^2)}$

Table 20: VIF-test

The VIF values are low for all variables which implies that there is no multicollinearity within our data. Therefore, we do not have to correct for any multicollinearity. The dependent variable is the funds' return minus the risk-free rate (excess return). The variable excessretu~x describes the excess return of the index.

Variable	VIF	1/VIF
SMB	2,56	0.391177
MOM	2,53	0.395081
excessretu~x	1,06	0.941074
HML	1,03	0.974817
Sustainable	1,00	0.999956
Mean VIF	1,64	

11.4.4 Autocorrelation

Lastly, we also test our models for autocorrelation by using the Wooldridge test for autocorrelation in panel data. In cases where autocorrelation was present, the regressions are adjusted.

Table 21: Test for autocorrelation

In this table we show the result from the Woolridge test on the dummy model during the pre-crisis period. It shows no sign of autocorrelation. However, autocorrelation was present and adjusted for in some regressions.

Wooldridge test for autocorrelation in panel data	
H_0: no first order autocorrelation	
F(1,32)	0.593
Prob > F	0.4469