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Risk and Return of Ethical Funds: The Case of UN PRI

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Sammendrag

Denne oppgaven undersøker hvordan etiske fond skiller seg fra fond uten etisk klassifisering, når det gjelder risiko og avkastning. Vi gjennomfører en event-studie og beregner ulike egenskaper ved fondene, for å finne ut hvordan fondene forandrer seg når de blir etiske. I tillegg gjennomfører vi en tverrsnittsanalyse for å undersøke om resultatene påvirkes av visse karakteristikker. Utvalget vårt består av 48 fond som investerer globalt, og som er underlagt FNs prinsipper for ansvarlig investering. Perioden vi analyserer strekker seg fra ett år i forkant til ett år i etterkant av signering av avtalen. Vi finner ingen unormal avkastning, men det er en signifikant reduksjon i risiko. Dette støtter tidligere studier av best-in-class investeringsstrategi, som har avdekket lavere volatilitet. Vi ser også at resultatene i stor grad påvirkes av fondets geografiske opphav og året for signering.

Abstract

This thesis investigates whether ethical fund investments differ from fund investing without an ethical mandate, in terms of risk and return. We conduct an event study and calculate several fund properties, in order to detect how funds change when becoming ethical. In addition, we perform a cross-sectional analysis, to see whether the results depend on certain characteristics. Our sample consists of 48 global investing funds that are subject to the UN's Principles of Responsible Investment. The period analyzed ranges from one year pre- to one year post- signing of the agreement. We find no abnormal returns, but there is a significant decrease in risk. This supports previous studies of best-in-class investment strategy, which have detected lower volatility. We also find that the results are highly dependent on the fund's geographical origin and year of signing.

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Preface

This thesis is written as a part of the Master of Business and Administration program at Oslo and Akershus University College of Applied Sciences, within the field of Finance.

The motivation for the thesis is based on the growing debate of responsible investments. Even though there have been previous studies on ethical investing, we wanted to perform a study on an ethical event, using a unique dataset of funds. We see the study as a great opportunity to gain more knowledge within the discipline of fund investments, and becoming familiar with the impact of ethical criteria.

Working with the thesis has been both interesting and a great educational experience. There have been challenging times when collecting data and using R, but the process has been enlightening. During our work, we have increased our knowledge of ethical fund investments, as well as mastering data collecting from trading software.

Finally, we would like to thank our supervisor Knut Nygaard for valuable contributions and feedback during the process. We would also like to thank Andreea Ioana Alecu for great help with programming in R.

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Elisabeth Ausen Engen and Erika Nylander

Content

1 Introduction

It is important for individuals to secure their future financial situations. People's need to save and invest for their retirement has led to different forms of savings. One form of saving that was introduced early is mutual funds investment. Today the number of mutual funds worldwide is 76,200, with assets managed totaling $30 trillion (Statista).

In recent years, there has been a growing focus on maximizing capital while also being socially responsible. This has led to the development of so-called ethical investing. The number of funds with focus on ethical criteria in the United States has grown dramatically, and from 2012 to 2014 these funds' assets under management grew from $1.01 trillion to $4.31 trillion. At the start of 2014, more than one out of every six dollars under professional management was earmarked for Socially Responsible Investments (SRI), representing 18% of total assets under management (US SIF). Similarly, in the European market ethical investments where estimated to cover 11% of all professionally managed assets (Eurosif).

As a result of the focus on sustainability, different organizations have been established to motivate and assist ethical investors. The UN's Principles for Responsible Investment (UN PRI) lays the foundation for our thesis. The UN PRI is an international network with a mission to advertise the implications of sustainability. Even though ethical investments have received quite a lot of attention in the past years, this paper is as far as we know the first study on ethical funds' risk and return in the case of UN PRI.

Based on the background presented, the overall question of this thesis is:
How does ethical fund investments differ from fund investing without an ethical mandate, in terms of risk and return?

We classify the funds as "without an ethical mandate" before PRI agreement signed, and as "ethical" after agreement signed. According to Modern Portfolio Theory, having restrictions that narrows down the investment universe like ethical funds do, will increase risk (Markowitz, 1952). This suggests that there should be a difference between ethical and traditional funds. Previous studies on SRIs show that there is no

clear answer to the question whether ethical funds differ from traditional funds, as the results point in different directions.

In this thesis we use a dataset consisting of 48 globally investing mutual funds in the period 2006 – 2015. To determine the significance of our results, we use the Student T-test. Our results document that there is no significant difference in return between ethical and conventional mutual funds. There does however appear to be a reduction in volatility for funds that incorporate ethical investments criteria. A cross-sectional analysis indicates that there are geographical differences. Funds located in the European or US market experience a greater increase in return per total risk than funds in other markets when investing ethically.

In the next section we will present Principles of Responsible Investments, and give an overview of relevant literature for this research. Section 3 contains all data and sample selection. This section provides the reader with a thorough understanding of how the data for net asset value, benchmark and risk-free rate are collected and processed. In section 4 we show how excess return and different measures of risk for the funds are calculated, in addition to conducting a cross-sectional analysis. The main results of our study are presented in this section. Finally, in section 5, we provide a conclusion for the study, limitations of the analysis and suggestions for further research.

2 Defining SRI and institutional background

2.1 Principles for Responsible Investments

PRI is an initiative started by The United Nations in 2006 in order to create and support responsible investments. It focuses on environmental, social and governance (ESG) issues. The initiative consists of a network of companies that have signed an agreement committing them to work together towards six principles defined by the PRI.[1] We refer to these companies as "signatories".

The six principles of PRI are:

1. We will incorporate ESG issues into investment analysis and decision-making processes.

[1] http://www.unpri.org/viewer/?file=wp-content/uploads/PRI_Brochure_2015.pdf (02.02.2015)

2. We will be active owners and incorporate ESG issues into our ownership policies and practices.

3. We will seek appropriate disclosure on ESG issues by the entities in which we invest.

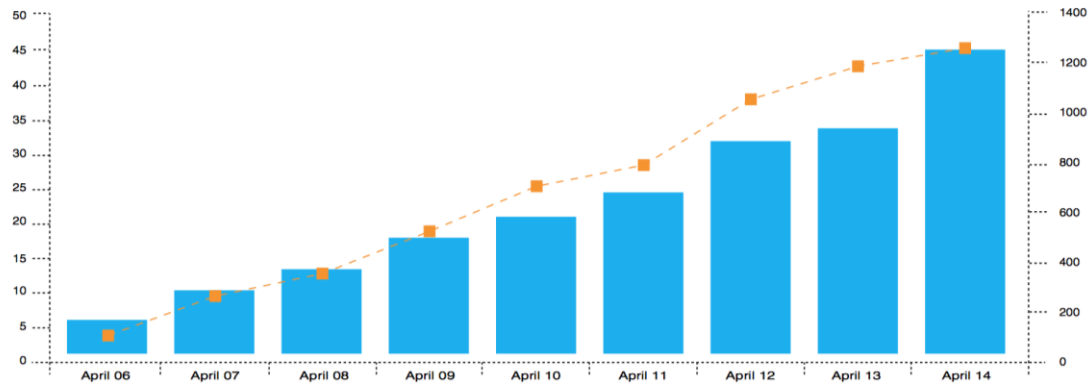
4. We will promote acceptance and implementation of the Principles within the investment industry.

5. We will work together to enhance our effectiveness in implementing the Principles.

6. We will each report on our activities and progress towards implementing the Principles.

In 2014 the PRI had 1325 signatories and the sum of assets under management represented approximately $45 trillion in total. The number of signatories has increased steadily since the release in 2006.[2]

Figure 1: Growth of the PRI initiative



The orange squares shows the number of signatories and the blue bars shows the assets under management. (UN PRI)

2.1.1 The benefits of signing the PRI

The aim of the PRI initiative is to increase companies' and stakeholders' responsible behavior within ethics and environment. The initiative also provides help and assistance to their signatories in incorporating these issues in their ownership and how they make decisions. According to the initiators of the PRI there are several benefits

[2] http://www.unpri.org/viewer/?file=wp-content/uploads/PRI_Brochure_2015.pdf (02.02.2015)

to joining the network. They argue that by implementing the principles of SRIs, one will gain a complete understanding of a range of material issues, which will lead to increased return and lower risk. Having a common focus on long-term responsible investment could lead to a more predictable and less volatile financial market.

In addition, the PRI serves as a framework for investors in their daily operations. The PRI principles are designed to fit each organization's investment strategy and approach. Meaning that it is possible for every organization, no matter starting point, to sign up and start adopting ESG principles. The PRI also allows variation in implementation between signatories. Some signatories choose the investments that conduct their business in a sustainable way while others choose to exclude companies that are not engaged in sustainable business. The former strategy is called positive screening, while the latter is called negative screening. Another way to implement the principles is to engage in a dialogue to influence companies that violate international conventions, and this is called impact investing.[3]

2.1.2 What do the signatories commit to?

When companies join the PRI and implement the principles, they agree to contribute to the development of a more sustainable financial system. The high focus on ESG issues gives us ground to define each company as ethical after signing up. This definition also covers the funds they are managing.

Signatories commit to submitting an annual framework report to highlight how they work to implement the principles. After the first year the reporting is mandatory and new signatories must annually complete the report to measure their progress with the implementing of the principles. Failure to report will lead to exclusion.[4]

All signatories must pay an annual fee that is calculated from the institution's total assets, type of asset, and number of employees.[5] This annual membership fee paid by all signatories is the primary funding for the PRI Initiative. The fees vary between £1,000 – 11,500 for companies with assets under management with a value between

[3] http://www.unpri.org/viewer/?file=wp-content/uploads/PRI_Brochure_2015.pdf (02.02.2015)
[4] http://www.unpri.org/areas-of-work/reporting-and-assessment/ (02.02.2015)
[5] The fee is stated in GBP because the UN PRI is located in London, UK.

$0.09 – 50 billions. The highest fee is £12,500 for companies that have assets under management that exceed $50 billions.[6]

2.2 Related literature

When it comes to determining SRI effect on portfolio performance, the literature is rich with various studies conducted. Researchers have found evidence that a focus on SRI can lead to both better performance than the overall market, but there is also evidence of sub-performance. Supporters of SRI claim that responsible investment is the only sustainable approach, and therefore responsible investments will outperform the market, especially in the long term. As a contrast, skeptics believe that taking an SRI approach is not without a cost, and that this cost will be seen in the decreased returns.

Kempf and Osthoff (2007) found that a best-in-class investment strategy outperformed the market, when looking at stocks.[7] The portfolios with this strategy had a significant high alpha when using the Carhart four-factor model. Similarly, Weber et al. (2010) found that funds that invested in companies with a high ESG score performed better than the market, when looking at SRI funds. However, after exceeding a certain level, the more investments in ESG, the worse the performance. This could indicate increased risk as a result of a reduced investment universe, which is in line with Adler and Kritzman (2008). They concluded that exclusion of sinful industries, such as the tobacco- and weapon industry, would lower returns and increase risk.

Hong and Kacperczyk (2009) find that exclusion of sinful industries give less returns, explained by such industries having a stable demand, even when the market declines. In addition, Fabozzi, Ma and Oliphant (2008) explain how the costs associated with making sure that the portfolio is -and keeps staying- ethical, will force SRI returns to be lower than for general investments.

Furthermore, there have been some studies on ESG investments and volatility. Bollen (2007) finds that the monthly volatility of investor cash flows is lower in socially responsible funds than in conventional funds. Credit Suisse (2012; 1) studies ESG

[6] http://www.unpri.org/about-pri/pri-governance/pri-financial-information/ (10.05.2015)
[7] Best-in-class strategy means no complete exclusions of industries, but instead to invest in the companies with the highest rating on ESG factors within the industry, that is, positive screening.

performance and volatility, and conclude that volatility is lowest among best-in-class rated companies and tends to gradually increase with inferior ESG-performance. Additionally, companies with ESG commitment above the median have lower volatility and significantly smaller spread in stock price compared to companies below the median.

In spite of this, many studies find no significant differences between funds with SRI focus, and those without. Humphrey and Tan (2014) conclude that return and risk are the same for SRI funds and conventional funds, when testing for both positive and negative screening. Cortez, Silva and Areal (2009) investigated ethical funds in the US and European markets, but found no significant differences from unrestricted mutual funds.

With an overview of the relevant literature, it seems that an SRI strategy that excludes certain industries will perform worse than the market, while a best-in-class strategy could give better performance than the market. The latter can be shown both in higher returns and in lower volatility. The conducted studies have all used data from the US and the European market.

2.3 Fund Choices

When companies agree to sign the PRI we expect them to follow a new investment approach. We therefore classify the funds they are managing as ethical immediately after the signup. It must however be clarified that we do not know to which degree the funds are incorporating ESG before signing up. In order to meet the new criteria it is reasonable to assume that the funds make some changes in their portfolios. It is of interest to understand how the fund managers change their portfolios. There are many different strategies when it comes to taking an ethical approach in investing, but the specific demand that follows from the UN's initiative is to focus on promoting environmental, social and governance issues. From a fund manager's point of view, this can be done by 1) investing in companies with high ratings on Environment-, Social-, or Governance factors, 2) excluding companies and industries that do not promote these issues, or 3) taking an active role in creating focus on these areas, i.e. shareholder activism.

2.3.1 Assumptions

Using economic theory, we have come up with some assumptions for what we expect will happen when the funds become ethical. First, as with every transaction, changing the fund's portfolio to meet new demands involves costs. We expect that there will also be costs associated with monitoring that the investments score sufficiently on ESG factors (Fabozzi, Ma and Oliphant, 2008). In addition to the annual membership fee, labor costs for completing the required annual framework are likely to incur. There is also a different kind of cost; the loss of turning down potential high returns of sinful industries (Hong, Kacperczyk, 2009). Based on this, our first assumption is

(1) There will be negative abnormal returns after signing up.

This can be tested by performing an event study, which detects abnormal returns in the period after signing.

Also, Markowitz (1952) explained how to reduce risk by having a well-diversified portfolio. However, when excluding industries, i.e. negative screening, the investment universe is narrowed down and risk will increase. If this is the case, we should see a higher volatility in fund returns. Our second assumption is therefore

(2) If the fund chooses to exclude certain industries, there will be an increase in the fund's volatility.

This can be tested by comparing volatility prior to and after the signature date.

Next, we proceed to the Capital Asset Pricing Model (Sharpe 1964, Lintner 1965, Mossin 1966). CAPM calculates expected return from an asset, on the base of its correlation with a benchmark index. If a fund manager changes his portfolio by investing in new assets, we should see a change in the index correlation. This leads to assumption number 3, which can be tested by comparing beta before the signup with beta after the signup.

(3) If the fund chooses to invest more in companies with high ESG-scores, there will be a change in market beta, and an increased relationship with an ethical benchmark index.

Also, seeing how it is voluntarily to sign the UN PRI, we have reason to believe that the first signatories were already incorporating ESG to some degree, and therefore did not have to make significant changes in their portfolios in order to meet the UN PRI

requirements. As the PRI grew popular, less ethical funds wanted to sign on, perhaps for reputational reasons. The new signatories would then have had to make more of an adjustment, which could give poorer returns compared to the first signatories, due to e.g. transaction costs. Our fourth assumption is therefore

(4) Funds that signed in the earliest years did this with a smaller cost than those that signed in the later years.

Assumption 4 can be evaluated by performing a cross-sectional analysis, where we use each year of signing as an explanatory variable. If the assumption holds, we should see a decreasing fund performance as the years pass from 2006.

Finally, even though all of our funds invest in the global market, they belong to different countries. We know from US SIF and Euro SIF that the markets for ethical investments have been well established both in the US and in Europe. However, our sample includes countries outside these markets as well. It is natural to believe that the different markets have varied knowledge, and have incorporated ESG investing to different degrees. Our final assumption is therefore

(5) There will be different results depending on the geographical origin

Like assumption 4, this can be tested using cross-sectional analysis, where the explanatory variables are the different regions.

3 Data and sample selection

3.1 PRI Funds

Our dataset is unique for our study and consists of daily change in net asset value for 48 globally investing funds. The net asset value contains end-of-day market prices for the funds. The analyzed period lasts nine years and examines mutual funds in the period between April 2006 and March 2015.

To be able to conduct an event study, and to compare the pre- and the post-period, the exact date of when the funds announced to sign the PRI agreement is required. We contacted the PRI and got a list of the sign-up dates for 1,360 different companies. In the annual reports on the PRI´s website we found 170 companies that had been excluded over the years. The excluded companies were eliminated from the list,

assuring the presence of only active signatories in the sample. We have also been in contact with the companies to get an announcement date, but it turned out that the sign-up date was the same date as for the announcement. For this reason we chose to use the sign-up date as the announcement date in this master thesis.

To collect daily returns, we use Thomson Reuters "Eikon". We use the search function to find the companies from the PRI list that manages funds, and we then sort out these companies. An important part of the selection is to find funds that were active during the signup date and have enough data before and after the signup. Since we want to study the fund one calendar year prior to, and one calendar year after the signup date, we eliminate 20 funds that do not provide sufficient data. Left in the sample are 347 companies that manage funds with approximately 250 trading days before the event date and 250 trading days after the event date. When the companies and funds are sorted out, we filter the funds through three characteristics; private equity, global market and open-end. Then we end up with a couple of funds for each company and chose a sample fund from each firm. Some of the funds do not have the company name in the fund name. To ensure that the signed-up companies manage the funds we have found in Eikon, we have done some research on the companies' websites. We have been able to match the majority of the funds that we found in Eikon with the correct company, but when there were any doubts then we have excluded the company. After the selection process, we are left with a unique dataset consisting of 48 funds. They all have a common feature of investing the majority of the portfolio in the US market.

Survival bias is important to consider when examining the funds' performance since funds with poor performance tend to merge or disappear from the market faster than funds with good performance. This could lead to overly optimistic assumptions since failures are ignored, which may lead to a misleading result of the study. The funds that have been excluded from this study have been excluded because they have too few data points before the event, i.e. that the funds were founded just before the signing. Another reason for the exclusion of funds is insufficient data after the event, i.e. that it was recently signed up. No funds have been excluded from our sample because they ceased. Therefore, this study is free from survival bias.

3.2 Selection of benchmarks

We use “MSCI World” as a market index, and daily data is obtained from Thomson Reuters Eikon. The Index captures large and mid cap representation across 23 developed markets (MSCI INC.). This index is used since the funds in our sample have a global investment strategy and represents funds in developed markets.

It is optimal to use an ethical index in order to investigate the funds' actions after they have signed up for the UN PRI. When searching for a global ethical index, we do not find one that cover the whole period for our study. Thomson Reuters recommends using the OMX Ethical Price Index available from Eikon as a global ethical benchmark, and this index is therefore the choice used. The index is an ethically screened version of the OMX Stockholm 30 Index (Nasdaq). Unfortunately, since this index does not reflect the global market, there were misleading results. The results were inaccurate and were therefore excluded.

3.3 Selection of risk-free rate

The daily 1-Month Eurodollar Deposit rate available from Federal Reserve Economical Data is used as a proxy for the risk-free rate. The Eurodollar deposits are not guaranteed by any government, but they represent an investment at a low-risk, as they combine the rate from two of the largest federal banks. According to John Hull (2012), it is common for practitioners to use the Eurodollar as a proxy for a risk-free rate.

4 Method and Results

In this section we conduct an event study, calculate property measurements for each fund pre- and post- signing, before conducting a cross-sectional regression. The significance of the results are tested using a T-test. Furthermore, for each measurement an analysis of the results is presented.

4.1 Event Study

We start by performing an event study, which reveals the potential abnormal returns that follows from the commitment of signing up. In order to estimate what is an

expected return for each fund, we use the Market Model, and calculate beta for each fund as:

$$\beta_i = \frac{Cov(R_i,R_m)}{Var(R_m)} \quad (4.1.1)$$

where $Cov(R_i,R_m)$ is the covariance between fund *i*, and market return (MSCI World), and $Var(R_m)$ is the variance of market return. We use observations from the estimation windows, which start one calendar year prior to the event and stops three days before the event. This gives us data from approximately 250 trading days for each fund.[8]

Alpha is calculated by:

$$\alpha_i = \bar{R}_i - (\beta_i \bar{R}_m) \quad (4.1.2)$$

where $\bar{R}_i$ is the average return for fund *i*, and $\bar{R}_m$ is the average market return.

The error term is given by:

$$u = R_i - (\alpha_i + \beta_i R_m) \quad (4.1.3)$$

where R_i is the return for fund *i*, α_i is the alpha for fund *i*, and R_m is the market return.

Fund performance is determined by the value of its current investments, and it is only when the fund manager decides to change the portfolio due to the event that we can investigate the effect on fund performance. We therefore define the event window as the number of days that we expect it would take the fund manager to adjust to the event and the new investment criteria. In this study, the event window starts the day before the announcement, and spans over 1 calendar year. This means that we have data from approximately 250 trading days for each fund,[9] and we can classify the study as being short-horizon ≤ 12 months.

Let $t = 0$ represent the time of the event. For each sample security *i*, the abnormal return of the security for time period *t* relative to the event, e_{it}, is:

[8] Number of trading days varies between 146 and 303. The high number of trading days is due to one fund, Hunter Hall, which traded six days a week in 2009.
[9] Number of trading days vary between 163 and 263.

$$e_{it} = R_{it} - K_{it} \quad (4.1.4)$$

where R_{it} is the observed return, and K_{it} is the expected return given the market model.

It is necessary to aggregate the observations before we can draw overall inferences for the event. The immediate response in the market can take place both prior to and after the exact date, hence the event window. Let horizon length be $L = T_2 - T_1 + 1$. We skip one day from the estimation window to avoid overlap. The cumulative abnormal return for asset i starting at time T_{1+1} through T_2 is defined as:

$$CAR_i = \sum_{t=T_{1+1}}^{T_2} AR_{i,t} \quad (4.1.5)$$

where $AR_{i,t}$ is the abnormal return for fund i on day t.

CAR_i uses aggregation through time for an individual asset. In addition, we include aggregation across assets by introducing cumulative average abnormal return, which is defined as:

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i \quad (4.1.6)$$

Having a null hypothesis, which says that the expected abnormal return is zero, it is now possible to test the significance of the observed results and draw inferences. In order to test the results we need an estimate of the variance of $CAAR$. This is calculated as:

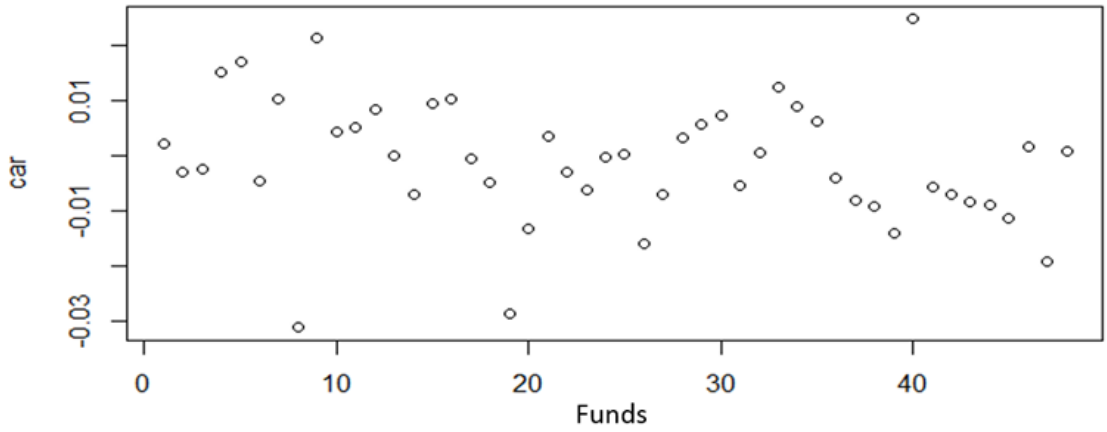
$$S^2_{CAAR} = \frac{1}{N-1}\sum_{t=1}^{N}(CAR_i - CAAR)^2 \quad (4.1.7)$$

When performing a cross-sectional test, the cumulative average abnormal return is divided by its estimated standard deviation. Since none of the funds in this study have the same event date, we can assume absence of cross-sectional correlation in residuals, which is necessary for the test.

Results of Event study

Figure 2 shows the cumulative abnormal return for the 48 funds. The figure represents one data point for each of the funds, starting from the signatory in 2006 and ending in 2014. The sample contains three outliers.

Figure 2: Cumulative abnormal return for each fund, in the first year after signing up to the UN PRI



The results from the event study shows that there is no significant difference in cumulative average abnormal return for the funds. Table 1 shows that the cumulative average abnormal return is -0.0220. When having an alternative hypothesis of the abnormal return being negative, it is necessary to conduct a one-sided T-test. For this test, the critical value that must be exceeded is |1.684|,[10] which means that our result is not significantly different from zero. Overall, we find that there is no significant change in the funds' return for the periods before and after the sign-up. Thus, if an investor invests in one of the companies that signed up, the investor would not expect the sign-up to affect the return. Based on this, it does not seem to be of any importance for the return that the funds are becoming ethical, which is in line with the studies done by Cortez, Silva and Areal (2009) and Humphrey (2014).

[10] On a 5 % significance level, with 47 degrees of freedom

Table 1: Cumulative abnormal return (CAR), variance of CAR, and test of significance

	CAR	VAR(CAR)	J stat
Mean	-0.0220	0.0004	-1.0883
Min	-0.0310		
Max	0.0246		

From assumption number 1, we expected a negative return due to the costs associated with paying the fee, adjusting the portfolio and so on. In addition, we expected the funds to experience a loss as a result of giving up sinful industries with stable demands. However, the results from the event study do not support the assumption about PRI costs decreasing fund performance. The lack of abnormal returns may indicate that the signatories do not exclude certain industries, but instead use a different investment strategy such as a best-in-class approach. If we still believe that there exist PRI costs and losses from exclusion, one could imagine that the funds actually had increased return before these costs were subtracted. However, we are not able to compare the cumulative abnormal return without these costs, and therefore we cannot draw any conclusions.

4.2 Property measurements

In the next subsections, we calculate different property measurements pre- and post-signing the PRI, in order to test if there are significant differences between the two periods. For all measurements, a two-sided paired T-test is used, which gives a critical value of |2.021|.[11] This is given by:

$$T = \frac{\bar{d}}{S_d/\sqrt{N}} \qquad (4.2.1)$$

where $\bar{d}$ is the sample mean difference, S_d is the sample standard deviation of the differences and *N* is number of pairs. The null hypothesis for the measurements is that there are no significant differences.

4.2.1 Calculating Sharpe ratio

When investigating the potential excess return of the signatories, it is of interest to study the Sharpe ratio. The ratio shows whether the funds have increased the risk

[11] On a 5 % significance level, with 47 degrees of freedom

compared to return or vice versa. We want to compare the Sharpe ratio of each fund, before and after signing the PRI. We choose to use Sharpe ratio since we assume that the investor is not well-diversified.[12] The Sharpe ratio is calculated one calendar year before the event and then the calculation is repeated for the calendar year after the event. The formula for the Sharpe ratio is represented by:

$$Sharpe = \frac{R_p - R_f}{\sigma_p} \qquad (4.2.2)$$

Where R_p is the historical return to the portfolio, R_f is the risk-free rate and σ_p is the standard deviation to the portfolio.

Then we look at the difference in the Sharpe ratio between the two periods, and calculate an average difference in Sharpe ratio for the funds, before testing the significance.

Results of Sharpe ratio

As can be seen from the results in table 2, there is a significant change in the Sharpe ratio between the two periods. The pre-event Sharpe is -0.2967 and the post-event Sharpe is -0.1681, which is a positive change of 0.1286. The result is significant at a 5% level. This means that on average, the fund's return compared to its risk have increased. However, average Sharpe ratio is still negative even after signing, indicating that a risk-free asset performs better than our funds.

Table 2: Results of Sharpe ratio

	Pre	Post	Diff	St.dev(Diff)	T stat
Mean	-0.2967	-0.1681	0.1286	0.3164	2.8165
Min.	-2.1684	-2.0807			
Max.	0.0695	0.0432			

The table shows the pre-event Sharpe ratio, the post-event Sharpe ratio and the difference between the two periods. The standard deviation of the difference and the T-test of significance are also shown.

Since we know that there is no significant change in the return after the event, then the increase in Sharpe ratio must be a result of a lower risk. This is contrary to

[12] When dealing with well-diversified portfolios, the Treynor ratio would be a better measure.

assumption 2, which expected the volatility to be higher if it were true that the funds would use negative screening after signing up. We therefore disregard the assumption about funds choosing to exclude industries in order to meet the PRI criteria.

One explanation to the positive Sharpe ratio could be that the fund managers become better at picking investments as screening becomes more selective. As we know, the PRI encourages long-term investments, which they claim will give less volatility. This implies that investors could be making a more rigorous selection process and therefore manages to invest in more stable stocks. The improved selection could lead to them increasing the return in relation to the risk.

4.2.2 Calculating Volatility

We want to investigate the direction of the risk after signing up. In order to do so, we calculate the funds volatility for the pre- and post-period, and compare the difference by using a T-test. Since the study examines a historical event, the historical volatility is calculated. The formula for the daily historical volatility is given by:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(R_i - \bar{R})^2}{N-1}} \qquad (4.3.1)$$

where R_i is the return, $\bar{R}$ is the mean of the return and *N* is the sample size.

Furthermore, we want to calculate the annualized volatility. The number of trading days in one year for stocks is assumed to be 252 (Hull, 2011, 306). To calculate the annualized volatility we multiplied daily volatility with the square root of 252. The annualized volatility can be calculated as:

$$\sigma_{Annual} = \sigma\sqrt{252} \qquad (4.3.2)$$

This measure tells us if and how the volatility has changed between the two periods. However, it does not tell us how the funds volatility has changed in relation to the market, and the market may experience a corresponding decline in volatility. This makes it difficult to compare volatility between different time periods, especially since our sample include the financial crisis. For this reason, we want to conduct an additional test, where we take market volatility for the same period in to

consideration. We repeat the calculations in formula 4.3.1 and 4.3.2 and calculate the volatility for the market in the same time period as the fund.

Furthermore, we construct a volatility ratio. The ratio uses the funds' volatility in relation to the markets' volatility. By using this ratio, we account for circumstances that concern the entire market, and will affect the volatility. The ratio is given by:

$$Volatility\ ratio = \frac{\sigma_f}{\sigma_m} \tag{4.3.3}$$

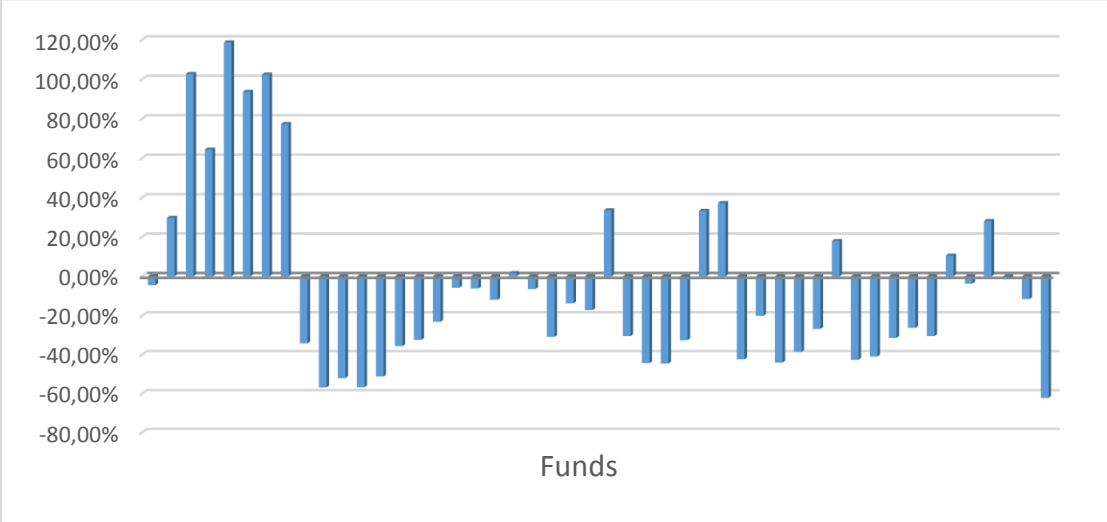
where σ_f is the yearly volatility to the fund and σ_m is the yearly volatility to the market.

A ratio greater than 1 implies that the funds volatility is higher than the market volatility, and a ratio less than 1 implies that the funds volatility is lower than the market volatility.

Results of Volatility

The average absolute volatility to the funds has decreased between the pre-and post-period.

Figure 3: Percentage change in volatility for each fund



The volatility has decreased by 3.34 percentage points and the results are significant at a 5% level. This confirms our assumption about the increase in Sharpe ratio that we believe must stem from decrease in volatility. The decrease in volatility is consistent

with Bollen's (2007) findings of lower volatility for a best-in-class strategy. One explanation for the lower volatility could be better investment decisions, as we discussed for the change in Sharpe ratio. The explanation may also be that they invest more in long-term responsible investments and thereby limit the financial risk. Again, this argument corresponds with what PRI states is one of the benefits of signing the agreement.

The market-adjusted volatility ratio is also lower for the post-period than the pre-period. However, the change is now smaller and not significant. Still the results (both when we include and exclude the market) violate our assumption number 2. Instead of an increase in volatility, there has on average been a decrease. The lower risk has the potential to make the signing of PRI attractive for risk-averse investors.

Table 3: a) Absolute volatility; b) Marked-adjusted volatility ratio

a)		Pre	Post	Diff	St.dev(Diff)	T stat
	Mean	21.69%	18.35%	-3.34%	0.1080	-2.1436
	Min.	9.55%	8.81%			
	Max.	46.79%	43.19%			
b)		Pre	Post	Diff	St.dev(Diff)	T stat
	Mean	1.2240	1.1990	-0.0245	0.3867	0.4389
	Min.	0.7309	0.8683			
	Max.	4.0754	1.9551			

Table a) shows the pre-event volatility of the funds, the post-event volatility and the difference between the two periods. The standard deviation of the difference and the T-test of significance are also shown. Table b) shows the same calculations, but for the volatility ratio.

We see that the volatility ratio is larger than 1, both prior to and after signing. So even if the funds volatility has decreased after the event period the volatility of the ethical funds is still higher than the market.

4.2.3 Calculating Beta

One way of investigating whether the funds have changed their portfolio, is to see if there is a significant difference in the beta between the periods. Beta is a measure of the correlation between the fund and a benchmark. To calculate market beta, we use daily returns of each fund and the return of MSCI World for the same period. We use formula 4.1.1 for this calculation. The difference between pre-beta and post-beta is

calculated for each fund. In order to test significance, we calculate the average difference in beta and perform a T-test.

Results of Beta

When we look at the market beta in table 4, we see that the average beta has increased from 0.7859 to 0.8282. This increase is not significant at a 5% level, but it is significant at a 10% level. This means that the funds' fluctuation follows the market index more closely after the signup. We can also see that the beta follows the market index, not perfectly but very close. This supports assumption number 3 about a change in beta because of portfolio adjustments.[13] The new market beta does not give an obvious link to the implementation of PRI, but it shows that there have been significant changes. The increase in beta tells us that the fund portfolios on average have become more similar to the market portfolio. Which would be the case if the fund manager for example sold securities that were moving in the opposite direction of the market.

Table 4: Results of beta

	Pre	Post	Diff	St.dev(Diff)	T stat
Mean	0.7859	0.8282	0.0422	0.1530	1.9121
Min.	-0.1524	-0.0085			
Max.	1.3172	1.3285			

The table shows the pre-event beta, the post-event beta and the difference between the two periods. The standard deviation of the difference and the T-test of significance are also shown.

4.2.4 Calculating Tracking error

Furthermore, we continue to calculate tracking error to see how closely the portfolios' return follows the market index. This is to see whether the funds indicate active or passive management, using the market as a benchmark. We calculate the tracking error as a mean annualized difference between the funds return and the market return. Then we take the standard deviation of the return and end up with a tracking error for each fund, as:

[13] The ethical beta based on OMX went from 0,3725 to 0,3820, but the change was not significant.

$$TE = \sqrt{\frac{\sum_{i=1}^{n}(R_p - R_b)^2}{N-1}} \quad (4.5.1)$$

where R_p is the return of the portfolio and R_b the return of the benchmark.

Since we want to test the change in tracking error we use a paired T-test. This tracking error is calculated with a short-term horizon to avoid the problem with underestimating risk (Scowcroft and Sefton, 2002).

Results of Tracking Error

The result from the change in tracking error indicates that there is no significant difference between the pre- and post-period on a 5% significance level. As we can see, the tracking errors for the two periods are almost the same. Since the mean tracking error is close to zero both pre- and post-event, it indicates that the portfolios follow the MSCI world index closely, which we consider to be passive management. However, this could also just be a coincident, seeing how it is not expected (nor consistent with PRI) that signing the PRI would lead to the fund managers becoming passive. The change in tracking error supports the change in market beta, in that the fund portfolios on average follows the market more closely post-signing. Apart from this, the change in tracking error does not support any of the assumptions.

Table 5: Results of tracking error

	Pre	Post	Diff	St.dev(Diff)	T stat
Mean	0.0097	0.0086	-0.0012	0.0065	-1.2559
Min.	0.0022	0.0023			
Max.	0.0276	0.0263			

The table provides the pre-event tracking error, the post-event tracking error and the difference between the two periods. The standard deviation of the difference and the T-test of significance are also shown.

4.3 Cross-sectional analysis

In order to see what effect the different fund characteristics have on our results, we want to do a cross-sectional regression. We use "Cumulative abnormal return" and "Change in Sharpe ratio" as our two dependent variables, and conduct one regression for each. These variables are used since we are investigating risk and return. From the

dataset, we know the following characteristics: which country the fund belongs to, which date it signed the PRI agreement, and which year the fund was founded.[14] For the regression, it is useful to make dummy variables. We therefore re-classify the three characteristics as "geography", "year of signing", and "number of active years before signing".

For "geography", the following four dummy variables are constructed: "Nordic", where all Nordic funds are gathered. "Europe", which involves all European funds, but excluding the Nordic ones. "USA" consists of all funds within the US. Finally a dummy for "World" is constructed, where we put funds that are neither European nor from the U.S. For "year of signing", we make one dummy variable for every year between 2006 and 2014. Funds that signed the PRI in 2006 will be labelled as "2006" and so on. We use dummy variables instead of a continuous variable, because we do not expect there to be linear relationship in this matter. For the final category, "number of active years before signing", we have made three dummy variables: "One-to-five" means that the fund has been active between 1 to 5 years before it signed the PRI. "Six-to-ten" involves funds that were active between 6 and 10 years prior to signing. And the final variable "Eleven plus" consists of funds that have been active for more than 11 years before signing.

The cross-sectional regression tells us how much of the results in "CAR" and "Change in Sharpe Ratio" that can be explained by the different fund characteristics. As we are interested in finding both positive and negative effects, we test the significance using a two-sided test. For each category one dummy variable is left out, and thereby avoiding issues with perfect multicollinearity. The left-out variables will be the references to which we compare the output from our regression. The following benchmarks are chosen: from "geography" – USA. From "year of signing" – 2006. From "number of active years before signing" – Eleven plus. The effect of signing in e.g. 2010, will then be the effect relative to 2006, and so on. We perform a multiple regression with all three categories; one regression for CAR and one regression for "Change in Sharpe ratio".

[14] See appendix, table 10, for summary of fund characteristics

The model is described by:

$$Y_i = \beta_1 + \beta_2 2007 + \beta_3 2008 + \beta_4 2009 + \beta_5 2010 + \beta_6 2011 + \beta_7 2012 + \beta_8 2013 + \beta_9 2014 + \beta_{10} Onetofive + \beta_{11} Sixtoten + \beta_{12} World + \beta_{13} Europe + \beta_{14} Nordic + u$$

where Y_i is the dependent variable, β_1 is the constant term consisting of the three reference dummies, β_2 is the weight given to a fund that signed in 2007, β_3 is the weight given to a fund that signed in 2008, and so on. β_{10} is the weight given to a fund that has been active between 1 to 5 years, β_{12} is the weight given to a fund belonging to a country outside the American or European market, and *u* is the error term.

Results when CAR is the dependent variable

We can see from the summary in table 6 that the chosen regression model only explains 22.8% of the change in cumulative abnormal returns. This is pointed out by "R Square", and indicates that the effect on CAR is not highly dependent on the three categories of fund characteristics that we have selected. However, there was no significant change in average CAR as a result of signing the UN PRI, which could explain the low power of our model. When adjusting for the number of independent variables, the explanatory power is close to zero, as we can see in "Adjusted R Square". This is of importance only when the model is used for prediction (Løvås, 2013, 290).

In the same table, we find the estimated effect on CAR from each dummy variable. If we start by looking at "year of signing", it turns out that when compared to the funds that signed in 2006, the funds that signed in the following years performed similarly, or slightly worse. Funds that signed in 2011 and 2013 had the biggest negative difference, and performed on average 0.011 percentage points worse in the first post-event year. This is in line with our assumption number 4, which says that the funds that signed after 2006 should experience higher costs. However, none of the results were significant. We keep in mind that for the reference dummy of «2006» only one fund signed. This fund had a positive CAR of 0.00223%.

Table 6: Regression coefficients and model summary for both dependent variables

	Dependent variable	
	CAR	Change in Sharpe ratio
2007	0.000	1.14***
2008	-0.006	1.036***
2009	0.000	0.425***
2010	-0.008	0.256*
2011	-0.110	0.241
2012	-0.002	0.367**
2013	-0.011	0.222
2014	-0.010	0.225
One to five	-0.007*	-0.116**
Six to ten	-0.004	-0.2
Nordic	-0.002	0.002
Europe	-0.002	0.002
World	0.000	-0.109
Constant	0.010	-0.224
Observations	48	48
R2	0.228	0.877
Adjusted R2	-0.067	0.83
Std. Error	0.011	0.13045
F Statistic	0.772	18.651***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Next, we look at the estimated effect of "number of years active before signing". Our reference dummy consists of funds that were active for eleven years or more before signing, and this group had an average positive CAR of 0.002%. The dummy "six to ten" performed on average 0.004 percentage points worse than the reference, while the youngest group of "one to five" performed 0.007 percentage points worse on average. The latter dummy has the only significant result in this model, with a t-value of -1.819[15]. This is statistically significant at a 10% level. To sum it up, the funds that have been active the longest time have the best performance. This could be explained by the fact that funds that have survived for eleven years or more, are better than those that did not survive in the same period. When looking at the funds that have been active for less than eleven years before signing, it is likely that we also include poor funds that are not likely to be around for ten years.

[15] See appendix, table 15, for full regression summary

Finally, we have the estimated the effect of geography. Our reference dummy is "USA" with a negative average CAR of -0.0023. Both "Nordic" and "Europe" performs 0.002 percentage points worse than the reference category, but the results are far from significant, with t-values of -0.418 and -0.456 respectively. The World-category is no different from the reference when it comes to CAR. These results do not give support to our assumption number 5, which expects differences between regions. However, this could be because of the lack of a significant CAR.

Results when "Change in Sharpe Ratio" is the dependent variable

As we see from table 6, the regression model explains 87.7% of the effect when "Change in Sharpe Ratio" is the dependent variable. Adjusted R Square is now 83.0 and that indicates that our three types of fund characteristics have an important impact on the effect on Sharpe ratio. As we have seen, the "Change in Sharpe Ratio" was significant different from zero, in the first year after signing.

Still continuing with table 6, we find the estimated effect on "Change in Sharpe Ratio" from each variable. When we look at "year of signing", the fund that signed in 2006 still makes up our reference dummy, and this fund had a decrease in Sharpe ratio of 0.34 after signing the UN PRI.[16] Compared to the reference, every sign year had a positive change in the ratio. The most significant difference was for the funds that signed in 2007 and 2008, with 1.14 units higher and 1.03 respectively. These coefficients, and the coefficient for signing in 2009, are all significant on a 1 % level. For the latter years, we see that the coefficient for 2012 is significant on a 5% level.

From this, we can conclude that the funds that signed after 2006 has had a better risk-adjusted return. This is contrary to our assumption number 4, which expected there to be greater costs for the funds that signed in the later years. However, the enormous increase in Sharpe ratio that came from signing in 2007 and 2008 could be related to the financial crisis in that period. Tang and Whitelaw (2011) explain how it is expected to find high Sharpe ratios when the market decline; "Generally, Sharpe ratios are low at the peak of the cycle and high at the trough". We must also keep in mind that the reference dummy consists of only one fund that signed in 2006, and that we are comparing all other years with this one decreased ratio.

[16] See appendix, table 16, for full regression summary

Moving over to "number of active years before signing", we find that both funds that have been active for one to five years before signing, and those that were active for six to ten years prior to signing up, have had a smaller increase in Sharpe ratio than the reference "eleven plus". The reference dummy had an average increase in Sharpe ratio of 0.2, so the overall change for the different categories is still positive. Funds in the "one to five"-category would on average have a Sharpe ratio 0.116 units smaller than a fund in "eleven plus", and this is the only coefficient that is significant in this category (with t = -2.527). Similar as for the effect on CAR, it is natural to assume that much of the differences we see again come from the fact that the long-living funds are better than those that did not survive in the same period.

For the final category, "geography", we see that compared to the reference dummy, both Nordic and European funds have had a slightly greater increase in Sharpe ratio. Our reference dummy, "USA", had an average post-event increase in Sharpe ratio of 0.064. Neither the coefficient of "Nordic" nor "Europe" is significantly different from this. "Nordic" has a coefficient of 0.002 and a t-value of 0.038, while "Europe" has a coefficient of 0,006 and a t-value of 0.117. When we look at "World", we see an underperformance relative to the USA-dummy. With a coefficient of -0.11 and t-value of -1.503, this category is almost significant on a 10% level.

This result gives support to our assumption number 5 about differences between regions. The result can be explained by the fact that the European and American market to a larger degree has incorporated ethical investing (Cortez, Silva and Areal, 2009), and that there have more pressure and/or support from stakeholders when investing ethically. For funds that are located in other regions, one would think that there is less organization around ethical investing, and that these fund managers have less experience when it comes to picking stable ESG stocks. After signing the PRI, they would therefore not get the same decrease in Sharpe ratio as the European and American fund managers.

5 Conclusion

The aim of this study has been to evaluate the performance of ethical funds and see if these differ from funds without an ethical mandate, in terms of risk and return. We have analyzed the funds' performance after signing the UN's Principles of

Responsible Investment. We studied the same sample of funds one year before and one year after they become ethical by signing. By conducting an event study, we detected potential abnormal returns. We also calculated the following measurements; Sharpe ratio, historical volatility, market beta and tracking error, to find the effect of PRI. Finally, we used cross-sectional regression in order to see if the results depended on certain fund characteristics.

We found no significant abnormal returns as a result of signing the PRI. However, we found a decrease in volatility, and a significant average increase in Sharpe ratio. This is in line with previous studies of best-in-class strategy, and indicates that the PRI signatories are likely to follow this type of investment strategy. The results of our study may promote the signing of PRI as attractive to risk-averse investors. When it comes to the decrease in volatility, our study documents that funds belonging to countries outside well-established ethical markets do not experience the same change.

The results of our paper are of interest and importance because they can be used to highlight ethical alternatives for investing. Our study shows that it is possible to act socially responsible, while getting the same return as conventional mutual funds. It is also of interest for companies that consider signing the PRI, to see what immediate effect it is expected to have on their funds' performance.

Ideally, we would have used a sample of funds that we knew had to make changes in their portfolio after signing, in order to meet the PRI criteria. In our research, we have not been able to see how the starting point of each fund was prior to signing. In addition, our dataset consists of a relative small sample, especially since the funds derive from different countries, and the countries are at different stages of implementing ethical investments. Even if we find differences that are subject to certain characteristics, the sample size is too small to claim that they are significant.

For future research, it could be of interest to have a larger sample size, and compare characteristics of categories in which there are at least 30 funds. In addition, monitoring the post-period over several years would make it possible to make statements about long-term effects. This could give a clearer picture of the effects of signing. It would also be of interest to investigate more specific what the funds do when they decide to sign the PRI. This could be done by examining what methods the

funds use to meet the ethical requirements, and by looking at fund holdings before and after signing the agreement.

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Appendix

Defining SRI and ESG

There are many definitions of social responsible investments (SRI) and the definitions may vary based on different subjective perceptions. In this master thesis we use PRIs definition of "responsible investment" since the thesis mainly reflects PRI's work and their approach to responsible investment.

> *Responsible investment is an approach to investment that explicitly acknowledges the relevance to the investor of environmental, social and governance factors, and of the long-term health and stability of the market as a whole. It recognizes that the generation of long-term sustainable returns is dependent on stable, well-functioning and well governed social, environmental and economic systems.*[17]

Event Study

It was Ball and Brown (1968) and Fama et al. (1969) who first introduced the methodology to study stock market reaction to new information and its impact on stock pricing. Semi-strong market efficiency implies that all public information is calculated into the current price of assets. With this assumption, the effect of an economic event will be reflected immediately in asset prices. A typical example of an event that has led to significant abnormal returns is company merges. When studying such an event, it is the date of the announcement that is of interest, and not the date of the actual merge. This is because of the link between public information and market efficiency (Campbell, 1997).

When looking at the stock market, it is possible to use the event study to find out how the market incorporates new information into stock prices, and get an insight of how efficient the market is. That is, with an efficient market, we would expect to see the immediate response in asset prices on the exact event date and in the next trading day. However, if the market response is less efficient, it might take several months/years before the market has adjusted to the new information. Kothari (2007) explains how to conduct event studies when we believe that there are inefficiencies in the market. He differs between "long-horizon event studies", where the event window is longer

[17] http://2xjmlj8428u1a2k5o34l1m71.wpengine.netdna-cdn.com/wp-content/uploads/1.Whatisresponsibleinvestment.pdf (02.02.2015)

than 12 months, and "short-horizon event studies", where the event window is shorter than 12 months.

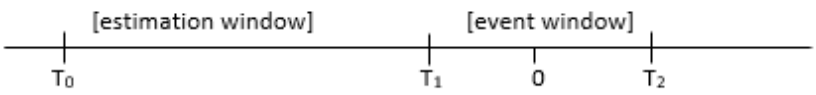
The structure of event studies is quite simple. First, it is necessary to have an estimate of what is normal (expected) return for the asset. This can be done by looking at historical performance over a number of days prior to the event. These days, which normally spans over 250 days prior to the event, are called the *estimation window* (Campbell, 1997). By using a market model, we can determine the relationship between the asset return and the market return. For the market model, we assume that asset returns are jointly multivariate normal, and independently and identically distributed through time. Short-horizon methods are not highly sensitive to the specification of benchmark model of normal returns, and using the relationship to the market return would be sufficient (Campbell, 1997). The market model is defined as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it} \qquad (10.1)$$

where R_{it} and R_{mt} are the returns on security i and the market portfolio for time t, and ϵ_{it} is the zero mean disturbance term. α_i and β_i are the parameters in the market model, and we will show in section 5 how they are estimated.

The next step is to define the *event window*. When studying stock market reaction, the event window is normally the day of the announcement, plus a few (if any) days before and after. The shorter the event window, the more precise measure we get. However, if the announcement is expected, some of the response can be seen days before the event (Kothari, 2007). Because it can take time to adjust to the new information, the immediate response of the event can also be seen days or weeks after the announcement. For long-horizon studies, the event window spans over years.

Time line:



With both a defined event window and a model for expected return in place, we find abnormal returns by subtracting the expected return from the actual return.

One way of testing our results is to divide cumulative average abnormal return with an estimate of its standard deviation. This is shown by:

$$J_1 = \frac{\overline{CAR}}{\sqrt{VAR(\overline{CAR})}} \sim^a N(0,1) \qquad (10.2)$$

If the equation exceeds a critical value, we can reject the null hypothesis and claim that the event has had a significant effect. This cross-sectional test has a Student's T-distribution, with N-1 degrees of freedom. It assumes normal distribution, and that the abnormal returns are uncorrelated across securities. It also assumes that both expected mean and standard deviation will be unaffected by the event. However, economic events often increase volatility in asset returns, which could lead us to falsely reject the null hypothesis even when there are no abnormal returns (Kothari 2007).

Property Measurements

Sharpe Ratio

In 1966 William Sharpe developed the reward-to-variability ratio, commonly known as the Sharpe ratio. The ratio provides a method to analyze how good a given portfolio is, given its risk. It defines how much return per total risk the investment manager has achieved. Sharpe ratio is calculated by dividing average portfolio excess return over the sample period, by the standard deviation of returns over the same period. The ratio adjusts for total risk rather than just the systematic risk. That is, it assumes that the portfolio is not completely well-diversified, in the way that it is still exposed to unsystematic risk factors. The higher the Sharpe ratio is, the greater is the profits for taking an additional risk. The model is described by:

$$Sharpe = \frac{r_p - r_f}{\sigma_p} \qquad (10.3)$$

Where r_p is the historical return to the portfolio, r_f is the risk-free rate and σ_p is the standard deviation to the portfolio.

The ratio uses the standard deviation in the denominator, and uses this as a proxy of total risk of the portfolio. This implies that the returns are normally distributed. However, deviations from the normal distribution are quite significant and therefore difficult to ignore (Bodie, Kane and Marcus, 2014). The Sharpe ratio is therefore an adequate measurement for non-diversified investors, as it focuses on total risk.

Beta

Beta measures the covariability between a security and a benchmark index. In the Capital Asset Pricing Model, beta is a measure of systematic risk, that is, the risk that cannot be diversified away (Sharpe, 1970). The estimation of beta is calculated as:

$$\beta = Cov(R_i, R_m)/Var(R_m) \qquad (10.4)$$

where $Cov(R_i,R_m)$ is the covariance between security *i* and the market, and $Var(R_m)$ is the variance of the market.

A beta of 1 indicates that the security return follows the movements of the market, and that the volatility is the same. If $\beta < 1$ it is natural to assume that that the security has smaller volatility than the market, or that its price changes are not highly correlated with the market. Similarly, when $\beta > 1$ the security is expected to be more volatile than the overall market, and follows the market's movements.

It is important to keep in mind that the calculated beta is just an estimate of the relationship. The beta is however, considered to be the best estimate because it is based on OLS regression, which uses the smallest squared standard deviation from the regressed line. The estimated beta does not need to be a constant number. If the benchmark is stable but the securities own idiosyncrasies (e.g. the covariance of its return with the benchmark) change over time, then beta will change (Gong and Cullinane 2002).

Tracking error

Another method to estimate risk is to use tracking error. Tracking error is the annualized difference between the return on a specified portfolio and the return of a benchmark portfolio. The tracking error describes how closely the portfolio return has followed the return to the benchmark portfolio (Bodie, Kene, Marcus, G-13). If the tracking error to the fund is high, then the fund's return has varied widely in relation to the benchmark. Tracking errors close to zero indicate that the portfolio is passively managed and seeks to follow its benchmark portfolio.

Assume that we have a sample with *n* different observations. Let R_p be the return of the portfolio and R_b the return to the benchmark. Also, suppose that the return is normally distributed and the volatility is constant, then:

$$TE = \sqrt{\frac{\sum_{i=1}^{n}(R_p - R_b)^2}{n-1}} \qquad (10.5)$$

Scowcroft and Sefton (2001) applied this calculation on different data sets. There results suggest that tracking error have performed reasonable well over a short-term horizon consisting of one year. While it has tended to underestimate risk in the long-term horizons of a period longer than one year.

Volatility

In addition to expected return; investors are highly focused on the risk to their portfolio. A useful measure of risk is volatility, which shows the deviation from the mean, or how much the return deviates from the expected return. The risk of a portfolio is normally related to the return of the portfolio. The reason is that high risk is often compensated with a higher return. If the returns are high it usually indicates that there is considerable uncertainty. This means that the risk, i.e. volatility becomes high (Brealey, Myers, Marcus, 2004).

T-test

For all the property measurements we have introduced in section 3.2, we want to test if there has been a significant change between the period prior to, and after, signing the PRI. The framework for the t-distributions was introduced by William Sealy Gossett (1908) under the pseudonym "Student". This resulted in what we now call a Student t-test.

There are several statistical tests that use the t-distribution, and one of them is the paired t-test. The paired t-test compares one set of measurements with a second set of measurements from the same sample, where the samples are correlated. This is often used to compare a sample before and after an event to determine whether any significant change has occurred. The paired t-test uses the mean difference between the two samples in the numerator and the standard deviation of the differences divided by the square rot of the samples in the denominator. The mean difference between the two samples is given by:

$$\bar{d} = \frac{\sum_{i=1}^{n}(x_i - y_i)}{n} \qquad (10.6)$$

Where x_i is the sample before the event, y_i is the same sample after the event and n is number of pairs. The test statistic is calculated from the formula:

$$t = \frac{\bar{d}}{s_d/\sqrt{n}} \qquad (10.7)$$

Where $\bar{d}$ is the sample mean difference, S_d is the sample standard deviation of the differences and *n* is number of pairs.

To get a robust paired T-test there are some assumptions that need to hold. The data must be continuous and the data for the matched pairs must follow a normal probability distribution. Also, the data for the matched pair must be a simple random sample from the population. The null hypothesis is that that there is no change between periods (Løvås, 2013, 322).

Cross-sectional regression

A cross-sectional analysis detects possible dependence between the results and certain fund characteristics (Wooldridge, 2009). This is done by cross-sectional regression, which estimates a beta for each characteristic. The characteristics are typically which country the fund belongs to, size of portfolio, number of active years, and so on. The estimated beta reveals how much weight the dependent variable relies on the specific characteristic.

In order to prevent problems of endogeneity, it is better to do a multiple regression with several independent variables, instead of performing one regression per variable. Endogeneity arises when we have omitted variables, which gives correlation between variables and the error term (Wooldridge, 2009). When using dummy variables, it is important that we leave one category out. This will be the reference dummy – that is, the category which the coefficients will be compared with. If we do not leave one category out, we will have perfect multicollinearity, which brings bias to our beta estimates (Hayashi, 2000).

Dataset

Table 10: Summary of fund characteristics

	Name	Country	Founded	Sign date
1	NEI Investments	Canada	2002	15.09.2006
2	OceanRock Investments Inc.	Canada	2005	07.02.2007
3	AXA Investment Managers	France	1988	29.05.2007
4	Baillie Gifford	UK	2005	26.06.2007
5	OFI Asset Management	France	1995	17.01.2008
6	BankInvest	Denmark	1989	11.02.2008
7	Skandinaviska Enskilda Banken (SEB) AB	Sweden	2007	11.06.2008
8	BlackRock	USA	2006	07.10.2008
9	La Banque Postale Asset Management	France	1986	20.01.2009
10	Swedbank Robur	Sweden	1975	19.02.2009
11	UBS Global Asset Management	UK	2002	22.04.2009
12	Martin Currie Investment Management	UK	2006	31.07.2009
13	Russell Investments	USA	2000	25.08.2009
14	Meeschaert Asset Management	France	2000	23.09.2009
15	FIM Asset Management	Finland	2000	22.10.2009
16	Delta Lloyd Asset Management	Netherlands	1960	09.12.2009
17	MFS Investment Management	USA	1993	01.02.2010
18	Comgest	France	1991	04.03.2010
19	Sumitomo Mitsui Asset Management	Japan	2000	31.03.2010
20	Edmond de Rothschild Asset Management	France	2009	12.04.2010
21	Sydinvest	Denmark	2007	23.04.2010
22	Hunter Hall Investment Management	Australia	2001	20.07.2010
23	T. Rowe Price	USA	2008	28.07.2010
24	Standard Life Investments	UK	1998	09.08.2010
25	Maj Invest	Denmark	2005	10.08.2010
26	eQ Asset Management Ltd	Finland	1999	14.12.2010
27	Kleinwort Benson Investors	Ireland	2009	05.01.2011
28	Portfolio 21 Investments	USA	1999	14.04.2011
29	Carnegie Asset Management	Denmark	2001	21.12.2011
30	Janus Capital Management LLC	USA	2009	26.01.2012
31	Magellan Asset Management	Australia	2007	08.03.2012
32	Dodge & Cox	USA	2008	25.05.2012
33	Carmignac Gestion	France	1998	14.06.2012
34	CamGestion	France	2005	21.06.2012
35	ODIN Forvaltning AS	Norway	2007	29.06.2012
36	SKAGEN AS	Norway	1997	14.09.2012
37	Hexavest	Canada	2009	20.09.2012
38	Deka Investment GmbH	Germany	1998	25.09.2012
39	Erste Asset Management GmbH	Austria	2001	04.10.2012
40	M&G Investments	UK	1973	11.01.2013
41	Franklin Templeton Investments	USA	2008	01.05.2013
42	PRO BTP Finance	France	1988	07.02.2013
43	Optimix Vermogensbeheer NV	Netherlands	1999	10.09.2013
44	Morgan Stanley Investment Management	USA	2008	30.10.2013
45	Didner & Gerge Fonder AB	Sweden	2011	04.02.2014
46	CONINCO Explorers in finance SA	Switzerland	2011	10.02.2014
47	AQR Capital Management	USA	2006	11.02.2014
48	Mackenzie Investments	Canada	1998	24.07.2014

Cumulative abnormal return

Table 11: CAR for each fund

Name	CAR
NEI Investments	0.00223245
OceanRock Investments Inc.	-0.00291828
AXA Investment Managers	-0.00232616
Baillie Gifford	0.01514994
OFI Asset Management	0.01703437
BankInvest	-0.0044694
Skandinaviska Enskilda Banken (SEB) AB	0.01030549
BlackRock	-0.03104932
La Banque Postale Asset Management (LBPAM)	0.0055433
Swedbank Robur	0.02124852
UBS Global Asset Management	0.00436173
Martin Currie Investment Management	0.00522138
Russell Investments	0.00826566
Meeschaert Asset Management	-0.00010486
FIM Asset Management	-0.00695547
Delta Lloyd Asset Management	0.00093445
MFS Investment Management	0.01015775
Comgest	-0.00050246
Sumitomo Mitsui Asset Management (SMAM)	-0.00476264
Edmond de Rothschild Asset Management	-0.02862751
Sydinvest	-0.01315645
Hunter Hall Investment Management Limited	0.00343719
T. Rowe Price	-0.00287609
Standard Life Investments	-0.00619203
Maj Invest	-0.00232861
eQ Asset Management Ltd	0.00736065
Kleinwort Benson Investors	-0.00550184
Portfolio 21 Investments	0.00025424
Carnegie Asset Management	-0.01594355
Janus Capital Management LLC	-0.00701277
Magellan Asset Management	0.00045348
Dodge & Cox	0.00330557
Carmignac Gestion	0.01237827
CamGestion	0.00901265
ODIN Forvaltning AS (ODIN Fund Management)	-0.00921943
SKAGEN AS	-0.01400638
Hexavest	0.0062735
Deka Investment GmbH	0.02463841
Erste Asset Management GmbH	-0.0056099
M&G Investments	-0.00700028
Franklin Templeton Investments	-0.00839163
PRO BTP Finance	-0.00414104
Optimix Vermogensbeheer NV	-0.00875575
Morgan Stanley Investment Management	-0.00114328
Didner & Gerge Fonder AB	0.00172829
CONINCO Explorers in finance SA	-0.01908013
AQR Capital Management	0.00090301
Mackenzie Investments	-0.00809478

Property measurements

Table 12: Calculation of volatilities, Sharpe ratios, tracking errors and betas for each fund

	Volatility		Adjusted volatility		Sharpe ratio		Tracking error		Beta		Beta ethical	
Funds	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
NEI	11.2%	10.7%	10.2%	10.5%	-1.740	-2.081	0.004	0.003	0.944	0.938	0.332	0.373
OceanRock	11.8%	15.3%	9.6%	14.4%	-1.840	-1.405	0.005	0.005	0.882	0.888	0.263	0.333
AXA	10.2%	20.6%	8.9%	15.8%	-2.168	-0.905	0.005	0.010	0.779	0.856	0.372	0.403
Baillie Gifford	15.3%	25.2%	9.3%	15.9%	-1.415	-0.693	0.009	0.016	0.773	0.487	0.356	0.290
OFI	16.9%	36.9%	13.2%	32.8%	-1.337	-0.425	0.011	0.026	0.479	0.321	0.179	0.231
BankInvest	18.4%	35.6%	14.4%	33.6%	-1.247	-0.385	0.012	0.020	0.441	0.624	0.077	0.214
SEB	17.8%	36.1%	16.5%	36.7%	-0.945	-0.324	0.012	0.024	0.421	0.435	0.231	0.317
BlackRock	24.4%	43.2%	20.3%	35.0%	-0.711	-0.080	0.007	0.016	1.080	0.998	0.378	0.512
SwedBank	44.9%	29.5%	32.8%	20.6%	-0.355	0.038	0.023	0.011	0.794	1.163	0.652	0.647
UBS	42.5%	18.3%	35.6%	15.8%	-0.294	0.040	0.028	0.012	0.464	0.460	0.312	0.129
Martin Currie	39.1%	18.7%	36.6%	17.1%	-0.237	-0.060	0.026	0.012	0.436	0.501	0.256	0.184
Russell	46.8%	20.2%	36.7%	17.2%	-0.172	-0.061	0.013	0.005	1.149	1.099	0.521	0.514
Meeschaert	35.2%	17.1%	35.7%	17.2%	-0.165	-0.111	0.009	0.005	0.902	0.882	0.467	0.441
FIM	39.5%	25.4%	30.4%	16.9%	-0.037	-0.066	0.022	0.008	0.709	1.328	0.378	0.677
Delta Lloyd	24.0%	16.2%	23.3%	16.7%	-0.045	-0.059	0.017	0.010	0.358	0.497	0.147	0.226
MFS	23.7%	18.2%	21.5%	16.3%	-0.012	-0.028	0.006	0.004	1.020	1.047	0.423	0.517
Comgest	18.5%	17.4%	20.0%	16.1%	0.043	-0.038	0.012	0.008	0.505	0.765	0.242	0.389
SMAM	24.2%	22.7%	17.2%	16.4%	0.022	-0.026	0.018	0.017	0.108	0.119	-0.032	-0.052
EdR	23.9%	21.1%	16.2%	16.4%	0.064	-0.052	0.007	0.004	1.317	1.241	0.533	0.596
Sydinvest	16.5%	16.8%	15.9%	16.4%	0.033	-0.036	0.010	0.008	0.538	0.700	0.204	0.330
Hunter Hall	13.9%	13.0%	15.2%	13.4%	-0.065	0.006	0.006	0.005	0.700	0.761	0.334	0.298
T. Rowe	23.0%	15.9%	17.5%	13.6%	-0.048	-0.023	0.008	0.005	1.131	1.038	0.514	0.442
Standard Life	19.5%	16.8%	17.1%	14.7%	-0.024	-0.018	0.013	0.011	0.431	0.494	0.147	0.175
Maj Invest	16.9%	14.0%	17.0%	15.2%	-0.019	-0.080	0.007	0.007	0.749	0.688	0.377	0.294
Portfolio21	17.8%	23.8%	16.6%	21.5%	-0.054	-0.066	0.005	0.004	0.982	1.058	0.490	0.523
Carnegie	21.7%	15.1%	21.5%	12.6%	-0.078	-0.001	0.008	0.007	0.819	0.786	0.429	0.353
Janus	29.9%	16.6%	21.6%	12.8%	-0.061	-0.079	0.008	0.005	1.280	1.141	0.597	0.436
Dodge & Cox	27.6%	15.3%	21.5%	11.8%	-0.083	0.014	0.006	0.004	1.214	1.181	0.570	0.500
La Banque	31.5%	21.2%	32.7%	21.9%	-0.448	-0.021	0.005	0.005	0.932	0.899	0.488	0.374
eQ	21.4%	28.5%	16.6%	20.9%	-0.034	-0.125	0.005	0.007	1.194	1.301	0.608	0.649
Kleinwort	18.0%	24.8%	16.4%	21.3%	-0.024	-0.166	0.004	0.012	1.039	1.125	0.509	0.552
Magellan	18.6%	10.7%	21.2%	12.3%	-0.163	-0.160	0.012	0.012	0.807	0.755	0.391	0.288
Carmignac	15.6%	12.5%	21.3%	11.2%	-0.156	-0.010	0.008	0.004	0.586	0.929	0.269	0.522
CamGestion	19.1%	10.7%	21.3%	11.6%	-0.114	-0.011	0.006	0.006	0.798	0.810	0.382	0.408
Hexavest	14.4%	8.8%	9.2%	7.2%	-0.074	-0.146	0.010	0.012	-0.152	-0.008	0.358	0.339
PRO BTP	12.3%	9.0%	12.5%	10.1%	-0.049	-0.005	0.002	0.002	0.947	0.846	0.415	0.365
Mackenzie	10.4%	12.2%	8.4%	10.1%	-0.001	-0.163	0.003	0.005	1.078	1.060	0.385	0.390
ODIN	25.1%	14.4%	22.0%	11.8%	-0.138	-0.008	0.011	0.005	0.986	1.019	0.499	0.555
Skagen	21.9%	12.9%	17.9%	10.2%	-0.034	0.042	0.006	0.006	1.059	0.949	0.492	0.474
Deka	20.6%	14.1%	17.4%	10.4%	-0.045	0.043	0.006	0.006	0.993	0.994	0.498	0.501
Erste Asset	16.2%	11.9%	16.8%	10.3%	-0.067	0.027	0.005	0.006	0.846	0.900	0.403	0.399
M&G	16.5%	11.5%	12.8%	9.6%	-0.076	-0.135	0.009	0.006	0.653	0.592	0.321	0.249
Franklin	13.1%	14.4%	12.2%	9.9%	0.069	-0.021	0.003	0.007	1.018	0.950	0.400	0.346
Optimix	13.9%	13.4%	10.4%	8.3%	0.025	-0.019	0.009	0.009	0.389	0.379	0.223	0.179
Morgan Stanley	13.4%	17.2%	10.4%	8.8%	0.060	-0.015	0.006	0.008	0.958	1.281	0.407	0.390
Didner og Gerge	9.5%	9.4%	10.1%	9.5%	0.022	-0.058	0.006	0.006	0.457	0.511	0.303	0.354
Coninco	13.2%	11.7%	9.7%	9.3%	0.048	-0.048	0.007	0.004	0.845	0.896	0.432	0.374
AQR	41.6%	15.7%	10.2%	9.3%	-0.056	-0.068	0.026	0.008	0.887	1.067	0.348	0.383

Table 13: Measure of difference in beta between the period before and after signing, calculated for each fund

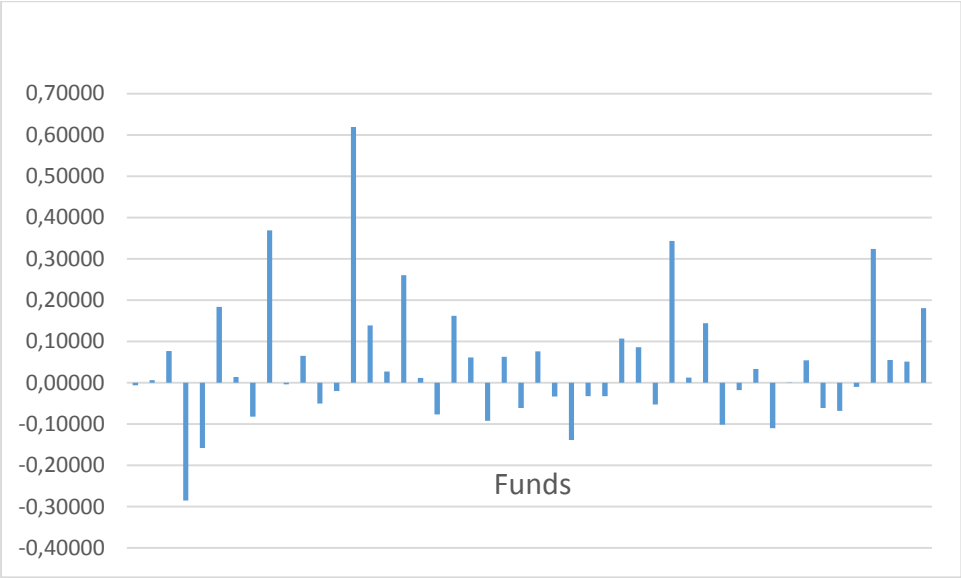


Table 14: Annual fee for signing PRI

Fee Investment Manager signatories	
AUM (US$ billions)	**2015/16 fee (£)**
>50	12.500
30 – 50	11.000
10 – 29.99	10.000
5 – 9.99	7.000
1 – 4.99	4.000
0.1 – 0.99	1.500
0 – 0.09	1.000

Cross-sectional analysis

Table 15: Model summary when CAR is dependent variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,478[a]	,228	-,067	.0113223385

a. Predictors: (Constant), World, Onetofive, twoeleven, twofourteen, twoeight, twothirteen, twoseven, Nordic, twoten, Sixtoten, twonine, Europe, twotwelve

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,010	,012		,791	,434
	twoseven	,000	,014	,003	,010	,992
	twoeight	-,006	,013	-,162	-,485	,631
	twonine	4,784E-5	,013	,002	,004	,997
	twoten	-,008	,012	-,308	-,661	,513
	twoeleven	-,011	,014	-,255	-,842	,406
	twotwelve	-,002	,012	-,080	-,172	,864
	twothirteen	-,011	,013	-,317	-,880	,385
	twofourteen	-,010	,013	-,251	-,751	,458
	Onetofive	-,007	,004	-,330	-1,819	,078
	Sixtoten	-,004	,005	-,147	-,782	,439
	Nordic	-,002	,005	-,080	-,399	,693
	Europe	-,002	,005	-,093	-,425	,674
	World	,000	,006	-,011	-,059	,954

a. Dependent Variable: CAR

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,001	13	,000	,772	,682[b]
	Residual	,004	34	,000		
	Total	,006	47			

a. Dependent Variable: CAR

b. Predictors: (Constant), World, Onetofive, twoeleven, twofourteen, twoeight, twothirteen, twoseven, Nordic, twoten, Sixtoten, twonine, Europe, twotwelve

Table 16: Model summary when Change in Sharpe ratio is dependent variable

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,936[a]	,877	,830	.1304513299

a. Predictors: (Constant), World, Onetofive, twoeleven, twofourteen, twoeight, twothirteen, twoseven, Nordic, twoten, Sixtoten, twonine, Europe, twotwelve

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,224	,138		-1,619	,115
	twoseven	1,140	,159	,882	7,172	,000
	twoeight	1,036	,152	,915	6,837	,000
	twonine	,425	,149	,506	2,853	,007
	twoten	,256	,143	,332	1,783	,084
	twoeleven	,241	,156	,186	1,539	,133
	twotwelve	,367	,143	,477	2,575	,015
	twothirteen	,222	,147	,216	1,506	,141
	twofourteen	,225	,151	,198	1,484	,147
	Onetofive	-,116	,046	-,183	-2,527	,016
	Sixtoten	-,020	,060	-,025	-,328	,745
	Nordic	,002	,059	,003	,038	,970
	Europe	,006	,055	,010	,117	,908
	World	-,109	,072	-,115	-1,503	,142

a. Dependent Variable: Endring i Sharpe ratio

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4,126	13	,317	18,651	,000[b]
	Residual	,579	34	,017		
	Total	4,705	47			

a. Dependent Variable: Endring i Sharpe ratio

b. Predictors: (Constant), World, Onetofive, twoeleven, twofourteen, twoeight, twothirteen, twoseven, Nordic, twoten, Sixtoten, twonine, Europe, twotwelve

Table 17: Reference dummy variables

	11plus	2006	USA
CAR	0.0020	0.0022	-0.0028
Change in Sharpe	0.2018	-0.3404	0.0639

Table 18: Calculation of change in Beta, using the ethical index as benchmark.

	Pre	Post	Diff	St.dev(Diff)	T stat
Mean	0.3725	0.3830	0.0105	0.0932	0.7795
Min.	-0.0316	-0.0525			
Max.	0.6523	0.6770			