Ethical Investments

An Analysis of the Performance of Ethical Funds in Europe, the US and Scandinavia

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Executive Summary

Based on the hypothesis that an ethically conscious investor must pay a price for opting to invest ethically correct, the thesis analyses the financial performance of ethical investments. Due to the restricted access of private investors to non-financial information about individual companies, the analyses are conducted on ethical mutual funds.

Ethical funds use screens to identify ethical companies for inclusion in the fund’s portfolio. The screening criteria applied by the funds are subjective and inconsistent among different funds. Hence a set of minimum ethical criteria which ethical fund must apply to be included in the analyses is established. European, US and Scandinavian ethical funds that comply with the screening criteria are pooled into three portfolios based on geographical location. For each fund two conventional reference funds are included in a reference portfolio for comparison of performance.

Analysis of the fund performance is conducted by the use of regression analysis on monthly time-series performance data. The models applied are the single index CAPM model and the Carhart (1997) 4-factor model. Both models are market equilibrium model, and the multi-factor model is consistent with a market equilibrium model with four risk factors. Using the method of ordinary least square, factor loadings of the fund performances are obtained.

The market portfolios and the factor proxies are defined by the universe of regional MSCI indices and listed companies. Size and book-to-market proxies for use in the multi-factor model are constructed using the regional MSCI Cap and Style indices and the OMX Nordic 40 index in one instance. The momentum proxy is created on semi-annually performance data on individual, publicly listed stocks in the MSCI universe.

Results obtained from the multi-factor analysis provide statistically vague evidence that European ethical funds underperformed relative to conventional funds, in the period from 01.1997 - 06.2008. The analyses does not allow for statistically significant conclusions on other periods or regions.

When utilizing the performance attribution results of the models, a relatively large exposure towards the regional market for all ethical funds becomes evident. This finding suggest a home-base bias of ethical funds, possibly explainable by the increased requirements of non-financial information for ethical funds, which is easier to obtain in the local regions. Regardless of the explanation the thesis proves that ethically conscious investors carry increased exposure to the local market index.
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Introduction

Investors are no longer just concerned about the return they obtain from their investments. An increasing number of investors are showing concerns regarding the ethical standards upheld by the companies they invest in. Hence investors are using their money to do-good for the society through the selection of their investments.

The movement of investors that are conscious about the behavior of the companies they invest in is called Ethical Investments. As the expression suggests, these investors use their money to influence the policies and administration of companies to behave in a manner which the investors are comfortable being associated with.

Several ways of using investments to promote ethics in business world are available. Some investors invest in a limited amount of shares, so that they get the opportunity to make lobbying at the general assembly and thereby try to change business process of companies to become more ethically conscious. A small number of wealthy investors chose to invest large sums of money in the shares of single unethical company and use the resulting influence to change company’s the behavior. But the most dominant ethical investment approach is for the investors to place their money in companies that uphold a superior ethical standard.

Finding information about the ethics of a company is not easy for individual investors. There are no rules forcing companies to reveal their ethical conduct and no common auditing standards exist in the area. Some ethical indices have been launched, but it is still a relatively extensive process to identify companies that are ethical. Hence the way most investors go about finding ethical companies for their investments is through ethical funds. Ethical funds investigate the individual companies on a list of ethical criteria and identify whether the company in question can be considered ethical as defined by the individual fund. After identifying ethical companies the ethical fund the make an investment decision based on either more traditional financial analysis or by following an index.

However admirable these intentions may be for the common good, the ethically conscious investor are in effect limiting themselves from making investments in a large part of listed companies, namely those not regarded as ethical. While limiting their investment universe ethical investors likewise limits the possibility of differentiating their portfolios. Common financial theory reasons that when limiting the differentiation in investments, the risk should increase or the return should decrease, relative to well diversified portfolios. Consequently ethical investors of ethical funds
should be paying a price for their decision to place their money in ethically conscious companies.

The intention of this thesis is to investigate whether ethical investors are in fact paying a price for making ethical investments and what this price may be. In particular the thesis focus on the European and Scandinavian market for ethical funds and compare it to that of the US market.

Some limited previous literature exists on the investigation of ethical fund performance. However, most of the literature investigates the US, UK or Australian markets which are all historically dominant in the area of ethical investments. The US have a culture which encourage ethics in company behavior, whereas the UK and Australian markets have had governmental intervention that has encourage the emerging of ethical investments. Recently other developed countries, mainly in Europe, have increased the attention on ethical investments and the market for ethical investment funds have expanded in most of Europe. Hence it has now become relevant to conduct an examination of the performance of European ethical funds.

But ethics is a subjective matter. The number of ethical funds is large, but they may not all be considered truly ethical in the eyes of the investors. Some of these funds only make screens in limited areas, while others screen on a variety of ethical criteria. Hence the thesis investigates each ethical fund to reveal if it is indeed ethical, or if the screening process of the fund is too hollow to be considered ethical as per the criteria of this thesis. Once a list of ethical funds is identified, the fund performance is measured through the use of a CAPM single-index model and a multi-factor model, to reveal the price investors pays for their ethical investments.

**Problem Formulation**

Deriving from the hypothesis that ethical investor must pay a price for investing in ethical funds as opposed to conventional funds; the thesis will seek to answer the following questions:

- What is the price a European, Scandinavian and US investor must endure when investing in ethically screened mutual funds relative to regular equity funds?

**Delimitation**

The thesis will conduct an analysis of ethical investments from an individual investor’s point of view. For a company to be regarded as an ethical investment it is required that the company complies with a number of ethical criteria. Information about the ethical conduct of individual companies is not readily available. Hence to identify the
ethical companies the analysis of ethical investments will be conducted on investment funds specializing in ethical equities, hereafter called ethical funds.

A list of ethical funds is obtained from the independent companies SRI FUND SERVICE® in corporation with Vigeo® for European funds and Social Investment Forum for US funds. The SRI FUND SERVICE® claims to include all ethical funds in Europe, while the list supplied by Social Investment Forum contain contains all their members which is assumed to be a fulfilling representation of US ethical funds.

The funds are investigated to determine if the ethical criteria upheld by the fund conforms to the minimum requirements set forth in the thesis. Funds analyzed in the thesis are those obtained from the independent sources later described. According to the sources, the lists of ethical funds include those funds open to individual investors and domiciled within the geographical area. Furthermore only funds that market themselves as ethical and show ethical conduct in their investments are included.

The thesis will refrain from investigating whether the list is complete and rely on the information provided by the provider of the ethical fund list. An investigation will be made of the extent to which screens are conducted in each ethical fund. Only funds that fulfill the minimum requirements set forth in the thesis will be included to ensure only ethical companies are included through ethical funds. There will not be made an investigation into the controls applied by the independent investment company to ensure that screens being followed as informed.

The list of European ethical funds is provided by Viteo.com in corporation with Morningstar. The Morningstar database does not include dead funds and information regarding dead ethical funds is therefore limited. Hence the analysis will not include dead ethical funds which may bias the results of the analysis. To allow for an equal comparison of ethical funds between the US and Europe, none of the data will include dead funds.

An analysis will be made of ethical investment funds from the US, Europe and Scandinavia to compare the performance. For each ethical fund a group of reference funds will be made, with similar attributes based on the market, the listed currency, and base-date of the fund, using the information available through Datastream.

The theory section will identify and explain a number of commonly used performance attribution models for determining the economic performance of ethical funds. The reader is assumed to have a basic knowledge of portfolio theory. Focus of the theory section will be to explain the connections behind a single index CAPM model and a multi-factor model. Summary statistics, not directly included in the construction of the
model, will only be shortly described when provided but will not be thoroughly explained in the theory section. Hence a basic knowledge of statistics for time-series and regression analysis is assumed as well.

For the benchmark market portfolios the appropriate Morgan Stanley Capital Index (MSCI) will be used. These indices do not include information on smaller companies, but the use of the MSCI universe is motivated by the acknowledgement that it provide a common standard in professional analysis. An alternative benchmark, the Thompson Analytics database provided World Scope, is also considered. World Scope has a better market capitalization coverage than MSCI, suggesting it captures the returns of smaller companies better, but it is not available for the Scandinavian markets through Datastream. Furthermore the available access to information on the underlying constituents of World Scope makes the index impractical for the multi-factor analyses. World Scope is the more popular choice for academics conduction analysis of mutual funds, but it is not directly applicable for this thesis. Consequently the empirically investigated universe is limited to that defined by the regional MSCI indices.

The periods investigated are two-fold and overlapping, and defined by the availability of relevant information. The first period investigated runs from January 1st 1997 through June 1st 2008. The analysis for this period will be conducted on European and US funds. Adequate information on Scandinavian funds stems back to October 1st 2005 which defines the second period investigated. The second period runs from October 1st 2005 through June 1st 2008.

In the multi-factor model three reference portfolios are necessary. The reference portfolios are intended to capture the fund’s sensitivity towards the returns of small relative to large companies, the return of stocks with high relative low book-to-market ratios, and the return of the last 12 months best performing stocks relative to the worst performing (momentum effect). Construction of these customized reference portfolios is best made from data on all stocks in the appropriate market. The best tool made available for extraction of financial data is Datastream. However, neither Datastream nor any other database available practically allow for the construction of customized portfolios that include all stocks in a market or index. Hence the construction of reference portfolios is made by other means.

The reference portfolios will therefore be made from the combination of relevant indices whenever possible. Namely the local MSCI large, mid and small cap indices are used in the construction of the size reference proxy. For the book-to-market proxy, the regional value and growth indices are utilized. Although the selection of value and
growth stocks by MSCI is not solemnly based on book-to-market ratios, it is assumed that the indices adequately mimic the alternate book-to-market ratio rating.

No index available captures the momentum effect. Hence for the momentum factor an extraction on all MSCI companies in the respective markets is made using Datastream. The access provided to data extraction in Datastream is not intended for the quantity of information necessary for construction of the momentum portfolio. To limit the quantity of information to be extracted, the investment universe for the extraction is limited to MSCI companies and is made on a semi-annually basis rather than monthly as suggested by Carhart (1997).

During the extraction process of data for the momentum proxy unsystematic corruptions of data occurred. An attempt to correct the data has been made, but errors may still be present in the information used for the analyses. It is however the conviction of the author that the data used for the analyses is correct and should be considered reliable.

The procedure for conducting regression analysis on time series is explained, but the actual application of the models is conducted through the use of a statistical Excel Add-in, Analysis ToolPak. Similar programs are available through statistical programs such as i.e. SAS or SPSS.

Methodology

For the selection of funds that are ethically correct, a set of minimum screening criteria are set up. The criteria are based on academic and independent literature on the subject of ethical investments. The selection of funds for inclusion in the analysis is made from a simple screen excluding funds that do not apply sufficiently thorough screens to their investments. Another selection screen is conducted based on the financial information available on each fund, to ensure a thorough base of data for the analyses. Both the ethical criteria and the financial information screens excludes funds that do not comply with either criteria.

The financial screen is also conducted on the reference portfolio of conventional funds to ensure financial coherence.

For the determination of the risk adjusted returns of ethical funds two models are applied on monthly time series on publicly quote funds. The first model, a single index CAPM model, is a market equilibrium regression model that can be used to test the performance of funds relative to a market index. Hence the model is in effect a performance attribution model correcting for market risks and the risk free rate.
The second model used is the Carhart (1997) 4-factor model. The 4-factor model is consistent with a market equilibrium model with four risk factors. The multi factor is used to determine the returns of the fund portfolios after correction for market, size, book-to-market ratios, and momentum factors. Hence the multi index model is in effect a performance attribution model that allows correction of several factors. Furthermore the multi index model allows for in depth analysis of each factor included in the model.

In the application of both analyses the model is applied to time series data of the above factors, a market proxy, the ethical and reference portfolios. Hence the application of the model is made on empirical monthly financial data extractions. The estimation of the alphas and betas of the models is made using the method of ordinary least square (OLS).

The models are hypothetically deductive, meaning a hypothesis is made that the factors included in the models are determining for the performance of the included funds. The factors included in the models are chosen based on the findings of existing literature and research on the performance of mutual funds. The significance of the factors is expressed in the results. This provides an insight into the distribution of risks for the analyzed funds and a subsequent test of the underlying hypothesis about the determining factors.

Alternate multi-factor models are considered, mainly in the shape of the Fama and French 3-factor model. This model is consistent with the Carhart 4-factor model excepting the momentum factor. Though other authors have created and tested other hypothesized factors for inclusion in the multi-factor model, there is a general acceptance in academic literature that the factors included in the Carhart model are superior in determination of mutual fund performance.

Other ways of comparing the returns of ethical funds exist, but most are unable to explain the underlying risk allocation of the fund performance.
Defining Ethical Investments

As the emerging of ethical investments has been a rather fast development happening simultaneously in numerous western counties, no one clear universal definition of ethical investments has yet been agreed upon. Terms like Socially Responsible Investments and Sustainability Investments are commonly used in the ethical literature alongside Ethical Investments. Some are of the opinion that the terms are interchangeable and just arise as different terms for the same definition. Others believe they cover different aspects of ethical discussions. Hence a clear definition of the terms used in this thesis is useful.

The following section will first relate the different terms to each others, and then explain what the term used in this thesis covers. The latter part will inevitably run into the ongoing and very subjective discussion of what is, should and can be described as ethical investments.

Socially Responsible Investments

As the Americans were the leaders in the development of ethical investments, they naturally had the first shot at finding a universal term for what we now know as ethical investments. Following the background of ethical investments in the US, the obvious and, at least initially, well descriptive term “Socially Responsible Investments”, or SRI, was first adopted. However, EI in the US initially had a different ethical focus than would European investors.

It is no secret that the American culture is somewhat different from the cultures of Europe. The generally less invasive government policy towards companies, and the lack of a fulfilling public health care and pension system has historically enhanced the need for a more self-regulating behavior on the part of private US companies. In recognition, or as a consequence, thereof there has been more focus on the ethical behavior of US companies by all stakeholders. But not all aspects of what we now consider ethical behavior has always been in the focus. Initially employee rights, health care and pension schemes as well as the support of corporations to their local communities through i.e. sponsorships, were among the main focuses. All of the mentioned aspects have a degree of social value to them, making the term Socially Responsible Investments appear very well suited. But none of these focuses has been necessary in Europe to the same extend, consequently attracting less attention.

The area of ethical investments eventually expanded from these initial concerns and started to merge with other concerns. Stakeholders started avoiding companies
supporting wars or suppressive regimes, environmental exploitation and child labor, among other things. These areas of concern have a more ethical aspect to them as opposed to social, yet they were all generally included in the US under the common description SRI. The consequence is that SRI now covers much more than just literally socially responsible investments, making SRI a poor description in regards to the concerns of most investors. But SRI is still the most widely used term in ethical discussion in the US. A general acceptance has therefore emerged that SRI is the US equivalent of EI.

Unfortunately the discussion does not get to a halt there, because not everyone is buying into SRI covering all the aspects of EI. Some investors and academics use SRI as a description covering most of the social aspects of ethical investments, but leaving out some of the more ethical considerations. It is as if they have refused to constantly add new aspects to the SRI description as new concerns became popular. Others use the SRI in connection with other terms such as environmental, green, value based or mission based investing to describe what the thesis defines as EI. And finally a group of academics claim that EI is directly misleading, arguing that a more precise and objective description would be preferable. The purpose of this thesis is not to be the judge of who is right. It is, however, important to acknowledge that in some articles SRI, EI and other such terms are used interchangeably, but other times they cover over different definitions. In this thesis the term used to cover all ethical criteria will be EI. Exactly what criteria EI then covers is a completely different, and unfortunately much longer, discussion.

**Defining Ethical Investments**

Numerous articles have set out to find the one true universal definition of what constitutes an EI. The process of screening the stock market to create a portfolio consisting solemnly of ethical companies must be tied to certain criteria. But defining ethics is by no means straight forward since it is a very subjective matter. The amount of EI definitions is probably as high as the number of ethically conscious investors. Although the discussion would arguably be better suited for a group of philosophers, many ethical fund managers and academics have expressed their opinion on the subject.

The following section will try to give an overview of the subjects most widely discussed in the definition of ethical screening criteria. These subjects are of interest in regards

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to the thesis, since the definition of EI is obviously crucial to what stocks will be included or excluded in the ethical portfolio.

It will be useful in the coming section to mention that as a point of reference EI includes all ethical screening criteria. This may sound strange, but if EI are seen in regards to “environmental”, “sustainable” or “socially aware” investments, the need for a point of reference covering it all becomes evident. Environmentally aware funds might, for instance, be screened on environmental criteria, but are not necessarily screened for companies with a legally questionably conduct of companies in the gambling industry. On the other hand, a company like Shell might get through an ethical screening (as explained later), but would probably be excluded from an environmentally screened portfolio, because of the impact on the environment caused by the industry Shell is in.

**Gray Ethical Criteria**

Most people would probably agree that producing tobacco or alcohol is unethical and such companies should never show up in an EI portfolio. But it is not a black and white business to set up ethical criteria. As an example let us consider weapon producing companies.

Most people would deem weapon producers unethical. Weapons are used to harm people, which is obviously not ethically justifiable. But NATO counties mainly use their armies on peacekeeping missions, to stop drug smugglers and pirates or to aid after natural disasters. Apart from the last example, they all demand the use of weapons and they are all for the common good of people. In that sense weapons are arguably promoting ethics. Yet many deem weapons unethical, because we all know how much pain they can evoke in the wrong hands. A tempting solution to the problem would be to screen weapon producers in regards to what armies and countries they support. But aside from being practically challenging it would also call upon another ethical dilemma of determining *whose* ethics should be considered. Although most westerners agreed that it was ethically correct to send peacekeeping armies to Afghanistan, the supporters of the former Taliban government would likely see NATO as the aggressors. Hence, what one group of people sees as a good deed others might regard as an unjust violation. So we need not only consider *what* is ethically justifiable but also *from which point of view* it should be justifiable.
Whether we agree or disagree with the evaluation that weapon producers are unethical, most ethical screens excludes weapon producers\(^3\). But this exclusion inevitably leads to another moral cross road: When is a company a weapon producer? In a concrete example a producer of computer chipsets specialize in durable electronic hardware for laptops and cellular phones. When the company became renowned for the quality of their products, it caused Lockheed Martin (the company behind the development of the new Joint Strike Fighter) to contact the chipset company about the delivery of certain electronic components for use in the fighter. Consequently the company entered the weapons systems industry, although by far the majority of their turnover came from civil electronic companies. The question arising is whether the small contract with Lockheed Martin should disqualify the company from entering ethical portfolios on the ground of being in the weapons industry? If not, then at what point can a company be considered a weapons manufacturer? Is it when five percent of the turnover comes from the weapons industry? Having a zero tolerance towards engagements in the weapons manufacturing industry would lead to an enormous number of companies being excluded. Yet setting a certain tolerance level implies that it is acceptable to be unethical five, ten or twenty percent of the time. Obviously this discussion is important for the determination of ethical screening criteria and consequently the EI portfolios.

The discussion is illustrative of the theoretical discussions surrounding most ethical criteria. It would be beyond the scope of this thesis to go into the details of all the discussions, but it is worth noticing that similar discussion are continuously going on in ethical and financial magazines. Although much effort is put into making the ethical criteria objective, discussions like the one above are the basis for many critics of EI Funds, claiming that the EI criteria are subjective and that ethical fund managers are interpreting criteria in a way to optimize the financial performance of the fund. Regardless of the ongoing problem with defining objective ethical criteria, the following section will present the most commonly used ethical screening criteria.

**Exclusion Criteria**

Ethical Investments started out having mostly screens based on “exclusion criteria”, or “avoidance criteria”. Exclusion criteria are in a sense a filter that excludes companies if they are producing certain products or behave in a questionable manor. Hence, as the name suggests when an ethical investment fund uses exclusion criteria for their

\(^3\) Although some screening companies attempts to divide the companies into offensive and defensive categories, most simply exclude weapon producers.
screen, companies that do not fulfill one or more of the criteria are excluded from the fund.

Most commonly exclusion criteria are applied mainly to the industry of the company in question. For instance, if a company produces tobacco it is excluded because of the health risk associated with the products. But other exclusion criteria are also commonly applied focusing on the conduct of the company and the corporate partners. If the company supports oppressive regimes or if the company, any of its customers or suppliers exploits child labor it is usually excluded.

Many of the exclusion criteria have religious roots, therefore called “sin shares”. Sin shares are namely shares in the industries of tobacco, alcohol, weapons, gambling and pornography. Sin share exclusions were among the first exclusion criteria to be widely adopted by ethical screening funds. But over time, new criteria beyond the grasp of sin shares have been added to the list of avoidance criteria. These are for instance nuclear energy and GMO products.

Other exclusion criteria are culturally affected such as certain religious criteria. Religious concerns are generally greater in the US than in Europe. The discussion regarding free abortion, for instance, is still regarded as a controversial issue in the US and has led some US screening companies to adopt a “sanctity of life” criterion, under which they exclude companies producing abortifacient drugs. In Europe, however, the abortion issue has not received any greater attention in public discussions and evidently it is of no greater concern for European ethical funds.

Religious investment funds not only restricted to the Christian faith. Ethical investment funds that have Islamic or Jewish roots are rapidly emerging with a different set of ethical exclusion parameters from those usually applied, seeking to uphold the underlying religious values. Hence Islamic ethical investments funds are for instance further restricted from investing in companies that produce or process swine, or financial institutions that provide loans carrying interest – which is obviously most financial institutions.

Table 1 presents the most common exclusion criteria used by ethical screening funds. The list is not complete, but presents the most important criteria used.
Common Exclusion Criteria
(Avoidance Criteria)

Sin shares
- Tobacco
- Alcohol
- Weapon
- Gambling
- Pornography
- Support of Oppressive Political Regimes
- Nuclear energy

Specialized criteria:
- Animal testing and welfare
- Financing of environmentally and socially controversial projects
- High interest consumer credits
- Genetic modification (GMO)
- Environmental Impact
- Human and Labor Rights Abuses
- Abortifacient drugs and research involving embryonic stem cells
- Production or processing of swine (Jewish and Islamic)
- Financial loans carrying interest (Islamic)

Inclusion Criteria

Complying with the exclusion criteria is no longer sufficient for a company to be considered ethically correct by all ethical funds. Companies must now adopt a proactive behavior to be considered an ethical company. The screens that control for these proactive behaviors are called “inclusion criteria”, or – perhaps more describing – “affirmative criteria”.

Affirmative criteria cover actions taken by companies, as well as products and services, with environmental and social benefits towards stakeholder groups. Examples of actions could be community support programs, environmental management and reporting, human rights policies, labor standards and development of stakeholder relationships.

Furthermore, the nature of the products produced by the company can be part of these criteria. Such product could be organic, development of educational products, social housing, environmentally beneficial or the improvement of disabled access, to name a few of the positive criteria.

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Source: O’Rourke (2001), FTSE4Good Inclusion Criteria, Schwartz (2003), Vitero.com and ethicalscreening.com
The presence of affirmative criteria presents new challenges in determining the degree of conformity in the screens used by EI funds. As opposed to the exclusion criteria, it is hard to imagine many companies - if any - that comply with all of the inclusion criteria. Such a company would have to be a major conglomerate covering a wide variety of products and services, while maintaining a high social standard. Hence, the inclusion criteria are not all applied as a definite list (as with the exclusion criteria) but mainly used to give “plus points” to the company in question. The exception by many screening companies is the adoption of an environmental strategy and reporting which most often is prerequisite for the inclusion in the ethical portfolio.

Another challenge presented by the affirmative criteria is the increased impact of cultural differences. Charitable and community support programs for instance are very common in the US and most have come to expect such an involvement from companies. But in most of Europe, the need for local community involvement by the companies is limited because of the traditionally stronger public sector. Most charitable involvements by European companies are seen in connection with some sort of promotion or image creation of the company. Consequently a European company cannot compete with US companies in regards to the application of community support programs, which occasionally offset the balance in the pool of ethical companies by US standards.

Table 2 presents the most widely used ethical inclusion criteria.

Table 2

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Source: O’Rourke (2001), FTSE4Good Inclusion Criteria, Schwartz (2003), Vitero.com and ethicalscreening.com
**Ethical Investment Funds**

As a natural consequence of the increased competition among the growing number of ethical funds, differentiation of the funds has resulted in different screening methods and criteria. The following section will provide an overview of the most common approaches taken by EI funds.

**“Screened investment universe” funds**

The most clear-cut ethical funds are those who apply a screen to extract an eligible investment universe. Such funds apply both exclusion and inclusion criteria to the universe of companies, and then consider the remaining companies for their investments. This category of funds is what most thinks of when they consider ethical funds and they are the most common occurring ethical funds.

Nearly every ethical fund has their individual screening process. But most screened funds apply the exclusion criteria they have identified as absolute criteria, meaning companies that do not meet the exclusion criteria are screened out of the portfolio. The remaining companies are then screened based on inclusion criteria, where some criteria have to be met. Other inclusion criteria are used in a rating system, in which companies have to achieve a certain score to be eligible for the fund investments.

Once the ethical screen has been applied a number of companies are left for the fund to invest in. The fund manager then applies normal financial criteria and analysis to optimize the funds financial performance. Most often the investments are further restricted in regards to the geographical area, the size of companies in the portfolio or other specific characteristics. Hence the fund’s investment process can be described as a series of screens to define an investment universe and the investment itself.

The advantage to the screened funds approach (as opposed to “best-in-class” or “voice” funds) is that the companies benefitting from the investments are solemnly ethical companies as defined by the fund. It gives an incentive for the companies to adopt and implement an ethical policy, by lowering the costs of capital and making the shares more liquid, because it opens the shares of the company to the investments of the ethical funds.

However, screened funds can only provide incentives for companies that can pass the exclusion screen. Companies in sin-industries do not get an incentive to behave more ethically correct, because they will be ineligible through their products in any case, which means that screened funds have a limited range of influence. In other words, screened funds can only improve ethics in certain industries.
Another problem with screened funds is, that even though ethical investors wish to improve ethics, they are usually also seeking the best possible economic return. This gives the fund managers an incentive to ease up on the screening criteria, possibly allowing for a better return on the portfolio, but also jeopardizing strength of the screen. Hence a clear and palpable definition of what ethical screens are applied and how should be provided by the fund.

Obviously it takes a substantial amount of work to create and perform a screen on ethical criteria. The information needed is usually not made readily available by companies, and the funds are forced to make a lot of research on each company to assess whether it can be regarded as an ethical company. Hence a market has evolved for ethical research companies. These research companies provide a list of stocks that are screened on a variety of ethical criteria. Ethical research companies not only put the ethical screening and surveillance into a specialized company, splitting the costs between several funds, but they also relieves the fund managers of possible suspicions of altering the screens to accommodate financial performance. Furthermore, ethical research companies ease the comparison of ethical funds, since the criteria used by several funds are applied uniformly.

As ethical investments have gained more widespread interest some screening companies have gone joined index companies to create ethical indices. The UK based Ethical Investment Research Service (EIRIS) have joined up with FTSE to make a series of indices under the FTSE4Good umbrella. Similarly Morgan Stanley and Dow Jones have joined with STOXX and SAM (Sustainable Asset Management) and launched the Dow Jones Sustainability index series. These indices are based on screens provided by EIRIS, STOXX, and SAM respectively. The indices are mainly based on a rating of the companies included. They thereby provide a list of companies that can be regarded as ethically conscious to a certain degree, but the list is not screened on absolute exclusion criteria. Although the indices started out within defined geographical areas, they now cover the global market. But they are still mainly based on a large-cap index, which means that in defining the investment universe as one of these indices, EI funds are restricting themselves from small-cap companies.

A number of ethical companies have however begun taking advantage of ethical indices and define these indices as their investment universe. The obvious advantage to such a strategy is the lowing of administration costs, since it limits the amount of ethical research necessary. As in the general mutual fund market, some funds have adopted an index strategy relative to the ethical indices. Other funds are choosing their investments from the constituents of the indices. Although the indices define a degree of ethics in the included companies, the underlying criteria are not fulfilling for
most EI funds. Hence most ethical funds use either one of the indices as their starting point and further apply exclusion or inclusion screens.

The most common ethical investment process applied by screened funds can be illustrated by Figure 1. As shown, the process can be considered as a multi screen process. For screened funds the first screen applied is a definition of the investment universe to limit the ethical and financial research process. The investment universe is usually defined as the Morgan Stanley, Dow Jones or FTSE index-listed companies or companies of their respective ethical indices. Then an ethical screen is conducted, either by the fund itself or by an independent screening company, based on the criteria adopted by the fund. Aside from scrutinizing the publicly available information about the company, the ethical research requires questionnaires, company visits and discussions. Furthermore information is gathered from NGO’s (Non-government organizations), regulatory agencies, industry organizations and independent rating schemes etc. Following the ethical screening process a traditional financial analysis is made of the companies in the defined universe left by the screening process.6

Figure 1

“Best in class” funds

The most common approach taken by EI funds in Scandinavian and continental Europe is the “best in class” approach. With this approach the companies are rated on a variety of criteria with in an industry. That way, companies are rated against their competitors in the various industries and the best ethically performing companies are eligible for the fund investments.

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If an investor genuinely wishes to proactively promote ethics in companies through his investments, this method is argued to give the best results. The reason is that a “best in class” approach rewards companies with good ethical track records relative to their industry, thereby giving the companies an incentive to improve their corporate social responsibility and eco-efficiency. Where other fund-approaches mercilessly screen out companies in “sin industries”, this approach can include such companies, giving them an incentive to improve their ethical performance and extending the range of influence obtained by ethical funds.

From an investor point of view, it is often argued that there is an economic advantage to the “best in class” funds. A “best in class” approach returns companies that are focusing on implementing cost saving activities through cleaner production and environmental effectiveness. This leads to companies that often have a “first mover” advantage on their competitors and consequent reduced environmental risks. Hence some fund managers see this approach as providing a sound long term investment strategy, both from an environmental and a financial point of view.

The problem with the “best in class” approach is that it is mainly applied by environmentally concerned funds. An inclusion of companies that many deem unethical will occur, since the filtering of companies does not include many of the ethical criteria. But it is obviously impossible to make “best in class” ratings based on absolute exclusion criteria. Hence most “best in class” fund should be regarded solemnly as an environmental or sustainable fund. Alternatively the screen should be combined with a screen of inclusion and exclusion criteria for the fund to be labelled an ethical investment, at least by the definition adopted in this thesis.

“Voice” Funds

Screened and “best in class” funds are wide examples of “exit”-strategies, in which investors simply choose not to be associated with unethical firms. But the perhaps most idealistic of funds are those who seek to actively influence the companies in which they invest, called “voice” funds. These funds use the influence they gain from buying stocks in a company to change the way the company is run in regards to their ethical values. As in the case of screened funds, these funds also apply screens but in the opposite way. They screen the market for companies that are not ethically correct in one or more areas and buy shares in these companies. The resulting influence gain is then used to try and force an environmental, social or other ethical focus upon the management of the company.

Voice-funds can be split into two categories; “activist funds” who buy enough shares in companies to have a direct influence from the voting rights assigned to the shares, and
“lobbyist funds” who just buy enough shares to get speaking time at the general assembly or to lobby shareholders.

Voice-funds in general are a category under shareholder or investor activism. It is the most direct and idealistic approach to force ethics into a company. But it is a difficult approach to treat. First off, the funds have to be very precise about the goals they are trying to achieve, so that every investor knows what to expect from the fund management. Secondly, the strategy has certain “cost” since it is often a time consuming process to get at company to change its ethical values. Thirdly, economic results are secondary to ethical results, and an investor in voice funds should be less concerned with economic performance of the fund. Furthermore, for the “activist-fund” approach, it often takes quite substantial investments to force a change of ethical values upon a company, unless the fund is able to lobby other shareholders into supporting the policy change.

The “voice” strategy approach tends to be used by institutions rather than individuals, and there is evidence that firms have complied with the request and demands set forth by such institutions. But the amount of individual investors pursuing a “voice” strategy is very limited. The size of the investments needed to make the strategy effective and the commonly impalpable criteria applied by the “voice” funds, makes it a rarely used approach by individual investors. Furthermore it is hard for the investors to identify “voice” funds, because they are excluded from most lists of ethical funds, since they include unethical companies.

Although the “voice” strategy is an interesting approach “voice” funds will be disregarded for the remainder of this thesis on two accounts. First off, “voice” funds per definition include unethical companies and the focus of the thesis is to determine the performance of ethical companies. Secondly the thesis focuses on the price paid by individual investors, and the “voice” strategy is mostly used by institutions.

Synthesis

Although an investment fund may market and ultimately believe it self to be an ethical investment fund, their criteria of selection will always be subjective. Hence the investment fund may not be ethical in its investments from a given investor’s point of view. This problem can be solved by the release of adequately palpable information by

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7 As there are no uniform terms for the two kinds of funds, the descriptive terms assigned here are for the purpose of distinction between the funds in the thesis.
the investment fund and by the ethically conscious investor’s research of the funds ethical criteria. The increasing number of ethical investment funds allows most investors to find a fund which reflects their own criteria for what constitutes an ethical investment fund.

As for the purpose of this thesis, the multitude of subjective criteria selections by ethical investment funds makes a comparison of the ethical mutual funds biased. The varying geographical investment areas can be overcome by creating and comparing the fund to a benchmark portfolio of funds operating in within the same geographical area. Likewise, we can construct the benchmark as to accommodate the varying sizes of the investment funds. But the fact that two ethical investment funds, although apparently identical when operating with the same size and in the same geographical area, can have two different investment universes based on their subjective screening criteria, will inevitably lead to the comparisons being biased.

The solution could be to rate the ethical investment funds on how ethically conscious they are. That is to say, how many of the ethical criteria they have adopted and how stringent they judge the companies from these criteria. Another approach would be to split the funds into categories based on how they select their companies; be it based on exclusion criteria, inclusion criteria or on their ratings in different ethical categories. Although such a distinction would give a more comprehensive result from the point of view of the ethically conscious reader, it would be beyond the scope of this thesis to make such a distinction.

What would further complicate a distinction of ethical investment funds based on their screening criteria is the fact that the criteria applied are not uniform. The criteria used in the selection of the Dow Jones Sustainability index are very similar to those used by EIRIS but not exactly identical. Even when funds use ethical screening companies like EIRIS, they are able to get lists of companies based on customized criteria. Hence, for the purpose at hand, the attempt to compare the investment funds based on their “level of ethicality” would in effect be too overwhelming.

To avoid polluting the sample of ethical funds by including funds that are merely green or sustainable funds, this thesis will investigate each fund included in the data. The ethical funds must as a minimum have certain exclusion criteria. For the fund to be included in the sample, the ethical funds must apply exclusion screens in regards to the criteria mentioned in Table 3. Some of the criteria can be fulfilled either through exclusion or inclusion criteria. The formal procedure for application of the criteria is irrelevant, but the screen must account for consideration of labor rights,
environmental protection and reporting, and the avoidance of child labor as either exclusion or inclusion criteria.

<table>
<thead>
<tr>
<th>Criteria applied by fund for inclusion in portfolio for the analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exclusion criteria application</strong></td>
</tr>
<tr>
<td>• Tobacco industry</td>
</tr>
<tr>
<td>• Gambling industry</td>
</tr>
<tr>
<td>• Support of oppressive regimes</td>
</tr>
<tr>
<td>• Excessive environmental impact</td>
</tr>
<tr>
<td>• Human rights violations</td>
</tr>
<tr>
<td>• Employee Standards</td>
</tr>
<tr>
<td><strong>Either exclusion or inclusion application of criteria</strong></td>
</tr>
<tr>
<td>• Labor rights</td>
</tr>
<tr>
<td>• Environmental protection and reporting</td>
</tr>
<tr>
<td>• Avoidance of child labor</td>
</tr>
</tbody>
</table>

Table 3

The list of criteria thereby includes what most independent academic articles identify as the most substantial criteria. (Although most US, UK and Scandinavian academics would also include alcohol production as an exclusion criterion, this thesis will refrain from doing so. The motivation is that most Italian, Spanish and French ethical funds do not regard alcohol production as ethically controversial. By including alcohol production as an exclusion criterion the sample would therefore become unnecessarily bias because of the differences in culture.)

After discussing the problems with identifying ethical investments and ethical funds, the thesis will now move on to the process of finding the best models to measure the performance of ethical funds. Once the appropriate models have been identified, the ethical criteria will be used in selecting the ethical funds to be included in the analysis.
Measuring the Performance of Ethical Investment Funds

After discussing the problems we encounter when trying to identify ethical investments, we now move on to finding the best possible model for determining the performance of ethical investment funds. When one or more appropriate models have been identified, we will move on to look at the results when the models are applied to the empirical data.

Find a model that returns an accurate measure of what we wish to find is a process with several steps. The first step is to define what we wish to measure, which will be discussed in the first part. The next step is to investigate classic models and identify one that gives a comparable return of the measure we have identified. As it will be necessary to tailor the model to give an accurate result, the third step will be to determine what benchmarks and alterations are necessary for the model to ultimately give us a useful measure. The final step is to summarize the findings into the model that will be used.

The Nature of the Data to be Examined

The purpose of this thesis is to determine what price an investor must be prepared to pay for investing in ethical companies as opposed to investing in unscreened companies. In order to do so, we have found that data on the return of ethical investments is best found by examining ethical investment funds. These funds contain shares of companies that have been screened on different ethical criteria. As previously discussed, the screening criteria can be questioned but for the purpose at hand, we must accept the uncertainty and the variations caused by the varying screening methods and criteria.

Evidently, the results of the thesis will therefore risk being biased because two ethical investment funds in the same market can have different investment universes. However, since these ethical funds as a total represent the market of ethical investment opportunities for a private investor (unless he wish to construct his own portfolio from his own screen), it can be argued that considering the funds as a uniform group will give a less biased result than initially assumed. The background for this claim would be, that unless the individual investor makes a thorough research into the screening criteria of each fund, he must be assumed to consider all ethically branded investment funds as “equally ethical” in their approach to investments. Regardless of whether this bias should be accepted, it is practically overwhelming to investigate all the criteria used by each ethical fund and then classify them thereafter.
Consequently ethical investment funds will all be regarded as being comparable in terms of their ethical screening process.

Hence, we wish to find a model for measuring fund performance relative to a benchmark. But it is not the stock picking abilities of the fund manager that is under investigation, but rather the return of ethical funds as a total. This is important for the selection of the benchmark and the model. Measuring the ethical funds against a benchmark constructed of ethical indices would return a result as an expression of how well the fund manager had chosen financially well performing stocks among the ethical stocks. The result would ignore the possibility of investing in unethical stocks.

Furthermore, most ethical funds are restricted in more ways than just by the ethical screening. Like most other funds, ethical funds are restricted in regards to the geographical area they are operating in. In the US the geographical area would usually be either domestic stocks or international stocks. In Europe, the fund would usually be restricted to International, European or domestic stocks. But since the investment universe here is limited to ethical stocks, smaller countries in Europe would be operating with very limited stocks if they were confined to domestic stocks only. Hence, ethical fund in smaller European countries does not have domestic restriction, but only International or European. However, some European countries have sufficiently incorporated ethics in their domestic companies that it is possible to operate domestic ethical funds. The UK, for instance, have several domestically operating ethical funds. Again, the proxy portfolios have to reflect the alternative investment universe of the investor. If a UK investor chooses to invest in a domestic ethical fund, his alternative to the ethical fund must be considered among unscreened domestic funds. Hence, for the result to reflect the performance of the ethical funds relative to unscreened funds, each fund must be compared to funds that have the same geographical restrictions. Failure to do so, would incorporate the uncertainty of whether the under or over performance is caused by the investment universe being ethically screened, or by differentiating fluctuations in the different markets and/ or relative exchange rates.

As we will see later on, recent literature on regression analysis suggests that there is a connection between the size of mutual funds and their performance. Furthermore book-to-market has been suggested to have an influence on explaining the performance of the mutual funds. Hence the model we are looking should incorporate a proxy to account for both book-to-market ratios and mutual fund size.
To summarize, we wish to measure the performance of ethical funds relative to unscreened funds. The unscreened funds must be comparable in their geographic operating universe, size and book-to-market ratio.

The Purpose of the Evaluation

The assumption that there is indeed a price to pay for an ethical investor is based on the hypothesis, that when limiting the investment universe to ethical securities the investor limits its possibilities of differentiation, resulting in a lower risk adjusted return. Hence the model we will be choosing must give a measure of the risk adjusted return.

Obviously this excludes many of the commonly used models for evaluating fund performance, since these usually seek to unveil the return of the fund, relative to one or more benchmarks, with similar risk profiles. Such models are indeed useful for investors and fund managers to evaluate the portfolio manager’s performance, but the intention of this thesis is not to evaluate the stock selection capabilities of individual fund managers. Instead the intention is to determine the return and risk of a group of funds with certain restraints relative to a benchmark consisting of funds without these restraints. Furthermore, we seek to control for the risk exposures of the funds in an attempt to determine which risks an ethical investor must endure relative to a conventional investor.

The CAPM model

Historically a version of the capital asset pricing model (CAPM) based single-index model has been the most commonly used model in studies on ethical investment funds. Several variations of the CAPM exist in financial literature. We will investigate the most appropriate version of CAPM for our analysis, but in order to understand the justification for using CAPM in performance analysis, a thorough understanding of CAPM is necessary.

The Sharp-Lintner-Mossin CAPM

The standard version of CAPM would provide a complete description of capital market behaviour if all of the underlying assumptions held. However, as often seen with basic economic models, most of the assumptions are unrealistic in the real world, and alterations are necessary to accommodate factors in the real world. The standard version of CAPM was developed by Sharpe, Lintner, and Mossin, and is often referred

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9 Bauer et al. (2005) p. 1758.
to as the Sharpe-Lintner-Mossin form. The basic version of CAPM is developed to determine the expected return of a single security. Although this is not the intention of the thesis, it is useful to start with the basic version to show how we get to the relevant derived version of CAPM.

Most commonly the Sharpe-Lintner-Mossin form is written as:

\[ \bar{R}_i = R_F + \beta_i (\bar{R}_M - R_F) \]

*Equation 1*

Where:
- \( \bar{R}_i \) is expected return on security \( i \)
- \( R_F \) is the risk free return
- \( \beta_i \) is the Beta, or the systematic risk, of the security \( i \)
- \( \bar{R}_M \) is the expected return of the market portfolio

NB: \( \bar{R}_i \) and \( \bar{R}_M \) are written differently here than in the equation. This is merely a result of the shortcomings of the typing program, and should be considered synonyms in this thesis. The correct way to write it is the one in the equation.

In writing, this equation states, that the expected return on any security is equal to the risk free return plus the risk of the security relative to the market times the expected excess return of the market. The return of the equation is a straight line called the security market line and it describes the expected return on any security or portfolio in the economy. The line can be determined by finding two points of the line. If Beta is 0, i.e. there is no risk on the portfolio; the expected return is equal to the risk free return, which becomes the intercept point. If Beta is 1 the risk of the security or portfolio is equal to the risk of the market portfolio, and the expected return is equal to \( \bar{R}_M \). From those two points, a straight line can be drawn, illustrating the market security line (see Figure 2).

![Market Security Line](image)


According to the Sharpe-Lintner-Mossin model, every security, or portfolio of securities, can be placed somewhere on the market security line depending on the Beta of the security in question. In other words, the expected return of any two securities differentiates only because of their different Beta.
The background of the single index model

In order to make alteration of the standard CAPM form to further accommodate the purpose of this thesis, it is necessary to have at more rigorous understanding of the connections in the model. Hence, to make the CAPM directly applicable, it is necessary to briefly elaborate on how to find the systematic risk Beta. Please note, that this description is a brief summary of the proof for finding Beta. The proof will not be presented in detail, since it would be too overwhelming to give the full proof\(^{10}\).

The return on a stock can be written as:

\[
R_i = a_i + \beta_i R_m
\]

\(^{1}\)Equation 2

Where:
- \(R_i\) is expected return on stock \(i\)
- \(a_i\) is the part of stock \(i\)'s return that is independent of the market's performance (random variable).
- \(R_m\) is the rate of return on the market index (random variable).
- \(\beta_i\) is a constant that measures the expected change in \(R_i\) given a change in \(R_m\).

Hence the return on a stock is broken down into a part that is due to the market index, and a part that is independent of the market. The part of the equation that is independent of the return of the market, the term \(a_i\), can be broken down into two components:

\[
a_i = \alpha_i + e_i
\]

\(^{2}\)Equation 3

Then \(\alpha_i\) represents the expected value of \(a_i\) and \(e_i\) is the random element of \(a_i\). If we insert this into Equation 2 we get:

\[
R_i = \alpha_i + \beta_i R_m + e_i
\]

\(^{3}\)Equation 4

By doing so, we are able to isolate two random variables, \(R_m\) and \(e_i\), that both have a probability distribution, a mean and a standard deviation. Their standard deviations can be denoted as \(\sigma_{ei}\) and \(\sigma_{m}\) and are assumed to be uncorrelated. Likewise the variance of \(e_i\) and \(R_m\) can be written as \(\sigma_{ei}^2\) and \(\sigma_{m}^2\) respectively. Usually a time series-regression analysis is used to find \(\alpha_i\), \(\beta_i\) and \(\sigma_{ei}^2\), which ensures that \(e_i\) and \(R_m\) will be uncorrelated. However, this implies that the only reason two stocks vary together systematically is due to common co-movement with the market index. There are no other effects beyond the market that account for co-movement of stocks. Following

\(^{10}\) Please refer to Elton et al. (2003) pp. 130-146 for a full description of the proof.

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the above assumptions and since the mean of $e_i$ by construction is equal to zero, a 
proof can be made to derive the mean return, variance of a security and covariance 
when the single index is used to describe the joint movement of securities\textsuperscript{11}. (Only the 
results are presented here):

Mean return of security $i$: $\bar{R}_i = \alpha_i + \beta_i \bar{R}_m$

Variance of security $i$’s return: $\sigma^2_i = \beta^2_i \sigma^2_{m} + \sigma^2_{ei}$

Covariance of returns between the return of two securities $i$ and $j$: $\sigma_{ij} = \beta_i \beta_j \sigma^2_{m}$

The use of a single index model is dependent on the estimation of Beta. Very often 
Beta is estimated from historical data. Whether it is used to estimate future expected 
return, or, as in the case of this thesis, for unveiling historical performance, a historical 
Beta is usually calculated using a regression analysis.

To find Beta we can use Equation 4:

$$R_i = \alpha_i + \beta_i R_m + e_i$$

Though the values of $\alpha_i$, $\beta_i$, and $\sigma^2_{ei}$ might differ over time, the equation is expected to 
hold at any single point in time. However, it is not possible to directly observe $\alpha_i$, $\beta_i$, 
and $\sigma^2_{ei}$ when looking at the historical data, but instead on observes the historical 
returns of the security and the market. If $\sigma^2_{ei}$ was equal to zero, $\alpha_i$ and $\beta_i$ could be 
determined from just two observations. But the presence of $e_i$ as a random variable, 
presents the actual returns as a number of points scattered around a straight line, 
running from $\alpha_i$ with the slope of $\beta_i$. Each point is representing the return on the 
security versus the return of the market in a given month (or any other time interval 
for that sake). See Figure 3 for illustration. The horizontal axis is the return on the 
market and the vertical axis is the return of security $i$.

\textsuperscript{11} For the full proof, please refer to Elton et al. (2003) pp. 134-135.
As $\sigma^2_{ei}$ increase, the scatter around the line increase. And since the line cannot actually be observed, the greater becomes the uncertainty. Hence we can use a regression analysis to find the slope that minimizes the sum of the squared deviation from the line in the direction of $R_m$. The slope would then be the best estimate of $\beta_i$, and the intercept of that line would be the best estimate of $\alpha_i$.

Formally this estimation could be made with the Equation 5:

$$\beta_i = \frac{\sum_{t=1}^{60} (R_{it} - \bar{R}_m)(R_{mt} - \bar{R}_m)}{\sum_{t=1}^{60} (R_{mt} - \bar{R}_m)^2}$$

Equation 5

In which the time frame is 60 periods, equivalent of five years if each period is one month. In more plain language; the Beta of a stock is equal to the covariance of the return of the stock with that of the market, divided by the variance of the return of the market. Note that $\bar{R}_m$ and $\bar{R}_{mt}$ here is mean return of the stock $i$ and the market index respectively. Afterwards Alpha can be estimated as the interception point with the vertical axis using an equation derived from Equation 4:

$$\alpha_i = \bar{R}_{it} - \beta_i \bar{R}_{mt}$$

Equation 6

Using the regression analysis, one can also derive the size of $\sigma^2_{ei}$ over the observed period, by looking at the variance of the deviations of the actual return from that found by the model. Hence $\sigma^2_{ei}$ can be found by:

$$\sigma^2_{ei} = \frac{1}{60} \sum_{t=1}^{60} [R_{it} - (\alpha_i + \beta R_{mt})]^2$$

Equation 7
For later use it is worth mentioning that there are four basic assumptions for the probability distribution of the residual error term \( e_t \):

Assumption 1: The mean of the distribution of \( e_t \) is 0.
Assumption 2: The variance of the probability distribution of \( e_t (\sigma_{e_t}) \) is constant for all settings of the market proxy.
Assumption 3: The probability function of \( e_t \) is normal.
Assumption 4: The values of \( e_t \) associated with any two values for the market proxy is independent.

Furthermore one can compute a coefficient of determination, which in effect is a measure of association between two variables. In this example, one would measure the variation in return on the individual stock associated with the variation in the return on the market. This measure is the correlation coefficient squared where the correlation coefficient is found by the following equation:

\[
\rho_{im} = \frac{\sigma_{im}}{\sigma_i \sigma_m} = \frac{\beta_i \sigma_m^2}{\sigma_i \sigma_m} = \beta_i \frac{\sigma_m}{\sigma_i}
\]

*Equation 8*

**Beta in portfolios**

Although the example so far has been made with a single security, the single index model can also be used with a portfolio of securities. In fact the predictive power of Beta has been proven to increase as the number of securities in the portfolio increase\(^{12}\). More precisely expressed, the value of \( \sigma_{e_t}^2 \) decrease as the portfolio is further diversified. In very well-diversified portfolio \( \sigma_{e_t}^2 \) tends to go to zero, meaning that non-systematic risk becomes irrelevant and the only relevant risk remaining is systematic risk, measured by \( \beta \). Hence Beta is arguably better suited for portfolios than individual securities.

When adapting the single index model to portfolios, we define the Beta \((\beta_p)\) and the Alpha \((\alpha_p)\) of the portfolio as the weighted average of the individual \( \beta_i 's \) and \( \alpha_i 's \), respectively, on each stock in the portfolio. Hence:

\(^{12}\text{As found by Blume and referred by Elton et al. (2003) pp. 142-143.}\)
\[
\begin{align*}
\beta_p &= \sum_{i=1}^{N} X_i \beta_i \\
\alpha_p &= \sum_{i=1}^{N} X_i \alpha_i
\end{align*}
\]

Where: 

\(X_i\) is the fraction of the portfolio that is invested in each stock.

Similarly the Equation 2 on the expected return of the portfolio can be rewritten as:

\[
\bar{R}_p = \alpha_p + \beta_p \bar{R}_m
\]

\textit{Equation 9}

\textit{Introducing a risk free asset}

On top of building on the regression analysis of the single index model described above, the Sharpe-Lintner-Mossin form also incorporates the return of a risk free asset. It is assumed that the reader is familiar with the concept of risk free assets and the efficient frontier in general\textsuperscript{13}, and will only briefly describe it here.

A risk free asset could be a savings account or a short-term government bill. One can consider the risk free asset as an alternative to the market portfolio with a set outcome. Any investor will invest in an efficient portfolio, that is to say a combination of risky assets which optimizes the expected return relative to the risk. The efficient frontier will be different from investor to investor depending on their expectations, but assuming they all will maximize their expected return relative to the risk, all relevant portfolios will be situated on the efficient frontier.

When introducing lending and borrowing at a risk free rate, a straight line can be constructed to represent any combination of the risk free asset and the efficient portfolio situated at the tangency point of the efficient frontier (see Figure 0-3). Assuming every investor had the same expectations, the diagrams of every investor would be identical, and so would the efficient portfolio \(P_i\). Hence, if the risky portfolio of every investor is the same, this portfolio must be the market portfolio, in equilibrium.

\textsuperscript{13} For a more detailed description of the efficient frontier, see chapter 5 in Elton et al. (2003).
Since all investors are assumed to have the same expectations all investors would hold any combination the two assets; the risk free asset and the market portfolio. This line is called the capital market line (not to confuse with the security market line mentioned earlier).

Obviously not every portfolio would in fact be placed on the capital market line, in fact, only efficient portfolios would be lie along the line. Hence to describe the capital market line as an equation, one can write it as the expected return of an efficient portfolio, combining a risk free asset and a risky portfolio:

\[ R_e = R_F + \frac{R_M - R_F}{\sigma_M} \sigma_e \]  

\textit{Equation 10}

Where  
\( R_e \) is the expected return on an efficient risky portfolio  
\( R_F \) is the risk free return  
\( R_M \) is the expected return on the market portfolio  
\( \sigma_e \) is the standard deviation of the efficient portfolio  
\( \sigma_M \) is the standard deviation of the market portfolio

Since the term \((R_M-R_F)/\sigma_M\) is an expression of how much can be gained from increasing the standard deviation on an efficient portfolio by one unit, this term is often referred to as the market price of risk for all efficient portfolios. In other words, it can be referred to as the market price of risk times the amount of risk in the portfolio. Meanwhile, since the term \(R_F\) is an expression of a know return the risk free asset can be interpreted as the price of time.

\textbf{Elaborating on the Sharpe-Lintner-Mossin CAPM form}

After getting this look into the background of single index models, we can now return to explaining the Sharpe-Lintner-Mossin form of CAPM.
We now know that when assuming homogenous expectations and unlimited lending and borrowing, all investors will hold the market portfolio. And recall that in very well-diversified portfolios, non-systematic risk becomes irrelevant. Since the market portfolio is per definition very well-diversified, the only relevant risk measure left is the systematic risk that cannot be diversified away, Beta.

Further recall, that the equations describing the expected return of portfolio i, is a straight line in a space defined by expected return and Beta. Consider the equation for the straight line representing $\bar{R}_i$:

$$\bar{R}_i = a + \beta b$$

When all of the funds are invested in the risk free asset, Beta becomes zero, defining the interception point of the market security line with the expected return axis as $R_f$ (see Figure 2):

$$R_f = a + \beta b = a + b(0) = a$$

The second point defined by the equation is the market portfolio with a Beta of 1. This can be written as:

$$\bar{R}_M = a + b(1) \Rightarrow (\bar{R}_M - a) = b$$

Combining these two equations yields the Sharpe-Lintner-Mossin form of CAPM as shown in Equation 1:

$$\bar{R}_i = R_f + \beta_i (\bar{R}_M - R_f)$$

We have now learned that the basic version of CAPM is build on the single index general equilibrium model, and can describe the security market line. However the model is based on numerous unrealistic assumptions that violate conditions in the real world. There are several underlying assumptions for the basic CAPM that does not hold in the real world. The most important ones are:

- Infinite risk less lending and borrowing – this is obviously not possible in the real world, it is more relevant to assume that investors can lend infinite money at the risk free rate, but is limited in borrowing and cannot do so at the risk free rate.
- Unlimited short sales allowed – although some institutional investors practice short sales of securities, this option is limited and hard to come by for private investors (although possible in the US).
• No personal taxes – if all taxes are equal, the results of the CAPM should hold non-the-less, but the equilibrium would be affected if there is a difference between private and institutional taxation and/or between the taxation of dividends and capital gains.

• Heterogeneous expectations – as there is no such thing as perfect information in the real world, investors would hold different expectations, rendering a determination of equilibrium extremely complex.

• No non-marketable assets – the model assumes that all assets are marketable, rendering an optimization of the individual portfolios possible. In fact, not all assets are marketable.

• Non-price taking behaviour – it is assumed that the individual buying or selling of securities does not affect the price of the security.

• Multi period horizons – it is assumed that all investors make investment decisions on a single-period horizon, which is obviously unrealistic.

Furthermore, the Sharpe-Lintner-Mossin form is designed to find the expected return of a portfolio, which irrelevant for this thesis. Recall, that our interest lies with determining the historical performance of funds relative to the market, as opposed to determining the future expected return. Hence to accommodate our demands, it is necessary to consider an alteration of the basic CAPM.

Alternated CAPM form

One version of CAPM that could be useful for the intentions of this thesis is a CAPM based single-index model. Specifically we will be looking at a model that allows for a time series analysis measuring the ethical funds out- or under-performance relative to non screened funds. The basic CAPM time series model, as defined by Black, Jensen, and Scholes\textsuperscript{14} is as follows:

\[ R_{it} - R_{Ft} = \alpha_i + \beta_i (R_{Mt} - R_{Ft}) + \epsilon_{it} \]

\textit{Equation 11}

Where:
- \( R_{it} \) is return on security \( i \) at time \( t \)
- \( R_{Ft} \) is the risk free return at time \( t \)
- \( \alpha_i \) is the intercept of the regression
- \( \beta_i \) is the slope of the regression, or an expression of the non-systematic risk of the security.
- \( R_{Mt} \) is the return of the market portfolio at time \( t \)
- \( \epsilon_{it} \) is a residual variance error term on security \( i \) at time \( t \)

\textsuperscript{14} Black, Jensen and Scholes were the first to conduct an in-depth time series analysis of the CAPM. Although many versions of CAPM has been constructed since their analysis, this version is still widely used for time series analysis. Elton et al. (2003) p. 344.
In this model, the result is expressed as the excess return of the security ($R_t$) over the risk free return ($R_f$). The residual variance error term is once again a part of the equation, since it is constructed to analyse single securities. As explained above, the error term can still be diversified to become irrelevant by conducting the time series analysis on diversified portfolios. Although the data section of the thesis will consider it as a portfolio of securities rather than a single security, the error term will become minor, although still occur. As the thesis seeks to investigate a portfolio of ethical funds, it is limited in terms of diversification. Hence, when using portfolios for the analysis, the residual variance from the regression will incorporate any cross-sectional interdependencies. Consequently, the residual error term can then be used to test the difference of $\alpha_i$ from zero.

As mentioned $\alpha_i$ is the intercept of the regression and it is commonly called Jensen’s alpha. $\alpha_i$ can be interpreted as a measure of out-of under-performance of the portfolio relative to the chosen market proxy. $\beta_i$ is the slope of the regression and an expression of the non-diversifiable risk associated with the portfolio.

The above equation was the basis for the empirical time series test of CAPM carried out by Black, Jensen and Scholes in their 1972 analysis\(^{15}\). In the analysis, they used date on securities from 35 years and constructed portfolios of several stocks divided into deciles based on their previous observed historical Betas (since their true Beta cannot be observed, historically observed Betas are used as an instrumental variable). The individual portfolios were then held against the market portfolio\(^{16}\). Without getting into the details of the analysis, they proved that they could obtain a coefficient of determination of 0.98 (recall from Equation 8 that this is the correlation coefficient squared, and is a measure of the association between the two variables). In other

\(^{15}\) Black et al. (1972).

\(^{16}\) Black, Jensen and Scholes did not only use a risk less asset in their analysis, but also a minimum variance zero Beta (Z) portfolio instead. Z is a portfolio constructed of risky assets in a way that creates a minimum variance portfolio, which still have a $\beta$ of zero. The reason for using minimum variance zero Beta portfolios as opposed to a risk free asset is founded in the fact, that borrowing at the risk free rate is not generally possible in the real world. Though $R_f$ has a beta of zero, the outcome is still uncertain for portfolios constructed with any combination of this and other portfolios, because Z is constructed of risky assets and consequently has a higher standard deviation than portfolios constructed using $R_f$. Hence, the expected return of Z ($R_Z$) is higher than $R_f$. In determining the $\alpha$, Black, Jensen and Scholes used the formula $\alpha_i = (R_Z - R_f) - \beta_i$. Since the first term of the right hand side should be positive, then $\alpha_i$ should be positive when $\beta_i$ is negative and vice versa. This is consistent with the proof presented from their analysis. But the involvement of Z actually makes the tested CAPM a two factor model, which it is sometimes referred as. A more thorough proof of the justification for using $R_Z$ as opposed to $R_f$ has been omitted here, since the empirical part of the thesis will be using government bills as a proxy for the risk free asset, and not a minimum variance zero Beta portfolio. For a thorough proof of the minimum variance zero Beta portfolio, please refer to Elton et al. (2003) pp. 309-320.
words, 98% of the variations in return were explained through CAPM. This is evidence suggesting, that the straight line of CAPM is a fairly good description of returns\textsuperscript{17}.

\textit{CAPM and ethical funds}

As the Black, Jensen and Scholes analysis showed, the CAPM model can in fact be used for performance evaluation of the return of portfolios. They also showed, that their model returns a measure of the historical performance, and proved that it is indicative to a certain degree of the future performance of the securities. Historically this and other versions of CAPM have been used to investigate fund performance, which is well justified according to the empirical test. Hence it seems appropriate to us CAPM as a performance evaluation of our ethical funds.

To use the CAPM for evaluation of ethical funds performance, it is necessary to construct a portfolio of funds to be tested. Previous literature on ethical fund performance has made use of Morningstar (US and Australia), EIRIS (UK) and Ecoreporter (Germany) to identify ethical mutual funds\textsuperscript{18}. In theory the database used is irrelevant, since either database should return all ethical funds in each market. However, as mentioned above, the selection criteria applied by each fund can vary greatly. Besides the fact, that the selection criteria of the individual funds will affect their performance, the databases should take the selection criteria of the ethical funds into consideration, in order to supply a list of ethical mutual funds that are in fact ethical according to the definition set forth by the database. No further documentation has been provided for the selection criteria of the databases, leaving us uncertain of the level of ethics investigated by previous literature. However, assuming the definition of ethics by all three databases are similar, they should all return the same kind of ethical funds, making the findings comparable.

For the market portfolio Bauer et al. have chosen the relevant market wide indices supplied by Worldscope. The selection of Worldscope is motivated by the fact that Worldscope seeks to cover 98% of market capitalisation\textsuperscript{19}. This has lead Worldscope to gain interest with many academics. Another commonly used market proxy is MSCI, but MSCI serves well as a large cap proxy, which is unfortunate in the analysis of ethical fund performance, since ethical funds tend to invest in smaller stocks. In his 1997-test of CAPM Carhart\textsuperscript{20} use (for the US market) a value weighted portfolio of all NYSE, Amex and Nasdaq stocks. Other authors have chosen S&P 500 or the Dow Jones

\textsuperscript{17} Elton et al. (2003) pp. 344-346.
\textsuperscript{18} Bauer et al. (2005) and Bauer et al. (2006).
\textsuperscript{19} Bauer et al. (2006) p. 36.
\textsuperscript{20} Carhart, Mark (1997) p. 61.
Index. The choice of market proxy is obviously important for the result of the analysis, and the quality of the benchmark should be judged by its coverage of the investment universe in which the portfolio in question operates. Hence, for the purpose of this thesis, it would be appropriate to use a market proxy that covers as extensively as possible the relevant geographical areas.

For the risk free rate, Carhart use the one-month T-bill rate, while Bauer leans toward the 1-month inter-bank rate. The choice of risk free asset proxy should be dependent of the location of the portfolio and be an asset that involves as low risk as possible.

The thesis will use the CAPM to investigate the performance of ethical funds in the data chapter. Under that chapter, we will get into detail about and motivate the choices of market proxy, risk free proxy and the choice of database for selection of ethical funds.

**Multi Index Models**

As determined in the previous section, CAPM can be used to determine the performance of a given portfolio of securities. However, this thesis has set out to examine the performance of a group of mutual funds. Hence it pays to investigate the use of CAPM in determining mutual fund performance.

Although versions of customized CAPM is still being used extensively in determining mutual fund performance, recent literature on cross-sectional variations in stock returns questions the adequacy of single index models to explain fund performance. For example, different funds may hold any combination of small or large stocks, domestic or international stocks or they may hold a combination of stocks and bonds. Hence, it could easily become a problem if the performance of mixed funds is compared to a single index that does not contain the types of assets held in the fund portfolio. Single index models are therefore unable to explain if the performance of the funds relative to the benchmark is due to the fund manager’s stock selection abilities or caused by the performance of the security categories not included in the benchmark.\(^{21}\)

In order to alleviate some of the inconsistencies obtained in the CAPM models, multifactor models have been constructed by different authors. Multifactor models are based on what is called Arbitrage Pricing Theory Models or APT, and is a different way of explaining asset prices. The advantage of APT models is that it does not rely on

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all of the same unrealistic assumptions that CAPM is based on, although some assumptions still have to be made.

APT is based on the law of one price, which states that two items that are the same cannot have different prices. And the assumption of homogenous expectations is also upheld in APT. However, APT recognizes that pricing can be affected by other factors than means and variances. Hence, APT requires returns on stocks to be linearly related to a set of indexes or variables. The basic definition of the return generating process of APT can be described as:

\[ R_i = a_i + b_{i1}I_1 + b_{i2}I_2 + \ldots + b_{ij}I_j + e_i \]

Equation 12

Where:
- \( R_i \) is the return non security \( i \)
- \( a_i \) is the expected level of return for security \( i \) if all indices are zero
- \( b_{ij} \) is the sensitivity of security \( i \)’s return to the \( j \) index
- \( I_j \) is the value of index \( j \)
- \( e_i \) is a random error term with mean equal to zero and variance equal to \( \sigma_{ei}^2 \)

Another way to express the same equation is:

\[ R_i = a_i + \sum_{j=1}^{J} b_{ij}I_j + e_i \]

Equation 13

Hence, if the portfolio is well diversified, the random error term becomes irrelevant (as previously) the APT model deducted from the return generating process can be described as:

\[ \bar{R}_i = R_F + \sum_{j=1}^{J} b_{ij}(I_j - R_F) \]

Equation 14

It should be mentioned, that the term \((I_j - R_F)\) is used here to make the below intuitive connection easier. However, the usual term used instead of \((I_j - R_F)\) is \(\lambda_j\), and it is formally defined as the extra expected return required because of a security’s sensitivity to the \(j\)’th attribute of the security.

The \(I_j\)’s can be virtually any variable such as inflation rates, bonds, the market portfolio, indexes or portfolios of securities with certain characteristics. Or it could be

22 For the standard version of APT to fully describe the return generating process of the security, the indices should be uncorrelated. Although convenient, it is in fact not necessary for the model to work, although the mathematics does get more complicated.

any combination of all these or ratio between two specified portfolios. The only requirement is that is has some descriptive value for the return of security i.

Imagine j is equal to one and Ij is the market portfolio. Then notice how this equation becomes the Sharpe-Lintner-Mossin form of CAPM presented in Equation 1. This is no coincidence, since a CAPM model can be thought of as an APT model with only one index variable, illustrating the connection of the underlying theory supporting the two models. In fact, including additional indices and subsequent factor dependencies into the equation does not necessarily mean that the simple CAPM no longer holds. This is because CAPM is not actually based on the assumption that the market portfolio is the only source of covariance. Rather CAPM simply assumes that whatever set of indices used will capture all sources of covariance among the securities.

The complication is that with the simple CAPM the index (Ij) is defined as the market portfolio, but when using an APT or multifactor model the index is no longer defined by the theory. If once again abandoning the connection to the CAPM model, the APT model requires the identification of Ij’s and bij’s. That is to say, it is required to identify relevant indices or variables and the associated sensitivities of the target portfolio.

There are several ways of identifying Ij’s and bij’s, which we will list shortly, but avoid analyzing in depth. Some of the methodologies are rather complicated to explain and the explanations would be purposeless since they are inconsequential to the intentions of this thesis. Before we get at it, it is worth mentioning, that the purpose of the factors in the APT model is to explain as much of the return of portfolio i as possible. That is to say, in the optimal (or utopia) situation the factors will leave the covariance of residual returns (ei) at zero.

Nevertheless there are three main methods of identifying the relevant indices and security sensitivities. The first one is to simultaneously estimate the factors (Ij) and the security specific attributes (bij). This is done by applying a statistical methodology called factor analysis, which determines a set of Ij and bij’s that renders the residual covariance return as small as possible. Another approach is to specify some firm characteristics that on would assume to affect expected return (bij’s) and use Equation 14 to find λj and APT.

One can hypothesize a set of macroeconomic influences or specify a set of portfolios as factors (Ij), which the researcher assumes to capture the relevant influences of security i’s return. Then Equation 13 is used to estimate the sensitivity of the return of

security i \( (b_{ij}) \) to the factor. And finally Equation 14 is used to estimate \( \lambda_j \) and APT\(^{25}\). The latter method is then method chosen by Fama and French in their (1993) three-factor model, which we will take a closer look at shortly.

The advantage of APT or multifactor models that is of specific importance to this thesis, is that they are more apt to explain returns of portfolios containing assets not included in the market portfolio. Many mutual funds have a portfolio containing a combination of securities and bonds. But the market portfolio of the simple CAPM does not include bonds. Hence the use of multifactor models can be motivated by the fact that the factors can be constructed to include bonds or to include a portfolio of comparable mutual funds, aiding with the explanation of the return of mutual funds.

This is illustrated by a study of CAPM using single indices carried out by Ippolito. When comparing mutual fund performance to the S&P (as the market portfolio), he found an average Jensen’s alpha of 0.4%. But he also found that a small stock index, CRSP, had showed an alpha of 10.06% when held up against the S&P. This could lead to the conclusion that small index mutual funds had managers with superior stock selection abilities, which obviously would be misleading, since index funds are supposed to follow an index. However, when using a multi index model which included a small cap index and a bond index, Ippolito found the alpha of mutual funds to become -1.59%\(^{26}\). Hence, the results of Ippolito were due to an inapt benchmark, and not to the outperformance of the small index mutual funds. Consequently, when looking at fund performance, multifactor models emerge as superior, since they enable us to compare the performance of ethical funds to the performance of unscreened funds.

*The Fama and French (1993) three factor model*

Fama and French set out to construct a version of the multifactor model that was able to explain returns and expected returns on both stocks and bonds. They set forth a hypothesis that a specified set of specifically constructed portfolios could explain the return of both bonds and securities, and then tested the hypothesis.

In their model they used some factors such as the return on a relevant equity benchmark (i.e. the market portfolio as in the CAPM model) but further included returns on other portfolios, constructed to capture the effect of other factors that are thought to influence the return-generating process. These portfolios were\(^{27}\):

• “Small minus large” – meaning the difference in return on a portfolio of small stocks and a portfolio of large stocks.

• “High minus Low” – meaning the difference in return between a portfolio of high book-to-market stocks and a portfolio of small book-to-market stocks.

• The difference between the monthly long-term government bond return and one-month Treasury bill return.

• The difference in the monthly return on a portfolio of long-term corporate bonds and a portfolio of long-term government bonds.

The most interesting thing in this model is Fama and French’s formulation of the two risk factors, size and book-to-market. When taking the difference in returns on portfolios of small and large stocks respectively, Fama and French turn the size aspect into a return concept, rather than a direct measure. Hence, they capture the sensitivity of a security to the return on the size portfolio. By doing so Fama and French was able to investigate both the time-series and cross-sectional effects of the size aspect.

The Fama and French’s (1993) 3-factor model, as conveyed by Carhart (1997) and interpreted by Bauer et al. (1996) becomes as follows:

\[ R_{it} - R_{Ft} = \alpha_i + \beta_{ii}(Rm_t - R_{Ft}) + \beta_{ii}SMB_t + \beta_{ii}HML_t + \epsilon_{it} \]

\textit{Where}

- \( R_{it} \) is return on security, fund or portfolio \( i \) at time \( t \)
- \( R_{Ft} \) is the risk free return at time \( t \) (Bauer et al. uses the return on a local three month T-bill in month \( t \))
- \( \alpha_i \) is the Jensen’s alpha measure for fund \( i \) (as explained under the CAPM section)
- \( Rm_t \) is the return on the relevant equity benchmark at time \( t \)
- \( SMB_t \) is the difference in return between a small cap (or small stocks) portfolio and a large cap (or large stocks) portfolio at time \( t \)
- \( HML_t \) is the difference in return between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks at time \( t \)
- \( \epsilon_{it} \) is a residual variance error term on fund \( i \) at time \( t \)

\( R_{it} = \alpha_i + h_{it}R_{MRF} + s_{it}SMB_t + h_{it}HML_t + e_{it} \)

Where \( R_{it} \) is the return on portfolio in excess of the one-month T-bill return; \( R_{MRF} \) is the excess return on a value-weighted aggregate market proxy at time \( t \); \( SMB_t \) and \( HML_t \) the return on a value-weighted, zero-investment, factor-mimicking portfolio for size and book-to-market equity at time \( t \); and \( e_{it} \) is an error term for portfolio \( i \) at time \( t \). Although the terms used in the equation are different, the equation corresponds to the one used above.

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\( p.38 \)
Fama and French tested this model in a number of time-series tests. In the test, they investigated the cross-sectional implications by examining if intercepts of the excess returns of the time series equalled zero, and found that indeed it did. This implies, as they concluded themselves, that their factors are apt for explaining the common variations in bonds and security returns and the cross-section of average returns\(^29\). In other words, according to Fama and French, the factors included by their model should be very well suited for investigating mutual fund performance.

However, according to empirical evidence, the Fama and French’s (1993) model does indeed improve on the average pricing errors of the CAPM\(^30\). But according to Carhart (1997), the Fama and French’s (1993) model is not, in general, economically different from CAPM.

Carhart conducted an analysis in which he investigated CAPM, the Fama and French (1993) three factor model and a model he constructed himself, further building on the Fama and French model, as we will see later. In the test, Carhart used a CAPM model defined as:

\[
\begin{align*}
    r_{it} &= \alpha_{it} + \beta_{it}VWRF_t + \epsilon_{it}
\end{align*}
\]

Where:
- \(r_{it}\) is the return on a portfolio \(i\) in excess of the one-month T-bill return
- \(VWRF\) is the excess return on the CRSP value-weighted portfolio of all NYSE, Amex and Nasdaq stocks.

For the Fama and French model, Carhart defined the model as:

\[
\begin{align*}
    r_{it} &= \alpha_{it} + \beta_{it}RMRF_t + s_{it}SMB_t + h_{it}HML_t + \epsilon_{it}
\end{align*}
\]

Where:
- \(RMRF\) is the excess return on a value-weighted aggregate market proxy
- \(SMB\) is the return on value-weighted, zero-investment, factor-mimicking portfolio for size
- \(HML\) is the return on value-weighted, zero-investment, factor-mimicking portfolio for book-to-market equity

(Both SMB and HML was obtained from Fama and French).

Furthermore, Carhart included his own model, which we will get to later.

Carhart then went on to test the model on time series comprised of data from July 1963 through December 1993. He finds that in comparing the CAPM and the Fama and French’s (1993) 3-factor model the mean absolute errors are 0.35 %, and 0.31 % per month, respectively\(^31\).

The Fama and French’s 3-factor model evidently does improve on the CAPM results. But in 1993 Jegadeesh and Titman carried out an analysis of a strategy in which past winners in the stock market are bought and past losers are sold. They find that by


following such a strategy, one can realize significant abnormal returns of 12.01% per year in average. Several authors have suggested that this momentum anomaly is caused by slow reaction to new information by the market (including Jegadeesh and Titman themselves), meaning it is caused by a market inefficiency. Another interpretation could be that investors following this strategy temporarily affect the prices of the securities and cause the prices to overreact. The analysis is inconclusive as to the cause of the momentum effect. However, Jegadeesh and Titman (1993) found the momentum anomaly to be robust to time-periods. But the Fama and French model it is unable to explain cross-sectional variation in momentum-sorted portfolio returns. Hence Carhart set out to construct and test a multi-factor model which accounted for the momentum anomaly as revealed by Jegadeesh and Titman.

The Carhart (1997) 4-factor model

As mentioned earlier, Carhart recognized that the Fama and French’s (1993) 3-factor model showed more precise results in determining the performance of mutual funds. But Carhart sought to address the momentum anomaly, which Fama and French’s 3-factor model failed to explain. Hence Carhart build on the Fama and French (1993) 3-factor model but added a factor to capture the cross-sectional variation in momentum-sorted portfolio returns, as identified by Jegadeesh and Titman (1993), since they had proven the momentum anomaly to be robust to time.

Carhart went about constructing the model by adding a term consisting of equal-weight average of firms with the highest 30 percent eleven-month returns lagged one month, minus the equal-weight average of firms with the lowest 30 percent eleven-month returns lagged one month. The stocks in the portfolio for his test of the model consisted of all stocks from NYSE, Amex and Nasdaq re-formed monthly to get a rolling momentum factor.

Hence the Carhart (1997) 4-factor model, referred in the terms of Bauer et al. (2006), becomes as follows:

\[ r_{it} = \alpha_{it} + b_{RMRF} + s_{it} SMB_{it} + h_{it} HML_{it} + p_{it} PR1YR + \epsilon_{it} \]

Where the new added term:

\[ PR1YR \] is the return on value-weighted, zero-investment, factor-mimicking portfolio for a one-year momentum in stock return.

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35 Hence the Carhart (1997) 4-factor model, referred in the terms of Bauer et al. (2006), becomes as follows:

\[ R_{it} - R_{it} = \alpha_{it} + \beta_{RMRF} (Rm_{it} - Rf_{it}) + \beta_{SMB} SMB_{it} + \beta_{HML} HML_{it} + \beta_{Mom} Mom_{it} + \epsilon_{it} \]

Where: \( R_{it} \) is return on fund i at time t, \( R_{it} \) is the risk free return at time t (Bauer et al. uses the return on a local three month T-bill in month t), \( Rm_{it} \) is the return on the
Carhart finds his 4-factor model to be superior to both the CAPM and the Fama and French’s (1993) 3-factor model in terms of mean absolute error. As described above, Carhart finds the mean absolute errors of the CAPM and the Fama and French’s (1993) 3-factor model to be 0.35 % and 0.31 % per month respectively, whereas his own 4-factor model returns a mean absolute error of 0.14 % per month. Furthermore, Carhart finds that the 4-factor model eliminates virtually all patterns in pricing errors. Evidently this indicates that the Carhart (1997) 4-factor model is good at describing the cross-sectional variation in average stock returns\(^3^6\).

*The multi factor models and ethical funds*

In the 1960’s, multi-factor models enjoyed wide spread interest. However, the multi-factor models were mainly used for portfolio management, but turned out as rather inefficient at predicting the future development of price-earnings of securities. Probably because of the rise of IT technology which enabled the researcher to efficiently incorporate more data into the analysis, multi-factor models had a renaissance and regained interest in the early of the 1990’s\(^3^7\). Since then the use of multifactor models have increased rapidly and today, one of the most widely used multi factor model in the performance estimation of mutual funds is the 4-factor Carhart (1997) model\(^3^8\).

Obviously many other factors have been hypothesized and tested by different authors. But the most widely recognized factors for evaluation of mutual fund performance – in terms of applicability and precision - are those identified by Carhart. Hence we have now identified the Carhart (1997) 4-factor model (Equation 16) as the most appropriate model for the evaluation of ethical fund performance. We will be using the Carhart model along with the Black, Jensen and Scholes CAPM model for time-series regression analysis (Equation 11). Although the CAPM have been proven to be inferior in describing the returns of mutual funds (as described above) it is still widely used, and allows for a mutual comparison.

Having identified the relevant models for our performance analysis of ethical mutual funds, the next section will identify the relevant data, including indices, risk free rates and benchmarks, to be used for our analysis.

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\(^{38}\) Bauer et al. (2006) p. 38.
Application of the Models to the Data

Though an identification of two useful models has been made, the direct application of the models and the presentation of results require further explanation. The following section will present an in-depth explanation of the extraction and significance of the later reported results.

Description of Presented Data

The tables will be presenting the results from the application of the models and associated summary statistics. In order to achieve a complete understanding of the data presented, it will be useful with a description of some of the more intriguing statistically terms.

Since both the CAPM and the Carhart 4-factor model are regression models, the following explanation of the terms and summary statistics will be based on the CAPM model. This will allow for an easier and more intuitive understanding of the terms, although the terms and procedures are analogous to those used in the application of the Carhart 4-factor model.

Ordinary Least Square

The mathematical ground pillar of regression analysis is the method of Ordinary Least Square (OLS). To explain how it is applied through the model, let’s take a look at the CAPM model as found in Equation 11:

\[ R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + e_i \]

In order to simplify the model for this explanation section, we will be replacing the left hand side of the equation with the term for the excess return of fund i at time t \( (r_{it}) \). Likewise we replace the term for the return on the market portfolio at time t \( (R_{mt-1}) \) with the \( r_{mt} \). Hence the essence of the model remains unchanged but the model now looks like:

\[ r_{it} = \alpha_i + \beta_i (r_{mt}) + e_i \]

Where
- \( r_{it} \) is excess return on fund i at time t (the return of the fund minus the risk free interest rate)
- \( r_{ft} \) is return on the market portfolio at time t (the return of the market minus the risk free interest rate)
- \( \alpha_i \) is the Jensen’s alpha measure for fund i (as explained under the CAPM section)
- \( \beta_i \) is the sensitivity of the return of fund i to the excess return of the market portfolio
- \( e_i \) is the residual error of the model

Recall that the model is the result of a hypothesized connection between the excess return of the fund relative to the market return. Evidently it results in a straight line,
which means that we are expecting a linear connection between the two returns. We are assuming that alpha and beta are constants. Hence the beta is the slope of the line and alpha is the intercept of the line. And the residual error term, \( e_{it} \), is an expression of how far the observation for each time period is placed from the line. The degree of the models ability to predict the excess return of the fund relative to the excess return of the market portfolio can be measured by observing the residual error term.

Further recall from Figure 3, that unless there is a perfect connection between \( r_{it} \) and \( r_{Mt} \), the graph will result in a number of scattered points in the space defined by \( r_{it} \) and \( r_{Mt} \). Hence the line is not actually observable but must be estimated. This is why we conduct the regression analysis. We wish to minimize the collected \( e_{it} \). Hence, when constructing the model we seek to ensure that the sum of the observed \( e_{it} \) is equal to zero.

![Figure 5](image)

As illustrated by Figure 5, given the observations there are a number of lines, with different slopes and corresponding intercepts that can be constructed to leave the sum of \( e_{it} \) at zero. The perforated line, \( r_{it} = \alpha_{\text{ALT}} + \beta_{\text{ALT}} r_{Mt} \), and the imperforated line \( r_{it} = \alpha_{\text{OLS}} + \beta_{\text{OLS}} r_{Mt} \), both yields a residual error that summarize to zero. However, from observing the figure it is fairly easy to conclude, that the OLS sub noted line gives the better description of the relationship between \( r_{it} \) and \( r_{Mt} \). Hence it is not sufficient to measure the sum of the residual errors, since negative and positive \( e_{it} \) measures cancel out\(^{39}\).

So if we measure the sum of the squared \( e_{it} \) we will get an expression of how big the total residual errors are, since both negative and positive \( e_{it} \)’s will be included in the measure. Consequently the sum of squares of residual errors (or SSE) gives more emphasis to larger deviations from the points to the estimated line\(^{40}\). Hence, if we

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\(^{40}\) In general this is called the Sum of Squared Errors, explaining the abbreviation.
construct the alpha and beta as to minimize the sum of the $e^2_{it}$ we will get the model that most accurately describes the influence of $r_{Mt}$ on $r_{it}$. This result is also called the least squares estimates\(^{41}\). Evidently, the sum of $e^2_{it}$ can be interpreted as a measure of how well the deducted model predicts the excess return of the funds relative to the excess return of the market.

However, the sum of squared errors will not actually be reported in the tables. This is because although the calculation of SSE is essential for determining the optimal model factors, the number in itself is of little or no information, unless it is in some way related to the results of the model.

Hence, when applying the CAPM model to the data, we will be comparing the excess return of the equally weighted portfolio of funds (ethical and conventional funds respectively) for each region, to the excess return of the relevant market portfolio of securities. The alpha ($\alpha$) and beta ($\beta$) results reported for the various portfolios will be the OLS estimates; meaning the estimated values for the factor loadings, that return the smallest SSE or unexplained residual error.

\textit{OLS in the Carhart 4-Factor model}

The explanation above is made based on the CAPM model. But an analogous application of the OLS can be made for multi-factor regression-models, although the computation becomes more complex. However, since the Carhart 4-factor model has four different independent variables and on dependent variable, the line would become a plane placed in a five dimensional space. Evidently this renders a graphic illustration of the model impossible.

Nevertheless, the principal behind the procedure is the same as for the CAPM model. If we take the Carhart 4-factor model from Equation 16 and once again use $r_{it}$ to denote the excess return of the funds and $r_{Mt}$ for the excess return of the market portfolio, the equation becomes as follows:

$$r_{it} = \alpha_i + \beta_{1i}r_{Mt} + \beta_{2i}SMB_i + \beta_{3i}HML_i + \beta_{4i}Mom_i + \epsilon_{it}$$

Where

- $r_{it}$ is excess return on fund $i$ at time $t$
- $\alpha_i$ is the Jensen’s alpha measure for fund $i$ (as explained under the CAPM section)
- $\beta_{1i}$ is the sensitivity of the return of fund $i$ to the excess return of the relevant MSCI portfolio ($R_{MSCIt}$-$R_{Ann}$)
- $r_{Mt}$ is the excess return on the relevant market portfolio at time $t$
- $\beta_{2i}$ is the sensitivity of the return of fund $i$ to the SMB factor
- $SMB_i$ is the difference in return between a small cap (or small stocks) portfolio and a large cap (or large stocks) portfolio at time $t$
- $\beta_{3i}$ is the sensitivity of the return of fund $i$ to the HML factor
- $Mom_i$ is the sensitivity of the return of fund $i$ to the HML factor

\(^{41}\) Also called the regression line, the least squares line or the least squares prediction equation. Reference: McClave et al. (1998) p. 435.
Once again the observed value for each factor in each period is inserted and the factor loadings are estimated so that SSE is minimized. The estimation of $\alpha_i$ and the four $\beta_i$’s are obtained as solutions of a number of simultaneous linear equations\(^{42}\). This procedure is rather complex and the risk of making errors is great when performed manually. Hence a statistical program in Excel, Analysis ToolPak, is therefore applied to perform the regression analysis and obtain the OLS estimates of the factor loadings presented. Other statistical programs such as SAS, SPSS or Minitab, offers the same applications.

**Assessing the Utility and Predictability Powers of the Model**

Once the OLS estimates for $\alpha_i$ and $\beta_i$ are determined the certainty levels of the model can be assessed using different kinds of statistics. The reported statistics in the tables will be described shortly here to illustrate the underlying connections and thereby give an understanding of the significance of the statistic values reported.

To make an inference about the model’s ability to predict the return of the funds $i$, it is necessary to test the model to see if there is even a connection between the return of fund $i$ and the market proxy. If $r_i$ is completely unrelated to $r_M$, then $\beta_i = 0$. In the CAPM model, this would mean that the mean of $r_i [E(r_i)]$ does not change as $r_M$ changes. To see if this is the case, we would test the “null hypothesis” against the alternative hypothesis that the model does provide information for determining $r_i$:\(^{43}\)

$$H_0 : \beta_i = 0$$
$$H_a : \beta_i \neq 0$$

*Equation 17*

To test these hypotheses the sampling distribution of the estimated $\beta_i$ must be determined (when the ‘ is inserted it signals that the factor in question is the OLS estimate obtained – in this case to distinguish between the true $\beta_i$ and the estimated $\hat{\beta}_i$). Provided the assumptions about the probability distribution of $\epsilon_i$ holds, the OLS estimation of $\beta_i$ will be normal with the mean of the true $\beta_i$ and standard deviation\(^{44}\):

\[ \sigma_{\beta_i} = \sum \sigma_{ei}^2 (r_{Mt} - \bar{r}_M) \]

Where
- \( \sigma_{\beta_i} \) is the standard deviation of the OLS estimate of \( \beta_i \)
- \( \sigma_e \) is the standard deviation of the OLS estimated residual error term
- \( r_{Mt} \) is the return on the market proxy at time \( t \)
- \( \bar{r}_M \) is the mean return of the market proxy

Since \( \sigma_e \) is unknown, the test for the hypotheses should be a t-test set as follows:

\[ t = \frac{\beta_i - \text{Hypothesized value of } \beta_i}{\sigma_{\beta_i}} \]

Substituting the hypothesized value for \( \beta_i \) into the equation for the null hypothesis, the equation becomes:

\[ t = \frac{\beta_i - 0}{\sigma_{\beta_i}} \]

The number of degrees of freedom are the same as the number of degrees of freedom associated with \( \sigma_e \), which becomes N-2 because the CAPM model is a straight line. The rejection region for the test is then \( t < -t_\alpha \) (or \( t > t_\alpha \) for the one-tailed test). Alternatively, the rejection region is \( |t| > t_{\alpha/2} \) for the two-tailed test. The \( \alpha \) levels (for the \( t_\alpha \) – not to be mistaken for the \( \alpha \) values) that will be tested for are 0.10, 0.05, and 0.01. These standard rejection regions will be found externally and not reported. The results are however reported as “*”s to indicate the interval at which the results can be rejected along with the \( t \)-values for each factor.

Another statistic of interest that will be reported is the Adjusted R Square \( (R^2_{\text{Adj}}) \). This is a scale-less measure of how much of the variation in \( r_t \) that can be accounted for using the model. As mentioned above, the SSE (Sum of Squared residual errors) can describe the same thing, but the SSE has no greater information value unless related to the values of the analysis. \( R^2_{\text{Adj}} \) makes this relation, making the value comparable across models. To understand the significance of the \( R^2_{\text{Adj}} \) it is necessary to first understand \( R^2 \).

As mentioned in the model section, the coefficient of determination, \( \rho_{it} \), is the square of the correlation coefficient. However, if rearranging the terms squared, we can express the coefficient of determination as \( r^2 \) or \( 46 \):

\[ 45 \text{ McClave et al. (1998) p. 452.} \]
\[ 46 \text{ Chatterjee and Price (1991) p. 64-65.} \]
\[ r^2 = \frac{SS_{\text{ri}_i} - SSE}{SS_{\text{ri}_i}} = 1 - \frac{SSE}{SS_{\text{ri}_i}} \]

Where:

\[ SS_{\text{ri}_i} = \sum (r_{it} - \bar{r}_i)^2 = \sum r_{it}^2 - \left( \frac{\sum r_{it}}{N} \right)^2 \]

And:

\[ SSE = \sum (r_{it} - \hat{r}_{it}) \]

\( r_{it} \) is the excess return on fund \( i \) at time \( t \)
\( \bar{r}_i \) is the mean excess return on fund \( i \)
\( \hat{r}_{it} \) is the estimated excess return on fund \( i \) at time \( t \)
\( N \) is the number of observations

\( SS_{\text{ri}_i} \) can be expressed as the total variability of the model, while \( SSE \) is the sum of squared residual errors as expressed earlier. Hence, if the model explains all of the return on fund \( i \), \( SSE \) will be equal to 0. Hence the coefficient of determination will be equal to \( SS_{\text{ri}_i} \) divided by itself which is 1. If none of the variability of \( r_{it} \) explained by the model, \( SSE \) will be equal to \( SS_{\text{ri}_i} \) and the coefficient of determination will become 0.

Consequently, the term \( (SS_{\text{ri}_i} - SSE) \) can be described as the “explained variability of \( r_{it} \)”. This is divided by the “total variability of the model”. Hence the coefficient of determination is an expression, in percent, of how much of the returns of funds \( i \) that can be explained by the given model\(^{47}\).

Please note that from now on \( r^2 \) will be replaced with \( R^2 \) to illustrate the coefficient of determination. The use of \( r^2 \) has not been inappropriate though, since it also shows another connection. For the simple linear regression it can also be expressed as the square of the Pearson product moment coefficient of correlation, \( r \).\(^{48}\)

For the CAPM model this \( R^2 \) would be an appropriate summary measure of how well the model fits the true line of the model. However, because the CAPM model and the Carhart (1997) 4-factor model have different numbers of explanatory variables, an adjustment to \( R^2 \) is necessary. If a multifactor model has as many parameters as observations, the value of \( R^2 \) will become equal to 1, regardless of the actual


\(^{48}\) The Pearson product moment coefficient of correlation, \( r \) is expressed by the formula:

\[ r = \frac{\sum r_{it} r_{\alpha} - (\sum r_{it}) (\sum r_{\alpha})}{\sqrt{\left[\sum r_{it}^2 - (\sum r_{it})^2 / 2\right] \left[\sum r_{\alpha}^2 - (\sum r_{\alpha})^2 / 2\right]}} \]

usefulness of the given predictors. Hence, although the model may have no explanatory value, $R^2$ will lead us to believe that there it is a perfect fit\textsuperscript{49}.

Hence an alternative to $R^2$ has been developed to adjust for the possibility of the model artificially returning a high correlation estimate. This alternative is called “adjusted $R^2$” or abbreviated $R^2_{\text{Adj}}$. It is given by the formula\textsuperscript{50}:

$$R^2_{\text{Adj}} = 1 - \left[ \frac{N - 1}{N - (p + 1)} \right] (1 - R^2)$$

Where

- $R^2$ is the coefficient of determination ($p$)
- $N$ is the number of observations
- $p$ is the number of parameters in the model

The advantage to $R^2_{\text{Adj}}$ is that it cannot artificially be forced to 1 by adding more independent variables, which is why many academics lean towards using this measure. $R^2_{\text{Adj}}$ will always be lower than $R^2$. However, the disadvantage to $R^2_{\text{Adj}}$ is that unlike the $R^2$ it cannot be interpreted as the proportion of total variation in $r_i$ explained by the regression model.

For the purpose at hand, both the $R^2$ and the $R^2_{\text{Adj}}$ will be reported. This is motivated by the fact that the number of observations in most of the models will be sufficiently large for $R^2$ to be an appropriate measure and present the better measure for CAPM. Meanwhile, the external results to which the results of this thesis will be compared are all reporting the $R^2_{\text{Adj}}$ results and should therefore be compared on the same basis.

Obviously this excludes many of the commonly used models for evaluating fund performance, since these usually seek to unveil the return of the fund, relative to one or more benchmarks, with similar risk profiles. Such models are indeed useful for investors and fund managers to evaluate the portfolio manager’s performance, but the intention of this thesis is not to evaluate the stock selection capabilities of individual fund managers. Instead the intention is to determine the return and risk of a group of funds with certain restraints relative to a benchmark consisting of funds without these restraints. Furthermore, we seek to control for the risk exposures of the funds in an attempt to determine which risks an ethical investor must endure relative to a conventional investor.

\textsuperscript{49} Sincich et al. (1999) pp. 630-632.
\textsuperscript{50} Chatterjee and Price (1991) p. 65.
Data Selection

After identifying two appropriate models for analyzing the return of ethical funds, the next step is to identify the relevant data on which to apply the analysis. The following section will explain and motivate the selection process for the funds to analyze and the benchmark portfolios.

The general intention has been to duplicate the data selection criteria applied by similar studies on ethical fund returns, to make the results comparable. Furthermore, it has been intended to stay true to the benchmark properties suggested by Fama and French, and Carhart respectively. However, due to the limited database access and availability of information, certain modifications of the benchmark and proxy constructions have been necessary.

**Ethical Funds Portfolio**

Construction of the portfolio of ethical funds to be analyzed starts out by identification of the individual ethical funds. Once identified, a screening process is applied to ensure that each fund conforms to the ethical criteria set forth by the thesis. Further screens are then applied in regards to the character of the fund and availability of information. These screens are similar for US and European/Scandinavian ethical funds, and will be explained and motivated once the identification of ethical funds has been carried out.

It has been impossible to identify a worldwide registry of all ethical funds and it now seems unlikely that such a registry exists. Most registries of ethical funds are limited to a specific country or area. Alternately, the registry is largely dominated by funds in the country and severely limited in regards to the inclusion of foreign ethical funds. Hence the construction of the portfolio of ethical funds has been conducted through two different registries; one in the US and one in Europe. The next sections will explain the identification process for the European and US ethical funds respectively.

**Identification of European Ethical Funds**

As mentioned in the chapter on ethical criteria, there are no uniform definitions of what constitutes an ethical fund. Consequently none of the major databases of

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51 This is to build on the hypothesized and tested proxies suggested by the authors in their articles - Fama and French (1993) and Carhart (1997).
investment funds allows for an easy and comprehensive selection of ethical funds. Hence alternative methods of obtaining a list of ethical funds must be applied.

A number of ethical screening companies and charitable institutions in Europe supply lists of ethical funds. An example is the UK based EIRIS\(^{52}\). However, the list supplied is only comprised of UK ethical funds and the international customers of EIRIS’ screens. Hence the list obtained would be biased towards UK funds and the screen application of EIRIS. Furthermore, the list of international customers of EIRIS mainly names the underlying financial institution rather than the name of the fund itself. This further complicates the selection of ethical funds, since each financial institution must be investigated, and not all of the supply fund information in English.

The broadest and most fulfilling international database of European ethical funds is the SRI FUND SERVICE\(^{\circledR}\) provided by Vigeo Italia\(^{53}\). The SRI FUND SERVICE\(^{\circledR}\) is based on the Morningstar\(^{\circledR}\) platform and supplies a list of ethical funds, screened and rated by Vigeo Group\(^{\circledR}\), based on various ethical criteria\(^{54}\). According to Vigeo Italia\(^{\circledR}\) the list includes all European SRI and ethical funds\(^{55}\). From the SRI FUND SERVICE\(^{\circledR}\) a list of ethical funds is extracted. The list is comprised of ethical funds that have equity holdings and are domiciled in Europe.

For a fund to be on the list at this point the demands towards the degree of ethical conformity of the fund is rather limited and further research into the selection criteria applied by each fund is necessary, as explained later.

As mentioned, the list is based on the Morningstar\(^{\circledR}\) platform. This is important to notice, since the Morningstar\(^{\circledR}\) database deletes the no-more-existing-funds or dead funds. Consequently the portfolio of ethical funds will merely comprise of surviving funds, making the portfolio subject to survivorship-bias. This will likely lead to an overestimation of return on the portfolio since dead funds historically has proven to be less successful\(^{56}\). In a study of ethical mutual fund performance in the period 1990-

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\(^{52}\) See www.eiris.org. Another example would be www.ethicalinvestors.co.uk, which supplies a list of solemnly UK funds available for private investors.

\(^{53}\) The SRI FUND SERVICE\(^{\circledR}\) is available through www.vigeo.com.

\(^{54}\) Furthermore, the Vigeo Group\(^{\circledR}\) provides certification and assessments of more than 1500 international companies and 200 bond issuers. The Viteo Group\(^{\circledR}\) is also cooperating with the shareholder of Viteo Group and independent association Forum ETHIBEL, www.ethibel.org, which is a Belgian-based international organization that certifies companies on ethicality based on Viteo criteria as insurance to investors of the conformity of the companies to the ethical criteria. Forum ETHIBEL further advises banks and brokers offering ethical funds. The members of Forum ETHIBEL count a number of associations and NGO’s.

\(^{55}\) This information is according to a private email correspondence with Simonetta BONO, SRI Business Development, Vigeo Italia, on September 11th 2008.

2001, Bauer et al. finds that: “The percentage of mutual funds that disappeared throughout the sample period for Germany, the United Kingdom and the United States is 6%, 28% and 19%, respectively.” They further find that: “Restricting our sample to surviving mutual funds leads to a substantial overestimation of average returns, namely by 0.14% (Germany), 0.17% (United Kingdom) and 0.31% (United States) per year.”

According to the findings of Bauer et al. the survivorship bias is a concrete factor. There are however a number of ways to correct for the survivorship bias. One is to use a database of both surviving and dead funds, but this is evidently impossible, since the Morningstar® registry deletes the dead funds. Another way is to obtain a list of funds that ceased to exists during the sample period, and then to add the dead funds back to the sample for the period in which they did exist. Since the financial information on each fund is extracted using Datastream®, as explained later, which does obtain information on dead funds, this latter procedure could be duplicated for the portfolio of ethical funds, if a list of dead ethical funds could be obtained. Unfortunately it has not been possible to obtain a list of dead ethical funds, and an exposure of the ethical fund portfolio towards survivorship-bias has proven inevitable.

The SRI FUND SERVICE® is also utilized for identifying the Scandinavian ethical funds. On top of the above bias, the problem with the SRI FUND SERVICE® database in regards to the Scandinavian portfolio is that the reported country specification is based on the registered domicile of the fund. In some cases, the registered domicile is not the country in which the fund is listed or their market. Funds are often registered in Switzerland, Luxembourg or the UK even though it might be a Swedish or Norwegian fund, operated by and marketed towards Scandinavians. Hence an attempt has been made to identify Scandinavian funds that are listed elsewhere. This is done through information obtained by further investigation of each fund, the currency in which they are listed and by the use of market information through Datastream®.

The complication in regards to the registered domicile of the collected European funds is less severe. The compiled European portfolio of ethical funds is merely done by extracting the list of European ethical funds from SRI FUND SERVICE®. Whether the fund is registered in a different country than where they operate is irrelevant since the performance used is measured in “Synthetic Euro”58. The only potential problem in is

57 Bauer et al. (2005) p. 1755.

58 For European funds. Synthetic Euros are constructed of Euro in the period of which Euros have been accessible. Beyond that period, the EMU has been used analogous.
that the database contains a few funds registered in Hong Kong, the Bahamas, the US etc. but none of the ethical equity funds are subject to this complication.

The initial list of European ethical equity funds comprise of 238 funds\(^{59}\). This list is then screened using the criteria listed below after the section of identifying US ethical funds.

**Identification of US Ethical Funds**

Like the case for European Funds, no accessible list of US ethical funds is available for private investors through the large traditional fund databases. Hence once again we will have to resort to other methods of obtaining a list of US ethical funds.

In the US there are a number of screening companies, NGO’s and charitable organizations that provide a list of ethical funds. But most of these lists are either biased towards the funds serviced by the screening company, or very limited in regards to the amount of listed funds. The most comprehensive listing of US ethical funds identified is a list provided by Co-op America\(^\circ\) in association with Social Investment Forum\(^{60}\).

The list of US ethical funds comprise of the members of Social Investment Forum, which is a US “...national membership association dedicated to advancing the concept, practice, and growth of socially and environmentally responsible investing (SRI).”\(^{61}\) The members include financial institutions and professionals that seek to integrate ethics in their investment decisions. Because the list only comprise members of the Social Investment Forum it is possible that there are other ethical funds in the US. Because of the relatively low cost of becoming a member and the marketing benefits associated with such a membership, it is assumed that most or all major us ethical funds are members and therefore included in the list\(^{62}\). Hence we are assuming that the list obtained from Social Investment Forum is fulfilling for US ethical funds.

The obtained list of ethical funds investing in equities provides an overview of the ethical screening criteria applied by each fund. However, the information is provided by the funds and the Social Investment Forum is not auditing the funds in terms of conformity in application of the criteria. Hence a short research into each fund is conducted to assess whether they comply by the ethical criteria set forth in this thesis.

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59 The complete list of ethical funds considered for inclusion is available from the author upon request.
60 The Co-op America\(^\circ\) organization can be found at www.coopamerica.org. The list of ethical funds is obtained from the home of Social Investment Forum at www.socialinvest.org.
61 Quote from www.socialinvest.org/about/.
62 For a company with 1 billion dollar (US) under management the annual due is 12.370 $ equal to 0.012%.
as explained below, but in general the information provided is assumed correct, as per the delimitation of the thesis.

As it was the case with the European ethical fund list, the US list is also survivorship biased. However, since it proved impossible to alleviate the survivorship bias in regards to the European funds, no further effort has been put into obtaining a list of dead US ethical funds. This is motivated by the assumption that comparing a survivorship biased portfolio to an unbiased portfolio would result in inconsistent or even incomparable outputs. Hence all ethical portfolios will regrettably but inevitably be survivorship biased.

The initial list of ethical funds investing in equities comprise of 65 funds. This list is then screened as explained in the following section. The full list can be found in the following section.

*Screening of Ethical Funds*

Having extracted the two lists of ethical funds from the before mentioned databases, the next step is to screen the funds in terms of the ethical screening criteria applied and the available financial information. This section will present the assessment procedure applied in the construction of the ethical fund portfolios used in the analysis.

Recall from the chapter on ethical criteria that the label “ethical fund” is not uniformly applied and it does not necessarily mean that the fund is screening for all ethical criteria. Hence it is necessary to make further research into the criteria applied in the selection process for each fund. For this research the information provided by Social Investment Forum (US) and SRI FUND SERVICE® is utilized as well as a further research into the ethical criteria of funds for which the provided information was inconclusive.

For a fund to be labeled ethical in the terms of this thesis, it must screen the stocks based on a number of criteria. Recall from Figure 3 the minimum criteria a fund must apply in their investment decisions, for it to be included in the thesis as an ethical fund:

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63 The complete list of ethical funds considered for inclusion is available from the author upon request.
Criteria applied by fund for inclusion in portfolio for the analysis

<table>
<thead>
<tr>
<th>Exclusion criteria application</th>
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<tbody>
<tr>
<td>• Tobacco industry</td>
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<tr>
<td>• Gambling industry</td>
</tr>
<tr>
<td>• Support of oppressive regimes</td>
</tr>
<tr>
<td>• Excessive environmental impact</td>
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<tr>
<td>• Human rights violations</td>
</tr>
<tr>
<td>• Employee Standards</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Either exclusion of inclusion application of criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Labor rights</td>
</tr>
<tr>
<td>• Environmental protection and reporting</td>
</tr>
<tr>
<td>• Avoidance of child labor</td>
</tr>
</tbody>
</table>

Hence a screen is conducted on the funds to ensure that all funds are complying with these criteria. As mentioned some of the criteria can be upheld by the fund as either an inclusion or an exclusion criteria. It should be noticed as well, that some of the funds are complying with some standard criteria set forth by independent screening companies. If a fund uses the investment universe defined by the independent agency, and further conducts a screen based on their own criteria, it is considered sufficient that the above minimum screening criteria are included in just one of the screens – obviously screening for the same criteria twice would be an overkill.

Not all ethical funds by the definition of the thesis are included, since another screen has been conducted based on the financial information available. This screen requires the ethical fund to have more than one year of financial data available from the cut-off date June 1st 2008. Also, index funds have been excluded. The motivation for excluding index funds is two-fold. First if we measure an index fund, we would in fact measure the fund manager’s ability to retain the weighting of the index in the fund portfolio. But the thesis is not set out to measure managerial abilities, and if we were testing the performance of an ethical index, we would choose the index itself for the analysis, rather than an index mimicking fund. Secondly, most ethical indices do not fully comply with the ethical criteria upheld by the thesis, automatically disqualifying the fund in question.

Furthermore, some funds have proven impossible to locate in the Datastream® database, although thorough searches have been conducted. Others have been located but the extract of information on the fund’s financial performance returned no useful information. Finally some funds have been excluded on the grounds that they are a sub fund of a previously included fund. Since the portfolio for the analysis is an equally weighted portfolio of all ethical funds, the inclusion of a sub fund with equal adjusted returns would in effect double the weight of the primary fund, biasing the results towards the given fund.
The full financial screen is conducted on funds that comply with the ethical criteria upheld by the thesis. The funds that comply with both the ethical screening criteria and the financial screening and therefore included in the portfolio for analysis are listed in the Appendix 1a and 1b. Funds that comply with the ethical screening criteria are marked with a “✓” in the “Screening Criteria” column and those that comply with the financial screen are marked in the “Financial Information” column.

Information on fund performance has been collected using monthly data from Datastream. The data is collected for the period of June 1st 1993 through June 1st 2008. However, due to lack of data on proxies the analyses will be conducted on two periods, namely January 1997 through June 2008 and October 2005 through June 2008. Data on the US and European market is available throughout the first period, while adequate information and ethical funds for the Scandinavian market only can be dated back to the second period.

The portfolios of ethical funds consist of 34, 102 and 10 funds for the US, European and Scandinavian portfolios respectively. As mentioned earlier, it has not been possible to correct for survivorship bias meaning the number of funds rise throughout the periods. Each fund is included from the first period of which monthly performance change is reported. The performance is reported in percent, includes dividends and is net of management fees. Front loads and exit costs are not accounted for. Summary statistics are reported in Table 4 below.

**Funds for Reference Portfolios**

The focus of the thesis is to determine the costs associated with making ethically correct investments relative to unscreened investments. Hence a reference portfolio consisting of conventional equity funds is needed for comparison of fund performances.

Equity funds included in the reference portfolio are selected based on their base date, market and listed currency using Datastream. For each ethical fund in the portfolio of ethical funds, two reference funds have been selected as closely related as possible based on the above criteria.

Monthly performance information has been collected using Datastream. As it has been impossible to correct for survivorship bias in the data collection on ethical funds, only surviving funds have been considered in the reference portfolio for comparison reasons. Each fund is included from the first period of which monthly performance is reported. The performance is reported in percent, includes dividends and is net of
management fees. Front loads and exit costs are not accounted for. Summary statistics on the reference portfolio are reported in Table 4 below.

**Proxies and Factor Mimicking Portfolios**

After identifying the ethical funds and benchmark portfolios for the analysis we must now identify the proxies. Starting out with identifying the proxies for use in the CAPM analysis, the relevant risk free rates and market portfolios will be found first, followed by the extra factor mimicking portfolios for the Carhart 4-factor analysis.

**Risk Free Rates**

For determining excess returns a common risk free return proxy has been the one month t-bill rate, when applicable\(^{64}\). However, recent empirical academic literature has adopted the one month inter-bank rate as the preferred risk free return proxy. In line with this tendency we will be using the one month inter-bank rate as the risk free rate proxy in the analysis\(^{65}\). The rates used will be the one month inter-bank rates in Euro and US-Dollar for the US and European funds, respectively, to reflect the investment possibilities of a local private investor. Since the analysis extends beyond the period of the Euro, the one-month UK inter-bank rate in British Pounds (£) has been used as the risk free rate for the European part of the analysis prior to January 1\(^{st}\) 1999.

**Market Mimicking Portfolio**

For the market mimicking portfolio, the Morgan Stanley universes MSCI Europe, MSCI USA and MSCI Nordic indices are utilized. Recently the Thomson analytics provided World Scope index has become popular for cross sectional regression analysis in academic literature\(^{66}\). However, with the limitations in access granted for this thesis to financial information through Datastream and associated analytical tools, the use of the World Scope has not proven appropriate. Hence it has been deemed necessary to resort to using the MSCI indices. The advantage to using the World Scope index as opposed to the MSCI is that World Scope seeks to cover 98% of the market capitalization, where MSCI only covers approximately 70%\(^{67}\). This could be unfortunate for the results, since ethical funds historically have carried fairly high loadings in smaller equities. However, Bauer et al. (2005) concludes, that the selection of relevant MSCI indices instead of the World Scope index as the market proxy does

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\(^{65}\) In line with Otten and Bams (2002), Bauer et al. (2005).

\(^{66}\) As used by Bauer et al. (2005), Bauer et al. (2006) and Otten and Bams (2002).

\(^{67}\) Bauer et al. (2005) pp. 1757-1758.
not have an influence on their results. Consequently it is assumed that the respective MSCI indices are adequate substitutes for the World Scope index.

The use of local MSCI indices as the respective market mimicking portfolios, is motivated by the recognition that the investment options of private investors in the respective regions is greatly facilitated if kept in the local area. Furthermore, although some funds are globally minded, the majority of their investments are usually concentrated within the local MSCI index.

Table 4 presents summary statistics on the respective MSCI indices, as well as the portfolios of ethical funds and the reference funds respectively:

<table>
<thead>
<tr>
<th></th>
<th>Ethical Funds Portfolio</th>
<th>Benchmark Portfolio</th>
<th>MSCI Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Excess Return</td>
<td>Std. Dev. # of Funds</td>
<td>Mean Excess Return</td>
</tr>
<tr>
<td>US:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 01.1997:</td>
<td>0.87</td>
<td>6</td>
<td>4.28</td>
</tr>
<tr>
<td>From 10.2005:</td>
<td>-1.93</td>
<td>28</td>
<td>2.92</td>
</tr>
<tr>
<td>At End 06.2008:</td>
<td>34</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Europe:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 01-1997:</td>
<td>-2.27</td>
<td>16</td>
<td>4.37</td>
</tr>
<tr>
<td>At End 06.2008:</td>
<td>102</td>
<td>201</td>
<td></td>
</tr>
<tr>
<td>Scandinavia:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From 10.2005</td>
<td>-2.96</td>
<td>3</td>
<td>4.23</td>
</tr>
<tr>
<td>At End 06.2008:</td>
<td>10</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 presents the summary statistics on the US, European and Nordic MSCI indices after subtraction of the relevant risk free proxy for the periods 01.1997-06.2008 and 10.2005-06.2008. All Mean Excess Returns have been annualized. The information is computed using data extracted using Datastream. The data used for construction of the ethical fund portfolios is provided by Social Investment Forum® of the US funds and SRI FUND SERVICE® for the European funds.

An interesting observation can be made from Table 4 in that the mean excess return of all funds are inferior to the associated MSCI benchmark. This adds likelihood to the theory that mutual funds tends to underperform relative to the market portfolio, mainly due to management fees. However, no initial observation of the over or under performance of ethical funds relative to the conventional reference portfolio can be concluded from this data.

**SMB Factor**

For the SMB proxy, Fama and French (1993) used all listed US stocks for their analysis. They then sorted the stocks based on market value and divided them two value weighted portfolios. One portfolio contained the 20% smallest companies based on market value and the rest were in the second portfolio. The SMB proxy was then constructed by subtracting the large portfolio from the small portfolio for each month. The portfolio was reweighted annually.
The same procedure was used by Carhart (1997) and a similar procedure was used Bauer et al. (2005), Bauer et al. (2006) and Otten and Bams (2002). The last three used all of the stocks in the World Scope index as opposed to merely the US quoted stocks.

However, once again the limitations in access to analytical tools have made it practically impossible to copy that procedure for the analysis of this thesis. The access to information and analytical tools made available through Datastream does not practically allow for analysis on individual constituents of indices, but only on the indices themselves. It is apparently possible to extract information on larger portfolios of stocks through Datastream, but this requires an expanded access which was not granted. Hence it has been necessary to resort to alternative ways of constructing the SMB proxy. (The same is the case for the HML and the Mom Proxy as explained later.)

Fortunately this is a common problem for academics that wish to conduct multifactor regression analysis on financial information. An Australian author, Robert Faff, has investigated the possibility of using available indices for the construction of the proxies necessary for conducting a Fama and French regression analysis\(^68\). The research was conducted on the Australian financial market. The procedure that was tested included construction of the SMB proxy through the use of the Australian MSCI Small Cap and MSCI Large Cap\(^69\). Robert Faff concluded that the results were consistent with the results obtained through the normal procedure for obtaining the SMB proxy. The thesis will therefore use an equivalent procedure for the construction of the individual SMB proxies for the three analyses.

The SMB proxy is then constructed by extracting monthly information on the MSCI Europe Small Cap price index and the MSCI Europe Large Cap price index. For each month the large cap index is subtracted from the small cap index to compute the SMB proxy for the European part of the analysis. The process is then repeated for the US market.

However, there is no MSCI Large Cap price index for the Scandinavian market with an adequate history of information. Hence for the Scandinavian part of the analysis, the SMB proxy is constructed by use of the MSCI Nordic Small Cap price index and the OMX Nordic 40 price index, which includes the 40 largest listed stocks on the Scandinavian stock exchanges.

\(^{68}\) See Faff, Robert (2004).

\(^{69}\) In fact the indices used were the MSCI Small Cap Value, MSCI Small Cap Growth, MSCI Large Cap Value and MSCI Large Cap Growth indices. The two Small Cap indices were then added together and divided by two for each month. The same was done with the Large Cap indices.
HML Factor

The HML proxies in previous literature on Fama and French and Carhart 4-factor regression analyses has been constructed using the book-to-market ratios of the individual stocks in the defined universes. The procedure usually applied has been to rank the stocks on their book-to-market ratio and then construct two value weighted portfolios. One portfolio consisting of the bottom 30% of stocks with the lowest book-to-market ratio based on market value and one consisting of the equivalent top 30%. The return of the top book-to-market ratio portfolio was then subtracted from the bottom portfolio for each month to compute the HML proxy.

Since the limitations in the access to financial information mentioned above also affects the construction of the HML proxy, it has once again been necessary to resort to alternate methods. Hence, utilizing the findings and procedures suggested by Robert Faff we construct the HML proxy using the relevant MSCI Value and MSCI Growth indices. Although the precise procedure behind the construction of the MSCI Value and Growth indices remains unrevealed, value stocks are stocks with a low book-to-market ratio, while growth stocks have a high book-to-market value. Theoretically it should therefore be possible to construct the HML proxy by subtracting the growth stocks from the value stocks in the defined universe. Faff tested this hypothesis using the Australian MSCI Growth and Value price indices and found that his results were indeed consistent with the results obtain through the traditional Fama and French procedure.

Replicating the approach suggested by Faff the HML proxy is then constructed by the use of the relevant MSCI Growth and Value indices. Hence the mean of the relevant MSCI Large, Mid and Small cap Growth indices is then subtracted from the mean of the similar MSCI Value indices to construct the HML proxy. This procedure is conducted on both the US and European parts of the analysis. For the Scandinavian HML proxy the procedure remains the same, although there is no division of the MSCI Growth and Value indices into different Cap sizes.

Mom Factor

The momentum factor that Carhart added to the Fama and French multi factor model was constructed by rating all shares on their performance in the previous 11 months lagged one month. The top 30% based on market capitalization was then pooled into a value weighted portfolio of top momentum performers, while the bottom 30%
constituted the low performers. The analysis done by Carhart involved rebalancing the portfolio every month to obtain a rolling momentum factor\textsuperscript{72}.

While most academics follow the approach set out by Carhart, others have made their analysis based on the past six months reweighting the portfolio semi-annually, allegedly arriving at a similar conclusion.\textsuperscript{73}

Traditionally the momentum factor of the analysis has been regarded as the most complicated factor for which to obtain adequate and relevant information. Similarly it is the factor that presents the greatest challenge for the information collection of this thesis. We have not been successful in an attempt to obtain useful financial information that could be inserted to mimic the momentum factor. Hence a major information extraction project has been undertaken to be able to compute a momentum proxy that can reasonably account for the Mom factor.

The approach taken is to extract information on market value and performance on all stocks included in the MSCI index as of June 1\textsuperscript{st} 2008 for the US, Europe and Scandinavian countries respectively. The information is collected semi-annually on June 1\textsuperscript{st} and December 1\textsuperscript{st} for the period analyzed. In line with established procedures, the stocks are rated based on the previous six months performance. The stocks are then split into two value weighted portfolios of the top and bottom 30\% performers based on market value. The Mom proxy is then computed by subtracting the bottom from the top portfolio.

However, it should once again be duly noted, that the access to Datastream available for the author is not intended for extraction of information on this scale. Technical problems did occur in the data gathering process, occasionally corrupting the lists or forcing errors in the listings. Although great emphasis has been put on ensuring correct and reliable data, it cannot be guaranteed that no errors exist in the data underlying the Mom proxies\textsuperscript{74}. Hence, minor deviations in the data can occur, though such small corruptions in individual stock's performance data are likely to have no major effect on the obtain results. Since the databases consist of monthly quotes on 2726, 1875 and 295 individual stocks for the US, European and Scandinavian respectively, minor deviations on individual stocks would be washed out by the quantity of stocks. Conclusively, despite the problems encountered it is the conviction

\textsuperscript{72} Carhart (1994).
\textsuperscript{73} See Otten and Bams (2002) for illustration.
\textsuperscript{74} The data is available from the author upon request, but it is not practically possible, nor very informative, to present the data in written form.
of the author that the data obtained has been corrected and should be considered reliable.

The stocks are included from the first period of which they convey performance information. All performance information is inclusive of dividends.

Table 5 presents summary statistics on the factors included in the Carhart (1994) 4-factor analysis.

Table 5 presents summary statistics of the relevant MSCI index less the risk free rate for the periods 01.1997-06.2008 and 10.2005-06.2008. The column labelled ‘Excess Returns’ presents the excess return of the relevant MSCI indices and the mean of the proxies SMB for size, HML for book-to-market and Mom for momentum factor. The information is computed using data extracted through Datastream.

Having identified the data to be analyzed along with the reference portfolio and the various factors included in the analyses, the next section will present the results obtained from applying the models and conclude on the findings.
Results of the Analyses

This next chapter will present the results obtained from application of the CAPM and the Carhart (1994) 4-factor models. The results will be interpreted and compared to studies conducted on ethical funds by other academics.

Empirical Results from the CAPM model

Table 6 provides the results obtained from applying the CAPM analysis to the data.

<table>
<thead>
<tr>
<th></th>
<th>Alpha</th>
<th>Market Proxy</th>
<th>R2</th>
<th>R2Adj</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-1,878</td>
<td>0,797 ***</td>
<td>0,790</td>
<td>0,788</td>
<td>2,009</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-3,186</td>
<td>0,587 ***</td>
<td>0,870</td>
<td>0,869</td>
<td>1,108</td>
</tr>
<tr>
<td>Difference</td>
<td>1,308</td>
<td>0,210</td>
<td>-0,080</td>
<td>-0,081</td>
<td>0,901</td>
</tr>
<tr>
<td><strong>The US</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-1,593</td>
<td>0,948 ***</td>
<td>0,865</td>
<td>0,864</td>
<td>1,578</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-2,284</td>
<td>0,904 ***</td>
<td>0,788</td>
<td>0,786</td>
<td>1,979</td>
</tr>
<tr>
<td>Difference</td>
<td>0,691</td>
<td>0,044</td>
<td>0,077</td>
<td>0,078</td>
<td>-0,401</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Alpha</th>
<th>Market Proxy</th>
<th>R2</th>
<th>R2Adj</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-2,012</td>
<td>0,929 ***</td>
<td>0,870</td>
<td>0,866</td>
<td>1,242</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-2,738</td>
<td>0,657 ***</td>
<td>0,851</td>
<td>0,846</td>
<td>0,948</td>
</tr>
<tr>
<td>Difference</td>
<td>0,726</td>
<td>0,273</td>
<td>0,019</td>
<td>0,019</td>
<td>0,293</td>
</tr>
<tr>
<td><strong>The US</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-2,691</td>
<td>1,025 ***</td>
<td>0,898</td>
<td>0,894</td>
<td>0,948</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-2,433</td>
<td>1,003 ***</td>
<td>0,693</td>
<td>0,682</td>
<td>1,832</td>
</tr>
<tr>
<td>Difference</td>
<td>-0,258</td>
<td>0,022</td>
<td>0,205</td>
<td>0,212</td>
<td>-0,884</td>
</tr>
<tr>
<td><strong>Scandinavia</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-4,471</td>
<td>0,916 ***</td>
<td>0,823</td>
<td>0,818</td>
<td>1,805</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-3,034</td>
<td>0,684 ***</td>
<td>0,782</td>
<td>0,775</td>
<td>1,535</td>
</tr>
<tr>
<td>Difference</td>
<td>-1,437</td>
<td>0,233</td>
<td>0,041</td>
<td>0,043</td>
<td>0,270</td>
</tr>
</tbody>
</table>

Notes: Table 6, reports the results of the OLS estimations obtained through the CAPM model for the periods January 1997 through June 2008 (A) and October 2005 through June 2008 (B). Reported are the estimates for the portfolio of ethical funds and the reference portfolio of conventional funds for Europe, the US and Scandinavia. ‘Difference’ is the results of the reference portfolios subtracted from the results of the ethical portfolios. The results are obtained by application of the CAPM model (Equation 11): \( R_t - R_f = \alpha + \beta (R_m - R_f) + \epsilon_t \)

Where \( R_t \) is the monthly return of the fund, \( R_f \) is the one-month interbank rate in Euro (or UK£) and US dollar respectively, \( R_m \) is the monthly return on the MSCI Europe and MSCI US index respectively. All returns are net of costs and all alpha are annualized.

Identification of ethical funds has been provided by SRI FUNDS SERVICE® for Europe and Social Investment Forum for US ethical funds. All financial information has been extracted through Datastream.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.
Since the Alpha is usually interpreted as an out- or under-performance of the portfolio relative to the market proxy\textsuperscript{75}, Table 6 suggests that all funds underperform relative to the local MSCI index. However, only the alpha of the European reference portfolio of funds in the period 01.97-06.08 has any statistical significance. There is therefore no significant statistical evidence from the CAPM model suggesting a difference in performance between ethical and conventional funds. This is consistent with the findings of Bauer et al. (2005) in their investigation of ethical funds in various European countries\textsuperscript{76}.

The loadings towards the market proxy ($\beta_1$) are all statistically significant at the 1% level and for all periods and regions. These results suggest that the ethical funds are more market sensitive than the conventional funds. This finding is directly contrarian to the findings of Bauer et al. (2005), who find that conventional funds tends to be more market sensitive than ethical funds\textsuperscript{77}. The difference in findings could be explained by the selection of market benchmark. Bauer et al. (2005) makes use of a market wide equity index supplied by World Scope, while the regional MSCI indices are utilized in this analysis. Hence it could be interpreted as an indication that ethical funds tends to invest in companies in their own region. However, Bauer et al. were also attentive of this possibility and ran a series of test using local indices. They were not able to obtain different results. It is unknown if they tested regional indices as the MSCI indices used in this thesis.

Alternatively it could mean that European and US companies, respectively, provide greater opportunities for ethical investments than external counterparts. The background for such a hypothesis could be either the accessibility of information of the development of ethical companies. Either way this would expose ethical funds to the “home-bias” phenomenon by forcing local investments rather than international. Supportive of this claim is the finding that the reference portfolios of conventional funds exhibit a lower factor loading towards the market proxy. These funds would have an easier access to external investments since they do not need as much specialized information as ethical funds does. This would explain the findings of greater loadings towards the regional MSCI index, relative to the market wide World Scope index.

Further, the high market factor loadings could suggest that a “catching up phase” of ethical companies has been undergone and the quantity of larger companies that are

\textsuperscript{75} Bauer et al. (2005) p. 1758.
\textsuperscript{76} Bauer et al. (2005) p. 1759.
\textsuperscript{77} Bauer et al. (2005) p. 1760.
concerned with their ethical conduct have increased. This claim would be based on several observations: MSCI indices only cover 70% of the market capitalization (as opposed to World Scope’s 98%) and thereby is biased towards larger companies. The loadings of the ethical funds towards the local MSCI index increase from the first to the later period. And the Bauer et al. (2005) analysis was conducted for the period January 1990 through Marts 2001. Since the overlapping of the periods in the two analyses is marginal, this latter explanation could be justified. It is however impossible from this statistic to determine which claims (if any) are correct.

Another result worth noticing is that the US funds has a considerably higher loading towards the market proxy than their European counterparts. This could be supportive of several conclusions. First there is the possibility that US companies have had greater focus on incorporating ethically conscious conduct, leading to a greater part of the market index being eligible for the investments of ethical funds. This could stem from the longer tradition of focus on the ethical conduct of companies in the US, as explained earlier. Another possible explanation is that the screening process is more leisurely regarded by US ethical funds, which therefore allows for greater diversification for US ethical funds relative to the market.

It should further be noticed that US conventional funds also carry greater factor loadings towards the market proxy than their European counterparts. This opens for the possible explanation that the accessibility and informational boundaries within the US equity markets are smaller than those of the European markets. This would explain the greater loadings towards the market proxy by the US companies, while accounting for the relatively low loadings of the European funds.

**Empirical Results from the Carhart (1994) 4-factor model**

The Table 7 below presents the OLS estimates obtained from the Carhart (1994) 4-factor model. The results presented leads to observations.

First, although most alphas values reported are statistically insignificant the alpha values of the European ethical funds and their reference portfolio are statistically significant at the 10% level for the period 01.1997-06.2008. Both portfolios underperform relative to the market index, which is consistent with the findings of Otten & Bams (2002) that mutual funds tend to underperform relative to the market portfolio. Further it is worth noticing that the ethical funds carry a lower alpha (-0.560) than the reference portfolio (-0.308), which present some weak statistical evidence that there is a difference in performance.

<table>
<thead>
<tr>
<th></th>
<th>Alpha</th>
<th>Market Proxy</th>
<th>SMB proxy</th>
<th>HML Proxy</th>
<th>Mom Proxy</th>
<th>R2</th>
<th>R2Adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-6,518 *</td>
<td>0,840 ***</td>
<td>0,415 ***</td>
<td>-0,107 *</td>
<td>0,705</td>
<td>0,852</td>
<td>0,847</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-3,631 *</td>
<td>0,609 ***</td>
<td>0,209 ***</td>
<td>-0,009</td>
<td>-0,016</td>
<td>0,905</td>
<td>0,902</td>
</tr>
<tr>
<td>Difference</td>
<td>-2,887</td>
<td>0,231</td>
<td></td>
<td>-0,099</td>
<td>0,721</td>
<td>-0,053</td>
<td>-0,055</td>
</tr>
<tr>
<td>The US</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-2,758</td>
<td>0,957 ***</td>
<td>0,225 ***</td>
<td>-0,007</td>
<td>-0,006</td>
<td>0,916</td>
<td>0,914</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-2,549</td>
<td>0,891 ***</td>
<td>0,261 ***</td>
<td>-0,057 *</td>
<td>-0,259</td>
<td>0,873</td>
<td>0,869</td>
</tr>
<tr>
<td>Difference</td>
<td>-0,210</td>
<td>0,067</td>
<td></td>
<td>0,051</td>
<td>0,253</td>
<td>0,043</td>
<td>0,045</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Alpha</th>
<th>Market Proxy</th>
<th>SMB proxy</th>
<th>HML Proxy</th>
<th>Mom Proxy</th>
<th>R2</th>
<th>R2Adj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
<td>-0,442</td>
<td>0,874 ***</td>
<td>0,283 ***</td>
<td>0,088</td>
<td>-0,388</td>
<td>0,920</td>
<td>0,908</td>
</tr>
<tr>
<td>Conventional Benchmark</td>
<td>-3,073</td>
<td>0,637 ***</td>
<td>0,193 ***</td>
<td>0,000</td>
<td>-0,004</td>
<td>0,894</td>
<td>0,878</td>
</tr>
<tr>
<td>Difference</td>
<td>2,631</td>
<td>0,237</td>
<td>0,089</td>
<td>0,088</td>
<td>-0,383</td>
<td>0,026</td>
<td>0,030</td>
</tr>
<tr>
<td>The US</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Funds</td>
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<td>0,957 ***</td>
<td>0,201 ***</td>
<td>-0,140</td>
<td>0,631</td>
<td>0,933</td>
<td>0,923</td>
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<td>0,923 ***</td>
<td>0,206 ***</td>
<td>-0,167</td>
<td>-1,198</td>
<td>0,725</td>
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<td>0,034</td>
<td>-0,004</td>
<td>0,026</td>
<td>1,829</td>
<td>0,208</td>
<td>0,239</td>
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</table>

Scandinavia

<table>
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<th>HML Proxy</th>
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<td>-0,190</td>
<td>0,026</td>
<td>-0,186</td>
<td>0,024</td>
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</table>
Consistent with the findings from the CAPM model, the ethical funds have a higher exposure to the market index than their reference portfolios. Once again this is contrary to the findings of Bauer et al. (2005) who, in their Carhart (1994) 4-factor analysis, once again find ethical funds to have less exposure to the market portfolio than conventional funds\(^78\). The results here are however fairly robust with a significance level for all fund portfolios at 1%.

Unlike the CAPM model, the Carhart (1994) 4-factor model allows for an investigation into the exposure of the portfolios towards small cap stocks (the SMB factor). Observing the SMB factor loadings it is evident that European ethical funds, for the 97-08 period, are considerably more exposed to small cap companies relative to their US peers. Although the European SMB factor loading falls for the 05-08 period, European ethical funds maintain their higher exposure to small cap companies, relative US ethical funds.

This observation is interesting in that it further encourages the conclusion that a greater quantity of large US companies are considered ethical investments. Since the MSCI indices are biased towards larger companies, this conclusion would account for both the higher factor loading of US ethical funds towards the US MSCI index and for the lower European exposure to the MSCI Europe index. Furthermore, the lessened exposure of European ethical funds towards the SMB factor in the most recent period supports the claim that larger companies are becoming more ethically conscious.

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\(^78\) Bauer et al. (2005) p. 1761. In their 2006 analysis of Australian ethical funds Bauer et al. establish the same tendency. But since their 2006 analysis is conducted on Australian funds, further comparison has been omitted here, because the funds are excluded from the analyses conducted in this thesis.
An alternate conclusion is that European ethical funds are more apt to invest in companies outside of the region, whereas US funds mainly concentrate their investments inside the US. This would also explain the equally high exposure of the reference portfolio towards the market proxy. However, such a conclusion offers no related explanation for the increased exposure of European ethical funds towards small cap companies.

The Scandinavian results suggest a significantly increased spread in the exposure to the MSCI Nordic index of the ethical funds relative to their reference group. This would once again this adds to the suspicion that ethical funds are more exposed to “home-base” bias, since the information and surveillance demands of ethical funds are greater. Collection of non-financial information is facilitated for local companies explaining this tendency.

Since the emphasis on ethical investments in Scandinavian is apparently rather young – the first ethical funds in the analysis are included from 10.2005 – the “catching-up” theory would lead us to expect an increased exposure towards small cap companies. There is however, unlike the European ethical funds, no statically significant evidence suggesting this exposure. This could be explained by the traditionally high standard of ethical conduct by Scandinavian companies, facilitating an adoption of larger companies in ethical fund portfolios.

Further it should be observed that the results are inconclusive as to the performance difference of ethical funds relative to the reference portfolio in Scandinavia.

Another observation that can be made from the comparison of the Carhart (1997) 4-factor analysis with the CAPM analysis is that $R^2_{Adj}$ has in general increased significantly. This supports the expectation that multifactor models are superior at explaining the return of mutual funds. Furthermore the statistical significance levels of the loadings towards the SMB proxy suggest a style tilt that CAPM cannot account for, and expose the inadequacies of the single index model thereby achieving a decreased explanatory power.

Although the Carhart 4-factor model has superior explanatory power in terms of the performance contribution of funds, no statistical significant conclusion on the difference in performance can be drawn from the achieved results.
Conclusion

The thesis set out to test the hypothesis that ethically conscious investors must pay a price for investing ethically correct. In order to test the hypothesis an identification of ethical investments were conducted through ethically labeled funds. Afterwards an analysis was made of the financial performance of the ethical funds relative to a reference portfolio of conventional equity funds.

An investor who opts for ethical investments will encounter complications in identifying ethically conscious companies. The lag of an international standard definition of ethical criteria and subsequent auditing makes the ethical investment market impalpable to private investors.

To facilitate the investment process, the investor can choose to make his or her investments through ethical mutual funds. Although most funds reveal the ethical and financial screening criteria applied, the overall ethical standard of the screens conducted is inconsistent. The identification process of an ethical fund that complies with the subjective ethical preferences of the investor is rather tedious, and requires the investor to conduct a great amount of research on each fund.

After identifying a portfolio of ethical funds that comply with an expressed set of ethical criteria, many of the ethically labeled funds in both Europe and the US were excluded. Since no international control of ethical funds exist, the market for ethical funds seems to be inflated by funds seeking to obtain investors by ethical marketing, although the applied screening process is either sparse or selective.

The results of the CAPM single index model on the portfolios of ethical and conventional reference funds in Europe, the USA and Scandinavia were inconclusive to differences in performance of ethical and conventional funds. Statistically vague evidence indicated that mutual funds in general under perform relative to the market portfolio.

There was further evidence that ethical funds had a greater exposure to the local MSCI index of all regions, suggesting that ethically conscious investors indirectly make more local investments. This could stem from the increased dependence on non-financial information, and the facilitated access to such information on regional companies by ethical funds. Alternately it could mean that companies in the western countries are more ethically conscious, thereby increasing the local ethical investment opportunities and increasing the exposure to the regional market portfolios.
The results from application of the Carhart (1997) 4-factor model show an increase in \( R^2_{\text{Adj}} \) relative to the CAPM. This proves that the multi-factor model is superior as a performance measurement of mutual funds and it further allows for a more detailed analysis for the performance contributing factors.

After controlling for size, book-to-market and momentum factors, only statistically vague evidence is present that ethical funds underperform relative to conventional funds. The evidence is present in the European market for the period January 1997 through June 2008 and is statistically significant at the 10% level. For all other regions and periods the results are inconclusive.

In line with the conclusions from application of the CAPM model, the Carhart 4-factor model indicates a significantly greater exposure of ethical funds to the regional MSCI index in comparison to their reference funds. This finding supports the conclusion that ethical funds have a lower degree of international diversification than conventional funds, thereby increasing the risk exposure of their investors to the local market.

Furthermore the multi-factor model indicates that European ethical funds tend to be more small-cap oriented than their conventional counterparts. However, this orientation decreases for the most recent period suggesting evidence in support of the claim, that larger companies have adopted an ethically conscious conduct in recent years. Ethical funds can therefore increase their share of large-cap companies, decreasing their exposure to small-cap companies.

Finally it is concluded that the thesis find only vague statistical evidence that investments through ethical funds carry a price relative to conventional funds. However, investors in ethical funds will indirectly obtain an increased risk exposure to the local region of the fund, suggesting a decreased international diversification relative to conventional funds.
### References

**Articles:**

Books:

Appendix 1.a presents a list of all ethical funds included in the construction of the European ethical fund portfolio. All the listed funds comply with both the minimum ethical screening requirements and the requirements for available financial information. Funds included in the Scandinavian portfolio are marked in italic.

## Complete List of European Ethical Funds

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<td>Triodos Meerwaarde Aandelenfonds</td>
<td>21.48</td>
<td>EUR</td>
<td>Hol</td>
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<tr>
<td>UBI Pramerica Azionario Etico Acc</td>
<td>4.92</td>
<td>EUR</td>
<td>Ita</td>
</tr>
<tr>
<td>UBS (Lux) EF-Eco Performance (CHF) B Acc</td>
<td>515.83</td>
<td>CHF</td>
<td>Lux</td>
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<tr>
<td>UBS (Lux) EF-Global Innovators (EUR) B Acc</td>
<td>62.40</td>
<td>EUR</td>
<td>Lux</td>
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<tr>
<td>UBS (Lux) RF-European Equities B Acc</td>
<td>99.92</td>
<td>EUR</td>
<td>Lux</td>
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</table>

Appendix 1.a presents a list of all ethical funds included in the construction of the US ethical fund portfolio. All the listed funds comply with both the minimum ethical screening requirements and the requirements for available financial information.

**Complete List of US Ethical Funds**

<table>
<thead>
<tr>
<th>Fund Name</th>
<th>Assets (mill. US $)</th>
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</thead>
<tbody>
<tr>
<td>AHA Socially Responsible Equity I</td>
<td>58.31</td>
</tr>
<tr>
<td>AHA Socially Responsible Equity N</td>
<td>0.90</td>
</tr>
<tr>
<td>Calvert Capital Accumulation A</td>
<td>98.33</td>
</tr>
<tr>
<td>Calvert Large Cap Growth A</td>
<td>737.55</td>
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<tr>
<td>Calvert Large Cap Growth B</td>
<td>35.24</td>
</tr>
<tr>
<td>Calvert Large Cap Growth C</td>
<td>92.62</td>
</tr>
<tr>
<td>Calvert Large Cap Growth I</td>
<td>467.64</td>
</tr>
<tr>
<td>Calvert Mid Cap Value Fund</td>
<td>35.18</td>
</tr>
<tr>
<td>Calvert New Vision Small Cap A</td>
<td>89.76</td>
</tr>
<tr>
<td>Calvert New Vision Small Cap C</td>
<td>10.82</td>
</tr>
<tr>
<td>Calvert Small Cap Value Fund</td>
<td>33.20</td>
</tr>
<tr>
<td>Calvert Social Investment Equity A</td>
<td>912.80</td>
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<tr>
<td>Calvert Social Investment Equity C</td>
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<tr>
<td>Calvert Social Investment Equity I</td>
<td>129.84</td>
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<tr>
<td>Domini Institutional Social Equity</td>
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<tr>
<td>Domini Social Equity A</td>
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<tr>
<td>Domini Social Equity I</td>
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<td>Green Century Equity</td>
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<tr>
<td>MMA Praxis Core Stock Fund A</td>
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<td>MMA Praxis Core Stock Fund B</td>
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<td>MMA Praxis Growth Index Fund A</td>
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<td>MMA Praxis Growth Index Fund B</td>
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<td>MMA Praxis Small Cap Fund A</td>
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<td>MMA Praxis Small Cap Fund B</td>
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<tr>
<td>MMA Praxis Value Index A</td>
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<tr>
<td>MMA Praxis Value Index B</td>
<td>9.56</td>
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<tr>
<td>Neuberger Berman Socially Resp Inv</td>
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<td>Parnassus Equity Income Fund</td>
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<td>Parnassus Fund</td>
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<td>Parnassus Mid-Cap Fund</td>
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<td>Parnassus Small-Cap Fund</td>
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<td>Pax World Growth</td>
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<td>Pax World Women's Equity Fund - Institutional Class</td>
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<tr>
<td>Walden Social Equity Fund</td>
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</table>

*Source of information: Social Investment Forum.*