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A Fund Analysis of Sustainable Investing in the Norwegian Market

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This master thesis is written as part of the Master of Science in Business program at BI Norwegian Business School. It analyzes risk and return dynamics of sustainable and conventional funds in the Norwegian market. The process of writing this thesis has been demanding, and we are thankful for the great help and encouragement from fellow students and professors at BI. We would like to thank our supervisor Ignacio Garcia De Ollala Lopez for his guidance and support. His advice and counselling have been of great value. We also want to recognize Professor Bern Arne Ødegaard for his work on calculating the pricing factors for the Norwegian market, making them available for us to use, as well as answering our questions.

Abstract

This thesis analyzes risk – adjusted returns for a sample of sustainable and conventional funds in the Norwegian market during a nine-year period (January 2011 to December 2018). It contributes with further research on the sustainable versus conventional investing debate, in the little investigated Norwegian market. The methodological approach incorporates internationally accepted capital asset pricing models. Additionally, we consider pricing factors relevant specifically for the Norwegian market and we construct a Norwegian model that incorporates empirically valid pricing factors for this region. Like in previous international research, we find that the risk-adjusted performance of Norwegian sustainable funds is matched with that of Norwegian conventional funds. Our findings are particularly interesting for environmental, social, and governance – oriented investors and organizations. An example is the Norwegian Government Pension Fund Global as the fund uses sustainable investment approaches in its portfolio management. The data suggests that such investors do not have to pay a premium for investing sustainably. Additionally, we find that sustainable funds are significantly less exposed to small capitalization stocks than conventional funds. Our risk-adjusted performance findings are robust for a range of time periods and sustainability definitions. Risk factor exposure has showed minor variances depending on periods and sustainability definitions.

Contents

1. Introduction

Today's investment climate is rapidly changing. Investors' criteria and considerations are steadily evolving and are now more complex than ever. In addition to financial returns, the modern investor is looking for social and environmental gain when allocating their resources. Not being conscious of such factors might hurt the investment long-term. We need only to look at the latest company controversies to see how social and environmental scandals affect firms financially. Following the Deepwater Horizon spill in 2010, BP saw its share price reduced to almost half (Bloomberg, 2019). Volkswagen took a similarly hard hit after its emission scandal, with Bloomberg estimating the total cost of its diesel emission cheating to a staggering $35 billion (Matussek, 2018). In 2018 Facebook stock owners suffered a $119 billion shaving off of its company market value after its great privacy scandal (Neate, 2018). In addition to investors, CEOs seem to have internalized the link between conscious operations and the bottom line, evidenced in a 2016 study surveying over 1,000 CEOs. It found that 97% of CEOs believe that sustainability is vital to the future success of their business (Accenture & UNGC, 2016). With this acute awareness, approaches to investment have developed to become more conscious with time. Investors' consideration of environmental, social, and governance (ESG) factors in portfolio selection and management is also known as socially responsible investing (SRI) (The Global Sustainable Investment Alliance, 2018). The investment movement has evolved from a risk management focus to one that seeks opportunities for the creation of long-term value for business and society.

Globally, assets managed under sustainable investing approaches stood at an impressive $30.7 trillion at the beginning of 2018. Furthermore, Europe is the most significant player in this industry with $14.1 trillion total assets committed to sustainable and responsible investment strategies (The Global Sustainable Investment Alliance, 2018), with $925.1 billion placed in Scandinavian countries (EUROSIF, 2018).

The SRI market in Norway is well established, one of the reasons being the critical role that governments and public pension funds play in the industry. The Norwegian Government Pension Fund Global (GPFG) is one of the most significant sovereign wealth funds in the world, managed under ethical guidelines (Regjeringen, 2019). In general, public pension funds account for a majority of SRI investments in the nation, which is likely to stem from the fact that certain funds are required by law to consider ethical aspects in their investment and management practices (Bengtsson, E. 2008). Generally, legislation has been a strong determinant in the manifestation of SRI in the Scandinavian region (Louche and Lydenberg, 2006). Despite this, there seems to be a lack of research investigating this market. Renneboog, Ter Horst & Zhang (2008) investigated Norway as a part of a global study of 17 countries. They used a limited number of funds and the sustainable investing industry has developed considerably since their period of investigation (1991 – 2003). Furthermore, the researchers understandably utilized international asset pricing models. We are interested to understand the Norwegian sustainability industry in depth, using market specific pricing factors. Consequently, this thesis analyzes whether sustainable investment approaches reduces risk and enhances returns as compared to conventional investment approaches in the Norwegian equity fund market. Moreover, we investigate if there are any differences in risk factor exposure between sustainable and conventional funds.

The analysis is built on ordinary least squares (OLS) regression using one one-factor model and three multifactor models. Three portfolios grouped on sustainable criteria are regressed; one sustainable portfolio consistent of fund verified by the Morningstar Sustainability Ratings and a sustainability mandate, one portfolio consisting of conventional funds, and one difference-portfolio constructed by taking the equal-weighted portfolio of average sustainable fund returns minus the equal-weighted average of conventional funds returns. To control for different risk factors, we have used the CAPM (Sharpe, 1964; Lintner, 1962), Fama and French three-factor model (1993) and Carhart's four-factor model (1997). Additionally, we construct a Norwegian model that is consistent with systemic risk factors relevant to the Norwegian market (Næs, Skjeltorp & Ødegaard, 2009).

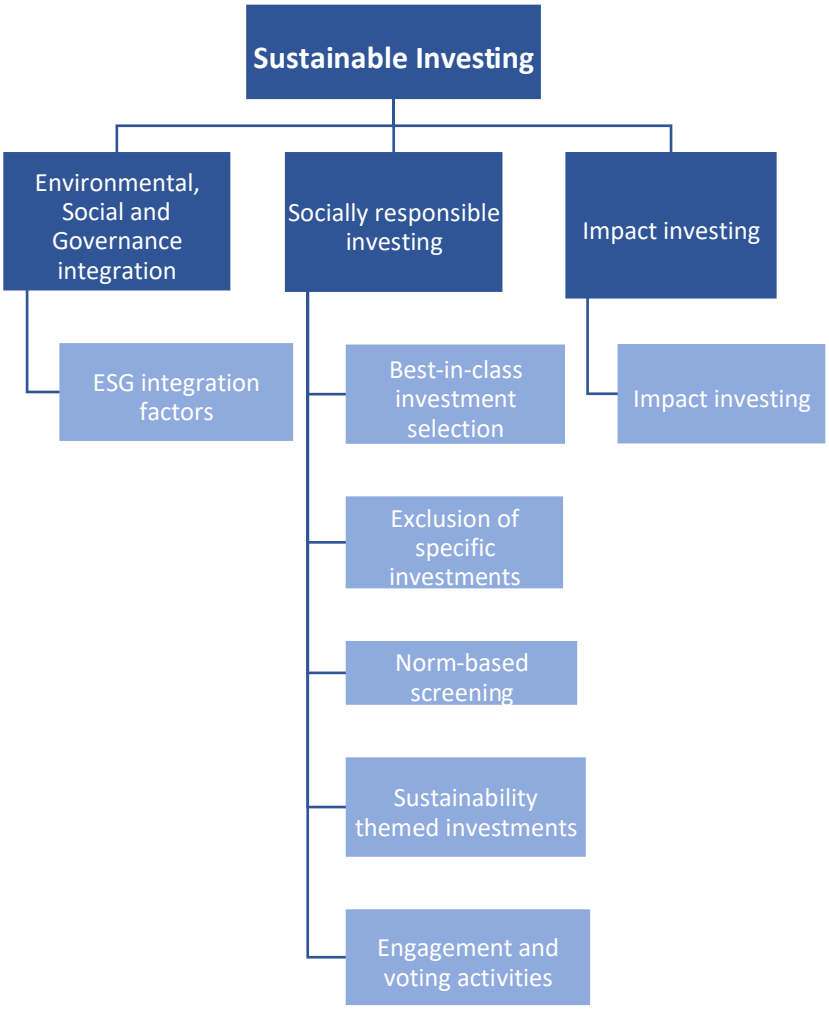
We find no evidence that there exist significant differences in the performance of sustainable and conventional funds in the Norwegian market after controlling for different pricing factors. These findings are consistent with previous research (Renneboog et al., 2008; Lobe & Walkshäul, 2014; Hoepner & Schopohl, 2018). Implications are that an investor in the Norwegian market can on average expect the same risk-adjusted return using a sustainable or conventional investment approach. We find some evidence that there are differences in factor exposure between sustainable and conventional funds, notably sustainable funds seem to be less exposed to small capitalization stocks than conventional funds. These findings align with previous findings from Nofsinger & Varma (2014) that report the same tendency.

The remainder of the thesis has the following outline; Chapter 2 will outline the different approaches to sustainable investing. Chapter 3 presents our research question in detail while chapter 4 will go through the related literature. Chapter 5 will discuss the data used and the associated collection of the data. Chapter 6 will go through the methodological approach; the motivation and limitations for the research and the models used. Chapter 7 presents our empirical analysis, and chapter 8 concludes the thesis.

2. Sustainable Investing

Alongside the proliferation of ethical investing, there is a selection of investing methods and strategies that needs further explanation. EUROSIF defines seven main strategies of sustainable investing (see appendix 1) (EUROSIF, 2019). These are; Best-in-class investment selection, engagement & voting activities, ESG integration factors, exclusion of specific investments, impact investing, norm based screening, and sustainability-themed investments. The strategies are categorized into three different pillars; Environmental, Social, and Governance (ESG) Integration, Socially Responsible Investing (SRI), and Impact Investing.

Figure 1: *Overview of SRI strategies*



There is a certain amount of overlap between the approaches, which can be a source of confusion. Thus, the following section will highlight the different methods of investing.

It will outline how they differ from each other; in what ways they are similar and where they belong in the sustainable investment universe.

2.1 ESG Integration

ESG integration is an overarching theme in sustainable investing. The acronym ESG is divided into its respective components, namely; social, environmental, and governance issues. In contrast to traditional financial analysis tools, ESG investment aims to improve financial performance by taking sustainability into account (Caplan, Griswold & Jarvis, 2013). There are numbers of ESG-factors that may influence the financial performance of a firm, and accompanying security either directly or indirectly. Table 1 shows ESG issues as presented by Thomson Reuters.

Table 1: *Thomson Reuters ESG Categorization (Thomson Reuters, 2019)*

Environmental	Governance	Social
Resource use	Management	Workforce
Emissions	Shareholders	Human Rights
Innovation	CSR Strategy	Community
		Product Responsibility

The idea behind ESG integration is to uncover risks and opportunities that potentially are missed using standard technical valuation techniques, but still, have the potential to affect the performance of an investment materially. In order to account for these and make the financial analysis more comprehensive, the incorporation of ESG criteria is said to be valuable by supporters. Translated into a qualitative measure, an instrument with high ESG-scores will reflect a potential for value-added, while a low score implies a handicap in driving returns. Verheyden, Eccles & Feiner (2016) Find that screening an investment universe for ESG issues adds approximately 0,16% in average annual performance, globally. The notion of ESG integration driving asymmetric returns is shown in multiple studies (Kempf & Osthoff, 2007; Statman & Glushkov, 2009). While social consciousness is evident with the employment of ESG considerations, the fundamental aim of their use is that of predicting financial performance.

In order to illustrate the idea behind ESG issues and their material impact on firm performance, we refer to the infamous case of sports giant Nike. The company saw its stock fall by approximately 50% during its infamous sweatshop scandal in the late '90s (Bloomberg, 2019). In this case, particularly the Social dimension of ESG issues was relevant. Due to infringement on human rights and the use of child labor, Nike's shareholders saw a value loss despite competing firms gaining in market value during the same period (Forbes, 2001). The logic follows that using the ESG integration techniques during this period would have excluded the Nike stock from an investor's possible investment pool and thus avoided the loss in investment value.

2.2 SRI Approaches

Socially responsible investing (SRI) can be seen as a progression of ESG that couples personal and social values with investment decisions. It does so by actively eliminating or selecting investments based on a particular set of ethical guidelines. The money management strategy gives due consideration to the social, moral, religious, and environmental repercussions of an investment. Anchored in the idea that an injection of capital into any firm is an endorsement of its activities (Shah & Ramamoorthy, 2014). SRI utilizes ESG factors as a proxy of an investments moral congruence - meaning the coherence between the investors ethical protocol and the investment. This is different from a standard ESG analysis, which on its own is first and foremost an apparatus for forming well informed valuations. One caveat worth noting is that SRI's overarching goal is still that of profits; however, the objective is revenue generation under a set of ideals. Despite the recent attention surge, the concept of SRI has been around for quite some time. At its infancy, the aim was to avoid products or industries that conflicted with a set of moral values. The traditional SRI methods brought into the mainstream today are primarily positive and negative screening, as well as engagement.

2.2.1 Negative Screening

Negative screening has an exclusion focus, meaning the methodology excludes companies whose operations are not congruent with predetermined ethical standards.

Alternatively, such investments are called “sin” stocks or “sin” investments. “Sin” companies are those whose business is based upon what are traditionally morally condemnable industries. Examples are gambling, tobacco, alcohol, pornography, weaponry, and nonrenewable energy (Fabozzi, Ma & Oliphant, 2008). One type of negative screening is norm-based. With this approach, an ESG-filter, usually created by index management or an ethical advisory firm, is applied to the portfolio. This type of screening evaluates individual companies in a portfolio based on a set of norms, goals, and standards. The analysis method aids the portfolio manager in assessing whether a firm is compliant with global norms on various topics such as labor conditions, human rights, transparency, and environmental issues. International initiatives and guidelines like the OECD Guidelines for Multinational Enterprises and the UN Global Compact usually lay out such Global norms (ISS-Ethix, 2015).

Drawbacks to this method of screening are the reduction in the investment universe and biased sector representation. According to modern portfolio theory, putting limitations on the investment-universe is disadvantageous due to the drawbacks of an undiversified portfolio. Negative screening contributes further to unsystematic risk by eliminating specific industries and types of companies, resulting in partisan industry weights. Diversification of portfolios is valuable because it drives out idiosyncratic risk and provides investors with more efficient portfolios.

2.2.2 Positive Screening

Positive screening has an inclusion focus. It is an overarching term used to denote many different SRI approaches like best-in-class selection, sustainability-themed investing, and impact investing. Their commonalities are that portfolio managers include companies based on desirable ESG performance. Selection based on top ESG performance within an industry is aptly named best-in-class selection. Sustainability-themed investing is recognized by its direct investments into firms and sectors that are using greener and more sustainable energy sources to run their businesses.

Positive screening is distinctly different from negative screening in that its diversification is not impaired in the same way. Negative screening reduces the pool of possible investments; contrarily positive screening shifts optimal weights in the optimal portfolio. Positive screening looks to find those companies that promote social and environmental sustainability. In other words, where negative screening merely excludes companies with socially irresponsible products, positive screening takes a more proactive role and systematically incorporate the social responsibility factors into the investment decision. The portfolio manager takes care in optimizing the return-volatility trade-off while maximizing social, environmental and governance impact.

2.2.3 Engagement

Corporate engagement and shareholder action are for those investors who want to use their shareholder power to influence the corporate behavior of the firm, either through majority votes or through other forms of influence. The goal is to drive the company to be more sustainable, to have a higher social gain for its stakeholders and improve the firm governance. By being engaged in the company's decision-making, portfolio managers can leverage their ownership and threaten to exclude firms with poor ESG performance. The intention behind such threats is to incentivize the firms to rectify and improve their strategies and operations. Within this mechanism lies the investors' impact on the invested firm.

2.3 Impact Investing

Targeted investments aimed at solving social and environmental problems characterize impact investing. Many of the same concerns motivate impact investors and SRI investors, and SRI investments have often served as a bridge between traditional investing and impact investing (Rodin & Brandenburg, 2014). Where SRI investors generally exclude "bad companies" from their portfolio of investments, an impact investor would invest in companies that are proactively working to address social or environmental problems. Example of impact investing is the injection of capital into renewable energy startups and companies that aim to transform education and healthcare. The measures used to evaluate the success of impact investment is comprehensive and combines quantitative and qualitative measures of returns (Bugg-Levine & Emerson, 2011).

3. Research Question and Development

As previously discussed, this study investigates the differences between risk-adjusted performance and exposure to risk factors of sustainable and conventional funds in the Norwegian market. Norway makes for a compelling case due to the variety in natural and human resources, which offers itself to a unique and diverse blend of industries. On one hand, it is known for its SRI unfriendly petroleum, natural gas, and shipping industry. Additionally, its defense-related exports are considerable. In 2017, the country exported arms and military equipment worth more than 550 million euros (Regjeringen, 2017). On the other hand, the country has managed to build a "green" brand name for itself. Besides its non-sustainable petroleum industry, the nation also produces considerable amounts of clean energy. Renewable energy is the source of 98% of Norwegian electric production, with hydropower being the primary source (Regjeringen, 2016). A whole host of Norwegian policies and legislation aims to cut emissions and promote sustainable living; resulting in the world's biggest market share of electric cars (Vaughan, 2017) and Oslo being awarded the European Green Capital of 2019 by the European Commission (European Commission, 2019). Furthermore, the Norwegian capital is the home of the Nobel peace prize, which famously honors "fraternity between nations, for the abolition or reduction of standing armies and the holding and promotion of peace congresses" (Nobel, 1985).

As mentioned in the introduction, the Norwegian investor community has a generally well-developed SRI implementation and a high sustainability focus, evidenced by for example the Norwegian Government Pension Fund Global' ethical investment framework (Regjeringen, 2017). Despite this, there is little research on the differences between sustainable and conventional funds in this region. Renneboog et al. (2008) is the only research we could find specifically investigating these differences. It is primarily a global study where Norwegian funds are included. However, the sustainable portfolio of funds is quite small at three funds.

Research Question 1

Our expectations are developed based on modern portfolio theory as a fundamental truth in finance. As sustainable investing approaches limit the potential investment universe, one should expect these approaches to limit the diversification of a portfolio's unsystematic risk. A portfolio built from a reduced pool of possible investments might shift the mean-variance frontier towards a less optimal risk-return tradeoff then that of a portfolio built on an unrestricted investment universe. Due to the potential move away from the optimal risk-return tradeoff, the natural assumption is that a sustainable portfolio would underperform compared to a conventional portfolio, adjusted for risk. At best, we can expect that there is a non-significant difference in the alphas of sustainable and conventional funds so that no type of fund systemically drives asymmetric returns. The above drive our expectations as well as findings of reviewed literature in the upcoming chapter. On that basis, we form the first research question.

> *Do sustainable investment approaches reduce risk and enhance returns compared to conventional investment approaches in the Norwegian equity fund market?*

Research question 2

Given that empirically motivated risk factors apply to the Norwegian market, we are interested to see if there are significant differences in the factor loadings of sustainable and conventional funds, reflecting investment style differences. We expect such differences to exist, in line with previous international research outlined in the next chapter. We, therefore, form research question 2:

> *Are there differences in risk factor exposure between sustainable and conventional equity funds in the Norwegian market?*

4. Literature Review

Going back 200 years, we can see varieties of SRI, but it was not until the transformative 1960s and 1970s that it molded into the investing behavior we would recognize today. The rise of the anti-war movement and the maturity of movements on racial equality, women's rights, consumer protection, and the environment led to the creation of the first mutual funds reflecting faith-based values, civil rights-era sensibilities, and environmental concerns. As ethical investing is a relatively new phenomenon, Moskowitz (1972) provided some of the earliest literature on this topic in his paper "Choosing Socially Responsible Stocks." He provided examples and guidelines for what constitutes a socially responsible company. As moral investing became a global trend and socially responsible investing received public recognition, it incentivized researchers to look into the risk and return dynamics of SRI further.

4.1 Performance Literature

We have observed three main hypotheses regarding the performance (alphas) of sustainable investments that are supported by the relevant literature. They are underperformance, neutral, and outperformance. Before we cover the research, we will relate it to modern portfolio theory, as its implications are powerfully influential on the research.

4.1.1 Modern Portfolio Theory and Screening

Modern portfolio theory is a common starting point for hypothesis development in much of the financial research we have covered. Markowitz (1952) who provided the first clear conceptualization of the investors' diversification gain and how this gain is affected by individual assets return correlations, builds the foundations of the theory. The theory assumes that the investor is inherently risk averse. He combines the need for a high expected return with an associated low risk, in a world where expected return and risk are positively correlated. In other words, an investor will only make a riskier choice of investment if his expected return goes up. Modern portfolio theory helps the investor construct optimal portfolios along the "efficient frontier" that provide the highest return possible given a certain risk level.

With any equity investment, the associated risk encountered is two-fold; there is an idiosyncratic risk (diversifiable) and systematic risk (undiversifiable). The firm-specific risk (idiosyncratic) is diversifiable, meaning the investor can forego this risk if he or she holds a diversified portfolio. The systematic risk, however, is non-diversifiable as it springs from the unpredictability of financial markets and affects all assets. Examples are inflation and stock market fluctuations. The models utilized in the reviewed literature incorporates risk factors shared amongst all investors, meaning they are undiversifiable. The market return, company size, company value, and momentum are used most frequently. In addition to this, we review a factor particularly relevant for the Norwegian market, liquidity.

The implications of modern portfolio theory on diversification influence literature hypothesis development heavily. The theory says that a reduction in the investment universe is suboptimal as it inherently inhibits risk diversification. In literature hypothesis development, the focus is often on how non-congruent negative screening is to rational, wealth-maximizing investing behavior. Specific drawbacks highlighted with the screening approach are notably partisan industry weights due to industry elimination and the restriction of investment opportunities. The conclusion being that the sustainable portfolio yields less return for the same amount of risk as a conventional portfolio.

4.1.2 Underperformance Hypothesis

Renneboog et al. (2008) provide research on whether SRI funds are underperforming relative to conventional funds, and whether a higher screening intensity reduces the performance of SRI funds. They find that France, Ireland, Sweden, and Japan had alphas for sustainable funds that were 7% - 4% negative compared to that of the conventional portfolios. When it comes to screening intensity, the researchers found that a higher number of ESG screens yield lower risk-adjusted returns. They conclude that one additional screening is associated with a 1% lower four-factor-adjusted return per year. This finding is consistent with the underperformance hypothesis as it shows that a higher screening intensity constraints the risk-return optimization and does not help the fund managers in his mission of selecting an underpriced stock.

There is evidence that SRI stocks' opposition, sin stocks, outperform relative to various benchmarks. Hong and Kacperczyk (2009) famously explore the return effects of negative screening. They find that sin stocks (limited to tobacco, alcohol, and gambling firms in the study) are held by rather few institutional investors and followed less by financial analysts compared to a control group of stocks. In keeping with, Merton (1987) rationalization of depressed prices and higher future returns for stocks neglected by a majority of investors, they find a sin stock outperformance of 3-4% per year. Furthermore, Fabozzio, Ma, & Oilphant (2008) and Trinks & Scholtens (2017) show the same tendencies for sin stock to display high returns in several international markets.

4.1.3 Neutrality Hypothesis

Contrastingly, there is also support in the literature that there is no significant drawback to SRI screening and that such practices are congruent with the aims of a wealth maximizing, rational investor. In their global study, Renneboog et al. (2008) find that in most countries, including Norway, there is no evidence that sustainable funds underperform conventional funds. The authors hypothesized that investors of sustainable funds pay a premium for SRI screens, causing them to underperform compared to conventional funds and benchmarks. By researching 17 countries around the world, they find that SRI funds in many European, North American, and Asian-Pacific countries strongly underperform relative to their domestic benchmark portfolios. However, they do find that this underperformance relative to the benchmark affects the conventional funds as well. The conclusion is, therefore, that there is no statistically significant evidence that SRI funds underperform their conventional counterparts in most countries, exceptions are France, Ireland, Sweden, and Japan.

Bauer, Koedijk & Otten (2005) also discover no such differences in Germany, the UK, and the US. When it comes to the Scandinavian investment universe, and negative screening, Hoepner & Schopohl (2018) have some interesting results. Their study looked at the performance of stocks excluded from the Swedish AP-funds and the Norwegian Government Pension Fund-Global (GPFG). The type of screen utilized was primarily norm-based, meaning that the exclusion of companies is made based on nonconformity to standards and norms issued by organizations like the OECD, ILO, UN, and UNICEF.

They do not find an abnormal return relative to the benchmark for excluded companies. They do however find statistically significant evidence that the excluded portfolio of one of the funds (GPFG) has enhanced risk. The paper concludes that the elimination did not hurt the funds' performance. The researchers' interpretation of the findings is supportive of SRI screening, noting that exclusionary screening allows asset owners to meet the ethical aspirations of their beneficiaries without jeopardizing financial returns. Additionally, Lobe & Walkshäusl (2014) find no significant difference between the returns of indices of sin stocks and SRI investments relative to the market benchmark, in their international study. The findings of this research reveal an indifference in the monetary gain of investing in line with any orientation. Consequently, a rational investor will purchase securities keeping in mind that neither a «sin» stock nor a sustainable stock is preferred over the other.

4.1.4 Overperformance Hypothesis

The literature available related to ESG ratings have produced some evidence that suggests higher rating ESG stocks exhibit high future returns, with some period sensitivities. Between the early 1990s until 2004, the evidence is the strongest to suggest the link between high ESG scores and high returns (Kempf and Osthoff, 2007: Statman and Glushkov, 2009). Between 2005 and 2012 a high ESG score did not seem to beat the benchmark (Borgers, Derwall, Koedijk & Ter Horst, 2013). Supporting the notion of periodic outperformance, Nofsinger & Varma (2014) find that ESG selection drive asymmetric return patterns in which SRI funds outperformance relative to conventional funds in market crisis periods. However, they also observed an underperformance in non-crisis periods. The global study of Verheyden, Eccle, and Feiner (2016) showed that the ESG screening adds approximately 0,16% on average in annual performance. Furthermore, they discovered that in three out of four global portfolios the specific risk brought about through ESG screening was more than counterbalanced by the excess risk-adjusted returns of a screened investment universe compared to an unscreened universe.

4.2 Risk Factor Exposure of Sustainable Funds

Assuming that the fundamentals behind the models used in the reviewed literature holds the regression results give us insight into investment styles of sustainable funds. It is assumed that positive exposure to the market factor, size, value, momentum, and liquidity factor drive returns. The risk factor exposure differences, alternatively investment style differences, between conventional and sustainable funds are especially well investigated in three studies. These are Nofsinger & Varma (2014), Bauer et al. (2005) and Renneboog et al. (2008). Collectively their research covers the world-market, with an emphasis on the UK and US. Renneboog et al. (2008) had a sample of funds representative of seventeen countries in three regions, Europe, North America, and the Asia Pacific. Bauer et al. (2005) investigated the German, UK, and the US market, while Nofsinger & Varma (2014) limited their research to US funds. We have not found similar research regarding investment styles of SRI-specific fund in the Norwegian market in addition to Renneboog et al. (2008), but we have included findings of Næs et al. (2009) on the empirics of Oslo Stock Exchange, to understand what factors demand risk compensation in our market. We review the previous findings in exposure differences and their role in driving returns below.

4.2.1 Market Loading

Using a four-factor risk-adjusted model (Carhart, 1997) Renneboog et al. (2008) find a slight negative discrepancy in market loadings between sustainable and non-sustainable funds worldwide. The implication being that the sustainable funds' market return sensitivity is slightly lower than that of conventional funds. Their findings for the Norwegian market suggest the opposite; however, that market loadings are significantly positive, meaning that Norwegian sustainable funds are more exposed to the market factor than Norwegian conventional funds. Using a one-factor model (CAPM) and the same four-factor model, Bauer et al. (2005) find a small, negative, and statistically significant difference in market loadings. Again, implying that sustainable funds have a greater inelasticity to market returns compared to conventional funds. Contrastingly, Nofsinger & Varma (2014) find a small, positive difference. Thus, their study suggests the opposite; sustainable funds have a higher sensitivity to the market return.

4.2.2 Size Loading

In the UK, Luther, Matatko & Corner (1992) find that ethical funds have a relatively large portfolio weight on small capitalization companies. Geezy et al. (1997) support this UK finding by uncovering a significant exposure to the same stock group in ethical funds. Bauer et al. (2005) find regional differences in funds exposure to big and small capitalization stocks. Their research reveals that ethical funds in the UK and Germany are largely exposed to small capitalization stocks, again consistent with previous research. However, they also find that American ethical funds are invested more heavily in large capitalization stocks than their conventional peers. The notion of regional differences is supported by Renneboog et al. (2008) who's results align mostly with previous research, but also adds Canadian and Japanese SRI funds as relatively heavy investors in large-capitalization stocks along with the US. They also report that Norwegian sustainable funds have a higher small capitalization tilt than the benchmark. This is true for the conventional fund sample as well, but even more so. They find no significant results in the differences between the two types of funds. The research of Nofsinger & Varma (2014) find that their long SRI/short conventional portfolio loads slightly negatively on the size factor, meaning that SRI funds have a slight large capitalization tilt as compared to conventional funds. Furthermore, their conventional portfolio had a small but positive SMB beta. Underlining that in their sample, conventional funds had a slight small capitalization tilt.

4.2.3 Value Loading

Bauer et al. (2005) find that ethical funds have tendencies to be growth-oriented compared to conventional funds. These findings are consistent with Guerard (1997) who, using the Domini Social Index (DSI), finds a growth bias when SRI screens are used. Bauer et al. (2005) suggest that the growth-orientation might be due to sustainable investors forgoing sectors that traditionally have a low book-to-price ratio (value stocks). Examples are chemical, energy, and primary industries. The reason that sustainably oriented investors often forgoes these investments is their generally higher environmental risk. This exclusion leads to a sustainable fund often having underweight of common value stocks. Nofsinger & Varma (2014) find that SRI funds have a small, but positive and statistically significant HML beta, showing a value-orientation.

Similarly, previous research on the Norwegian market tells us that SRI funds in Norway (as well as Canada and Japan) have higher exposure to value stocks than their matched conventional counterparts (Renneboog et al., 2008).

4.2.4 Momentum Loading

Nofsinger & Varma (2014) find that SRI funds load a little less on the momentum factor than conventional funds. Despite the differences being statistically significant, they conclude that the economic magnitude is small. This lower SRI fund momentum loading is also supported in the research of Renneboog et al. (2008). However, Norwegian SRI funds, along with Dutch, Swiss, and Australian SRI funds show a positive, non-significant difference compared to their conventional peers. Bauer et al. (2005) have mixed results that are inconclusive on momentum loadings.

4.2.5 Liquidity Loading

Næs et al. (2009) investigate whether systematic risk factors relevant to other markets demand compensation in the Norwegian market. With extensive empirical testing of the Oslo stock exchange (OSE), they find that the market (CAPM) and size factor (Fama and Frenchs three-factor model) are valid in the Norwegian market. The value factor (Fama and French) and momentum effects (Carhart) are not deemed valid premia paying risk factors in the Norwegian market. Furthermore, they discover that the empirically motivated factor of liquidity does seem to demand risk compensation for this particular market. Multiple researchers have offered liquidity as an explanatory factor of CAPM and Fama and French three-factor anomalies across companies and over time (Acharaya & Pedersen, 2005; Liu, (2006); and Sadka, 2006). The liquidity factor significance challenges one of the CAPMs unrealistic assumptions; namely that the markets are frictionless and static. Næs et al. (2009) show that on the OSE, a portfolio of the least liquid stocks pays a systematically higher return than a portfolio constructed of the exchanges' most liquid stocks. The inference being that there is a risk premium in investing in stocks that have low liquidity. As far as we are aware, there is no peer-reviewed research on liquidity factor loadings on sustainable versus conventional funds, let alone findings related to the Norwegian market.

The literature reviewed has not included liquidity as a factor in their models; however, we do find it essential to introduce the findings by Næs et al. (2009) as it is relevant for our market and consequently our analysis.

4.3 Oil Price as a Pricing Factor in the Norwegian Market

The leading position of the energy sector is an interesting aspect to consider when studying the country's economy in relation to its sustainable investment industry. Specifically, petroleum has a dominant position in Norway's GDP and total exports. The oil and gas sector is the country's most extensive measured in terms of value added, government revenues, investments, and export value (Norsk Petroleum, 2019). Understanding the sustainable investment industry in light of this fact is essential to our analysis.

In their examination of the empirics of the Oslo stock exchange, Næs et al. (2009) investigate whether oil price is a macroeconomic variable that can influence the stock market. Firstly, the researchers show a positive correlation between both a value-weighted and equal weighted market portfolio and changes in the oil price. The value-weighted portfolio has a higher correlation, which is expected, considering the tendency for countries with vast oil reserves to have sizable national oil companies that are weighted more heavily than smaller companies are. Moreover, when exploring the effect of oil prices on different sectors returns, they find that many sectors have significant exposure to oil price changes. Nevertheless, these findings are not enough to infer that oil price is a priced risk factor on the Oslo stock exchange. When rigorously testing oil price as a priced risk factor on multiple models and portfolios, the evidence shows no significance; thus, oil price does not indicate expected returns on the exchange. In summary, there is no evidence to support the oil price as a systematic risk factor in the Norwegian market.

The researchers also test for other macroeconomic factors on the Norwegian market such as money stock, investments, and consumption, but do not find any significant relationships. Such results argue that the macro economy is foreshadowed by the stock exchange, and not the other way around. In other words, the stock exchange is the leading indicator for the macroeconomic state.

5. Data

We have used the Morningstar Sustainability Ratings (MSR) to proficiently select our sample of Norwegian sustainable funds. Morningstar is a renowned provider of investment research and hosts ample information on many securities and markets. Their sustainability rating system was first introduced in 2016 as an evaluation tool, helping investors get independent and reliable assessments on the sustainability of mutual and exchange traded funds, notably their performance related to ESG criteria. The ranking offers investors a mode for quantifying sustainability, converting ESG performance to a measurable standard.

5.1 Identifying Sustainable Funds

Using the Portfolio Sustainability Score the Morningstar's sustainability rating is determined (Morningstar, 2018). The score is calculated as follows:

$$Portfolio\ Sustainability\ score = Portfolio\ ESG\ Score - Portfolio\ Controversy\ Deduction \quad (1)$$

Portfolio ESG score

The ESG score is an asset-weighted average of normalized company-level ESG scores. Morningstar uses Sustainalytics, which is a leading provider of ESG research, as their provider of company-level ESG scores. Sustainalytics' company level ESG scores are a reflection of the disclosure, preparedness and performance on a series of ESG indicators (Morningstar, 2018). A 0-100 scale is utilized in order to evaluate individual companies' performance on ESG issues relative to its global industry peer group. ESG issues are unique and tailored to each industry peer group, depending on relevance. Consequently, scores are not necessarily comparable between industry peer groups. To rectify this incomparability, scores for each industry group are normalized using a z-score transformation. The normalized ESG scores are aggregated into a portfolio ESG score using an asset-weighted average of all covered securities (Morningstar, 2018).

$$Portfolio\ ESG\ Score = \sum_{x=1}^{n} ESGNormalized\ x\ Weightsadj \quad (2)$$

Controversy Deduction

The controversy metric quantifies ESG-related incidents. Such incidents could be environmental accidents or corporate scandals like embezzlement or fraud. Each incident receives a score severity (1-5) reflecting its impact on the environment, society, and the related risk to the company itself. The overall portfolio sustainability score is a weighted average of the prior twelve months of sustainability scores, meaning that the scores incorporate data one year prior. The historical portfolio scores are not equally weighted, as newer portfolios are weighted more heavily than more-distant portfolios. Portfolio Controversy Deduction is calculated as follows:

$$MContra_p = 100 - \sum_i^n w_i \, SContra_i \qquad (3)$$

Where:

$MContra_p = the\ Morningstar\ Portfolio\ Controversy\ Score$

$SContra_i = the\ Sustainalytics\ controversyscore\ of\ company\ i$

Morningstar's sustainability rating is expressed using a five-globe system. One globe indicates that the funds ESG performance is at the bottom end for the industry group, while the five globe rating is the highest possible score. It means that the fund performed above average and is an ESG leader in its category.

Figure 3: *Morningstar Globe rating system*

Distribution	Score	Descriptive Rank	Rating Icon
Highest 10%	5	High	
Next 22.5%	4	Above Average	
Next 35%	3	Average	
Next 22.5%	2	Below Average	
Lowest 10%	1	Low	

5.2 Data Collection

The data used has been collected through Bloomberg. The sample consists of total return data for twenty-one funds where seven are categorized as sustainable funds and the remaining twelve as conventional funds. The benchmark total return is also downloaded from Bloomberg. The time horizon is nine years, measured at monthly intervals, from January 2010 until December 2018. The market factors used are constructed especially for the Norwegian market by Norwegian professor Bernt Arne Ødegaard (Ødegaard, 2019).

5.2.1 Sample Limitations

Firstly, we have added a geographical restriction to our sample. As the Norwegian market is the population of interest, the sample needs to be reflective of the population. Thus, we only include Norwegian registered funds in our sample that are primarily invested in the Norwegian equity market. The majority of funds in the sample are entirely invested in the Norwegian market, with some that have a 20% cap on invested capital in foreign markets.

Secondly, we have limited our study to research equities as the asset group in order to ensure comparability within the sample. The Norwegian Fund and Asset Management Association define equity funds as funds that have an equity exposure of 80% or more (Vff.no, 2018). All funds in our sample meet this criterion, with an average equity exposure of 97%.

Thirdly, in order to evaluate the category performance and investment style, we have grouped the funds into sustainable and conventional funds. The sustainable fund criteria is a Morningstar sustainability rating of four or more globes. Further, the funds need to have a sustainability mandate in their by-laws, making it evident that sustainable practices are being used in their portfolio management. The conventional funds in the sample are ranked with four or fewer globes. Additionally, only funds with no sustainability-mandate are included as conventional funds in the sample.

Fourth, all funds have been active in the sample period, which starts January 2011 until December 2018.

In summary, we limit our final sample to funds that (1) regional exposure to the Norwegian market of above 80%, as well as (2) an equity exposure of above 80%. Further, they (3) meet the sustainability criteria, and (4) have been active during the sample period.

Return Measure

We have used total returns in order to measure returns for our fund sample. Using the total return has multiple advantages over a Net Asset Value measure of return. The total return takes into account capital gains and losses from the funds' security holdings; dividends and interest, and expenses charged by the fund. Unlike changes in Net Asset Value (NAV), which can be reduced in the event of dividend distributions. The total return gives a more accurate depiction of fund performance, as in the event of a distribution the value still belongs to the shareholder.

5.2.2 Model Factors

Most pricing factors are retrieved from Ødegaards website (Ødegaard, 2019), except for the market return. The factors are calculated precisely for the Norwegian market and are calculated in the following ways.

The Market Return

Value weighted indexes are appropriate when considering investments in the whole market.

As we are interested in the performance of selected funds as a representation of the whole market, our analysis has used a value-weighted market index. Furthermore, the use of a value-weighted market return index is supported through practice in the research (Hamilton et al. 1993; Bauer et al., 2005; Geczy et al., 2006; Renneboog et al. 2008; Nofsinger & Varma, 2014). A value-weighted index will also reflect sector contributions by market capitalization, which is desirable given the strong presence of the energy sector in the Norwegian market.

The Oslo Stock Exchange Fund Index (OSEFX) is used as a proxy for the market return. The total returns for the index are downloaded for the sample period using the Bloomberg terminal.

The Risk-Free Rate

As a proxy for the risk-free rate, Ødegaards estimates have been used. The rates are forward-looking and are calculated using government bonds and the Norwegian Interbank Offered Rate (NIBOR). Government bonds and interbank offer rates are commonly used as proxies for the risk-free rate in financial research. Norwegian government bonds, such as T-bills are essential riskless as the Norwegian government default risk is close to zero. Interbank offer rates are popular choices, and it is the rate at which banks lend to and borrow from each other. The NIBOR is specific to the Norwegian market.

Market Premium

The market premium of an asset is the market return minus the risk-free rate (5). The market return (4) is calculated as the difference in value between time t and t-1 divided by the value at t-1.

$$R_{mt} = \frac{R_t - R_{t-1}}{R_{t-1}} \quad (4)$$

Where:

R_t is the return at time t

R_{t-1} is the return at time t-1.

$$Market\ Preium = R_{mt} - R_{ft} \quad (5)$$

Where:

R_{mt} is the market return at time t

R_{ft} is the risk-free rate at time t

Small Minus Big (SMB) and High Minus Low (HML)

The Fama and French factors are constructed using six value-weighted portfolios formed on size and book-to-market (see appendix 2) SMB is the difference between the average return of the three small portfolios and the average return on the three big portfolios.

$$SMB = average(SL, SM, SH) - average(BL, BM, BH) \quad (6)$$

Where:

SL, SM, SH, BL, BM, and BH refer to the value-weighted portfolios described in appendix 2.

HML is calculated using the difference of average return on the two value portfolios and the average return on the two growth portfolios.

$$HML = average(SH, BH) - average(SL, BL) \quad (7)$$

Where:
SH, BH, SL, and BL refer to the value-weighted portfolios described in appendix 2.

Momentum (PR1YR)

Calculated in the same fashion as the original Carhart factor (1997). Appendix 3 displays the construction of this factor. Stocks returns are estimated on a monthly basis over the previous eleven months. Subsequently, they are split into three portfolios; 30%, median 40% , and bottom 30%. The PR1YR is the average return of the top portfolio minus the average return of the bottom portfolio. The ranking is recalculated every month.

Liquidity (LIQ)

Næs et al. (2009) create a liquidity factor by sorting stocks into three portfolios based on average relative spread in the previous month. Returns are calculated, holding the three portfolios constant throughout the month. Difference returns are the difference between the return of the least liquid portfolio and the most liquid portfolio.

5.3 Weaknesses of Dataset

5.3.1 Survivorship Bias

Our sample is limited to funds that have been active for the entire sample period. Inadequate performing funds terminated or merged into other funds are therefore not included in the sample. Consequently, our sample might have a survivorship bias. It is one of the most common forms of biases in data analysis and will typically be addressed in mutual fund studies. As we only surviving funds "make the cut," there is a risk of overestimating average returns. This can lead to a different conclusion than using a sample that includes all funds (Carhart et al., 2002; Rohelder et al., 2007). The problem of survivorship bias is generally tackled by using a survivorship-bias-free database.

However, we found it impossible to do so. Our dataset is derived from Morningstar, which gives new Sustainability Ratings every 12 months. Thus, terminated funds are not rated. We have decided that the inclusion of non-rated, terminated funds is not appropriate for our research purposes. Our research questions concern itself with the differences in sustainable and conventional fund performance; we are less interested in their absolute returns. Therefore, we conclude that the exclusion of terminated funds will not affect our results significantly.

5.3.2 Management Fees

Our study does not consider gross and net returns (the difference being management fees) when evaluating performance between the fund categories. Several studies that have considered this aspect has not found significant differences between sustainable and conventional fund management fees (Renneboog et al. 2008; Orbe, Ferreira & Gil Bazo, 2010). Bauer et al. (2005) find some differences in management fees. However, these differences left the material difference between fund performances unaffected. We, therefore, find it reasonable to not consider the two different dimensions of returns in our models.

5.3.3 Sustainability Ranking Variance Across Time

The Morningstar sustainability ranking is a static score, and it is developed using sustainability scores on a trailing 12-month basis. The ratings available to us are not indicative of past year scores; it is only a reflection of the past year.
The reviewed literature and research on sustainable funds, in general, suffer from this limitation due to the time sensitivity of scores and the data availability. A dataset showing historical sustainability rankings of funds is not available to us. However, there is evidence that ESG scores are persistent for approximately two years, with the persistence of the scores terminating after approximately three years (Wimmer, 2012). The limitation brings forth the need for researchers to weight the benefits and drawbacks of a long time series with less relevant sustainability scores against the benefits and drawbacks of fewer observations with a more accurate sustainability profile.

We have circumvented this weakness is by implementing one additional metric for sustainability and shortened the number of observations to 108 months (9 years). The second metric is the sustainability mandate. All funds in the sustainable portfolio have a sustainability mandate in their by-laws. Consequently, we know that the funds have been purposefully implementing sustainable approaches to investing during the whole sample period. They all have an underlying sustainable mission. This is an independent factor from the ranking, as even funds with the mandate could have a below-average score. This is naturally an anomaly; however, using two independent factors to verify if a fund is sustainable or not enhances our confidence in the data selected.
Furthermore, it ensures us that funds are not included in the portfolio by "accident." Though unlikely, a five-globe ranking could be due to managers picking investments that just so happens to be ESG favorable without using sustainable investment practices. We particularly see this as relevant in the highly regulated Norwegian market, where rankings are high across the board, for both sustainable and conventional funds (we will touch upon this in our methodological limitations). This two-step verification with a current ranking and a sustainability mandate makes us confident using a longer time horizon, which increases the significance of our findings through more observations.

6. Methodological Approach

In order to create an estimate that accurately reflects the performance of the funds sampled, we use asset-pricing models that incorporate systematic risk factors. A fundamental and ingrained truth in finance is that investors do not receive a higher return as compensation for taking on non-systematic risk. Therefore, it is crucial to account for systemic risks in our return model. Consequently, our analysis is constructed using a combination of the CAPM, Fama and French's three-factor model (1992,1993), Carhart's four-factor model (1997) and additionally, Ødegaards "Norwegian model" (2009). The commonality between the model factors is that they all represent systematic risk factors, which, according to theory and empirics, pays risk premiums on assets.

6.1 Motivation and Limitation

6.1.1 Motivation Fund Analysis

The motivation for using funds is derived from their relatively stable return patterns. Individual stocks generally display returns that have considerably higher volatility than those of a portfolio of stocks. Consequently, using single stocks would make it near impossible to draw conclusions on a general level. When measuring returns in a grouping of stocks based on return characteristics, it is possible to observe average return differences. This notion is supported in Fama and Macbeths (1973) research, which used the portfolio method to measure the CAPM beta, due to portfolios propensity to display stability over time.

6.1.2 Limitation and Weaknesses

This study is, as mentioned previously, based on funds primarily invested in the Norwegian stock market. The Norwegian stock market is small compared to most other stock markets with a market capitalization of NOK bill 2,634 as of May 2019 (Oslo Børs, 2019). Further, to be able to answer our question, we had to limit the funds to Norwegian specific equity funds (>80% cap on foreign exposure). Moreover, we only included funds that have had total return figures for the complete sampling period, from January 2010 to December 2018. Adding these necessary constraints to an already limited sample gave us a total of 21 funds and 108 observations.

Naturally, it would be advantageous for our research if more funds met our criteria and could be included in our sample. This is, however, not the case and our analysis incorporate a limited number of funds.

Another weakness with this research is that the majority of Norwegian funds obtain rather good Morningstar Sustainability ratings. As mentioned in chapters 1 and 3, this is primarily due to the well-developed sustainable investment market in Norway and governmental influences. A good portion of the funds used in this study has been given more than three globes, which means they perform better than average when it comes to ESG performance. The trend towards high sustainability across all funds weakens the difference between the two groups of funds, potentially weakening the research data.

Our study is also affected by the lack of holding data for the funds. We could not obtain complete holding data for all the funds and thus we could not control for industries in our regressions. It would be beneficial to conduct research looking into industry weight differences between the funds. It would also be interesting for further research to obtain data on screening intensity and investigate the differences between intensity levels. We hope future research can take this into consideration.

6.2 Models

Previous research has effectively evaluated fund performance using different methods. Certain studies only use a one-factor adjusted model (CAPM, 1965), while some adjust for as many as four risk factors (Carhart, 1997). Due to the variety of methodological approaches, making comparisons across studies can be challenging. We, therefore, use a combination of models in our analysis. The following section will introduce the models used, the mechanics behind them, and justify why they are appropriate for our research. In order to proficiently utilize the models, we create three portfolios. One equal-weighted average of sustainable fund returns known as the sustainable portfolio. A second equal-weighted average portfolio, but using conventional funds returns, known as the conventional portfolio. This allows us to regress a sustainable and conventional portfolio that is a reflection of the fund returns in our sample.

Like Bauer et al. (2005), we have also created a third portfolio, the difference portfolio, in order to strengthen the comparability of our results. The difference portfolio is created by subtracting the equal-weighted average of the conventional fund returns from the equal-weighted average of the sustainable fund returns. This results in a portfolio that is long in sustainable funds and short in conventional funds; allowing us to observe the differences in risk and return between the two investment approaches. The contrasts in the risk-adjusted average performance of the fund types are implicitly ascribed to sustainability screens.

6.2.1 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) is built as a continuation of Markowitz's efficient frontier (Modern Portfolio Theory). William Sharpe (1964) and John Lintner (1965) were the inventors of the model, which is the first to express the relationship between expected return and risk comprehensively. The model implies that risk is rewarded in the market; that increasing the variance of an asset will produce a higher return above the risk-free rate. The associated risk of an investment is comprised of two parts, idiosyncratic risk and systematic risk. The firm-specific risk (idiosyncratic) is diversifiable, meaning the investor can forego this risk if he or she holds a diversified portfolio. The beta measured this risk. The systematic risk, however, is non-diversifiable as it springs from the unpredictability of financial markets and affects all assets. The model approximates an investment expected return given the market return rate (risk-free), the investments idiosyncratic risk (beta), and the assets excess return over the risk-free rate.

$$R_{it} - R_{ft} = \alpha_{it} + \beta_i(R_{mt} - R_{ft}) + \varepsilon_{it} \qquad (8)$$

Where:

R_{it} is the return on portfolio i in in month t

R_{ft} is the risk-free rate in month t

R_{mt} is the market return in month t

ε_i is the error term

β_i measures the market risk exposure and α_i expresses Jensen's alpha

Studying funds, the intercept of the regression, also known as Jensen's alpha (1968), indicates whether the asset has out- or underperformed relative to its benchmark. A significant positive or negative alpha is associated with a positive or negative return, respectively. For example, a positive alpha of 5% means that we would expect the fund to return 5% in a period where the benchmark returned 0%

Despite being widespread and a fundamental model used in the financial industry today, scholars have combated the CAPMs validity for years. Researchers have pointed out the unrealistic assumptions of the model in their critiques. Examples of such assumptions are that all investors can borrow and lend at a given riskless rate, that they all act rationally and have the same probability distribution, as well as the exclusion of taxes and transactional cost (Black, Jensen & Scholes, 1972). Fama and French (2004) invalidate the model empirically in their research; they argue that it does not hold up in practice. The testing of the model has mainly been focused on the implications of the market factor, and the models' expected return relationship. Due to the linear relationship between the expected return and the market factor, the model rules out that other factors have marginal explanatory power on the expected return. This relationship has been extensively tested and rejected many times in the literature. Banz (1981), Basu (1983), Bhandari (1988), Rosenberg, Reid, and Lanstein (1985) and Stattman (1980) referred in Novak & Petr (2010), have all tested and rejected the hypothesis that the market factor alone is sufficient in explaining expected returns.

6.2.2 Fama and French Three-Factor Model

In order to improve the predictability and accuracy of previous return models, Fama and French (2004) empirically tested multiple risk factors. As a result, the pair have added two additional factors to the CAPM; small minus big (SMB) and high minus low (HML). The model sprung from their observation that small-cap stocks and stock with a high book-to-market ratio (value stocks) tended to outperform the market. According to Fama and French small-sized firms and firms with high book-to-market ratios are a riskier investment. Furthermore, they are less liquid and are more prone to mispricing. Hence, the investor is awarded a higher return.

A value-weighted market portfolio is used in their model as a proxy for the CAPM's market factor. This value-weighted average of all portfolios is also used to form the two additional factors. The estimated advantage gained from investing in small stocks rather than big stocks is represented using the SMB portfolio. Similarly, the estimated advantage of investing in value stocks (high BE/ME) rather than growth stocks (low BE/ME) is represented using the HML portfolio.

$$R_{it} - R_{ft} = \alpha_{it} + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i}SMB + \beta_{2i}HML + \varepsilon_{it} \qquad (9)$$

Where:
$\beta_{2i}SMB$ Measures the exposure to the size factor
$\beta_{2i}HML$ Measures the exposure to the value factor

6.2.3 Carhart Four-Factor Model

Jegadeesh and Titman (1993) found that trading strategies where investors buy past winners and sell past losers realize a significant abnormal return over a given time period. The finding inspired the use of the Fama and French model with an additional factor to examine whether momentum can have a risk-based explanation. This research was the background for the construction of the momentum factor by Carhart (1997). In his research, Carhart (1997) find that mutual fund performance persistence is not the result of portfolio managers' stock-picking skills, but rather that returns have a tendency to follow a given the trajectory. In addition to the SMB and HML factors, Carhart added one additional factor to the Fama and French model that captures a one-year momentum anomaly; PR1YR. The Carhart four-factor model is outlined below.

$$R_{it} - R_{ft} = \alpha_{0i} + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i}SMB + \beta_{2i}HML + \beta_{3i}PR1YR + \varepsilon_{it} \qquad (10)$$

Where:
$\beta 3i$ PR1YR measure the exposure to the momentum factor

6.2.4 «The Norwegian Model»

The above-mentioned models are heavily influenced by empirical motivated factors based on findings in the American market. Seen as the Norwegian market is considerably smaller, with a different composition, it is reasonable to question these models relevance for our study.

Næs et al. (2009) have extensively researched which factors affect the Oslo stock exchange. They find evidence that a liquidity factor (LIQ) is a valid systematic risk factor for the Norwegian market that demands compensation. Furthermore, they invalidate value and momentum as relevant risk factors. Naturally, the market factor is a valid risk factor. Additionally, size is shown to be compensation demanding risk factor. Based on the empirics of the Oslo Stock Exchange, we have constructed a model which we call "the Norwegian model":

$$R_{it} - R_{ft} = \alpha_{0i} + \beta_{0i}(R_{mt} - R_{ft}) + \beta_{1i} SMB + \beta_{2i} LIQ + \varepsilon_{it} \quad (11)$$

Where:
B_{2i} LIQ measures the exposure to the liquidity factor

6.3 Model Requirements

To estimate the excess return, we have used ordinary least squares (OLS) regressions and regressed all models. To ensure that results are as accurate as possible, we have in addition tested for both heteroscedasticity, multicollinearity, and autocorrelation. A brief presentation of our findings is presented below. Test results can be found in appendix 4.

Test for Heteroscedasticity

The central assumption when using ordinary least squares regression is that we have homogeneity in the variance of the residuals. When one of the assumptions is violated, there is a chance that the statistics results are not trustworthy. If the variance of the residuals is non-constant, the residual variance is said to be heteroscedastic; linear regression assumes that the spread of the residuals is constant across the plot. A time-series model can have heteroscedasticity if the dependent variable changes significantly from the beginning to the end of the series.

There are different ways to check for heteroscedasticity, where we have used three of them. We used both Cameron and Trivedi's decomposition of the IM-test and the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. Both tests gave us the same results - indicating that the model is not affected by heteroscedasticity. Further, we used the graphical method, a scatter plot, to see how the residuals react to the timeframe.

Analyzing the scatterplot, we conclude that the variance in the residuals weighted more towards constant than non-constant; therefore, we conclude that we do not have heteroscedasticity in our model.

Test for Multicollinearity

We tested for multicollinearity to ensure that the explanatory variables in the regression were not highly correlated. Collinearity indicates that two of the variables in an OLS regression are close to perfect linear combinations of one each other. When there is a perfect linear relationship between the variables, the estimates cannot be uniquely computed, and the coefficients become unstable, and the standard errors might be inflated. A variable whose VIF value is greater than ten should be taken into consideration (Kennedy 2008), and further investigation is often recommended. Tolerance, which is defined as 1/VIF, is used to check the degree of collinearity. Variables whose values are lower than 0.1 is comparable to a VIF of 10. These are the most common criteria used to determine whether multicollinearity exists or not. According to these criteria, we retrieved satisfactory values running the test and concludes that further investigation is not considered necessary.

Test for Autocorrelation

Another assumption in linear regression is the assumption of autocorrelation. To be able to get valid results in linear regression, the error terms must be independent of one another. A widely used method testing for autocorrelation is the Breusch-Godfrey LM test for serial correlation. With a null hypothesis being that there is no serial correlation, the test use residuals from the regression model to derive the test statistics. The results obtained by running the test are presented in the table below. We do not reject the null hypothesis, which implies no serial correlation between the error terms.

7. Empirical Analysis

7.1 Descriptive Statistics

Our final sample consists of twenty-one funds; fourteen conventional funds and seven sustainable funds (appendix 5). The number of observations is 108, meaning monthly returns from January 2010 - December 2018. The following table shows descriptive statistics for the regression sample. Using the simple arithmetic mean we find average annual returns for the sustainable portfolio to be 7,94% and 8,00% for the conventional portfolio. The difference in annual returns is not tremendous, however it does account for six basis points. Average annual variances are also more favorable for the conventional portfolio, suggesting that the Sharpe ratio will be higher for this fund type.

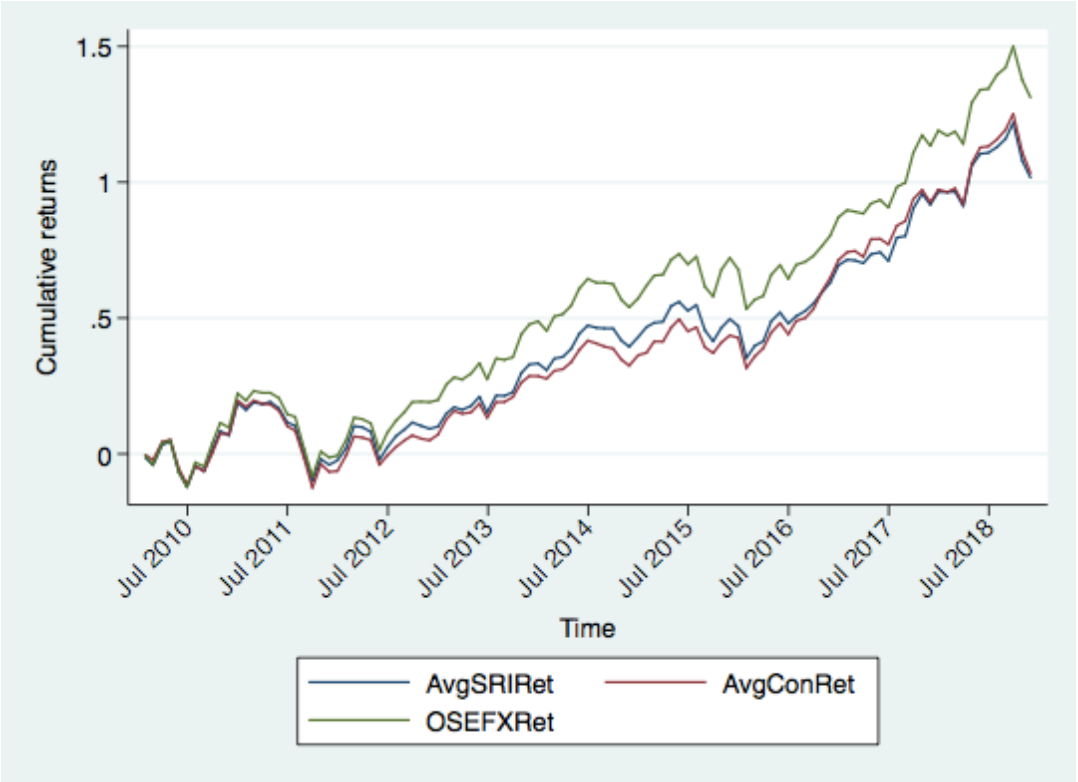
Table 2: *Descriptive statistics regression sample (January 2010 - December 2018)*

	Nr. of funds	Mean	Stdev	Sharpe	Skewness	Kurtosis
Sustainable	7	0,0823	0,140	0,1640	-0,3545	3,8433
Conventional	14	0,0830	0,137	0,1688	-0,4112	4,0145
All funds	21	0,0828	0,137	0,1676	-0,4040	3,9682

Mean return is annualized by $(1+R_{month})^{12}-1$. R_{month} *is the simple arithmetic monthly mean. Stdev is annualized by* $stdev_{month} * \sqrt{12}$. $stdev_{month}$ *is the simple arithmetic monthly mean. Skewness and kurtosis is based on monthly return data. The sharpe ratio is calculated by dividing the excess return of the portfolio on the standard deviation of the portfolios excess return.* $Sharpe\ ratio = \frac{R_p - R_f}{\sigma_p}$

Sustainable and conventional portfolios are highly correlated with each other (0,9803). The sustainable portfolio has a correlation with the market of 0,9898. The conventional portfolio correlates with the market to a smaller extent at 0,9732. The high correlation with the market is not surprising when taking into account our assumption that all funds in the sample are diversified and representative of the market. According to this assumption, the funds' return should generally move with the market, both in scope and direction. The ups and downs of the market should be captured in the risk factors of the models used to explain returns. These factors are common for the market and non-diversifiable, meaning our sample returns are influenced in roughly the same degree as the market, depending on their exposure to the factors.

Figure 2: *Cumulative returns for the sustainable, conventional and market portfolio (full period)*



The cumulative return is calculated using an equal weighted portfolio constructed from all funds in the sample, both for the sustainable (AvgSRIRet) and conventional (AvgConRet) portfolio. The portfolios are compared to the market (OSEFXRet).

Looking at the sustainable and conventional portfolio cumulative returns, it seems like they are indistinguishable from each other from January of 2010 until fall 2011. Between late 2011 and late 2016, the sustainable portfolio accumulates greater returns relatively consistently compared to the conventional portfolio. In the latter part of the sample period, from late 2016 until December 2018, there is a shift, and the conventional portfolio has a higher cumulative return.

7.2 Main Findings

The regression results obtained from our factor models are presented in Table 3 to 6. Reported are findings using our sustainable and conventional fund portfolios (average equal-weighted portfolios), and the difference portfolio which is the equal-weighted portfolio of average sustainable fund returns minus the equal-weighted portfolio of average conventional funds returns. Equal-weighted fund portfolios are normally used for this type of analysis, confirmed in the research of Bauer et al. (2005), Renneboog et al. (2008) and Nofsinger & Varma (2014).

Since the main ambition of our analysis is to understand the differences between sustainable and conventional funds' performance and risk exposure, we are primarily interested in the statistics of the difference portfolio. The statistics for the individual sustainable and conventional fund portfolios and their performance and risk exposures compared to the benchmark are interesting to us as an affirmation of their differences.

Table 3: *Results CAPM*

	Alpha	Market (β_1)	R^2_{adj}
Sustainable	0,004	0,950***	0,9794
	(0,50)	(64,78)	
Conventional	0,007	0,913***	0,9466
	(0,63)	(33,39)	
Difference	-0,003	0,036	0,0269
	(-0,39)	(1,33)	

Table 4: *Results Fama and French three-factor model*

	Alpha	Market (β_1)	SMB (β_2)	HML (β_3)	R^2_{adj}
Sustainable	0,002	0,962***	0,032	0,015	0,9795
	(0,31)	(58,83)	(1,35)	(0,81)	
Conventional	-0,002	0,980***	0,161***	0,017	0,9567
	(-0,17)	(41,23)	(5,60)	(0,72)	
Difference	0,004	-0,018	-0,130***	-0,002	0,1898
	(0,52)	(-0,64)	(-4,39)	(-0,10)	

Table 5: *Results Carhart four-factor model*

	Alpha	Market (β_1)	SMB (β_2)	HML (β_3)	PR1YR (β_4)	R^2_{adj}
Sustainable	0,002	0,962***	0,032	0,015	0,002	0,9793
	(0,22)	(57,25)	(1,32)	(0,80)	(0,14)	
Conventional	-0,000	0,980***	0,161***	0,017	-0,000	0,9563
	(-0,15)	(42,16)	(5,39)	(0,74)	(-0,00)	
Difference	0,004	-0,018	-0,130***	-0,002	0,002	0,1821
	(0,49)	(-0,65)	(-4,60)	(-0,10)	(0,10)	

Table 6: *Results the Norwegian three-factor model*

	Alpha	Market (β_1)	SMB (β_2)	LIQ (β_2)	R^2_{adj}
Sustainable	0,002	0,960***	0,028	-0,000	0,9794
	(0,26)	(46,27)	(1,27)	(-0,02)	
Conventional	-0,002	0,970***	0,162***	-0,016	0,9566
	(-0,21)	(35,08)	(5,09)	(-0,60)	
Difference	0,004	-0,009	-0,134***	0,016	0,1919
	(0,51)	(-0,29)	(-4,43)	(0,71)	

The tables presents coefficients estimates for the CAPM, three-factor model, four-factor model, and the Norwegian model, respectively. Alphas estimates are annualized using $(1+\alpha)^{12}-1$. $\beta_1, \beta_2, \beta_3, \beta_4$ *represent loadings on the excess market return (MKT), size factor (SMB), value factor (HML), momentum (PR1YR), and liquidity facto (LIQ). Regressions have used Newey-West standard error with four lags. Number of lags is determined by* $4(n/100)^{2/9}$ *(Newey & West, 1987). The t-statistics are presented in parenthesis. *p<0,10 , **p<0,05 , ***p<0,01.*

7.2.1 Performance – Alpha

We find no statistical significance in difference portfolio alphas, meaning that adjusted for risk factors, there is no evidence that sustainable funds either outperform or underperform relative to their conventional peers. All models report a close to zero alpha, meaning the observed performance is uniform between fund categories. We observe a minuscule difference in performance. The CAPM reports a negative zero alpha whilst the other multi-factor models report a positive zero alpha. Nonetheless, we cannot infer anything from these results due to their non-significance.

When evaluating each portfolio compared to the benchmark, we again observe non-significant results. The non-significant results, however, report near the uniform performance of both fund types. Using the CAPM, both the sustainable and conventional portfolio has a positive zero alpha. With the Fama and French three-factor model, the sustainable portfolio is a zero alpha outperformer compared to the benchmark, and the conventional portfolio is a zero alpha underperformer. We see the same tendency using the Carhart model and the three-factor Norwegian model.

Our findings are consistent with the neutrality hypothesis and supported by the findings of Renneboog et al. (2008), Hoepner & Schopohl (2018) and their findings using Norwegian market data. Lobe & Walkshäusl (2014) also supports such a hypothesis in their international study.

Regression results are consistent with the descriptive statistics presented in table 3. As a measure of return compared to risk, the Sharpe ratio showed little difference between the two fund categories. Such marginal differences alluded to relatively similar risk-adjusted performance and that neither the sustainable nor the conventional portfolios would outperform the other.

7.2.2 Systematic Risk Exposure – Market Loading

Reported results show no significant variability in market loadings between the two types of funds. We see that the CAPM reports a positive beta, meaning that the sustainable portfolio has a higher sensitivity to the market than the conventional portfolio has. Had these results been significant, we could have said that sustainable funds load more on the market factor and that the difference portfolio will move in the reported extent in the event of a 1% change in the market portfolio estimate. In other words, given a 1% return of the market portfolio, the market exposure in the difference portfolio would yield a 1,036% return as reported by the CAPM. The other models show the opposite effect; that the sustainable portfolio has a lower market sensitivity than the conventional portfolio. Notwithstanding, the results are not statistically significant and we cannot infer anything form them. A significant, positive market beta for the Norwegian difference portfolio is found in Renneboog et al. (2008). As many of our expectations are led by findings from this research, we are intrigued by our non-significant and mostly negative market beta findings. As mentioned earlier, we do have a bigger sample size of Norwegian funds as well as a different sample period than that of Renneboog et al. (2008).

When observing the market factors, it is evident that these are considerably higher compared to all other factor loadings (SMB, HML, and LIQ). This is due to the substantial factor returns that come from loading on the market factor and not so much from the loading differences themselves. Market loadings are positive and statistically significant at the 99% level for both the sustainable and conventional fund portfolio as compared to the benchmark. Loading of below one indicates that the portfolio has a lower risk than the market portfolio. We observe loadings between 0,913 and 0,980. Similar statistically significant values are reported in the previous literature (Bauer et al., 2005; Renneboog et al.,2008; Nofsinger and Vamra, 2014).

7.2.3 Systematic Risk Exposure – Size Loading

Size loadings for the difference portfolio are negative and statistically significant in all three multi-factor models. Thus, there is evidence that the sustainable portfolio invests less in small capitalization stocks compared to the conventional portfolio. The implication being that the sustainable funds have lower exposure to the risk and subsequent premia that comes with investing in small capitalization stocks versus big capitalization stocks. The three-factor and four-factor model reports a negative size loading of 13% and the Norwegian model of negative 13,4%. The results imply that the difference portfolio will move in the respective percentages given a 1% change in how the explanatory size factor moves. In the event that the factor benchmark drives a return of 1% on only size-investing, the difference portfolio would return 87% (three-factor and four-factor) and 86,6% (Norwegian model). Size loadings on the individual portfolios are only statistically significant for the conventional portfolio, and this observation is consistent throughout all models. The positive loadings indicate a higher small capitalization weighting for the conventional funds as compared to that of the benchmark. Our findings are consistent with those of Nofsinger & Varma (2014), which find that sustainable funds have a big capitalization tilt as compared to conventional funds.

Renneboog et al. (2008) find no significant result in the Norwegian market, but find that Canadian and Japanese sustainable funds also have a large-capitalization overweight compared to conventional funds. Bauer et al. (2005) support these findings for American sustainable funds. Our findings contrast those of Bauer et al. (2005) on the German and UK market, who find a small-capitalization tilt for sustainable funds compared to conventional funds.

7.2.4 Systematic Risk Exposure – Value Loading

We find no significant differences in the value loadings between sustainable and conventional funds. However, insignificant results point to a slightly higher growth stock exposure for sustainable funds compared to conventional funds. This difference is quite small as both factors are measured as near zero betas. Comparing value loadings of the two types of funds to the benchmark, we find no significant results.

Our non-significant findings on differences align with the statistically significant results from Bauer et al. (2005) that reveal a stronger growth-orientation of sustainable funds as compared to conventional funds. Results are contradictory to previous research on the Norwegian market done by Renneboog et al. (2008), which found that there was a greater value stock weighting in sustainable funds compared to conventional funds.

7.2.5 Systematic Risk Exposure – Momentum Loading

We find no evidence of a difference in momentum exposure between sustainable and conventional funds. The difference in portfolio beta is insignificant, small, and positive. Similarly, the momentum values for the individual portfolios compared to the benchmark are non-significant. Like Renneboog et al. (2008), our research finds a positive, non-significant momentum loading on the difference portfolio in Norway. The significant negative momentum loading for sustainable funds versus conventional funds found by Nofsinger & Varma (2014) do not align with these results.

7.2.6 Systematic Risk Exposure – Liquidity Loading

The difference in liquidity loading between sustainable and conventional funds are non-significant. However, the insignificant value is positive and hints to a higher momentum loading for sustainable funds versus conventional funds. Furthermore, the individual portfolios as compared to the benchmark provide no statistically significant results.

7.3 Addressing the Research Question and Hypotheses

This section aims to summarize the significant and principal findings that have sprung from our analysis and concisely answer the research questions. We will also cover the implications of our results in this section.

7.3.1 Research question 1

Do sustainable investment approaches reduce risk and enhance returns compared to conventional investment approaches in the Norwegian equity fund market?

We find no evidence that any investment approach has a significant advantage over the other. We only observe zero, non-significant alphas when regressing the difference portfolio. Furthermore, none of the individual fund portfolios have significantly underperformed or outperformed the market. This implies that no approach is preferred over the other, which falls in line with the neutrality hypothesis. Findings are supportive of sustainable investing in that they suggest an investor can invest in line with his or her moral convictions, without reduced returns and increased risk. Considering the prevalence of SRI practices in the Norwegian market, these findings are not too surprising. The use of such practices is congruent with the behavior of a wealth-maximizing investor.

7.3.2 Research Question 2

Are there differences in risk factor exposure between sustainable and conventional equity funds in the Norwegian market?

We do find no evidence that there is a difference in market factor exposure between the two portfolio types. Thus, there is no significant findings to suggest that any type of fund is more sensitive to the market than the other. Apart from the CAPM, our result show that the conventional portfolio has higher market exposure to the benchmark than the sustainable portfolio has to the benchmark. We note that the individual market factor loading for the sustainable and conventional portfolios is significant and below one, meaning that the portfolios have less sensitivity than the market. Contrarily to our expectations, there is no evidence to support a difference in value - orientation in sustainable funds compared to conventional funds. What we do find is that sustainable funds have a significant big-capitalization tilt compared to conventional funds. This means that on average sustainable funds lose out on some of the risk and subsequent return that comes from investing in small capitalization stocks.

7.4 Robustness Checks

In order to control for our results, we have performed additional regressions on our dataset as robustness checks.

7.4.1 Alternative Sample Periods

From figure two, we can observe a few trends in cumulative returns. As previously commented, we particularly see an increased cumulative return for the sustainable portfolio from late 2011 to late 2016. Furthermore, there the opposite seems to be true for the conventional portfolio between late 2016 until December 2018, the trend starting after a dip mid – year 2016. We use this is our point of departure for our alternative sample period robustness checks.

November 2011- November 2016

Comparing the regression results for this period (appendix 6) with the full sample period we observe no change in significant alphas. Neither difference nor individual portfolio alphas are significant. This supports our findings for the full period. Consistent with previous full-sample findings using multi-factor models there no observation of significant differences in market loadings between sustainable and conventional funds. Using the CAPM, however, we do find evidence that the sustainable portfolio has a higher market sensitivity than the conventional portfolio during this period. Like previously, there is evidence that size loadings are smaller for the sustainable portfolio, indicating a big capitalization tilt also in this period. In keeping with loadings from the full sample, there is no significant differences in value, momentum and liquidity.

June 2016 – December 2018

As a second robustness check, we investigate the period June 2016 until December 2018, where it seems that the conventional portfolio starts trending towards and actually accumulates higher returns than the sustainable portfolio. The risk-adjusted performance, presented as the alphas, are similarly to the full sample findings, non-significant. Thus, there is no evidence of differences in performance between sustainable and conventional funds. We do find some interesting deviations from full period finding as it relates to risk factor exposures. Firstly, the difference portfolio size-beta in the Norwegian model is non-significant.

It does however; report the same big-capitalization tilt as the previous findings and the other significant size-betas. As opposed to our main findings, this period reports some interesting value – exposure significant betas. There is no evidence for differences between the two types of funds, similarly to the main findings, but there are some significant findings on the individual portfolios. The individual sustainable portfolio shows a stronger value orientation compared to the benchmark than the conventional portfolio show to the benchmark (three and four-factor model). Lastly, we see a negative and significant difference portfolio momentum-beta, indicating that in this period, sustainable funds loaded less on momentum compared to conventional funds.

7.4.2 Alternative Sustainability Requirements

As a final check, we adjusted the fund selection criteria. For this check, we operated with stricter sustainability criteria. We ran the regression for the full sample period, but only included sustainable funds from our original sample with a top sustainability rating (five globes) in the new sustainable portfolio and excluded conventional funds with more than three globes in the new conventional portfolio. This change had no major effects on the results compared to the full sample. Non-significant Alphas continue to underline that there is no difference in performance between funds categories at different periods or under other sustainability criteria. The significant size-factor betas are consistent, indicating a large stock tilt for sustainable funds as compared to conventional funds. Like in the second robustness check, we observe a negative, significant momentum beta for the difference portfolio. Using the stricter selection criteria portfolio shows that sustainable funds are less exposed to the momentum factor than the conventional funds.

8. Conclusion

This research has expanded previous literature by investigating the risk-adjusted performance and factor exposure in Norwegian sustainable and conventional equity funds during a nine-year period. We have used internationally acknowledged asset pricing models as well as a region specific, empirically motivated pricing model and pricing factors specifically constructed for the Norwegian market. We find that sustainable funds risk-adjusted performance in this market is on par with their conventional counterparts. Furthermore, we find a tendency for sustainable funds to have a higher large capitalization exposure compared to conventional funds. Our alpha results are robust for a range of periods and sustainability criteria. Risk factor exposures are largely robust for periods and sustainability criteria, with some deviations.

Our findings are supportive of sustainable investing, suggesting that investors motivated by environmental, social and governance issues do not pay a premium for investing according to their motivations. This is relevant for institutional investors, government and private investors. Especially considering how eagerly the Norwegian market has embraced such investment practices, our findings can be seen as good news to many.

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10. Appendix

Appendix 1: *Definition of SRI strategies*

SRI Strategy	Definition
Best-in-class	This approach involves the selection or weighting of the best performing or most improved companies or assets as identified by ESG analysis.
Engagement & voting	This is a long-term process, seeking to influence behavior or increase disclosure.
ESG integration	This type covers explicit consideration of ESG factors alongside financial factors in the mainstream analysis of investments. The integration process focuses on the potential impact of ESG issues on company financials, which may affect the investment decision.
Exclusion	This approach systematically excludes companies, sectors, or countries from the permissible investment universe if involved in certain activities based on specific criteria.
Impact investing	Impact investments are investments made into companies, organisations and funds with the intention to generate social and environmental impact alongside a financial return. It includes microfinance, community investing and social business/entrepreneurship funds.
Norm-based screening	This approach involves the screening of investments based on international norms or combinations of norms covering ESG factors.
Sustainability-themed	Sustainability themed investments inherently contribute to addressing social and/or environmental challenges such as climate change, eco-efficiency and health.

Source: Global Impact Investing Network (GIIN) (2012); EUROSIF (2019)

Appendix 2: *Fama and French Factor construction*

The construction of the SMB and HML factors where constructed by splitting data from the Norwegian stock market as shown here:

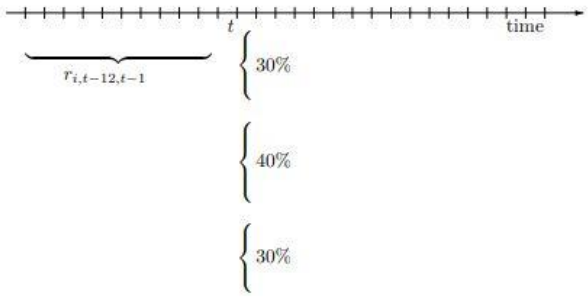
		Book/Market		
		L	H	M
Size	Small	S/L	S/M	S/H
	Big	B/L	B/M	B/H

SMB = average(S/L, S/M, S/H) – average(B/L, B/M, B/H)

HML = average(S/H, B/H) – average(S/L, B/L)

Appendix 3: *Carhart Momentum construction*

Each month the stock return is calculated over the previous eleven months, further they are ranked and split into three different portfolios.



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Appendix 4: *Results from model testing*

Test for multicollinearity

Fama and French three-factor model

Variable	**VIF**	**1/VIF**
SMB	1.51	0.663248
MarketPrem	1.47	0.679716
HML	1.03	0.966540

Carhart four-factor model

Variable	**VIF**	**1/VIF**
MarketPrem	1.53	0.655323
SMB	1.53	0.653906
PR1YR	1.04	0.958271
HML	1.04	0.963460

Norwegian Market Factor model

Variable	**VIF**	**1/VIF**
MarketPrem	2.52	0.396155
SMB	1.64	0.609423
LIQ	2.75	0.364142

Test for autocorrelation

```
. estat bgodfrey

Number of gaps in sample:  107

Breusch-Godfrey LM test for autocorrelation
```

lags(p)	chi2	df	Prob > chi2
1	**0.000**	**1**	**1.0000**

H0: no serial correlation

.

Test for heteroscedasticity

CAPM - Sustainable funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvgSRIRetRf

         chi2(1)      =     3.44
         Prob > chi2  =   0.0635
```

CAPM - Conventional funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvtgConRetRf

         chi2(1)      =     3.91
         Prob > chi2  =   0.0479
```

CAPM - Difference portfolio

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Difference

         chi2(1)      =     2.40
         Prob > chi2  =   0.1212
```

Fama and French model - Sustainable funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvgSRIRetRf

         chi2(1)      =     2.35
         Prob > chi2  =   0.1250
```

Fama and French model - Conventional funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvtgConRetRf

         chi2(1)      =     2.48
         Prob > chi2  =   0.1153
```

Fama and French model - Difference portfolio

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Difference

         chi2(1)      =     0.00
         Prob > chi2  =   0.9578
```

Carhart model - Sustainable funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvgSRIRetRf

         chi2(1)      =     2.32
         Prob > chi2  =   0.1276
```

Carhart model - Conventional funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvtgConRetRf

         chi2(1)      =     2.48
         Prob > chi2  =   0.1153
```

Carhart model - Difference portfolio

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Difference

         chi2(1)      =     0.01
         Prob > chi2  =   0.9402
```

Norwegian model - Sustainable funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvgSRIRetRf

         chi2(1)      =     2.74
         Prob > chi2  =   0.0980
```

Norwegian model - Conventional funds

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of AvtgConRetRf

         chi2(1)      =     3.13
         Prob > chi2  =   0.0769
```

Norwegian model - Difference portfolio

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Difference

         chi2(1)      =     0.07
         Prob > chi2  =   0.7952
```

Appendix 5: *List of all funds in sample*

Sustainable funds

Name	*Sustainability rating*
DNB Norge Selektiv (III)	5
KLP Aksjenorge	5
Storebrand Aksje Innland	5
Storebrand Norge I	5
Alfred Berg Humanfond	4
Storebrand Norge A	4
DNB Norge (IV)	4

Conventional funds

Name	*Sustainability rating*
Alfred Berg Aktiv	2
Alfred Berg Gambak	3
Alfred Berg Norge Classic	4
Danske Invest Norge Vekst	4
DNB Norge	4
DNB Norge (III)	4
Holberg Norge	4
Nordea Avkastning	4
Nordea Kapital	4
Nordea Norge Verdi	4
Pareto Aksje Norge A	4
Pareto Aksje Norge B	4
Pareto Aksje Norge I	4
Pareto Investment Fund A	4

Appendix 6: *Results Robustness test (November 2011 – November 2016)*

Table 1: *Results CAPM*

	Alpha	Market (β1)	R^2_{adj}
Sustainable	0,007	0,933***	0,9630
	(0,68)	(37,48)	
Conventional	0,021	0,860***	0,9019
	(1,51)	(22,16)	
Difference	-0,013	0,073**	0,0683
	(-1,27)	(2,49)	

Table 2: *Results Fama and French three-factor model*

	Alpha	Market (β_1)	SMB (β_2)	HML (β_3)	R^2_{adj}
Sustainable	0,007	0,939***	0,007	0,028	0,9627
	(3,31)	(35,14)	(0,17)	(1,23)	
Conventional	0,004	0,961***	0,199***	0,188	0,9242
	(0,34)	(26,34)	(4,99)	(0,72)	
Difference	0,003	-0,022	-0,192***	0,009	0,3466
	(0,34)	(-0,61)	(-4,38)	(0,36)	

Table 3: *Results Carhart four-factor model*

	Alpha	Market (β_1)	SMB (β_2)	HML (β_2)	PR1YR (β_3)	R^2_{adj}
Sustainable	0,006	0,941***	0,008	0,028	0,004	0,9621
	(0,32)	(31,41)	(0,18)	(1,21)	(0,16)	
Conventional	0,004	0,961***	0,199***	0,188	-0,000	0,9228
	(0,24)	(22,91)	(4,19)	(0,70)	(-0,00)	
Difference	0,002	-0,020	-0,190***	0,009	0,004	0,3352
	(0,22)	(-0,52)	(-4,26)	(0,36)	(0,17)	

Table 4: *Results the Norwegian model*

	Alpha	Market (β_1)	SMB (β_2)	LIQ (β_2)	R^2_{adj}
Sustainable	0,007	0,933***	0,006	-0,004	0,9617
	(0,56)	(30,39)	(0,14)	(-0,15)	
Conventional	0,004	0,950***	0,205***	-0,192	0,9239
	(0,33)	(25,94)	(4,13)	(-0,43)	
Difference	0,003	-0,016	-0,199***	0,016	0,3469
	(0,37)	(-0,43)	(-4,39)	(0,42)	

*The tables presents coefficients estimates for the CAPM, three-factor model, four-factor model, and the Norwegian model, respectively. Alphas estimates are annualized using $(1+\alpha)^{12}$ -1. $\beta_1, \beta_2, \beta_3, \beta_4$ represent loadings on the excess market return (MKT), size factor (SMB), value factor (HML), momentum (PR1YR), and liquidity facto (LIQ). Regressions have used Newey-West standard error with four lags. Number of lags is determined by $4(n/100)^{2/9}$ (Newey & West, 1987). The t-statistics are presented in parenthesis. *p<0,10 , **p<0,05 , ***p<0,01.*

Appendix 7: *Results Robustness test (June 2016– December 2018)*

Table 1: *Results CAPM*

	Alpha	Market (β1)	R^2_{adj}
Sustainable	0,030	0,952***	0,7994
	(0,75)	(7,68)	
Conventional	0,037	0,957***	0,7902
	(0,90)	(7,77)	
Difference	-0,007	-0,005	-0,0341
	(-0,49)	(-0,10)	

Table 2: *Results Fama and French three-factor model*

	Alpha	Market (β1)	SMB (β2)	HML (β2)	R^2_{adj}
Sustainable	0,017	0,993***	0,118	0,095***	0,7982
	(0,50)	(8,41)	(1,39)	(3,53)	
Conventional	0,016	1,021***	0,189**	0,159***	0,8085
	(0,47)	(8,43)	(2,43)	(4,07)	
Difference	0,001	-0,028	-0,071*	-0,054	-0,0175
	(0,06)	(-0,51)	(-1,53)	(-1,16)	

Table 3: *Results Carhart four-factor model*

	Alpha	Market (β1)	SMB (β2)	HML (β3)	PR1YR (β4)	R^2_{adj}
Sustainable	0,004	0,989***	0,139	0,0743**	0,079	0,7949
	(0,22)	(8,29)	(1,22)	(2,31)	(0,66)	
Conventional	-0,008	1,013***	0,134	0,110***	0,150	0,8167
	(-0,37)	(8,98)	(2,42)	(3,00)	(1,25)	
Difference	0,012	-0,025	-0,090**	-0,035	-0,704*	0,0127
	(0,72)	(-0,48)	(-2,23)	(-0,90)	(-1,77)	

Table 4: *Results the Norwegian model*

	Alpha	Market (β1)	SMB (β2)	LIQ (β3)	R^2_{adj}
Sustainable	0,014	1,090***	0,044	0,163	0,8073
	(0,56)	(11,77)	(0,88)	(1,02)	
Conventional	0,021	1,035***	0,115	0,089	0,7944
	(0,62)	(9,13)	(1,54)	(0,60)	
Difference	-0,008	0,056	-0,071	0,075	0,0019
	(-0,46)	(0,93)	(-1,60)	(1,82)	

The tables present coefficients estimates for the CAPM, three-factor model, four-factor model, and the Norwegian model, respectively. Alphas estimates are annualized using $(1+\alpha)^{12}-1$. $\beta_1, \beta_2, \beta_3, \beta_4$ *represent loadings on the excess market return (MKT), size factor (SMB), value factor (HML), momentum (PR1YR), and liquidity facto (LIQ). Regressions have used Newey-West standard error with three lags. Number of lags is determined by* $4(n/100)^{2/9}$ *(Newey & West, 1987). The t-statistics are presented in parenthesis. *p<0,10 , **p<0,05 , ***p<0,01.*

Appendix 8: *Results Robustness with stricter sustainability criteria*

Table 1: *Results CAPM*

	Alpha	Market (β1)	R^2_{adj}
Sustainable	0,002	0,961***	0,9710
	(0,18)	(57,43)	
Conventional	0,032	0,935***	0,8522
	(1,42)	(24,86)	
Difference	-0,029	0,026	-0,0049
	(-1,24)	(0,55)	

Table 2: *Results Fama and French Three Factor model*

	Alpha	Market (β1)	SMB (β2)	HML (β3)	R^2_{adj}
Sustainable	0,001	0,974***	0,032	0,029	0,9713
	(0,12)	(47,41)	(1,20)	(1,44)	
Conventional	0,022	1,001***	0,160*	-0,013	0,8595
	(1,03)	(18,32)	(2,17)	(-0,29)	
Difference	-0,020	-0,027	-0,127	0,042	0,0303
	(-0,90)	(-0,45)	(-1,59)	(0,78)	

Table 3: *Results Carhart Four Factor model*

	Alpha	Market (β1)	SMB (β2)	HML (β3)	PR1YR (β4)	R^2_{adj}
Sustainable	0,006	0,969***	0,028	0,031	-0,029	0,9716
	(0,52)	(44,87)	(0,97)	(1,57)	(-1,61)	
Conventional	-0,005	1,030***	0,184***	-0,022	0,157***	0,8733
	(-0,29)	(23,02)	(2,83)	(-0,55)	(3,00)	
Difference	0,012	-0,061	-0,156**	0,529	-0,186***	0,1633
	(0,60)	(-1,26)	(-2,25)	(1,12)	(-4,04)	

Table 4: *Results Norwegian model*

Results Norwegian Market Factor model

	Alpha	Market (β1)	SMB (β2)	LIQ (β3)	R^2_{adj}
Sustainable	0,000	0,983***	0,193	0,020	0,9709
	(0,00)	(39,51)	(0,73)	(0,79)	
Conventional	0,024	0,922***	0,208**	-0,145**	0,8655
	(1,14)	(16,68)	(2,58)	(-2,57)	
Difference	-0,024	0,061	-0,188**	0,165	0,0760
	(-1,05)	(1,07)	(-2,14)	(3,06)	

The tables present coefficients estimates for the CAPM, three-factor model, four-factor model, and the Norwegian model, respectively. Alphas estimates are annualized using $(1+\alpha)^{12}$ *-1.* $\beta_1, \beta_2, \beta_3, \beta_4$ *represent loadings on the excess market return (MKT), size factor (SMB), value factor (HML), momentum (PR1YR), and liquidity facto (LIQ). Regressions have used Newey-West standard error with four lags. Number of lags is determined by* $4(n/100)^{2/9}$ *(Newey & West, 1987). The t-statistics are presented in parenthesis. *p<0,10 , **p<0,05 , ***p<0,01.*

Table 5: *Funds included in Robustness check three*

Sustainable funds

Name	*Sustainability rating*
DNB Norge Selektiv (III)	5
KLP Aksjenorge	5
Storebrand Aksje Innland	5
Storebrand Norge I	5

Conventional funds

Name	*Sustainability rating*
Alfred Berg Aktiv	2
Alfred Berg Gambak	3