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Are the MSCI ESG Leaders ahead?

An Empirical Matched Paired Study of the MSCI ESG

Leaders Indexes

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Abstract

This thesis investigates the comparative financial performance of 62 indexes within the MSCI universe, between the years 2010 and 2019, the subperiod 2016 to 2019 and analyses the investment approach employing the Carhart four-factor model. The main motivation behind this study is to take a closer look at the concern of the Department of Labor, with regards to the employment of non-financial metrics, i.e., employing ESG factors as is an investment method.

Of these 62 indexes, 31 are categorized as MSCI ESG Leaders indexes and 31 are their respective parent indexes. This paper uses a matched pair approach based upon the matching executed by MSCI, leaving all the indexes subject to the same methodology. The financial performance evaluation investigates whether MSCI ESG Leaders indexes have managed to deliver better risk adjusted return than their reference indexes and examines the MSCI ESG Leaders indexes by applying well known performance measures like Sharpe Ratio, Information Ratio and Tracking Error. The Carhart four-factor model is applied to explore whether the MSCI ESG strategy possibly is a factor strategy.

While there does not exist a statistically significant difference in returns for the whole time period, and the same holds true for the subperiod, the MSCI ESG Leaders indexes show better returns. The MSCI ESG Leaders indexes also delivers lower volatility in both time periods. Irrespective of the chosen method, the Jensen Alpha, Sharp Ratio, and Information Ratio, the MSCI ESG Leaders seems to be the slightly more optimal choice. The findings contradict Modern Portfolio Theory, that an investment into the entire market will deliver the lowest returns, thereby providing support of the proponents of the ESG strategy, who claims lower risk is expected.

The Carhart four-factor model reveals that there are some applications of tilting the MSCI ESG indexes within the factor SMB, HML and MOM, however for the majority of the MSCI ESG Leaders indexes no significant factor strategy is revealed.

This thesis represents the end of a long and winding road, a master's degree in Master of Science in Economics. At the same time, it represents the beginning of another, hopefully far longer and more profitable road; my working and investing career. I am grateful for what I have learned, and the framework as to view the world through, all while knowing that theory is not actual life.

Thanks to Torun Fretheim and Ole Gjølberg for their suggestions as to what to write about, and how to go about transforming an idea into a paper. I appreciate all your support and insights.

Thanks to Hanne, for her patience and encouragement, and my dogs, Kieran, and Collin, for always letting me know when it's time to take a real break and go outside – according to them all the time.

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Key Terms and Abbreviations

Under are listed, in order of appearance, some key terms used within the paper.

Short	Long
MSCI	Morgan Stanley Capital International
ESG	Environmental, Social and Governance
SR	Sharpe Ratio
IR	Information Ratio
TE	Tracking Error
JA	Jensen's Alpha
TBL	Triple Bottom line
DOL	The Department of Labor (USA)
ERISA	Employee Retirement Statement Act
401(k)	Company-sponsored retirement savings plan with employee contribution matching opportunities and tax savings advantages
CFP	Corporate Financial Performance
SRI	Sustainable Responsible Investment
WCED	World Commission in Environment and Development
AUM	Assets under Management
UNPRI	UN Principles for Responsible Investments
ACWI	All Country World Index (within the MSCI)
CAPM	Capital Asset Pricing Model
US SIF	The Forum for Sustainable and Responsible Investment
CPR	Cross-Product Ratios
CSR	Corporate Social Responsibility
ROA / ROE / ROI	Return on Assets / Equity / Investment
4-FACTOR	Carhart four-factor model
3-FACTOR	Fama-French three-factor model
	Matched-Pair Approach
SMB / HML / MOM	(additional factors) Small Minus Big / High Minus Low / Momentum

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1 Introduction

1.1 Background

The Final Rule[1] issued by the Department of Labor (DOL) to regulate the fiduciary duties under the Employee Retirement Income Statement Act (ERISA), to focus on economic factors when proposing investments, became effective January 12th, 2021, meaning that fiduciaries should not emphasize non-financial metrics like Environmental, Social and Governance (ESG) factors if these investments may lead to lower returns or increased risks. In the proposal[2] in June 2020 the DOL revealed its concern:

"Given the increase in ESG investing, the Department is concerned that without rulemaking, ESG investing will present a growing threat to ERISA fiduciary standards and, ultimately, to investment returns for plan participants and beneficiaries."[3]

The DOLs worries raises an interesting question, as to whether ESG investments are financially suboptimal, and do impose higher risks to investors. If such options should be part of a long-term investment decision for future retirees, their 401(k) plans and other pension plans, they will need to provide as good or better returns than traditional investments, as the possible loss in compounded returns over time may be significant. Currently, the financial market is being overwhelmed with terminology within the sustainable investment universe, and as their buffet of investment options are ever increasing, the following questions remains: Are ESG investments able to deliver adequate risk adjusted returns compared to conventional investments? Do they offer proper diversification – or does ESG investing subject investors to increased financial risks?

Numerous studies the last decades have analyzed how sustainable investment strategies affects performance, many without accounting for the differences in the methodologies among

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1 https://www.federalregister.gov/documents/2020/06/30/2020-13705/financial-factors-in-selecting-plan-investments
2 https://www.federalregister.gov/documents/2020/11/13/2020-24515/financial-factors-in-selecting-plan-investments
3 Federal Register / Vol. 85, No. 126 / Tuesday, June 30, 2020 / Proposed Rule p.39121

different ESG metrics providers, and the lack of transparency regarding methodology and definition of ESG, which may also lead to biased results. Often the analysis is made with reference to one single benchmark, thereby neither adjusting nor accounting for the geographical and market-based differences, often referred to as the *benchmark problem*. After all, the empirical studies employing different approaches to search for the relation between ESG-investing and corporate financial performance (CFP), or lack thereof, the findings are yet to be conclusive. However, two main views within the field appears when addressing the sustainable investment strategies: the *value creating view* and the *value destroying view*.

The value creating view hypothesizes that the adaptation of ESG into the business is a risk minimizing strategy for a firm, and that a firm should seek to keep all their stakeholders in mind when overseeing business. Caring for stakeholders and incorporating ESG could lead to a lower cost of capital and thereby better returns. Investments into ESG is also believed to provide better business opportunities and shelter from future setbacks in the economy, as the business model is more sustainable and robust, and can therefore, in the long term, possibly be able to deliver better risk adjusted returns. Proponents of the ESG investment strategies are mostly based on the advantage of building an ethical sustainable business model that seeks to meet environmental, as well as stakeholders needs in the long run, arguing that an adherence to ESG factors will lead to less risk. The assumption of a positive relationship between ESG and financial performance was supported by an analysis Friede et al. (2015) conducted in their meta study of over 2,000 articles.

On the other side, the value-destroying theory argue that the focus on environmental and social responsibility will lead to a lack of focus on the business itself, and thereby possibly lead to lower profitability, that may, in the end, be a strategy that pleases the stakeholders at the shareholders expense (Alshehhi et al., 2018, p. 2). This view may be placed in context with shareholder theory, famously made known to the public by Friedman (1970), where he argues that corporations do not have social responsibilities, since social responsibilities only can be assigned to people. The antagonist's critique of ESG is often based on the modern portfolio hypothesis, namely that as ESG investments is a subset of the entire market, the investment must be subject to higher risk i.e., less diversification. Therefore, the argument is that ESG

cannot be an adequate investment strategy as the efficient market hypothesis argues that investors that are taking on increased idiosyncratic risk should not be compensated for doing so.

Morgan Stanley Capital International (MSCI) is an American financial company in New York, which is providing services within different parts of the financial market and offering a wide range of financial product, amongst these are the ESG related products. This study seeks to answer the question of whether investing in MSCI ESG Leaders indexes, which is their best-in-class investment options, has been value creating for investors the last decade, by analyzing risk adjusted measures like Sharpe ratios, information ratios, tracking error and Carhart factor models. The analysis also conducted on a subperiod, as the demand for ESG related assets have been soaring since 2016 (Lossing, 2020). The Carhart four-factor model is employed to look closer at the different MSCI ESG indexes and their investment tilts, if any. According to Bauer et al. (2005), Gjølberg and Johnsen (2008) and Lean et al. (2015) sustainable indexes tend to tilt towards large growth companies.

The market for ESG rating providers is enormous, and Li and Polychronopoulos (2020) found 70 rating providers, after excluding investment banks and other research organizations. Therefore, this paper looks only at the strategy that is referred to as "best-in-class", theoretically the best ESG investments options based on MSCIs methodology. An analysis of these best-in-class indexes should be able to provide some information regarding the investment strategy. Evaluating indexes compared to funds and single assets minimizes the effects that could possibly skew the results, like transactions costs, market timing and management skills. This way one also stays clear of the possible survivorship biases[4] that may affect the results when analyzing funds. By focusing solely on MSCI's investment universe, these complications and possible biases are bypassed. In this paper a matched pair analysis is conducted by utilizing a total of 62 MSCI indexes, where one half (31) are MSCI ESG Leaders indexes, and the other half (31) are their respective reference indexes. The reference indexes

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[4] Survivorship bias – the tendency to not account for funds that have been terminated. This may lead to an overestimation of the performance

are employed as benchmarks to bypass the common benchmark problem addressed above. The main questions that this paper seeks to answer are:

- **How does the MSCI ESG Leaders indexes perform compared to their respective reference indexes between 2010 and 2019?**

- **Are there changes in the performance when evaluating the subperiod 2016-2019?**

- **What does the Carhart four-factor model reveal about the investment approach and may the MSCI ESG Leaders indexes be following a factor strategy?**

This paper seeks to contribute to the literature by conducting a matched pair analysis within a specific investment universe, a type of analysis that is less common within the research of sustainable investment strategy. Hopefully, an analysis of the MSCI ESG Leaders' best-in-class investment strategy will provide answers as to whether this strategy has material value, and as to whether the DOL has any real cause for concern.

1.2 Structure

This paper is assembled as the preceding: Chapter 2 looks closer at ESG and sustainable investing. Chapter 3 takes a closer look at the literature that exists within the field related to this paper. Chapter 4 presents the financial theory behind the analysis. Chapter 5 presents and takes a closer look at the data employed to conduct the analysis. Chapter 6 presents the findings. Discussion, further research, and conclusions are presented in chapter 7.

The term "sustainable investment" may sometimes seem like a catchall phrase for any investment style with a social or environmental purpose. There are numerous terms and acronyms that are applied when various styles of sustainable investments are addressed. There is no consensus regarding the definitions, and various terminology are used interchangeably as they are largely overlapping (Hill, 2020, p. 13). This chapter will take a deeper dive into how ESG fits into the world of sustainable investments, what ESG is and at the terms within the field to draw a high-level image of the investment universe. Lastly, a closer look at the ESG Leaders Indexes within the MSCI investments universe and the methodology behind their best-in-class MSCI ESG Leaders category.

2.1   Moving Towards ESG

The progress towards ESG as we know it today, began centuries ago with the movement within the Methodist Church to address social challenges. Guidelines were imposed to address the morality of investments, often with the use of *negative screening[5]* processes of companies involved with tobacco, alcohol, gambling and other types of behaviors that were considered antisocial (Cort & Esty, 2020, p. 215). In response to this more conscious investment movement, the first Sustainable Responsible Investment (SRI) fund Pax World Fund (today Pax Sustainable Allocation Fund), was launched in 1971, a fund that eliminated investments into military related stocks (Gittell, 2012). The focus on environment and sustainability continued internationally with the formation of the organization World Commission in Environment and Development (WCED) in 1983. The goal of the WCED was to motivate nations to pursue sustainable development goals (SDG's) together. The commission defined sustainable development in their main report "Our Common Future" in 1987, as:

> *"Sustainable development is development that meets the needs of the present*
> *without compromising the ability of future generations to meet their own needs"*
> *(Brundtland & Dahl, 1987).*

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[5] Negative screening – assets or funds that are eliminated from the possible investment set due to a set of criteria

The real burst for ESG as a term arose after the 2004 UN report "Who Cares Wins Connecting Financial Markets to a Changing World", where the UN, in collaboration with the financial industry, published recommendations as how to better integrate environmental, social and governance issue in the financial service industry (Washington, 2004). The UN report resulted in a real burst for Environmental, Social and Governance (ESG) investing, with USD 86 trillion in Asset Under Management (AUM) (Jon Hale, 2020) and increasing. Today more than 2,900 organizations have signed the UN Principles for Responsible Investments (UNPRI), an agreement to follow UN's principles when making investment decisions (UNIPRI, 2021). Several countries have recognized ESG as an investment factor and passed legislations that requires these factors to be takes into consideration in the management of pension assets. The United Kingdom with the U.K Pension Act and France, Germany and Australia have adopted similar legislations (Caplan et al., 2013, p. 4), the general international fear of non-financial factors seems smaller than that of DOL.

2.2 ESG within the World of Sustainable Investments

Value vs. values driven investments – Generally, one would think of a good investment as being one that yields the highest possible profit, thereby cash flow or appreciation. This type of investing can be categorized as being *value driven.* This is where ESG belongs, as it aims to deliver performance that maximizes value to the investor on a risk adjusted return. Value driven investment approaches places return on investments as the single most important factor (Managment, 2017, p. 3).[6]
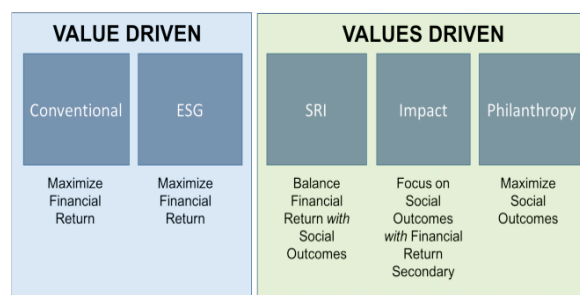
Figure 1. Value vs. values driven investments, (Managment, 2017)

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[6] A better overview of the expected financial performance of the different types of sustainable investment approaches are given in the appendix, Table 12

Values driven investments, on the other hand, which may be related to religious or ethical beliefs, are investments that do not look at the potential returns first, but on whether the investment offer the right investment strategy. This may result in exclusions of certain investments for the benefit or inclusion of others that are more in line with beliefs mentioned above. There is more to be said for a value driven investor than just the balance sheet, there is also what may be thought of as an *ethical balance sheet*. In this category, as one can see from Figure 1, we find SRI, Impact and Philanthropical investments.

ESG – an acronym for environmental, social and governance – assumes that there are more than just financial metrics that affect the value of a company. As quantitative data may be used to generate estimates as to what is a fair market value today and projections into the future, ESG related investments also uses non-financial factors or qualitative data to produce estimates of how the company is expected to perform. Generating financial results is important, but how the results are generated and what is behind the numbers has become increasingly more interesting for investors. The main thought within ESG is that the companies that have a robust sustainable business model and values their stakeholders will outperform the ones that do not.

Figure 2. ESG factors, (Solutions, 2019)

Environmental criteria – analyses how the company is performing in relation to the environment. Factors of interest is, amongst others, how a company is employing renewable energy, managing its waste and how the company is working to lower its carbon footprint now and into the future. Also, issues relating to air and water pollution and how the company's attitude towards the global climate changes are is of interest, as well as the origin and source of material.

Social criteria – the focus is wide, from the emphasis of ending slavery and child labor to the fight for fair wages and workplace diversity. Other employee relations apply, like employee turnover, employee engagement with management and how customer relations are managed.

Governance criteria – a factor that evaluated the diversity of the board of a company, bribery, and corruption. A factor that is highly related to evaluate the executive officers of a company and how they conduct business.

SRI investments, which stands for social, responsible investment – mainly focuses on screening for certain types of investments, often within a specific field of interest. It may include negative screening of companies involved with tobacco, alcohol, and gambling or, on the other side, positive screening, by including companies that are environmentally friendly or supports some desirable cause. Making an impact employing positive and negative screening is intuitively easy to understand. Most criteria will in turn leave room for interpretation, raising questions as to what a negative investment is and what is a good one, indirectly invested or directly invested. For example, SRI funds employed a divestment strategy to exclude companies that were active in South Africa under apartheid (Hill, 2020, p. 14). This is a clear example how SRI funds have used their investment choice as an instrument to affect social change.

Impact investing is a term that was first introduced in 2007 by The Rockefeller Foundation, a long-lived charity organization (Hill, 2020, p. 261). As can be seen by the illustration presented earlier, tTable 12 it is closely related to *mission investing*. Impact investing is often focused on achieving or supporting one specific cause, with the focus on financial return being secondary. This form of investing is often used interchangeably with mission investing (Hill, 2020, p. 19).

Philanthropical investments are investments that only seek to maximize the social outcome. Many of these investments are made through charitable organizations that are established to give away or donate the money of wealthy individuals or businesses.

2.3 ESG Within MSCI and MSCI ESG Leaders Indexes

Alongside MSCI there are a large amount of other ESG raring providers. Today, there does not exist one unified way for the financial service industry to classify or rate ESG metrics. MSCI and other financial institutions that provide ESG ratings use their own research methodologies (Li & Polychronopoulos, 2020, p. 1), leaving the world of ESG overwhelming, inconsistent and with little transparency. By examining the data from 2008 to 2018 researchers found that there had been a shift in what was analyzed but point out that the evaluation of the data provided is limited to the transparency by the agencies. This points to the fact that a lot of the methodology is easily publicly available, leaving the comparison of different metrics even more challenging, as not only does the different agencies use their own methods, but these methods are not written in stone and has been changing over time, meaning that different ESG providers might evaluate a company in different ways (Li & Polychronopoulos, 2020, p. 6). Not all ESG investments seek to provide risk adjusted return that is above market returns, many are merely an option for investors to align investments with beliefs – or, as addressed above, value investments. Within MCSI there are several categories of equity ESG indexes; MSCI ESG Select, MSCI ESG Universal, MSCI ESG Focus and MSCI ESG Leaders to name a few, where the latter are indexes that follow a best-in-class rating of the 50 percent highest ESG-rated companies, all based on the investment universe of the MSCI ACWI (All country world index). They are thereby invested into the companies that have the highest ESG scores compared to industry peers and are designed to avoid investments into business that are subject to controversy and taking on too much market risk. MSCI explicitly informs that the indexes are designed to meet the fiduciary obligations (MSCI, 2019a, p. 1).

CCC	B	BB	BBB	A	AA	AAA

LAGGARD	AVERAGE	LEADER
A company lagging its industry based on its high exposure and failure to manage significant ESG risks	A company with a mixed or unexceptional track record of managing the most significant ESG risks and opportunities relative to industry peers	A company leading its industry in managing the most significant ESG risks and opportunities

Figure 3. MSCI ESSG SCORES AND RATING, (MSCI, 2021b)

The focus is narrowed down to the ESG Leaders indexes because these are the highest rated within the MSCI universe, or the so-called best-in-class. This means that these are the indexes that should have the highest probability and expectancy of performing better than the overall market. The best-in-class funds and indexes are the ones that are supposed to be able to deliver above market risk adjusted returns (Fulton et al., 2012, p. 19). MSCI has divided ESG investing approaches into three main categories: Integration, Values & Constraints, and Impact investing. This can be viewed as a high-level approach as to how the objective of the investments are selected. ESG Integration is tailored to investors that seek to use ESG related information to optimize their risk and seek to improve investment results.

Values & Constraints seek to align the values and belief of the investor. Impact looks to investments in business that have environmental impact, and at the same time is seeking good financial returns (Giese, 2019, p. 4). The exact way in which the index is constructed is not the topic of this paper, but all indexes follow a rule-based approach (Giese, 2019, p. 5). The ESG scores are factors that are believed to be forward looking and therefore also believed to yield better risk return possibility. The indexes that will be analyzed in this paper are the ones that are rated AA and AAA. MSCI ESG Controversies assesses the company regarding environmental, social and governance impact. The framework used by MSCI is following the norm based on the UN Declaration of Human Rights. The score goes from 0 to 10, where 0 is the most severe (MSCI, 2019b, p. 4).

This means that the index consists of companies with the highest MSCI ESG rating and is designed to replicate the sector weight in the parent index to limit the systematic risk (MSCI, 2019b, p. 4)The index is then constructed by considering the Global Industry Classification Standard (GICS) – seeking to consist of a 50 overlap with the parent index (MSCI, 2019b, p. 5). The construction of MSCI ESG Leaders Indexes is based on an analysis of the investment universe of the parent index and by taking into consideration ratings, controversy, and business involvement. MSCI ESG Leaders Indexes are subject to reviews on an annual basis. Then the current construction of the parent index is considered and the ESG index is updated according to the parent index, ratings, controversies and business involvement and scores a rebalancing of the portfolio is done annually (MSCI, 2019b, p. 8) .

The definition of what is meant by applying the different types of sustainable investment terminologies has not been adequately defined across the investment universe. The largely overlapping terminology is contributing to challenges relating to comparison of research results and to drawing meaningful conclusions. When investigating what literature exists on the topic of this paper, there is a large amount of research, analyzing different kinds of strategies. The research is conducted on different types of sustainable investing, somewhat interchangeably, resulting in a mixed review of ethical, green, sustainable, SRI and ESG research literature. Also, the different rating scales and methodology within each type of sustainable investments and different financial security providers adds to the complexity. The interpretation of the results needs to consider these differences.

Mallin and Saadouni (1995) applied a matched pair analysis based on indexes' age and size to examine the performance of 29 ethical and 29 non-ethical trusts in the UK in the years between 1986 and 1993 and compared these funds to a general benchmark. The objective was to test two hypotheses; ethical investments and their performance in relation to the market and that the ethical investments do not differ from the non-ethical investments. To analyze their findings, performance measures like Sharpe, Treynor and Jensen were calculated. Their findings showed that on a risk adjusted basis both types of funds, ethical and non-ethical funds, underperformed compared to the market, however, the ethical trust outperformed the non-ethical trust. The research found no statistically significant differences in the performance between these two types of funds.

Inspired by Mallin and Saadouni (1995) Kreander et al. (2005) conducted a similar matched pair analysis, consisting of 30 ethical funds and 30 non-ethical funds in the European market during the period of January 1995 to December 2001, to examine whether there were any performance differences between these investment approaches. The benchmark for each ethical fund was determined based on the age, size, and country within its investment universe. By utilizing risk adjusted performance measures like Sharpe, Treynor and Jensen, the research did not uncover any significant differences between the ethical and non-ethical investments,

concluding that the results were in line with the article the study was inspired by and other similar studies at the time.

By examining the investment styles of ethical funds from Germany, the United Kingdom and the United States, Bauer et al. (2005) analyzed 103 mutual funds between 1990 and 2001. The method that was applied was a matched pair analysis, matching the firms by size and age, just like the methods of Kreander et al. (2005) and Mallin and Saadouni (1995). The researchers found that excluding non-surviving funds would lead to an overestimation. These non-surviving funds were added back to the dataset to adjust for this possible survivorship bias. To adjusts for possible return differences each ethical fund was matched with three appropriate conventional funds for the analysis. The analysis was performed with the use of the single-factor method and the four-factor method. Findings showed that there was no evidence of a statistical significance in returns, after controlling for factors like size, book-to-market, and momentum. The study did uncover that the ethical mutual funds have a different investing style and that these funds are more growth oriented. The ethical benchmarks that where employed were worse at explaining the performance of the funds than the conventional ones.

Cortez et al. (2009) analyzed 88 socially responsible funds from seven European countries to evaluate the performance of the funds between August 1996 and February 2007. The funds that were selected were chosen from six different classifications of socially responsible investments and then merged into a broader classification for the study; Global Equity, Europe/Eurozone and Euro Balanced. The methods applied were traditional unconditional methods Jensen's alpha and partial conditional methods allowing for time-varying betas. The analysis thereby investigated the time variations of the performance measures, allowing for an analysis of how different economic conditions affect the financial performance. The results from the study showed that the funds in general performed in line with comparable conventional and social benchmarks, raising the question as to whether these funds are any different than conventional funds, as the conventional benchmarks had a higher explanatory power than the sustainable benchmarks.

Climent and Soriano (2011) conducted an analysis of the performance of US green mutual funds to investigate the financial performance of the funds compared to conventional funds. The study analyzed funds between the years 1987 and 2009 with the use of a matched pair analysis, where the matching was based on the age, size, and investment strategies. Both the Capital Asset Pricing Model (CAPM) and the Carhart four-factor model[7] were used. The findings showed lower returns for the green funds compared to conventional peers between 1987 and 2001. The lack of performance may be explained by a restricted investment set or poor management. However, in the time frame 2001-2009, the green funds return was not significantly different from other conventional mutual funds, as well as other SRI funds.

Chang et al. (2012) conducted a study where they examined the performance of 131 green mutual funds in the US, defining green funds as comprised of firms that seek to minimize resource usage in production, producers of renewable energy and eco products. The objective of the paper was to test the performance of green mutual funds compared to traditional funds. The data was collected by retrieving stats from firms that were sorted through US SIF. They found that the risk profiles of the green funds were like regular funds, but that the returns did not keep up over the 5- and 10-year periods, as the high expense ratio and lower returns were significant. Over the 3- and 15-year timeframe the collection of data was tested for, the results were not conclusive. The study found that the standard deviation within green mutual funds were equal to regular mutual funds. Therefore, the conclusion was that green funds underperformed on a risk adjusted basis, in the paper referred to as Sharpe ratios, as the green funds, on a general basis delivered a lower Sharpe ratio. A noteworthy observation from the paper was that the research also divided the funds into different categories, like large cap, mid cap, and others, and were able to discover some time periods where these companies did perform significantly better that their peers. However, on a general basis the green funds underperformed. The researchers point to possible reasons for this underperformance as being a lack of diversification or high expense ratios imposed by the fund providers, as the strategy is new, in high demand and developmental costs apply to these assets, as they are believed to be in the early stage of their product cycle.

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[7] Capital Asset Pricing Model (CAPM) and the Carhart four-factor model will be addressed in Chapter 4

An analysis of socially responsible investment funds (SRI) was conducted by Lean et al. (2015). The purpose of this analysis was to examine the funds' performance, compare performance and performance persistence with the analysis of 500 SRI European funds and 248 North American funds, between January 2001 and December 2011. To conduct the analysis, the funds were separated into categories based on their annual returns; top, middle, and bottom performers. Based on these categories, the cross-product ratios (CPR) were calculated to test for persistence, however the researchers found little evidence of persistence. Other methods that were employed to evaluate performance was the Fama-French three-factor model and the Carhart four-factor model. The findings showed that the SRI funds in Europe and North America outperformed the market and that the lack of diversification didn't harm the financial performance. There was not much evidence of performance persistence. Lastly, the findings showed that the European SRI funds had a higher downside risk than the North American SRI funds.

A similar study was conducted by Ibikunle and Steffen (2017). The analysis was comprised by 175 green, 259 black and 976 conventional funds in the time between 1991 and 2014. Green funds in this context means funds that were committed to environmental principles, while black funds were defined as funds that were invested into companies that lead to exploitation of natural recourses. The main objective was to test the following two hypotheses; the first being that expected returns on green mutual funds do not differ statistically from conventional funds, the second test to conduct a comparative analysis between the green and conventional funds and the black funds. When observing the whole period, the researchers found that the green funds underperformed relative to the conventional funds, while, in the same time frame, there were no significant performance differences between the green and black funds. However, in the period between 2012 and 2014 the green funds did outperform their black peers. The differences between the green and black investments are evident, as the researchers conducted a multifactor analysis and found that the green funds were mainly invested in small cap and growth stocks while the black funds were tilted towards value stocks.

A 2019 study performed by Salazar Fernandez et al. (2019) investigated German Green Mutual Funds, and compared this category to their peers. Green funds in this study were defined as environmentally conscious funds within Germany. To test whether the German environmental mutual funds pay a premium for going green, they used one- and four-factor models. The study concluded that during the entire sample period from 2007 to 2018 the green funds had lower performance compared to conventional funds. However, in the same study, the researchers divided the time periods into smaller periods dependent of whether they were defined as periods of crisis or non-crisis, and in these shorter time periods the results revealed that green funds did perform slightly better.

In a meta study Fulton et al. (2012) analyzed the results of 100 academic studies, 56 research papers, 2 literature reviews and 4 meta studies. Their main objective was to provide a precise image of the "mixed results" that are often referred to within this kind of research. This was done by employing a specific methodology to draw some conclusions regarding the sustainable terminologies SRI, CSR and ESG. There seemed to be a consensus within these academic papers with findings concluding that high ratings of ESG would lead to lower cost of capital, meaning that the market recognized these companies as entailing lower risk, and with a lower cost of capital, the possibility of superior return does exist. This result showed that 89 % of the studies within the field ESG, find that companies with high ESG ratings show market-based outperformance.

The most exhaustive overview of literature regarding the relationship between ESG and CFP was performed in 2015 by Friede et al. (2015) who investigated an impressive 3700 studies from 2,200 unique primary studies. The meta study was conducted by analyzing vote-count-studies and meta-analysis, and thereby was able to combine a total number of 3,700 study results. The main objective of the meta study was to examine whether the findings would uncover a relationship between ESG and CFP and if this relationship was positive, negative, or nonsignificant. The researchers conclude that it is possible to fins ESG outperformance in many markets, and that capital markets are increasingly becoming aware of the ESG-CFP relationship. The researchers find that by analyzing the studies, about 63 % of the meta studies, find positive relation between CFP and ESG, overall combining all the different types of studies

that where subject to analysis in this paper, the researcher finds that 90 % of the studies found a non-negative relation between ESG and CFP. The research denotes that most of the studies do find a positive relationship between ESG and CFP.

Verheyden et al. (2016) tested if it was possible to verify whether a fund manager could be negatively affected if the investment universe that presented to the manager were subject to some ESG screening criteria. This was then compared to an unscreened investment universe. The goal was to evaluate if the ESG screening could lead to a sacrifice in the risk adjusted return. The analysis was divided into two investment universes based on two main portfolios; one with developed and emerging markets and the other with just developed markets. Both portfolios consisted of 85 % of their respective investment universes. Regarding the ESG screening, the researchers used three forms of screening; *best-in-class ESG scores*, *compliance with the UN Global Compact*, and the last screening criteria was *ESG momentum*. The analysis was conducted only with companies that had ESG data, and given the information constraint, the analysis was engineered by sampling data from the years between 2010 to 2015. Then six portfolios were constructed, the two original portfolios and subjecting the two portfolios to ESG constraint, one where the bottom 10 % regarding ESG criteria were excluded and two portfolios that were subject to the bottom 25 % of ESG companies being screened out. The returns for the six portfolios did not show significant differences, ranging from 7.7 % to 8.9 %. The standard deviations among the six portfolios were almost the same, ranging from 14.1 % to 14.4 %. The Shape ratios were almost identical for these three portfolios in the two different investment universes. When examining the stock lower tail risk, researchers found that there was some higher degree of risk in non EGS investments.

This chapter takes a closer look at the theory and method applied to evaluate the financial performance of the MSCI ESG Leaders indexes and their parent indexes, also referred to as *benchmarks* or *reference indexes*. First a brief look at methods and relevant financial theory, then risk adjusted performance measures, lastly the Carhart four-factor model.

4.1   Matched Pair Approach

This paper is based on a matched pair approach, matching the MSCI ESG Leaders indexes to their respective reference indexes within the MSCI investment universe. The matching criteria that are applied is based on the MSCI factsheets, meaning that the matching of the indexes is based strictly on a logical match between an ESG index and its reference index. The matched pairs are invested into the same geographical regions and further leaving a degree of overlap, as reviewed previously[8], as the MSCI ESG indexes are rebalanced to keep expected tracking errors.

This matched pair approach is not directly in line with previous studies on the field, as matched pair analysis is often based on size, age, and investment universe. Matching based on *age* considers the timing of an investment and allows for a selection that eliminates survivorship biases. Matching based on *size* reflects upon the fact that it is believed to be increasingly challenging to manage larger pools of capital, as one may easily imagine the last investment to be less favorable than the first one. The *investment universe* criteria are met here, as the matched-pair indexes do invest into the same region.

It appears to be the consensus that age, size, and investment universe (Mallin & Saadouni, 1995), (Kreander et al., 2005b) and (Climent & Soriano, 2011) should be taken into consideration when mutual funds are compared, however, this analysis is executed on indexes. Keeping the indexes within the same methodology ecosystem, age and size of investment funds are not a main criterion of this paper. Matching pairs to evaluate the differences between two

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[8] The overlap between the indexes is addressed in chapter 2

groups is a general method within statistics and the matching criteria ought to be able to answer the main objective of this paper, namely, if there is a financial advantage to invest into best-in-class ESG indexes compared to their parent indexes.

4.2 Financial Theory

According to the **Market Efficiency Hypothesis**[9] (EMH) the market is efficient when the price, at any point in time, is a good estimate for the real intrinsic value (Bodie et al., 2013, p. 235). The market price may be thought of as a reflection of all available information within the market (Fama, 1970, p. 383). If efficiency really do exist, all information gathering, and security analysis activities have no significant value and may as well be terminated. Capital markets become more efficient as understanding about different investments approaches are widely understood (Bodie et al., 2013, p. 237). This would, in theory, suggest that if there is a real financial advantage to ESG as an investment strategy, the market will ultimately close the gap and the advantages will seize to exist. The assumption within EMH, that all available information is absorbed by the market at a high pace, is subject to criticism (Naseer & Tariq, 2016, p. 2). Three levels of efficiency are hypothesized in response to this, namely the *Weak Form*, *Semi-Strong Form* and *Strong Form*.
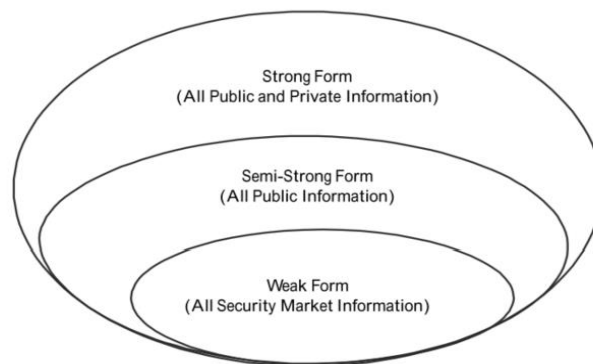
Figure 4. Forms of Efficiency (Naseer & Tariq, 2016)

Weak Form of Efficiency – Current prices already reflect all historically available information in the market regarding past prices, volume, and short positions. There is no value to be gained from analyzing trends. If trends and other signals were reliable, such information would lose its value as the market gained knowledge (Bodie et al., 2013, p. 238) This is in line with the *Random Walk Hypothesis*, meaning that the price movements of a given security is random and does not follow any pattern that can be predicted (Jones & Jensen, 2013, p. 318).

Semi-Strong Form Efficiency – New information without bias will be almost instantaneously priced into the market, leaving technical analysis and fundamental analysis unable to reliably provide abnormal returns (Rabbani et al., 2013, p. 136). If investors do experience that new information is not priced into an asset, then the market is not efficient in the semi strong form (Jones & Jensen, 2013, p. 317).

Strong Form Efficiency – In this form of market efficiency, which encompasses both weak and semi strong form, stock prices reflect all available information, information available to the market, including information that is only known to the insiders, leaving this form of efficiency quite extreme (Bodie et al., 2013, p. 238). If the strong form of market efficiency holds, then no one with inside information could make money by using the information, which is highly unlikely (Jones & Jensen, 2013, p. 317). In this form of efficiency, technical or fundamental analysis would obviously not be able to provide strategies to defeat the market.

Modern Portfolio Theory (MPT) – assumes that, given a set of conditions, an investor will solve for the minimum-variance portfolio, i.e., the set of combinations of assets that yields the highest expected return for a given amount of risk. This emphasizes that the importance of diversification and the need to evaluate the different covariances among assets, is what will yield lower volatility in a portfolio and contribute to true diversification (Markowitz, 1968).
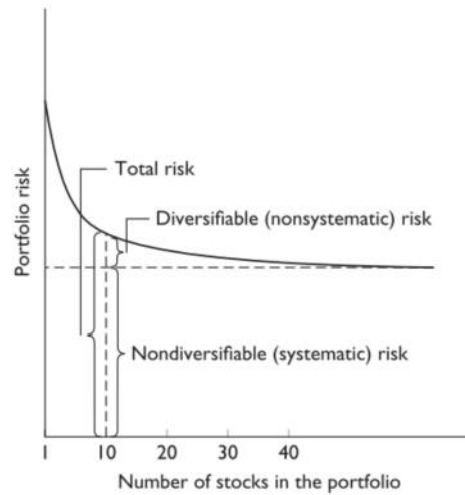
Figure 5. Systematic and Nonsystematic Risk (Jones & Jensen, 2013, p. 215)

As shown by the figure above, the riskiness of a portfolio is generally believed to decline as more assets are added, because the additional assets lowers the non-systematic risk until the portfolio is basically a proxy for the entire market (Jones & Jensen, 2013, p. 215). Then, the next question is, how many assets are needed to lower the risk of a portfolio towards the market risk? This question will not be addressed in this paper; however, this is where opponents of the ESG strategy places their main argument, that ESG might lead to a loss of diversification, arguing that an ESG strategy will never be as diversified as the market, because ESG investments are a subset of the latter. This is often where the argument opposing ESG and other types of sustainable investing strategies are placed (Cortez et al., 2009, p. 573).

The MPT was taken into consideration when the Capital Asset Pricing Model (CAPM), a one-factor model given by the equation (1) was presented by Sharpe (1964).

$$E(R_{it}) - R_{ft} = \alpha_i + \beta_i[E(r_{Mt}) - r_{Ft}] + \varepsilon_{it}$$

The CAPM describes the relationship between the risk, more specifically the systematic risk and the expected return, and yields the theoretical appropriate required rate of return, given the risk in the market, represented by β (beta). It thereby only considers the market risk, where beta will be one if the portfolio is as volatile as the market, and higher (lover) than one if the

portfolio is more (less) volatile. It follows from the model that $E(R_{it})$ is the expected return, R_{ft} is the risk-free rate, α_i is the alpha of the portfolio, a positive means outperformance, a negative underperformance, β_i is the coefficient that represents the market systematic risk, $[E(r_{Mt}) - r_{Ft}]$ represents the market risk premium and ε_{it} is the error term for the portfolio i at time t.

4.3 Performance Measures

To create an analysis based on the performance of the different indexes, it is of importance to evaluate what method is applied in these assessments. Generally, one might say that there are two classifications of ex-post performance measures. The differences between them are the assumptions that are made regarding the returns, referring to whether the returns are normally or non-normally distributed (Lückoff, 2011, p. 137). In this paper the robustness test is executed on subperiods to evaluate the distribution of the returns, and standard deviations are calculated. Robustness tests are further addressed in chapter 6.2. The assumption in this paper is that the returns are independent and identically distributed (i.i.d.), which enables the option of conducting t-tests to investigate the different hypothesis. The returns are calculated by using a standard logarithmic return. The simple linear and multiple regressions that are run, are all based on the assumptions that the properties of the Ordinary Least Square (OLS)[10] are met.

The risk-free rate, as will be further considered in chapter 5.1, is the 3-month Treasury bill, calculated using the logarithmic return[11]. Returns for the indexes are calculated with the standard logarithmic formula, calculated for the ESG index and parent index, respectively. The excess market return, which is the return above risk free rate, is calculated by subtracting the risk-free rate from the return of the parent index, thereby resulting in the difference in return.

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[11] $Return = ln\left(\frac{P_t}{P_{t-1}}\right)$ Excess market return = $r_{Index} - r_f$, P_t is the price today

$$\alpha_i = E(R_{it}) - R_{ft} + \beta_i[E(r_{Mt}) - r_{Ft}] + \varepsilon_{it}$$

The Jensen Alpha is a risk-adjusted measure, which was presented by Jensen (1968) and is based on the underlying theory of CAPM. The estimate is made ex-post and looks at the term α (alpha) given the β (beta) value. It thereby considers at the return premium of the single period investment, given the estimated value, that can be derived by calculating the CAPM measure. If the Alpha value is significantly positive (negative), this will be interpreted as evidence of superior (inferior) performance compared to the market (Jones & Jensen, 2013, p. 588). This may be tested by running the following hypothesis: $H_0 = 0$ The Alpha value is equal to 0, $H_A \neq 0$ The Alpha value is not equal to 0.

$$\beta_i = \frac{cov\ (r_i - r_m)}{\sigma_m^2} \ [12]$$

The Beta is a representation of the asset's sensitivity to the overall market, or, in this paper, the ESG indexes' sensitivity to their parent indexes. Generally, a Beta equal to 1 means that a portfolio will move in tandem with the market, or the parent index. A beta below 1 means less risky than the benchmark, and above 1 means riskier than the benchmark. $cov\ (r_i - r_m) = $ covariance between the MSCI ESG index and the parent index, $\sigma_{Parent\ Index}^2 = $ as the variance of the reference index, $H_0 = 0$, The beta value is equal to 0, $H_A \neq 0$, The beta value is not equal to zero.

$$Diff\ return = Return_{ESG} - Return_{Parent\ index}$$

While the matched pairs analysis is applied in this paper, it is of interest to further investigate the differential returns, i.e., between the MSCI ESG Leaders indexes and their benchmarks, which are calculated by applying a test for statistical significance. The analysis is performed by observing the pairs of indexes. $H_0 = 0$, The differential return is equal to zero, $H_A \neq 0$, The differential returns are not equal to zero[13].

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[12] $T-test = \frac{\bar{X} - \mu}{\sigma_X}$ [12] , $\bar{X} = $ Tested value, $\mu = $ The null hypothesis, $\sigma_X = $ standard errors of x

$$Sharpe\ ratio = \frac{r_m - r_f}{\sigma_m}\ ^{14}$$

Sharpe (1966) presented the reward to volatility measure, often referred to as Sharpe Ratio (SR), and the measures are based on the Markowitz paradigm. The approach is essentially a ratio between the return and the standard deviation. A higher ratio is preferred (Lückoff, 2011, p. 142).

$$Correlation = \frac{Cov\ (Parent, ESG)}{\sigma_{parent},\sigma_{ESG}}$$

Correlation examines to what degree two variables move together in tandem. Given that the MSCI ESG Indexes and their parent indexes have a degree of overlap, even by following different investment approaches, the correlation is of interest. Often the correlation may be evaluated to determine whether there is evidence of active management, as a higher correlation is interpreted as evidence of less active management (Lückoff, 2011, p. 34).

$$TE = \sqrt{\frac{1}{T - 1} \sum (R_{Parent} - R_{ESG})^2}$$

Tracking Error (TE) is mostly used to evaluate the degree of active management. The calculation is performed by examining the standard deviations between the difference of the ESG index and the parent index return.

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[14] Yearly $= Monthly\ Ratio \times \sqrt{12}$

$$Information\ ratio = \frac{(R_{ESG}) - (R_{Parent})}{\sigma_{Parent,\ ESG}}\ {}^{15}$$

The information ratio (IR) is a measure of the ROI, in this paper the ESG index above the return of the benchmark divided by the volatility of the returns, also referred to as being the tracking error. $H_0 = 0$, $H_A \neq 0$

The CAPM model assumes that there is only one risk factor that influences the returns of an asset, namely the market macroeconomic factor (beta). In this paper the market is represented by the parent indexes. However, the CAPM seemed to be insufficient in empirical testing of stock returns, leading to the search for other relevant factors that could explain the returns in a more satisfactory manner (Lückoff, 2011, p. 157)Factors that might explain the stock returns which are not explained by factor models, is often referred to as *anomalies*. There are many of them, from behavioral anomalies to the market anomalies introduced by Fama and French. In their paper (Fama & French, 1996, p. 76) they argued that cross-sectional variations which CAPM does not manage to capture, is explained by their model.

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_{i1}(r_{Parent\ index,i} - r_f) + \beta_{i2}(SMB) + \beta_{i3}(HML) + \beta_{i4}(MOM) + \varepsilon_i\ {}^{16}$$

Their model builds on the observation of two additional factors, extending from the CAPM, the *small-minus-big* (SMB), and the *book-to-market value* (HML) (Lückoff, 2011, p. 157). The factor SMB is related to the fact that small firms tend to outperform larger ones over the long run. The HML factor relates to value stocks i.e., high book to market value, which in the long run can generate a higher return than growth stocks, the latter often having lower HML,

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[15] T-test = IR $\times \sqrt{N}$

[16]

SMB = $\frac{1}{3}$(Small Value + Small Neutral + Small Growth) - $\frac{1}{3}$ (Big Value + Big Neutral + Big Growth)

HML = $\frac{1}{2}$(Small Value + Big Value) $-\frac{1}{2}$ (Small Growth + Big Growth)

MOM = $\frac{1}{2}$(Small High + Big High) $-\frac{1}{2}$ (Small Low + Big Low)

meaning that a firm's size and its book-to market ratio can be a good representation of the risk within the company (Lückoff, 2011, p. 158)

A further extension of the CAPM and Fama and French's three-factor model is the Carhart four-factor model. In this model the last factor, referred to as the momentum factor, is added, a factor that Jegadeesh and Titman (1993) reported as being a strategy that generated significantly positive abnormal returns. The momentum factor is based on selling past losers and buying past winners, thereby following the momentum in the market.

The interpretation of the alpha – α – is the same in this model as in the CAPM model. A positive alpha means that the index has outperformed the market and a negative alpha is evidence of underperformance, without saying anything about the significance. A positive (negative) SMB value could indicate that the ESG Leaders index consists of a higher fraction of small (large) stocks, compared to the reference index. In the same way, a positive (negative) HML, would indicate whether the ESG index holds a larger fraction of investments in high (low) value (growth) stocks compared to the reference index. Once again, the market is represented by the parent index.

5 Data

The data sample analyzed consists of MSCI ESG indexes collected by applying Thomson Reuters DataStream[17]. By searching for Equity Indexes, MSCI, ESG, USD and total returns (TR)[18], total returns ensures that the data collected is net of dividends and fees. Data for the MSCI parent indexes were also collected in the same manner, deducting ESG. The initial results collected from Thomson Reuters DataStream consisted of 58 MSCI ESG Leaders indexes after eliminating all the lower rated MSCI ESG indexes. This elimination was performed for the purpose of only incorporating the "best-in-class" indexes, which are ranked "BB" and higher, and thus in accordance with MSCI's methodology.[19]. Further exclusion from the dataset was carried out using two screening criteria: (1) the MSCI ESG Leaders index needed to consist of minimum 10 years of data and (2) the index had to be matched with a benchmark proxy i.e., parent index, based on information provided by the MSCI. The matching of the indexes is largely performed by verifying investment area and objective with the use of MSCI Factsheets. After further screening, a total of 31 MSCI ESG Leaders indexes were found suitable for the analysis. Data for 31 parent indexes were also collected, with a total of 62 indexes when the parent indexes are included. A list of the indexes in the sample is provided in Table 1.

The data was collected at a monthly frequency between December 2009 to December 2019, a total of 121 observations. All the data are obtained in USD, as the analysis is made from an investors perspective within the United States, making all data directly comparable. Given that the analysis is assembled by applying indexes, no screening regarding survivorship bias has been necessary. The specific period, and thus the specific dataset, was chosen to avoid the inclusion of data from both (1) the previous financial crisis in 2008 and (2) the ongoing Covid-19 pandemic (2020-), thus avoiding the subsequent market declines, which took place before and after this period, respectively. There has been a consistent increase in the amount of (AUM) related to ESG over the entire sample period, and thus a 10-year life span should yield some information regarding ESG as an investment strategy.

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[17] Financial data service provider

[18] Total returns – assumes reinvestment

[19] A brief overview of the different ratings within MSCI are made in chapter 2

The same dataset is used when analyzing the subperiod from December 2016 to December 2019. This subperiod was chosen to provide more insight into the performance of the MSCI ESG Leaders indexes in a time frame where the general market has been increasingly requesting ESG related assets. This ensures the possibility of comparing data between the whole stretch of time (2009-2019) and the subperiod (2016-2019) and research for possible interesting observations about the performance development of these indexes.

This analysis differs from many other academic papers written about funds and indexes, because there is neither one common benchmark for all indexes nor for the majority of the ESG Leaders indexes, there is just one. In theory, other benchmark(s) could have been applied, and some research has been conducted this way, like Chris Mallin (1995) and Kreander et al. (2005). However, the objective of this paper is comparing the performance between MSCI ESG Leaders indexes and their parent indexes, and thereby the use of other benchmarks are simply unnecessary.

5.1   Risk Free Rate and Factors

The analysis is executed with the index data being collected in USD, and with the perspective of a US investor, therefore the 3-month Treasury Bill (T-Bill) will work as a proxy for the risk-free rate. This is in line with similar research on the field (Lean et al., 2015). The application of the risk-free interest rate is a prerequisite for carrying out an analysis of the excess return on the market, as well as offering more accurate risk-adjusted performance measures. The risk-free rate is also of interest when the factor models are employed, as the model in this paper is specified net of risk-free rate to provide a more accurate factor alpha.

To run the multiple regressions that yields information about the investment style, here referring to the Carhart four-factor model that is employed and the factor SMB, HML and MOM, there is no need to calculate these, as they are easily accessible at the Fama French website[20]. First the factors applied in the Fama-French three-factor model is downloaded, then

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[20] https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

the last factor, often referred to as the momentum factor, is added. All the factors in the dataset, the T-bill and the factors are in USD, and thereby suitable for analysis. Additional factors, besides the factor calculated for the US market by Fama and French, could have been employed, for instance the factors for the European market. However, given that the analysis is made from an investors perspective within the US market, and because the proxy for the risk-free rate is in US Treasury Bills, the US factor have been selected.

6 Empirical Results

This chapter presents the findings of the comparative financial performance of 62 MSCI ESG indexes – 31 MSCI ESG Leaders and 31 corresponding parent indexes. This part of the chapter will start with a brief overview regarding how to place the results into a wider context and some explanations about the robustness tests. Then a review of the best and worst performing indexes with regards to return and standard deviation and a look at the differential returns. Following that, the performance measures, among them Sharpe Ratio and Information Ratio, lastly a look at the results from the single and multiple regressions.

6.1 The Findings in a Wider Context
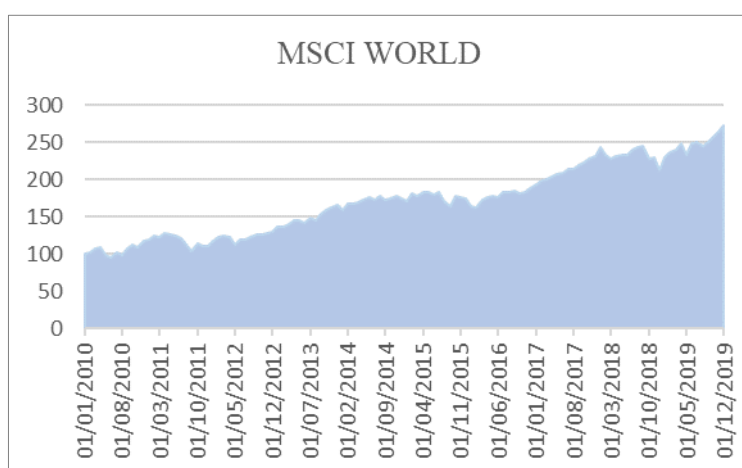
Figure 6. The Pricedevelopment of ACWI, 2010=100

During the time frame of this evaluation the US stock market has been in the longest economic expansion in history (Li, 2019). Generally, the interests have been declining globally and the central banks have largely provided monetary stimuli to the economy following the financial crisis, also most likely contributing to a rising stock market (Boyle, 2021). The quantitative easing is prominent in the US, the UK, Japan, and the Euro zone to name a few, as the Bank of England declares the goal is to attain the inflation target (England, 2021). The economy within many other parts of the world have similarly been expanding strongly, suggesting that it is natural to expect both the MSCI ESG Leaders indexes and their reference indexes to deliver positive returns. The questions remains whether ESG is the superior choice.

Given that this analysis is applied within the MSCI universe and thereby MSCI methodology, this could have been placed into a larger context, comparing the matched pair of indexes with multiple other large world indexes, for example as performed by (Kreander et al., 2005); Mallin and Saadouni (1995), who both conducted a matched-pair analysis and compared that to a global index. However, this study analyzes the performance within MSCI, and the main interest is in the performance of the MSCI ESG Leaders indexes compared to their respective parent indexes. Nevertheless, in order place the findings into a more global context, it can be of interest to bear in mind that the MSCI ACWI (All Country World Index) is a sizable global index, covering more than 2,900 assets (within 11 sectors) and 85 percent of the free float-adjusted capitalization within these markets (MSCI, 2021a), meaning that the MSCI index may work as a proxy for the entire global market, leaving the need for a range of other larger indexes insignificant, as this will be able to place the performance of the different index pairs into a similar perspective. Between the years 2010 and 2019 ACWI, in this paper referred to as index 31A, delivered a return of 10 percent and a volatility of 13 percent.

6.2 Robustness Test

To test the robustness of the data, two shorter time periods were examined, 2010-2014 and 2015-2019. All financial performance calculations i.e., return, standard deviation, differential returns, as well as the risk adjusted performance measures were calculated. The analysis is performed to test for possible economic turbulence or differences in the dataset. The two time periods of the robustness test are two subperiods with economic expansion in most of the world economy, and the findings reflect this. Their variation in the data for the general return and standard deviations are mentioned here to shed light at these small differences. The differences are marginal, and basically the two time periods presented here, show a similar image.

Between 2010 and 2014, the MSCI ESG Leaders indexes had a return of 7.5 percent compared to 8.6 percent for their reference indexes. The numbers for the volatility were 17.5 percent and 17.8 percent, respectively. As for the time period 2015-2019 the MSCI ESG Leaders managed to deliver a return of 7.7 percent compared to their benchmarks of 8.5 percent. The standard deviation was 15.9 percent for the MSCI ESG Leaders and the same for the parent indexes. The skewness and kurtosis of the data were also evaluated; however, some deviations are to be

expected and could possibly be even better adjusted for with a higher data frequency. For example, the data is moderately negatively skewed, leaving the data approximately symmetric. The findings within the sub periods are not further discussed here, as the performance of the two time periods of interest will be in focus, however i.i.d. is assumed.

6.3 Summary Statistics

6.3.1 Returns 2010-2019

	#	MSCI PARENT INDEXES	Returns	#	MSCI ESG LEADERS INDEXES	Returns
Top 5	28A	**MSCI USA :L**	**12,7 %**	28B	**MSCI USA :L ESG LEADERS**	**12,0 %**
	27A	**MSCI USA**	**12,6 %**	26B	**MSCI USA BROAD ESG LEADERS**	**12,0 %**
	26A	**MSCI US BROAD MARKET INDEX**	**12,6 %**	27B	**MSCI USA ESG LEADERS**	**12,0 %**
	29A	**MSCI USA :M**	**12,3 %**	30B	**MSCI USA :S ESG LEADERS**	**11,9 %**
	30A	**MSCI USA :S**	**12,1 %**	29B	**MSCI USA :M ESG LEADERS**	**11,8 %**
Bottom 5	9A	MSCI CHINA	4,3 %	22B	MSCI PACIFIC ex JP ESG LEADERS	6,1 %
	8A	MSCI CANADA	4,2 %	7B	MSCI AUSTRALIA ESG LEADERS	5,9 %
	12A	MSCI EM	4,1 %	13B	MSCI EMU ESG LEADERS	5,8 %
	17A	MSCI INDIA	3,9 %	8B	MSCI CANADA ESG LEADERS	5,8 %
	24A	MSCI SOUTH AFRICA	3,4 %	25B	MSCI UK ESG LEADERS	4,7 %
		Min. parent indexes	*3,4 %*		*Min. ESG Leaders indexes*	*4,7 %*
		Max. parent indexes	*12,7 %*		*Max. ESG Leaders indexes*	*12,0 %*
		Average parent indexes	*7,5 %*		*Average ESG Leaders indexes*	*8,4 %*
		Median parent indexes	*6,1 %*		*Median ESG Leaders indexes*	*7,5 %*
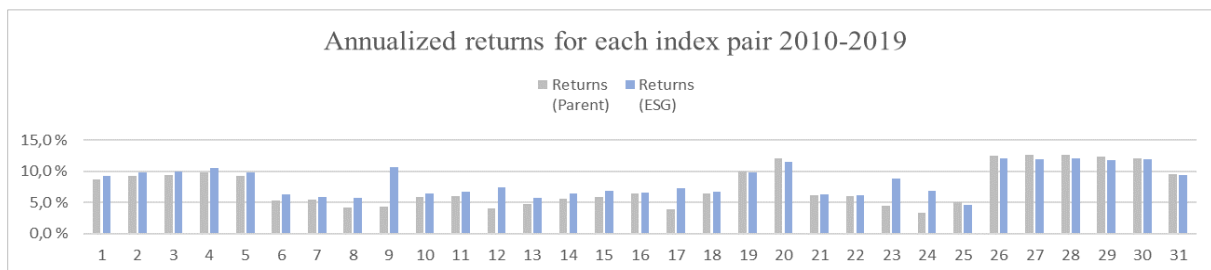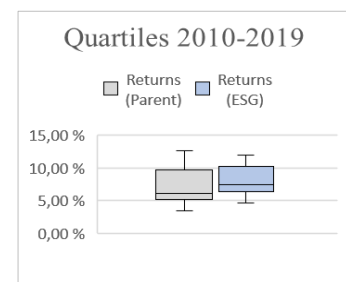
Figure 7. Returns, 2010-2019

The returns are summarized in Table 2 in the appendix. Returns are higher for the MSCI ESG Leaders indexes than their respective reference indexes for 22 out of the 31 indexes between 2010 and 2019. The best performing ESG indexes deliver marginally lower returns than the best performing parent indexes. On the opposite side of the spectrum, this image is reversed, as the ESG indexes perform better than their parent indexes. When addressing the average returns summarized for all the 31 ESG indexes and parent indexes, respectively, the ESG indexes do deliver better returns, with the average differential returns being 0.9 percent. Also, the median return is higher for the ESG indexes.

The best performing MSCI ESG Leaders indexes can be found among the five best performing reference indexes, indicating a level of correlation over the time frame. For the bottom performers, the MSCI ESG Leaders and benchmarks do not overlap. The box and whisker plots show the data divided into quartiles, the first quartile being the lower whisker, the second and third quartiles being the box, divided by the solid line (median) and the upper wisher being the fourth quartile. The parent indexes have a wider range within their data, shown by the box and whisker plots compared to the MSCI ESG Leaders indexes. From this, the interpretation is that the returns for the ESG indexes are denser than for their reference indexes. From the figure, plotting the returns from MSCI ESG Leaders and their parent indexes, one may observe that the different pairs of returns are largely the same, however for the pair 9 the difference is noticeable. Other pairs, like 12, 17, 23 and 24 also show a deviation between the returns for the parent indexes and the ESG indexes, however, for the majority the performance is quite similar.

6.3.2 Returns 2016-2019

	#	MSCI PARENT INDEXES	Returns	#	MSCI ESG LEADERS INDEXES	Returns
Top 5	23A	MSCI RUSSIA	20,2 %	23B	MSCI RUSSIA ESG LEADERS	24,5 %
	28A	MSCI USA :L	13,0 %	9B	MSCI CHINA ESG LEADERS	13,5 %
	27A	MSCI USA	12,7 %	28B	MSCI USA :L ESG LEADERS	13,2 %
	20A	MSCI NORTH AMERICA	12,5 %	27B	MSCI USA ESG LEADERS	12,8 %
	26A	MSCI US AROAD MARKET INDEX	12,4 %	20B	MSCI NORTH AMERICA ESG LEADERS	12,6 %
Bottom 5	18A	MSCI JAPAN	6,9 %	10B	MSCI EAFE ESG LEADERS	7,1 %
	13A	MSCI EMU	6,5 %	18B	MSCI JAPAN ESG LEADERS	7,1 %
	14A	MSCI EUROPE	6,0 %	24B	MSCI SOUTH AFRICA ESG LEADERS	6,9 %
	25A	MSCI UK	4,9 %	14B	MSCI EUROPE ESG LEADERS	6,3 %
	24A	MSCI SOUTH AFRICA	4,6 %	25B	MSCI UK ESG LEADERS	2,4 %
		Min. parent indexes	*4,6 %*		*Min. ESG Leaders indexes*	*2,4 %*
		Max. parent indexes	*20,2 %*		*Max. ESG Leaders indexes*	*24,5 %*
		Average parent indexes	*9,8 %*		*Average ESG Leaders indexes*	*10,1 %*
		Median parent indexes	*10,2 %*		*Median ESG Leaders indexes*	*10,3 %*

Figure 8. Returns, 2016-2019

Between 2016-2019, i.e., the subperiod, given in Table 3, the returns for the MSCI ESG indexes are higher than their reference indexes for a total of 22 of the 31 indexes. The best performing ESG indexes do deliver higher returns than their best performing parent indexes, but when it comes to the bottom performers, the MSCI ESG indexes do not manage to deliver higher returns than their respective benchmarks. When the average returns are summarized for all the

31 ESG and parent indexes, results show that the ESG indexes do have better returns, with the average differential returns being 0.3 percent, while the median return is marginally higher for the ESG indexes. The returns for the best performing ESG indexes have managed to outperform their reference indexes in the time frame 2016-2019, however, the worst performing ESG indexes have underperformed their respective parent indexes between 2016-2019. On average it seems like the ESG indexes, and their parent indexes have become increasingly similar, as the difference in returns has changed from 0.9 percent between 2010-2019 to 0.3 percent for the subperiod 2016-2019. In the subperiod the MSCI ESG Leaders indexes have a wider range, shown by the box and whisker plots. Still, the second and third quartile are almost the same, leaving the median with little difference. The difference is still noticeable for the index pair 9, also index pair 23, has delivered satisfactory results, but for the majority the performance regarding returns is similar.

6.3.3 Standard Deviation 2010-2019

	#	PARENT INDEXES	Std.dev.	#	ESG LEADERS INDEXES	Std.dev.
5 Highest vol.	23A	MSCI RUSSIA	26,3 %	3B	MSCI WORLD ex EMU ESG LEADERS	26,6 %
	24A	MSCI SOUTH AFRICA	23,8 %	23B	MSCI RUSSIA ESG LEADERS	26,4 %
	9A	MSCI CHINA	23,5 %	24B	MSCI SOUTH AFRICA ESG LEADERS	24,8 %
	17A	MSCI INDIA	22,9 %	17B	MSCI INDIA ESG LEADERS	21,1 %
	13A	MSCI EMU	19,6 %	9B	MSCI CHINA ESG LEADERS	21,0 %
5 Lowest vol.	20A	MSCI NORTH AMERICA	13,5 %	2B	MSCI WORLD ex AU ESG LEADERS	13,5 %
	27A	MSCI USA	13,5 %	20B	MSCI NORTH AMERICA ESG LEADERS	13,4 %
	28A	MSCI USA :L	13,4 %	27B	MSCI USA ESG LEADERS	13,3 %
	1A	MSCI AC WORLD	13,1 %	4B	MSCI WORLD ex EUROP ESG LEADERS	13,1 %
	31A	MSCI WORLD	13,0 %	28B	MSCI USA :L ESG LEADERS	13,0 %
		Min. parent indexes	*13,0 %*		*Min. ESG Leaders indexes*	*13,0 %*
		Max. parent indexes	*26,3 %*		*Max. ESG Leaders indexes*	*26,6 %*
		Average parent indexes	*16,4 %*		*Average ESG Leaders indexes*	*16,6 %*
		Median parent indexes	*15,3 %*		*Median ESG Leaders indexes*	*15,2 %*
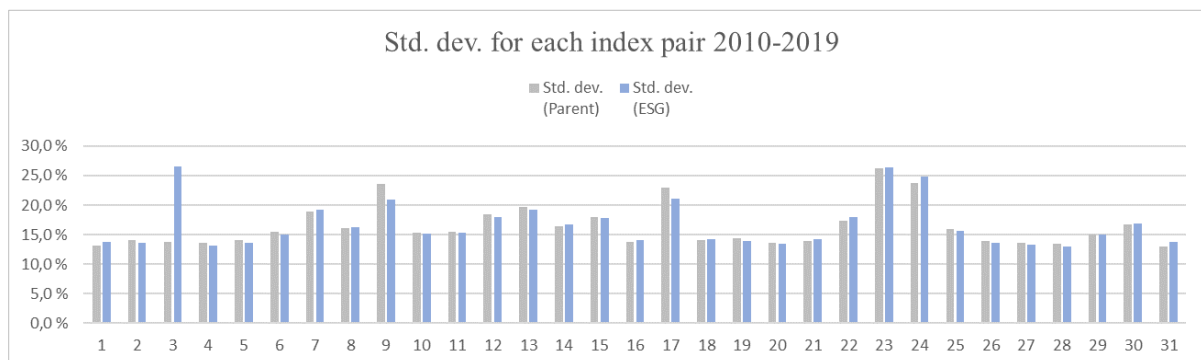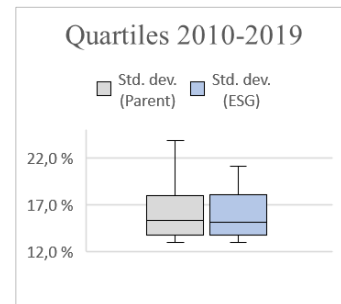
Figure 9. Standard deviation, 2010-2019

The standard deviations between 2010 and 2019 are located in Table 2 and are calculated to represent yearly volatility[21]. The volatility between the MSCI ESG Leaders and their parent

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[21] $monthly\ std.dev \times \sqrt{12} = annual\ volatilty$

indexes between 2010 and 2019 are similar when observing the lowest and highest volatility. There is a wider range between the two groups when considering the higher volatility, however, the difference is not substantial. The similarity in volatility is easily observed in the averages with a difference of 0.2 percent and median with a difference of 0.1 percent. The volatility among the pairs is mostly the same, with the most deviating difference is observed for pair 3. As may be seen by the box and wishers plots, the range of the volatility is highest for the parent indexes and lowest for the ESG indexes, however their respective second and third quartiles are the same, explaining an equal median.

6.3.4 Standard Deviation 2016-2019

	#	MSCI PARENT INDEXES	Std.dev.	#	MSCI ESG LEADERS INDEXES	Std.dev.
5 Highest vol.	24A	MSCI SOUTH AFRICA	27,4 %	24B	MSCI SOUTH AFRICA ESG LEADERS	28,4 %
	9A	MSCI CHINA	25,3 %	9B	MSCI CHINA ESG LEADERS	23,8 %
	23A	MSCI RUSSIA	19,5 %	23B	MSCI RUSSIA ESG LEADERS	20,2 %
	17A	MSCI INDIA	18,3 %	12B	MSCI EMERGING MKTS ESG LEADERS	17,6 %
	30A	MSCI USA :S	17,3 %	30B	MSCI USA :S ESG LEADERS	17,4 %
5 Lowest vol.	16A	MSCI FAR EAST	12,3 %	16B	MSCI FAR EAST ESG LEADERS	12,5 %
	18A	MSCI JAPAN	12,2 %	18B	MSCI JAPAN ESG LEADERS	12,5 %
	21A	MSCI PACIFIC	12,1 %	21B	MSCI PACIFIC ESG LEADERS	12,2 %
	1A	MSCI AC WORLD	11,2 %	1B	MSCI ACWI ESG LEADERS	11,2 %
	31A	MSCI WORLD	11,1 %	31B	MSCI WORLD ESG LEADERS	12,7 %
		Min. parent indexes	*11,1 %*		*Min. ESG Leaders indexes*	*11,2 %*
		Max. parent indexes	*27,4 %*		*Max. ESG Leaders indexes*	*28,4 %*
		Average parent indexes	*14,7 %*		*Average ESG Leaders indexes*	*14,8 %*
		Median parent indexes	*13,2 %*		*Median ESG Leaders indexes*	*13,2 %*

Figure 10. Standard deviation, 2016-2019

The standard deviation between 2010 and 2019 may be found in Table 3 and are calculated to represent yearly volatility. The volatility between 2016 and 2019 increased for the MSCI ESG indexes with the highest volatility but decreased for the indexes with the lowest volatility. The same is observed regarding the reference indexes. However, the average and median volatility has decreased for both groups and are essentially the same, probably indicating lower market volatility between 2016 and 2019. The range i.e., the variability in the volatility for the parent indexes, are still greater than the range for the ESG. One may still observe that the second and third quartile of the data are approximately the same, with the second quartile being a little bit lower for the MSCI ESG Leaders and the median being the same.

6.4 Differential Returns
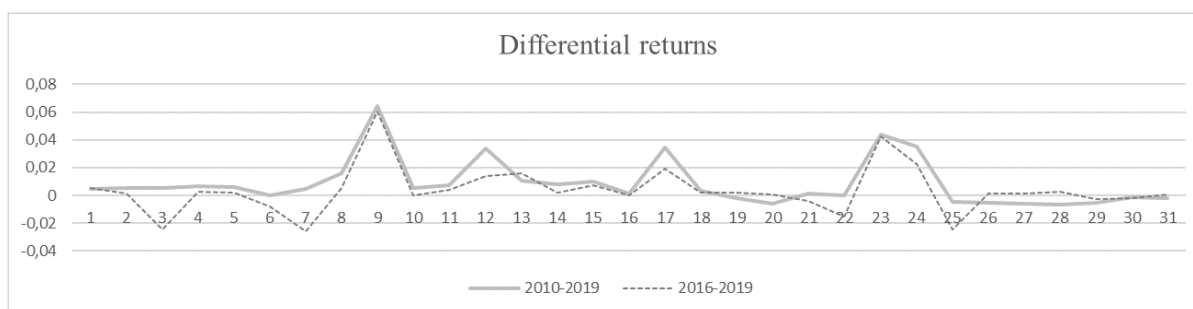
Figure 11. Differential returns for all the index pairs

The differential returns, that is the $MSCI\ ESG\ Leaders_{Bk} - MSCI\ PARENT_{Ak}$, simply calculated and here using the returns data, i.e., the differential returns, are not adjusted for risk, presented graphically above. The specific results from the calculations and the t-tests are located in the appendix, Table 2 and Table 3. As can be observed from the graph above, the difference in returns is trending similarly for the different pairs of indexes in the two time periods. The matched pairs are represented by the numbers along the x-axis, and the percentage difference along the y-axis. In the time frame 2010-2019 the spread in differential returns were between -0.6 and 6.4 percent, with an average difference of 1.1 percent. In the subperiod 2016-2019 the spread in differential returns were between -2.6 and 6.0 percent, with an average of 0.7 percent. As the spread in the data has increased in the subperiod, the average has declined, which may be placed in context with the more equal returns and standard deviation, as addressed above. The null hypothesis cannot be rejected.

6.5 Sharpe Ratio
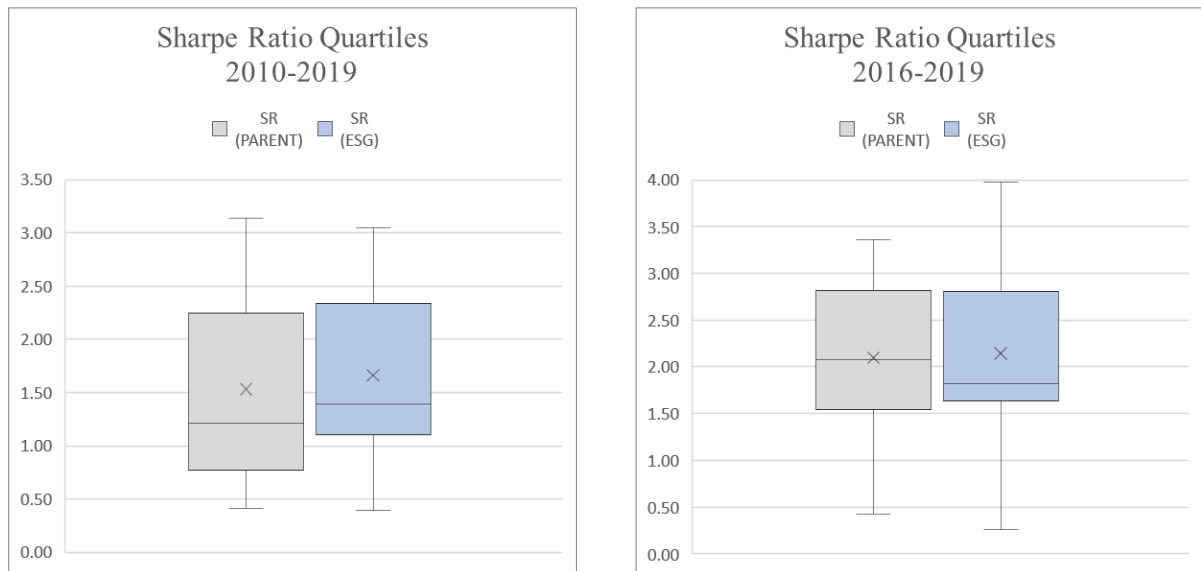
Figure 12. Sharpe Ratio Quartiles for the whole (left) period and the subperiod (right)

Table 4 andTable 5 show the Sharpe Ratio (SR) for the time periods 2010-2019 and 2016-2019, respectively. The higher the positive number, the better the ability to deliver risk adjusted return, as the formula calculates return per unit of risk (Lückoff, 2011, p. 142). A negative SR lower than 1 is suboptimal, and below 0 would imply that the performance is inferior to the return that could be generated by the risk-free rate. A SR>1 would be acceptable, and SR>2 and 3 would obviously be even better (Maverick, 2021), meaning that a ranking based on these measures are approximately correct and do provide meaningful information, given that the ratio is calculated using well diversified portfolios. The use of rankings based on SR are widely utilized within the investment world (Lückoff, 2011, p. 143).

In the time frame 2010-2019 a total of 21 of the MSCI ESG Leaders indexes had a higher (SR) than their respective parent indexes, meaning that 21 of the 31 indexes delivered higher returns compared to their parent indexes when adjusted for risk. In the time frame 2016-2019 a total of 20 of the MSCI ESG Leaders indexes had a higher (SR) than their respective benchmarks, meaning that 20 of the 31 indexes delivered better returns than their parent indexes when adjusted for volatility. Between 2010 and 2019 the median SR is higher for the ESG strategy, while the range in the SR is highest for the parent indexes. However, for the subperiod, things

have changed a little, as the parent indexes provide the highest median value, and the range in the SR data has increased for the MSCI ESG indexes.

6.6   Information Ratio

Table 4 and Table 5 show the information ratio (IR) and their t-values between 2010 and 2019, and 2016 and 2019, respectively. The parameter IR calculated in this analysis is an ex-post measure that investigates the return on the MSCI ESG Leaders portfolios beyond the return of their respective benchmarks i.e., alpha divided by the standard deviation of the excess returns. The parameter is based on the Markowitz mean-variance paradigm (Goodwin, 1998, p. 34). The measure provides data as to whether the active management adds or destroys value (Schneider, 2010, p. 12). Given that the MSCI ESG Leaders indexes are rebalanced and consists of a 50 percent overlap with their parent indexes, it is reasonable to label the ESG indexes as active tracking indexes, thereby the IR is of interest. Expressed in the simplest manner possible, all investors with a mean variance objective will desire the highest possible IR, where a positive IR means that the investment has generated return beyond what could be expected and a negative IR means the opposite (Grinold, 1989, p. 34). In the time frame 2010-2019 a total of 21 of the MSCI ESG Leaders indexes had a positive value for their respective IR compared to their benchmarks. In the time frame 2016-2019 a total of 20 of the MSCI ESG Leaders indexes had a positive value for their respective IR compared to their benchmarks. The IR is higher in the longer time period than in the subperiod, suggesting that the outperformance of the ESG strategy has been under pressure. The t-values are given in Table 4 and Table 5, suggesting that some are significantly different from zero, i.e., the hypothesis may be rejected for some, but not all.

6.7   Tracking Error and Correlation

The tracking error (TE) is closely related to the information ratio, as it is the denominator of the equation, often applied to analyze the volatility between the benchmarks. The TE shows how much deviation there has been between the MSCI ESG Leaders indexes and their parent indexes. Generally, the TE is expected to be relatively low, as MSCI follow a rule-based approach to avoid taking on too much diversifiable risk. Between 2010 and 2019 the TE ranges

between 1.25 % and 33 %, with the average being 5 %. The largest deviation is observed for the index pair 9. Between 2016 and 2019 the TE ranges between 1 % and 36 %, still the largest deviation is for the MSCI CHINA ESG Leaders. The average TE has declined and is 4 % in the subperiod. Most of the TE are below 5 % for the two time periods, meaning that the index pairs generally follow in tandem with each other. The scatterplot of the most deviating index is found in Table 10 and Table 11.

Correlation located in Table 8 may also be applied to evaluate the difference between the index and its benchmark over time, as a higher correlation indicates that the managers have been less active (Lückoff, 2011, p. 38). The correlation between the MSCI ESG Leaders indexes and their parent indexes are high. Between 2010 and 2019, the average correlation is 0.9025 and between the years 2016-2019 it increases to 0,9427.

6.8   Single-Factor Model

The values for the linear regressions with MSCI ESG indexes as the dependent and their respective parent indexes as the independent variable, i.e., an approximation of the CAPM regression, with the respective parent indexes as the proxy for the market, is summarized in Table 6 and Table 7, respectively. The alpha value, i.e., the Jensen alpha implies whether the MSCI ESG indexes has had a higher (positive value) or lower (negative value) return than the market (parent index). Between 2010 and 2019, two MSCI ESG Leaders indexes deliver significantly better return than their benchmarks at a 1 percent significance level. These are the indexes 12B and 24B. Between 2010 and 2019, they deliver a return of 3.52 % and 3.46 % better than their parent indexes, respectively. When examining the 5 percent significant level, the total of MSCI ESG indexes that deliver positive alpha values are four indexes, 2B, 11B, 15B and 17B.

In the subperiod none of the MSCI ESG indexes yields a statistically significantly better return than their parent indexes at the 1 percent significance, however at the 5 percent significance level there are three, namely 13B, 23B and 27B. The subperiod is (obviously) a subset of the

longer period, and interestingly, there are no indexes that deliver positive alphas within both the respective time periods. Given that most of the indexes do not deliver an alpha statistically significant from zero, the null hypothesis cannot be rejected.

The CAPM theory states that the beta value in the market is one, and here the parent indexes are a proxy for the market. This means that when making a comparison between the MSCI ESG indexes and their benchmarks, the expected value will also be one. All but one index has a beta statistically different from 1, between the years of 2010-2019 and 2016-2019. This is as expected. The null hypothesis may be rejected. The lowest beta value may be found for the MSCI ESG Leaders China pair 9 with a beta of -0.095 and – 0.0606, once again indicating that this index had a different investment approach than the market proxy, as this is the only index with a non-statistically significant beta value. Scatterplot and graph of index pair 9 can be found in Table 10and Table 11.

The r-square for the timeframe 2010-2019 is on average 0.90, and marginally lower for the sub period, on average 0.89, meaning that the return of the MSCI ESG Leaders indexes is explained to a marginally lower degree opposed to when observing the data regarding the subperiod. Generally, one would say the r-square is equal for the two time periods. The r-square reveals that the performance of MSCI ESG Leaders indexes is largely explained by their parent indexes.

6.9   Four-Factor Model

In this part the results from the Carhart four-factor model for the period 2010-2019 are presented. The results from the multiple regressions and the parameters that will be addressed here may be found in Table 9. The multiple regression examines the different MSCI ESG Leaders indexes regressed on their respective parent indexes and three additional factors, namely, SMB, HML and MOM.

The results show that there is only one MSCI ESG Leaders index that have managed to outperform its benchmark at a 1 percent level of significance. By employing the Carhart four-factor model, the index (12B) does provide a statistically significant positive alpha value of 3.2 %. A total of four MSCI ESG Leaders indexes (4B, 15B, 17B and 24B) have managed to deliver positive alpha values at 5 percent significance between 2010 and 2019. Generally, the MSCI ESG Leaders indexes do not manage to deliver statistically significant alpha values.

Once again all but one beta value is statistically different from zero at the 1 percent significance level. By employing the multiple regression, the deviation is clear regarding the investment approach of the MSCI ESG CHINA index, as it delivers a market beta value close to one, -0.09.

The result for the SMB factor shows that there is just one index, (19B), that is significant at the 1 percent significance, with a factor of -0.0589, meaning that this index is heavily tilted towards large cap stocks. There are three MSCI ESG indexes that are significant at 95 percent confidence level, indexes (4B, 5B and 8B), with two of them being exposed to small stock and one more heavily into large cap stocks. There does not seem to be a consistency as to how the MSCI ESG Leaders indexes are tilting their portfolios as it related to this factor.

When observing the results for the HML factor, there are three indexes that are significant at the 1 percent level of significance. These are (25B, 29B and 30B), with one, (25B), being negatively tilted with a factor of -2.072, and the two others positive, with factors of 5.687 and 4.559, respectively. This implies that index 25B is significantly tilted towards growth and that 29B and 30B are tilted towards value. The indexes 12B and 22B are significant at the 5 percent significance, one growth and one value tilt. It may be noteworthy that index 29B and 30b with significant HML factors, both are US indexes.

The MOM factor is significant at the 1 percent significance indexes 1B, 7B, 9B and 31B, with 1B, 7B and 9B being significantly negative, meaning that the indexes are invested into

contrarian stocks and 7B being highly tilted towards momentum stocks. At the 5 percent significance, there are two indexes, (14B) and (24B), that are significant.

The adjusted R-squared for the multiple regression is on a general basis expected to be higher for a multiple regression, however, that is not the case. The adjusted R-square is on average 0.9038, with the comparison of 0.9001 for the one-factor model based on the CAPM paradigm, meaning that most of the indexes employing an ESG strategy have not managed to deliver significantly higher alpha values compared to their respective parent indexes. The results from the regressions of the matched pair of indexes do not uncover any evidence to suggest that the ESG strategy is able to outperform a conventional investment strategy. There is no need to reject the initial hypothesis.

7   Summary

The results of this paper show that the MSCI ESG Leaders indexes have delivered a marginally better return that their parent indexes, and that the volatility is lower for the indexes following the ESG strategy. The return to volatility measure, here represented by Sharpe Ratio, and the Information Ratio, reveals a better performance for ESG indexes, however, this difference declines for the subperiod. This is also noticeable when analyzing the Tracking Error, which declines and is lower for the subperiod, meaning that the index pairs have become more similar over time. This is also supported by the fact that the correlation is decreasing within the subperiod. There are a few MSCI ESG Leaders indexes that can deliver positive Jensen alpha values, thereby indicating a level of outperformance for some of the indexes, but not for the majority. As for the Carhart four-factor model, some of the MSCI ESG Leaders indexes seem to be tilted toward one factor, but this may also be as a result of the general rebalancing as to track their parent's performance. A strong factor strategy does not seem prevalent. Generally, the index pairs do seem to be highly similar, however, this similarity does not seem to be present for the MSCI CHINA index pair, as the index pair deviates a lot.

7.1   Discussions and Further Research

The non-significant better performance of the MSCI ESG Leaders indexes falls in line with previous research, portraying a positive relation between ESG and CFP (Friede et al., 2015). The fact that ESG do entail lower risk than conventional investment approach has also been established by other researchers (Verheyden et al., 2016). However, the results from this analysis at hand, may be argued to match previous studies of mixed results (Fulton et al., 2012, p. 5) as the performance is not significant.

Interestingly, MSCI ESG Leaders indexes have managed to deliver better returns and on average lower volatility, contradicting *Modern Portfolio Theory*, thereby negating opponents to sustainable investment strategies as the lack of diversification is often their main argument, meaning that even though modern portfolio theory would argue that higher returns with lower risk should not be possible in a restricted investment universe, it seems as though the restriction is, in fact, not necessarily a hindrance to financial performance, as this study finds results similar to earlier research (Ibikunle & Steffen, 2017; Lean et al., 2015; Manuel Salazar et al.,

2019). The performance of the ESG indexes may also be placed in context with the research within academia on the number of assets needed to adequately diversify the unsystematic risk, as some argue that 90 percent of the benefit from diversification will be gained by having 12-18 assets (Reilly & Brown, 2000, p. 213). This implies that the need to be invested into the whole market may be a myth, however, further research could possibly yield more insight regarding this specific question.

Alongside the MPT, the positive selection criteria *best-in-class* strategy, may also result in a narrow investment universe, and thereby making it harder to reduce risk. As discussed in their report, a positive selection strategy will limit the possible investment universe to a larger degree than a negative selection strategy (Gjølberg & Johnsen, 2008, p. 7). Once again, the alleged financial truth does not hold, at least not as it is related to the timeframe and question at hand.

However, looking through the value creating view, it may be the case that the MSCI ESG Leaders investments are less exposed to risk, due to the possible reduction in litigation risk and other reputational risks that may affect a firms financial performance (Manuel Salazar et al., 2019, p. 298). Also, the increasing demand for ESG related investment assets might have pushed the prices upwards and contributed to lower volatility.

Given the large amount of rational profit maximizing, investors that participate in the market, and the assumption that the financial market is generally thought of as efficient, no strategy should be able to obtain consistently better returns, and thereby offer a possibility of arbitrage (Cortez et al., 2009, p. 574). The MSCI ESG Leaders do manage to deliver better performance, but it is not that much better as to question the efficiency of the market. However, one might imagine the advantage of an ESG investment strategy to be less efficient as markets gain knowledge about the approach, possibly leading any advantage to vanish (Bodie et al., 2013, p. 238). Maybe there is increased efficiency that might be observed through the numbers of this paper, as the return and volatility for the subperiod have become increasingly more similar, meaning, that as there was a small, but still some, advantage to invest into the MSCI ESG Leaders indexes in the whole period, the subperiod depicts a smaller advantage, alongside an

increasing demand for ESG related assets. The analysis reveals a lower tracking error and a higher correlation for the subperiod; however, further research would be of interest to shed some more light on this.

As to the question of integrating ESG into a long-term financial plan, referring here to the DOLs concerns regarding the increasing investment amount into ESG related assets, and the possible risk that may be arising from considering non-financial information, the concern does not seem justifiable. As mentioned, the MSCI ESG Leaders indexes manages to deliver high returns without taking on additional risk. The research generally portrays results that lead to the approval of the rule-based investment approach that MSCI refers to and causes no immediate concern for the long-term investor by investing into ESG. While, for the index pair (9A and B) the adherence to MSCIs rule based investing (MSCI, 2019b) seems hard to trust, as the beata value for the regression deviates considerably for both the entire time frame and the subperiod, and the correlation is low and the tracking error extreme. This leaves reasons to question whether the MSCI ESG CHINA Leaders and MSCI CHINA do in fact follow the rule-based approaches that MSCI claims, thereby leaving DOL with some justifiable concerns, all while knowing this study is within the MSCI universe and the large deviation seems prominent for only one index pair.

However, this does not in any way mean that MSCI ESG Leaders indexes will continue to deliver results in line with the findings of this paper, as one should know by the phrase "past performance is no guarantee of future results". It might be of interest to evaluate the performance of the ESG indexes, and more closely examine the inflow and turnover of funds, as to search for more answers regarding the ESG strategy. Further research investigating ESG assets under other types of methodologies would be of interest, an analysis that also adjusts for the flow of funds within an index might provide a better understanding of the possible advantage(s) of the strategy.

7.2   Conclusion

- *How does the MSCI ESG Leaders indexes perform compared to their respective reference indexes between 2010 and 2019?*

The findings from this comparative financial performance analysis of 62 MSCI indexes, 31 MSCI ESG Leaders indexes and 31 parent indexes, reveals that the MSCI ESG Leaders indexes have managed to deliver better risk adjusted returns than their parent indexes in the period 2010-2019. This is observed on a general basis, though on average with higher returns and lower volatility, as these measures naturally lead to favorable financial performance ratio calculations like, Sharpe Ratio calculations and a higher Information Ratio. However, the results also show that there is not a statistically significant difference between the ESG indexes and their parent indexes, even though the majority of the MSCI ESG Leaders indexes have delivered marginally better results. Only one index manages to deliver an alpha value at 1 percent significance level.

- **Are there changes in the performance when evaluating the subperiod 2016-2019?**

The finding shows that between 2016 and 2019 the MSCI ESG Leaders indexes did manage to deliver better performance. The returns are higher, the same is true of the standard deviation. The differences between the matched pairs have declined, which is also noticeable when taking a closer look at the parameters Sharpe Ratio, Information Ratio, Tracking Error and Correlation. No significant alpha value at the 1 percent significance level were found. In both periods the linear regression reveals that only one index pair does not seem to be following the same investment objective, namely index pair 9.

- **What does the Carhart four-factor model reveal about the investment approach and may the MSCI ESG Leaders indexes be following a factor strategy?**

By running multiple regressions, and applying the Carhart four-factor model, the result uncovers that some indexes are exposed to or employ a factor strategy. However, no index has

statistically significant values within more than one factor (SMB, HML and MOM). This summary only relates to the most statistically significant findings.

The index 12B does manage to deliver a positive alpha value at the 1 percent significance, and at the 5 percent level indexes 4B, 15B and 24B also deliver a positive alpha.

One index is heavily negatively tilted (large cap) with regard to the factor SMB, three within the factor HML, two positive (value) and one negative (growth). As for the last factor MOM four are significant, one (contrarian) three (momentum).

For the majority of the MSCI ESG Leaders indexes no significant factor strategy is uncovered.

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Tables

Table 1. List of Indexes, Strategy and Time Period

<div align="center">MSCI Indexes, Strategy and Time Period</div>

#	PARENT INDEXES	#	ESG LEADERS INDEXES	STRATEGY	TIME PERIOD
1A	MSCI AC WORLD	1B	MSCI ACWI ESG LEADERS	Best-in-class	2010-01-2019-12
2A	MSCI AC WORLD EX AU	2B	MSCI WORLD ex AU ESG LEADERS	Best-in-class	2010-01-2019-12
3A	MSCI AC WORLD EX EMU	3B	MSCI WORLD ex EMU ESG LEADERS	Best-in-class	2010-01-2019-12
4A	MSCI AC WORLD EX EUROPE	4B	MSCI WORLD ex EUROP ESG LEADERS	Best-in-class	2010-01-2019-12
5A	MSCI AC WORLD EX UK	5B	MSCI WORLD ex UK ESG LEADERS	Best-in-class	2010-01-2019-12
6A	MSCI AC WORLD EX US	6B	MSCI WORLD ex USA ESG LEADERS	Best-in-class	2010-01-2019-12
7A	MSCI AUSTRALIA	7B	MSCI AUSTRALIA ESG LEADERS	Best-in-class	2010-01-2019-12
8A	MSCI CANADA	8B	MSCI CANADA ESG LEADERS	Best-in-class	2010-01-2019-12
9A	MSCI CHINA	9B	MSCI CHINA ESG LEADERS	Best-in-class	2010-01-2019-12
10A	MSCI EAFE	10B	MSCI EAFE ESG LEADERS	Best-in-class	2010-01-2019-12
11A	MSCI EAFE EX UK	11B	MSCI EAFE ex UK ESG LEADERS	Best-in-class	2010-01-2019-12
12A	MSCI EM	12B	MSCI EMERGING MKTS ESG LEADERS	Best-in-class	2010-01-2019-12
13A	MSCI EMU	13B	MSCI EMU ESG LEADERS	Best-in-class	2010-01-2019-12
14A	MSCI EUROPE	14B	MSCI EUROPE ESG LEADERS	Best-in-class	2010-01-2019-12
15A	MSCI EUROPE EX UK	15B	MSCI EUROPE ex UK ESG LEADERS	Best-in-class	2010-01-2019-12
16A	MSCI FAR EAST	16B	MSCI FAR EAST ESG LEADERS	Best-in-class	2010-01-2019-12
17A	MSCI INDIA	17B	MSCI INDIA ESG LEADERS	Best-in-class	2010-01-2019-12
18A	MSCI JAPAN	18B	MSCI JAPAN ESG LEADERS	Best-in-class	2010-01-2019-12
19A	MSCI KOKUSAI ALL CAP	19B	MSCI KOKUSAI ESG LEADERS	Best-in-class	2010-01-2019-12
20A	MSCI NORTH AMERICA	20B	MSCI NORTH AMERICA ESG LEADERS	Best-in-class	2010-01-2019-12
21A	MSCI PACIFIC	21B	MSCI PACIFIC ESG LEADERS	Best-in-class	2010-01-2019-12
22A	MSCI PACIFIC EX JP	22B	MSCI PACIFIC ex JP ESG LEADERS	Best-in-class	2010-01-2019-12
23A	MSCI RUSSIA	23B	MSCI RUSSIA ESG LEADERS	Best-in-class	2010-01-2019-12
24A	MSCI SOUTH AFRICA	24B	MSCI SOUTH AFRICA ESG LEADERS	Best-in-class	2010-01-2019-12
25A	MSCI UK	25B	MSCI UK ESG LEADERS	Best-in-class	2010-01-2019-12
26A	MSCI US BROAD MARKET INDEX	26B	MSCI USA BROAD ESG LEADERS	Best-in-class	2010-01-2019-12
27A	MSCI USA	27B	MSCI USA ESG LEADERS	Best-in-class	2010-01-2019-12
28A	MSCI USA :L	28B	MSCI USA :L ESG LEADERS	Best-in-class	2010-01-2019-12
29A	MSCI USA :M	29B	MSCI USA :M ESG LEADERS	Best-in-class	2010-01-2019-12
30A	MSCI USA :S	30B	MSCI USA :S ESG LEADERS	Best-in-class	2010-01-2019-12
31A	MSCI WORLD	31B	MSCI WORLD ESG LEADERS	Best-in-class	2010-01-2019-12

Numbering of the indexes (1st and 3rd column) is for ease of comparison - 1A (parent) corresponds to 1B (ESG) and so on

Table 2. Returns, Excess Returns, Standard Deviation and Differential Returns 2010-2019

Returns, Excess Returns, Standard Deviation and Differential Returns 2010-2019

#	MSCI PARENT INDEXES	Returns (Parent)	Excess returns (Parent)	Std. Dev. (Parent)	#	MSCI ESG LEADERS INDEXES	Returns (ESG)	Excess returns (ESG)	Std. Dev. (ESG)	Differential returns	T-Value*
1A	MSCI AC WORLD	0.09	0.08	0.13	1B	MSCI ACWI ESG LEADERS	0.09	0.09	0.14	0.09	1.01
2A	MSCI AC WORLD EX AU	0.09	0.09	0.14	2B	MSCI WORLD ex AU ESG LEADERS	0.10	0.09	0.14	0.01	0.06
3A	MSCI AC WORLD EX EMU	0.09	0.09	0.14	3B	MSCI WORLD ex EMU ESG LEADERS	0.10	0.09	0.27	0.01	0.06
4A	MSCI AC WORLD EX EUROPE	0.10	0.09	0.14	4B	MSCI WORLD ex EUROP ESG LEADERS	0.11	0.10	0.13	0.01	0.07
5A	MSCI AC WORLD EX UK	0.09	0.09	0.14	5B	MSCI WORLD ex UK ESG LEADERS	0.10	0.09	0.14	0.01	0.07
6A	MSCI AC WORLD EX US	0.05	0.06	0.16	6B	MSCI WORLD ex USA ESG LEADERS	0.06	0.06	0.15	0.00	0.00
7A	MSCI AUSTRALIA	0.05	0.05	0.19	7B	MSCI AUSTRALIA ESG LEADERS	0.06	0.05	0.19	0.00	0.05
8A	MSCI CANADA	0.04	0.04	0.16	8B	MSCI CANADA ESG LEADERS	0.06	0.05	0.16	0.02	0.18
9A	MSCI CHINA	0.04	0.04	0.24	9B	MSCI CHINA ESG LEADERS	0.11	0.10	0.21	0.06	0.70
10A	MSCI EAFE	0.06	0.05	0.15	10B	MSCI EAFE ESG LEADERS	0.06	0.06	0.15	0.01	0.06
11A	MSCI EAFE EX UK	0.06	0.05	0.15	11B	MSCI EAFE ex UK ESG LEADERS	0.07	0.06	0.15	0.01	0.08
12A	MSCI EM	0.04	0.04	0.18	12B	MSCI EMERGING MKTS ESG LEADERS	0.07	0.07	0.18	0.03	0.37
13A	MSCI EMU	0.05	0.04	0.20	13B	MSCI EMU ESG LEADERS	0.06	0.05	0.19	0.01	0.11
14A	MSCI EUROPE	0.06	0.05	0.16	14B	MSCI EUROPE ESG LEADERS	0.06	0.06	0.17	0.01	0.08
15A	MSCI EUROPE EX UK	0.06	0.05	0.18	15B	MSCI EUROPE ex UK ESG LEADERS	0.07	0.06	0.18	0.01	0.11
16A	MSCI FAR EAST	0.06	0.06	0.14	16B	MSCI FAR EAST ESG LEADERS	0.07	0.06	0.14	0.00	0.02
17A	MSCI INDIA	0.04	0.03	0.23	17B	MSCI INDIA ESG LEADERS	0.07	0.07	0.21	0.03	0.38
18A	MSCI JAPAN	0.06	0.06	0.14	18B	MSCI JAPAN ESG LEADERS	0.07	0.07	0.14	0.00	0.04
19A	MSCI KOKUSAI ALL CAP	0.10	0.09	0.14	19B	MSCI KOKUSAI ESG LEADERS	0.10	0.09	0.14	0.00	-0.02
20A	MSCI NORTH AMERICA	0.12	0.11	0.14	20B	MSCI NORTH AMERICA ESG LEADERS	0.11	0.11	0.13	-0.01	-0.06
21A	MSCI PACIFIC	0.06	0.06	0.14	21B	MSCI PACIFIC ESG LEADERS	0.06	0.06	0.14	0.00	0.01
22A	MSCI PACIFIC EX JP	0.06	0.06	0.17	22B	MSCI PACIFIC ex JP ESG LEADERS	0.06	0.06	0.18	0.00	0.00
23A	MSCI RUSSIA	0.04	0.04	0.26	23B	MSCI RUSSIA ESG LEADERS	0.09	0.08	0.26	0.04	0.48
24A	MSCI SOUTH AFRICA	0.03	0.03	0.24	24B	MSCI SOUTH AFRICA ESG LEADERS	0.07	0.06	0.25	0.04	0.39
25A	MSCI UK	0.05	0.05	0.16	25B	MSCI UK ESG LEADERS	0.05	0.04	0.16	0.00	-0.05
26A	MSCI US BROAD MARKET INDEX	0.13	0.12	0.14	26B	MSCI USA BROAD ESG LEADERS	0.12	0.11	0.14	-0.01	-0.06
27A	MSCI USA	0.13	0.12	0.14	27B	MSCI USA ESG LEADERS	0.12	0.11	0.13	-0.01	-0.07
28A	MSCI USA :L	0.13	0.12	0.13	28B	MSCI USA :L ESG LEADERS	0.12	0.11	0.13	-0.01	-0.07
29A	MSCI USA :M	0.12	0.12	0.15	29B	MSCI USA :M ESG LEADERS	0.12	0.11	0.15	-0.01	-0.06
30A	MSCI USA :S	0.12	0.11	0.17	30B	MSCI USA :S ESG LEADERS	0.12	0.11	0.17	0.00	-0.01
31A	MSCI WORLD	0.10	0.09	0.13	31B	MSCI WORLD ESG LEADERS	0.09	0.09	0.14	0.00	-0.02

Returns, Excess Returns, Standard Deviation and Differential Returns 2016-2019

Table 3. Returns, Excess Returns, Standard Deviation and Differential Returns 2016-2019

#	MSCI PARENT INDEXES	Returns (Parent)	Excess return (Parent)	Std. Dev. (Parent)	#	MSCI ESG LEADERS INDEXES	Returns (ESG)	Excess return (ESG)	Std. Dev. (ESG)	Differential returns	T-Value*
1A	MSCI AC WORLD	0.11	0.09	0.11	1B	MSCI ACWI ESG LEADERS	0.11	0.10	0.11	0.01	0.06
2A	MSCI AC WORLD EX AU	0.12	0.10	0.13	2B	MSCI WORLD ex AU ESG LEADERS	0.12	0.11	0.13	0.00	0.01
3A	MSCI AC WORLD EX EMU	0.12	0.10	0.13	3B	MSCI WORLD ex EMU ESG LEADERS	0.09	0.08	0.13	-0.02	-0.27
4A	MSCI AC WORLD EX EUROPE	0.12	0.11	0.13	4B	MSCI WORLD ex EUROP ESG LEADERS	0.12	0.11	0.13	0.00	0.03
5A	MSCI AC WORLD EX UK	0.12	0.10	0.13	5B	MSCI WORLD ex UK ESG LEADERS	0.12	0.10	0.13	0.00	0.02
6A	MSCI AC WORLD EX US	0.09	0.07	0.13	6B	MSCI WORLD ex USA ESG LEADERS	0.08	0.07	0.13	-0.01	-0.08
7A	MSCI AUSTRALIA	0.10	0.09	0.14	7B	MSCI AUSTRALIA ESG LEADERS	0.08	0.06	0.14	-0.03	-0.28
8A	MSCI CANADA	0.10	0.09	0.14	8B	MSCI CANADA ESG LEADERS	0.11	0.10	0.14	0.01	0.06
9A	MSCI CHINA	0.08	0.06	0.25	9B	MSCI CHINA ESG LEADERS	0.14	0.12	0.24	0.06	0.66
10A	MSCI EAFE	0.07	0.06	0.13	10B	MSCI EAFE ESG LEADERS	0.07	0.06	0.13	0.00	0.00
11A	MSCI EAFE EX UK	0.08	0.06	0.13	11B	MSCI EAFE ex UK ESG LEADERS	0.08	0.07	0.13	0.00	0.04
12A	MSCI EM	0.10	0.09	0.17	12B	MSCI EMERGING MKTS ESG LEADERS	0.12	0.10	0.18	0.01	0.16
13A	MSCI EMU	0.06	0.05	0.16	13B	MSCI EMU ESG LEADERS	0.08	0.07	0.15	0.02	0.17
14A	MSCI EUROPE	0.06	0.05	0.12	14B	MSCI EUROPE ESG LEADERS	0.06	0.06	0.14	0.00	0.02
15A	MSCI EUROPE EX UK	0.08	0.06	0.15	15B	MSCI EUROPE ex UK ESG LEADERS	0.08	0.07	0.14	0.01	0.08
16A	MSCI FAR EAST	0.07	0.06	0.12	16B	MSCI FAR EAST ESG LEADERS	0.07	0.06	0.12	0.00	0.00
17A	MSCI INDIA	0.08	0.07	0.18	17B	MSCI INDIA ESG LEADERS	0.10	0.09	0.17	0.02	0.21
18A	MSCI JAPAN	0.07	0.06	0.12	18B	MSCI JAPAN ESG LEADERS	0.07	0.06	0.13	0.00	0.02
19A	MSCI KOKUSAI ALL CAP	0.11	0.09	0.13	19B	MSCI KOKUSAI ESG LEADERS	0.11	0.10	0.13	0.00	0.02
20A	MSCI NORTH AMERICA	0.13	0.11	0.13	20B	MSCI NORTH AMERICA ESG LEADERS	0.13	0.11	0.13	0.00	0.01
21A	MSCI PACIFIC	0.08	0.07	0.12	21B	MSCI PACIFIC ESG LEADERS	0.07	0.06	0.12	0.00	-0.05
22A	MSCI PACIFIC EX JP	0.10	0.08	0.14	22B	MSCI PACIFIC ex JP ESG LEADERS	0.08	0.07	0.14	-0.02	-0.17
23A	MSCI RUSSIA	0.20	0.19	0.20	23B	MSCI RUSSIA ESG LEADERS	0.24	0.23	0.20	0.04	0.47
24A	MSCI SOUTH AFRICA	0.05	0.03	0.27	24B	MSCI SOUTH AFRICA ESG LEADERS	0.07	0.06	0.28	0.02	0.25
25A	MSCI UK	0.05	0.04	0.14	25B	MSCI UK ESG LEADERS	0.02	0.01	0.16	-0.02	-0.27
26A	MSCI US AROAD MARKET INDEX	0.12	0.11	0.14	26B	MSCI USA AROAD ESG LEADERS	0.12	0.11	0.14	0.00	0.01
27A	MSCI USA	0.13	0.12	0.13	27B	MSCI USA ESG LEADERS	0.13	0.12	0.13	0.00	0.02
28A	MSCI USA :L	0.13	0.12	0.13	28B	MSCI USA :L ESG LEADERS	0.13	0.12	0.13	0.00	0.03
29A	MSCI USA :M	0.11	0.09	0.16	29B	MSCI USA :M ESG LEADERS	0.10	0.09	0.16	0.00	-0.03
30A	MSCI USA :S	0.11	0.09	0.17	30B	MSCI USA :S ESG LEADERS	0.10	0.09	0.17	0.00	-0.02
31A	MSCI WORLD	0.11	0.09	0.11	31B	MSCI WORLD ESG LEADERS	0.11	0.09	0.13	0.00	0.00

Table 4. Sharpe Ratio, Information Ratio and Tracking Error 2010-2019

Sharpe Ratio, Information Ratio and Tracking Error 2010-2019

#	MSCI PARENT INDEXES	SR (PARENT)	#	MSCI ESG LEADERS INDEXES	SR (ESG)	IR	T-Value (IR)	TE
1A	MSCI AC WORLD	2.16	1B	MSCI ACWI ESG LEADERS	2.18	0.27	0.92	0.06
2A	MSCI AC WORLD EX AU	2.15	2B	MSCI WORLD ex AU ESG LEADERS	2.37	1.18	4.09	0.02
3A	MSCI AC WORLD EX EMU	2.25	3B	MSCI WORLD ex EMU ESG LEADERS	1.23	0.09	0.30	0.22
4A	MSCI AC WORLD EX EUROPE	2.38	4B	MSCI WORLD ex EUROP ESG LEADERS	2.65	1.13	3.90	0.02
5A	MSCI AC WORLD EX UK	2.12	5B	MSCI WORLD ex UK ESG LEADERS	2.35	1.32	4.56	0.02
6A	MSCI AC WORLD EX US	1.06	6B	MSCI WORLD ex USA ESG LEADERS	1.33	1.39	4.83	0.02
7A	MSCI AUSTRALIA	0.90	7B	MSCI AUSTRALIA ESG LEADERS	0.96	0.49	1.69	0.03
8A	MSCI CANADA	0.78	8B	MSCI CANADA ESG LEADERS	1.11	2.25	7.81	0.02
9A	MSCI CHINA	0.55	9B	MSCI CHINA ESG LEADERS	1.68	0.67	2.33	0.33
10A	MSCI EAFE	1.19	10B	MSCI EAFE ESG LEADERS	1.33	1.46	5.04	0.01
11A	MSCI EAFE EX UK	1.21	11B	MSCI EAFE ex UK ESG LEADERS	1.39	2.10	7.28	0.01
12A	MSCI EM	0.66	12B	MSCI EMERGING MKTS ESG LEADERS	1.33	4.29	14.86	0.03
13A	MSCI EMU	0.73	13B	MSCI EMU ESG LEADERS	0.93	1.88	6.52	0.02
14A	MSCI EUROPE	1.08	14B	MSCI EUROPE ESG LEADERS	1.22	0.35	1.20	0.08
15A	MSCI EUROPE EX UK	1.02	15B	MSCI EUROPE ex UK ESG LEADERS	1.24	2.20	7.64	0.02
16A	MSCI FAR EAST	1.49	16B	MSCI FAR EAST ESG LEADERS	1.51	0.34	1.18	0.02
17A	MSCI INDIA	0.51	17B	MSCI INDIA ESG LEADERS	1.12	2.21	7.65	0.05
18A	MSCI JAPAN	1.44	18B	MSCI JAPAN ESG LEADERS	1.50	0.77	2.66	0.01
19A	MSCI KOKUSAI ALL CAP	2.25	19B	MSCI KOKUSAI ESG LEADERS	2.29	-0.43	-1.49	0.01
20A	MSCI NORTH AMERICA	2.93	20B	MSCI NORTH AMERICA ESG LEADERS	2.82	-1.32	-4.57	0.02
21A	MSCI PACIFIC	1.53	21B	MSCI PACIFIC ESG LEADERS	1.53	0.23	0.79	0.02
22A	MSCI PACIFIC EX JP	1.11	22B	MSCI PACIFIC ex JP ESG LEADERS	1.07	0.00	0.01	0.04
23A	MSCI RUSSIA	0.51	23B	MSCI RUSSIA ESG LEADERS	1.08	0.94	3.26	0.16
24A	MSCI SOUTH AFRICA	0.41	24B	MSCI SOUTH AFRICA ESG LEADERS	0.89	2.94	10.18	0.04
25A	MSCI UK	0.99	25B	MSCI UK ESG LEADERS	0.91	-0.38	-1.32	0.04
26A	MSCI US BROAD MARKET INDEX	3.00	26B	MSCI USA BROAD ESG LEADERS	2.91	-1.28	-4.42	0.01
27A	MSCI USA	0.42	27B	MSCI USA ESG LEADERS	0.40	-1.25	-4.34	0.02
28A	MSCI USA :L	3.13	28B	MSCI USA :L ESG LEADERS	3.05	-1.13	-3.90	0.02
29A	MSCI USA :M	2.72	29B	MSCI USA :M ESG LEADERS	2.58	-1.04	-3.61	0.02
30A	MSCI USA :S	2.38	30B	MSCI USA :S ESG LEADERS	2.34	-0.33	-1.16	0.01
31A	MSCI WORLD	2.41	31B	MSCI WORLD ESG LEADERS	2.24	-0.10	-0.35	0.06

Annualized numbers

Table 5. Sharpe Ratio, Information Ratio and Tracking Error 2016-2019

Sharpe Ratio, Information Ratio and Tracking Error 2016-2019

#	MSCI PARENT INDEXES	SR (PARENT)	#	MSCI ESG LEADERS INDEXES	SR (ESG)	IR	T-Value (IR)	TE
1A	MSCI AC WORLD	2.92	1B	MSCI ACWI ESG LEADERS	2.70	0.25	0.85	0.05
2A	MSCI AC WORLD EX AU	2.81	2B	MSCI WORLD EX AU ESG LEADERS	2.90	0.27	0.95	0.02
3A	MSCI AC WORLD EX EMU	2.76	3B	MSCI WORLD ex EMU ESG LEADERS	2.79	-0.09	-0.32	0.02
4A	MSCI AC WORLD EX EUROPE	2.89	4B	MSCI WORLD ex EUROP ESG LEADERS	3.02	0.53	1.84	0.02
5A	MSCI AC WORLD EX UK	2.67	5B	MSCI WORLD ex UK ESG LEADERS	2.80	0.52	1.79	0.02
6A	MSCI AC WORLD EX US	1.86	6B	MSCI WORLD ex USA ESG LEADERS	1.75	-1.02	-3.52	0.03
7A	MSCI AUSTRALIA	2.17	7B	MSCI AUSTRALIA ESG LEADERS	1.49	-2.71	-9.39	0.03
8A	MSCI CANADA	2.30	8B	MSCI CANADA ESG LEADERS	2.39	1.09	3.77	0.02
9A	MSCI CHINA	0.85	9B	MSCI CHINA ESG LEADERS	1.79	0.59	2.03	0.36
10A	MSCI EAFE	1.54	10B	MSCI EAFE ESG LEADERS	1.55	0.03	0.10	0.01
11A	MSCI EAFE EX UK	1.69	11B	MSCI EAFE ex UK ESG LEADERS	1.82	1.15	3.97	0.01
12A	MSCI EM	1.80	12B	MSCI EMERGING MKTS ESG LEADERS	2.04	2.11	7.30	0.02
13A	MSCI EMU	1.15	13B	MSCI EMU ESG LEADERS	1.54	3.16	10.94	0.02
14A	MSCI EUROPE	1.52	14B	MSCI EUROPE ESG LEADERS	1.36	0.15	0.50	0.08
15A	MSCI EUROPE EX UK	1.50	15B	MSCI EUROPE ex UK ESG LEADERS	1.72	1.60	5.55	0.02
16A	MSCI FAR EAST	1.66	16B	MSCI FAR EAST ESG LEADERS	1.64	-0.04	-0.13	0.01
17A	MSCI INDIA	1.33	17B	MSCI INDIA ESG LEADERS	1.81	1.82	6.29	0.04
18A	MSCI JAPAN	1.60	18B	MSCI JAPAN ESG LEADERS	1.60	0.49	1.69	0.01
19A	MSCI KOKUSAI ALL CAP	2.49	19B	MSCI KOKUSAI ESG LEADERS	2.62	0.55	1.92	0.01
20A	MSCI NORTH AMERICA	2.96	20B	MSCI NORTH AMERICA ESG LEADERS	3.00	0.19	0.65	0.02
21A	MSCI PACIFIC	1.87	21B	MSCI PACIFIC ESG LEADERS	1.75	-0.99	-3.43	0.02
22A	MSCI PACIFIC EX JP	2.10	22B	MSCI PACIFIC ex JP ESG LEADERS	1.78	-1.81	-6.26	0.03
23A	MSCI RUSSIA	3.36	23B	MSCI RUSSIA ESG LEADERS	3.97	1.28	4.42	0.12
24A	MSCI SOUTH AFRICA	0.43	24B	MSCI SOUTH AFRICA ESG LEADERS	0.68	2.43	8.43	0.03
25A	MSCI UK	0.87	25B	MSCI UK ESG LEADERS	0.26	-1.77	-6.14	0.05
26A	MSCI US BROAD MARKET INDEX	2.81	26B	MSCI USA BROAD ESG LEADERS	2.86	0.27	0.95	0.01
27A	MSCI USA	3.15	27B	MSCI USA ESG LEADERS	3.21	0.19	0.66	0.02
28A	MSCI USA :L	3.17	28B	MSCI USA :L ESG LEADERS	3.28	0.28	0.97	0.02
29A	MSCI USA :M	2.08	29B	MSCI USA :M ESG LEADERS	2.03	-0.47	-1.64	0.02
30A	MSCI USA :S	1.84	30B	MSCI USA :S ESG LEADERS	1.80	-0.54	-1.88	0.01
31A	MSCI WORLD	2.90	31B	MSCI WORLD ESG LEADERS	2.56	0.03	0.11	0.01

Annualized numbers

Table 6. Alpha, Beta and R-Squared 2010-2019

Alpha, Beta and R-Squared 2010-2019

	ESG LEADERS INDEX	α	β	R^2
1B	MSCI ACWI ESG LEADERS	0.0077	0.9495**	0.8156
		(0.0016)	(0.0412)	
2B	MSCI WORLD ex AU ESG LEADERS	0.0095*	0.9587**	0.9881
		(0.0004)	(0.0097)	
3B	MSCI WORLD ex EMU ESG LEADERS	0.0000	1.0577**	0.2985
		(0.0060)	(0.1493)	
4B	MSCI WORLD ex EUROP ESG LEADERS	0.0115	0.9501**	0.9790
		(0.0005)	(0.0128)	
5B	MSCI WORLD ex UK ESG LEADERS	0.0095	0.9627**	0.9876
		(0.0004)	(0.0099)	
6B	MSCI WORLD ex USA ESG LEADERS	0.0124	0.9511**	0.9757
		(0.0006)	(0.0138)	
7B	MSCI AUSTRALIA ESG LEADERS	0.0033	1.0143**	0.9759
		(0.0008)	(0.0147)	
8B	MSCI CANADA ESG LEADERS	0.0147	0.9999**	0.9775
		(0.0006)	(0.0140)	
9B	MSCI CHINA ESG LEADERS	0.1115	-0.0946	0.0113
		(0.0055)	(0.0816)	
10B	MSCI EAFE ESG LEADERS	0.0065	0.9847**	0.9924
		(0.0004)	(0.0079)	
11B	MSCI EAFE ex UK ESG LEADERS	0.0083*	0.9882**	0.9934
		(0.0003)	(0.0074)	
12B	MSCI EMERGING MKTS ESG LEADERS	0.0352**	0.9652**	0.9782
		(0.0007)	(0.0133)	
13B	MSCI EMU ESG LEADERS	0.0114	0.9788**	0.9905
		(0.0005)	(0.0088)	
14B	MSCI EUROPE ESG LEADERS	0.0130	0.9067**	0.7907
		(0.0020)	(0.0429)	
15B	MSCI EUROPE ex UK ESG LEADERS	0.0114*	0.9809**	0.9920
		(0.0004)	(0.0081)	
16B	MSCI FAR EAST ESG LEADERS	0.0009	1.0119**	0.9858
		(0.0004)	(0.0112)	
17B	MSCI INDIA ESG LEADERS	0.0385*	0.8976**	0.9489
		(0.0013)	(0.0197)	
18B	MSCI JAPAN ESG LEADERS	0.0026	1.0112**	0.9891
		(0.0004)	(0.0098)	
19B	MSCI KOKUSAI ESG LEADERS	0.0020	0.9636**	0.9922
		(0.0003)	(0.0078)	
20B	MSCI NORTH AMERICA ESG LEADERS	-0.0035	0.9813**	0.9875
		(0.0004)	(0.0102)	
21B	MSCI PACIFIC ESG LEADERS	-0.0001	1.0097**	0.9859
		(0.0005)	(0.0111)	
22B	MSCI PACIFIC ex JP ESG LEADERS	-0.0004	1.0078**	0.9552
		(0.0010)	(0.0201)	
23B	MSCI RUSSIA ESG LEADERS	0.0472	0.8151**	0.6579
		(0.0041)	(0.0541)	
24B	MSCI SOUTH AFRICA ESG LEADERS	0.0346**	1.0268**	0.9720
		(0.0011)	(0.0160)	
25B	MSCI UK ESG LEADERS	-0.0018	0.9475**	0.9336
		(0.0011)	(0.0233)	
26B	MSCI USA BROAD ESG LEADERS	-0.0028	0.9800**	0.9890
		(0.0004)	(0.0095)	
27B	MSCI USA ESG LEADERS	-0.0028	0.9743**	0.9848
		(0.0004)	(0.0112)	
28B	MSCI USA :L ESG LEADERS	-0.0016	0.9629**	0.9787
		(0.0005)	(0.0130)	
29B	MSCI USA :M ESG LEADERS	-0.0051	0.9985**	0.9863
		(0.0005)	(0.0108)	
30B	MSCI USA :S ESG LEADERS	-0.0018	1.0042**	0.9941
		(0.0004)	(0.0071)	
31B	MSCI WORLD ESG LEADERS	0.0026	0.9550**	0.8145
		(0.0016)	(0.0420)	
Annualized alphas		*p<0.05		**p<0.01

Table 7. Alpha, Beta and R-Squared 2016-2019

Alpha, Beta and R-Squared 2016-2019

	ESG LEADERS INDEX	α	β	R^2
1B	MSCI ACWI ESG LEADERS	-0.0010 (0.0020)	1.0654** (0.0602)	0.8695
2B	MSCI WORLD ex AU ESG LEADERS	0.0038* (0.0006)	0.9737** (0.0168)	0.9861
3B	MSCI WORLD ex EMU ESG LEADERS	0.0020 (0.0086)	0.9759** (0.0190)	0.9828
4B	MSCI WORLD ex EUROP ESG LEADERS	0.0037 (0.0008)	0.9682** (0.0208)	0.9788
5B	MSCI WORLD ex UK ESG LEADERS	0.0054 (0.0006)	0.9696** (0.0168)	0.9864
6B	MSCI WORLD ex USA ESG LEADERS	-0.0028 (0.0011)	0.9328** (0.0270)	0.9629
7B	MSCI AUSTRALIA ESG LEADERS	-0.0261 (0.0012)	0.9996** (0.0308)	0.9583
8B	MSCI CANADA ESG LEADERS	0.0050 (0.0009)	1.0004** (0.0216)	0.9790
9B	MSCI CHINA ESG LEADERS	0.1316 (0.0101)	-0.0606 (0.1392)	0.0041
10B	MSCI EAFE ESG LEADERS	-0.0007 (0.0006)	0.9939** (0.0157)	0.9886
11B	MSCI EAFE ex UK ESG LEADERS	0.0039 (0.0005)	0.9842** (0.0134)	0.9916
12B	MSCI EMERGING MKTS ESG LEADERS	0.0111 (0.0010)	1.0153** (0.0200)	0.9824
13B	MSCI EMU ESG LEADERS	0.0189* (0.0007)	0.9675** (0.0155)	0.9883
14B	MSCI EUROPE ESG LEADERS	-0.0047 (0.0026)	1.0527** (0.0735)	0.8167
15B	MSCI EUROPE ex UK ESG LEADERS	0.0086* (0.0007)	0.9690** (0.0157)	0.9881
16B	MSCI FAR EAST ESG LEADERS	0.0014 (0.0006)	0.9997** (0.0165)	0.9876
17B	MSCI INDIA ESG LEADERS	0.0207 (0.0014)	0.9255** (0.0275)	0.9609
18B	MSCI JAPAN ESG LEADERS	0.0052 (0.0006)	0.9693** (0.0180)	0.9858
19B	MSCI KOKUSAI ESG LEADERS	0.0052 (0.0005)	0.9693** (0.0147)	0.9895
20B	MSCI NORTH AMERICA ESG LEADERS	0.0037 (0.0007)	0.9867** (0.0184)	0.9843
21B	MSCI PACIFIC ESG LEADERS	-0.0025 (0.0006)	0.9894** (0.0194)	0.0045
22B	MSCI PACIFIC ex JP ESG LEADERS	-0.0128 (0.0012)	0.9446** (0.0316)	0.9509
23B	MSCI RUSSIA ESG LEADERS	0.1237* (0.0049)	0.7576** (0.0872)	0.6215
24B	MSCI SOUTH AFRICA ESG LEADERS	0.0257 (0.0013)	1.0256** (0.0167)	0.9879
25B	MSCI UK ESG LEADERS	-0.0271 (0.0021)	1.0328** (0.0517)	0.8968
26B	MSCI USA BROAD ESG LEADERS	0.0035 (0.0006)	0.9879** (0.0166)	0.9872
27B	MSCI USA ESG LEADERS	0.0032* (0.0007)	0.9861** (0.0193)	0.9831
28B	MSCI USA :L ESG LEADERS	0.0062 (0.0008)	0.9785** (0.0204)	0.9800
29B	MSCI USA :M ESG LEADERS	-0.0088 (0.0008)	1.0047** (0.0198)	0.9825
30B	MSCI USA :S ESG LEADERS	-0.0031 (0.0055)	1.0064** (0.0097)	0.9957
31B	MSCI WORLD ESG LEADERS	0.0054 (0.0020)	1.0287** (0.0642)	0.8483
Annualized alphas		*p<0.05		**p<0.01

Table 8. Correlations Between the Index Pairs

Correlations Between the Index Pairs

#	PARENT INDEX	ESG LEADERS INDEX	2010-2019	2016-2019
1	MSCI AC WORLD	MSCI ACWI ESG LEADERS	0.9046	0.9331
2	MSCI AC WORLD EX AU	MSCI WORLD ex AU ESG LEADERS	0.9940	0.9929
3	MSCI AC WORLD EX EMU	MSCI WORLD ex EMU ESG LEADERS	0.5463	0.9914
4	MSCI AC WORLD EX EUROPE	MSCI WORLD ex EUROP ESG LEADERS	0.9894	0.9932
5	MSCI AC WORLD EX UK	MSCI WORLD ex UK ESG LEADERS	0.9938	0.9932
6	MSCI AC WORLD EX US	MSCI WORLD ex USA ESG LEADERS	0.9878	0.9813
7	MSCI AUSTRALIA	MSCI AUSTRALIA ESG LEADERS	0.9879	0.9777
8	MSCI CANADA	MSCI CANADA ESG LEADERS	0.9887	0.9886
9	MSCI CHINA	MSCI CHINA ESG LEADERS	-0.1055	-0.0588
10	MSCI EAFE	MSCI EAFE ESG LEADERS	0.9962	0.9942
11	MSCI EAFE EX UK	MSCI EAFE ex UK ESG LEADERS	0.9967	0.9956
12	MSCI EM	MSCI EMERGING MKTS ESG LEADERS	0.9890	0.9911
13	MSCI EMU	MSCI EMU ESG LEADERS	0.9952	0.9939
14	MSCI EUROPE	MSCI EUROPE ESG LEADERS	0.8892	0.9028
15	MSCI EUROPE EX UK	MSCI EUROPE ex UK ESG LEADERS	0.9960	0.9940
16	MSCI FAR EAST	MSCI FAR EAST ESG LEADERS	0.9929	0.9947
17	MSCI INDIA	MSCI INDIA ESG LEADERS	0.9728	0.9810
18	MSCI JAPAN	MSCI JAPAN ESG LEADERS	0.9945	0.9938
19	MSCI KOKUSAI ALL CAP	MSCI KOKUSAI ESG LEADERS	0.9961	0.9953
20	MSCI NORTH AMERICA	MSCI NORTH AMERICA ESG LEADERS	0.9937	0.9931
21	MSCI PACIFIC	MSCI PACIFIC ESG LEADERS	0.9929	0.9925
22	MSCI PACIFIC EX JP	MSCI PACIFIC ex JP ESG LEADERS	0.9774	0.9784
23	MSCI RUSSIA	MSCI RUSSIA ESG LEADERS	0.8111	0.7895
24	MSCI SOUTH AFRICA	MSCI SOUTH AFRICA ESG LEADERS	0.9859	0.9940
25	MSCI UK	MSCI UK ESG LEADERS	0.9662	0.9511
26	MSCI US BROAD MARKET INDEX	MSCI USA BROAD ESG LEADERS	0.9945	0.9944
27	MSCI USA	MSCI USA ESG LEADERS	0.9924	0.9926
28	MSCI USA :L	MSCI USA :L ESG LEADERS	0.9894	0.9900
29	MSCI USA :M	MSCI USA :M ESG LEADERS	0.9931	0.9919
30	MSCI USA :S	MSCI USA :S ESG LEADERS	0.9970	0.9981
31	MSCI WORLD	MSCI WORLD ESG LEADERS	0.9025	0.9290

Table 9. Carhart Four-Factor Model 2010-2019

Carhart Four-Factor Model 2010-2019

| ESG LEADERS INDEX	α	Parent index - RF	SMB	HML	MOM	Adj. R²
1B MSCI ACWI ESG LEADERS	0.0161	0.9119**	0.0222	-0.0524	-0.1656**	0.8260
	(0.0015)	(0.0426)	(0.0700)	(0.0729)	(0.0537)	
2B MSCI WORLD ex AU ESG LEADERS	0.0095	0.9567**	0.03002	0.00969	0.00937	0.9881
	(0.0004)	(0.0106)	(0.0180)	(0.0189)	(0.0143)	
3B MSCI WORLD ex EMU ESG LEADERS	-0.0008	1.0642**	-0.1019	-0.0874	-0.0496	0.2758
	(0.0062)	(0.1660)	(0.2755)	(0.2874)	(0.2176)	
4B MSCI WORLD ex EUROP ESG LEADERS	0.0121*	0.9445**	0.0528*	0.0421	0.0197	0.9800
	(0.0005)	(0.0137)	(0.0226)	(0.0235)	(0.0178)	
5B MSCI WORLD ex UK ESG LEADERS	0.0096	0.9603**	0.0380*	0.0224	0.0151	0.9879
	(0.0004)	(0.0107)	(0.0183)	(0.0191)	(0.0144)	
6B MSCI WORLD ex USA ESG LEADERS	0.0110	0.9565**	0.03098	0.00311	0.03081	0.9756
	(0.0006)	(0.0151)	(0.0281)	(0.0298)	(0.0228)	
7B MSCI AUSTRALIA ESG LEADERS	0.0011	1.0237**	0.0357	0.0341	0.0773**	0.9768
	(0.0008)	(0.0155)	(0.0358)	(0.0375)	(0.0280)	
8B MSCI CANADA ESG LEADERS	0.01529	1.0054**	-0.0600*	0.05912	0.01287	0.9781
	(0.0006)	(0.0162)	(0.0298)	(0.0307)	(0.0241)	
9B MSCI CHINA ESG LEADERS	0.1208	-0.0900	0.3370	-0.4640	-0.7311**	0.1237
	(0.0052)	(0.0778)	(0.2335)	(0.2519)	(0.1783)	
10B MSCI EAFE ESG LEADERS	0.0053	0.9882**	0.0055	-0.0219	0.0122	0.9924
	(0.0004)	(0.0086)	(0.0159)	(0.0168)	(0.0128)	
11B MSCI EAFE ex UK ESG LEADERS	0.0078	0.9888**	0.0142	-0.0119	0.0054	0.9933
	(0.0003)	(0.0080)	(0.0151)	(0.0160)	(0.0121)	
12B MSCI EMERGING MKTS ESG LEADERS	0.0320**	0.9765**	-0.0361	-0.0663*	0.0280	0.9793
	(0.0007)	(0.0141)	(0.0309)	(0.0331)	(0.0255)	
13B MSCI EMU ESG LEADERS	0.0106	0.9788**	0.0078	-0.0369	-0.0034	0.9904
	(0.0005)	(0.0094)	(0.0226)	(0.0241)	(0.0180)	
14B MSCI EUROPE ESG LEADERS	0.0167	0.8790**	0.0656	-0.1141	-0.1519*	0.7926
	(0.0020)	(0.0446)	(0.0907)	(0.0966)	(0.0713)	
15B MSCI EUROPE ex UK ESG LEADERS	0.0106*	0.9809**	0.0120	-0.0325	-0.0007	0.9919
	(0.0004)	(0.0086)	(0.0190)	(0.0203)	(0.0152)	
16B MSCI FAR EAST ESG LEADERS	0.0003	1.0164**	-0.0032	0.0082	0.0166	0.9854
	(0.0005)	(0.0122)	(0.0203)	(0.0215)	(0.0164)	
17B MSCI INDIA ESG LEADERS	0.0344*	0.8959**	0.0333	-0.1208	0.0230	0.9472
	(0.0013)	(0.0198)	(0.0575)	(0.0622)	(0.0447)	
18B MSCI JAPAN ESG LEADERS	0.0018	1.0129**	0.0212	-0.0246	0.0072	0.9891
	(0.0004)	(0.0105)	(0.0178)	(0.0190)	(0.0143)	
19B MSCI KOKUSAI ESG LEADERS	0.0009	0.9716**	-0.05888**	-0.0069	-0.0050	0.9931
	(0.0003)	(0.0081)	(0.0143)	(0.0148)	(0.0111)	
20B MSCI NORTH AMERICA ESG LEADERS	-0.0019	0.9737**	0.0213	0.0214	-0.0082	0.9875
	(0.0004)	(0.0111)	(0.0185)	(0.0190)	(0.0142)	
21B MSCI PACIFIC ESG LEADERS	-0.0011	1.0166**	0.0100	0.0192	0.0318	0.9859
	(0.0005)	(0.0121)	(0.0204)	(0.0215)	(0.0164)	
22B MSCI PACIFIC ex JP ESG LEADERS	-0.0008	1.0159**	0.0280	0.0991*	0.0665	0.9561
	(0.0010)	(0.0215)	(0.0454)	(0.0478)	(0.0361)	
23B MSCI RUSSIA ESG LEADERS	0.0562	0.7848**	-0.0362	0.0434	-0.2224	0.6544
	(0.0041)	(0.0581)	(0.1873)	(0.1979)	(0.1471)	
24B MSCI SOUTH AFRICA ESG LEADERS	0.0322*	1.0403**	-0.0075	0.0337	0.0829*	0.9721
	(0.0011)	(0.0173)	(0.0493)	(0.0527)	(0.0403)	
25B MSCI UK ESG LEADERS	-0.0035	0.9453**	-0.0279	-0.13243**	-0.0483	0.9356
	(0.0011)	(0.0249)	(0.0474)	(0.0502)	(0.0382)	
26B MSCI USA BROAD ESG LEADERS	-0.0013	0.9728**	0.0190	0.0197	-0.0076	0.9889
	(0.0004)	(0.0105)	(0.0180)	(0.0183)	(0.0135)	
27B MSCI USA ESG LEADERS	-0.0012	0.9663**	0.0292	0.0190	-0.0067	0.9848
	(0.0005)	(0.0121)	(0.0202)	(0.0208)	(0.0154)	
28B MSCI USA :L ESG LEADERS	-0.0006	0.9562**	0.0294	0.0006	-0.0090	0.9785
	(0.0005)	(0.0141)	(0.0233)	(0.0242)	(0.0179)	
29B MSCI USA :M ESG LEADERS	-0.0016	0.9912**	-0.0054	0.1122**	-0.0009	0.9894
	(0.0004)	(0.0110)	(0.0202)	(0.0197)	(0.0148)	
30B MSCI USA :S ESG LEADERS	-0.0003	1.0014**	-0.0033	0.0703**	0.01502	0.9948
	(0.0003)	(0.0085)	(0.0174)	(0.0154)	(0.0115)	
31B MSCI WORLD ESG LEADERS	0.0104	0.9180**	0.0402	-0.0413	-0.1578**	0.8223
	(0.0016)	(0.0436)	(0.0707)	(0.0736)	(0.0540)	
Annualized alphas		*p<0.05		**p<0.01		

Table 10. Scatterplot MSCI CHINA and MSCI ESG CHINA Leaders
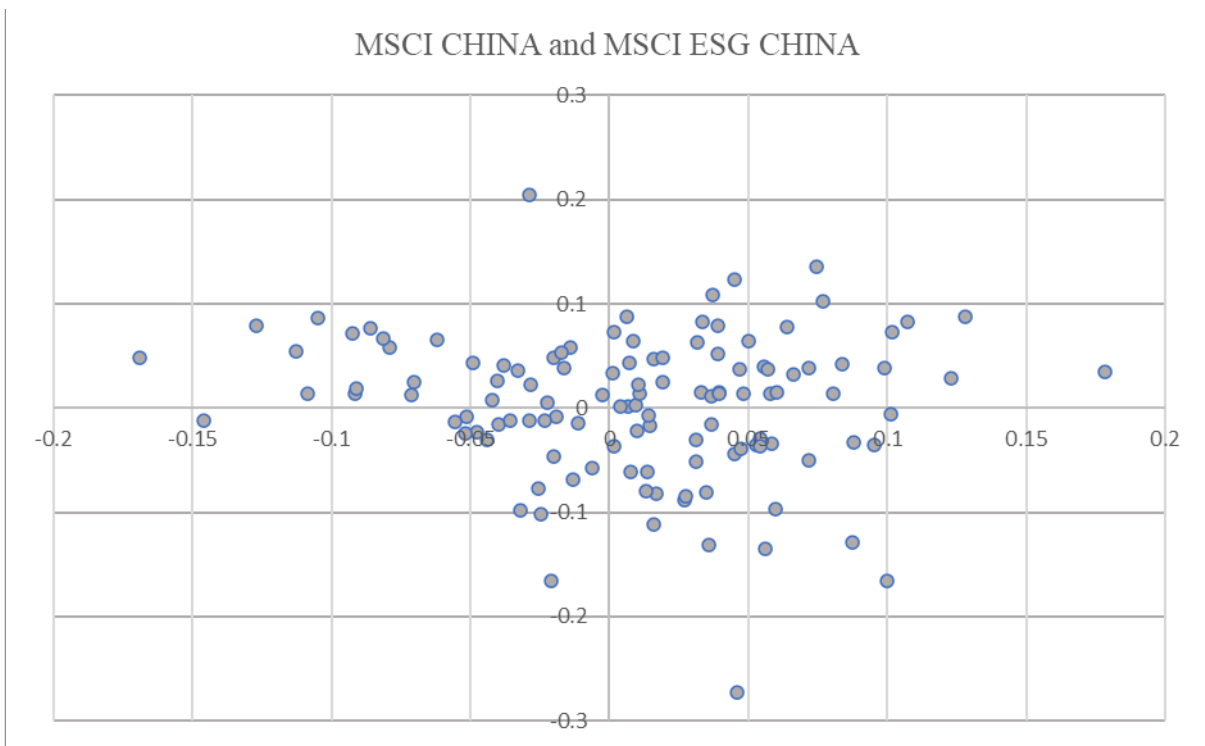
Table 11. Price Development Index Pair 9
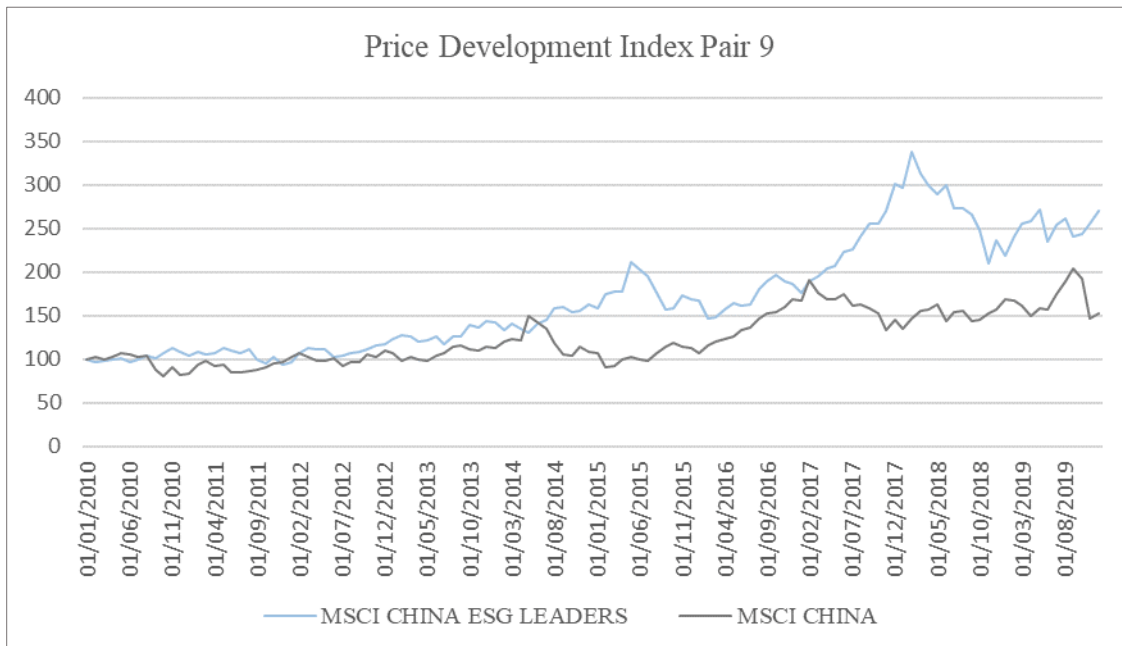
Table 12. Risk vs. Return for the Different Sustainable Investment Strategies (Hill, 2020)