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Doing Well by Doing Good?

An Empirical Study of 69 S&P Dow Jones ESG Indices 2009-2019

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ABSTRACT

This thesis discusses whether one sacrifices returns by investing in Environmental, Social and Governance (ESG) screened portfolios. Assuming that the ESG investments are channelled into funds that are trading one of the many S&P ESG indices, I analyse the performance of these investments using S&P Global 1200 as the benchmark. I focus on tracking error, information ratio and alpha to investigate whether the 69 S&P Dow Jones ESG Indices have outperformed, underperformed or performed in line with the benchmark.

The empirical analysis is aligned with previous studies on performance and compositions of ESG indices compared to the benchmark, and the conclusion is manifest. On average the ESG indices underperform on overall risk-adjusted return the S&P Global 1200. Among the worst or best performers, neither positive nor negative screening is significant. Bottom performers have had inferior risk and return due to the indices tilted towards the industry sector, the European market and constituent size. While top performers have gained due to tilt towards technology and exposure to the U.S market. The Fama-French approach with adjusting for fluctuations in the value and size premiums, do not indicate any difference whether the investing style is tilted in any directions. However, the indices exposure to the market premium is significant low for top and high for bottom performers. The relative performance measures showed positive information ratios for indices with exposure to Carbon and the U.S market due to the relative low tracking error, while Europe and Emerging market registered high negative information ratios caused by relative high tracking error. As a result, this thesis shows that environmental, social, and governance investor should have selected Climate instead of Thematic and Core ESG indices to have enhanced the probability of risk-adjusted returns compared to the S&P Global 1200.

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1 Introduction

Today, many financial investors are concerned about whether they sacrifice return when investing sustainably. Could their concern be true? Carbon reporting, sustainability metrics, the ethical working environment has expanded rapidly among financial institutions, investors and companies. As a result, companies have adopted the idea of corporate social responsibility (CSR), leading the way for ESG factors to emerge. Hence, the saying "doing well by doing good". Nevertheless, while the broad interest in ESG might be right for society, is it accurate for shareholders?

This is the problem being discussed and analysed in this thesis. Environmental, Social and Governance (ESG) is an investing approach under responsible investing, which addresses non-financial information into an investor's investment decision. ESG integration has become more broadly expanded globally, with 60 per cent new assets managed with this approach in 2018 than in 2016, according to the Global Sustainable Investment Alliance (2019). A responsible investor can invest with an approach focusing on avoiding companies with questionable ethical activities or investing in companies that have solid ethical standards. This implies a reduction of the investment universe and according to traditional financial theory, as a result, lead to limited valuable portfolios and enhanced idiosyncratic risk. If the market is efficient, taking on additional idiosyncratic risk would not indicate compensation for the sacrifice. This means that investing with an ESG approach shall result in underperformance of traditional investments on a risk-adjusted foundation. Yet, followers of ESG claim that the advantages of mixing ESG into the portfolio neutralise the efficient loss made by the diminished investment world. Many studies of ESG performance find equivalent results, either the ESG perform similarly or underperform to their conventional benchmark (Chang et al. 2012; Friede et al. 2015; Ibikunle & Steffen, 2017). Although, some studies have found coating for additional risk-adjusted return over conventional ones mainly by reduced tail risk (Lee & Faff, 2009; Verheyden et al. 2016; Nagy et al. 2016).

However, how do we measure whether or not we have achieved at least similar results compared to conventional investments, i.e. investments that are not based on some ethical screening?

How do we measure results? How do we take relevant risk factors into consideration? And how do we benchmark our ethical investments against?

Earlier research of ESG performance examines funds from several providers, without accounting for the differences in ESG criteria ratings, this could lead to ambiguous results because of the scale difference of ESG ratings. Another barrier in evaluating ESG performance of funds is that funds lead to complications of show effect due to notably various management skills, transaction costs and timing (RBC GAM, 2012). An alternative to studying performance with an attempt to isolate the problems with funds biases could be done with indices from the same provider. Therefore, this thesis studies the risk-adjusted performance from only the S&P Dow Jones ESG Indices. The result will be measured with a broad index, namely, the S&P Global 1200. If an investor considers investing in S&P Dow Jones ESG indices, how have S&P Dow Jones ESG Indices performed compared to the S&P Global 1200? Do we have underperformance as Chang et al. (2012) found from the U.S. market or have the S&P DJI performed better or in line with a standard benchmark as Verheyden et al. (2016) found. Even though past research results have shown varied results in the performance of the ESG indices and their benchmarks, ESG has continued to grow with tremendous pressure from the public to address these issues has risen and principally given corporations and governments big responsibility to incorporate sustainable actions. Green mutual funds need to perform in order to be attractive and investor-friendly. If so, why not invests in green funds to help the planet earth.

I have analysed the index performance with relative measures with most considerable weight on information ratio, tracking error and Fama and French three-factor model**.** With the purpose of account for different systematic risk factors, the three-factor model is used to investigate the findings by Gjølberg & Johnsen (2008), that sustainable indices tend to tilt towards large growth companies. I Analyse 69 diverse indices and the S&P Global 1200 over 10 years from 2009 to 2019.

As comparing the ESG indices with S&P Global 1200 yields varied result, and for some indices, the benchmark may not be the best comparison since some indices track explicit other benchmarks. But what is the alternative to track every index to same benchmark, other ETFs or funds? That

would be another discussion. In order to generalise my results and compare each index with the same benchmark, I have used the S&P Global 1200 by trying to connect each index with a broad benchmark.

There are several providers of ESG data to guide investors through the jungle of indices, and this thesis focuses on ESG indices provided by S&P Dow Jones Indices. Expanded focus on sustainability between investors and corporations raise questions for whom sustainability can create value. This thesis objective will be as follows:

(I) How do ESG indices from S&P Dow Jones Indices perform compared to a standard benchmark[1] over the past ten years?

(II) What are the main characteristics of the top and bottom performing ESG indices?

This study aims to contribute to the literature about the performance of sustainability indices, specifically ESG investing by using a portfolio performance evaluation-based approach. Hoping to provide more helpful knowledge of what ESG is and insight on how indices from S&P Dow Jones Indices have performed. ESG is a fast-growing market, and there is no sign of decreasing tact. Based on this, I hope that market participants get a meaningful insight into the performance of ESG, a clearer picture of why or why not invest in ESG indices versus S&P Global 1200, and what is necessary to consider when investors want to invest in this market.

The thesis is organised as follows: Next chapter will provide us with a more profound understanding of sustainable investing and especially ESG. Chapter 3 includes a literature review. In chapter 4, I examine appropriate methods to understand and interpret the measurement performance of ESG indices. Chapter 5 describes and provides information about the data. Chapter 6 presents the empirical results of the analysis. Lastly, in chapter 7, I dig further into the implications of the findings in the results and state the conclusion for the thesis.

[1] Standard benchmark = S&P Global 1200

2 What is ESG investing?

ESG is the acronym for Environmental, Social, and Governance. Investors have typically used profit margins, cash flows and alternative quantitative financial data to find a company's value, "ESG investment" takes additional non-financial factors into investment reflection.

Environmental, social, and governance (ESG) information demand awareness within the asset management industry because it has become internationally accepted that making an allowance for ESG criteria within an equity portfolio may enhance returns. Hard exclusions force participants in the financial market to trade-off certain risks for others. By contrast, ESG strategies range from active ownership and engagement to positive screening (selecting for certain attributes), to relative weighting (sometimes called "best-in-class selection"), to risk factor investing, to full integration (Steadman & Perrone, 2019).

ESG refers to the three key factors when measuring the sustainability and ethical impact of an investment in a company. Investors that are socially responsible use ESG criteria as a framework to screen investments or assess risks in investment decision-making. The criteria are used in capital markets for evaluating the companies, also to regulate their future performance. The amount of investments funds that include ESG factors has been growing at a tremendous rate since the start of this decade and anticipated to carry on significantly over the next years to come.

As mentioned, ESG's tree central factors are (Corporate Social Responsibility, 2018):

Figure 1: ESG factors by the UN PRI[2]

[2] United Nations Principles for Responsible Investment

- Environmental criteria: Examines how businesses perform in terms of the natural environment and focus, for example, what is on the left side in figure 1. As a consequence, favourable outcomes, in particular, improving profitability and lowering costs due to better energy efficiency are expected; also, reputational risks will reduce.
- Social criteria: Studies how the company treats and value people, and concentrates on what is on the middle circle. As a result, it is easier to work without social pressure, employers moral and business productivity increase.
- Governance criteria: Examines how a corporation polices itself – how the company is governed. Likewise, how companies are making rights, expectations and responsibility to its stakeholders for achieving long-term strategic growth. Basically, it is focused on what is on the right circle. The outcome of these strategies can proceed from avoiding unpleasant financial surprises and having a better social acceptance to be transparent for the shareholders to the management.

As the United Nation-supported Principles for Responsible Investment (PRI) states in their report in their annual report, US$62 trillion assets under management is used in responsible investment strategies, and over 1500 investment institutions have become signatories. PRI reports state that by approaching an investing that aims to incorporate ESG factors into investment decisions generates better risk management and long-term returns (UN Global Compact, 2019). If ESG produces a lower risk-adjusted return because the necessity of having restrictions put on them, lack of diversification could be the problem. Hence, ESG considerations would not outweigh the loss of investing with an ESG approach. From the article "From 'why' to 'why not': Sustainable investing as the new normal", Bernow et al. (2017) write that more institutional investors recognise ESG factors as drivers of value, and the key for effectively investing is to integrate these factors across the investment process. Sustainable investing has come a long way. More than 25 per cent of assets under management (AUM) globally are now being invested according to the premise of ESG factors can materially affect a company's performance and market value.

There is no universally accepted definition of ESG. It is hard to find a consistent terminology for ESG and other sustainability definitions. When we study responsible investments, we meet on terms such as SRI, ESG and Impact Investing. Familiar to these terms is that their common goal is

to make the world better, but the goal could deviate. Before we dig further into this topic, it is important to keep in mind that terms in sustainability universe are used over each other so numbers could be hard to compare, and words are sometimes overlapping. Therefore, I will use this part to highlight different sustainable investing approaches. Sustainable investing could be separated into three approaches (Pai et al. , 2018):

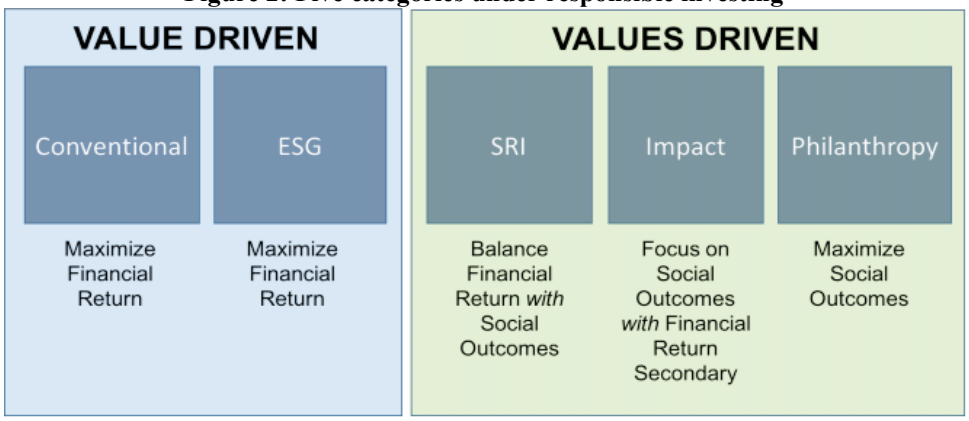
1. ***Impact investing*** is investments made to generate positive, measurable social and environmental impact alongside a financial return. Real impact investing is a specific strategy that aims squarely at making the world a better place. Depending on investors' strategic goals, impact investing targets a range of performances from below market return to market returns. Hence, investors aiming to invest with this approach focus most on social results and financial return is secondary. This approach can carry significant investment risk. Investors supply capital to innovate firms who are working to solve social problems like unemployment.

2. ***Socially Responsible Investing (SRI)*** tries to avoid investments in individual shares or industries through negative screening under defined ethical guidelines. This sort of investment uses negative screening criteria to filter and exclude those viewed as unethical, usually those associated with tobacco, gambling, weapons, nuclear power and fossil fuels. SRI was first developed to allow investors to avoid companies they disliked for ethical or values-based reasons. This initial form is now called exclusions or negative screen investing. Different SRI strategies have been developed, including positive screen or Thematic investing, where only businesses aligned to the investors' values are bought.

3. ***Environmental, Social and Governance (ESG)*** involves incorporating environmental, regulatory and social factors into the fundamental investment analysis to the extent that they affect the investment result. The philosophy behind ESG investments is that companies that are taking their business practices will eventually surpass companies that do not. Companies that adhere to ESG criteria are environmental stewards, ensuring that the company's policies correspond to the expectations and interests of shareholders, managing their employees fair. Investors looking at the company's ESG criteria are interested in how the companies they invest in will perform concerning their competitors, and also appreciate the insight of the company's culture and how the risk. Identically as SRI, strategies for ESG also includes best-in-class, exclusion, and Thematic, but only

because these strategies will enhance risk and returns. A framework for sustainable investing is given below to make a meaningful distinction:

Figure 2: Five categories under responsible investing



Source: (Vert Asset Management, 2017)

The *value-driven* categories, both conventional and ESG, are investment approaches that aim to maximise financial return for the risk taken. They both put financial return first, before any other issues. Value risks and opportunities into traditional financial analysis. While the *values-driven* categories consider financial return after the investors' values have been satisfied (Vert Asset Management, 2017).

Various focus on social and financial returns makes this distinction between the value-driven and the values-driven approaches clearer. In other words, ESG is about economic value, while SRI is about values. Confusion arises when economic value and individual values overlap; for instance, corruption is a risk to companies profit in terms of unhappy workers, but also ethical reasons. Therefore, avoiding corrupt companies makes sense for both reasons. Investors would do it for both, and for this reason, some funds could be called SRI or ESG. Because of the vague distinction between them, furthermore, in chapter 5, we will understand how S&P DJI have structured three subcategories as ESG.

3 Literature review

The literature on socially responsible or ESG investing has increased substantially in the latest years. However, terms are overlapping and numbers hard to understand. Since there are several terminologies in sustainable investing, broadly writing about the same topic such as Socially responsible investing (SRI), Environmental, Social and Governance (ESG) and other related investing-sustainability-words. Instead of defining the investment approach, many previous studies have used the word sustainable investing for both SRI and ESG. Therefore, it is essential to remember that some studies use the word SRI when they write about ESG; the conclusion is that plenty of investment styles consider themselves within the SRI or ESG segment without being directly attached to only one area. The outcomes of research on the performance of sustainable funds/indices as SRI may not apply to ESG funds/indices. Average results of SRI or ESG performance studies will be mixed because of the mix of investment objectives. Meaningful conclusions can only be made when making the same comparisons. ESG funds/indices that aim to maximise financial returns have different results from SRI funds/indices that balance objectives.

I will in this survey, focus on the most recent literature, i.e. literature published after 2009. This part focuses mainly on ESG performance. Verheyden et al. (2016) did a screening of ESG indices on return, risk and diversification. They used a starting point as a fund manager, and by doing so, they tried to discover the extent to which ESG data can add utility to any investment approach. By removing 10 of the least effective on an ESG scale, they found that both in a global and developed market, the portfolios gained risk-adjusted returns. This showed higher return and lower tail risk compared to a standard benchmark, also no significant loss in diversification. Doing the same with 25, they found different results, but every time they found reduced tail risk. The authors' findings are that the incorporation of ESG information adds better decision-making in every investment approach. Better risk-adjusted return is also found in Lee and Faff (2009), where whey investigates if sustainable companies can produce alpha. One of the key findings is that leading sustainability firms do not underperform compared to their benchmark and firms whom CSP gives lower idiosyncratic risk. Nagy et al. (2016) find that investors who take ESG considerations by tilt and

momentum with their portfolio, manage to outperform the MSCI world index between 2008-2016. Their study provides an example of how investors with the limit to take some vital risk, while simultaneously looking to improve the ESG profile of their portfolios on a systematic basis, can combine such strategies in their investment methods.

The meta-study conducted by Friede et al. (2015) investigated the results from about 2000 empirical studies and 1816 based on ESG factors' effect on corporate financial performance (CFP). The analysis detects roughly 90 of the reviewed papers that ESG factors and CFP have a non-negative relationship. 48.3 outperformed the benchmark positively, 10.7 negative, and 41 were neutral or mixed. The study infers neutral or mixed for a portfolio level and positive on a company level based on the ESG-CFP relationship. In the Journal of Business Ethics, Aouadi & Marsat (2018) aims to investigate the relationship between ESG controversies and firm value. With a dataset of more than 4000 firms from 58 countries in the timeframe 2002-2011. The analysis shows that ESG controversies are associated with higher firm value, but when ESG and CSP interact with each other, there is no relationship. The paper indicates that higher corporate social performance (CSP) score has an impact on market value only for high-attention firms. Therefore, firms can profit from their CSP. Similar result to what Friede et al. have found was the conclusion from RBC GAM (2012) as well. RBC GAM finds that conventional indices do not outperform SRI indices and that investors can consider taking ESG factors into considerations without reducing risk or return. They are concluding that the evidence is mixed, but on aggregate, there is little or no difference in the performance of sustainable indices compared to conventional indices.

A study by Chang et al. (2012), analysed how green mutual funds performed against traditional mutual funds in the U.S. market where the funds were organised according to their investment strategy. In total, they used approximately 130 green funds and 11.900 conventional funds. The analysis is done for the last 5, 10 and 15 years, and the results show that green mutual funds have underperformed on a risk-adjusted basis. Based on the results, the authors point out that it is vital for the green mutual funds to perform as their peers in order to be attractive and investor-friendly. Similar findings are also found in another study that analysed the European market by Ibikunle & Steffen (2017), where green funds are underperforming against conventional funds. However, the inferior risk-adjusted return decreasing as they move forward in time. The question is, thus, how

the situation is today for the S&P DJI. Do we find underperformance as Chang et al. (2012) found in the U.S. market, or have they performed in line with the S&P Global 1200?

The authors in the study*, Investing for a Sustainable Future*, found that investors tend to mind more about sustainability than most executives assume that they do (Unruh et al., 2016). This study was answered through a survey by 3000 investors and managers in investment organisations from over 100 countries. Their findings were that 74 of investors think a company's sustainability performance is more critical than it was three years back. The study also found that 75 of investment managers took investment considerations related to a company's sustainability performance. Another exciting discovery is that 60 of managers in public traded companies think that investors consider sustainability performance as essential. It seems like there is a misunderstanding of what an investor value about a company and what the companies think they evaluate when investors are taking their investment decision which is essential results for this thesis. Since part of the goal for my thesis is to give insight into ESG performance, the findings of Unruh et al. will be useful in terms of an investors point of view. If my thesis indicates that ESG based indices outperform the S&P 1200, it will incentivise investors to tilt their portfolios toward sustainable investing. More investors are interested in ESG performance according to the study by Unruh et al., and the authors are pointing to that it is top executives and board of directors' accountability to comprehend the investors' interests. Besides, 80 of investors that answered the survey believes a company's likelihood of creating long-term value is stronger if the company focuses on sustainability performance. Even though studies have found different performance results, very few studies have compared funds or indices provided by the same supplier.

As ESG have emerged, literature has shown that ESG ratings are indeed ambiguous metric. I will, in this part, present some earlier studies with emphasise on the lack of standardisation in reporting and measuring ESG.

Olmedo et al. (2010) looked at socially responsible investing and compared indices, ESG rating and agencies which provide the information. Their sample consists of six sustainability indices and ten ESG agencies. The results suggest that the modern methods being used by ESG agencies and sustainability indices are various and show a lack of standardisation. There is no standard

methodology because each index and agency give different weights to analysis criteria. Most of the indices and agencies used either positive or negative criteria. Furthermore, the information provided by ESG agencies regarding the measurement of risk is insufficient and complex.

Cappucci (2018) offers several explanations on ESG play for CEO in worldwide companies which are a probable "misalignment of ESG's long-term benefits and firms' short-term performance incentives". On his list of other obstacles to integration is data quality, contradicting measuring standards, underperformance, and cost. An initial and widely known problem of ESG data is the relatively short historical coverage. This does the search for short-term statistically significant patterns far more challenging and seriously prevents an assessment of the long-term profitability of ESG compliant companies. Based on Cappucci and Olmedo et al., I have only used one supplier, S&P DJI with data from 2009 to 2019.

In recent year, the discussion of whether ESG is an appropriate measurement has been questioned. Therefore, I will use this part to emphasise what the literature has found.

Sustainability reporting has been frequently adopted by corporations worldwide given the demand of stakeholders for greater transparency on ESG issues. In an article posted in the Journal of Environmental Management, Siew (2015) reviews corporate responsibility reporting tools. Corporate sustainability reporting tools (SRTs) are categorised into frameworks, ratings and indices. Correct corporate SRTs are essential as they serve information about ESG. However, different factors and methodology create complications for stakeholders. Two main conclusions: There are limitations with corporate SRTs and much needs to be prepared to improve the effectiveness of SRTs.

Breedt et al. (2019) wrote a study to examine if investors should use ESG is an equity factor or just as an investment Guide. They check if a portfolio constructed by relying on ESG criteria means tilted towards securities with a high ESG ranking, showing higher risk-adjusted returns. Earlier Academic research suggested that incorporating ESG metrics might increase risk-adjusted returns. This study indicates no significant gain from incorporating ESG tilt into a portfolio is already captured by other well defined and known equity factors. Therefore, a portfolio with ESG tilt yields no additional return because any benefits from tilting are already well defined; however, it does

not hurt returns. After they removed the market cap and volatility bias, ESG as an equity factor has returns compatible with noise. They conclude that ESG should not be considered as a unique equity factor.

A paper by Utz (2019) studies the reliability of ESG assessments in the case of corporate scandals. He indicates why investors would allocate their money to ESG and find motives for why investors should reduce exposure to non-ESG because of scandal and significant losses. Utz finds, for instance, that reliable disclosure in ESG assessments might reduce information asymmetry in terms of due diligence. Utz concludes that ESG assessments consisting of both retrospective and future indicators are defective when it comes to predicting corporate scandals.

As a result of review recent literature, the official findings from ESG performance is that there are mixed signals if ESG adds a risk-adjusted return. Some researchers find that the ESG fund does systematically better than conventional mutual funds, while other studies do not find such a pattern. A barrier of criteria standardisation for comparing various performance outcomes of sustainability indices is needed.

4 How to evaluate ESG performance?

This chapter focuses on the methods used to study ESG indices performance. The primary purpose of the empirical analysis in this thesis is to compare the performance of an ESG index compared to a global standard benchmark. Firstly, a brief outline of principles that are relevant for measuring performance that form the foundation of the analysis. Secondly, going through what outcome ESG investing could imply for the results. Thirdly, models and key figures are displayed and described in order to state the measurement methods. After this chapter, we should be able to understand how this thesis has interpreted the results in chapter 6.

4.1 Investigate ESG based on index data

There are widely different views if the responsibility of sustainability should be put in finance, namely corporations and previous studies have tried to answer the relationship between corporate financial performance (CFP) and corporate social performance (CSP) on the firm level. Friedman (2002) created shareholder theory, who states that the goal of businesses should be to maximise the profit if its shareholders. This theory is the baseline for CFP and argues that corporations involved in socially responsible activities are spending stakeholders' money beyond their best interest. The counterpart to stakeholder theory is shareholder theory, which states that corporations are better off taking into consideration all stakeholders in its operations, rather than just maximising shareholders' wealth, and that this broader objective ultimately will maximise wealth for all stakeholders, including shareholders (Parmar et al., 2010).

Problems with studying on firm-level arise because of causality difficulties. A meta-study by Margolis et al. (2007) concludes that firm-level data gives no use and unsolicited to continuing study further because of the low correlation between CFP/CSP. Therefore, I will study ESG with index data.

This study investigates index data, meaning it inform the investor if an ESG index has a performance differential to a standard benchmark. This is important research as it sets performance expectations and deviations from a standard benchmark selection. A historical approach to

investigating sustainability performance is made by using market-level data, often by comparing the performance of sustainability funds to conventional funds. Nevertheless, examining fund performance issues effects like market timing, transaction costs and management skills. Carhart (1997) neglect that fund data usually undergo survivorship bias. To bypass this bias, I prefer to review the performance of ESG indices instead. For instance, many ESG indices are screened versions of conventional indices. Still, investigating the performance of ESG indices versus a benchmark is not just smooth. Pointed out by Gjølberg & Johnsen (2008) style differences between ESG indices and their benchmark has to be adjusted for, essentially loadings on the size and the value factor.

Indexes consist of a hypothetical portfolio of securities and represent a particular market or a segment of a market. In this paper, it is looking to analyse equity ESG indices from S&P DJI. Stock indices should express developments in prices of the segments that the index encompasses and is a weighted average of selected shares. Indices can be classified according to geography, approach or/and market. World or global indices will include companies from several regions and reflect various economic development globally. Regional indices include companies from a limited area, such as Asia or Europe. National indexes only follow national companies and thus provide a substitute for a domestic stock market. Another approach is indices whose classified according to market specifications, distinguished between developed markets, emerging markets, sustainability and more. Developed markets are seen as safer in terms of risk than Emerging Markets. Various indices and forms exist that only follows specific industry or small-cap companies.

4.2 ESG investing: Screening sensitivity

The investors who claim to use an objective ethical strategy, so-called positive or negative selection reduces the investment universe. If the market is efficient and the investment universe is considerably concentrated, some studies have shown that excluding companies may lead to skewed sector weights. As mentioned in the introduction of this thesis, sector tilts and reduced investment universe could cause underperformance due to lack of diversification. As a result, the portfolio manager may need to take on additional risk, but investors do not obtain more extraordinary yield

as counterbalanced for bearing on unsystematic risk. Hence, this will lead to lower-adjusted return according to modern portfolio theory. If the correlation between ESG factors and financial performance are negatively correlated, the outcome would be underperformance. For instance, ethical investors tend to exclude "sin" stocks, which imply to avoid alcohol, tobacco, gambling, entertainment and weapons. However, various studies show that "sin" stocks deliver a better return than average. Mainly two reasons are emphasised. Basically, they are undervalued since investors avoid them. As well as, their industries impose increased risk such as reputation risk. Controversially, investors get therefore a higher risk premium due to compensation (Robeco Institutional Asset Management, 2019).

Blitz & Fabozzi (2017) provide an explanation to "sin" stocks outperformance and conclude it is due to the profitability factor and investment factor. The profitability factor means that companies with a high profitability margin outperform, while the investment factor implies that firms with high asset growth tend to do worse. For example, the oil industry tends to have exposure to both factors, obtaining high margins due to a strict market, and low asset growth due to a restricted market. KPMG reports that the SDGs of the world's 250 largest companies find that the healthcare sector leads the way with implementing Sustainable Development Goals (SDG). Controversially, 57 per cent of the healthcare companies set SDG-related goals while none of the oil and gas companies reviewed in this report disclosed any SDG performance goals (Blasco et al., 2018).

Followers of ESG argue that the advantages of mixing ESG into the portfolio neutralise the efficient loss made by the diminished investment world. They claim that if the firms are involved in unethical activities over time, it will damage the profitability. Volkswagen has been an example of what could happen if firms violate with ESG factors. As a result, the expected return of ESG firms may be habitually higher due to underestimation of the benefits or overestimate the damage of being ethical and socially accountable.

Utz (2019) studied the reliability of ESG assessments in the case of corporate scandals. He finds motives for why investors should reduce exposure to non-ESG because of scandal and significant losses. Utz observes, for instance, that reliable disclosure in ESG assessments might reduce information asymmetry in terms of due diligence. The questions about whether investors are

underestimating the benefits or overestimating the costs vary, but there is no doubt that it is a trendy hot topic. Ernst & Young (2017) reports a trend of increasing demand for sustainable investments, driven mainly by millennial investors, as a recent survey show that 84 per cent of millennials cite investing with a focus on ESG impact as a central goal.

4.3 Performance measures

In this thesis, I will calculate the standard performance measures alpha, Sharpe ratio, information ratio, tracking error, and Fama-French factors. This subchapter provides some brief background essence to assess these measures.

One assumption modern portfolio theory suggests is that imposing constraints on the investment portfolio results in an efficient loss because it assumes a risk-averse investor. Every screening method such as ESG screening limits the investment opportunity hence constraints on the portfolio.

Another critical element to remember is that investors do not receive a higher return as compensation for taking a non-systematic risk. So how is it possible to represent the financial performance of ESG? According to Fama (1970), there is no such thing as "abnormal" return or alpha because an efficient market reflects all available information, and it is already reflected in the prices. ESG indices in this thesis using both negative and positive screening as a part of their strategy, and according to EMH, investors with semi-strong belief would consider that abnormal return gained from screening is not possible. Even though EMH is a vital part of financial theory, it has got several criticisms. Researchers have disputed the theory since it does not consider psychology such as behavioural finance with cognitive biases as an important cornerstone founded by Kahneman and Tversky. As a result of discovering alpha, which violates with EMH - researchers have found market patters that do seem to lead to abnormal return called anomalies. Two anomalies could be mentioned based on this paper: *Size effect*: Small companies perform better than big if we look at historical prices. *P/B effect:* Companies with high book-to-market ratios outperform companies with low book-to-market ratios.

According to the theory of efficient markets, it will not be possible to predict any connection price development and anomalies. Most investors assume that by screening for ESG criteria, their

portfolio is less jeopardised to extreme price movements. Meaning an index with environmental, social and governance focus is experiencing limited downside risk compared to non-ESG index rivals. Given the EMH and if this were true, indices who focuses on ESG-aspect would yield reduction in expected returns. Since investors are not compensated for taking on increased idiosyncratic risk, the question that arises is, can ESG indices benefit from the financial market estimation of idiosyncratic risk related to ESG frameworks?

Obtaining an estimate of the financial performance of ESG could be done use of an asset-pricing model that incorporates systematic risk factors. Capital Asset Price Model (CAPM) and Fama & French three-factor models could be useful.

$$E(r_i) = r_f + \beta_i\big(E(r_b) - r_f\big) \quad (1)$$

Where: $E(r_i)$ is the estimated expected investment returns, r_f is a measure for the risk-free rate, $E(r_b)$ is the estimated expected market return, β_i is beta to asset *i*.

The Singel Index Model (SIM) is derived from CAPM and let us use regression analyses to assess whether a portfolio has achieved abnormal or less return in relation to the market. The equation is the starting point for regression analyses, where we look 10-years monthly historical data.

$$r_i - r_f = \alpha + \beta_i\big(r_b - r_f\big) + \varepsilon_i \quad (2)$$

Where: α is the abnormal rate of return, ε_i represents the idiosyncratic risk, $r_i - r_f$ is the excess return.

If Modern Portfolio Theory holds, the return should be restricted. So, what are investors motive for restricting their portfolio? As mention earlier in this thesis, Utz (2019) finds little evidence that ESG could be used as a measurement for prediction, and this vision is also backed by Breedt et al. (2019). While other studies find that ESG outperforms conventional indices are the opinions split. Following these statements, supporters use an ESG approach based on their moral values that a sustainability approach does not decrease return with the same idiosyncratic risk, Bernow et al. (2017) confirm this statement.

Fama & French (1993) expanded the CAPM by introducing two new risk factors: value and size. This model adds more factors than just market risk alone to make it a better tool for evaluating the average return. The motive behind the value and size premium is that value and small-capitalisation stocks ordinary are limited liquidity, riskier and likely to be mispriced, therefore, capturing the fact that value and small-cap stocks tend to outperform markets on a regular basis.

The value factor, HML, or *high minus low* is defined as the excess return on companies with high relative to low market pricing relative to book value of equity. A positive factor premium indicates that an index is tilted toward high price/book value. The size factor, SMB, *small minus big* is correspondingly defined as the excess return on small-cap relative to large-cap companies, as measured by the total stock market value of the companies. A positive factor premium indicates if the index is tilted towards small-cap. Three-Factor model is expressed as:

$$r_i - r_f = \alpha + \beta(r_b - r_f) + \gamma SMB + \delta HML + \varepsilon_i \quad (3)$$

Where: The factor coefficients, β = market premium, γ = capitalisation premium, and δ = book-to-market premium.

Research has found that both factors have directed to match to positive excess returns relative to what would be shown by ordinary risk evaluations, such as market beta risk. As Gjølberg & Johnsen (2008) emphasised, style differences have to be adjusted for, such as loadings on the size and the value factor.

Jensen's measure is a risk-adjusted performance measure that represents the average return on investment based on beta and average market return adjusted for a risk-free rate, while Fama-Frence adjusts for additional factors.

$$\alpha_i = (r_i - r_f) + \beta(r_b - r_f) + \varepsilon_i \quad (4)$$

$$\alpha = r_i - r_b + \beta(r_b - r_f) + \gamma SMB + \delta HML + \varepsilon_i \quad (5)$$

Where: α_i represents index abnormal excess return, r_i is the total index return, r_f = risk-free rate, β = Beta of the index, r_b = Expected benchmark return, ε_i is the idiosyncratic risk.

The Sharpe ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. A way of calculating the risk-adjusted performance emerged as Sharpe (1994) changed how to calculate the Sharpe ratio. It is this formula that is used to calculate the Sharpe in this thesis.

$$Sharpe\ Ratio = \frac{r_i - r_f}{\sigma(r_i - r_f)} \quad (6)$$

Where: r_i = return of an index, r_f = risk-free rate, σ ($r_i - r_f$) is the standard deviation to the risk-adjusted excess return.

The information ratio (IR) is the ratio of investment returns above the return of a benchmark to the volatility of returns. The formula is given below:

$$Information\ ratio_i = \frac{r_i - r_b}{\sigma(r_i - r_b)} \quad (7)$$

Where: $\sigma(r_i - r_b)$ is the *tracking error*, which is the standard deviation of the difference between the returns of a portfolio and to the returns of a benchmark, i.e. how different will the ESG indices perform compared to the S&P Global 1200.

The Information Ratio is linked to the t-Statistic, to see whether an excess return is significantly different from zero. The t-Statistic is calculated as follows:

$$t - stat = IR \times \sqrt{N} \quad (8)$$

Where: *N* is the numbers of periods used to calculate *IR*.

5 Data

In order to calculate what this study should convey, it is necessary to make choices about the frequency of data, how to measure the data, and which index to compare with. Part 5.2 look closer at which indices that are used in this thesis and their characteristics.

Proper indices should include a long-time horizon and a meaningful benchmark for comparison. S&P Global 1200 fulfils these requirements. See the graphic price development of the benchmark, which is displayed in figure 6 in chapter 6.1. The data selection contains 69 ESG indices on various geographical areas from September 2009 - October 2019, and I have used S&P Dow Jones Indices, index tracker, to find information and time series from all 69 indices. I had to go through them manually because of time-frequency and sort out indices that had at least ten years of data, which I consider as the acceptable length of time.

The choice of time span in my study makes the data as updated as possible. Because of missing data further behind than to 2009, it does not include crisis such as the financial crisis or dot-com. Nevertheless, ESG was not so popular and applied back then, so data even further might result in unreliable results. The historical time series that is used in my analysis is gathered from *S&P Dow Jones Indices,* which is a global leader in providing investable and benchmark indices to the financial markets. The monthly closing price observations are adjusted to USD for all indices.

The first criteria in my data selection were that indices should only include equities and therefore, getting cleared of commodities, fixed income and other indices. At this stage of the screening process, the index tracker showed 1716 equity indices. The next I looked at was the theme, namely ESG. This cleared out themes like asset allocation, REITs, factor, quantitative strategies and more. Now, in this stage of the screening process, only 168 indices were present. Further, checking if some of the indices were duplicates, just with a different currency, for example, one index in USD and one in EUR. Finally, I controlled the time-frequency so that all current ESG indices had at least ten years of data. After using the criteria to filter the final list of indices, I ended up with 69 ESG indices from S&P Dow Jones Indices. An overview of all indices that are included in the study is presented in the Appendix.

5.1 Factor data, benchmark and risk-free rate selection

The choice of index should be the index that has the greatest explanatory power on the data range. The S&P Global 1200, widely regarded as one of the best single gauges of the world's equities, is a global index that is a valid representation of the total markets. For choosing one broad index that represents multiple geographies, I find the S&P Global 1200 the natural index to represent a standard benchmark since the index covering seven distinct regions, 30 countries, and approximately 70 per cent of global stock market capitalisation. Its build on the relative size of each region attached to relative size in the overall equity market, based on float-adjusted market value. The S&P Global 1200 is one of the world's most-followed market index for professional participants with $2.5 trillion in benchmarked assets and $1.6 trillion indexed attached (Thomson Reuters). The benchmark is also adjusted for dividends, which is appropriate considering that all the 69 analysed indices are adjusted for the same.

Since this study shall examine ESG indices compared to a standard benchmark, return calculations must be equivalent. As Gjølberg & Johnsen (2008) states in their study, that is, "geometric average returns are always lower than arithmetic average returns. Geometric returns have the most relevance to our purpose, which is to describe historical returns and examine a portfolio shortfall risk relative to future withdrawals, i.e. the probability that the growth in value will not be sufficient to cover the withdrawals". Therefore, monthly closing prices and geometric returns are applied in this thesis.

The Fama-French (F&F) model was initially created for the U.S. market, but Kenneth French has later added separate factors for other markets to his database, including developed markets (French, 2019). F&F presented a paper in 2012 that these factors are better suited for regional analysis. Factors in French's database are in U.S. dollars and is based on one-month T-bill as the risk-free rate. For generalisation, the one-month T-bill from F&F is used for all indices because I have translated every index to U.S currency, even though European and other indices are used in my study. As a result of concern about exchange rate fluctuations, changing the currency of all 69 indices to dollars avoid this problem. Data for the three-factor model are downloaded from Kenneth French's homepage.

5.2 S&P Dow Jones' ESG Indices

As the demand for ESG products and services are increasing, research and data providers are responding to the growth, and there are now several providers such as MSCI, Bloomberg, Thomson Reuters, S&P Dow Jones Indices, Morningstar, Dana, RobecoSAM, Sustainalytics and more. Dana Funds Investment (2018) used a correlation matric to estimate the difference in ESG score between providers. Lowest correlated scores were 0.3 between Bloomberg and MSCI, while the highest correlation was 0.7 between Sustainalytics and Bloomberg. The conclusion from Dana Funds is that the scores views are highly subjective. The results overall had low correlations between the data providers, and it is therefore necessary to have this in mind when comparing ESG scores. This thesis does not discuss why such difference in score, since only data provider used in the thesis comes from S&P DJI ESG database. Nevertheless, who is S&P Dow Jones Indices? It is the largest global resource for essential index-based market concepts, data, and research; it is a major investor resource to measure and trade the markets (S&P Dow Jones Indices, n.d.). S&P Dow Jones Indices, namely S&P DJI has been a guide in ESG indexing for many years, starting back in 1999. They broad-ranging sustainability data from SAM[3] to deliver a range of ESG indices to fit varying risk, return, and ESG expectations. Mainly three categories are offered of ESG (S&P Dow Jones Indices, n.d.):

- ***Core ESG:*** Include best-in-class or positive screening approaches such as the DJSI, as well as indices, that aim to improve ESG performance while maintaining the risk and return profile. DJSI also offer two *exclusion* index such as *Armaments & Firearms, Alcohol, Tobacco, Gambling and Adult Entertainment*, and *select indices* which; I will explain further below. DJSI best-in-class approach is a rules-based selection of top 10 per cent[4] most sustainable market caps per industry, based on their sustainability scores. (S&P Dow Jones Indices, 2013)

[3] SAM is a tag of RobecoSAM, an asset management firm focused exclusively on sustainability investing since 1995. The company has been a partner of S&P Dow Jones Indices since 1999.
[4] Top 10 per cent if global, top 20 per cent if regional, and top 30 per cent if country

- ***Climate ESG***: Measures firm performance against different carbon reduction objectives. It is designed to address climate change and the transition to a low-carbon economy. Range from these indices addresses different carbon reduction objectives - including carbon-efficient and fossil-fuel-free-strategies. The indices use both current and forward-looking approaches (S&P Dow Jones Indices, 2019).

- ***Thematic ESG:*** Provide targeted exposures to specific ESG themes, frequently with a relatively conservative objective. Included are clean and renewable energy indices and global water indices (S&P Dow Jones Indices, 2016).

A number of different ESG investing approaches are used to select based on selective criteria, but S&P DJ Indices have mainly two categories of them, *best-in-class* or positive screening and *exclusion* or negative screening. *The Dow Jones Sustainability Indices* are float-adjusted market capitalisation-weighted indices that measure the performance of companies selected with ESG criteria using mostly a best-in-class approach. *The S&P Indices* are a mix of float-adjusted and capitalisation-weighted indices, which measure the performance of companies selected with ESG criteria using best-in-class or exclusion, or both.

Most included indexes in this analysis are based on Float-adjusted capitalisation method shown in equation (9). Instead of using all the active and inactive shares, as with the total-market capitalisation method, the float-adjusted way excludes locked-in shares. As mentioned, most of the ESG construction indices from S&P DJI are constructed this way. The S&P DJI with a float approach, are rebalanced quarterly.

$$Float - Adjusted\ Capitalization = Stock\ Price\ \ x\ Number\ of\ Available\ Shares \quad (9)$$

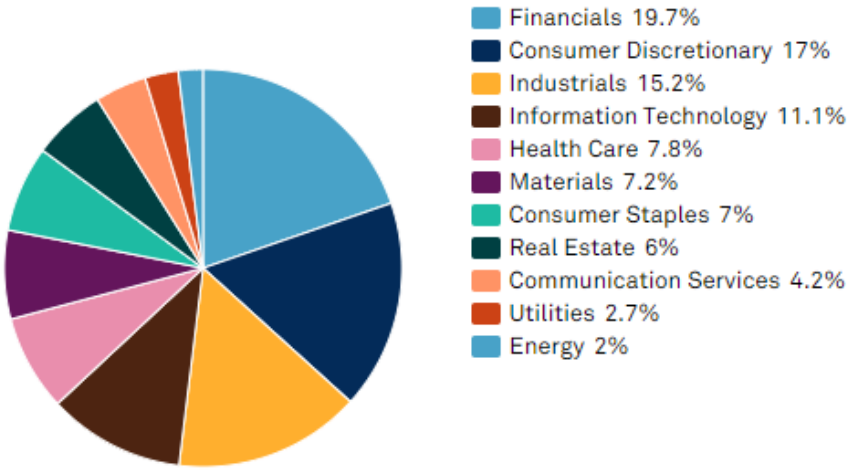
Because of some indices have endless names and to manage as limited space as possible, I have done some abbreviations by using stars (*) on some Core ESG indices, for examples from DJSI:

- *Dow Jones Sustainability Asia Pacific E-ATGAF*,* where *E-ATGAF** stands for *exclusion indices such as Alcohol, Tobacco, Gambling, Adult Entertainment and Firearms.*

- *Dow Jones Sustainability Asia Pacific Developed* **,* where ** stands for *diversified* index, is a best-in-class index.
- *Dow Jones Sustainability Asia Pacific Developed****,* where *** stands for *diversified select index,* together with best-in-class, *select,* adds exclusion as well.

*,**,*** will be the norm and used in all tables from now and onwards. Below is an example of sector breakdown from *Dow Jones Sustainability Asia/Pacific Developed Diversified Index*:

Figure 3: Sector breakdown[5], Core ESG



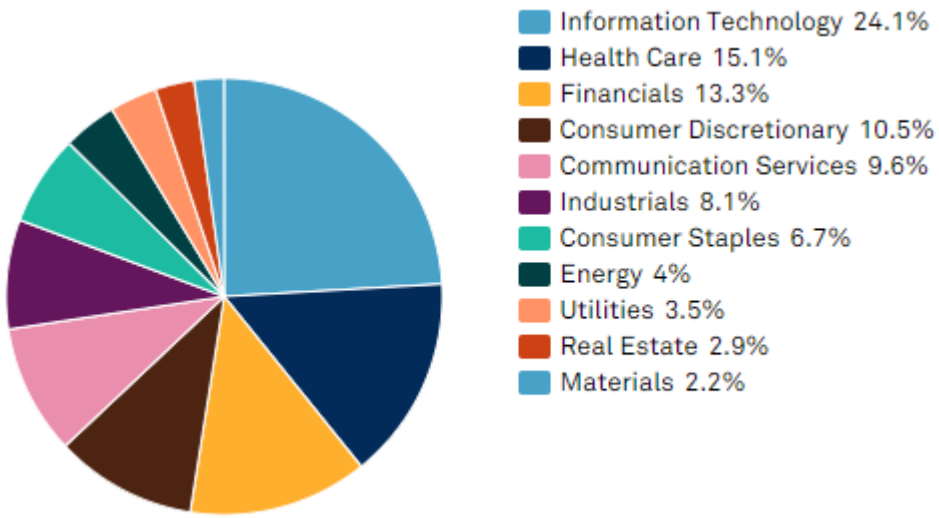
For the Climate category, there are essentially three names: *Carbon Efficient Index, Carbon Efficient select index* and *LargeMidCap Carbon.* For example:

- *S&P 500 Carbon Efficient Index*, overweighting and underweighting companies based on their levels of carbon emissions.
- *S&P 500 Carbon Efficient Select Index*, in addition to the index above, supplementing with *Select*, exclude companies with the top 10% relative carbon footprints.
- *S&P Developed LargeMidCap Carbon Efficient*, invest in companies in a particular area and a certain size while overweighting or underweighting those companies that have lower or higher levels of carbon emissions per unit of revenue.

[5] Sector breakdowns are based on GICS® sectors

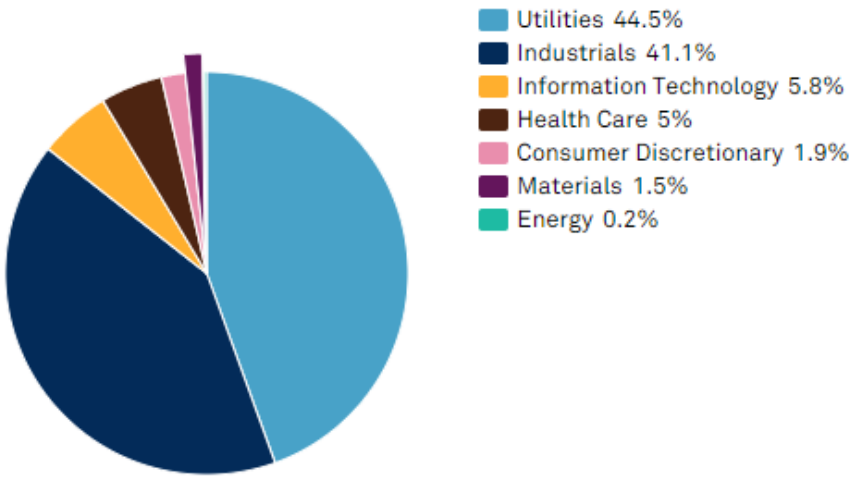
Below is an example of sector breakdown from *S&P 500 Carbon Efficient Select*:

Figure 4: Sector breakdown, Climate



Thematic are specific names such as S&P Global Water or S&P Global Timber and Forestry. With exclusion as a standard strategy within specific segments. For instance, figure 5 show, the *S&P Global Water Index*:

Figure 5: Sector breakdown, Thematic



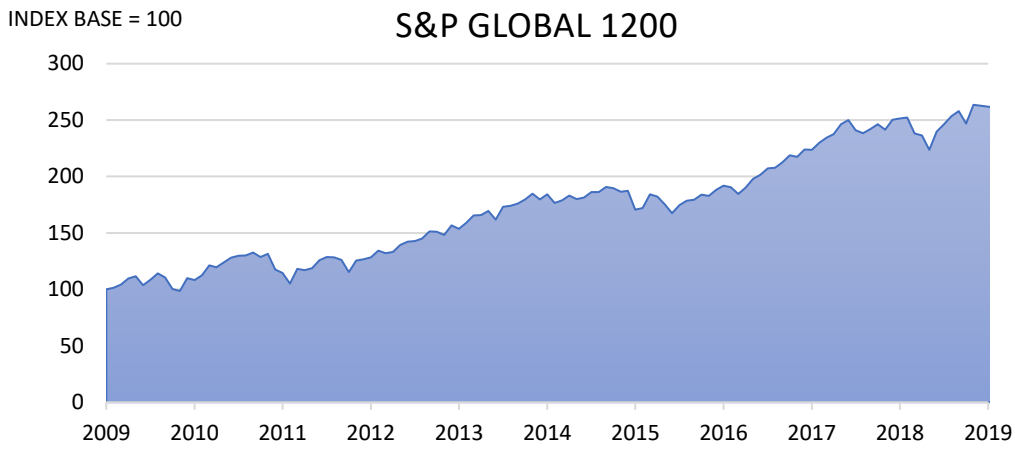
6 Empirical results

This chapter presents the results of the conducted analyses of top and lowest ESG indices, and the subcategories: Core ESG, Climate and Thematic. The part starts with a performance presentation of how the S&P Global 1200 have performed during the analysed period and some takeaway points to have in mind reviewing the results. Then a short introduction to the characteristics of the subcategories. Next, I present the descriptive statistics for the top ten and the ten lowest index performers, combined with the benchmark and the three subcategories of ESG. Further, looking at the most significant indices with respect to correlations, Sharpe ratios and tracking error. The top and bottom performing indices, as well as the subcategories, will be studies additionally by analysing information ratios, tracking error and Fama-French factors, which will equip us with knowledge about the index performances. Lastly, the top and bottom performing indices being further decomposed to acquire a deeper understanding of their characterisation.

6.1 S&P Global 1200 2009-2019

Figure 6 illustrates the S&P Global 1200 market index over the last ten years – it has performed strongly during the analysed period with small bounces down, followed by higher peaks. Each point in figure 6 represents the monthly closing price for the market index over the last ten years. Narratives could be something like *a time of mediocre economic growth backed by cooperative central bank policy*. However, the stock market has had some corrections starting from 2011, 2015 and last trading months in 2018. Still, before I briefly describe the past ten years, a quick recap around what happened during the financial crisis is appropriate.

Figure 6: S&P Global 1200 price development with monthly closing prices 2009-2019



Rebased, sept 2009=100, Source: Thomson Reuters

The consequence of poor mortgage policies and routines from banks and other financial institutions began to reveal when the borrowers failed to serve their loans, and the number of defaults increased drastically. "Sub-prime" loan resulted in enormous losses; therefore, banks started to raise their interest rates. This uncertainty led to broader credit spreads due to the collapse world exchanges fell between 40 to 60 per cent, including S&P Global 1200.

For this reason, extensive rescue packages were implemented. However, the rescue packages did not come without consequences. Many countries that already had high debt before the financial crisis had this increased further and the central banks have been dovish steering towards low-interest rates.

The analysed decade is influenced by central banks that doing a monetary policy strategy called Quantitative Easing (QE). Chiefly, central bank purchases securities in order to increase the money supply leading to encourage investment and lending hence provide financial players with liquidity. As a result of low-interest rates, normal market operations are no longer useful, so QE has been practised through the analysed decade - guard to support the stock market. Other reasons for the bullish market are economic growth, especially in developed markets, and companies buying back their own shares to boosts the share price and earnings by reducing the total number of shares outstanding.

Economists explain the downturn in 2011 with several factors. First, downgrading the U.S from AAA to AA+ because of the country's deficit issues wiped out numerous percentages from the

benchmark[6]. Second, China is a leading contributor to the world's economic growth and estimates concerning economic slowdown had an impact on investors risk-taking. Lastly, European debt crisis strikes as countries experienced lower growth with concern about their ability to maintain their high level of debt. In 2015, mainly three factors influenced a sell-off in the stock market - a further and surprising decline in commodity prices, especially oil. Similar to earlier downturns, the world is anxious related to low economic growth and China's situation with both growth and currency devaluation as well as the Federal Reserve felt bold enough about the U.S. economy to begin raising interest rates.

The most current market crash occurred during the end of 2018 when the market experienced its most critical drop since the Great Depression. Set off by uncertainty about the trade war between U.S and China together with fears of a hawkish Central Bank a potential recession, the S&P 1200 fell 20 per cent from its high in December to its lowest point through Christmas Eve, but again, the bull market recovered. However, is it possible to gain risk-adjusted returns from ESG when a standard benchmark and the overall markets have performed remarkably stable?

This part will explain characteristics of the subchapters: Core ESG, Climate and Thematic versus the benchmark. The number of constituents, market capitalisation size, and screening strategies that are used in the investment method are given in table 1.

As shown from Gjølberg & Johnsen's (2008) study, features of sustainable indices have shown that the indices are tilted towards large-cap companies. Figures from table 1 indicate that this is likewise the case for 2 out of 3 ESG indices supplied from S&P DJI. Nevertheless, Thematic is the group with fewest constituents, lowest mean and median market cap. As Nagy et al. (2016) point out, the ESG indices are tilted towards large companies since that is suitable for the indices to meet specific requirements for positive screening. As figures show, Nagy et al. (2016) have valid arguments with respect to Core and Climate, left out following this is Thematic since its investment approach is *exclusion* and not *best-in-class*.

[6] Benchmark = S&P Global 1200

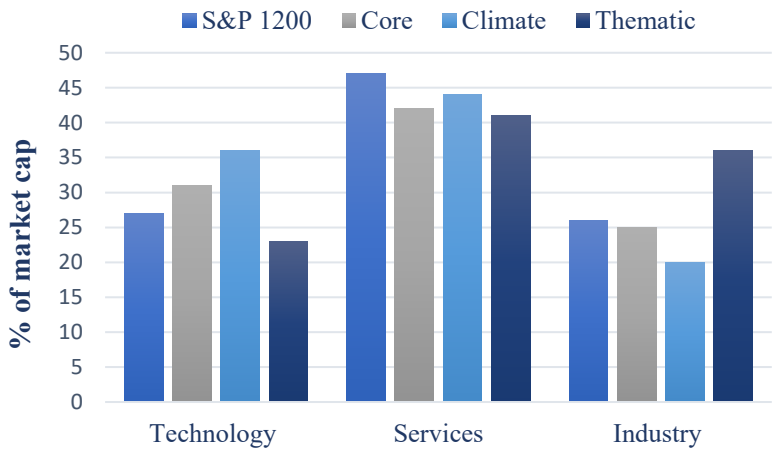
Table 1: M-cap, constituents and strategy of the ESG categories and S&P 1200

	S&P 1200	Core ESG	Climate	Thematic
Number of constituents	1220	404	411	185
Mean Market Cap*	39	58	52	29
Median Market cap*	19	23	28	17
Strategy**	none	B = 41, E = 11	B = 3, E = 16	B = 0, E = 5

*market cap equal to billion USD. ** Strategy; B=best-in-class, E=exclusion, if both then 1 to each group.

Figure 7 presents the sector weights of the S&P Global 1200 and the three subcategories. Indices analysed in this thesis are based on GICS[7] sectors, but since that is to many, dividing into three groups, let us easier analyse the differences. Therefore, *the industry sector* includes material production, real estate, utilities, energy and other traditional industries, *the service sector* consists of customer service, financial services and health care, and finally, *the technology sector* includes IT, telecom and communication services (e.g. Facebook, Alphabet). For example, Core and Climate are more tilted towards technology and less industry compared to the S&P Global 1200. On the contrary, the Thematic category is an outlier where it is underrepresented in the technology and overrepresented in the industry sector with 36 per cent compared to the S&P 1200 with 20 per cent.

Figure 7: Sector composition of the categories versus benchmark



Because of considerable differences in sector composition and mean constituent size between the subcategories, this could help us understand why any subcategory has performed inferior or better compared to the other categories and the benchmark - it would be an essential causality to

[7] GICS sectors consists of 11 sectors

understand. An explanation to why Thematic has had such concentrated portfolios could be that they exclude so many companies in order to fulfil the investment requirement, which goes against what Nagy et al. (2016) found with respect to positive versus negative screening.

6.2 Descriptive statistics

In this part, I present descriptive statistics for the top and bottom 10 performers together with the benchmark and respective three categories of ESG: Core, Thematic and Climate. An overview of the 69 indices and who belongs to which category is in appendix A1. Table 2 shows mean returns, risks, and beta, R-squared for twenty ESG indices, for the entire period September 2009 – October 2019, and the benchmark S&P Global 1200 collectively with the three groups which will be discussed later.

As the table 2 shows, the benchmark yielded 9.4 per cent p.a and a standard deviation of 13.6 per cent p.a., while the top 10 performers ranging from 14.3 per cent points annualized p.a. for *Dow Jones Sustainability North America* *** to 12.1 per cent p.a. for *Dow Jones Sustainability U.S. Index*. All top performers produced a positive differential return compared to the S&P Global 1200. Remarkably, only three top performers, namely *S&P 600 Carbon Efficient Index, S&P 400 Carbon Efficient Index and S&P 500 ESG Factor Weighted Index* higher volatility of return compared to the benchmark. As for the bottom 10 performance, they are observed from 4.1 per cent points annualized p.a. for *Dow Jones Sustainability Emerging Markets* ** to negative 5.2 per cent p.a. for *S&P Global Clean Energy Index*. Furthermore, all ESG bottom 10 indices, have higher volatility than the benchmark.

The difference in mean return between the top average indices and the benchmark are 3.5 per cent p.a. and volatility is 0 per cent p.a. with respect to 13.6 per cent p.a. for both. While the difference in mean return between the average bottom 10 indices and the benchmark are 8 per cent p.a. and volatility of 4.9 per cent p.a.

Table 2: ESG, Benchmark and subcategories September 09-October 19

% Annualized Mean Return and Standard Deviation, beta from CAPM and R-squared.

The top and bottom performers are measured by returns.

	Return	Std.Dev	β[8]	R^2
S & P Global 1200	**9.4**	**13.6**		
Unweighted Core ESG Average	7.5	14.9	0.9	0.8
Unweighted Climate Average	8.7	15.4	1.0	0.8
Unweighted Thematic Average	5.2	17.4	1.0	0.7
Top 10 performers				
Dow Jones Sustainability North America ***	14.6	13.4	0.7	0.5
S&P 600 Carbon Efficient Index	13.3	16.6	1.0	0.7
S&P 500 Carbon Efficient Select Index	13.1	12.9	0.9	0.9
S&P 500 Catholic Values Index	13.0	13.0	0.9	0.9
S&P 500 Carbon Efficient Index	12.8	13.0	0.9	0.6
S&P 400 Carbon Efficient Index	12.8	15.2	1.0	0.8
S&P 500 ESG Factor Weighted Index	12.7	13.8	1.0	0.9
S&P North America LargeMidCap Carbon Efficient Index	12.2	12.9	0.9	0.9
Dow Jones Sustainability World Developed ***	12.2	12.8	0.7	0.6
Dow Jones Sustainability U.S. Index	12.1	12.7	0.9	0.9
Unweighted Average top 10	**12.9**	**13.6**	**0.9**	**0.8**
Bottom 10 performers				
S&P Global Clean Energy Index	-5.2	26.4	1.5	0.6
Dow Jones Sustainability Emerging Markets ***	-1.1	19.6	1.2	0.6
Dow Jones Sustainability Eurozone E-ATGAF*	0.3	20.3	1.1	0.5
Dow Jones Sustainability Europe Developed ***	1.8	17.7	1.2	0.9
Dow Jones Sustainability Europe	1.8	17.8	1.2	0.9
Dow Jones Sustainability Korea 20 Index	2.8	14.3	0.7	0.5
Dow Jones Sustainability Eurozone Index	2.9	20.3	1.1	0.6
Dow Jones Sustainability Asia Pacific Developed ***	3.6	14.8	1.0	0.8
Dow Jones Sustainability Korea Capped 25 Index	3.6	14.8	0.8	0.5
Dow Jones Sustainability Emerging Markets **	4.1	18.7	1.1	0.7
Unweighted Average bottom 10	**1.4**	**18.5**	**1.1**	**0.7**

As the figures show, the average estimated beta for CAPM regression for top 10 performers have been close to 1. The top indices show that the S&P Indices are well presented with market premium from 0.9 to 1, i.e. relatively close to the benchmark. While *DJS world and DJS North America* have had a market premium on 0.7 for the analysed period. For the bottom indices, on average the

[8] CAPM computed with standard errors based on heteroskedasticity robust standard errors

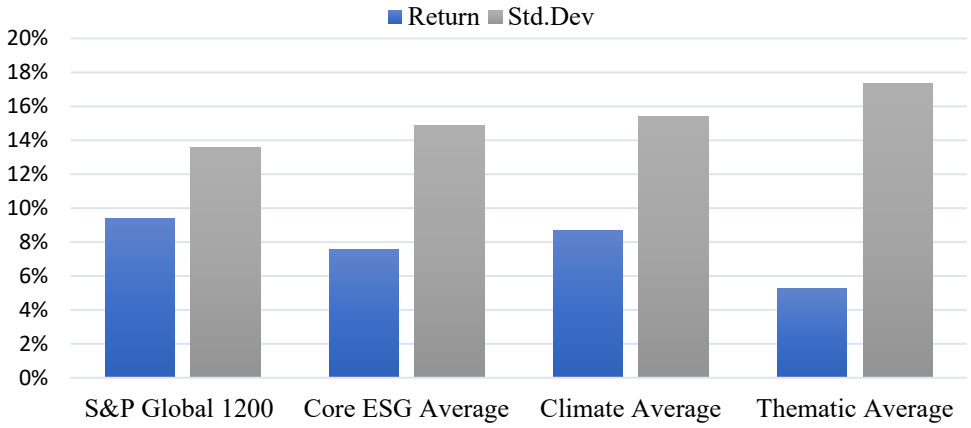
beta has been over the market with 0.1. This indicates that top performers have lower volatility to the market than bottom performers. Respectively, R-squared has been 0.8 on average for the top and average 0.7 for the bottom. On average, top indices have a higher R-squared and give us an indication that their historical price movements could be explained by the movement in the benchmark contrast to bottom performers.

The bottom indices are overrepresented of DJI that have on average beta on 1.1. Beta for the worst performers varies a great deal 1.5 and 0.7. The Eurozone represents four of the bottom 10 performers. For the top and bottom ESG indices, both beta and R-squared varies a great deal because they are compared with the S&P 1200. The difference in both beta and R-squared for the individually ESG indices are natural since they are striving to replicate diverse markets or themes. S&P Carbon follows the U.S market where beta measure is in line with the theory, meaning beta equal to 1. While the Eurozone, Asian and Emerging markets show various results in beta. As from the average, the difference in the top and bottom are 0.2 in R-squared.

For example, *S&P Global Clean Energy Index,* which is the worst performed index, has had high volatility compared to the benchmark equal to 1.5. In contrast, *Dow Jones Sustainability North America* ***, which is the best, have had low volatility compared to the benchmark equal to 0.7. On the contrary, both have had a relatively low-price correlation to the S&P 1200 with R-squared from 0.5 to 0.6.

The upper part of table 2 shows risk, return, beta and R-squared for the three ESG subcategories, which will be discussed in this subchapter for the three unweighted average subcategories: Core ESG, Climate and Thematic. Illustrated in figure 8, S&P Global 1200 have had the highest return ant the lowest risk compared to the average three subcategories. Unlike the benchmark, Thematic ESG investing scores under the two other categories subsequently with 5.2 per cent p.a. return and 17.4 per cent p.a., while Climate has generated the highest return 8.7 per cent p.a. However, Climate has had a slightly higher standard deviation than Core ESG; the difference in risk is 2 per cent p.a.

Figure 8: Annualised mean return and standard deviation 2009-2019



As table 2 show, the estimated market beta for the subcategories is close to 1, except for Core ESG with 0.9. That indicates the returns to the three groups[9] are sensitive to the market risk premium. Looking at the R-squared, 2 out of 3 groups show the same number, which is 0.8, while Thematic historical price movements explained by the benchmark has been 0.7.

6.3 Sharpe Ratios, tracking error and correlations

The correlation relationship showed in table 3 indicate that for global and world indices have a strong correlation to the S&P Global 1200, represented with six of the highest correlated indices with the benchmark. S&P indices are strongly represented, and if we recall table 1, top return indices such as *S&P 500 Carbon and Catholic* have a correlation of 0.97 to the benchmark.

Table 3: Correlations between S&P Global 1200 and the ESG indices 2009-2019

Top 10*	S&P 1200	Bottom 10*	S&P 1200
S&P Global 1200 Carbon Efficient Index	0.99	S&P Global Clean Energy Index	0.76
S&P Global Large Mid Cap Carbon Efficient Index	0.99	S&P/ASX All Australian 50 Carbon	0.74
Dow Jones Sustainability World Index	0.99	S&P South Africa Carbon Efficient	0.74
S&P Global 1200 ESG Factor Weighted Index	0.99	S&P/JPX Carbon Efficient Index	0.69
Dow Jones Sustainability World Developed Index	0.98	S&P/TOPIX 150 ESG Factor Weighted	0.69
Dow Jones Sustainability World Gross Index E-ATGAF*	0.98	Dow Jones Sustainability Emerging Markets	0.68
S&P Developed Large Mid Cap Carbon Efficient Index	0.98	S&P/TOPIX 150 Carbon Efficient Index	0.67
S&P North America Large Mid Cap Carbon Efficient	0.97	Dow Jones Sustainability North America**	0.67
S&P 500 Carbon Efficient Index	0.97	S&P/BMV IPC Sustainable	0.67
S&P 500 Catholic Values Index	0.97	Dow Jones Sustainability Japan 40	0.65

*Some indices are dropped because of very similar results, for example Dow Jones Sustainability World Developed Ex-Korea are left out because Dow Jones Sustainability World Index represent the "world" category.

[9] Groups meaning subcategories namely: Core, Thematic and Climate ESG.

In the lower part of the correlation related to the benchmark, I find primarily indices from Asia, Africa and emerging market ranging from 0.65 to 0.76. In contrast, none of the European indices is represented in the table. Hence, they are in the middle part of the correlation relationship with respect to the benchmark.

Table 4 represents a vital measurement to understand the connection between the S&P Global 1200 and the indices, expressly tracking error (TE). If we start to the right of the table, indices with lowest TE are not surprising Global and World. More remarkable was that Carbon indices had so low TE. The 10 lowest TE range from 0.6 for *S&P Global 1200 Carbon Efficient* to 3.4 for *S&P 500 Carbon Efficient*. As for the indices with highest TE, Emerging, Asia and the specific *Clean Energy index* have the highest standard deviation percentage difference in return compared to the benchmark. In contrast to the lowest TE, the 10 highest TE rage from 18.3 for *Global Clean Energy* down to 10.7 for *S&P/Topic ESG factor*. A narration of the differences in TE is explained by the different investment universe, yet, there are some differences to S&P 1200 between the indices who invest in the same market.

Table 4: % annualised tracking error between S&P Global 1200, ESG indices & subcategories ranging lowest and highest TE 2009-2019

10 Highest Tracking Error	S&P 1200	10 Lowest Tracking Error	S&P 1200
S&P Global Clean Energy Index	18.3	S&P Global 1200 Carbon Efficient	0.6
S&P South Africa Domestic Shareholder Carbon	14.7	S&P Global LargeMidCap Carbon Efficient	1.0
Dow Jones Sustainability Japan 40	14.3	Dow J. Sustainability World Developed Ex-Korea **	1.4
Dow Jones Sustainability Eurozone E-ATGAF*	14.2	Dow Jones Sustainability World Index	1.5
Dow Jones Sustainability Eurozone Index	14.1	S&P Global Ex-Japan LargeMidCap Carbon Efficient	1.5
S&P/TOPIX 150 Carbon Efficient Index	13.5	Dow Jones Sustainability World **	1.6
Dow Jones Sustainability Emerging Markets Index	12.9	S&P Global 1200 ESG Factor Weighted	2.1
Dow Jones Sustainability Emerging Markets ***	11.9	Dow Jones Sustainability World Enlarged	2.1
S&P/BMV IPC Sustainable	11.4	S&P Developed LargeMidCap Carbon Efficient	2.7
S&P/TOPIX 150 ESG Factor Weighted Index	10.7	S&P 500 Carbon Efficient	3.4

Since TE represents the distinction between the return an investor receives compared to the S&P 1200, more significant TE should either give high losses or gains. In contrast, low TE should yield low losses or gains. It is therefore interesting to compare the TE with the indices which have done excellently or poorly and examine if they have a high or low TE. I will present TE again, down below, in relative performance measures. Then we could instead observe how different the TE are for the top and bottom performing alpha and IR Indices.

Table 5 shows how the top 5 and bottom 5 indices have performed in terms of the annualised Sharpe ratios. Top performers deliver risk-adjusted returns from 0.91 to 1.06 while the benchmark has been 0.65. *Dow Jones Sustainability North America Diversified Selected Index* performs best with 1.06 with closely followed by S&P 500 indices, carbon and catholic.

Table 5: Sharpe Ratios for benchmark, top and bottom ESG indices 2009-2019

Top 5	SR
Dow Jones Sustainability North America Diversified Select	1.06
S&P 500 Carbon Efficient Select	0.98
S&P 500 Catholic Values	0.96
S&P 500 Carbon Efficient	0.95
Dow Jones Sustainability U.S.	0.91
Bottom 5	SR
Dow Jones Sustainability Europe Developed Diversified Select	0.06
Dow Jones Sustainability Europe	0.06
Dow Jones Sustainability Eurozone ATGAFI*	-0.02
Dow Jones Sustainability Emerging Markets Diversified Select	-0.10
S&P Global Clean Energy	-0.23
S&P Global 1200	**0.65**

*Ex-Alcohol, Tobacco, Gambling, and Armaments & Firearms Index

The bottom 5 performers have yielded 0.06 as for the Europe indices, which is 0.59 lower than compared to the benchmark. With respect to negative Sharpe ratios for *Dow Jones Sustainability Eurozone ATGAFI**, *Dow Jones Sustainability Emerging Markets Diversified Select Index* and *S&P Global Clean Energy Index* means that the risk-free rate is greater than the index return in that way does not convey any useful meaning.

The dispersion of Sharpe among the 69 indices compared to S&P 1200 resulted in 22 indices that had a higher Sharpe ratio than benchmark and 47 had a lower risk-adjusted return. Three out of five indices top 5 performers are using an exclusion strategy, whereas for bottom 5, four out of five using a best-in-class strategy.

6.4 Relative performance measures

Previous statistics give us an indication of how good the ESG indices have performed, but this is in a simplistic absolute context. To get even more familiar with our data, I need to examine beyond absolute risk and return. In this section, I will use relative measures such as information ratio and different regression models to investigate the performance of ESG indices and how they differ from the S&P Global 1200 in relative terms. This part looks at annualised alpha values from CAPM and

Fama-French, market, value and size from F&F, and annualised information ratio and tracking error for the top and bottom performers along with the subcategories.

Table 6 shows the top and bottom performers for alpha and IR values, notice that 3-5 are in bold. It is because they represent the top for both alpha and IR. While top IR range from 3-7 and top alphas from 1-5. The first number of columns present annualised CAPM alpha, while F&F alpha is shown in column four. I will use F&F alphas when I comment further, i.e. factor-adjusted excess returns of the ESG indices over the S&P 1200. The second represents annualised tracking error, i.e. the indices consistency versus the benchmark over the analysed period. Next column shows IR, i.e. how the ESG indices have performed relative to the volatility of the excess return. The fifth column represents systematic risk from Fama-French; similarly, sixth and seventh columns present the difference in factor supplement from the ESG indices relative to the S&P 1200.

Table 6: Annualised percentage alphas and IR, and Fama-French factors 2009-2019.

Top alpha and IR* **							
Indices	α_{CAPM}	**TE**	**IR**	$\alpha_{F\&F}$[10]	$\beta_{F\&F}$	γ_{SMB}	δ_{HML}
1. Dow Jones Sustainability North America Diversified Select	8.1**	10.8	0.5*	8.5**	0.7**	-0.10	0.14*
2. Dow Jones Sustainability World Developed Diversified Select	5.0**	8.6	0.3	5.2**	0.7**	-0.06	0.11**
3. S&P 500 Carbon Efficient Select Index	4.1**	3.5	1.0**	4.4**	0.9*	-0.03*	-0.002
4. S&P 500 Catholic Values Index	4.4**	3.4	1.1**	4.0**	0.9*	-0.02	-0.02
5. Dow Jones Sustainability U.S. Index	3.6**	4.2	0.6**	4.1**	0.9*	-0.001	0.12**
6. S&P North America LargeMidCap Carbon Efficient Index	2.9**	3.0	0.9**	3.0**	0.9	0.01	0.0003
7. S&P 500 ESG Factor Weighted Index	3.7**	4.6	0.7**	4.0**	1.0	-0.23**	0.08
Bottom alpha and IR							
Indices	α_{CAPM}	**TE**	**IR**	$\alpha_{F\&F}$	$\beta_{F\&F}$	γ_{SMB}	δ_{HML}
S&P Global Clean Energy Index	-18.7**	18.3	-0.8**	-18.4**	1.4**	0.83**	0.01
Dow Jones Sustainability Emerging Markets Diversified Select	-11.9**	11.0	-0.9**	-12.3**	1.1*	0.34*	0.41**
Dow Jones Sustainability Europe Developed Diversified Select	-9.5**	7.4	-1.0**	-8.2**	1.2**	-0.12	0.05
Dow Jones Sustainability Europe	-9.4**	7.2	-1.1**	-9.3**	1.2**	0.05	0.21**
Dow Jones Sustainability World Enlarged Index	-5.1**	2.1	-2.1**	-4.9**	1.0	-0.03	0.03
Subcategories	α_{CAPM}	**TE**	**IR**	$\alpha_{F\&F}$	$\beta_{F\&F}$	γ_{SMB}	δ_{HML}
Unweighted Core ESG Average	-1.2	7.0	-0.2	-1.1	0.9	0.05	0.12
Unweighted Climate Average	0.3	7.0	0.02	0.2	1	0.13	0.17
Unweighted Thematic Average	-4.4	10.6	-0.3	-4.2	1	0.4	0.03

** Significant level = 0.1 ** Significant level = 0.05.*
****The top alpha performers are from 1-5 and IR from 3-7. Alpha's and IR are annualised.*

[10] F&F and CAPM computed with standard errors based on heteroskedasticity robust standard errors

As the figures show, top-performing indices have had significant positive alphas. The annualised alphas differ from 3.0 percentage points for *S&P 500 ESG Factor Weight* to 8.5 percentage points *DJS North America Diversified*. Because it was expected that top indices would have a significant positive risk-adjusted return since the number of indices is 69. It is, therefore, more interesting to figure out where top indices are located, i.e. which geographical area. Indices, who has America as their investment universe have had a solid risk-adjusted return. For example, S&P companies have America as their investment market. The outlier here is *Dow Jones Sustainability World Developed Diversified Select* with an annualized alpha of 5.2 percentage point. For bottom-performing indices, the annualised alphas range from negative 4.9 percentage points for DJS world enlarged to negative 18.4 percentage point for *S&P Global Clean Energy*. I would characterize *S&P global clean energy* as an outlier with 13.5 percentage point in difference *DJS world enlarged*. The underperformance is related to geographic areas as Emerging markets and Europe. As given from the table, CAPM and F&F alphas differ minimally in value.

Nevertheless, some differ more than others, for example, *DJS Europe Developed Diversified* show negative 9.5 per cent p.a. with CAPM and negative 8.2 per cent p.a. with F&F. This shows the importance of correcting for differences in factor contributions among the ESG indices to the benchmark. Because the overall factor contribution from value and size are various for the ESG indices for both top and bottom, the factor contributions conduct no clear trend tilt.

Interestingly is that market values for top performers have been relatively low, which makes DJ world' and North America's value 0.7. Low volatility to the benchmark has resulted in positive risk-adjusted return. In comparison, the bottom indices have had a significant beta over 1. They show that high volatility to the benchmark resulted in inferior performance. Thus, low volatility to the benchmark results in positive risk-adjusted return.

The information ratios for top and bottom indices are all significant different positive or negative except for 1. and 2. because they have had superior TE thus no significant IR. It is not necessary for the index with the highest or lowest alpha that has the most significant IR. Due to the difference in tracking error. For instance, the difference in alpha value *for S&P Catholic Values* and *DJS*

North America is 4.5 percentage points. However, the difference in the IRs are 0.5 - makes the tracking error largest for *DJS North America* relative to *S&P Catholic Values*.

Among the indices with respect to the tracking error, they are considerably spread, the top-performing indices ranging from 3.6 to 10.6, while the bottom is ranging from 18.3 to 2.1. As tracking error shows how active the indices as regards to the benchmark, not surprisingly, the best and poor performances have had a relatively high TE. They have deviated to a great extent, which results in better or worse results, depends if it is positive or negative excess return. For example, *Dow Jones Sustainability North America Diversified Select* wants low TE since it has gained high alpha, which result in good IR. In the opposite, *Dow Jones Sustainability World Enlarged Index* stands out because of low TE have resulted in high IR even though the alpha value is less negative than for example, the Europe indices. From the top performers, the *S&P 500 Carbon Efficient Select Index* and *S&P 500 Catholic Values Index* provide relatively low TE and high alpha which is reflected in the excellent IR. It is especially U.S and Carbon indices which provide consistent results with high alpha and low TE.

6.5 Summarising the results

In order to generalise my result, I have looked at the average in each category. The annualised alphas deviate from positive 0.2 percentage points for Climate and negative 4.2 percentage points for Thematic. For Core ESG and Thematic, I find that most indices underperform till the S&P 1200. The substantial underperformance of Thematic investing is contrary to what Lee & Faff (2009) and Verheyden et al. (2016) found in their research. Whereas in line with what Chang et al. (2012) and Ibikunle & Steffen (2017) found, while others conclude that there is neither a substantial inferior result nor gain from ESG investing (RBC GAM, 2012; Friede et al., 2015). I find the support that Climate neither outperform nor underperform the S&P Global 1200. As previously shown, Climate performs best on average and consists of only the S&P indices (Appendix A1).

As we can see from the table, CAPM and F&F alphas differ minimally in value. Nevertheless, some differ more than others, for example, Thematic shows negative 4.4 per cent p.a. with CAPM and negative 4.2 per cent p.a. with F&F. This shows the value of correcting for differences in factor

contributions among the ESG indices and the benchmark. On the one hand, the overall factor contribution from value and size are positive for the ESG indices. On the other hand, it is small differences in factor corrections even though indices have a positive tilt towards size and value stocks. It is an obvious trend. Consequently, excess return from CAPM is close to a factor-adjusted excess return.

In contrast, the market factor is in line with theory, which states that beta for the market should be 1. Both Climate and Thematic average are facing a smaller market contribution than Core ESG with 0.9. As shown for the top and bottom, the market contribution is enormous, but on average, it is close to 1. Information ratios range from negative 0.3 for Thematic to positive 0.02 for Climate. It makes IR for the subcategories not significantly different from 0. Important to have in mind is that tracking errors for Core and Climate are 7 per cent p.a. and 10.6 per cent p.a. for Thematic. Since TE indicates consistency an investor receives of the returns compared to the S&P 1200, it makes sense that Thematic has had the highest to explain that they either produce high losses or gains compared to the S&P Global 1200. In contrast, Climate and Core ESG deviate less yielding lower loss or gain. Because TE is a part of the formula for calculating IR, have I only focused on top and bottom alpha and IR indices when I investigate the subcategories further.

Table 7 are aligned with previous studies and shows unnatural market capitalisation and number of constituents for ESG indices compared to top vs lowest performers. As the figures show, constraint on the investment universe seems to be the case for lowest-performing indices with totally 131 constituents. Another observation is that lowest are tilted towards small-cap relative to the benchmark and top performers. Top IR and alpha have about 30 per cent of the total number of constituents related to benchmark, but higher mean and median capitalisation.

Table 7: M-cap, constituents and strategy of top and bottom performers and S&P 1200

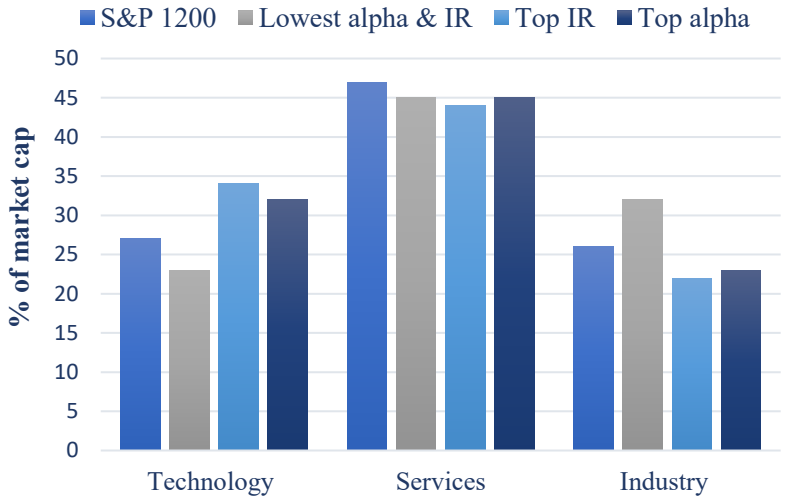
	S&P 1200	Lowest alpha and IR	Top IR	Top alpha
Number of constituents	1220	131	405	377
Mean market cap*	39	20	55	53
Median market cap*	19	10	24	23
Strategy**	none	B = 5, E = 2	B = 4, E = 4	B = 4, E = 3

*market cap equal to billion USD. **Top/low alpha and IR used strategy, B=1, E=2; B=best-in-class, E=exclusion, if both then 1 to each group

Although it is contrasted with the composition of the indices, I find no evidence in favour or against one or the other strategy, considering best-in-last or exclusion approach.

As previously, GICS 11 sectors have been put into three sectors: Technology, Services and Industry. Figure 9 shows the sector weights of the S&P Global 1200 along with the top and bottom alphas and IRs. An Interesting result is that lowest-performing alpha and IR indices tilt towards industry sector and away from technology compared with the benchmarks and the top-performing indices. On the other hand, Top performers tilt towards technology and less industry compared with the benchmark.

Figure 9: Sector composition of top and bottom performers versus benchmark



This result is aligned with the subcategory performance in figure 7, where Thematic, who has lowest average alpha and IR value has the same characteristics as lowest alpha and IR for the indices; independent of subcategory. For example, Top IR has 34 per cent of the allocated capital in technology, while Climate has 36 per cent. The conclusion is very clear. There are significant costs for ESG indices related to tilting the allocation towards industry, whereas gaining from technology.

7 Conclusions and implications

The findings from the empirical results indicate that there are weak financial losses on average from S&P DJI ESG universe compared with S&P Global 1200 since 2009. However, the results show that pick indices with a relatively high number of constituents, relative concentrated portfolio towards technology and away from industries, besides, to invest in Climate ESG would have increased the probability of beating the benchmark. This indicates that the effect of ESG, in this case, the increased idiosyncratic risk from the skewed sector tilts and decreased investment world, exceed the benefits, resulting in ESG underperforming the benchmark in the analysed period.

(I) How do ESG indices from S&P Dow Jones Indices perform compared to a standard benchmark over the past ten years?

In order to answer the research question, I take the consensus based on the average and since Core and Thematic ESG underperform, while Climate provides the same risk-adjusted return as S&P Global 1200. There is evidence for several individual indices of ESG that overperform and underperform, but unweighted average slightly underperformance the benchmark is my answer to the (I) research question.

(II) What are the main characteristics of the top and bottom performing ESG indices?

There are significant costs related to the number of constituents; the study shows that the higher the amount, the better. The characteristics of top-performing ESG indices are that they are tilted towards the technology sector and away from the industry sector while it is the opposite for the bottom performing indices. Relatively high market capitalisation has performed significantly better than low market capitalisation both in terms of mean and median market capitalisation. The study does not find any evidence of whether to allocate capital towards best-in-class or exclusion indices.

According to Vert Asset Management (2017), ESG's only concerns are the financial result with corporate ESG criteria. But when we look at the Thematic and Core ESG, it is obvious that they have slightly underperformed a standard benchmark such as S&P 1200. Makes investing in ESG based on only financial result non-questionable.

Some limitations of this thesis are that information for all indices is back-tested by S&P DJI - based on the methodology that was in effect on the launch date. Since back-tested performance, which is hypothetical and not actual performance, is subject to constitutional limitations. It reflects operation of an index methodology and selection of index constituents in hindsight. Since it is used a theoretical approach, some deviation from the actual returns may be the case. Back-testing returns might be different because of factors in the markets and decisions that may have been made during the real process of controlling an index.

A problem arose when working with this thesis was information gathering for the indices. To obtain more extended details about the data is expensive, and my attempt to get data for index composition over time has failed, due to the cost of collecting the data. Industry and sector holdings can vary significantly over time and should be studied over the time period to strengthen this study. For further research, it would be interesting to look at ESG scores combined with performance to see if one provider has high ESG scores for high or low return indices and vice versa. Access to the S&P DJI ESG scores requires another separate licence even though some individual indices have ESG scores; it was not enough to gather reliable data to perform other analysis steps, for example, panel data.

Even though the term ESG have been used in finance for some years now, structural change takes time. Risk and return from sustainable investing could be even more interesting in the years to come and divide into periods might differentiate the ESG effect versus none ESG effect, which has not been done in this thesis.

In conclusion, the empirical analysis shows that the performance of ESG indices on average was weak inferior to the broad benchmark, S&P Global 1200 since 2009. Most indices have had a higher risk than the S&P 1200, especially the lower bond of indices, because of sector composition, geographical market and constituents' size. In other words, some indices are highly concentrated and have a limit investing universe. The difficulty about examines the relationship from an ESG strategy approach indicated that there is no clear trend to which approach an investor should have obtained during the past ten years. By using a Fama-Frech model, I estimated the systematic risk factor between the benchmark and the 69 ESG indices. The value and size factors provide various

and ambiguous results for top and bottom performers. Whereas the market factor had a negative correlation to alpha, i.e. the top performers had a beta lower than one, while bottom performers over one. However, on average, the market premium was approximately zero.

As shown, I find weak results in both overperformance and but clearer underperformance on average. Nevertheless, some evidence reoccurred for both the categories, the top and bottom indices. Sector composition indicated that technology was important for generating a high return while staying away from too much industry exposure. The indices must have a decent market capitalisation size besides not extremely concentrated. Geographic reach was important, and as shown, the U.S. market was important for gaining high risk-adjusted return and in contrast staying away from Europe and Emerging markets. The tracking error was relatively higher for Europe than for the U.S market and Climate indices. A numerous of the indices have done well compared to the S&P Global 1200, but to gaining risk-adjusted return required the investor to have index picking skills, if not the Climate indices were the only choices.

The index data imply there is no reason to assume a substantial difference in the performance of a standard benchmark, S&P Global 1200 compared to S&P DJI ESG universe. Investors should look at the index construction, particularly since some of the indices can lack diversification.

If a future investor wants to look at the past performance to know whether to invest with an ESG approach or not, it should be based on ethical values and belief that investing in environmental, social and governance would have an impact in making the world a better place. If the investor is indifferent in selection choice, investing in the S&P Global 1200 would be the best estimate on optimal future risk-adjusted return. If ESG is the only choice, historical prices show that Climate has performed in line with the S&P Global 1200.

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Appendix

Table A1: Launch Date and strategy

#	Indices	Strategy	Launch Date
	Core ESG		
1	Dow Jones Sustainability Asia Pacific E-ATGAF*	Exclution	Jan / 09
2	Dow Jones Sustainability Eurozone E-ATGAF*	Exclution	Aug / 10
3	Dow Jones Sustainability Asia Pacific Developed **	Best-in-class	May / 13
4	Dow Jones Sustainability Asia Pacific Developed ***	Both	Sep / 15
5	Dow Jones Sustainability Emerging Markets Index	Best-in-class	Feb / 13
6	Dow Jones Sustainability Asia Pacific Index	Best-in-class	Jan / 09
7	Dow Jones Sustainability Emerging Markets **	Best-in-class	Oct / 16
8	Dow Jones Sustainability Emerging Markets ***	Both	Feb / 13
9	Dow Jones Sustainability United	Best-in-class	Aug / 10
10	Dow Jones Sustainability Emerging	Best-in-class	Feb / 13
11	Dow Jones Sustainability Europe	Best-in-class	Aug / 10
12	Dow Jones Sustainability Europe Developed ***	Both	Aug / 10
13	Dow Jones Sustainability Korea 20 Index	Best-in-class	Oct / 09
14	Dow Jones Sustainability Japan 40 Index	Best-in-class	Jul / 09
15	Dow Jones Sustainability Eurozone Index	Best-in-class	Aug / 10
16	Dow Jones Sustainability Nordic Index	Best-in-class	Nov / 10
17	Dow Jones Sustainability Korea Capped 25 Index	Best-in-class	Jun / 16
18	Dow Jones Sustainability North America 40 Index	Best-in-class	Aug / 08
19	Dow Jones Sustainability Nordic Index	Best-in-class	Nov / 10
20	Dow Jones Sustainability U.S. Index	Best-in-class	Sep / 05
21	Dow Jones Sustainability North America ***	Both	Sep / 05
22	Dow Jones Sustainability North America Composite Index	Best-in-class	Jul / 14
23	Dow Jones Sustainability North America **	Best-in-class	Sep / 05
24	Dow Jones Sustainability North America index	Best-in-class	Sep / 05
25	Dow Jones Sustainability World 80 Index	Best-in-class	Aug / 08
26	Dow Jones Sustainability United States 40 Index	Best-in-class	Aug / 08
27	Dow Jones Sustainability World Developed ***	Both	May / 13
28	Dow Jones Sustainability World Index	Best-in-class	Sep / 99
29	Dow Jones Sustainability World Developed Ex-Korea ***	Both	Sep / 15
30	Dow Jones Sustainability World Developed Ex-Korea **	Best-in-class	Sep / 15
31	Dow Jones Sustainability World Developed Index	Best-in-class	May / 13
32	Dow Jones Sustainability World Enlarged Index	Best-in-class	Sep / 08
33	Dow Jones Sustainability World Developed Index	Best-in-class	May / 13
34	Dow Jones Sustainability World ***	Both	May / 13
35	Dow Jones Sustainability World **	Best-in-class	Sep / 15
36	Dow Jones Sustainability World Index	Best-in-class	May / 13
37	Dow Jones Sustainability World Enlarged Index	Best-in-class	Nov / 10
38	Dow Jones Sustainability World Gross Index E-ATGAF *	Exclution	Sep / 99

39	S&P 500 Catholic Values Index	Exclution	Aug-15
40	S&P 500 ESG Factor Weighted Index	Best-in-class	Feb-16
41	S&P Europe 350 ESG Factor Weighted Index	Best-in-class	Feb-16
42	S&P Global 1200 ESG Factor Weighted Index	Best-in-class	Feb-16
43	S&P Europe 350 ESG Factor Weighted Index	Best-in-class	Feb-16
44	S&P/TSX 60 ESG Factor Weighted Index	Best-in-class	Jun-14
45	S&P/TOPIX 150 ESG Factor Weighted Index	Best-in-class	Feb-16
	Climate		
46	S&P 500 Carbon Efficient Select Index	Exclution	Mar-09
47	S&P 500 Carbon Efficient Index	Exclution	Jul-09
48	S&P Developed LargeMidCap Carbon Efficient Index	Exclution	Oct-18
49	S&P Emerging LargeMidCap Carbon Efficient Index	Exclution	Oct-18
50	S&P Europe 350 Carbon Efficient Index	Exclution	Oct-18
51	S&P Global 1200 Carbon Efficient Index	Exclution	Oct-18
52	S&P Europe LargeMidCap Carbon Efficient Index	Exclution	Oct-18
53	S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	Exclution	Jul-18
54	S&P Global LargeMidCap Carbon Efficient Index	Exclution	Jul-18
55	S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	Exclution	Jul-18
56	S&P North America LargeMidCap Carbon Efficient Index	Exclution	Oct-18
57	S&P 400 Carbon Efficient Index	Exclution	Oct-18
58	S&P 600 Carbon Efficient Index	Exclution	Oct-18
59	S&P South Africa Domestic Shareholder Carbon index	Exclution	Oct-18
60	S&P/ASX All Australian 50 Carbon Efficient Index	Best-in-class	Aug-15
61	S&P South Africa Carbon Efficient Index	Exclution	Oct-18
62	S&P/JPX Carbon Efficient Index	Both	Jul-18
63	S&P/TSX 60 Carbon Efficient Index	Best-in-class	Sep-15
	Thematic		
65	S&P Global Clean Energy Index	Exclution	Feb-07
66	S&P Global Eco Index	Exclution	Jan-08
67	S&P Global Water Index	Exclution	Feb-07
68	S&P Global Timber and Forestry Index	Exclution	Aug-07
69	S&P/BMV IPC Sustainable	Exclution	Dec-11

*Ex-Alcohol, Tobacco, Gambling, and Armaments & Firearms Index
** Diversified Index
*** Diversified Select Index
*,**,*** **is the norm for all tables**
Both = exclusion and best-in-class

Table A2: % Annualised Mean Return and Standard Deviation

	Return	Std.Dev	β_{CAPM}	R^2
S & P Global 1200	9.4	13.6		
Core ESG				
Dow Jones Sustainability Asia Pacific E-ATGAF*	4.7	14.8	1.0	0.8
Dow Jones Sustainability Eurozone E-ATGAF*	0.3	20.3	1.1*	0.6
Dow Jones Sustainability Asia Pacific Developed **	5.6	14.5	1.0	0.8
Dow Jones Sustainability Asia Pacific Developed ***	3.6	14.8	1.0	0.8
Dow Jones Sustainability Emerging Markets Index	5.0	17.6	0.9	0.6
Dow Jones Sustainability Asia Pacific Index	5.0	14.5	1.0	0.8
Dow Jones Sustainability Emerging Markets **	4.1	18.7	1.1*	0.7
Dow Jones Sustainability Emerging Markets ***	-1.1	19.6	1.2**	0.6
Dow Jones Sustainability United	10.5	13.6	0.9	0.9
Dow Jones Sustainability Emerging	5.6	17.4	0.9	0.6
Dow Jones Sustainability Europe	1.8	17.8	1.2**	0.9
Dow Jones Sustainability Europe Developed ***	1.8	17.7	1.2**	0.9
Dow Jones Sustainability Korea 20 Index	2.8	14.3	0.7**	0.6
Dow Jones Sustainability Japan 40 Index	8.3	18.8	0.9	0.6
Dow Jones Sustainability Eurozone Index	2.9	20.3	1.1*	0.6
Dow Jones Sustainability Nordic Index	8.5	15.2	0.9*	0.6
Dow Jones Sustainability Korea Capped 25 Index	3.7	14.6	0.8**	0.6
Dow Jones Sustainability North America 40 Index	10.6	13.4	0.9*	0.9
Dow Jones Sustainability Nordic Index	5.7	18.0	1.2**	0.8
Dow Jones Sustainability U.S. Index	12.1	12.7	0.9	0.9
Dow Jones Sustainability North America ***	14.6	13.4	0.7**	0.6
Dow Jones Sustainability North America Composite Index	11.4	12.9	0.9	0.9
Dow Jones Sustainability North America **	11.5	13.1	0.9*	0.9
Dow Jones Sustainability North America index	9.6	13.2	0.9	0.9
Dow Jones Sustainability World 80 Index	6.4	15.3	1.1*	0.9
Dow Jones Sustainability United States 40 Index	11.5	13.1	0.9	0.9
Dow Jones Sustainability World Developed ***	12.2	12.8	0.7**	0.6
Dow Jones Sustainability World Index	9.0	13.7	1.0	1.0
Dow Jones Sustainability World Developed Ex-Korea ***	9.1	13.6	1.0	1.0
Dow Jones Sustainability World Developed Ex-Korea **	12.0	13.1	0.7**	0.6
Dow Jones Sustainability World Developed Index	11.9	12.6	0.7**	0.6
Dow Jones Sustainability World Enlarged Index	4.8	14.4	1.1*	1.0
Dow Jones Sustainability World Developed Index	7.5	14.8	1.1	1.0
Dow Jones Sustainability World ***	8.6	13.8	1.0	1.0
Dow Jones Sustainability World **	8.9	13.9	1.0	1.0
Dow Jones Sustainability World Index	7.6	12.9	0.8**	0.7
Dow Jones Sustainability World Enlarged Index	10.0	12.6	0.8**	0.7
Dow Jones Sustainability World Gross Index E-ATGAF *	8.0	14.8	1.1*	0.9
S&P 500 Catholic Values Index	13.0	13.0	0.9	0.9
S&P 500 ESG Factor Weighted Index	12.7	13.8	1.0	0.9

S&P Europe 350 ESG Factor Weighted Index	8.1	13.8	0.8**	0.7
S&P Global 1200 ESG Factor Weighted Index	9.8	14.1	1.0	1.0
S&P Europe 350 ESG Factor Weighted Index	5.6	17.3	1.2**	0.9
S&P/TSX 60 ESG Factor Weighted Index	6.7	11.6	0.7**	0.6
S&P/TOPIX 150 ESG Factor Weighted Index	7.1	13.8	0.7**	0.6
Unweighted Core ESG Average	**7.5**	**14.9**	**0.9**	**0.8**
Climate				
S&P 500 Carbon Efficient Select Index	13.1	12.9	0.9	0.9
S&P 500 Carbon Efficient Index	12.8	13.0	0.9	0.6
S&P Developed LargeMidCap Carbon Efficient Index	9.1	12.9	0.9	1.0
S&P Emerging LargeMidCap Carbon Efficient Index	4.1	17.6	1.1*	0.7
S&P Europe 350 Carbon Efficient Index	5.2	15.9	1.1	0.8
S&P Global 1200 Carbon Efficient Index	9.5	13.6	1.0	1.0
S&P Europe LargeMidCap Carbon Efficient Index	5.4	16.9	1.2**	0.9
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	9.2	14.2	1.0	1.0
S&P Global LargeMidCap Carbon Efficient Index	9.0	13.7	1.0	1.0
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	11.0	18.7	1.2**	0.8
S&P North America LargeMidCap Carbon Efficient Index	12.2	12.9	0.9	0.9
S&P 400 Carbon Efficient Index	12.8	15.2	1.0	0.8
S&P 600 Carbon Efficient Index	13.3	16.6	1.0	0.7
S&P South Africa Domestic Shareholder Carbon index	4.4	21.4	1.2**	0.6
S&P/ASX All Australian 50 Carbon Efficient Index	8.8	12.4	0.7**	0.6
S&P South Africa Carbon Efficient Index	4.9	21.4	1.2**	0.6
S&P/JPX Carbon Efficient Index	5.8	13.2	0.7**	0.6
S&P/TOPIX 150 Carbon Efficient Index	8.2	18.2	0.9*	0.6
S&P/TSX 60 Carbon Efficient Index	6.4	11.7	0.7**	0.6
Unweighted Climate Average	**8.7**	**15.4**	**1**	**0.8**
Thematic				
S&P Global Clean Energy Index	-5.2	26.4	1.4**	0.6
S&P Global Eco Index	7.1	14.1	0.9	0.7
S&P Global Water Index	10.4	13.6	0.9	0.8
S&P Global Timber and Forestry Index	7.2	19.3	1.2**	0.7
S&P/BMV IPC Sustainable	6.7	13.4	0.6**	0.6
Unweighted Thematic Average	**5.2**	**17.4**	**1**	**0.7**

*p < 0.05, **p < 0.01

Table A3: % annualised absolute and relative performance

Core ESG	SR	IR	T-value (IR)	TE
Dow Jones Sustainability Asia Pacific E-ATGAF*	0.3	-0.71	-2.26	6.5
Dow Jones Sustainability Eurozone E-ATGAF*	0.0	-0.64	-2.02	14.2
Dow Jones Sustainability Asia Pacific Developed **	0.3	-0.58	-1.84	6.6
Dow Jones Sustainability Asia Pacific Developed ***	0.2	-0.88	-2.78	6.6
Dow Jones Sustainability Emerging Markets Index	0.2	-0.34	-1.08	12.9
Dow Jones Sustainability Asia Pacific Index	0.3	-0.69	-2.18	6.4
Dow Jones Sustainability Emerging Markets **	0.2	-0.49	-1.54	11.0
Dow Jones Sustainability Emerging Markets ***	-0.1	-0.88	-2.80	11.9
Dow Jones Sustainability United	0.8	0.50	1.58	4.2
Dow Jones Sustainability Emerging	0.3	-0.31	-0.97	12.5
Dow Jones Sustainability Europe	0.1	-1.05	-3.33	7.2
Dow Jones Sustainability Europe Developed ***	0.1	-1.03	-3.27	7.4
Dow Jones Sustainability Korea 20 Index	0.2	-0.62	-1.97	10.6
Dow Jones Sustainability Japan 40 Index	0.4	-0.08	-0.24	14.3
Dow Jones Sustainability Eurozone Index	0.1	-0.46	-1.47	14.1
Dow Jones Sustainability Nordic Index	0.5	-0.10	-0.31	9.2
Dow Jones Sustainability Korea Capped 25 Index	0.2	-0.55	-1.72	10.7
Dow Jones Sustainability North America 40 Index	0.8	0.29	0.92	4.1
Dow Jones Sustainability Nordic Index	0.3	-0.41	-1.31	8.9
Dow Jones Sustainability U.S. Index	0.9	0.65	2.05	4.2
Dow Jones Sustainability North America ***	1.1	0.48	1.52	10.8
Dow Jones Sustainability North America Composite Index	0.8	0.53	1.68	3.7
Dow Jones Sustainability North America **	0.8	0.55	1.75	3.7
Dow Jones Sustainability North America index	0.7	0.05	0.17	3.8
Dow Jones Sustainability World 80 Index	0.4	-0.78	-2.46	3.8
Dow Jones Sustainability United States 40 Index	0.8	0.50	1.58	4.2
Dow Jones Sustainability World Developed ***	0.9	0.32	1.00	8.7
Dow Jones Sustainability World Index	0.6	-0.30	-0.95	1.5
Dow Jones Sustainability World Developed Ex-Korea ***	0.6	-0.23	-0.73	1.4
Dow Jones Sustainability World Developed Ex-Korea **	0.9	0.27	0.86	9.5
Dow Jones Sustainability World Developed Index	0.9	0.29	0.91	8.6
Dow Jones Sustainability World Enlarged Index	0.3	-2.15	-6.80	2.1
Dow Jones Sustainability World Developed Index	0.5	-0.68	-2.14	2.9
Dow Jones Sustainability World ***	0.6	-0.53	-1.66	1.5
Dow Jones Sustainability World **	0.6	-0.31	-0.97	1.6
Dow Jones Sustainability World Index	0.5	-0.24	-0.76	7.3
Dow Jones Sustainability World Enlarged Index	0.8	0.08	0.25	7.6
Dow Jones Sustainability World Gross Index E-ATGAF *	0.5	-0.47	-1.50	2.9
S&P 500 Catholic Values Index	1.0	1.05	3.31	3.4
S&P 500 ESG Factor Weighted Index	0.9	0.71	2.25	4.6
S&P Europe 350 ESG Factor Weighted Index	0.5	-0.17	-0.54	7.9
S&P Global 1200 ESG Factor Weighted Index	0.7	0.17	0.53	2.1
S&P Europe 350 ESG Factor Weighted Index	0.3	-0.57	-1.79	6.7
S&P/TSX 60 ESG Factor Weighted Index	0.5	-0.32	-1.02	8.3

S&P/TOPIX 150 ESG Factor Weighted Index	0.5	-0.21	-0.67	10.7
Unweighted Core ESG Average	**0.5**	**-0.2**	**-0.7**	**7.0**
Climate				
S&P 500 Carbon Efficient Select Index	1.0	1.05	3.32	3.5
S&P 500 Carbon Efficient Index	1.0	1.00	3.17	3.4
S&P Developed LargeMidCap Carbon Efficient Index	0.7	-0.14	-0.43	2.7
S&P Emerging LargeMidCap Carbon Efficient Index	0.2	-0.55	-1.75	9.5
S&P Europe 350 Carbon Efficient Index	0.3	-0.66	-2.08	6.4
S&P Global 1200 Carbon Efficient Index	0.7	0.08	0.24	0.6
S&P Europe LargeMidCap Carbon Efficient Index	0.3	-0.64	-2.04	6.3
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	0.6	-0.12	-0.39	1.5
S&P Global LargeMidCap Carbon Efficient Index	0.6	-0.44	-1.38	1.0
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	0.6	0.18	0.58	8.8
S&P North America LargeMidCap Carbon Efficient Index	0.9	0.92	2.90	3.0
S&P 400 Carbon Efficient Index	0.8	0.54	1.69	6.3
S&P 600 Carbon Efficient Index	0.8	0.42	1.32	9.2
S&P South Africa Domestic Shareholder Carbon index	0.2	-0.34	-1.09	14.7
S&P/ASX All Australian 50 Carbon Efficient Index	0.7	-0.07	-0.21	9.3
S&P South Africa Carbon Efficient Index	0.2	-0.31	-0.97	14.5
S&P/JPX Carbon Efficient Index	0.4	-0.35	-1.11	10.4
S&P/TOPIX 150 Carbon Efficient Index	0.4	-0.09	-0.28	13.5
S&P/TSX 60 Carbon Efficient Index	0.5	-0.38	-1.19	7.9
Unweighted Climate Average	**0.6**	**0.02**	**0.06**	**7.0**
Thematic				
S&P Global Clean Energy Index	-0.2	-0.80	-2.52	18.3
S&P Global Eco Index	0.5	-0.32	-1.01	7.2
S&P Global Water Index	0.7	0.17	0.55	5.6
S&P Global Timber and Forestry Index	0.3	-0.21	-0.66	10.6
S&P/BMV IPC Sustainable	0.5	-0.24	-0.75	11.4
Unweighted Thematic Average	**0.4**	**-0.3**	**-0.88**	**10.6**

Table A4: Regression analysis

% Annualized CAPM and Fama-French alpha, and contributions

Core ESG	α_{CAPM}	$\alpha_{F\&F}$	$\beta_{F\&F}$	γ_{SMB}	δ_{HML}
Dow Jones Sustainability Asia Pacific E-ATGAF*	-4.5*	-4.2*	1.0	0.05	-0.02
Dow Jones Sustainability Eurozone E-ATGAF*	-9.7**	-7.3*	1.0	-0.06	0.45**
Dow Jones Sustainability Asia Pacific Developed **	-3.4*	-3.3*	1.0	0.09	0.04
Dow Jones Sustainability Asia Pacific Developed ***	-5.6**	-5.6**	1.0	0.06	0.04
Dow Jones Sustainability Emerging Markets Index	-3.4	-3.8	0.9	0.28	0.43**
Dow Jones Sustainability Asia Pacific Index	-4.1*	-3.7*	1.0	0.03	-0.06
Dow Jones Sustainability Emerging Markets **	-6.4*	-6.8*	1.1*	0.23	0.39**
Dow Jones Sustainability Emerging Markets ***	-11.9**	-12.3**	1.1	0.34*	0.41**
Dow Jones Sustainability United	2.8	2.9**	0.9*	-0.01*	0.06
Dow Jones Sustainability Emerging	-3.0	-3.3	0.9	0.30	0.35*
Dow Jones Sustainability Europe	-9.5**	-8.2**	1.2**	-0.12	0.21**
Dow Jones Sustainability Europe Developed ***	-9.4**	-9.3**	1.2**	-0.12	0.05
Dow Jones Sustainability Korea 20 Index	-4.4	-4.4	0.7**	0.23	0.09
Dow Jones Sustainability Japan 40 Index	-0.3	-0.2	0.9*	0.13	-0.01
Dow Jones Sustainability Eurozone Index	-7.2	-4.9	1.0	-0.11	0.41**
Dow Jones Sustainability Nordic Index	0.0	-0.3	0.9	0.12	-0.09
Dow Jones Sustainability Korea Capped 25 Index	-3.9	-3.3	0.8**	0.29	0.18
Dow Jones Sustainability North America 40 Index	1.7	1.7	0.9*	-0.04	-0.02
Dow Jones Sustainability Nordic Index	-5.1*	-5.5*	1.2**	0.21	-0.13
Dow Jones Sustainability U.S. Index	3.6**	4.0**	0.9	0.00	0.11**
Dow Jones Sustainability North America ***	8.1**	8.5**	0.7**	-0.10	0.14
Dow Jones Sustainability North America Composite Index	2.7*	3.0*	0.9	-0.04	0.10*
Dow Jones Sustainability North America **	2.7*	3.1*	0.9*	-0.01	0.11*
Dow Jones Sustainability North America index	0.8	1.1	0.9	0.00	0.09*
Dow Jones Sustainability World 80 Index	-3.8*	-3.8*	1.1	-0.08	-0.01
Dow Jones Sustainability United States 40 Index	2.8	3.2*	0.9*	0.03	0.11’
Dow Jones Sustainability World Developed ***	5.1**	5.4**	0.7**	-0.06	0.10
Dow Jones Sustainability World Index	-0.5	-0.3	1.0	0.01	0.07**
Dow Jones Sustainability World Developed Ex-Korea ***	-0.3	-0.1	1.0	-0.01	0.07**
Dow Jones Sustainability World Developed Ex-Korea **	5.0**	5.2**	0.7**	-0.07	0.08
Dow Jones Sustainability World Developed Index	4.8**	5.2**	0.7**	-0.11	0.12
Dow Jones Sustainability World Enlarged Index	-5.0**	-4.9*	1.0	-0.03	0.03
Dow Jones Sustainability World Developed Index	-2.6	-2.6	1.1	-0.07	-0.01
Dow Jones Sustainability World ***	-0.9	-0.7	1.0	0.04	0.07
Dow Jones Sustainability World **	-0.6	-0.5	1.0	0.06	0.06*
Dow Jones Sustainability World Index	-0.1	0.0	0.8**	-0.17	0.06*
Dow Jones Sustainability World Enlarged Index	2.5*	2.7*	0.8**	-0.13	0.07**
Dow Jones Sustainability World Gross Index E-ATGAF *	4.2*	-2.0	1.1	-0.04	-0.03
S&P 500 Catholic Values Index	4.4**	4.1**	0.9*	-0.02	-0.01

S&P 500 ESG Factor Weighted Index	3.7**	4.0**	1.0	0.23	0.08
S&P Europe 350 ESG Factor Weighted Index	0.0	0.8	0.8**	-0.24*	0.05
S&P Global 1200 ESG Factor Weighted Index	0.1	0.2	1.0	0.19	0.03
S&P Europe 350 ESG Factor Weighted Index	-5.4**	-4.5**	1.2**	0.04	0.21
S&P/TSX 60 ESG Factor Weighted Index	0.1	1.1	0.7**	0.15	0.30
S&P/TOPIX 150 ESG Factor Weighted Index	0.3	1.2	0.7**	0.41**	0.24
Unweighted Core ESG Average	**-1.2**	**-1.1**	**0.9**	**0.05**	**0.12**
Climate					
S&P 500 Carbon Efficient Select Index	4.1**	4.4**	0.9*	-0.02	0.00
S&P 500 Carbon Efficient Index	0.1	4.0	0.9*	-0.03	-0.01
S&P Developed LargeMidCap Carbon Efficient Index	0.2	0.3	0.9	0.01	0.04
S&P Emerging LargeMidCap Carbon Efficient Index	-6.1**	-6.4**	1.1*	0.21*	0.32**
S&P Europe 350 Carbon Efficient Index	-4.9**	-3.2**	1.0	-0.16*	0.27**
S&P Global 1200 Carbon Efficient Index	0.0	-0.1	1.0	-0.01	-0.02
S&P Europe LargeMidCap Carbon Efficient Index	-5.5**	-4.6**	1.1*	-0.10	0.14
S&P Global Ex-Japan LargeMidCap Carbon Efficient	-0.5	-0.7	1.0	0.03	-0.05
S&P Global LargeMidCap Carbon Efficient Index	-0.5	-0.6	1.0	0.05	-0.04
S&P Global Ex-Japan LargeMidCap Carbon Efficient	-0.5	0.6	1.2**	-0.10	0.35*
S&P North America LargeMidCap Carbon Efficient	3.4*	3.4*	0.9*	0.01	0.00
S&P 400 Carbon Efficient Index	3.2*	3.6**	1.0	0.45*	0.10
S&P 600 Carbon Efficient Index	3.7*	4.5*	1.0	0.69**	0.21
S&P South Africa Domestic Shareholder Carbon	-6.4**	-6.9**	1.1*	0.40*	0.53**
S&P/ASX All Australian 50 Carbon Efficient Index	2.2	2.2	0.7**	-0.17	-0.08
S&P South Africa Carbon Efficient Index	-5.9**	-6.3**	1.1	0.36*	0.47*
S&P/JPX Carbon Efficient Index	-0.8	-0.2	0.7**	0.38*	0.16
S&P/TOPIX 150 Carbon Efficient Index	-0.4	1.4	0.9*	0.18	0.56*
S&P/TSX 60 Carbon Efficient Index	-0.4	0.4	0.7**	0.21	0.24
Unweighted Climate Average	**-1.2**	**-1.1**	**1.0**	**0.13**	**0.17**
Thematic					
S&P Global Clean Energy Index	18.7**	-18.5**	1.5**	0.83**	0.01
S&P Global Eco Index	-1.4	-1.5	0.9	0.23*	-0.06
S&P Global Water Index	1.7	1.4	0.9*	0.25*	-0.11*
S&P Global Timber and Forestry Index	-4.0**	-3.3**	1.2**	0.66**	0.16
S&P/BMV IPC Sustainable	0.5	0.9	0.6**	0.03	0.15
Unweighted Thematic Average	**-4.4**	**4.2**	**1.0**	**0.40**	**0.03**

*p < 0.05, **p < 0.01

Table A5: Correlation matrix between ESG indices and the S&P Global 1200

Core ESG	S&P GLOBAL 1200
Dow Jones Sustainability World Developed Ex-Korea ***	0.99
Dow Jones Sustainability World ***	0.99
Dow Jones Sustainability World Index	0.99
Dow Jones Sustainability World **	0.99
Dow Jones Sustainability World Enlarged Index	0.99
S&P Global 1200 ESG Factor Weighted Index	0.99
Dow Jones Sustainability World Developed Index	0.98
Dow Jones Sustainability World Gross Index E-ATGAF *	0.98
Dow Jones Sustainability World 80 Index	0.97
S&P 500 Catholic Values Index	0.97
Dow Jones Sustainability North America ***	0.96
Dow Jones Sustainability North America Composite Index	0.96
Dow Jones Sustainability North America index	0.96
Dow Jones Sustainability North America 40 Index	0.95
Dow Jones Sustainability United	0.95
Dow Jones Sustainability United States 40 Index	0.95
Dow Jones Sustainability U.S. Index	0.95
S&P 500 ESG Factor Weighted Index	0.94
S&P Europe 350 ESG Factor Weighted Index	0.93
Dow Jones Sustainability Europe	0.93
Dow Jones Sustainability Europe Developed **	0.92
Dow Jones Sustainability Asia Pacific E-ATGAF*	0.90
Dow Jones Sustainability Asia Pacific Index	0.90
Dow Jones Sustainability Asia Pacific Developed **	0.89
Dow Jones Sustainability Asia Pacific Developed ***	0.89
Dow Jones Sustainability Nordic Index	0.88
Dow Jones Sustainability World Index	0.85
Dow Jones Sustainability World Enlarged Index	0.83
S&P Europe 350 ESG Factor Weighted Index	0.83
Dow Jones Sustainability Emerging Markets ***	0.81
Dow Jones Sustainability Nordic Index	0.80
Dow Jones Sustainability Emerging Markets *	0.80
S&P/TSX 60 ESG Factor Weighted Index	0.79
Dow Jones Sustainability World Developed Index	0.79
Dow Jones Sustainability World Developed **	0.78
Dow Jones Sustainability Eurozone E-ATGAF*	0.75
Dow Jones Sustainability World Developed Ex-Korea **	0.75
Dow Jones Sustainability Korea Capped 25 Index	0.72
Dow Jones Sustainability Eurozone Index	0.72
Dow Jones Sustainability Korea 20 Index	0.71
Dow Jones Sustainability Emerging	0.70
S&P/TOPIX 150 ESG Factor Weighted Index	0.69
Dow Jones Sustainability Emerging Markets Index	0.68
Dow Jones Sustainability North America **	0.67
Dow Jones Sustainability Japan 40 Index	0.65
Unweighted Core ESG Average	**0.87**

Climate	S&P GLOBAL 1200
S&P Global 1200 Carbon Efficient Index	0.99
S&P Global LargeMidCap Carbon Efficient Index	0.99
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	0.99
S&P Developed LargeMidCap Carbon Efficient Index	0.98
S&P North America LargeMidCap Carbon Efficient Index	0.97
S&P 500 Carbon Efficient Index	0.97
S&P 500 Carbon Efficient Select Index	0.97
S&P Europe LargeMidCap Carbon Efficient Index	0.94
S&P Europe 350 Carbon Efficient Index	0.92
S&P 400 Carbon Efficient Index	0.91
S&P Global Ex-Japan LargeMidCap Carbon Efficient Index	0.90
S&P Emerging LargeMidCap Carbon Efficient Index	0.84
S&P 600 Carbon Efficient Index	0.83
S&P/TSX 60 Carbon Efficient Index	0.81
S&P/ASX All Australian 50 Carbon Efficient Index	0.74
S&P South Africa Carbon Efficient Index	0.74
S&P South Africa Domestic Shareholder Carbon index	0.73
S&P/JPX Carbon Efficient Index	0.69
S&P/TOPIX 150 Carbon Efficient Index	0.67
Unweighted Climate Average	**0.87**
Thematic	S&P GLOBAL 1200
S&P Global Water Index	0.91
S&P Global Eco Index	0.86
S&P Global Timber and Forestry Index	0.85
S&P Global Clean Energy Index	0.76
S&P/BMV IPC Sustainable	0.67
Unweighted Thematic Average	**0.81**

A.2. Econometrics

Table A4: Augmented Dickey-Fuller test for stationarity

Core ESG	Test statistics[1,2]
Dow Jones Sustainability Asia Pacific E-ATGAF*	-3.62**
Dow Jones Sustainability Eurozone E-ATGAF*	-2.91**
Dow Jones Sustainability Asia Pacific Developed **	-2.94**
Dow Jones Sustainability Asia Pacific Developed ***	-3.02**
Dow Jones Sustainability Emerging Markets Index	-3.49**
Dow Jones Sustainability Asia Pacific Index	-2.52*
Dow Jones Sustainability Emerging Markets **	-2.8**
Dow Jones Sustainability Emerging Markets ***	-2.38*
DowJones Sustainability United	-2.80**
DowJones Sustainability Emerging	-2.45*
DowJones Sustainability Europe	-2.52*
Dow Jones Sustainability Europe Developed ***	-2.53*
Dow Jones Sustainability Korea 20 Index	-2.35*
Dow Jones Sustainability Japan 40 Index	-2.93**
Dow Jones Sustainability Eurozone Index	-3.30**
Dow Jones Sustainability Nordic Index	-3.20**
Dow Jones Sustainability Korea Capped 25 Index	-2.92**
Dow Jones Sustainability North America 40 Index	-2.95**
Dow Jones Sustainability Nordic Index	-2.70**
Dow Jones Sustainability U.S. Index	-3.84**
Dow Jones Sustainability North America ***	-2.77**
Dow Jones Sustainability North America Composite Index	-2.33*
Dow Jones Sustainability North America **	-2.88**
Dow Jones Sustainability North America index	-2.78**
Dow Jones Sustainability World 80 Index	-2.35*
Dow Jones Sustainability United States 40 Index	-2.68**
Dow Jones Sustainability World Developed ***	-2.79**
Dow Jones Sustainability World Index	-2.08*
Dow Jones Sustainability World Developed Ex-Korea ***	-2.32*
Dow Jones Sustainability World Developed Ex-Korea **	-2.79**
Dow Jones Sustainability World Developed Index	-2.26*
Dow Jones Sustainability World Enlarged Index	-3.28**
Dow Jones Sustainability World Developed Index	-2.39*
Dow Jones Sustainability World ***	-3.91**
Dow Jones Sustainability World **	-3.03**
Dow Jones Sustainability World Index	-2.53*
Dow Jones Sustainability World Enlarged Index	-3.25**
Dow Jones Sustainability World Gross Index E-ATGAF *	-3.19**
S&P 500 Catholic Values Index	-3.12**
S&P 500 ESG Factor Weighted Index	-2.51*
S&P Europe 350 ESG Factor Weighted Index	-3.01**
S&P Global 1200 ESG Factor Weighted Index	-2.97**
S&P Europe 350 ESG Factor Weighted Index	-2.89**
S&P/TSX 60 ESG Factor Weighted Index	-2.51*
S&P/TOPIX 150 ESG Factor Weighted Index	-2.47*

Climate	Test statistics[1,2]
S&P 500 Carbon Efficient Select Index	-2.92**
S&P 500 Carbon Efficient Index	-2.80**
S&P Developed LargeMidCap Carbon Efficient	-2.35*
S&P Emerging LargeMidCap Carbon Efficient	-3.16**
S&P Europe 350 Carbon Efficient Index	-3.18**
S&P Global 1200 Carbon Efficient Index	-2.48*
S&P Europe LargeMidCap Carbon Efficient	-2.62**
S&P Global Ex-Japan LargeMidCap Carbon Efficient	-2.90**
S&P Global LargeMidCap Carbon Efficient	-2.65**
S&P Global Ex-Japan LargeMidCap Carbon Efficient	-3.32**
S&P North America LargeMidCap Carbon Efficient	-2.98**
S&P 400 Carbon Efficient Index	-2.72**
S&P 600 Carbon Efficient Index	-2.55*
S&P South Africa Domestic Shareholder Carbon	-3.07**
S&P/ASX All Australian 50 Carbon Efficient	-2.43*
S&P South Africa Carbon Efficient Index	-3.19**
S&P/JPX Carbon Efficient Index	-2.55*
S&P/TOPIX 150 Carbon Efficient Index	-2.09*
S&P/TSX 60 Carbon Efficient Index	-2.86**
Thematic	
S&P Global Clean Energy Index	-3.34**
S&P Global Eco Index	-2.69**
S&P Global Water Index	-2.26*
S&P Global Timber and Forestry Index	-2.31*
S&P/BMV IPC Sustainable	-2.51*

[1]ADF test, none of the variables have significant trend.

[2] Statistic tests are compared to the DF distribution, which is H0: unit root, H1: stationarity, *=0.05 **=0.01

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