UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

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The value of a good deed; ESG-scores and returns in the Nordic stock markets

Abstract:

This paper seeks to answer which effect ESG-scores have on risk-adjusted returns for stocks listed on Nordic stock markets. To answer this, we create five null hypotheses and use unequal variance t-tests to determine if the hypotheses can be rejected. To make these tests, three portfolios are created where the first portfolio consists only of stocks with high ESG-ratings, the second consists only of lowly rated stocks and the third portfolio acts as a benchmark, containing all ESG-rated stocks in the Nordic region. Together, 109 companies were sampled over the period 2013 to 2022. The results show no evidence that ESG-scores have an effect on risk-adjusted returns, which is consistent with the efficient markets hypothesis as well as some previous studies on the topic. However, the results also contradict other studies and theories on the subject. Notwithstanding, the paper still provides investors in Nordic capital markets with further insights into the determinants of risk-adjusted returns.

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1. Introduction

In the introductory chapter, a broad overview of the research area is introduced, followed by a problem description which is narrower and connects more specifically to the thesis subject. This section motivates and justifies the field of study as well as the research question by addressing the problematic aspects of the research area. This is followed by a section which clearly states the hypothesis tests that will be used to answer the research question. Finally, the aim of the study is presented.

1.1. Background

Investors engage in various financial markets to acquire assets which store and grow value. One of the biggest financial markets globally, is the equities market, where shares and stocks of publicly listed companies are traded and issued. In their investment decisions, investors consider various factors, which naturally depends on the individual investor's profile (Guenther, Johan and Schweizer 2018). Notwithstanding, conventional financial theory assumes that most investors exhibit some degree of risk aversion. This means that investors penalize risk by demanding higher return to compensate them for it. Therefore, stocks which exhibit more risk will be unable to attract investors unless returns are commensurate. However, returns might also have to be compensating for an additional factor, which has become more popular in recent years.

Investors are becoming increasingly solicitous about their savings sustainability impact. More specifically, they are demanding that the stewards of their investments show greater care, transparency, and financial discipline regarding ecological, social and governance (ESG) factors (PwC 2022). There are no single causes to their increase in popularity, rather, various issues make them more important. One of them is IPCC's (Lee et al. 2023) warning that drastic actions need to be taken if global warming is to remain limited to 1.5 degrees Celsius. If this threshold is abandoned, the risk of extreme weather and water shortages could become more apparent without the possibility of return (Rockström et al. 2022). The increasing consensus around the severity of ESG-consideration has led to larger investments in ESG-assets. In 2021, ESG-assets reached 37.8 trillion USD (Chen and Lin 2022) and are expected to reach 53 trillion USD by 2025 according to Bloomberg (2021), a 40% increase.

ESG is an acronym which stands for ecological, social and governance and it relates to how sustainable a corporation is in these practices. The ecological criterion relates to how the company uses energy and resources as well as how it manages the waste it creates. Naturally, carbon emissions and the ways in which the operation aims to reduce its impact on climate change matters too (Henisz, Koller and Nuttall 2019). The social criterion regards the company's relation to its employees and to the communities in which it operates. Three important terms in this criterion are diversity, working conditions and inclusion meaning for example that companies should not disregard someone based on gender and that it should provide fair working conditions. Lastly, governance alludes to the internal systems of control that a company enforces to comply with laws and regulations within the legislation that it operates. One example of such is within the banking sector where many banks implement rigorous "Know Your Customer" (KYC) questions to ensure that new clients are not using their services for activities associated with illegal misconduct (ibid).

Much like risk, ESG will hardly impact the investment decision of the rational investors solely based on its qualitative description. Rather, a quantitative measure of ESG increases its impact on the investment decision while also allowing the investor to assess the company's sustainability-profile (Bloomberg 2023). When stated quantitatively, ESG takes the form of an ESG-rating. These ratings, nonetheless, differ based on the issuing institutes. The institutes in question are for example Bloomberg, MSCI and Fidelity. ESG-ratings are a useful tool for investors wanting to assess how well a firm manages and estimates ESG-issues as well as how good they are at disclosing such information (ibid).

One region displaying particular care for ESG-factors is the Nordic region. In 2021, the Nordic Ministerial Council released a report named "The Nordics as the World's Most Sustainable and Integrated Region", in which the members launched a common effort aimed at becoming the greenest, most socially sustainable and competitive region in the world. In this report, the countries explained that governments in each member country will act towards making it more attractive for Nordic consumers to prioritize a more climate friendly and sustainable consumption. The council also clarified that efforts will be made to keep the Nordics socially sustainable via equality and inclusion (Nordic Ministerial Council 2021). Furthermore, Robeco (2022) shows that the major Nordic countries are all in the top 6 of the most sustainable countries in the world as measured by ESG-factors. Not only has governmental efforts towards sustainability been made but citizens in these countries also

care about sustainability. Insight Intelligence (2019), for example, showed that 95% of Swedes care about sustainability to a large or fairly large extent. Similar results have been found for the Finnish (Sitra 2019) and Danish demographic (European Investment Bank 2021), showing that 78% of Finns regard sustainable ways of living as something important and 79% of Danes find climate change and its consequences as one of the biggest challenges of this century.

1.2. Problem description and analysis

As mentioned, ESG-consideration has become of greater importance in investment decisions. But does this imply that investors are rewarded for the effort they dedicate towards their assessment of company ESG-profiles or are they wasting their time screening for companies with high ESG-scores? Previous papers have attempted to find an answer to that question, however, the results have differed. Some argue that there is a positive relationship between ESG and stock returns (Eccles, Verheyden and Feiner 2016; Pollard, Sherwood and Klobus 2017; Ashwin Kumar et al. 2016), whereas others argue that there is a negative relation (Giuli and Kostovetsky 2014; Avramov et al. 2022). Multiple other studies find, on the other hand, no evidence that there is a link between ESG-scores and stock returns (Breedt et al. 2019; Auer 2016).

Evidently, there is no consensus on the issue of ESG-ratings and stock performance. Furthermore, many studies adapt a global or American perspective, thereby creating a void in financial science for smaller equities markets. As far as we are aware, the Nordic market for example remains unexplored and therefore becomes increasingly interesting to analyze with respect to the aforementioned topic. Also, the private attitudes towards sustainability as well as the common efforts stipulated by the governments in these countries (see section 1.1) could show a particular preference for ESG-securities. The opportunity to explore the Nordic markets while adding substance to the discussion surrounding stock returns and ESG-ratings lays the foundation for this thesis.

To gain clarity on the matter, while also contributing to the financial body of knowledge, we intend to create three different portfolios (i.e. a bottom, a top and a benchmark portfolio) consisting of stocks traded in the Nordic market. These portfolios are then analyzed by using the Sharpe ratio to calculate their risk-adjusted returns over a 10-year period. Besides risk adjusted returns, ESG-ratings will also be taken into consideration as we aim to combine

these two to explore whether or not ESG-ratings can actually impact the risk-adjusted returns of stocks listed on Nordic capital markets. With this, the research question becomes:

Does ESG-ratings affect risk-adjusted returns in the Nordic region and if so, in which direction?

1.3. Null hypotheses

To answer the research question proposed above, five null hypotheses about the portfolios are proposed. These are:

(1)
$$H_0: \mu_T - \mu_B \leq 0$$
$$H_A: \mu_T - \mu_B > 0$$

The first null hypothesis states that a portfolio consisting only of stocks with high ESG-ratings does not provide higher average risk-adjusted returns over a 10-year horizon than a portfolio with only low ESG-ratings. With this, the alternative hypothesis shows the opposite, namely that the high rating portfolio does provide higher average returns than a low rating portfolio.

(2)
$$H_0: \mu_T - \mu_{Be} \leq 0$$
$$H_A: \mu_T - \mu_{Be} > 0$$

The second null hypothesis states that a portfolio consisting only of stocks with high ESG-ratings does not render higher average risk-adjusted returns over a 10-year horizon than a benchmark portfolio consisting of all ESG-rated companies on Nordic markets over the same period. The alternative hypothesis, consequently, states the opposite, that the high-rating portfolio does provide average higher risk-adjusted returns than the benchmark.

(3)
$$H_0: \mu_{Be} - \mu_B \leq 0$$
$$H_A: \mu_{Be} - \mu_B > 0$$

The third null hypothesis states that a benchmark portfolio consisting of all ESG-rated stocks on the Nordic markets does not have higher average risk-adjusted returns over a 10-year

period than a portfolio consisting of stocks with low ESG-ratings. Contrarily, the alternative hypothesis suggests that the mean risk-adjusted return of an ESG-benchmark portfolio is larger than the portfolio with solely low ESG-rated stocks.

(4)
$$H_0: \mu_B - \mu_T \leq 0$$
$$H_A: \mu_B - \mu_T > 0$$

The fourth null hypothesis states that a portfolio only including Nordic public stocks with low ESG-ratings does not have higher average risk-adjusted returns over a 10-year period than a portfolio consisting of stocks with high ESG-ratings over the same period. Contrarily, the alternative hypothesis states that the mean risk-adjusted return of a portfolio consisting of stocks with low ESG scores is larger than the portfolio with solely high ESG-rated stocks.

(5)
$$H_0: \mu_B - \mu_{Be} \leq 0$$
$$H_A: \mu_B - \mu_{Be} > 0$$

The fifth null hypothesis states that a portfolio only consisting of Nordic public stocks with low ESG-ratings does not have higher average risk-adjusted returns over a 10-year horizon than a benchmark portfolio consisting of all ESG-rated companies on Nordic markets over the same period. In contrast, the alternative hypothesis states that the mean risk-adjusted return of a portfolio consisting of low ESG-rated stocks is larger than the benchmark portfolio.

1.4. Purpose and scientific contribution

This paper seeks to investigate whether investor's choosing to add highly rated ESG-stocks listed on the Nordic markets to their portfolios reap greater benefits in terms of risk-adjusted returns. Consequently, it also investigates if higher ESG-scores can inhibit risk-adjusted returns. If the former prospect is proven true, high rating ESG-portfolios could be used to improve investor wealth while the latter would show that those should be avoided from a return perspective.

The paper builds on as well as complements previous research conducted in similar fields. Notwithstanding, additional nuance is added to the financial body of knowledge as the Nordic region, which has remained unexplored in this regard, is analyzed. Previous studies on the

matter have mostly been concentrated around the U.S. stock markets and thus, adding an additional geographical region allows for a broader insight within financial science.

2. Theoretical framework

This chapter establishes much of the foundation for the subsequent chapters by explaining key terms, theories and previous scientific literature related to the subject. Firstly, important key-terms are clarified to simplify the readers navigation of the report. Secondly, various economic and financial theories are presented, followed by a rigorous examination of literature with regards to return, financial performance, the cost of debt and risk. The chapter ends with our predicted result which are based on previous empirical findings and theories.

2.1. CSR and ESG

CSR stands for Corporate Social Responsibility and is closely related to ESG. While both CSR and ESG concern a firm's social and environmental performance, ESG emphasizes governance explicitly, whereas CSR addresses governance implicitly based on its impact on social and environmental issues. Hence, ESG tends to be perceived as a more comprehensive term than CSR (Gillan, Koch and Starks 2021). Additionally, the objective of CSR is to hold companies responsible for their influence on society and the environment. Furthermore, the objective of ESG is to provide specific and measurable criteria which can be used to enable assessment of corporate accountability (Chang et al. 2022). Regardless of these differences, this thesis uses CSR and ESG interchangeably, in accordance with Gillan, Koch and Starks (2021).

2.2. Firm value

A company's value is calculated by using the following formula:

$$\text{Value} = \frac{Expected\ CF_1}{(1+r)} + \frac{Expected\ CF_2}{(1+r)^2} + \ldots + \frac{Expected\ CF_n}{(1+r)^n} \quad (6)$$

This formula shows that the value of a firm is calculated by discounting its future cash flows it can generate over time, using a risk-adjusted discount rate. There are multiple factors that drive the value of a firm, two of them being profitability and risk. Profitability is important since it increases the expected cash flows, whereas lower risk for a firm decreases the discount rate (Cornell and Damodaran 2020).

2.3. Prospect Theory

Prospect theory is an alternative model to expected utility theory which describes decision making under risk (Kahneman and Tversky 1979). Two pervasive behavioral biases called certainty effect and loss aversion are displayed by economic actors when choosing amongst risky prospects. The certainty effect suggests that actors tend to overweight outcomes which are certain, even though they have equivalent expected utility to some uncertain outcome. For example, getting 50 dollars today with absolute certainty is preferred to the 50% chance of getting 100 dollars, even though the expected utility (measured in amount of USD) is the exact same. This is a display of risk aversion (ibid).

Loss aversion is connected to a hypothetical value function proposed by the authors (ibid) and states that an individual's perceptual apparatus is not centered around an absolute magnitude. Rather, it is acclimatized to changes in relation to the present context. Therefore, two factors matter, one being that there is a reference point, the other being that there is a magnitude of change from said reference point. For example, an individual who wins 100 dollars but then loses 20 of these, does not feel as though they won 80 dollars but rather that they lost 20, due to their new reference point being 100 dollars. Lastly, Kahneman and Tversky add that a distinguishing characteristic of loss is that it triggers greater aggravation in an individual than a gain triggers satisfaction.

2.4. The ESG-efficient frontier

Pedersen, Fitzgibbons and Pomorski (2021) present a theory in which ESG-scores matter in two ways. Firstly, it provides information about firm fundamentals and secondly it affects investor preferences. This forms a modification of Markowitz's (1952) model and reformulates the efficient frontier, in which the investor is able to attain the highest return per unit of risk for different asset combinations. That creates the ESG-efficient frontier, which shows the highest possible Sharpe ratio per level of ESG. By using the theory, the authors propose several predictions. These are:

Prediction 1: A tradeoff exists between risk, return and ESG-score and all of this can be summarized with the ESG-efficient frontier which shows the highest risk-adjusted return attainable at each ESG-rating.

Prediction 2: The usage of ESG information can increase the risk adjusted return of the investor and does so by improving the ESG-efficient frontier.

Prediction 3: Given the available information, investors who prefer sustainability to a larger extent will choose portfolios with a higher ESG-rating and marginally lower risk adjusted returns.

Prediction 4: ESG investors place greater demand on securities with higher ESG scores, resulting in a reduction in the expected return. However, stronger inflows from investors can increase the price of the asset in the short run.

2.5. Efficient market hypothesis

Fama (1970) tests the hypothesis that markets are efficient, meaning that prices always reflect all available information by reviewing it theoretically and empirically. The empirical aspect of information is divided into three subsets; strong, semi-strong and weak form of market efficiency. In weak form efficiency, the only information that is shown in the asset price is the historical price of the asset. For semi-strong efficiency, publicly available information about the company and its outlook as well as historical prices are incorporated into the asset price. An example of such information would be published annual reports or corporate ESG-data. However, nondisclosed information known only by company insiders is not a part of the semi-strong market efficiency. For such information to be incorporated, strong form efficiency is applied and thereby current asset price consists of information from historical prices, publicly available firm data as well as non-public firm data known only by insiders.

Fama shows that, empirically, semi-strong form tends to be the most pervasive form of market efficiency as it is most consistent with the efficient markets model. A strong point regarding this evidence is its consistency over many types of information. This means, in essence, that publicly available information that is already priced into the asset should be inadequate to predict future stock performance. Instead, only new information, indicating that the stock is unfairly priced, should move stock prices. Also, if this new information was predictable, it must have been incorporated into the price as a form of expectation and thus, the only information able to change stock price has to be unpredictable new information.

2.6. Literature review

2.6.1. ESG/CSR and stock returns

Previous studies have pursued a similar methodology to ours, where they sort or tilt portfolios based on ESG-scores. For example, Auer (2016) studies the European stock market index STOXX 600 from 2004 to 2012 by using a bootstrap test and utilizing ESG-data from Sustainalytics. When excluding stocks with the lowest ESG-scores, he finds no evidence that this strategy will decrease or increase the Sharpe ratio. However, he observes that the Sharpe ratio starts to decline when the exclusion rate is too high since the diversification benefits are lost. Similarly, Breedt et al. (2019) reach the same conclusions as Auer (2016) when tilting portfolios towards companies with high ESG-scores. They argue that any advantages from the incorporation of ESG-credentials in a portfolio have already been accounted for by other established and recognized equity factors.

On the contrary, some studies find a negative relationship between ESG and stock returns. For example, Giuli and Kostovetsky (2014) find this negative link by studying the US market using CSR data from KLD (later MSCI). They suggest that these results are in line with recent evidence stating that CSR is costly. These results follow Dunn, Fitzgibbons and Pomorski (2018) who argue that the majority of academic research suggests that companies with low ESG-performance may potentially yield higher returns. This is based on the intuition that some investors are hesitant to invest in companies with low ESG-performance, resulting in a decreased demand for their shares. As a result, the stock prices may be lower today but higher in the future.

At the same time, multiple studies show a positive relationship between ESG/CSR and stock returns. Eccles, Ioannou and Serafeim (2014) study 180 US companies over a time period of 18 years. By using Carhart's four-factor model to study abnormal returns, they find evidence that highly sustainable companies significantly outperform their counterparts. They suggest that price pressures from SRI (i.e. Socially Responsible Investment) funds can be an explanation for this overperformance. Another explanation can also be that non-sustainable companies have weaker organizational processes in place compared to their counterparts.

Ashwin Kumar et al. (2016) studies the Dow Jones Sustainability Index during a time period of two years where the index only includes stocks with great ESG-practices relative to its peers. They use both the Sharpe- and the Treynor ratio and find evidence that the index

creates risk-adjusted overperformance compared to an equally-weighted industry benchmark. However, the authors argue that the overperformance is caused by lower volatility for these stocks instead of price pressures as suggested by Eccles, Ioannou and Serafeim (2014). In connection to this, Glossner (2021) creates two value-weighted portfolios (i.e. one US- and one European portfolio), consisting of companies that have violated ESG-rules in the past. Even after controlling for risk, industry and firm characteristics, he finds that these two portfolios create negative excess returns. He argues that these returns are caused by the market's underreaction to incidents.

Pollard, Sherwood and Klobus (2017); Stotz (2022); Eccles, Verheyden and Feiner (2016) also present findings showing a positive link between ESG and stock returns. Through the use of a cross-sectional approach and MSCI data, Pollard, Sherwood and Klobus (2017) identified this positive link by constructing global portfolios. Eccles, Verheyden and Feiner (2016) creates portfolios with the highest ESG-scores and finds that ESG-screening has a larger positive effect in the European and North American countries, where the ESG coverage and quality is the highest. When studying the possibility that ESG-screening creates risk through lowered diversification benefits, they find that such screening does not lead to diversification loss on average. This is because the majority of universes created had a positive net selectivity, meaning that any diversification loss from taking on specific risk is offset by enough alpha. Stotz (2022) studies the ESG-puzzle which regards the fact that the realized return tends to be higher for high ESG-stocks even though the expected returns are primarily lower compared to their counterparts. He argues that this puzzle can be primarily explained by the fact that investors apply lower discounts rates for stocks with good ESG-performance relative to stocks with low ESG-performance. The decrease in discount rates are related to the demand from ESG-investors and not to risk.

Moreover, multiple articles study the relationship between ESG upgrades, disagreements and stock returns. Avramov et al. (2022) studies both ESG-score and ESG-uncertainty, which is the standard deviation of ESG-scores between different rating institutes. The authors find that stocks that have a low ESG-score outperform stocks with high ESG, only when the ESG uncertainty is low. Giese et al. (2019) takes a different approach by studying global portfolios between 2007 to 2017. They find that companies who improve their ESG score the most outperform their counterparts, suggesting that a better ESG performance increases valuation over time. Shanaev and Ghimire (2022) studies the US stock market between 2016 to 2021.

They find that ESG-rating upgrades lead to positive abnormal yet inconsistently significant returns. Downgrades however, proved more crucial as a downgrade impacted stock performance by -1.2% on average at a monthly risk-adjusted basis with consistent significance. They also find that upgrades substantially increased during the COVID-19 pandemic, where potential explanations can be that individual investors increasingly used ESG-scores or that investors viewed companies that continued to invest in CSR during crises as more financially viable.

It is important to note that the majority of these studies (e.g. Pollard, Sherwood and Klobus 2017; Auer 2016), only use one ESG provider in their study. For that reason, there is no guarantee that the same conclusions can be made when using other ESG-providers. This is based on the fact ESG-scores vary depending which institute is used (Berg, Kölbel and Rigobon 2022).

2.6.2. ESG/CSR and asset returns

Some papers study the relationship between ESG and asset returns. Pedersen, Fitzgibbons and Pomorski (2021) consider three types of investors (ESG-motivated, ESG-aware and ESG-unaware). ESG-motivated investors use ESG-information in their decision making process and prefer high ESG-scores, while ESG-aware investors use ESG to revise their view on risk and expected return. The ESG-unaware investors are unaware of ESG-scores. By using an equilibrium model, they show in their paper that when an economy consists of many ESG-aware or ESG-motivated investors, the expected return should be lower since the demand for these stocks are higher.

Pastor, Stambaugh and Taylor (2021) also use an equilibrium model to show that green assets (i.e. assets that create positive externalities) are expected to underperform and brown assets outperform. They argue that the reason behind the green assets underperformance is driven by the fact that green assets have lower cost of capital because people are willing to pay more for these assets. Even though the expected return is lower for green assets, the authors show that green assets create a positive alpha if there is a positive shock towards them. Gehricke, Ruan and Zhang (2023) argue that a combination of the empirical findings in these aforementioned papers show that an alpha return or non-alpha return related to ESG depends on the width of the preference spectrum and the awareness towards ESG-risk displayed by investors.

2.6.3. ESG/CSR and financial performance

The empirical results about the effects of a company's ESG/CSR performance and corporate financial performance show mixed results. By studying the largest 3000 companies in the US, Giuli and Kostovetsky (2014) discover a negative link between future operative performance and CSR. They argue that the result is consistent with recent evidence which states that it is costly to implement CSR which in turn affects profits. In contrast to this, Schreck (2011) studies the relationship between financial performance and ESG/CSR by addressing the endogeneity problem that arises from simultaneous causality. He finds no causality between CSR and financial performance, even though the results suggest that there is a strong relationship between CSR initiatives that address individual stakeholder concerns and financial performance. Schreck suggests that one potential reason can be that managers try to distract people from dissatisfying results by increasing the social expenses.

Even though empirical research provides mixed results, most findings show a non-negative relationship between ESG/CSR and financial performance, suggesting that higher CSR have more advantages than disadvantages. For example, Friede, Busch and Bassen (2015) study this relationship by combining the findings of approximately 2200 studies. They find that about 90% of the studies examined find a non-negative relation between ESG and financial performance, where the vast majority of them have a positive relationship. Moreover, Margolis, Elfenbein and Walsh (2009) did a meta analysis of 251 studies that studied the relationship between corporate social performance and financial performance and found a weak positive relationship. Even though the relationship between financial performance and ESG is mostly positive, Cornell and Damodaran (2020) argues that the findings are fragile and sensitive to variations in sample periods and how profitability and ESG are measured.

2.6.4. ESG/CSR, risks and cost of debt

Most of the previous research shows that firms with higher ESG/CSR have higher credit ratings and lower cost of debt (Chang et al. 2022). For example, Chava (2014) argues that the cost of debt is higher for firms that are involved in environmental controversies and Liu and Ge (2015); Jirapron et al. (2013) finds that firms with better ESG performance have higher credit ratings. Additionally, firms with higher ESG score and thus lower cost of debt improves their firms growth potential and have lower capital constraints (Cheng, Ioannou, and Serafeim 2014; Khurana, Pereira and Martin 2006).

Furthermore, prior studies show that ESG can reduce various types of risks. For example, Dunn, Fitzgibbons, and Pomorski (2018) studies stocks in three major indexes (i.e. Russell 3000, MSCI World and MSCI Emerging) and they find that firms with high ESG performance have lower total and idiosyncratic volatility compared to their counterparts. The authors suggest that companies with high ESG-scores have reduced their risks since they have an improved positioning against environmental transactions, regulations and social issues. Moreover, Albuquerque, Koskinen and Zhang (2019); Oikonomou, Brooks and Pavelin (2012) find that there is a negative relationship between CSR and systematic risks. For instance, Albuquerque, Koskinen and Zhang (2018) provides a theory where CSR is a product differentiation strategy. They show that high ESG-firms have lower systematic risk since they have relatively lower price elastic demand. By using an instrumental variable approach and a matched sample of companies, Boyer and Kordonsky (2020) conclude that the legislation risk is reduced by investing in CSR activities. They argue that by allocating resources to CSR initiatives, companies can enhance their reputation, which helps insure companies against sanctions from stakeholders in the event of negative corporate incidents. Furthermore, Horn (2023) shows that higher ESG-ratings lowers the idiosyncratic risk.

2.7. Predicted result

As mentioned, previous papers examining the relationship between ESG-scores and the performance of stock returns show mixed results. However, because the majority of the studies show that ESG-scores impact the risk-adjusted return, we predict the same. Additionally, similar to the results presented by Pollard, Sherwood and Klobus (2017); Eccles, Ioannou and Serafeim (2014) for instance, we expect that there exhibits a significant positive link between ESG-ratings and risk-adjusted returns. This means that we predict that the null hypotheses 1, 2 and 3 can be rejected, whereas hypotheses 4 and 5 can not.

This prediction is based on the following reasons. Firstly, many previous studies (e.g. Friede, Busch and Bassen 2015) suggest that higher ESG-scores improves financial performance and decreases risks. By using these findings it is predicted that the volatility will be lower for companies with higher ESG-scores. If this effect is true, the risk-adjusted return is enhanced. Secondly, since the demand for these stocks is estimated to be high, the realized return and hence the risk-adjusted return should be further improved. This is based on the fact that the Nordic countries are regarded to be highly sustainable and at the same time the inhabitants regard sustainability as something important. Thirdly, by using the behavioral biases, loss

aversion and risk aversion, the demand for these stocks should rise even further because these biases state that people dislike risk and losses.

3. Data

In this chapter, the data collection process is explained. Firstly, we describe the data sources used for this study where one source is explained further. This is followed by a discussion and argumentation about the studied time period. Subsequently, the sample collection process is described and information about the sample data is presented.

3.1. Data sources

The risk-free rate of the respective Nordic countries comes from the Swedish Riksbank who in turn gather their data from Refintiv. Also, the firm returns as well as ESG-scores are collected directly from Refintiv's "Eikon" platform, where we utilize a screener app in which large amounts of data can be collected simultaneously with filters, so that the preferred sample can be obtained. We select Refinitive as our research data provider since it is used by many institutes (Refinitiv n.d.) and they have an extensive and objective ESG-database, covering more than 12 500 companies globally (Refinitiv 2022).

With this database, an ESG-score is constructed from each respective company, with the scores ranging from 0 to 100, where 100 is the highest score. In order to keep the data up to date, updates are made continuously in line with companies reporting patterns and scores are recalculated weekly. Note that this does not necessarily imply that the score changes weekly, rather, most new ESG data arrive on an annual basis, since that is typically how often companies review their ESG-disclosure. However, in exceptional cases data can be revised more frequently, such as when a company significantly changes their reporting standards. Notwithstanding, this paper will assume that scores are updated annually, as that is the standard (ibid).

Furthermore, some ESG-indicators are irrelevant in particular sectors and if they are, they are disregarded from the score calculation. This makes intra-industrial comparisons difficult as different industries are judged on different metrics. Also, the calculations of the environmental and social pillar scores are benchmarked against their relevant TRBC (The Refinitiv Business Calculation) industry, which is important to note as this further limits intra-industrial comparisons of ESG-scores (ibid).

3.2. Time period measurement

The sample period is partially determined by the availability of Refinitive's ESG-data. Many companies have insufficient ESG-data when looking over longer historical periods. So, even though Refinitiv has provided ESG-information since 2002 (Refinitiv 2022), we deem that it is most fruitful to sample over 10 years as such a time period allows us to capture adequate amounts of complete ESG-data over a period sufficient enough to make statistical inference. Also, when choosing a sampling period, we try to capture different general economic conditions, including economic downturns, such as the corona crisis in 2020 as well as more regular performance so that the sample does not only capture periods of over- or underperformance. This gives us a more holistic overview of reality. Therefore 2013-2022 is chosen, more specifically 4th January 2013- 30th December 2022. The reason as to why these specific dates are chosen is because January 4th is the first trading day of 2013 and December 30th is the last trading day of 2022.

3.3. Sample collection

This paper defines the Nordics as Sweden, Norway, Finland, Denmark and Iceland. Although Greenland, Åland and the Faroe Islands are part of the Nordics (Nordic Ministerial Council 2021), they are excluded from the sample, considering their insignificant or non-existent capital markets. Given this definition, we create a sample consisting of 1785 exchange traded stocks in Nordic markets. After this, further demarcation is made based on individual company ESG-profiles and those without any ESG-scores are excluded. This leaves us with 569 constituents. Nonetheless, many companies lack ESG-data over the 10-year period and thus, similar to Verheyden, Eccles and Feiner (2016), those companies are excluded from the investment universe. This means that no Icelandic companies remain within the sample as none of them have ESG-scores available for 10 consecutive years. After cleaning the data, 111 constituents remain. However, two companies, namely Seadrill Limited and H.Lundbeck A/S are also excluded from the sample because of a lack of historical price data. After having cleaned the data completely, the sample now consists of 109 constituents across the four largest Nordic countries.

Additional information about these 109 companies is shown in the figures below. Figure 1 displays the distribution of firms across the different countries, while figure 2 illustrates the number of companies within each specific industry. Figures 3 to 6 presents the industry-wise distribution of companies in the corresponding nations.

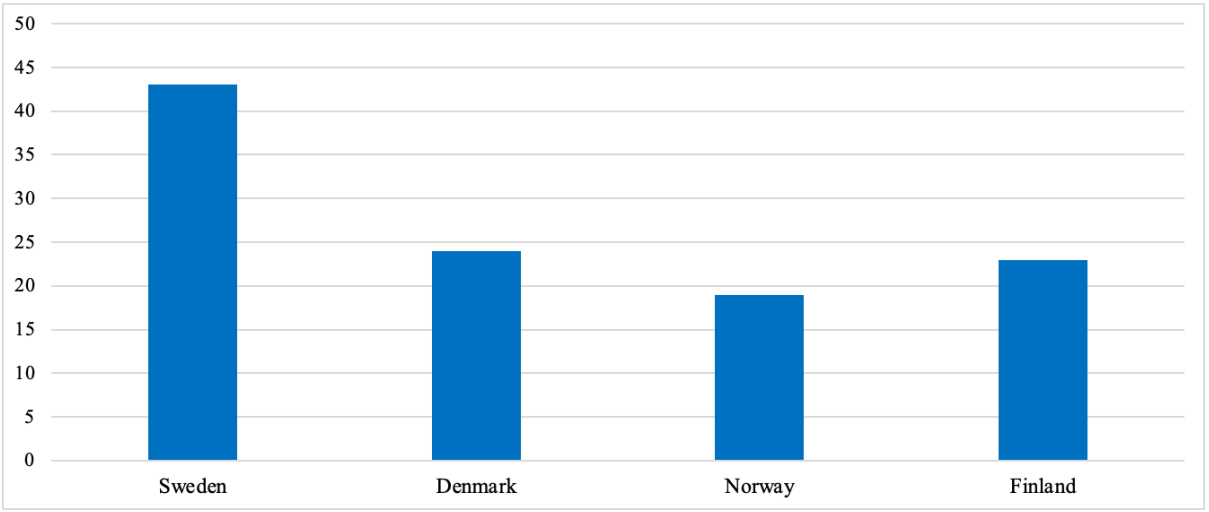

Figure 1: Number of companies per country

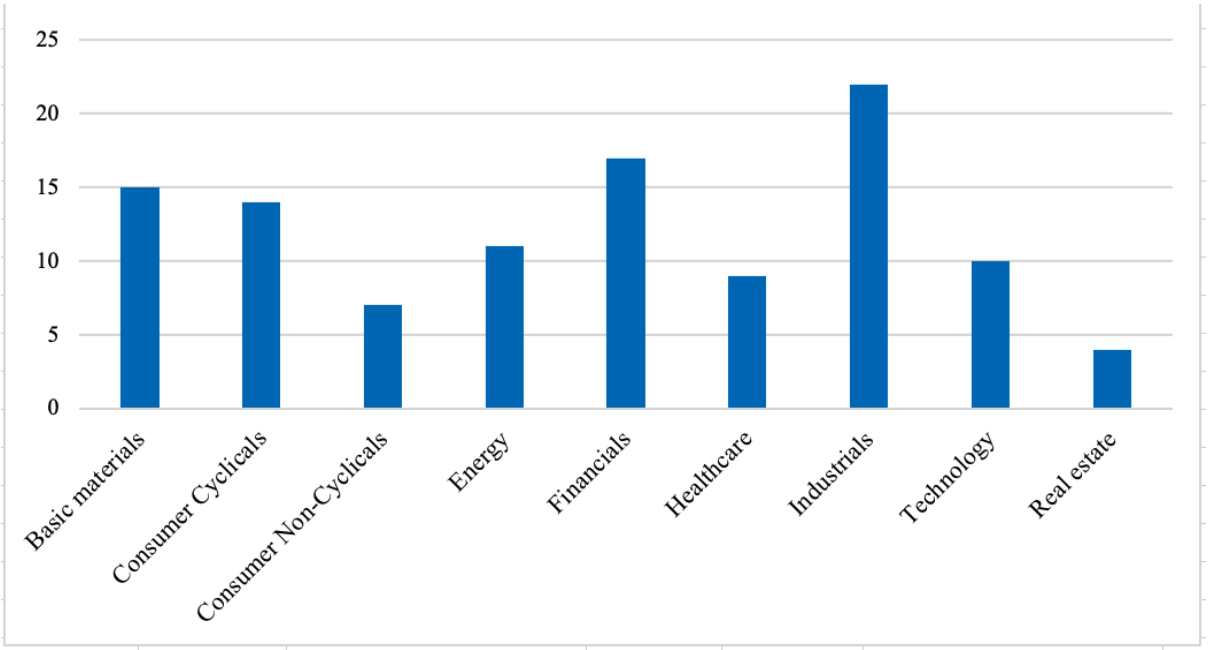

Figure 2: Number of companies per industry

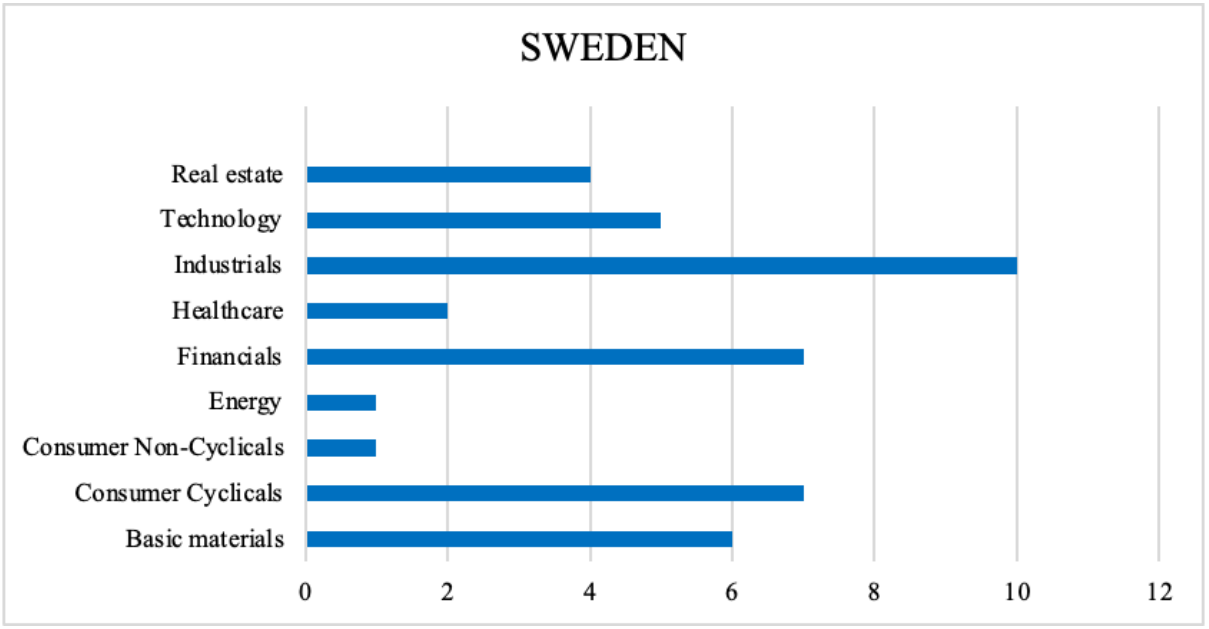

Figure 3: Number of companies per industry in Sweden

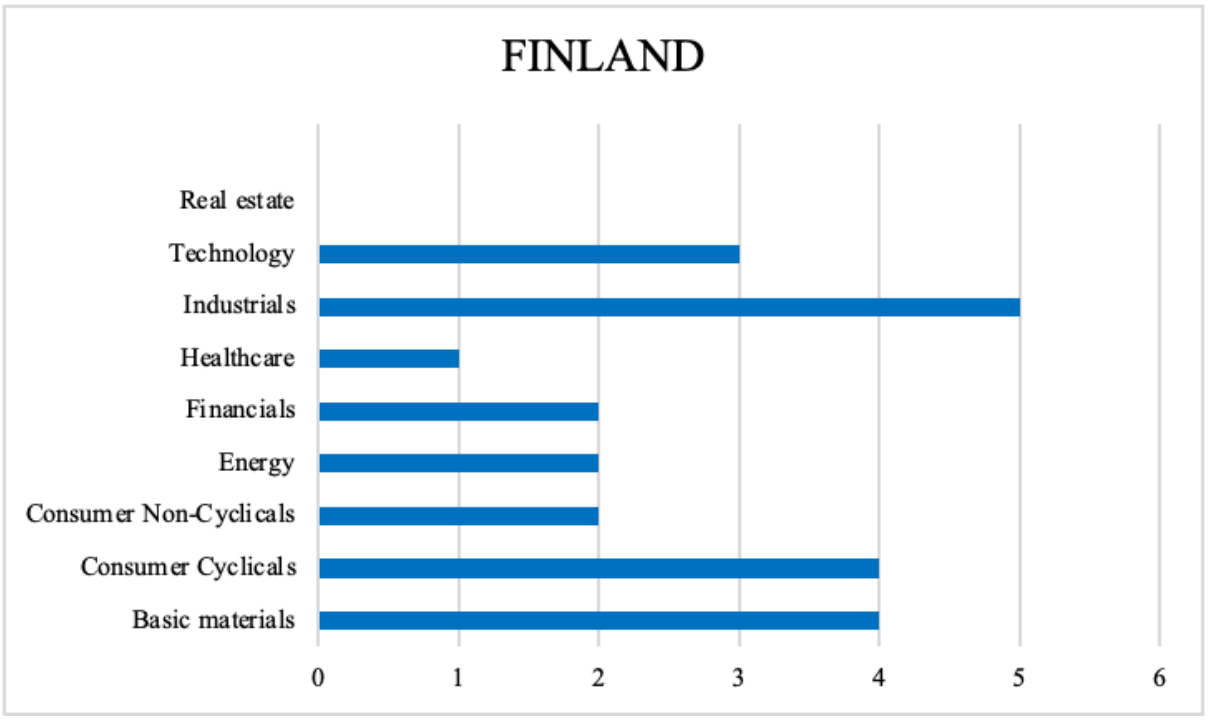

Figure 4: Number of companies per industry in Finland

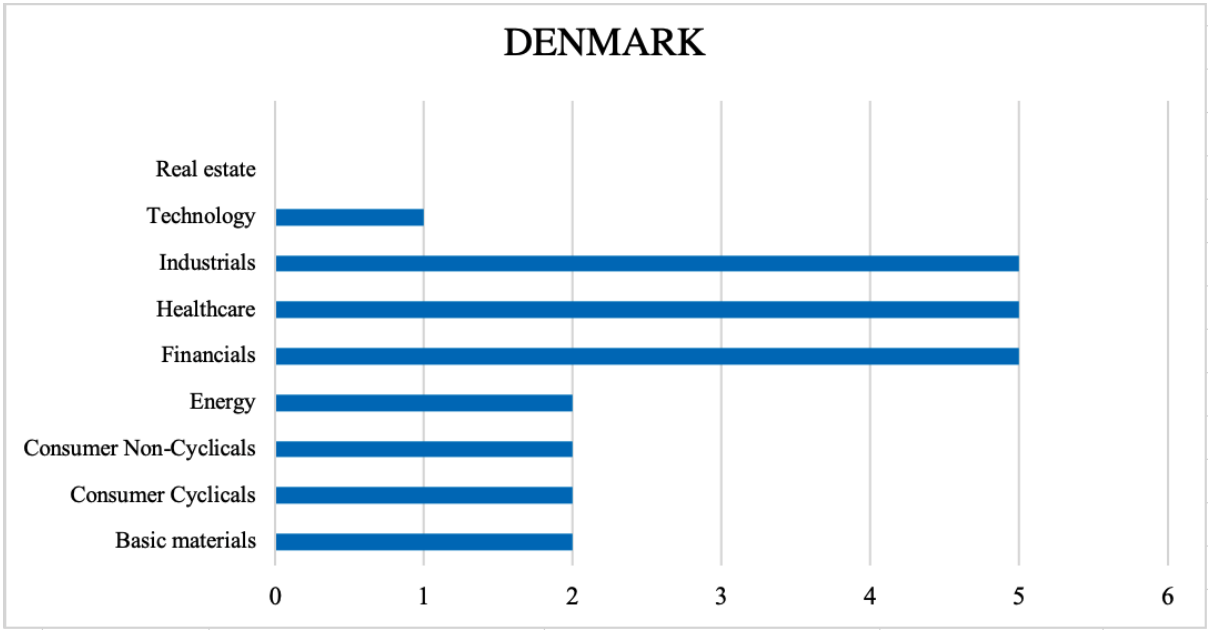

Figure 5: Number of companies per industry in Denmark

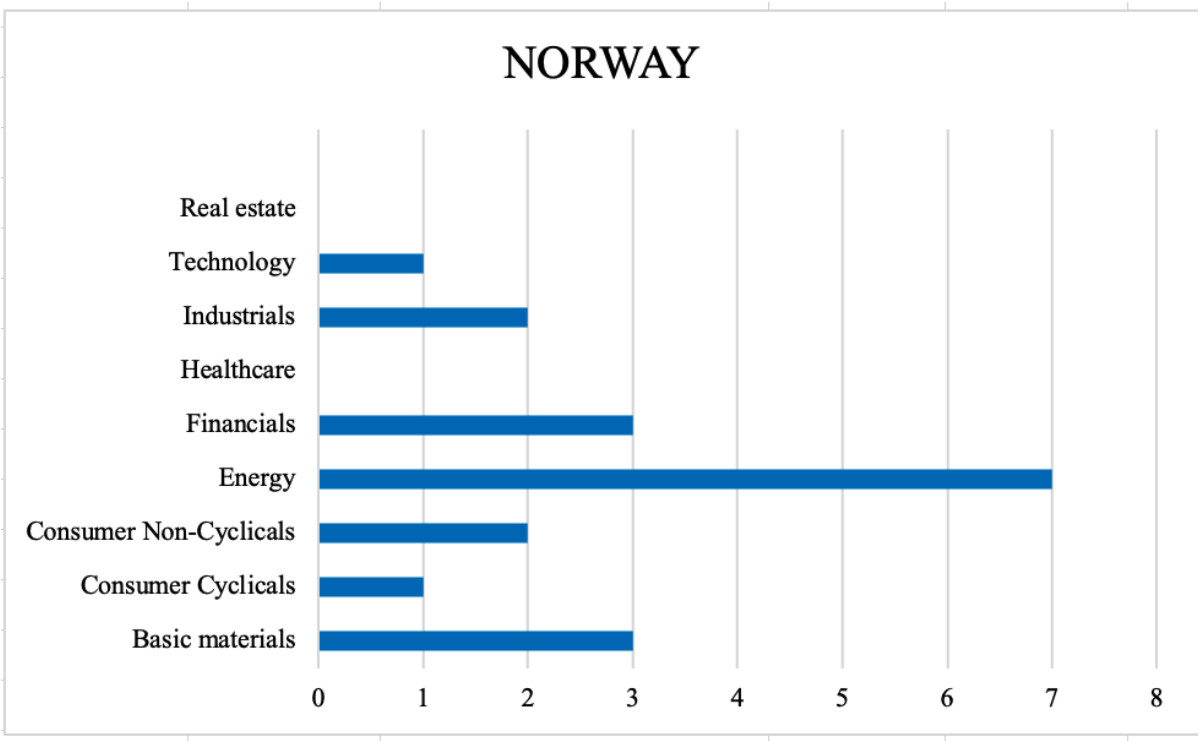

Figure 6: Number of companies per industry in Norway

3.4. Descriptive characteristics

To gather descriptive statistics of our data, empirical testing on the 10-year weekly excess returns are obtained from the three different portfolios.

Top		Bottom		Benchmark	
Mean	0,00207	Mean	0,00163	Mean	0,00197
Standard error	0,00103	Standard error	0,00111	Standard error	0,00103
Median	0,00385	Median	0,00229	Median	0,00425
Standard deviation	0,02357	Standard deviation	0,02542	Standard deviation	0,02344
Variance	0,00056	Variance	0,00065	Variance	0,00055
Kurtosis	8,77664	Kurtosis	6,16100	Kurtosis	7,44568
Skewness	-1,24658	Skewness	-1,01686	Skewness	-1,16176
Range	0,26911	Range	0,26255	Range	0,26086
Minimum	-0,18835	Minimum	-0,17965	Minimum	-0,17735
Maximum	0,08076	Maximum	0,08290	Maximum	0,08352
Sum	1,07971	Sum	0,85239	Sum	1,02831
Count	522	Count	522	Count	522

Table 1: The table above shows different descriptive statistics for the top, bottom and benchmark portfolio excess returns respectively over a 10-year period. The excess returns are calculated on a weekly basis.

When completing the empirical testing of the excess return data, the descriptive statistics above can be presented. As shown, all three portfolios exhibit negative skewness as well as positive kurtosis. Kurtosis measures the peakedness of a distribution. Kallner (2018) states that a normal distribution has a kurtosis of three, making it mesokurtic, while a kurtosis above three makes the distribution leptokurtic, meaning that the tails of the distribution are fat. Our data reports the excess kurtosis, showing the ordinary kurtosis subtracted by three, which makes the return distribution fat tailed on all three portfolios. This comes as no surprise, considering that asset returns, for the most part, tend to exhibit a more leptokurtic distribution (Xiong and Idzorek 2011). As for skewness, it measures the degree to which a distribution is asymmetrical (Jambu 1991). A negative skewness value means that the data is skewed towards the left (vice versa for positive values), contrary to a normal distribution, which has zero skew in any direction (Xiong and Idzorek 2011). Considering that all three portfolios have negative skewness, the returns can be said to skew leftward. A negative skewness, coupled with a leptokurtic distribution makes for something known as left-tailed risk, meaning an increased probability for extreme negative downturns.

4. Method

This chapter outlines the methodology employed to address the research question. Firstly, we present a short summary of the method used and then the portfolio construction is explained. This is followed by an explanation of the statistical test used to determine whether there is a significant difference between the different portfolios. Lastly, the formula for risk-adjusted return and the argumentations behind it are presented.

4.1. Methodology summary and portfolio construction

To determine what effect ESG-scores have on risk-adjusted returns for Nordic public stocks, three portfolios are created. For each year, the portfolio's risk-adjusted returns are calculated and these values are then used in the tests used to determine if the null hypotheses in section 1.3 can be rejected. The three portfolios are:

Benchmark portfolio: This portfolio consists of all companies included in the sample. The portfolio is not rebalanced annually since it consists of the same companies every year.

Top portfolio: This portfolio includes the top 25% performers in terms of ESG-score in each industry. Because we assume that ESG-scores are updated annually, it is rebalanced once every year.

Bottom portfolio: This portfolio consists of the bottom 25% ESG performers in each industry. Since we assume that ESG-scores are updated once a year, it will be rebalanced annually.

Note that both the bottom- and the top portfolio are based on industry. This is because both ESG-scores and industry sectors need to be controlled for when ESG-scores are industry dependent. Similar methodologies have also been adapted in two similar studies conducted by Auer (2016) and Ashwin Kumar et al. (2016).

We aim to avoid any bias originating from stocks with significant market capitalization, as their size significantly can influence the outcome. Therefore, we create equally-weighted portfolios, where the asset weight of each asset $\boldsymbol{i}$ in the respective portfolios at time $\boldsymbol{t}$ have the asset weight following the model below. This is also in accordance with the two papers mentioned in the previous paragraph.

(7) $$w_{i,t} = \frac{1}{N_t}$$

N_t = the number of companies included in the portfolio at time t.

4.2. Test

The tests employed are the unequal variance t-test at a significance level of 5%. The unequal variance t-test is chosen because it makes no assumptions about the equality of populations variances (Ruxton 2006). A 5% significance level is utilized as it is the prevalent level in academic research (Ross 2017) and at the same time similar studies use the same level (e.g. Auer 2016). This means that the observed t-stat is given by:

(8) $$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\overline{x}$ = average value

n = sample size

s = standard deviation

In order to calculate the critical t-stat, the degrees of freedom (df) are needed. The degrees of freedom are rounded down to the nearest integer by using the formula:

(9) $$df = \frac{\left(\frac{1}{n_1} + \frac{u}{n_2}\right)^2}{\frac{1}{n_1^2(n_1 - 1)} + \frac{u^2}{n_2^2(n_2 - 1)}}$$

$u = \frac{s_2^2}{s_1^2}$

n = sample size

s = standard deviation

4.3. Adjusted Sharpe ratio (AS)

The Sharpe ratio (Sharpe 1966) is used by many (e.g. Auer 2016; Breedt et al. 2019) to calculate the risk-adjusted return. The ratio allows the investor to evaluate the performance in terms of excess return per unit of risk (volatility).

(10) $$SR = \frac{r_p - r_f}{\sigma_P}$$

r_f = risk-free rate
r_p = return of the portfolio
σ_P = standard deviation of the portfolio

However, as shown in section 3.4, it is clear that all portfolios exhibit left-tail risk. The implication of this is that portfolio comparisons, based solely upon conventional Sharpe ratios are inadequate, namely due to the lack of consideration that the Sharpe ratio has for left-tail risk (Maillard 2018). Also, due to the skewness and kurtosis of the financial returns, t-testing can not be used since this test assumes normally distributed data (Park and Kim 2019).

Therefore, to cope with the non-normality of the financial returns and to be able to use the t-test, the ratio needs to be adjusted. We employ the formula that is derived from Wright, Yam and Yung (2014). However, we use the number of weeks per year instead of daily trading days, as proposed by the original article, since many of the stocks in the sample have inconsistent daily return data. This would reduce the robustness of our tests, as the yearly returns for the stocks, would be based on different amounts of data points. Weekly returns, however, are consistent throughout the entire period. The formula employed is:

(11) $$AS = \frac{(1/W)\sum_{t=1}^{W} d_{i,t}}{\sqrt{(1/W)\sum_{t=1}^{W} d_{i,t}^2 - ((1/W)\sum_{t=1}^{W} d_{i,t})^2}}$$

d= excess return = weekly return - risk-free rate - transaction cost
t= week
w= number of weeks per year

i= company

No currency conversions are made when calculating the adjusted Sharpe ratio since it will create implications for the calculations for the measurement due to the fact that the currency's exchange rate regularly changes. This means that all values included in the calculations are in the same currency as the company's country of exchange.

To get a more accurate description of reality, transaction costs are accounted for when calculating the excess returns. This is accomplished by subtracting the transaction costs from the returns whenever a company is added into the portfolios. This means that for the first week of the studied period, transaction costs are subtracted from the excess return for all companies in all portfolios. Since the benchmark portfolio always consists of the same companies, this is the only time transaction costs affect this portfolio. However, both the top and bottom portfolio incur transaction costs whenever their constituents change. If a new stock is added to either the top or bottom portfolio, a transaction cost is deducted from its first weekly return in that year. In this thesis, we use a fixed transaction cost of 50 basis points following Brandt, Santa-Clara and Valkanov (2009).

As for the risk-free rate, Israelsen (2005) as well as Wagenvoort and Swartz (2014) both suggest using the three-month U.S. treasury bill rate as a proxy for the risk-free rate when computing it for the U.S. market. However, using the U.S. short term debt rate while investing in Nordic markets would increase both political- and exchange rate exposure. To avoid this, we assign individual risk-free rates to each company by using the treasury bill rate specific to the market where the firm is traded. The treasury bill rate we consider is the average three-month rate, stated on a weekly basis, over the course of 10 years. Specifically, we use the SSVX 3M rate for Swedish companies, DK 3M rate for Danish companies, NO 3M rate for Norwegian companies, and EU 3M rate for Finnish companies.

5. Results

This section showcases the empirical results and provides the numerical values obtained from the respective tests.

5.1. Hypothesis testing

As mentioned in section 1.3, five null hypotheses are used to answer the research question; *"Does ESG-ratings affect risk-adjusted returns in the Nordic region and if so, in which direction?"*. The first hypothesis is:

(1)
$$H_0: \mu_T - \mu_B \leq 0$$
$$H_A: \mu_T - \mu_B > 0$$

By using equations (8) and (9), we create the table below.

	Top	**Bottom**
Mean	0,13393	0,08225
Variance	0,10310	0,05441
Observations	10	10
Assumed mean-differenc	0	
df	16	
t-stat	0,41180	
t-critical one-sided	1,74588	

Table 2: Results from the first hypothesis

As seen in table 2, the critical t-stat is larger than the observed t-stat. Because this is a right-tailed test, we are unable to reject the first null hypothesis. Therefore, we can not conclude that the risk-adjusted mean of the top portfolio is greater than the risk-adjusted mean of the bottom portfolio.

The second hypothesis is:

(2)
$$H_0: \mu_T - \mu_{Be} \leq 0$$
$$H_A: \mu_T - \mu_{Be} > 0$$

where this hypothesis is tested by using equations (8) and (9).

	Top	Benchmark
Mean	0,13393	0,05116
Variance	0,10310	0,02057
Observations	10	10
Assumed mean-differen	0	
df	12	
t-stat	0,74431	
t-critical one-sided	1,78229	

Table 3: Results from the second hypothesis

Table 3 presents the findings of the second hypothesis test. In this table, it is evident that the critical t-stat is higher than the observed t-stat. Since this is a right-tailed test, we can infer that there is inadequate evidence to reject the null hypothesis. Consequently, we can not conclude that the average risk-adjusted return of the top portfolio is larger than the mean risk-adjusted return for the benchmark portfolio is larger than zero.

The third hypothesis is:

(3)
$$H_0: \mu_{Be} - \mu_B \leq 0$$
$$H_A: \mu_{Be} - \mu_B > 0$$

By using equations (8) and (9) we get the following table.

	Benchmark	Bottom
Mean	0,05116	0,08225
Variance	0,02057	0,05441
Observations	10	10
Assumed mean-difference	0	
df	15	
t-stat	-0,35903	
t-critical one-sided	1,75305	

Table 4: Results from the third hypothesis

The table above shows that the critical t-stat is higher than the observed t-stat. Since this is a right-tailed test, we can not reject the third null-hypothesis. Therefore, we can not conclude

that the mean risk-adjusted return for the benchmark portfolio is higher than average risk-adjusted return for the bottom portfolio.

The fourth hypothesis is:

(4) $$H_0: \mu_B - \mu_T \leq 0$$
$$H_A: \mu_B - \mu_T > 0$$

By using equations (8) and (9) we get the following tale.

	Bottom	**Top**
Mean	0,08225	0,13393
Variance	0,05441	0,10310
Observations	10	10
Assumed mean-difference	0	
df	16	
t-stat	-0,41180	
t-critical one-sided	1,74588	

Table 5: Results from the fourth null hypothesis

The results presented from the fourth null hypothesis show an observed t-stat which is lower than the critical t-stat. Since this is a right-tailed test, we can not reject the null hypothesis. Therefore, we can not conclude that the mean risk-adjusted return for the bottom portfolio is larger than the average risk-adjusted return for the top portfolio.

The fifth hypothesis is:

(5) $$H_0: \mu_B - \mu_{Be} \leq 0$$
$$H_A: \mu_B - \mu_{Be} > 0$$

By using the equation (8) and (9) we get the following table.

	Bottom	Benchmark
Mean	0,08225	0,05116
Variance	0,05441	0,02057
Observations	10	10
Assumed mean-difference	0	
df	15	
t-stat	0,35903	
t-critical one-sided	1,75305	

Table 6: Results from the fifth hypothesis

In table 6, it is evident that the observed t-stat is lower than the critical t-stat. Because this is a right tailed test, we can not reject the fifth null hypothesis and we can therefore not conclude that the average risk-adjusted return for the bottom portfolio is higher than the average risk-adjusted return for the benchmark portfolio.

6. Discussion

In this section the results are discussed by using information from previous chapters. Then, a discussion about study limitations is made to highlight the potential shortcomings of the study that might affect our results.

6.1. The results

As seen in chapter 5, all five t-tests show insignificant results, which means that our findings show no evidence that ESG-scores affect the risk-adjusted returns for Nordic public stocks in neither a positive nor negative way. This result is in contrast to the prediction presented in section 2.7, which assumes that higher ESG-scores should increase risk-adjusted returns.

The result is consistent with both Breedt et al. (2019) and Auer (2016) where the former argue that an incorporation of the scores have already been accounted for by other equity factors. However, that argument stands against the second prediction laid out by Pedersen, Fitzgibbons and Pomorski (2021) who argue that the incorporation of ESG-information can actually increase the risk-adjusted return for the investor. Nonetheless, other financial theories actually stand in favor of both Breedt et al. (2019) and Auer (2016), one of them being the efficient market hypothesis. As mentioned, markets can exhibit semi-strong efficiency, which in this case would mean that market participants are unable to increase their risk adjusted returns by incorporating ESG-scores into their investment decisions. This means that our results are consistent with the semi-strong form of the efficient market hypothesis since ESG-information should already be reflected in the stock price according to the theory.

However, multiple other studies show results that are in contrast to our findings. For example, Pollard, Sherwood and Klobus (2017); Stotz (2022); Eccles, Verheyden and Feiner (2016) show a positive link between ESG-scores and risk-adjusted returns. Furthermore, numerous papers show that higher ESG-scores reduce the risk. This can be seen in articles such as Jiraporn et al. (2013) and Chang et al. (2022) who show that higher ESG-scores improve a firm's credit ratings, meaning that their ability to honor their debts improve and risk is reduced. Additionally, Dunn, Fitzgibbons and Pomorski (2018) show that higher ESG-ratings lowers both total and idiosyncratic risk of a company. A similar result is also presented by Horn (2023) who finds that firms with higher ESG-ratings have lower idiosyncratic risks. In connection to this, Ashwin Kumar (2016) presents evidence that portfolios containing only

stocks with higher ESG-ratings have higher risk-adjusted returns in terms of Sharpe ratio and that the reason behind this is that volatility is brought down on those stocks. Additionally, as seen in section 2.6.3, previous studies suggest that there is a positive relationship between financial performance and ESG-score. Coupling this with Cornell and Damodaran (2020), the lowered risk and higher financial performance should drive up the value of the firm, all else equal.

Regardless of the findings from these papers, our results show no such significant risk reduction benefit, even though volatility actually does differ between the three portfolios. As table 1 shows, the top portfolio has approximately 7.3% less volatility than the bottom portfolio and the benchmark has 8.4% less volatility than the bottom portfolio. However, there is a slight difference between the top and benchmark portfolios since the top has 0.5% more volatility than the benchmark. A possible explanation for the top-benchmark difference is the increased diversification benefit that the benchmark portfolio enjoys with its 109 constituents compared to the top portfolio, with only 29 constituents. Nonetheless, none of these portfolios, regardless of their reduced volatility, show any significant improvement in terms of risk-adjusted returns and there are multiple explanations to this. Analyzing lower volatility from the perspective of prospect theory, investors should prefer stocks with lower volatility, which according to, for example, Jiraporn et al. (2013) and Chang et al. (2022) would be stocks with high ESG-ratings. This preference ought to lead to an influx of investors towards highly rated ESG-stocks. Also, considering the Nordic preferences for sustainability, investors within the Nordic market should show a greater awareness and demand for sustainable stocks. An increased demand stemming from a will for risk reduction as well as high ESG-awareness could potentially be reducing expected returns of highly rated ESG-stocks, as explained by Pedersen, Fitzgibbons and Pomorski (2018). So, even though overall portfolio volatility has decreased, which improves risk adjusted returns, so has expected returns which worsens the situation. It is possible that these two effects, which affect risk adjusted returns in opposite ways, cancel eachother out. However, the top-benchmark difference would reject such an explanation. In theory, top should exhibit lower volatility than the benchmark, yet empirically, it does not. Therefore, such an explanation is refuted for the top-benchmark difference.

Another reason as to why our results contradict those of many previous studies who showed a positive relation may lie in our exclusion rates. Even though studies such as Eccles, Ioannou

and Serafeim (2014) are able to show a positive relationship between high ESG-scores and risk adjusted returns, Auer (2016) observes that the Sharpe ratio declines when exclusion rates are too high. As mentioned in section 3.3, we excluded 1676 stocks out of the original 1785 on Nordic markets when screening for those with consistent ESG-ratings over a 10-year period. With this, it is possible that our portfolios enjoy the benefits of ESG-investing described by Eccles, Ioannou and Serafeim (2014) but that these disappear due to our high exclusion rates. On the other hand, Eccles, Verheyden and Feiner (2016) disprove such an argument and did not find that screening caused any particular diversification loss on average. The authors suggest that any diversification loss that the investor might occur from her negative screening is offset by an increased alpha. Nonetheless, we are not able to infer which of these effects are dominant.

Our results are also inconsistent with the evidence presented by Giuli and Kostovetsky (2014) who state that ESG and stock's returns have a negative relationship due to the costly implementation of CSR. We suspect two factors which might have caused this discrepancy. Firstly, their study was conducted on the U.S. market which means that companies in their sample comply with different laws and regulations. Also, preferences, which we have not explored for stocks listed in the U.S. might differ from those which prevail in the Nordics. In fact, many studies whose results contradict ours might do so since they explore only the U.S. markets. Such studies include Shanaev and Ghimire (2022) as well as Eccles, Ioannou and Serafeim (2014). Secondly, there is also a difference when it comes to the ESG-score provider. They use data from KLD, which nowadays is named MSCI, while we use Refinitiv. Considering that each provider uses a different methodology for their calculation, results may differ even when researching the same topic.

Further inconsistencies can be found between our results and studies regarding upgrades of ESG-scores. Giese et al. (2019) finds that companies who increase their scores over time perform better than their peers. When analyzing the data, the bottom portfolio has seen bigger upgrades of its score over the 10-year period than the top portfolio has. According to the authors' observations, this should imply that the bottom portfolio overperforms its top counterpart. Shanaev and Ghimare (2022) also present similar arguments to Giese although they are slightly different. They observe that while higher risk-adjusted returns exist for upgraded stocks, these are inconsistently significant. To that, they add that downgrades play a more important role, as downgrades cause average losses of -1.2% with consistent

significance. These results are in line with the third behavioral bias of prospect theory, which argues that an individual loses more utility from a loss than she gains from a win, with the adjustment that individuals might perceive a downgrade of ESG-score worse than an upgrade. Nevertheless, our results are inconsistent with the findings of both papers. When analyzing the data, the bottom portfolio has bigger upgrades of its score over the 10-year period than the top portfolio has, yet, the bottom portfolio does not overperform its peer. This can be seen in the appendix.

6.2. The limitations

As with every thesis, several limitations can be found. One potential limitation to be aware of is the availability of data, where many Nordic companies from the chosen time period do not have ESG-data available every year, which we require to be included in the dataset. Additionally, many companies that do not have any ESG-ratings are excluded from the dataset as well. This in turn implies that it is possible that the circumstances that prevailed during these years are not well represented in the study.

It is also important to take into consideration that the findings from this paper might not hold when another ESG-provider is used. This is because different ESG-institutes can lead to other portfolio compositions due to variations in ESG-score between institutes, as highlighted by Berg, Kölbel and Rigobon (2022). The notion that a different ESG-institute may yield a different outcome is further strengthened by Shanaev and Ghimire's (2022) research since they show that divergent viewpoints among various ESG-providers significantly impact the risk-adjusted returns.

Another potential limitation to consider is our relatively small sample of 109 companies, where 25% of these are included in the top- and bottom portfolio respectively. The small sample poses a potential limitation to our study, as single companies included can heavily influence our results. Consequently, there is a possibility that the obtained results may not accurately reflect the true population characteristics. We attempted to reduce this limitation by creating equal-weighted portfolios because by using this weighting, all stocks affect the portfolios equally. However, it is possible that this is not enough to fully address this concern.

Thirdly, we are analyzing our research question by using an adjusted Sharpe ratio, an unequal variance t-test and a single transaction cost. Since we are only using one

measurement of risk-adjusted returns and one type of test, our paper relies on the robustness of this method. This can create biased results as we could potentially observe different results by using other models, such as Carhart's four-factor model (Eccles, Ioannou and Serafeim 2014), Treynor ratio (Ashwin Kumar et al. 2016) or a bootstrap test (Auer 2016). Moreover, using a single transaction cost fails to capture the true nature of the situation as transaction costs differ across stocks, countries and banks. Consequently, there is a possibility that we observe other results if this is taken into consideration. However, due to the impact of transaction costs on the adjusted Sharpe being small, it is highly unlikely that incorporating different transaction costs would have a significant effect on the results.

Fourthly, it is important to note that ESG-scores have a broad definition and that other other findings can be made if another time horizon is studied. Different time periods can yield different results since the world will look differently during those periods. The broad definition creates implications for the validity of our research since firms can have high ESG-scores, even though they are not fully sustainable companies. For example, firms with high social and governance scores may still possess relatively high ESG-score, even though the environmental scores are low.

7. Conclusion

In this section, the study is summarized and it also includes suggestions for future research.

This paper contributes to the existing research by studying the relationship between risk-adjusted returns and ESG-scores in the Nordic region. More specifically, we study if ESG-scores affect the risk-adjusted return for Nordic public stocks. This is done by creating five null hypotheses and using unequal variance t-tests to determine if these hypotheses can be rejected. In order to make these tests, three portfolios are created, where the first portfolio acts as a benchmark, consisting of companies with ESG-scores for all years between 2013 to 2022. The second portfolio only includes highly ESG-rated stocks and the third only consists of lowly rated stocks.

All five tests show insignificant results which means that we find no evidence that higher ESG-scores affect the risk-adjusted returns for Nordic public stocks. These findings are consistent with other papers such as Breedt et al. (2019) and the semi-strong efficient market hypothesis which states that all available public information should already be included in the stock price. However, these findings contradict other theories and papers, where potential explanations behind these deviations can be that our sample exclusion rate is high and that a different market is studied.

This conclusion is important for investors who invest in the Nordic region since it shows no evidence that investing in ESG-stocks have an effect on risk-adjusted return for Nordic public stocks. However, this paper has several limitations which can potentially affect our results. For example ESG-scores vary depending on which rating institute is used which creates a possibility that other conclusions can be drawn if another ESG-score provider is used. Therefore for future research, an important research area would be to include information from various ESG-institutes by for example doing separate calculations for each respective provider. Similar to Avramov et al. (2022), it would also be interesting to account for the overall disagreement in ESG-scores between different ESG-providers.

An analysis of the individual pillars within the ESG-score would be another intriguing topic for future research, as this study focuses solely on the combined ESG-score. Since we only use one model, it would also be interesting to see if similar conclusions can be made if other models are used.

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Appendix

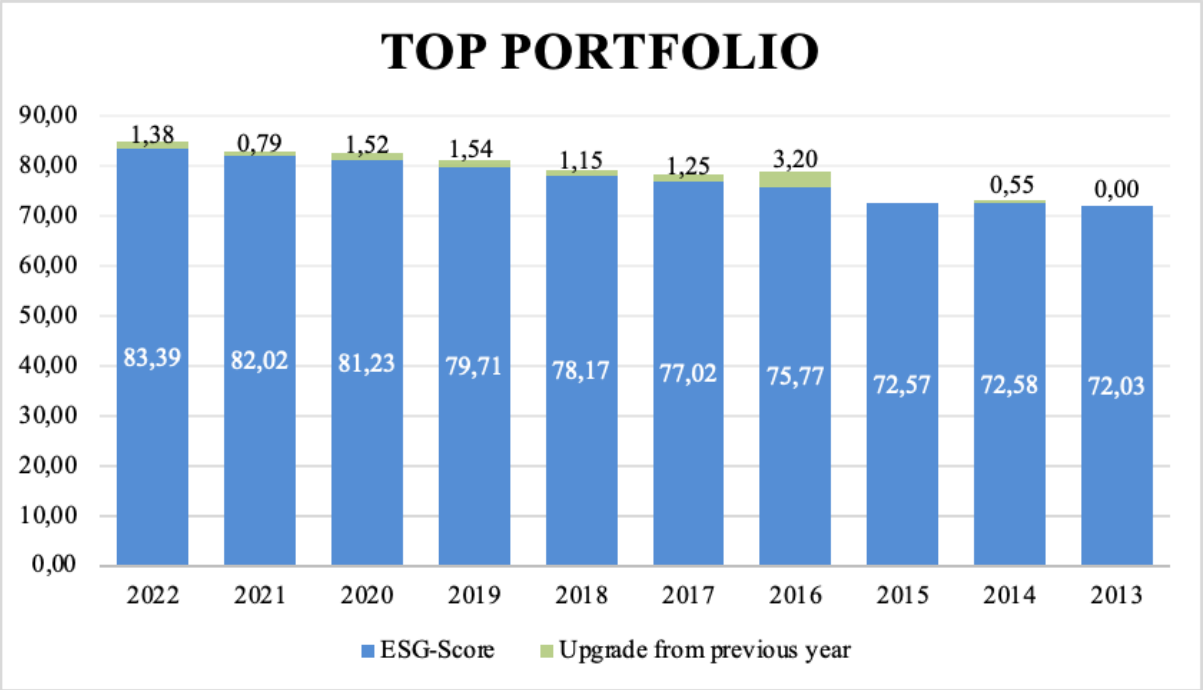

Figure A1: This figure includes both the top portfolio's average ESG-score for every year and ESG-upgrade from previous year. The total average ESG-upgrade for this portfolio is approximately 11,36.

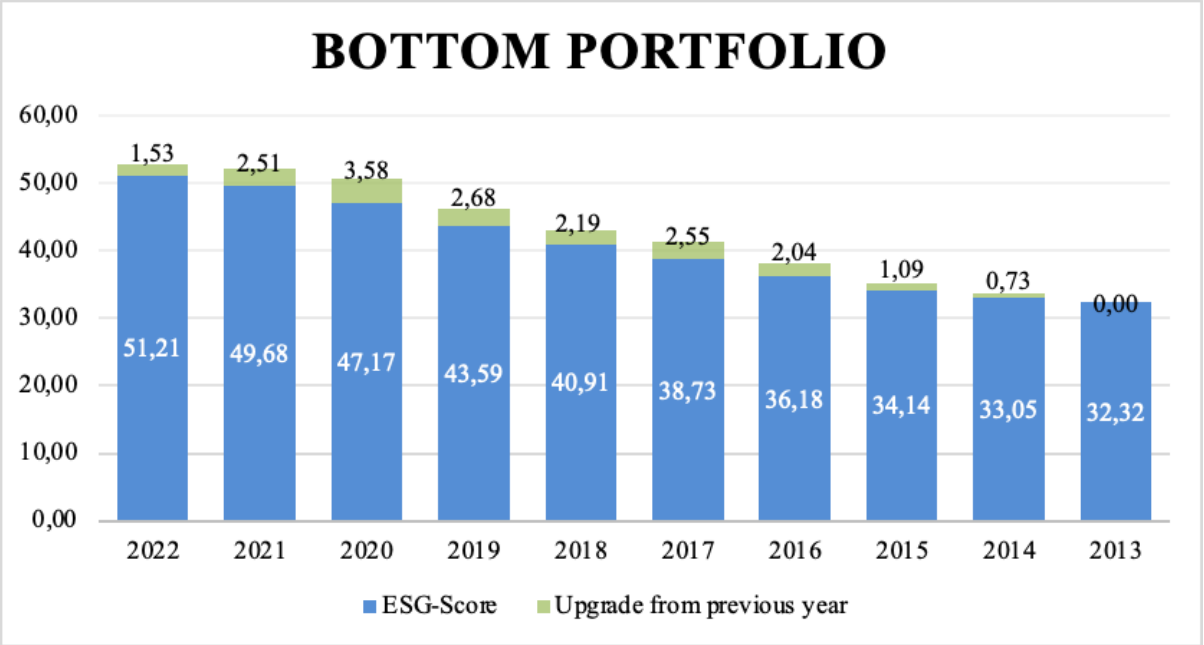

Figure A2: This figure includes both the bottom portfolio's average ESG-score for every year and ESG-upgrade from the previous year. The total average ESG-upgrade for this portfolio is approximately 18,89.

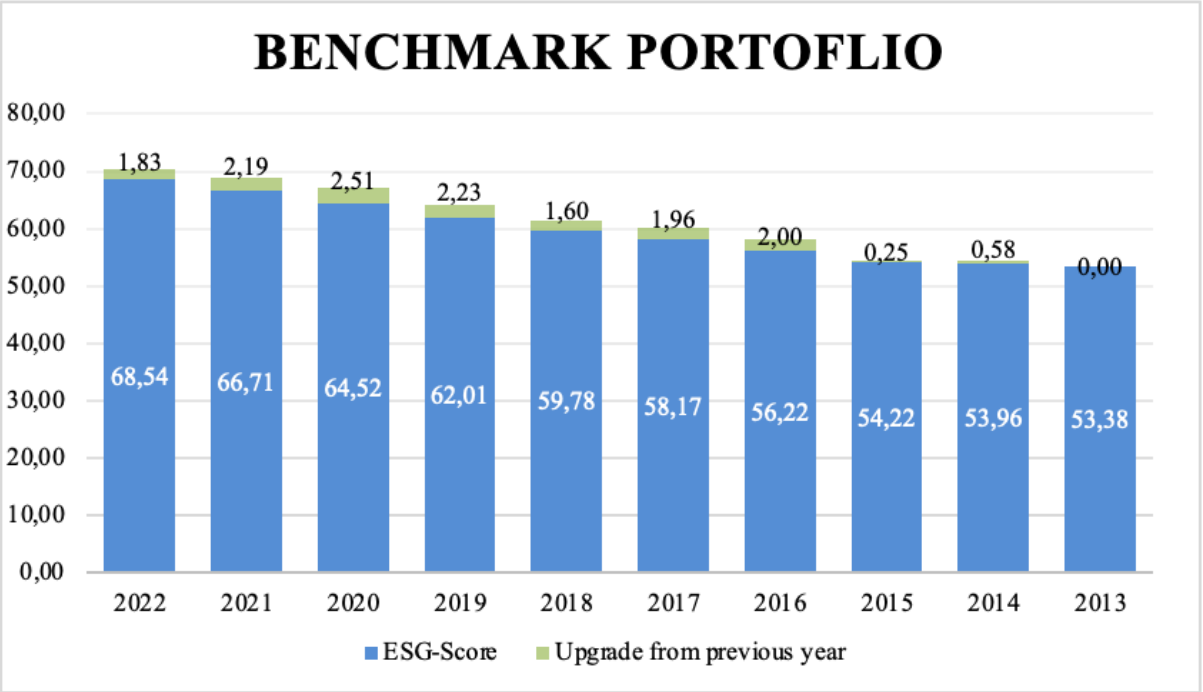

Figure A3: This figure includes both the benchmark portfolio's average ESG-score for every year and the average ESG-upgrade from the previous year. The total average ESG-upgrade for this portfolio is 15,16.