UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

The Relationship Between Environmental, Social and Governance Factors and Firm Performance

A Study Performed on the Swedish Stock Market

Bachelor of Science (B.Sc.) in Finance

University of Gothenburg – School of Business, Economics and Law
Institution: Centre for Finance
Supervisor: Jon Williamsson
Bachelor's Thesis Spring 2018
15 Credits

Erika Venäläinen and Johanna Sjöström

Gothenburg, Sweden
Spring 2018

Abstract

This thesis investigates the relationship between environmental, social and governance (ESG) factors and firm performance on the Swedish stock market over the years 2013-2017. Using the traditional Carhart's four-factor model, a quantitative research method has been applied by running panel and OLS regressions on historical stock returns. The thesis finds statistically significant evidence for a negative relationship between the ESG score and firm performance. Furthermore, the findings of the study provide statistically significant evidence for a difference in risk-adjusted alphas between two portfolios, where the bottom portfolio performs better than the top portfolio. The bottom portfolio consists of the ten companies in OMXS30 with the lowest ESG scores and the top portfolio consists of the ten companies in OMXS30 with the highest ESG scores. However, the findings for the two hypotheses are small negative values nearly equal to zero and can be interpreted as no-effect scenarios. Hence, investors on the Swedish stock market could, when determining a desirable level of return, choose whether to include ESG factors without a substantial difference in return.

JEL Classifications: G11, G12, Q56

Keywords: ESG, Abnormal Returns, Portfolio Returns, Swedish Stock Market

Acknowledgements

We would like to express our great appreciation to our supervisor Jon Williamsson for his guidance and useful support during the writing process of this thesis. Furthermore, we wish to acknowledge the assistance provided by Aineas Mallios when it comes to Stata. Lastly, we would like to offer our special thanks to the people at the Finance Department at the School of Business, Economics and Law at the University of Gothenburg for providing us access to financial databases such as Thomson Reuters.

Table of Contents

1. Introduction

Throughout the centuries, an awareness about humankind's dependence on the environment has been present in developed countries (Jeucken, 2001). However, the problems that arise with this dependence have become evident during the last decade (ibid.). The scale and degree of environmental problems have evolved correspondingly, leading to both political and social changes that make it harder for corporations not to strengthen their responsibilities regarding the environment (ibid.). The increased awareness has been reflected in the financial markets, where the demand for more sustainable and social responsible products and business relations have emerged (ibid.). Today, investors do not solely make decision on future financial performance, but also consider the potential environmental impact when choosing an investment (Morgan Stanley, 2015).

Numerous researchers have conducted different types of studies concerning corporations' sustainable actions relative to firm performance with various results (for example, Derwall, Guenster, Bauer & Koedijk, 2005; Climent & Soriano, 2011). Research suggests that corporations engaging in sustainable actions yield positive, neutral as well as negative stock performance (Sjöström, 2011). However, some argue that corporations are only responsible for maximizing profit and meeting shareholders' interest. One of the earliest critics to managements engagement in Corporate Social Responsibility (CSR) activities is the Nobel-winning professor Milton Friedman. Friedman (1970) argues that implementation of environmental controls on corporations would entail substantial direct or indirect costs that may erode the competitiveness of a firm and undermine its resources.

It is important to emphasize that no generally accepted definition of the concept "sustainability" exists nor does any general method to evaluate it (Escrig-Olmedo, Munoz-Torres & Fernandez-Izquierdo, 2010). Therefore, there is a tough task to define the concept "sustainability", but with produced measures it is possible. For example, Thomson Reuters provides structured and standardized environmental, social and governance (ESG) research data. Thomson Reuters claims that a measure like this can be as important as traditional financial metrics when investors evaluate firms' performance in a time of climate changes (Thomson Reuters, 2018).

Interestingly, the large number of published studies have not explored the impact of ESG factors on the performance of firms listed on the Swedish stock market. The previous studies

of ESG factors and stock returns have predominantly been applied on larger stock markets, such as the US market and the European market (for example, Cohen, Fenn & Konar, 1997; Rennings, Schröder & Ziegler, 2003). Sweden is a leader regarding climate policy, which can be seen as a sign that a transition process on the Swedish market has started (Finansinspektionen, 2016). This entails that Swedish banks, insurance companies and capital investors are neither widely nor directly exposed to climate related risk (ibid.). However, it is important to keep in mind that the Swedish financial sector is also affected by what is happening international (ibid.). Swedish financial firms work to a large extent together with both Swedish and international initiatives in the sustainability area, which all work on broad front with sustainability in terms of ESG factors (Finansinspektionen, 2016). It would be of importance to examine whether there is a relationship between ESG factors and the performance of firms listed on Stockholm stock exchange, to complement the previous studies that have not focused on the Swedish stock market.

1.1 Research Questions

In order to supplement the research area of sustainability and firm performance, this thesis focuses on the Swedish stock market by collecting data from a recent period, from January 2013 until January 2018. We argue that the Swedish market is especially interesting since Sweden is viewed as a leader regarding climate policy (Finansinspektionen, 2016). In order to investigate the relationship between ESG scores and firm performance of companies on the Swedish stock market, two hypotheses are constructed as follows:

Hypothesis I

Null hypothesis: There is no relationship between the ESG score and firm performance

Alternative hypothesis: There is a relationship between the ESG score and firm performance

Hypothesis II

Null hypothesis: The risk-adjusted alphas are not different between two created portfolios categorized by the level of the ESG score

Alternative hypothesis: The risk-adjusted alphas are different between two created portfolios categorized by the level of the ESG score

1.2 Purpose

The purpose of this thesis is to evaluate the relationship between the ESG score and firm performance of companies on the Swedish stock market. Furthermore, the aim is to draw conclusions regarding the relationship between the level of the ESG score and firm performance by determining whether the risk-adjusted alphas between two created portfolios categorized by the ESG score, differ from each other.

1.3 Thesis Structure

The rest of the thesis is organized as follows: The next section is a literature review which provides examples of earlier studies that examine the relationship between environmental, social and governance factors relative to firm performance by using different approaches. The literature review is followed by a theoretical framework presenting the models and the definition of the ESG measurement used in this thesis. Thereafter, the sections of data and methodology are presented, followed by our research results and tests of robustness. The thesis continues with a discussion of the results and ends with conclusions.

2. Literature Review

The following section provides an overview of previous studies which all have investigated the relationship between different kinds of sustainable factors and firm performance. These studies consist of various approaches and also diverge in terms of analyzed markets.

As previously stated, there are several empirical studies which have investigated the relationship between ESG factors and firm performance, and the results are not homogenous. Some studies find evidence that a portfolio with environmental leaders or a constructed green mutual fund would expect to meet or exceed the market or a conventional fund over certain time periods. Other studies find that there is no significant difference in corporations' financial performance based on how they engage in environmental and social activities. In addition, evidence that environmental funds perform worse than conventional ones can also be found in earlier research.

To determine the relationship between corporate responsibility and firm performance Derwall et al. (2005) used an eco-efficient rating in order to construct two portfolios based on this level of rating. The performance of the constructed portfolios was evaluated by using theoretical models such as CAPM, Jensen's alpha and Carhart's four-factor model. They found that companies with higher eco-efficient ratings tend to perform better than companies with lower eco-efficient ratings during the period 1995-2003 when evaluating firms on the US market. Thus, the findings suggested that an investment strategy based on corporate responsibility could have substantial advantageous impact on performance. Similarly, Cohen, Fenn and Konar (1997) constructed two industry-balanced portfolios and compared, among other things, the market returns of the "high polluter" to the "low polluter" portfolio. The results from the study showed that the portfolio with low pollution performed as well as, or better than, the portfolio with high pollution. Hence, they concluded that so-called "green" investors do not need to pay a premium for their convictions. Furthermore, they pointed out that one must remember that other aspects of the environmental leaders could be a part of their higher environmental performance, for example more efficient corporations may have lower pollution.

A study by Yamashita, Sen and Roberts (1999) examined the relationship between environmental conscientiousness score (EC-score) and firm performance on the US stock

market during the period 1986-1995. By assigning each company an EC-score, they could test the correlation between companies' returns and their EC-scores. The results showed a positive relationship between higher return and higher EC-score, but this relationship was not statistically significant. However, they found a statistically significant tendency that companies with lower scores had worse return in the long term. This view supports the findings of Derwall et al. (2005) and Cohen, Fenn and Konar (1997).

On the contrary, Rennings, Schröder and Ziegler (2003) found that more corporate environmental or social activities did not lead to an overall better economic performance than corporations in the same sector which were not engaged in such activities. They studied the effect of environmental and social performance on the stock return of European corporations during the period 1996-2001. The sustainable performance was measured through both an evaluation of the environmental or social risks of the industry in which each company was active, and an evaluation of the environmental and social activities each company was engaged in relative to its industry average. Another paper with partly similar conclusion is Climent and Soriano's (2011) study. They investigated the performance and risks of US green mutual funds in relation to conventional funds. Their analysis based on a CAPM-methodology found that during the period 1987-2009, environmental funds had a lower performance compared to the conventional funds. However, when they focused on a more recent period (2001-2009) they found that green funds achieved adjusted returns similar to conventional mutual funds.

Furthermore, a recent study by Atan, Alam, Said and Zamri (2018) evaluated the impact of ESG factors on firm performance of companies on the Malaysian market during the period 2010-2013 by using panel data. The findings of this study concluded that there was no significant relationship between a firm's ESG factors and firm performance when the ESG factors were measured both individually and combined. Manescu (2011) conducted a similar study in terms of research area and methodology. Manescu analyzed the relationship between stock return and ESG factors on the US market during the period 1992-2008. In the study, a "no-effect" scenario is described as a situation where there is no difference in the returns, adjusted for common risk factors, of high-ESG firms relative to low-ESG firms. Moreover, this scenario is entirely consistent with the efficient market hypothesis if the ESG performance of firms provides no information relevant for pricing (Manescu, 2011). Manescu found that the aggregated ESG factor had no statistically significant effect on stock return. The main

implication contributed by Manescu is that certain ESG attributes are value relevant, however they are not incorporated in stock prices in an efficient way.

Lastly, a study by Statman and Glushkov (2009) examined the relative returns of both socially responsible and conventional stocks. They stated that typical socially responsible portfolios were tilted towards stocks that earned high ratings on social responsibility characteristics and were excluding stocks of companies associated with alcohol, tobacco, gambling et cetera. They found that the tilt generated an advantage on socially responsible portfolios compared to conventional ones. The study also found that the approach to exclude some stocks was shown to be a disadvantage of social responsibility portfolios compared to conventional ones. Furthermore, Statman and Glushkov (2009) concluded that for socially responsible portfolios, the advantage from the tilt towards companies with high social responsibility ratings was at large offset by the disadvantage from excluding other companies. This net effect was consistent with their "no-effect" scenario, implying that social responsibility features of companies had no effect on the return. This no-effect scenario was also described by Manescu (2011). Moreover, they provided information about how to not end up in this "no-effect" situation. That is to tilt the portfolio towards stocks with high social responsibility ratings, while at the same time abstain from excluding any stocks.

To summarize, there appears to be various opinions on whether ESG factors have a positive influence on firm performance or not. Furthermore, the results highlighted above diverge in terms of periods, geographical markets and environmental influence measures. The research which has been conducted on the sustainability field in relationship to firm performance has mainly focused on the US stock market (for example, Yamashita, Sen & Roberts, 1999; Derwall et al. 2005). In addition, some researchers have investigated other markets, as for example Rennings, Schröder and Ziegler (2003), who studied the European market. However, studies examining the relationship between ESG factors and firm performance on the Swedish stock market are scarce, and therefore no Swedish studies are presented in the literature review.

3. Theoretical Framework

In this chapter, there is a description of the main theoretical framework applied in this study. The theories are used to describe the methodology and for discussion of the empirical evidence to be able to answer the two hypotheses. In addition, this section ends with a detailed description of Thomson Reuters ESG score which is used in this thesis.

3.1 Efficient Market Hypothesis

The efficient market hypothesis is a well-studied and documented theory which is often used in economic analyses. In an article by Eugene Fama (1970) the idea behind an efficient market is presented. Fama's (1970) hypothesis implies that in an efficient market, securities are correctly priced based on all information available at that time. The implication for investors on the stock market is that it is impossible to outperform the stock market since all information is already incorporated in stock prices.

Moreover, the efficient market can vary in three forms (Fama, 1970). Firstly, the weak efficient market in which the prices reflect all information regarding historical prices and news. Secondly, the semi strong efficient market in which the prices are adjusted regarding all publicly available information but also other news, for example stock splits. Lastly, the strong efficient market in which prices fully reflect all available information, including insider information.

3.2 Modern Portfolio Theory

The Markowitz portfolio model (1952) is about finding the optimal trade-off between risk and return in a portfolio, depending on the investors preferences of risk. The model assumes that investors will always prefer a portfolio with lower level of risk in front of a portfolio with higher level of risk, given the same expected return. In order to receive higher return, the model assumes that the investor must undertake higher level of risk. By diversifying, combining different types of assets that behave variously and with different levels of risk, investors can decrease the risk without affecting the expected return. All efficient portfolios given all levels of risk end up at the so called efficient frontier.

3.3 Capital Asset Pricing Model

The capital asset pricing model (CAPM) was introduced by Treynor (1961, 1962), Sharpe (1964), Lintner (1965) and Mossin (1966) independently, building on the modern portfolio theory developed by Markowitz (1952). CAPM is widely used throughout the field of finance when pricing risky securities and describes the relationship between the systematic risk and expected return of an asset. This model explains that investors need to be compensated for two factors, the risk and time value of money. The risk factor represents the compensation an investor needs in order to undertake any additional risk. The time value of money factor compensates an investor for placing money in any investment over a period of time. CAPM declares that the expected return of a portfolio or a security equals the rate of any risk-free security plus a risk premium. An investment should not be undertaken if this expected return does not meet or exceed the required return (Berk & DeMarzo, 2014). The model can be seen in formula (1).

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \varepsilon_{i,t} \quad (1)$$

i = the i:th portfolio
t = time t
$r_{i,t}$ *= return on the portfolio i at time t*
$r_{f,t}$ *= risk-free rate at time t*
$\alpha_{i,t}$ *= alpha, the risk-adjusted abnormal return for portfolio i*
$\beta_{1,i}$ *= the beta of the regressor*
$(r_{mkt,t} - r_{f,t})$ *= the difference in expected return of the market minus the risk-free rate in time t, the risk premium*
$\varepsilon_{i,t}$ *= error term for portfolio i at time t*

The intercept of CAPM, represented by the alpha, displays the risk-adjusted abnormal return of the portfolio. A positive value declares that the portfolio has performed better than the market, while a negative value indicates that the portfolio has performed worse than the market. Hence, with a positive value the portfolio earns a positive risk-adjusted abnormal return. The first variable, the beta, accounts for the market excess return. This means that the beta coefficient measures a sensitivity to market risk, indicating that when the value exceeds one, the investment entails more systematic risk than the market. At last, the error term captures the specific risk of an individual asset. This specific risk is idiosyncratic and can be diversified. The systematic risk, or market risk, is accounted for in the model.

3.4 Fama and French's Three-Factor Model

Another frequently used economic model is Fama and French's three-factor model (1993), which is provided in formula (2). It is a capital asset pricing model that expands CAPM by adding two additional factors beyond the market risk. The additional factors are size and value, which are included to adjust for an outperformance tendency that Fama and French found on the stock market. The size factor adjusts for the tendency that small-cap stock tend to outperform large-cap stocks, while the value factor adjusts for the tendency that value-stocks outperform growth stocks. In contrast to CAPM, this model would generate a lower performance considering portfolios including a large amount small-cap stocks or value stocks since the outperformance tendency is adjusted for (Fama & French, 1993).

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \varepsilon_{i,t} \quad (2)$$

i = the i:th portfolio
t = time t
$r_{i,t}$ = return on the portfolio i at time t
$r_{f,t}$ = risk-free rate at time t
$\alpha_{i,t}$ = alpha, the risk-adjusted abnormal return for portfolio i
$\beta_{1-3,i}$ = the betas of the regressors
$(r_{mkt,t} - r_{f,t})$ = the difference in expected return of the market minus the risk-free rate in time t, the risk premium
SMB_t = the difference in expected return with respect to the company size at time t
HML_t = the difference in expected return with respect to the market-to-book ratio at time t
$\varepsilon_{i,t}$ = error term for portfolio i at time t

The first variable Fama and French expand CAPM with is small minus big (SMB), which accounts for the findings that there exists a negative correlation between the return of a stock and the size of the firm (Fama & French, 1993). Hence, smaller firms are more sensitive to movements in the market than larger firms and therefore tend to generate higher returns. The SMB variable measures the difference in return that Fama and French (1993) found between small and large companies. A negative coefficient of this variable would indicate that the portfolio consists to a great extent of large companies, while a positive coefficient indicates that the portfolio is made up by more smaller companies.

The high minus low (HML) variable accounts for the additional finding of Fama and French (1993), that there exists a positive correlation between the return of a company's stock and the book-to-market ratio of the company. This finding implies that a company with higher book-to-market ratio, a value stock, generates a higher return than a company with lower book-to-

market ratio, a growth stock. The HML variable measures the difference in return that Fama and French (1993) found between value and growth stocks. A negative coefficient of this variable indicates that the portfolio consists of growth stocks to a greater extent, while a positive coefficient of this variable indicates that the portfolio consists of value stocks to a greater extent.

3.5 Carhart's Four-Factor Model

Formula (3) presents the main model used in this thesis, which is Carhart's four-factor model. This model is an extension on CAPM and Fama and French's three-factor model with the additional factor momentum. Carhart (1997) presented a four-factor model adding Jegadeesh and Titman's (1993) one-year factor momentum, representing a return differential from investing long in past winners and short selling past losers. The four-factor model is consistent with a model of market equilibrium with four risk factors.

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, MOM_t + \varepsilon_{i,t} \qquad (3)$$

i = the i:th portfolio
t = time t
$r_{i,t}$ *= return on the portfolio i at time t*
$r_{f,t}$ *= risk-free rate at time t*
$\alpha_{i,t}$ *= four-factor alpha, the risk-adjusted abnormal return for portfolio i*
$\beta_{1-4,i}$ *= the betas of the regressors*
$(r_{mkt,t} - r_{f,t})$ *= the difference in expected return of the market minus the risk-free rate in time t, the risk premium*
SMB_t *= the difference in expected return with respect to the company size at time t*
HML_t *= the difference in expected return with respect to the market-to-book ratio at time t*
MOM_t *= the difference in expected return with respect to momentum at time t*
$\varepsilon_{i,t}$ *= error term for portfolio i at time t*

Jegadeesh and Titman's (1993) variable momentum (MOM) accounts for the findings that stocks which rose in value during the previous one-year period tend to continue rising in the following period. Consistently, stocks that have fallen in value in the previous one-year period have a tendency to continue to fall in the following period. The MOM variable measures the portfolio's exposure to this divergence. A negative coefficient of this variable indicates that the portfolio consists of past underperforming stocks to a greater extent, while a positive coefficient of this variable indicates that the portfolio consists of past winners to a greater extent.

3.6 Thomson Reuters ESG Score

The ESG score that will be used in this thesis is produced by Thomson Reuters (2017). Thomson Reuters is a credible database and the ESG score is a thorough and comprehensive measure, and therefore the usage of this measure is deemed to be a trustworthy alternative. The numerical metric is designed to, in a transparent and objective way, measure companies' relative ESG performance, commitment and effectiveness across ten main categories based on data reported by the companies. The ESG score is based on three factors which in total consists of ten underlying categories. Firstly, an environmental factor which focuses on resource use, emissions and innovation. Secondly, a social factor focusing on workforce, human rights, community and product responsibility. At last, a governance factor focusing on management, shareholder and Corporate Social Responsibility (CSR) strategy (Thomson Reuters, 2017).

Thomson Reuters has ESG analysts in different countries analyzing data reported by companies such as annual reports, CSR reports, news sources, stock exchange filings et cetera. These analyses generate company-level ESG measures to the calculations of the ESG score. The company-level ESG measures are then grouped into the ten categories mentioned above and a combination of the categories, weighted proportionately to the number of measures within each category, formulates the ESG score on a scale of 0-100 (Thomson Reuters, 2013). Detailed counts and weights are provided in the table below.

Table I. Thomson Reuters Category Weights

Pillar	Category	Indicators in Rating	Weights
Environmental	Resource Use	19	11%
	Emissions	22	12%
	Innovation	20	11%
Social	Workforce	29	16%
	Human Rights	8	4.50%
	Community	14	8%
	Product Responsibility	12	7%
Governance	Management	34	19%
	Shareholders	12	7%
	CSR Strategy	8	4.50%
TOTAL		178	100%

Source: Thomson Reuters

4. Data

The following part of the thesis provides a description of how the data is gathered by using different databases. Furthermore, this section contains relevant information about the data and explains how the data is processed. A brief description of the construction of the factors gathered from Kenneth R. French database is also included.

4.1 Yahoo Finance

This thesis uses daily stock prices gathered from Yahoo Finance for the period 2013-01-01 to 2017-12-31. The prices from Yahoo Finance are adjusted prices, which are the closing prices after adjustments for all applicable splits and dividend distributions. The daily return for each company is calculated based on the following formula:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (4)$$

The companies analyzed in this thesis are chosen based on the construction of OMXS30 at date 2018-03-27. All 30 companies included in OMXS30 are not analyzed. No ESG score was published for Essity AB and therefore only 29 companies are used in the analysis. When processing the data, it could be seen that for a number of trading days some companies had no reported stock price at Yahoo Finance. To account for this, the average stock price for the five-year period for each company will be used as the stock price for those days of trading.

4.2 Thomson Reuters ESG Score

The individual ESG score for each of the 29 companies is collected from the Thomson Reuters Eikon database. The ESG score is not continuously updated for all companies over the research period and therefore the score gathered for each company is assumed to be constant over the research period, and the scores used are the last published ones. Companies work with environmental and social aspects in the long term and major annual changes are rare (Folksam, 2013). For further understanding of how the ESG score is defined and the process that Thomson Reuters uses to specify a score for a specific company, see the theoretical framework.

4.3 Kenneth R. French Database

The market excess return, the SMB variable, the HML variable and the MOM variable included in Carhart's four-factor model are collected from the Kenneth R. French database for the US

market. The factors have daily frequency and the database provides downloadable files consisting of the daily values of the factors. Kenneth R. French database is based on the US stock market and the data gathered from Yahoo Finance is based on the Swedish stock market. Consequently, the trading days differ between the markets and therefore we have decided to exclude 34 dates for the five-year period from the data collected from Kenneth R. French database. Consistently, 31 dates for the five-year period are excluded from the data gathered from Yahoo Finance.

The database provides a brief description of the construction of the factors, which can be seen in formulas (5) to (7). The factor SMB (small minus big) is calculated as the average return of the three small portfolios minus the average return of the three big portfolios.

$$\text{SMB} = \frac{1}{3}(\text{Small Value} + \text{Small Neutral} + \text{Small Growth}) - \frac{1}{3}(\text{Big Value} + \text{Big Neutral} + \text{Big Growth}) \quad (5)$$

The factor HML (high minus low) is calculated as the average return of the two value portfolios minus the average return of the two growth portfolios.

$$\text{HML} = \frac{1}{2}(\text{Small Value} + \text{Big Value}) - \frac{1}{2}(\text{Small Growth} + \text{Big Growth}) \quad (6)$$

The factor MOM (momentum factor) is calculated as the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios.

$$\text{MOM} = \frac{1}{2}(\text{Small High} + \text{Big High}) - \frac{1}{2}(\text{Small Low} + \text{Big Low}) \quad (7)$$

French uses the US one-month Treasury bill as the proxy for the risk-free rate. The market return is calculated as a value-weighted return of all Center for Research in Security Prices (CRSP) firms incorporated in US and listed at NYSE, AMEX or NASDAQ that have a CRSP code of ten or eleven at the beginning of month *t*, good shares and price data at beginning of *t* and good return data for *t*. For further understanding of the construction of the factors, visit Kenneth R. French database.

5. Methodology

This section moves on to describe the methodology used to test the two hypotheses in this study. First, the approach to test the first hypothesis is examined, followed by the methodology used in order to test the second hypothesis. The chapter ends with statistical properties and tests of robustness.

5.1 Econometric Analysis

In order to investigate whether there is a relationship between the ESG score and stock return for companies included in OMXS30, a panel study is conducted. The usage of panel data is justified as it accounts for the constant factor Score. The panel data is divided into 29 different panels, which represent the 29 companies included in OMXS30 with individual ESG scores gathered from Thomson Reuters database. The period for each panel is from 2013-01-01 until 2017-12-31. Daily returns are calculated for the companies included in OMXS30 with prices from Yahoo Finance adjusted for dividends and splits. By running panel regressions on the panel data using Carhart's model (1997) with the ESG score added, see formula (8), we can statistically test whether there is a relationship between the ESG score and stock return. For more information about Carhart's model, see the theoretical review. To adopt panel regressions while examining environmental, social and governance factors on firm performance is not something innovative. For example, this was done by Atan et al. (2018).

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\,SMB_t + \beta_{3,i}\,HML_t + \beta_{4,i}\,MOM_t + \beta_{5,i}\,Score + \varepsilon_{i,t} \quad (8)$$

To answer the second hypothesis, this thesis employs a quantitative research method using a time series methodology for statistical testing. The result is used to determine whether the risk-adjusted alphas between two created portfolios categorized by the level of the ESG score, differ from each other. Therefore, two portfolios are constructed in order to conduct a comparison in terms of risk-adjusted abnormal return. The top portfolio consists of the ten companies in OMXS30 with the highest ESG scores and the bottom portfolio consists of the ten companies in OMXS30 with the lowest ESG scores. In addition, a difference portfolio is created in order to statistically determine any difference between the top and bottom portfolio. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return. To construct portfolios by ratings in order to examine this kind of relationship is an established methodology used by, for example, Derwall et al. (2005). For more information

about the ESG score, see the theory section. The portfolios are equally weighted and are constructed as follows:

Table II: Portfolio Construction

Top Portfolio		**Bottom Portfolio**	
Company	**ESG Score**	**Company**	**ESG Score**
ABB Ltd	87.67	Tele2 B	65.94
AstraZeneca	86.85	Skanska B	65.91
Ericsson B	86.57	SCA B	64.84
Nordea Bank	84.82	Swedish Match	64.59
Swedbank A	83.11	SSAB A	63.95
Electrolux B	81.73	Autoliv SDB	54.89
Hennes & Mauritz B	80.29	Investor B	48.19
Boliden	80.25	Securitas B	41.62
Telia Company	79.55	Kinnevik B	34.23
SKF B	78.47	Fingerprint Cards B	32.24

In order to evaluate the two portfolios' risk-adjusted alphas and the difference between those, we run OLS regressions by using Carhart's four-factor model (9). Daily returns for the portfolios are calculated by equally weighting the included individual stocks' daily returns, for a five-year period using prices from Yahoo Finance adjusted for dividends and splits. In this model, alpha represents the constant on the regression equation's right side while the portfolio's actual return minus the risk-free rate represents the equation's left side. Abnormal returns are demonstrated with the alpha and if alpha is positive ($\alpha > 0$), the portfolio has generated an abnormal return.

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\,SMB_t + \beta_{3,i}\,HML_t + \beta_{4,i}\,MOM_t + \varepsilon_{i,t} \qquad (9)$$

The market excess return and the factor-portfolios in formulas (8) and (9) are collected from the Kenneth R. French database. All econometrical analysis in this thesis is conducted in Stata.

5.2 Statistical Properties and Robustness Tests

Since the sample in this thesis partly consists of time series data there are a number of properties that must be checked. First, the sample is assumed to be normally distributed in order to apply OLS. In large samples normality is assumed given the central limit theorem. Kwak and Kim

(2017) states that according to the central limit theorem, a sample size larger than 30 is considered to be normally distributed.

Second, tests for seasonality are conducted for the top, bottom and difference portfolio. Seasonality is present if the variables display a periodic pattern over the sample period, making the data seasonally biased (Woolridge, 2014). In order to test for seasonality in our sample, we include monthly dummy variables in our regressions made in Stata. We check for joint significance of the coefficients of the dummy variables in the regression output to find out if seasonality is present in the sample. These results can be seen in Appendix, Table I. Third, we check for multicollinearity. Table II in Appendix represents a correlation matrix for the independent variables. Multicollinearity exists if any correlation between the independent variables is more than 0.9.

Finally, Breusch-Pagan and White tests are conducted in order to check for heteroscedasticity in the error term. Heteroskedasticity in the error term exists when independent regressors are informative about the variance in the error term, meaning that the variance of the residuals is not constant (Stock, 2015). If heteroscedasticity is present in the data set, robust standard errors will be used while testing the hypothesis in order to correct for heteroscedasticity. Table III in Appendix shows the results for these tests.

In order to test robustness of the empirical results of this thesis, different econometric model specifications are used as well as different periods. The econometric models that will be used other than Carhart's four-factor model, are CAPM and Fama and French's three-factor model. Further, the five-year period examined is extended into a seven and a ten-year period to test whether the findings are consistent over time.

6. Empirical Results

In part six our results from the two hypotheses are presented. The chapter starts with a summarized statistic table for the data used in the tests, which is followed by the results for the first and the second hypothesis. At last, the robustness of the results is evaluated and tested.

6.1. Descriptive Statistics

Table III. Descriptive Statistics

Variables	Mean	St. Dev	Min	Max	No. Obs
Top Portfolio	0.0005039	0.0107336	-0.0767485	0.0402988	1,224
Bottom Portfolio	0.0009928	0.0117427	-0.0808936	0.0597359	1,224
Difference Portfolio	-0.0004889	0.0082109	-0.0361369	0.540176	1,224
Risk premium	0.0637306	0.7663608	-3.9	3.68	1,225
SMB	-0.000751	0.493293	-1.65	2.5	1,225
HML	0.0020327	0.471382	-1.68	2.37	1,225
MOM	0.0077796	0.7018274	-3.13	3.65	1,225
Score	69.54129	14.70476	32.24	87.67	35,524

Note to Table III: St. Dev is the standard deviation and No. Obs is the number of observations. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return.

Table III provides descriptive statistics for the data used. This summary of statistics represents the whole sample period from January 2013 until January 2018. Interestingly, the daily average return for the top portfolio is lower than the daily average return for the bottom portfolio. The same information is also provided by the difference portfolio. The standard deviation of the bottom portfolio is higher than the standard deviation of the top portfolio, suggesting that the bottom portfolio inherits more risk than the top portfolio. This result is in line with risk-to-reward theories (Sharpe, 1966) as the bottom portfolio's average return is higher contrasting to the top portfolio.

Table III also displays Carhart's variables SMB, HML and MOM. The descriptive statistics show that the SMB portfolio is on average negative. The HML portfolio on the other hand is on average positive for the same period. The momentum portfolio, MOM, also provides a positive result on average. At last, the descriptive statistics provide information about the factor score, which is included in the main model in order to test the first hypothesis regarding the relationship between the ESG score and firm performance. A remark regarding the sample data is that Table III in Appendix displays that heteroscedasticity is present in some of the portfolios. Hence, robust standard errors are used in all regressions to correct for this.

6.2. Hypothesis I

Table IV. Carhart's Model Including the Factor Score

Variable	Coefficient	p-value
Four-factor alpha	0.0016555*	0.078
Risk premium	0.0071566***	0.000
SMB	-0.0005046	0.428
HML	0.0005193	0.454
MOM	-0.0013626***	0.003
Score	-0.000026**	0.011

Note to Table IV: This table reports the coefficients on the four factors, the coefficient on the factor score, the alpha and the related p-values. The regression is made using panel data on the following model:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, MOM_t + \beta_{5,i}\, Score + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

The movement between Thomson Reuters ESG score and stock return of companies included in OMXS30 is investigated in order to answer whether there is a relationship between the ESG score and stock return. Table IV provides results from running a panel regression on the panel data, using Carhart's model including the regressor score. We can observe that the beta coefficient of score is -0.000026, indicating that the ESG score affect the return negatively. This regression result displays that companies with higher ESG score have lower risk-adjusted return. Furthermore, the risk-adjusted alpha is positive and statistically significant at a ten percent level, which indicates that there exists an aggregated abnormal return.

The results for the other variables included in Carhart's four-factor model are also displayed in Table IV. The beta of the factor risk premium is less than one and significant at a one percent level, implying that the investment entails a lower risk than the market. For the second variable, SMB, the coefficient is negative, indicating that the sample consists of large capitalization stocks to a greater extent. However, this cannot be supported statistically due to the high p-value. The third variable, HML, has a positive and insignificant beta. Hence, there is not enough evidence to support that the sample consists of value stocks to a larger extent. The coefficient of the momentum factor is negative and significant at a one percent basis and implies that the sample consists of past years underperforming stocks.

To summarize, Table IV presents that the null hypothesis regarding the relationship between the ESG score and stock return can be rejected since the beta coefficient of the factor ESG

score is significant at a five percent level. Hence, there is enough evidence to support the alternative hypothesis predicting that a relationship between the ESG score and firm performance exists.

6.3. Hypothesis II

Table V. Carhart's Model

Variable	Top Portfolio	Bottom Portfolio	Difference Portfolio
Four-factor alpha	-0.0007702***	-0.0002722	-0.0004979**
	(0.004)	(0.371)	(0.034)
Risk premium	0.0074677***	0.0071659***	0.0003026
	(0.000)	(0.000)	(0.345)
SMB	-0.0013805**	-0.0007578	-0.0006228
	(0.045)	(0.380)	(0.289)
HML	0.0007915	0.0012505	-0.0004587
	(0.222)	(0.094)	(0.412)
MOM	-0.0007702***	-0.003042	-0.0012114***
	(0.003)	(0.610)	(0.002)

Note to Table V: This table reports the estimates for the four factors and the alpha. P-values are reported in the parenthesis. Robust standard errors are used to correct for heteroscedasticity. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return. The OLS regressions are made using the following model:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, MOM_t + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

Table V includes the risk-adjusted abnormal return for the top, bottom and difference portfolio followed by a corresponding significance test, in order to draw conclusions regarding the abnormal returns for two created portfolios categorized by the level of the ESG score. Table V provides results from running an OLS regression on the data set by using Carhart's four-factor model. It can be seen that the top portfolio has a risk-adjusted alpha equal to -0.0007702, indicating that the top portfolio does not have an abnormal return and rather underperforms relative to the market on a daily basis. Moreover, the significance level of the four-factor alpha is statistically supported at a one percent level. Focusing on the risk-adjusted abnormal return for the bottom portfolio, Table V displays that the risk-adjusted alpha is equal to -0.0002722, suggesting that the bottom portfolio underperforms relative to the market as well. However, this statement cannot be statistically supported due to the high p-value, resulting in no rejection of the null hypothesis. Hence, no statistically significant result for underperformance of the bottom portfolio relative to the market can be shown.

Further examining the deviation in risk-adjusted alphas between the top and bottom portfolio, Table V provides the difference in risk-adjusted alphas and corresponding significance test in order to draw conclusions regarding the relative performance between the two portfolios. The result displays that the four-factor alpha is equal to -0.0004979. Since the difference portfolio is the return of the bottom portfolio subtracted from the return of the top portfolio, the negative sign implies that the bottom portfolio's four-factor alpha is less negative than for the top portfolio. The statement is supported statistically as the regression result shows that the difference is significant at a five percent level.

Moving on to the results of the other variables included in Carhart's four-factor model, the first variable is the risk premium that measures the sensitivity to market risk. The beta of the risk premium for the top portfolio is 0.0074677 and 0.0071659 for the bottom portfolio, where both are statistically significant at a one percent level. These betas are less than one, which indicate that these investments entail lower risks than the market. The second variable SMB has a negative coefficient of the two portfolios, as shown in Table V. The negative sign indicates that the portfolios consists of large capitalization stocks to a greater extent. The beta of the SMB factor is statistically significant for the top portfolio at a five percent level, while for the bottom portfolio this cannot be supported statistically.

The third variable in Carhart's four-factor model, the HML factor, has a positive coefficient for both the top and bottom portfolio. A positive value displays that the portfolios to a larger extent consist of value stocks, in other words companies with higher book-to-market ratio. For the top portfolio, this is not statistically significant whereas for the bottom portfolio it is significant at a ten percent significance level. The last variable, the momentum factor, shows if the portfolio consists of past years winners or losers. The negative sign of the beta for both the top and bottom portfolio indicates that the portfolios consist of past years underperforming stocks. This is only supported statistically for the top portfolio whereas the negative MOM factor for the bottom portfolio is not statistically significant.

To summarize, Table V presents that the null hypothesis regarding the difference in risk-adjusted alphas between two created portfolios categorized by the level of the ESG score can be rejected since the difference is significant at five percent significance level. Hence, there is enough evidence to support the alternative hypothesis that there is a difference in risk-adjusted alphas between two created portfolios categorized by the level of the ESG score.

6.4. Robustness tests

The first part of this section provides a robust check of this thesis' results by expanding the five-year period used in the original regressions. The hypotheses are tested again but with a period of seven (2011-01-01 to 2017-12-31) and ten (2008-01-01 to 2017-12-31) years, respectively.

Table VI. Carhart's Model Including the Factor Score

Variable	7 Year	10 Year
Score	0.0003304	0.0001314
	(0.275)	(0.545)

Note to Table VI: This table reports the coefficient on the factor score during a seven and ten-year period. The p-value is given in the parentheses. The regressions are made using panel data on the following model:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, MOM_t + \beta_{5,i}\, Score + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

Table VI provides the results obtained when the first hypothesis is tested with the expanded periods. When the period is widened to seven years, Table VI provides the information that the beta coefficient of the regressor score is no longer negative as in the findings in the original regressions. Instead the regressor score has a positive value close to zero, indicating that the ESG score affects the return of a company in a weak positive way. However, this statement cannot be supported statistically since the beta coefficient of the regressor score is insignificant even at a ten percent significance level. Table VI also displays that when the period for the first hypothesis is expanded to ten years, the coefficient of the regressor score is a positive value close to zero. However, this is not supported statistically either.

Table VII. Carhart's Model

	7 Year Period			10 Year Period		
Variable	Top Portfolio	Bottom Portfolio	Difference Portfolio	Top Portfolio	Bottom Portfolio	Difference Portfolio
Four-factor alpha	-0.0006116** (0.014)	-0.0001195 (0.673)	-0.0004921** (0.032)	-0.0009251*** (0.000)	-0.0002209 (0.537)	-0.0007034** (0.023)

Note to Table VII: This table reports the four-factor alpha for the portfolios during a seven and a ten-year period. P-values are presented in the parentheses. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return. The OLS regressions are made using the following model:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, MOM_t + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

Moving on to the second hypothesis, Table VII shows the risk-adjusted alphas for the portfolios during the two extended periods examined in this section of robustness. Focusing on the seven-year period, it can be seen that the risk-adjusted alphas for the portfolios are in line with the findings when using the five-year period. For the ten-year period, the findings are seen to be in line with the results presented in the original regression as well. This means that the risk-adjusted alphas for the portfolios are still small negative values and close to zero.

The second part of the robustness section is the usage of different regression models. This part is conducted in order to control the strength of the main model's reliability while some of its variables are excluded. The other models that are used to test the hypotheses are CAPM and Fama and French's three-factor model, replacing Carhart's four-factor model. The original period of five years is used.

Table VIII. CAPM and Fama and French's Model Including the Factor Score

Variable	CAPM	Fama and French
Score	-0.000026** (0.042)	-0.000026** (0.042)

Note to Table VIII: This table reports the coefficient on the factor score for two different models. P-values are presented in the parentheses. The regressions are made using panel data on the following models:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, Score + \varepsilon_{i,t}$$
$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \beta_{4,i}\, Score + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

Initially, the first hypothesis is examined. When replacing Carhart's four-factor model with CAPM and thereby excluding three variables, Table VIII shows that the coefficient of the

regressor score is still negative and close to zero. The table also reports a small negative value of the coefficient of the regressor score, when testing the first hypothesis with Fama and French's three-factor model and only one variable is excluded. In fact, when using both CAPM and Fama and French's three-factor model, the value of the coefficient of the regressor score is exactly the same as in the original regression model.

Table IX. CAPM and Fama and French's Model

	CAPM			**Fama and French**		
Variable	Top Portfolio	Bottom Portfolio	Difference Portfolio	Top Portfolio	Bottom Portfolio	Difference Portfolio
Four-factor alpha	-0.0007665*** (0.000)	-0.0002648 (0.383)	-0.0005017** (0.033)	-0.0007805*** (0.003)	-0.0002743 (0.365)	-0.0005064** (0.032)

Note to Table IXI: This table reports the four-factor alpha for the portfolios using two different models. P-values are reported in the parentheses. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return. The OLS regressions are made using the following models:

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \varepsilon_{i,t}$$
$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{1,i}(r_{mkt,t} - r_{f,t}) + \beta_{2,i}\, SMB_t + \beta_{3,i}\, HML_t + \varepsilon_{i,t}$$

** Significant at a 10 % level*
*** Significant at a 5 % level*
**** Significant at a 1 % level*

Looking at the second hypothesis, Table IX displays the risk-adjusted alphas for the portfolios using CAPM and Fama and French's Model. The results in this table do not provide any substantial findings that would indicate large deviation from the findings when using Carhart's four-factor model. The bottom portfolios underperformance can still not be supported statistically with any of the models, whereas it can still be done for the top portfolio using both of the models. The risk-adjusted return of the difference portfolio is still negative and significant.

7. Discussion

In this section we critically discuss the data collection and methodology before we analyze and discuss the empirical findings for the two hypotheses presented, including the robustness tests. The aim is to discuss and compare the results by using previous empirical studies presented in the literature section, together with the underlying theories from the theoretical framework.

7.1 Critical Discussion

The results of this study rely on rather strong assumptions for the data collection and methodology. To start with, due to the fact that some companies had no reported stock price for a number of trading days at Yahoo Finance, the average stock price for the five-year period for each company was used as the stock price for those days of trading. However, this is only one of several standardized methods to handle missing values, the choice is arbitrary since no theories specify a standard. Furthermore, the Kenneth R. French database is based on the US stock market, while gathered stock returns are based on OMXS30, the Swedish stock market. This study makes no attempt to determine the consequences of using data from the US market together with data from the Swedish market. Another important aspect to consider is the approach used to construct the portfolios as its impact is reflected directly in the outcome. Our portfolios consist of equally weighted pools of ten companies. Hence, no individual analysis in the two portfolios was made and no score-based weighting for each company was implemented. Consequently, these assumptions affect the outcome and might lead to biased results.

7.2 Hypothesis I and II

In this study, the findings of the first hypothesis concluded that there is a relationship between the ESG score and firm performance for companies included in the OMXS30. The displayed relationship implies that the higher a company's ESG score is, the lower performance would be expected for that specific company. This statement is statistically supported and contradicts Yamashita, Sen and Roberts (1999) study, which found statistically significant tendency that companies with lower EC-scores had worse return in the long term. However, even though our result presented a negative sign for the ESG score, the value is small and close to zero. According to this data, we can infer that the relationship between the ESG score and firm performance is nearly non-existing. In accordance with the finding, previous studies have demonstrated that more corporate environmental or social activities do not lead to an overall

better economic performance than in corporations in the same sector which are not engaged in such activities (Rennings, Schröder & Ziegler, 2003).

With respect to the second hypothesis, it was found that the risk-adjusted alphas are different between the two created portfolios categorized by the level of the ESG score. It is interesting to note that the bottom portfolio's four-factor alpha is less negative than for the top portfolio, which implies that the bottom portfolio performs better than the top portfolio. This statement is supported statistically as the difference portfolio indicates that the difference is significant at a five percent level. The difference in performance between the two portfolios is aligned with the study of Climent and Soriano (2011), who found that environmental funds had a lower performance compared to the conventional funds. Furthermore, the risk-adjusted alphas for the two portfolios turns out to be negative values, which indicate underperformance relative to the market. This underperformance may support the idea of Friedman (1970), who argued that implementation of environmental controls on corporations would entail substantial direct or indirect costs that may erode the competitiveness of a firm and undermine its resources. On the other hand, these negative values are so small that they can almost be interpreted as zero, which would indicate that there is no difference between the top and bottom portfolios. As for the first hypothesis, this discussion is in agreement with those obtained by Rennings, Schröder and Ziegler (2011).

7.3 General Discussion

A comparison of the two hypotheses reveals that the underperformance reported in the second hypothesis is not consistent with the findings of the first hypothesis where a statistically significant abnormal return exists. This inconsistency may depend on the usage of different approaches when examined the two hypotheses. The first hypothesis was tested with a panel regression, while the second hypothesis was tested with an OLS regression. Moreover, the factor score was included in the regression for the first hypothesis as opposed to the regression for the second hypothesis where the factor score was excluded.

The results presented in this thesis are robust when applied to different periods and different asset pricing models. The only divergent finding noticed from the robustness tests was the altered sign for the factor score when the period was expanded for the first hypothesis. However, the coefficient of the regressor score is not statistically significant in the expanded periods and do therefore not provide any contradictory information. These non-significant

relationships between a firm's ESG factors relative to firm performance are in line with the findings of Atan et al. (2018), who suggest that there is no significant relationship between ESG factors and firm performance at the Malaysian market. For the other robustness tests, the findings provided are consistent with the results presented in the original regressions.

The findings for our two hypotheses differ from several previous studies, such as the findings from the US stock market provided by Cohen, Fenn and Konar (1997). They explained that a portfolio with low pollution performed as well or better than a portfolio with high pollution. Another research with similar conclusion is the study made by Derwall et al. (2005), who found empirical evidence that companies with higher eco-efficient ratings tend to perform better than companies with lower eco-efficient ratings. A possible explanation for the deviation in results might be that the studies mentioned above focus on the US stock market, while we have investigated the Swedish stock market. The difference in results on the Swedish stock market compared to the US stock market should perhaps not be seen as surprising since two different countries are compared. For example, Sweden is a leader regarding climate policy, leading to no wide nor direct exposure to climate related risk (Finansinspektionen, 2016). It seems possible that this fact could implicate that ESG factors are already well incorporated in the Swedish society, which might lead to the outcome of nearly no difference between the top and bottom portfolios when considering the relationship between ESG factors and stock returns. However, one must keep in mind that the companies included in OMXS30 are large companies with international presence and are not only operating on the Swedish market. The discussion whether these companies are Swedish or international companies lies outside the research questions of this thesis and is not investigated any further.

Lastly, due to the small negative values for the ESG score and the risk-adjusted alphas, the empirical results of this thesis indicate nearly no-effect scenarios. The no-effect scenario indicates that there is no difference in returns between high-ESG firms relative to low-ESG firms, which is consistent with the efficient market hypothesis when the ESG performance provides no information relevant for pricing (Manescu, 2011). Furthermore, Statman and Glushkov (2009) describe a no-effect scenario, which implies that social responsibility features of companies have no effect on the return. The no-effect scenarios that our results nearly present can be connected to the efficient market hypothesis (Fama, 1970), which implies that investors on the stock market cannot outperform the market because all available information is already incorporated in the stock prices.

8. Conclusions

This study contributes to a relatively unexplored field of research by focusing on ESG factors on the Swedish stock market since earlier similar studies have predominantly not focused on this market. By doing so, we contribute to a broader perspective on how these factors are incorporated in different financial markets around the world.

Regarding the first hypothesis, the findings from this thesis suggest that the null hypothesis that there is no relationship between the ESG score and firm performance can be rejected since the factor ESG score is significant. Hence, there is enough evidence to conclude that there is a relationship between the ESG score and firm performance. Regarding the second hypothesis, a significant result is found and the null hypothesis that the risk-adjusted alphas are not different between the two created portfolios categorized by the level of the ESG score can be rejected. This rejection implies that the risk-adjusted alphas are different between the two portfolios. However, these findings are small negative values nearly equal to zero and can be interpreted as no-effect scenarios with the efficient market hypothesis as a possible explanation. These no-effect scenarios support the idea that ESG factors are well incorporated in Swedish society.

Taken together, the relationship between the ESG score and firm performance of companies on the Swedish stock market and the difference in risk-adjusted alphas between the two created portfolios categorized by the level of the ESG score seem to be nearly no-effect scenarios. Therefore, investors on the Swedish stock market are neither rewarded nor penalized when taking environmental, social and governance factors into consideration in their investment decision analysis. Hence, investors on the Swedish stock market could, when determining a desirable level of return, choose whether to include ESG factors without a substantial difference in return.

We believe that our results are interesting and could contribute to interest for further research on the Swedish stock market. Analyzing ESG concepts relative to investment returns is known as a complex area of research, often due to the lack of models capturing the potential effect from ESG factors. Therefore, interesting further research would be to focus on the methodology and the development of new asset pricing models that could capture the ESG factors in a more comprehensive way, as opposed to the exclusion in the typical asset pricing models in the literature.

References

Atan, R., Alam M.M., Said, J. & Zamri, M., 2018. The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality: An International Journal*, 29(2), pp.182–194. https://doi.org/10.1108/MEQ-03-2017-0033.

Berk, J. & DeMarzo, P., 2014. *Corporate finance*. 3rd ed. England: Pearson Education.

Carhart, M.M., 1997. On Persistence in Mutual Fund Performance. *Journal of Finance*, 52(1), pp.57–82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x.

Climent, F. & Soriano, P., 2011. Green and Good? The Investment Performance of US Environmental Mutual Funds. *Journal of Business Ethics*, 103(2), pp.275–287. https://doi.org/10.1007/s10551-011-0865-2.

Cohen, M.A., Fenn, S.A. & Konar, S., 1997. Environmental and financial performance: Are they related? *Working paper*, Vanderbilt University.

Derwall, J., Guenster, N., Bauer, R. & Koedijk, K., 2005. The eco-efficiency premium puzzle. *Financial Analysts Journal*, 61(2), pp.51–63.

Escrig-Olmedo, E., Munoz-Torres, M.J., & Fernandez-Izquierdo, M.A., 2010. Socially responsible investing: sustainability indices, ESG rating and information provider agencies. *International Journal of Sustainable Economy*, 2(4), pp.442–461.

Fama, E.F., 1970. Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance*, 25(2), pp.383-417. https://doi.org/10.1111/j.1540-6261.1970.tb00518.x.

Fama, E. & French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), pp.3–56. https://doi.org/10.1016/0304-405X(93)90023-5.

Finansinspektionen, 2016. *How can the financial sector contribute to sustainable development.* [Report]. Available at: https://www.fi.se/contentassets/123efb8f00f34f4cab1b0b1e17cb0bf4/finansiella_foretags_hallbarhetsarbete_eng.pdf [Last visited 07-04-2018]

Finansinspektionen, 2016. *Sustainability work of financial firms.* [Report]. Available at: https://www.fi.se/contentassets/123efb8f00f34f4cab1b0b1e17cb0bf4/finansiella_foretags_hallbarhetsarbete_engny.pdf [Last visited 07-04-2018]

Folksam, 2013. *Index för ansvarsfullt företagande 2013.* [Report]. Available at: https://www.folksam.se/media/index-2013-11-15_tcm5-19597.pdf [Last visited 04-05-2018]

Friedman, M., 1970. The social responsibility of business is to increase its profits. *New York Times Magazine*, 13 September, pp. 225–230. https://doi.org/10.1007/978-3-540-70818-6_14.

Jegadeesh, N. & Titman, S., 1993. Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. *Journal of Finance*, 48(1), pp.65–91.

Jeucken, M., 2001. *Sustainable Finance and Banking: The Financial Sector and the Future of the planet.* 1st ed. London: Earthscan Publications Ltd.

Kwak, S.G. & Kim, J.H., 2017. Central limit theorem: the cornerstone of modern statistics. *Korean Journal of Anesthesiology*, 70(2), pp.144–156. https://doi.org/10.4097/kjae.2017.70.2.144.

Lintner, J., 1965. The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 47(1), pp.13–37. https://doi.org/10.2307/1924119.

Manescu, C., 2011. Stock Returns in Relation to Environmental, Social and Governance Performance: Mispricing or Compensation for Risk? *Sustainable Development*, 19(2), pp.95–118. https://doi-org.ezproxy.ub.gu.se/10.1002/sd.510.

Markowitz, H., 1952. Portfolio Selection. *The Journal of Finance*, 7(1), pp.77–91.

Morgan Stanley, 2015. *Sustainable Investing Enters the Mainstream.* [Online]. Available at: https://www.morganstanley.com/ideas/sustainable-investing-enters-mainstream [Last visited 26-04-2018]

Mossin, J., 1966. Equilibrium in a capital asset market. *Econometrica: Journal of the Econometric Society*, 34(4), pp.768–783. https://doi.org/10.2307/1910098.

Rennings, K., Schröder, M. & Ziegler, A., 2003. The economic performance of European stock corporations: Does sustainability matter? *Greener Management International*, (44), pp.33–43.

Sharpe, W.F., 1964. Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk. *Journal of Finance*, 19(3), pp.425–442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x.

Sharpe, W.F., 1966. Mutual Fund Performance. *Journal of Business*, 39(1), pp.119–138. https://doi.org/10.1086/294846.

Sjöström, E., 2011. *The performance of socially responsible investment. A review of scholarly studies published in 2008-2010.* [Report]. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1948169 [Last visited: 07-04-2018]

Statman, M. & Glushkov, D., 2009. The wages of social responsibility. *Financial Analysts Journal*, 65(4), pp.33-46. https://doi.org/10.2469/faj.v65.n4.5.

Stock, J.H. & Watson, M.W., 2015. *Introduction to Econometrics*. 3rd rev. ed. England: Pearson Education.

Thomson Reuters, 2013. *Thomson Reuters Corporate Responsibility Ratings (TRCRR)*. [Report]. Available at: https://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/tr-com-financial/methodology/corporate-responsibility-ratings.pdf [Last visited 04-05-18]

Thomson Reuters, 2017. *Thomson Reuters ESG Scores.* [Report]. Available at: https://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/financial/esg-scores-methodology.pdf [Last visited 07-04-2018]

Thomson Reuters, 2018. *ESG Research Data.* [Online]. Available at: https://financial.thomsonreuters.com/en/products/data-analytics/company-data/esg-research-data.html [Last visited 03-06-2018]

Treynor, J.L., 1961. Market Value, Time, and Risk. https://dx.doi.org/10.2139/ssrn.2600356.

Treynor, J.L., 1961. Toward a Theory of Market Value of Risky Assets. https://dx.doi.org/10.2139/ssrn.628187.

Wooldridge, J.M., 2014. *Introduction to Econometrics.* EMEA ed. United Kingdom: Cengage Learning EMEA.

Yamashita, M., Sen, S., & Roberts, M.C., 1999. The rewards for environmental conscientiousness in the US capital markets. *Journal of Financial and Strategic Decisions*, 12(1), pp.73-82.

Databases:

Eikon, 2018. *Thomson Reuters Eikon*. [Online]. Available at: Subscription Service [Last visited 27-03-2018]

French, Kenneth R., 2018. *Kenneth R. French Data Library*. [Online]. Available at: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html [Last visited 27-03-2018]

Yahoo!, 2018. *Yahoo! Finance*. [Online]. Available at: https://finance.yahoo.com [Last visited 27-03-2018]

Appendix

Table I. Test for Seasonality

Variables	Top Portfolio	Bottom Portfolio	Difference Portfolio
Risk premium	0.5309	0.5082	0.7388

Note to Table I: The reported values are p-values. The null hypothesis states that no seasonality is present in the sample. The high p-values creates no possibility for rejection and hence no seasonality exists in our sample. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return.

Table II. Correlation Matrix

Variables	Risk Premium	SMB	HML	MOM
Risk premium	1.0000			
SMB	0.2333	1.0000		
HML	0.0054	-0.1360	1.0000	
MOM	-0.0002	-0.0618	-0.3584	1.0000

Note to Table II: The reported values are a measure on how the independent variables in the models used in this thesis correlates to each other. The no-multicollinearity assumption holds since no correlation between the independent variables is more than 0.9.

Table III. Test for Heteroscedasticity

Variables	Top Portfolio	Bottom Portfolio	Difference portfolio
Breusch-Pagan	0.0055	0.1452	0.3956
White	0.0000	0.0000	0.2352

Note to Table III: The reported values are p-values of the null hypothesis that the variance of the residuals is constant. Table III displays that heteroscedasticity is present in some of the portfolios and that the assumption of homoscedasticity is violated. In this thesis we use robust standard errors to correct for this. The difference portfolio is constructed by subtracting the bottom portfolio's return from the top portfolio's return.