Norwegian School of Economics
Bergen, Fall 2021

Norges Bank Investment Management in relation to ESG and Financial Performance

An empirical analysis on how companies part of the Norwegian Government Pension Fund Global perform on ESG relative to the rest of the market, and how ESG relates to financial performance, both at a company level and for the fund as a whole.

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Master thesis, Economics and Business Administration
Majors: Financial Economics & Business Analysis and Performance Management

NORWEGIAN SCHOOL OF ECONOMICS

Acknowledgements

This thesis was written as the final piece of our Master's degree in Economics and Business Administration at the Norwegian School of Economics, specializing in Financial Economics and Business Analysis and Performance Management.

In collaboration with the Office of the Supervisory Council in Norges Bank, we aimed to shed light on sustainable finance and responsible investment. Furthermore, we wanted to contribute to the existing literature on the matter and examine whether Norges Bank Investment Management's work on the subject appears in the ESG scores for the investee companies and how financial performance relates to ESG score both in terms of the companies included in the fund's portfolio and for the fund as a whole.

While writing this thesis, we have acquired valuable information on sustainable finance and responsible investments and how Norges Bank Investment Management manage the fund. The analysis has required knowledge of financial theory and econometric theory and as well as knowledge in R-Studio, Microsoft Excel, and LaTeX.

First and foremost, we would like to thank our Supervisor Stein Ivar Steinshamn for valuable guidance and the Office of the Supervisory Council for facilitation and giving us the opportunity, in a kind and helpful manner, so that we could investigate this field. The Corporate Governance Department in Norges Bank Investment Management has also contributed with insightful conversations. Finally, we would like to thank the Norwegian School of Economics for providing access to a rich database that has been highly important for our work.

Norwegian School of Economics

Bergen, December 2021

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Abstract

This thesis aims to analyze how the Norwegian Government Pension Fund Global, managed by Norges Bank Investment Management's (NBIM), performs on environmental, social, and governance (ESG), and what financial implications this has, both at a company level and for the fund as a whole. At a company level, we examine how the fund's ownership share relates to ESG score and the relationship between ESG and financial performance metrics regarding profitability, liquidity, and leverage. We use a fixed effects regression model shedding light on possible differences between the fund's investee companies and other companies and look at mean ESG scores and returns through descriptive analysis. The analysis further includes comparing the ESG scores and returns of three constructed portfolios: One with the fund's investee companies, one with non-investee companies, and one constituting the whole sample. Finally, we apply the methodologies of Fama-French three-factor, four-factor (Carhart), and five-factor, with and without momentum, including an additional ESG factor to examine how ESG relates to the fund's returns. Our findings indicate that companies part of Norway's Government Pension Fund Global perform stronger on ESG and worse in terms of return relative to non-investee companies, that the relationship between a company's financial metrics and the ESG score differs between these two company groups, and that more exposure to companies with high ESG historically has positively impacted the fund's financial performance.

Keywords – Sustainable Finance, Responsible Investment, ESG, Financial Performance, Norges Bank Investment Management, Fama-French

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List of Abbreviations

Abbreviation	Explanation
Adjusted R^2	Adjusted R Squared
BP	Breuch-Pagan
BLUE	Best Linear Unbiased Estimator
CAPM	Capital Asset Pricing Model
CD	Consumer discretionary
CFP	Corporate financial performance
CH	Carhart factor model
CMA	Conservative Minus Aggressive
COP26	2021 United Nations Climate Change Conference
CS	Consumer staples
CSR	Corporate Social Responsibilie
Debt2EQ	Debt-to-equity ratio
dNBIM	Dummy variable, equal to 1 if in NBIM portfolio
ESG score	Environment, Social, Governmental score
GMB	Good Minus Bad
H0	Null Hypothesis
HML	High Minus Low
I	Industrials
Mkt-RF	Market risk factor
MOM	Momentum
NA	Not Available
NBIM	Norges Bank Investment Management
OLS	Ordinary Least Squares
P-value	Probability value
PRI	Principles of Responsible Investment
R^2	R Squared
RMW	Robust Minus Weak
ROE	Return on Equity
SRI	Social responsible investments
SMB	Small Minus Big
VIF	Variance Inflation Factor
WML	Winners Minus Losers
YTD	Year to date
3FF	Fama-French three factor model
5FF	Fama-French five factor model
3FFM	Fama-French five factor model + Momentum

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1 Introduction

Norges Bank Investment Management (NBIM) manages the Norwegian Government Pension Fund Global, also known as the oil fund, which is the world's largest single-owner investor, owning approximately 1.4 % of all public listed companies globally. With this ownership lies a responsibility, with expectations from stakeholders from all angles, including the Ministry of Finance, regulators and multilateral agreements, the people of Norway, other investors, and the companies themselves.

One aspect of these expectations relates to reaching the Global Sustainable Development Goals (Desa, UN and others, 2016). Economist Lord Nicholas Stern states that "we need a new form of economic growth that breaks the destructive relationship between economic activity and the environment" (Stobierski, 2021). On the occasion of COP26, Stern (2021) explained how finance and investors have got a lot to do with climate change, especially capital flows from public sectors, as we need to invest to achieve the global goals. Fortunately, the world has seen a rise in demand for sustainable finance. According to Mansour (2021), data shows that global sustainable investments have sky-rocked after 2013, driven mainly by the pressure from millennials and impact investors who prefer investing in companies with intrinsic values driving positive change (Stobierski, 2021).

The most followed sustainable investment strategy globally is environmental, social and governance (hereafter ESG) integration, The Global Sustainable Investment Alliance (2021) state in their latest report. ESG integration is described as the systematic and explicit inclusion by investment managers of environmental, social and governance factors into financial analysis (The Global Sustainable Investment Alliance, 2021). The global increase in ESG integration and other sustainability strategies express investors' motivation for integrating ESG investment into their portfolios.

Over the past 20 years, NBIM's approach on how to exercise ownership rights as well as recognizing and handling the their responsibilities as a fund manager has evolved rapidly and has, in turn, made them a global leader on responsible investments (Norges Bank Investment Management, 2020c). A clearly stated purpose of the responsible investment work is to safeguard the interests of future generations. The work includes establishing principles, exercising ownership, and investing sustainably, where a visible part of their

work is to publish expectations documents, expressing the fund's values, expectations, and standards (Norges Bank Investment Management, 2020d).

However, these responsible actions must not exceed what the fund is meant to do, namely generating the highest possible long term return at moderate risk (Norges Bank Investment Management, n.d.-e). Morningstar (2020) expresses this question of a responsible profit-maximizing balance nicely: "one of the critical questions surrounding sustainable investing has long been whether investors must be willing to make a compromise on risk and return to invest in companies with strong ESG performance". Recent studies find that such compromise is not necessarily needed (Sargis & Wang, 2020; Stobierski, 2021). Moreover, they show that sustainable and financial performance tend to go hand in hand and that considering both aspects in investments could benefit all parties. Due to the continuing pressure in demand for sustainable finance and ESG integration, Bennani et al. (2018) and Maiti (2021), amongst others, argues that there is an increasing need for a model considering these aspects in the financial valuation of both companies and portfolios.

Our thesis aims to be an overall analysis of the Norwegian Government Pension Fund Global's sustainable performance and what implications this may have for the fund and its investee companies. We look at a twofold research question, seeking to answer: i) how companies in the Norwegian Government Pension Fund Global perform on ESG relative to the rest of the market and ii) how ESG relate to financial performance both at a company level and for the fund as a whole. As a measure for sustainable performance, we use ESG scores, focusing on the total ESG score. We first seek to identify a potential impact of NBIM's responsible investment management, by comparing the ESG score of companies in which the fund invest with other companies' score, and see how this score relates to the fund's ownership position through a regression model. Then, inspired by Crespi and Migliavacca (2020), we analyze how various financial metrics affect ESG performance in the fund's investee companies compared to other companies. Finally, building on existing literature of ESG as a risk factor, we investigate how the fund's exposure to companies scoring high on ESG affect its returns, and the efficiency of integrating an ESG factor in already existing factor models in addition to the traditional factors (Fama & Kenneth, 1993; Carhart, 1997; Fama & French, 2015).

The rest of our thesis is structured as follows: In chapter 2, we present what responsible

investment stands for and the principles for responsible investment. Then, we elaborate on how NBIM acts as a responsible investor and the purpose behind their responsible management. In the last parts of this chapter, we unfold the essence of sustainable finance before presenting our research question and existing literature. Chapter 3 presents the data used to conduct our analysis and explains how we retrieved the data, where from, and the variables included. Next, chapter 4 elaborates on the methodology of our analysis, with presentations of the different models applied and their rationale, assumptions and robustness. After that, in chapter 5, we present the results of our analysis, followed by a discussion of these in chapter 6. Finally, chapter 7 presents the conclusion that answers our research question.

2 Background

This chapter describes the essence of responsible investment and its principles, followed by a presentation of how NBIM acts as a responsible investment manager and its purpose of being responsible. Furthermore, the chapter elaborates on sustainable finance before we present our research question. Lastly, the chapter explores existing literature relevant to our thesis.

2.1 Responsible Management

2.1.1 What is Responsible Investment Management?

Responsible investment is described by the University of Cambridge (n.d.) as an approach to investment that emphasizes the relevance to the investor of ESG factors, as well as the long-term health and stability of the market as a whole. Furthermore, the purpose of responsible investment is to create long-term ESG value. Responsible investment can take many forms, and even though responsible investment group under the heading of 'ESG', other aspects can fall under the umbrella as well. Such aspects can be ethical investment, social responsible investment, sustainable investment, best-in-class investment, ESG integration, thematic investment, green investment, impact investment, and shareholder engagement. For the purpose of the analysis, we choose to only focus on certain aspects of the examples mentioned above. (University of Cambridge, n.d.)

ESG Integration

The concept of ESG integration is that ESG qualities of a company are incorporated at a more fundamental level when making investment decisions. Additionally, a more extensive analysis of the policies in a company is analyzed, such as a company's product strategy, business model. (University of Cambridge, n.d.)

Social Responsible Investments (SRI)

SRI includes an investment approach that applies social and environmental criteria when evaluating companies. The social criteria regard aspects like occupational health and

safety performance and discrimination concerning gender or race. The environmental criteria include quality of environmental management, emissions, where the raw materials are sourced from, waste, to name a few. (University of Cambridge, n.d.)

Sustainable Investment

Sustainable investments regard investments that either can be defined as sustainable or have the possibility to be become sustainable on a long-term perspective. Such investments can also be considered to solely be long-term environmental and social sustainable (University of Cambridge, n.d.). BlackRock, one of the world's largest investment management companies, describes sustainable investment as investments in process and about recognizing that companies that work to solve the world's problems are in a good position for growth. (BlackRock, n.d.)

Ethical Investment

The term ethical investments usually refer to divesting in companies that have certain aspects that the investor deems unethical (University of Cambridge, n.d.). Examples of this can be companies producing certain products such as alcohol or weapons or companies that violate human rights.

Green Investment

Green investment implicates an investment approach that seeks 'green' assets, like funds companies infrastructure, and so forth (University of Cambridge, n.d.). This term is broad, and the concept is closely linked to previously mentioned terms such as SRI and sustainable long-term investment (World Economic Forum, 2013, p. 12).

2.1.2 Principles for Responsible Investment

Principles of Responsible Investment (hereafter PRI) is the world's leading proponent of responsible investments, seeking to understand investment's implication on ESG factors (UN PRI, n.d.-a). Additionally, they support its network of investor signatories with incorporating ESG factors into decisions regrading both investments and ownership (UN PRI, n.d.-a). NBIM is one of the founding signatories to the PRI and thus supports the Six Principles of Responsible Investment (Ihenacho & Mohn, 2019). These principles were

developed for investors by investors and act as a guideline which includes possible ways to incorporate ESG issues into investment practice (UN PRI, n.d.-a).

Principle on ESG and Decision Making

Principle 1 states that the investor should incorporate ESG issues into investment analysis and decision-making processes (UN PRI, n.d.-a). For instance, addressing ESG issues in investment policy statements, and encouraging academic and other research are examples of actions aligning with this first principle. Additionally, developing ESG related tools, metrics, and analysis is included in the first principle. Furthermore, the first principle asks that investors assess external investment management's capability to incorporate ESG issues and ask investment service providers to integrate ESG factors into evolving research on this theme.

Ownership Policies and Practices

The second principle encourages investors to be active owners and incorporate ESG issues into ownership policies and practices. This includes that active ownership policies are consistent with the Principles. Exercising voting rights or monitoring compliance with voting policies is also essential as well as developing an engagement capability directly or indirectly through outsourcing. Additionally, the second principle includes participation in the development of policies, regulations, and standard settings and engaging with companies on ESG matters. (UN PRI, n.d.-c)

Appropriate Disclosure for ESG Issues

Principle 3 states that the signatories will seek appropriate disclosure on ESG issues, including asking for standard ESG issues to be both standardised in terms of reporting and integrated in annual financial reporting. Other expected aspects are, for example, the adaptation of norms, standards, or international initiatives such as the UN Global Compact. (UN PRI, n.d.-c)

Implementation of Principles

The fourth principle suggests the promotion of acceptance and implementation of the principles in the investment industry. This principle includes investment

mandates, monitoring procedures, performance indicators, and incentive structures aligned accordingly. Subserviently, ESG expectations are to be communicated with investment service providers and revise relationships if they fail to meet the ESG expectations. Furthermore, the development of tools for benchmark ESG integration should also be supported. (UN PRI, n.d.-c)

Effectiveness in Implementing the Principles

Principle 5 involves corporations to enhance effectiveness in implementing the principles. This can be done by participating in networks and information platforms to share tools, pool resources, and promote learning through investor reporting. As well as collectively addressing relevant emerging issues and promoting appropriate collaborative initiatives. (UN PRI, n.d.-c)

Reporting and Progress Towards Implementation

The final principle determines that principle implementations and activities must be reported. This includes disclosure on how ESG issues are integrated within investment practices and active ownership activities. Additionally, communications in terms of beneficiaries about ESG issues, reporting on progress and achievements, and determining the impact of the Principles are also a part of this sixth principle. (UN PRI, n.d.-c)

2.2 NBIM as a Responsible Investment Manager

NBIM manages Norway's Government Pension Fund Global (hereafter the fund), which is one of the largest funds in the world. The fund is almost invested in all listed companies globally, with an average ownership position of 1.4 percent. With such a substantial capital allocation worldwide comes both rights and responsibilities. (Norges Bank Investment Management, n.d.-f)

What NBIM's Responsible Investment Management Encompasses

According to NBIM, responsible investment includes several aspects that they take into consideration. Firstly, it is important to consider how sustainability issues impact the fund's investment performance and long-term value. Secondly, respecting human rights

established by international standards is also included in being a responsible investor. Thirdly, engaging in the development of regulatory frameworks and standards is important to promote healthy markets. As the fund manager, NBIM has the responsibility to ensure that company boards are accountable to shareholders and that its members represent that shareholder's interests. Additionally, NBIM strives to monitor, address and mitigate unwanted exposure to environmental and social risk across markets and sectors. Lastly, engaging with external stakeholders and seeking external advice to support its responsible investment management, for example, using advisory committees, is included in the responsible investment management. (Norges Bank Investment Management, 2020e)

2.2.1 The Purpose behind NBIM's Responsible Management

The purpose of NBIM's responsible investments is described as a mission to safeguard and build financial wealth for future generations. Additionally, NBIM emphasizes that the fund depends on long-term sustainable growth, well-functioning markets, and good corporate governance to obtain a long-term return. (Norges Bank Investment Management, n.d.-g)

2.2.2 Investing with a Mandate

Decisions regarding the fund's investments are based on research and the development in financial markets and the global economy (Norges Bank Investment Management, n.d.-d). The fund has a transparent governance model that structures and facilitates control and governance. The Ministry of Finance has the overall responsibility for the management of the fund and creating guidelines for its management (Norges Bank Investment Management, n.d.-a). NBIM's fund management is subject to the investment mandate, established by the Ministry of Finance on November 8th 2010 (Norges Bank Investment Management, n.d.-e).

The management objective is written in chapter 1, §1-1 in the Investment Mandate, stating that the "Bank shall seek to generate the highest possible return, net costs, measured in the currency basket of the investment portfolio, cf. Section 3-2, Section 1, within the applicable investment management framework" (Norwegian Ministry of Finance, n.d., §1-2). In other words, the fund's overall objective is to maximize return within the framework set by the mandate.

Chapter 4. Responsible Management

Throughout the years, expectations towards how the fund has been managed have evolved, and in later years it is expected of NBIM to be a responsible investor. Thus, responsible investment is expected to continue to be an integral part of NBIM's management of the fund (Norges Bank Investment Management, n.d.-e).

Establishing Principles

As the fund is globally diversified, it is in Norges Bank's and thus in NBIM's interest to align with both the UN Principles for Responsible Investment and UN Sustainable Development Goals (Norges Bank Investment Management, n.d.-c; UN PRI, 2018). NBIM aims to contribute to well-functioning markets and good corporate governance. The investment mandate's chapter 4 mainly refers to standards and principles developed by the UN Global Compact and OECD's principles (Norges Bank Investment Management, n.d.-e). Additionally, as mentioned earlier, NBIM supports the development of relevant standards and principles that preserve the fund's long-term investor interests. As better principles can improve company practices over time, NBIM considers this engagement to contribute to well-functioning markets and good corporate governance by creating a common set of sustainable standards across markets. (Norges Bank Investment Management, 2020e)

NBIM's priorities as a long-term investment manager are made clear through expectation documents, position papers, and voting guidelines. The expectation documents express NBIM's expectations towards the companies in which they are invested. These expectations largely coincide with the UN Sustainable Development Goals (Norges Bank Investment Management, n.d.-c).

Exercising Ownership

Active ownership is the use of rights and ownership position to influence the activities or behavior of investee companies. According to PRI, active ownership is one of the fastest-growing responsible investment strategies in listed equity globally. It is also recognized to be one of the most effective tools to reduce investor risk while maximizing returns and having a positive impact on society and the environment. (UN PRI, 2018)

Two of the most widely used instruments for listed equities that investors can use to influence companies are engagement and voting (UN PRI, n.d.-b). Having direct contact

with individual companies, such as attending company meetings, is an opportunity for investors to gain information and influence companies on important matters for the fund's long-term financial performance.

Moreover, NBIM believes that the future value of the fund depends on the value created by the companies in which they are invested. In line with PRI's Principle 2, NBIM has since 2005 covered a wide range of activities to exercise its ownership rights and hold company boards to account. NBIM uses both its hard and soft power, meaning they both use their legal right to nudge companies towards responsible practices, such as voting, as well as interacting more informally to influence the companies. The starting point for all of NBIM's ownership activities is to support the company while being clear about their expectations as an investor. The expectations are described in the eight expectation documents and in NBIM's position papers. (Norges Bank Investment Management, 2020d)

One of the most powerful tools to practice responsible and active ownership is for an investor to employ its voting rights in company meetings (Norges Bank Investment Management, 2020d). NBIM is transparent about principles and voting guidelines to make the rationale behind all voting outcomes clear (Norges Bank Investment Management, 2021c). Another activity is engagement with investee companies, involving structured processes such as company dialogue and monitoring on relevant topics (UN PRI, 2018). Additionally, NBIM regularly engages with the largest investee companies through company meetings or written communication. Thus, company dialogues are also important, as tracking information enables NBIM to understand better how the companies manage their risks and opportunities in their business operations. (Norges Bank Investment Management, 2021d)

Investing Sustainably in the Government Pension Fund Global

NBIM sees opportunities in companies that enable more environmentally friendly economic activity, as these companies can have positive repercussions on other companies in the portfolio through externalities such as reduced pollution, more efficient use of resources, and lower energy costs (Norges Bank Investment Management, n.d.-i). Likewise, there are certain risks the fund does not want to be exposed to, hence companies NBIM chooses not to invest in of sustainability and ethical reasons. The fund's sustainable investments are mainly managed through environmental-related mandates, adjusting the portfolio

through divestment, and considering climate issues in investment decisions.

The Ministry of Finance has included ethically motivated guidelines in the investment mandate for observation and exclusion of companies from the fund. The Council of Ethics, elected by the Ministry of Finance, performs ethical assessments of companies and provides the Bank with recommendations on observation and exclusion of companies, following the guidelines. According to the guidelines, "the Fund shall not be invested in companies that themselves or through entities they control produce weapons, tobacco, sell weapons or military materiel to certain states [1]". Furthermore, the fund does not have a mandate to invest in companies that base their operations on coal [2]. Beyond the mandate and recommendations from the Council of Ethics, it is Norges Bank who decides to observe or divest from companies that are not considered to be long-term sustainable. (Norwegian Ministry of Finance, 2019a)

Cf. section 4-4 of the fund's investment management mandate, Norges Bank must establish environmental-related investment mandates carried out by NBIM. These investments focus on eco-friendly assets and technology. At present, these mandates shall generally correspond to a market value of up to 2 % of the fund, including the recent investment in renewable energy infrastructure (Norwegian Ministry of Finance, 2019b). Since 2014, NBIM has been calculating and reporting the carbon footprint of companies in the portfolio through calculating companies' scope 1 and scope 2 emissions[3]. As the environmental-related investment mandates are actively managed, risk-based divestments and investments decisions can be made based on the carbon tracking information. Furthermore, in April 2021, Norges Bank signed an agreement to acquire 50 % of the offshore wind farm Borssele 1 & 2 (Norges Bank Investment Management, 2021b). This investment was the fund's first investment in unlisted renewable infrastructure. These investments are within the framework for the related environmental mandates (Norges Bank Investment Management, 2018).

[1]Described in the fund management mandate, section 3-1(2)(c) (Norwegian Ministry of Finance, 2019a)

[2]Observation or exclusion may be decided for mining companies and power producers which themselves or through entities they control derive (base) more than 30 of their income (operations) from (on) thermal coal. Observation or exclusion may also be considered for coal companies extracting more than 20 million tonnes of thermal coal per year or having a coal power capacity of more than 10 000 MW from thermal coal. (Norwegian Ministry of Finance, 2019a)

[3]Scope 1 refers to the direct emissions of a company, and scope 2 refers to a company's indirect emissions (GHG, 2013)

2.2.3 NBIM's Climate Effort and Management

NBIM emphasise four expectations on the topic of climate change, which is to i) integrate climate change considerations into policy and strategy, ii) into management, iii) report climate change risks and metrics, and iv) be transparent on their interaction and positions on climate change (Norges Bank Investment Management, n.d.-b). When voting and engaging with companies, these expectations are key. NBIM's responsible activities intend to nudge the fund's investee companies towards a more sustainable pathway.

2.3 Sustainable Finance

BlackRock (n.d.) define sustainable finance as investments that "combines the best traditional investing approaches with insights about, traditionally non-financial insights, to generate better long-term outcomes for our clients". In later years the world has seen a rise in demand for sustainable finance. According to Mansour (2021), data shows that global sustainable investments have sky-rocked; in 2013 sustainable investments amounted to 13 trillion dollars 2012 compared to around 30 trillion dollars in 2018.

Investigating how finance interacts with economic, social and environmental issues is the core of sustainable finance. As the main task of the financial system is to allocate funding to its most productive use, finance has the potential to play a leading role in allocating investments to sustainable corporates and projects, thus accelerating the transition towards a low-carbon economy and sustainable world. (Schoenmaker & Schramade, 2018)

In light of the purpose of being a responsible manager and everything this involves, sustainable finance is a key concept driving the responsible investment behavior. As a global investor, the fund relies on sustainable economic growth across the globe as a determining factor for its long-term rate of return. As such, they recognize both the risks and opportunities of climate change and other global developments and the effect these might have on global economies and markets in the long run, which in turn will impact the fund's performance.

2.4 Research Question

In this section, our research question is presented. This thesis seeks to analyze whether NBIM's responsible investment management is showing in the companies in which the fund invests and how this relates to the financial performance of both the companies and the fund as a whole. Throughout the analysis, we focus on how companies in the Norwegian Government Pension Fund Global perform on ESG relative to other, and how ESG relates to both companies' financial performance and the fund's historical annual returns. Our research question is:

i) How do companies part of the Norwegian Government Pension Fund Global perform on ESG relative to the rest of the market, and ii) how does the ESG score relate to financial performance, both at a company level and for the fund as a whole?

2.5 Literature Review

Before answering our research question, the following section presents existing literature on subjects relevant to our analysis.

2.5.1 The Impact of Responsible, Sustainable Investing

In 2020, Kölbel, Heeb, Paetzold and Busch explored how sustainable investing contributes to companies' environmental and social impact. One key finding was that sustainable investments scatter better business practices, yet its impact in driving more profound transformation is questionable without additional policy measures. Nevertheless, when distinguishing between the three impact mechanisms, shareholder engagement, capital allocation, and indirect impacts, they find that the mechanisms are well supported, partially supported, and miss empirical support, respectively, in the existing literature. For impact-seeking investors, they recommend pursuing shareholder engagement, allocating capital to sustainable companies with limited growth due to external financing conditions, and performing negative screening on companies with the absence of low-cost ESG practices (Kölbel et al., 2020). Moreover, a research by Ilhan, Krueger, Sautner and Starks (2020) shows that institutional investors can positively influence the climate disclosure of companies.

NBIM's Responsible Actions are Putatively Bearing Fruit

NBIM has assessed their potential impacts from responsible management. Since 2008, they have monitored their ownership activities internally to see how these potentially impact the fund's investee companies' ESG performance. Based on these, NBIM scores the companies on different topics[4]. Over the years, this has evolved into a valuable data set, enabling NBIM to analyze the historical development of these scores and the companies' reporting. From 2019 to 2020, NBIM saw an improvement in company reporting across all topics. Environmental-related topics showed the most significant improvement, in particular concerning climate change. Moreover, through this scoring system, NBIM finds that companies, for several years, have scored better on environmental-related topics.

[4]Scoring system on all topics consisting of the four pillars; Governance, Strategy and implementation, Risk Management, and Metrics and Targets. These are scored (0 - 25), leaving the maximum total score of a company to be 100 (Norges Bank Investment Management, 2021d)

(Norges Bank Investment Management, 2021d)

Furthermore, NBIM has, primarily through company dialogues, noticed improvements in how company boards oversee sustainability issues. NBIM has also seen improvements from words to numbers, as companies publish more metrics, such as Greenhouse-Gasses and water consumption, in addition to increasingly setting public goals, often aligned with a two-degree world. When analyzing the assessment data on companies they have engaged with versus those with which they have not engaged, NBIM has found encouraging signs that their actions lead to impact. However, NBIM states it is difficult to measure their isolated contribution to these improvements as the effort from peer investors, regulations, and trends across both countries and industries have driven the sustainable shift. Yet, they have run some regressions and find significance to a certain extent. (Norges Bank Investment Management, 2021d)

ESG's Impact on Financial Markets

Moreover, considering ESG investing's impact on financial markets, a study by Bennani et al. (2018) suggests that the question of impact-investing is related to the economic efficiency of ESG investing. According to their study, it is difficult to measure an ESG investor's impact at a micro level, i.e., on a particular company, while at a macro level, however, it is clear that ESG investors have had an impact on the financial markets.

2.5.2 ESG and Financial Performance

Meta-studies on ESG and financial performance

Friede, Busch and Bassen (2015) found that from 1970 to 2015, there had already been over 2000 scholars and investors studying the relationship between ESG and organizations' corporate financial performance (CFP). When combining the findings of these studies, they found a non-negative ESG-CFP relation in 90 % of the cases, and that ESG's positive effect on CFP appears to be stable over time (Friede et al., 2015).

In 2020, C. Clark, Whelan and Atz, together with NYU Stern Center for Sustainable Business and Rockefeller Asset Management, extended this literature by looking at more than 1,000 research papers conducted between 2015 and 2020. The report includes several conclusions about the relationship between ESG and financial performance. Firstly, they

conclude that financial performance improvements become more marked over longer time horizons. Similarly to Friede et al., they also found that their proxy for an implied long-term relationship had a statistically significant coefficient with a positive sign (C. Clark et al., 2021, p. 7). Next, they conclude that downside protection from ESG investments appears to be provided, especially during a crisis. This conclusion reflects, amongst other work, the work of Fernández et al. (2019). Moreover, they found that during the financial crisis, German green mutual funds delivered risk-adjusted returns slightly better than their peers (C. Clark et al., 2021, p. 8). Similar was the case for a set of ESG stock market indicators, FTSE4Good. These stocks performed better and quicker regained their value post-crisis (Wu, Lodorfos, Dean & Gioulmpaxiotis, 2017). Finally, the report concludes that mediating factors such as improved risk management and innovation drive better financial performance due to sustainability initiatives.

Furthermore, looking at over 100 academic studies from all over the world, Fulton, Kahn and Sharples (2012) found that 89 % of the studies they examined conclude that companies with high ESG ratings exhibit market-based outperformance. Moreover, 85 % agreed that high ESG score companies exhibit accounting-based outperformance, and 100 % agreed that they have a lower risk. They especially highlight how Corporate Social Responsibility (CSR) and ESG factors correlate with risk-adjusted returns, though at a security level. Also, an earlier meta-study by Arabesque Partners and University of Oxford G. L. Clark, Feiner and Viehs found that 88 % of their 200 reviewed researches concluded that good ESG standards improve operational performance, and 80 % find a positive stock price and sustainability relationship (G. L. Clark et al., 2015).

Corporate social performance and firms in the financial industry

In 2020, Crespi and Migliavacca investigated the dynamics underlying Corporate social performance (CSP), focusing on ESG in particular, within the financial industry. The sample comprises over 700 worldwide financial firms between 2006 and 2017. The objective was to look for firm, country, and temporary factors that affect CSP and ESG in particular. By conducting an OLS regression analysis, controlling for various variables, amongst them return on equity (ROE), they find that ESG has grown on a linear trend in the given period for the analysis and that both size and profitability enhance such growth (Crespi & Migliavacca, 2020).

The higher environmental performance, the higher reward

Bennani et al.'s research (2018), also analyzing the relationship between ESG and performance, shows that ESG investing has been rewarded since 2014, but not before. They found that ESG tends to impact best- and worst-in-class assets and that the environmental factor and governance factor perform the strongest in North America and the Eurozone, respectively. Furthermore, when Thomas Alison (2001) studied stock returns in relation to manager's long-term environmental dedication, he discovered that both adoptions of environmental policy and prosecution for breach of environment standards have significant explanatory power in excess returns of companies (Thomas, 2001).

2.5.3 ESG as a Risk Factor in Asset Pricing Theory

The key message of Maiti's (2021) study is that ESG factors should not be ignored in investment decisions, as he found that these factors are important in predicting returns. According to Bennani et al., the two criteria for ESG to be eligible as a new risk factor are 1) that it generates extra performance or reduces risk, and 2) it complements the traditional risk factors. In a letter to The Norwegian Ministry of Finance from Norges Bank, they claim, based on studies of correlations of climate risk and asset pricing, that there is no evidence of stating that climate risk is systematically mispriced (Norges Bank, 2021). On that account, there is reason to believe that climate is a systematic risk factor in the market. In a study conducted by Ick Jin (2018), the same is proved for ESG, i.e., ESG is a systematic risk factor.

In recent years, several studies have tried to quantify ESG risk exposures, by including an ESG factor into the existing factor models. The guidance document of UN PRI (2016) presents a practical case pursued by Bertolotti and Hoepner (2016) on attributing performance to ESG factors. Their methodology allows investors to investigate ESG integration's potential impact on their fund returns, and to assess the ESG factors's importance on financial performance through a sensitivity analysis (Bertolotti & Hoepner, 2016). They base their analysis around a US Large Cap Sustainable Alpha fund, assuming ESG characteristics are systematically mispriced in the market and that excess returns can be achieved by combining ESG with other fundamental data (Bertolotti & Hoepner, 2016). Using ESG data of Russel 1,000 firms during 2010 - 2015, they create an ESG

factor with the same 30 % cut-offs as Fama and French (French, n.d.-a). They found that the E, S and G factor explained 2.4, 1.6 and 2.7 % of the positive excess returns, respectively (Bertolotti & Hoepner, 2016). The study by Bennani et al. (2018) supports adding an additional ESG factor, as they find that an ESG factor can improve the five factor model significantly in explaining returns in the Eurozone.

Furthermore, in 2020, Sargis and Wang used a similar approach to see how investing in ESG companies affects returns, by including the additional factor *ESG Better Minus Worse* to Fama and French's factor model. Looking primarily at U.S. and Canadian securities, their finding adds to the growing body of evidence that investors can build global portfolios of companies with positive ESG attributes without compromising returns (Sargis & Wang, 2020). When looking at global portfolios, they concluded that the ESG ratings did not sort the good and bad securities into materially different risk or return groups. Finally, they found that the ESG factor is distinct from other well-known risk factors. Consequently, they conclude that the ESG factor should be considered in portfolio construction and risk management (Sargis & Wang, 2020). Furthermore, Hübel and Scholz conducted a study of integrating sustainability risks in asset management by constructing a similar ESG risk factor. They, too, found a significant increase in the explanatory power of standard asset pricing models, hence concluding that strategically managing ESG risks indeed can be beneficial to investors.

ESG's Impact on Portfolio Returns

Although several studies have found proof of ESG being a potential explanatory variable for returns, existing literature on sustainable investing is stated to yield 'mixed results' (Fulton et al., 2012). In Fulton et al.'s metastudy introduced above, they found compelling evidence of sustainable investing being a win for investors, but that many SRI[5] fund managers historically have failed to capture the potential which lies with it. Moreover, they find that actual SRI fund returns show neutral or mixed results in 88 % of the cases, yet they do not conclude that SRI funds generally underperform (Fulton et al., 2012). Furthermore, they speculate in a possible explanation of why some studies find a negative correlation between ESG score and returns, that is: the market may recognize that higher ESG and CSR score companies have lower risks, in terms of lower cost of capital, and

[5]Social Responsible Investment

reward them accordingly (Fulton et al., 2012).

Naffa and Fain on the other hand, find no significant outperformance of pure ESG portfolios, nor sufficient evidence for ESG being a valid risk factor in their factor approach (2021) to global equity investments' performance measurement. Additionally, NBIM has investigated the asset pricing effects of ESG investing, finding that ESG integration as a non-financial consideration leads to lower expected returns on 'green' assets with high ESG score and the opposite for 'brown' assets[6]. Nevertheless, since sustainable investments are being allocated increased capital flows, they find that such 'green' investments can, with time, outperform 'brown' assets (Norges Bank Investment Management, 2021a).

Summing up, the existing literature suggests that investors' effort on sustainability has an impact, yet that the impact is more clear on a macro level than micro level. Furthermore, studies have found that there seems to exist a relationship between ESG and financial performance, yet the results vary, as some find a positive and some find a negative relation. Based on this, sustainable investments do not need to imply that the investor forfeits financial returns. Indeed, considering that it is impossible to guarantee returns on whichever investment, sustainable investments can perform just as well, or better, as non-ESG investments (Stobierski, 2021).

[6]'Green' assets are often referred to all economic activities seeking to mitigate the consequences of climate change thus generating positive externalities for society, while 'Brown' assets refer to companies which contribute to climate change, i.e., imposing negative externalities(Pástor, Stambaugh & Taylor, 2021).

3 Data

This chapter highlights the process of selecting, extracting, and preparing the data for our analysis. We first present the data collected from NBIM and Thomson Reuters Datastream and elaborate on all selected variables chosen for the analysis. Next, we go through how we constructed the data set that we base our analysis on. After that, we describe the data collected from Kenneth R. French's Data Library and the Fama-French Factors before presenting how we constructed the different portfolios we used in parts of our analysis. Lastly, we discuss concerns regarding the data. All data used in our analysis is publicly available.

3.1 NBIM Data

Since NBIM seeks to be as transparent as possible about their fund management, we were able to download data on the fund's equity portfolio (Norges Bank Investment Management, n.d.-f). We chose to restrict our analysis to the period from 2008 to 2020, as it was in 2008 that NBIM published their first expectation document. Based on the data collected, we drew a sample of companies where the fund had registered ownership position over the selected period. We considered this sample period more relevant as we assume that NBIM, after 2008, has had a more conscious relation to responsible investment and ESG. The data sets contain a list of all companies included in the fund's portfolio each year, together with each company's respective sector and NBIM's market value (USD and NOK), voting power, and ownership position.

In addition to retrieving the equity portfolios from NBIM's website, we downloaded the monthly return and accumulated annualized returns of the fund's equity portfolio since its inception in 1998 (Norges Bank Investment Management, 2020a), which we used in the factor regressions introduced in section 4.3. To facilitate potential replications of our analysis, we chose to only deal with values in US dollars as, for example, publicly available factor returns typically are denominated in US dollars.

We included two of the variables from the Equity portfolio data set retrieved from NBIM in our panel data set: *Market Value (USD)* and *Ownership*. We used NBIM's Market Value in each company to calculate portfolio weights by dividing each company's market

value on each year's total market value of NBIM's investments. The Ownership variable is used in the ESG regression as one of the independent variables.

3.2 Thomson Reuters Datastream

The Thomson Reuters Datastream (hereafter Datastream) is a historical financial, and macroeconomic time-series database, including over 35 million individual instruments or indicators across all major asset classes globally (Reuters, 2018). Datastream provided us with ESG and financial data on more than 9,000 companies. We retrieved time-series data on all variables for all companies from the past 15 fiscal years, as multiple observations per company increase our number of observations and allow us to investigate trends and relation to external factors (Anish, 2020). Due to limited download access, companies with available emission data, across all industries and markets, were retrieved. This resulted in a data collection of 9,173 companies. The variables on which we collected data are presented below.

3.2.1 ESG Scores

As one of the most comprehensive ESG databases in the industry, Datastream covers more than 6,000 public companies globally across more than 400 different ESG metrics (Reuters, 2017). Thomson Reuters has created its own ESG scores, designed to objectively measure a company's relative ESG performance. In our analysis, we focus on the overall ESG Score. This is a performance-based score calculated based on information companies in the public domain report across ten categories[7], of which the 178 most relevant ESG metrics are carefully selected and divided into. Each of the ten categories are weighted when calculating the overall ESG score, i.e., a category with multiple issues will have a greater weight in the ESG score than lighter themes. We believe using Reuter's ESG evaluations allowed us to get an adequate impression of how companies are perceived on sustainability. A detailed overview of the score weighting is presented in table A1.1 in the appendix (Reuters, 2017).

[7]Resource use, emissions, environmental product innovation, management, shareholders, CSR, strategy, workforce, human rights, community and product responsibility (Reuters, 2017)

3.2.2 Financial Metrics

We retrieved several financial metrics from Datastream that we include in our analysis to overview the companies' health and look for developments that may explain movement in the chosen dependent variables. The financial metrics included represent a company's profitability, liquidity, and leverage. In addition, we retrieved annual observations on Market Capitalization, Price Close, YTD Total Return, and Outstanding Shares, which we used when constructing the portfolios[8].

Profitability

In our analysis, we used return on equity (ROE) as a metric for profitability. This metric is a recognized profitability measure calculated by dividing net profits over shareholders' equity. ROE tells us something about how well a company utilizes equity investment to earn profit for investors (Stobierski, 2020).

Liquidity

We included quick-ratio, also known as the liquidity ratio, which measures a company's ability to pay its short-term liabilities with readily convertible assets into cash (Corporate Finance Institute, n.d.). The quick ratio is calculated by subtracting inventory from current assets and dividing the result by current liabilities (Stobierski, 2020).

Leverage

The debt-to-equity ratio numerically displays the relationship between a company's borrowing, both short-term and long-term debt, and the level of leverage. In other words, how much a company finances itself using equity versus debt (Stobierski, 2020). Debt-to-equity is calculated by dividing total debt on total equity.

[8]The process of constructing the portfolios are elaborated on in section 3.4.

3.3 Data Set Construction

In the following section, we present how we created the data set used throughout our analysis.

3.3.1 Panel Data

Oxford Reference (n.d.) defines panel data as data collected over several periods on several individual units. As our data set has several variables measured over several periods, we deal with panel data. Our panel data consists of annual data from 2008 to 2020 on the different variables for companies we retrieved from Datastream and NBIM's web page. As a consequence of retrieving the data from different sources, we have an unbalanced data set, meaning that not all variables are observed for all companies in all periods.

3.3.2 Merging Data Sets

In order to separate only the companies included in the fund continuously from 2008 to 2020, we systematically merged the data sets retrieved from NBIM's web page without including unique values. Then, we extracted only the companies and industry information in a separate data set, attributing each company with 'NBIM' in a new column to make a dummy variable later. For analysis purposes and to be able to combine the variables with company data from the Reuters Datastream, we had to convert the data from a wide format to a longitudinal format [9].

The Datastream data too was in wide format, so each variable had to be transformed to a longitudinal format. We carried out such an operation for each variable included in the completed data set. Next, we systematically merged all the chosen variables into one data set, including those retrieved from NBIM's web page. Then, to make a variable that categorizes the companies into NBIM companies and not NBIM companies, we assigned the two companies with the dummy value 1 and 0, respectively. Consequently, we could make a dummy variable for whether or not the company was included in NBIM's portfolio.

Furthermore, to make the sample as representable and comparable as possible, we

[9] Wide format imply that all variables at all points in time for one unit is written on one line, and longitudinal format imply having one row for each company for each year (Spiess, Klienke & Reinecke, 2021)

eliminated all companies that conflicted with the fund's investment mandate[10]. After the screening and matching process, our data set contained 4,774 companies, 905 NBIM companies and 3,875 non-NBIM companies[11]. Moreover, in panel data terms, we have a total of 54,574 company-year observations. Further, to minimize the potential unpropitious influence of extreme values, we transformed such values for the applied variables [12]. This operation was essential for the analysis outcome to be as presentable of our sample as possible, creating more robust estimators of location and variability (Blaine, 2018).

3.3.3 Replacing Missing Values

Since our panel data is unbalanced, implying that not all companies have data for each variable in each year, we had some 'not available' (hereafter NA) values in the data set. Therefore, to reduce the number of NAs, we took some measures to replace some of them. When merging the data retrieved from NBIM's website with the Datastream data, only NBIM companies had values for *Ownership* and *Market Value (USD)*. Therefore, we sat the Ownership equal to zero for all non-NBIM companies. Furthermore, we left the NBIM companies that still had NA values in the Ownership variable unchanged[13].

3.3.4 Calculating the Return

Before constructing the portfolios, we calculated annual company returns based on the available closing prices in Datastream. As the Close Price metric was already adjusted for stock splits and dividends when we extracted the data, there was no need for us to make any adjustments (Reuters, 2017). We calculated the annual returns by using the formula below:

$$r_t = \frac{P_t}{P_{t-1}} - 1 \tag{3.1}$$

Where:

r_t = Return at time t

P_t = Adjusted stock price at time t

[10]Norwegian companies, and companies in the 'Exploration and Production' Oil&Gas sub-sector, tobacco- and weapon industry. Coal companies on the exclusion and observation list were also removed (Norges Bank Investment Management, 2021e)

[11]In the following, we will refer to these two company groups for companies included in the fund's portfolio and for companies not included in the fund's portfolio, respectively.

[12]Winsorized ROE, Quick-ratio, and the debt-to-equity ratio at a 0.5% level

[13]Constitutes 10 NA values for the Ownership variable, in total

P_{t-1} = Adjusted stock price at time *t-1*

We wanted as few NA values as possible for the return variable. We consequently got NA values in our new return metric for the observations with missing values on the Close Price metric. As a backup, we had retrieved a YTD Return metric from Datastream, with which we replaced the NA values. After, we removed the observations which still had NA values on the Return value in the main data set.

Other Remarks

We retrieved data from the last 15 fiscal years from Datastream. However, in order to ensure that all the companies in our sample had fiscal year 0 as the same year, i.e., 2021, we removed all the companies with last reporting dates different from 2021. In other words, we removed companies that did not have a fiscal year equal to 2021.

3.4 Portfolio Construction

This section presents the process of constructing the portfolios explored in our analysis. Since we did not have access to sustainability, financial and key company metrics for all companies in neither the fund or benchmark index, we constructed three portfolios based on our data sample with information retrieved from Datastream: a constructed NBIM, non-NBIM, and benchmark portfolio. The portfolios have unique portfolio compositions for each year, as the portfolio weights and company composition change from year to year.

3.4.1 Preparing the Data Set for Portfolio Construction

Prior to constructing the portfolios, adjustments were made to the construct data set. As the portfolio weights and returns depend on the fund's position in each company, and the company returns, respectively, we did some measures to minimize the number of NA values for these. First, we removed all companies with remaining NA values for return. Secondly, for all NBIM companies, we made sure there were no missing values on the Market Value variable[14]. Finally, we transformed extreme values[15] for the Return and the

[14]Did not remove any since there were no NA values.
[15]winsorized at a 0.5 % level

YTD Return variable, again to minimize the potential influence of potential outliers.

3.4.2 The 'NBIM' Portfolio

The constructed NBIM portfolio only constitutes of companies that have been included in the fund's portfolio all years from 2008 to 2020, i.e., of observations where the NBIM dummy equals 1 in our data set. We used the ownership positions[16] for each year to compute each firm's portfolio weight and portfolio return. We calculated the portfolio weights by dividing the fund's market value in each company by the its total market value invested (in USD). The calculation for portfolio weights and returns for the constructed NBIM portfolio is shown in the two equations below. Based on our data sample, we believe this reflected the most accurate portfolio weights, and returns, for the fund in the time horizon we are studying.

$$w_{i,t} = \frac{mv_{i,t}}{\sum_{i=1}^{N} mv_{i,t}} \tag{3.2}$$

$$r_{nbim,t} = \sum_{i=1}^{N} (w_{i,t} * r_{i,t}) \tag{3.3}$$

Where:

$w_{i,t}$ = Weight of company i at time t

$mv_{i,t}$ = NBIM's market value of company i at time t

$r_{nbim,t}$ = NBIM market-value weighted return for the $nbim$ portfolio at time t

$r_{i,t}$ = Return of company i at time t

3.4.3 The non-NBIM Portfolio

The non-NBIM portfolio only constitutes of companies in which the fund has *not* been invested all years from 2008 to 2020. We decided to value-weight this portfolio. Accordingly, we calculated the portfolio weights for the non-NBIM Portfolio based on each firm's market cap relative to the total market capsize of the portfolio. We believe this will provide us with more reliable portfolios as it will give the stock returns of larger-cap firms more

[16] Market Value (in USD) metric

weight in the portfolios. The portfolio weight and return calculations are shown below:

$$w_{i,t} = \frac{mcap_{i,t}}{\sum_{i=1}^{N} mcap_{i,t}} \tag{3.4}$$

$$r_{p,t} = \sum_{i=1}^{N} (w_{i,t} * r_{i,t}) \tag{3.5}$$

Where:

$mcap_{i,t}$ = Market cap of company i at time t

$r_{p,t}$ = Market cap-weighted return for portfolio p at time t

3.4.4 The 'Benchmark' Portfolio

The constructed benchmark portfolio constitutes all companies in our sample, seeking to reflect the fund's benchmark index. This portfolio was constructed similarly to the non-NBIM portfolio, i.e. based on market capitalization weights.

3.5 The Fama French Factors

We have collected monthly global factor returns for the Fama-French (1993) three factor model, the Carhart(1997) four-factor model and the Fama-French (2015) five-factor model from Kenneth R. French's Data Library (hereafter Data Library). Also sourced from the Data Library, we retrieved the yield on one-month treasury bills as a proxy for the risk-free rate, and a market proxy for each factor set. The factors and factor models will be described in section 4.3.

3.5.1 The Factors

The five Fama-French factors + momentum are *Mkt-rf, SMB, HML, RMW, CMA + WML (MOM)*[17]. These are acknowledged factors in global research and are commonly used in empirical asset pricing studies. They are constructed using six portfolios formed on size and book-to-market, six portfolios created on size and operating profitability, and six

[17] "Market return minus risk free return", "Small minus Big", High minus Low", "Robust minus Weak", "Conservative minus Aggressive" + "Winners minus Losers" (Momentum). The factor are elaborated on in section 4.3

portfolios formed on size and investment, where all six portfolios are value-weighted. The portfolio returns are in US dollars and include dividends and capital gains. The market return is calculated on a region's value-weight market portfolio, minus a risk-free rate. The applied risk-free rate is the US one-month T-bill rate. (French, 2021a)

3.5.2 Assigning a Factor Set to Each Observation

As the fund invests globally, we focused on companies from countries across all continents. Kenneth French (2021a) has created both continent-based factor sets and factor sets based on developing and emerging markets. Therefore, from his Data Library, we retrieved the Fama-French factors for Europe, North America, the Asia-Pacific (excluding Japan), Japan, and Emerging markets. An overview of the countries included in the different factor calculations are available in section A4 in the appendix.

The retrieved factors reflect a broader span of countries than we include in our portfolios. At the same time, our data set contains 32 countries[18] on which French's factor sets are not based. Still, we believe these are the most relevant factors reflecting explicit risk we found. Furthermore, Greece is categorized as both a developed and emerging market and included in a continent category. When dealing with the factor sets in our analysis, each country shall only be in one category. Due to these challenges and to reflect the risk most close to reality, we made some assumptions about the country classification before assigning each observation in our data set a factor set. All assumptions were made based on UN's region and country classification (The International Telecommunication Union, 2021; Nations, n.d.) and Kenneth French's categorization (French, 2021b, 2021a). The full list of which countries we have included in the emerging market category and in the different continents is presented in the table A4.3 in the appendix.

Assumptions European factor

French's European Factors include both countries we deal with in our analysis and countries we do not[19]. In addition to the countries French included when calculating these factors, we assumed the European factors also reflects the explicit risk in Cyprus, Faroe Islands, Gibraltar, Guernsey, Iceland, Isle of Man, Jersey, Luxembourg, Malta, and Romania.

[18] Countries marked with a * in table A4.3
[19] Norway

Additionally, we chose to categorize Greece as a European market, as UN classifies it as a developed country. (Nations, n.d.; The International Telecommunication Union, 2021).

Assumptions Asian factors

In addition to being representative factors for the countries which French have included in the Asia Pacific factors (excluding Japan), we assumed they also reflect the explicit risk in Israel, as Israel is categorized as a developed country in Asia by the UN (Nations, n.d.).

Assumption Emerging markets factor

Some companies in our sample are from countries categorized as 'developing' by the UN, yet are not included in French' Emerging market factors. Despite them not being included by French, we believe that his Emerging Market factors are the most applicable factors to represent these countries, which we were able to retrieve. (Nations, n.d.)

Factor Weights

According to the assumptions the above, we assigned a factor set to each observation in our data set. We did this to find the constructed NBIM portfolio's exposure to the various factor set categories for every year in the sample period. The factors were weighted in the same way as the portfolio, i.e., the weights are the sum of the portfolio weights each factor set category constitutes of the total portfolio. For example, as 27.5 % of the NBIM portfolio is invested in European markets, the weight of the European Fama-French Factor in the NBIM portfolio is 27.5 percent.

3.5.3 Construction of Additional Factors

When running the factor regressions in our analysis, we wanted our factors to explain as much of the fund's portfolio returns as possible. Therefore, we adjusted some of the factors to make them fit our models better. Furthermore, as wanted to analyze how ESG performance affects the fund's returns, we created an additional ESG factor which we integrated into the traditional asset pricing models.

Construction of Size-adjusted Factors

We followed NBIM's approach on factor and risk-adjusted return calculation (Norges Bank Investment Management, 2020b). Accordingly, we constructed additional size-based factors as average component returns, only using factor portfolios classified as 'Big' in Kenneth French's data library. In the factors of Fama and French (2015), the 'Big' stocks in the portfolios are the companies within the top 90 % largest market capitalizations (French, n.d.-a). Consequently, this approach corresponds to discarding the stocks in the bottom 10 % market caps, which initially are assigned a return weight of 50 %. We elaborate on the methodology for the calculations of these size-adjusted factors in chapter A5 in the appendix , but to illustrate, instead of for example constructing the HML-factor as originally according to *HML = 1/2(Small Value + Big Value) - 1/2(Small Growth + Big Growth*, the BIG value factor is constructed according to *HML = Big Value - Big Growth*. We did this on all factors, except the SMB factor[20], to make the factors more representative for the fund. The additional factors we now had in our factor set was therefore HML-big, WML-big, RMW-big and CMA-big, which we used when analyzing the fund's portfolio return in excess to the benchmark index.

Construction additional ESG factor

In addition to the BIG-factors, we created a new ESG factor, "Good-Minus-Bad" (GMB) through a hypothetical ESG Good Minus Bad portfolio. The objective of this factor is to capture the effect of how ESG scores explains variations in portfolio returns. We constructed the factor by creating 'good' and 'bad' portfolios for each year, consisting of 'good' and 'bad' companies respectively. We used a 30 % cut-off aligning with the Fama-French factor construction, meaning that we classified 'good' companies as the ones in the top 70 percentile of ESG scores and 'bad' as the ones in the bottom 30 percentile (French, n.d.-a). This GMB construction approach is the same as Bertolotti and Hoepner(2016) and Sargis and Wang when they built their ESG factors, using a 30 % cut-off.

In order to calculate the annual portfolio returns, we market cap weighted each company

[20]The "Small minus Big" (SMB) factor is the excess return that smaller market capitalization companies return versus larger companies. We therefore cannot size-adjust this factor to only big companies.

and calculated each company's weighted returns[21]. However, had to make some adjustments as the factor regressions we run in our analysis are based on a monthly data. As we only had annual company returns available for the companies in our sample, we needed to calculate the monthly rate of return[22].

Finally, to construct the GMB factor, we created the GMB portfolio by subtracting the monthly portfolio returns of the 'bad' portfolios from the 'good' portfolios, such that we had a GMB factor for all months in the sample period. Similarly to Sargis and Wang's apporach (2020), we constructed one GMB portfolio for the global universe. If the market places a higher premium on the 'good' ESG companies than the 'bad' ones, i.e. creating an ESG risk premium, the return on the overall GMB portfolio for that month is expected to be negative (Sargis & Wang, 2020). We find this ESG risk premium for 6/13 years[23].

Completing the Factor Sets

We created a new data set as we multiplied the constructed NBIM portfolio's factor weights with the original factors retrieved from the Data Library, as it is the fund's returns we will analyze. Before summing all the factors for each year, we also multiplied the factor weights for the NBIM portfolio with the additional size-adjusted factors. We then added, for each year, the risk free-rate, the fund's actual portfolio returns, benchmark returns, and portfolio returns in excess of both the risk-free rate and the benchmark portfolio. The latter is used as dependent variables in the factor regressions.

3.6 Concerns About the Data Set

This section shed light on these concerns and how we handled them. We have been aware of our concerns throughout the analysis.

3.6.1 Financial Metrics and Variations Between Industries

Since different industries tend to have different standards on what reflects a good and a bad value, we only looked at the three biggest industries represented in our data set

[21]Companies with no ESG score and no market cap values are excluded from this operation.

[22]This calculation can be found in the appendix chapter A5.1

[23]An overview of the average monthly returns for each year in the sample period is found in table A6 in the appendix. Higher premium on the 'good' ESG companies compared to 'bad' is found in 2008, 2010, 2011, 2014, 2015, and 2018.

and do so separately for each industry[24] (IndustriusCFO, n.d.). Accordingly, we made three data subsets: consumer discretionary companies, consumer staple companies, and industrial companies.

3.6.2 Deviations Between the Constructed and Actual NBIM Portfolio

We were concerned that our constructed NBIM portfolio did not reflect the actual NBIM portfolio. The concern lies with the factor weights, as we use the constructed NBIM portfolio to assign factor weights to each factor set. Potential deviations might be the case due to removed observations under the data set construction as we, for example, exclude companies that have not been continuously in the portfolio since 2008. Other reasons for such deviations might be the availability and the limited download access in Datastream. We retrieved data on the public listed companies available in Datastream with emission data available[25], which may not include all companies in the NBIM portfolio.

3.6.3 The ESG and Fama-French Factors

Fama-French Factors

We have some concerns regarding the applied Fama-French factors. Firstly, we were only able to extract these factors at a continent-level. Therefore, we dealt with a global market effect instead of extracting country-specific market effects, which would have improved our model. However, the global market effect was subtracted on a continent and emerging market level. To make the Fama-French factors as representable for the fund as possible, we weighted the factor sets according to the constructed NBIM portfolio's exposure on the different factor set categories. Secondly, several of the companies in our sample were from countries not included in French's factor calculations. The concern lies with the factors retrieved from Data Library not being perfectly applicable. Nevertheless, we made some assumptions about French's factor sets and these countries (Nations, n.d.; The International Telecommunication Union, 2021). We believe these assumptions made the factor sets more representable to our data set.

[24] See table A1.1 in the Appendix for an overview of the frequency of companies in each industry.
[25] 9,173 companies

ESG Factor

The ESG factor (GMB) was based on all companies in the sample for which we had available ESG score data, to make the factor as 'global' and 'benchmark alike' as possible. In addition, we decided to value weight this factor rather than weighting them by continent since we had the portfolio weights available. Therefore, this factor is more adjusted to the sample we are assessing than the Fama-French factors. However, our concern lies with the sample on which it has been calculated. Firstly, not all companies in the sample had available ESG score data. Consequently, the ESG factor does not represent the companies with NA ESG score values. Secondly, we only had annual returns available when calculating the monthly GMB portfolio return, meaning the monthly returns were estimates of the actual monthly GMB portfolio returns. In turn, this might have lead to deviations from what the optimal ESG factor would look like, yet we believe the ESG factor applied in our model is representable, as our sample is considerably large.

3.6.4 The GMB Factor in the Factor Regression

The constructed benchmark can not be precisely the same as the actual benchmark index, as we do not have a list of benchmark companies. Therefore, we had to make the assumption that our constructed benchmark reflected the ESG score of the Fund's Benchmark Index. This is important to consider when we run the factor models and interpret the results, as the ESG factor was constructed based on the 75 % and 25 % percentile of the ESG scores in the constructed benchmark, representing the 'good' and 'bad' ESG percentile of companies, respectively.

4 Methodology

This chapter aims to describe the methodologies applied to conduct our analysis. As our analysis uses different models, we structure the methodology chapter such that we first present the multiple panel data regression model with fixed effects, intending to explore ESG score in relation to the fund's ownership position in a company and to various financial metrics. Next, we present the risk-factor regression models, which we apply in our analysis on ESG and portfolio returns. Lastly, we discuss the models' rationality, before presenting assumptions and model testing.

4.1 Regression Models

The purpose of regression models is to be able to explain an outcome of a variable in terms of one or several explanatory variables and study how the outcome change if the explanatory variables changes (Wooldridge, 2012, p. 22). Several regression models are equipped to do so, and in our analysis, we have used multiple panel data regression with fixed effects and factor model regressions using ordinary least squares (OLS) methodology.

4.2 Multiple Regression: ESG and Financial Metrics

The first model in our analysis investigates the relationship between NBIM and non-NBIM companies, in terms of ESG score, using the fund's ownership share in companies as the explanatory variable. Moreover, we used a panel data regression model to explore whether or not there is a connection between ESG scores and financial metrics. Such model shows how movements in financial metrics affect the ESG score and how it differs between NBIM and non-NBIM companies. When studying the relationship between ESG and a company's financial metrics, we have chosen to include three independent variables: ROE, quick ratio, and debt to equity. The dependent variable is the ESG score. As mentioned earlier, since financial metrics often are hard to compare across industries, we chose to compute three different regression models in this context; one regression model for each of the largest industries in our sample.

4.2.1 Fixed Effects Panel Regression Model

We applied a fixed effects panel regression model, intending to explain the relationship between companies' ESG scores and NBIM's ownership, and its profitability, liquidity, and leverage. Additionally, the model explore the potential differences between NBIM companies and non-NBIM companies.

When dealing with panel data, several assumptions must be taken into account[26]. Pooled OLS regression is commonly used, but since we deal with unbalanced panel data we had to use either a fixed effects or a random effects estimation technique. Typical for these two techniques is that they eliminate the unobserved time-consistent company effect specific to the individual company that might correlate with the independent variables. What separates these two techniques is that fixed effect allows for such correlation between the time-consistent company effect and the independent variables, while the random effect requires these two to be uncorrelated and also that the unobserved effect be random. (Wooldridge, 2012, p. 484-501)

To decide between the two techniques, we performed a Hausman test. The fixed effects model is preferred when the p-value generated by the test is less than 0.05, and based on this, we decided to use the fixed effects model (Wooldridge, 2012, p. 495-496). The test results is presented in table A2.1 in the appendix.

Log Transformation

It can be advantageous to log transform the dependent variable so that the unit of measurement is the percentage change in the dependent variable related to change in the independent variables (Wooldridge, 2012, p. 39). Hence, we constructed a log-level model, by taking the natural logarithm of the ESG scores (Wooldridge, 2012, p.192). Consequently, the result from the regressions can be interpreted as a unit change in the independent variable that translates to a percentage change in the dependent variable.

We wanted to be able to separate the NBIM companies from the non-NBIM companies companies, in terms of ESG performance. According to Wooldridge (2012, p. 227), dummy variables for multiple categories can be helpful, as they can isolate the effect of any given

[26]The assumptions are presented in section 4.5.1.

independent variable. Hence, we apply such interactions of our dummy, aiming to look for differences in the context of financial metrics and ESG scores. As non-NBIM companies take the value 0, non-NBIM companies became our base group, meaning that this was the group to which the coefficients of the interaction terms were compared if the value of the dummy variable were equal 1 (Wooldridge, 2012, p. 239). Adding such interaction term is valuable for comparison purposes in our analysis, as the dummy tells whether or not the company is included in the fund's portfolio, and how this relates to the continuous financial variables.

The Models

The following regression model[27] was used when investigating the relationship between the fund's ownership share and a company's ESG score:

$$log(\ddot{ESG\ Score})_{i,t} = \beta_1 \ddot{Ownership} + \ddot{\epsilon_{i,t}} \tag{4.1}$$

We investigated the relationship between a company's ESG score and the given financial metrics as well as the differences between NBIM and non-NBIM companies in the three industries our sample is most exposed to. We used the following regression models, shown in equation 4.1, 4.2, and 4.3, where the difference between the three regression models is that they represent the companies in the consumer discretionary, consumer staple industry and industrial industry, respectively. The coefficients represents the time-demeaned data for both the dependent variable and the independent variables.

$$\begin{aligned} log(\ddot{ESG\_Score})_{i,t}^{CD} &= \beta_1 \ddot{ROE} + \beta_2 \ddot{Quickratio} + \beta_3 \ddot{Debt2EQ} \\ &+ \beta_4 (\ddot{dNBIM} * ROE) + \beta_5 (dNBIM * \ddot{Quickratio}) \\ &+ \beta_6 (dNBIM * \ddot{Debt2EQ}) + \beta_7 \ddot{Ownership} + \ddot{\epsilon_{i,t}} \end{aligned} \tag{4.2}$$

[27] See Appendix A3 for the explanation behind the technicalities of the models used

$$\begin{aligned} log(\ddot{ESG}\ \ddot{Score})^{CS}_{i,t} &= \beta_1 \ddot{ROE} + \beta_2 \ddot{Quickratio} + \beta_3 \ddot{Debt2EQ} \\ &+ \beta_4(\ddot{dNBIM} * ROE) + \beta_5(dNBIM * \ddot{Quickratio}) \\ &+ \beta_6(dNBIM * \ddot{Debt2EQ}) + \beta_7 \ddot{Ownership} + \ddot{\epsilon_{i,t}} \end{aligned} \tag{4.3}$$

$$\begin{aligned} log(\ddot{ESG}\ \ddot{Score})^{I}_{i,t} &= \beta_1 \ddot{ROE} + \beta_2 \ddot{Quickratio} + \beta_3 \ddot{Debt2EQ} \\ &+ \beta_4(\ddot{dNBIM} * ROE) + \beta_5(dNBIM * \ddot{Quickratio}) \\ &+ \beta_6(dNBIM * \ddot{Debt2EQ}) + \beta_7 \ddot{Ownership} + \ddot{\epsilon_{i,t}} \end{aligned} \tag{4.4}$$

Where:

i = refers to a specific company

t = refers to a specific year

4.3 Factor Regressions: ESG and Portfolio Returns

We wanted to isolate the effect of ESG risk on the fund's monthly portfolio returns in excess of the benchmark through factor regressions. Before elaborating on the applied factor models, we present the factor model's origin: The Capital Asset Pricing Model (CAPM) (1961; 1964; 1965; 1966). All the factor regressions are OLS regressions, i.e., that the parameters in a regression are estimated by minimizing the sum of the squared residuals. The dependent variables are the actual annual fund returns subtracted from the actual benchmark returns.

4.3.1 CAPM and Risk-Adjusted Return

The CAPM revolutionized modern finance, being the first framework relating the expected excess return of an investment to its risk (Perold, 2004). Treynor developed the model in 1961, before it was further improved by William Sharpe(1964), John Lintner(1965) and Jan Mossin(1966), pointing that higher risk should be compensated with higher returns. Moreover, the model introduces various risk factors related to return, and proves that

risky assets not necessarily are risky, as the risk can be diversified away when held together with other investments(Perold, 2004).

We were mainly interested in the CAPM's intercept (α) and in the estimated risk factor exposures. The alpha can be interpreted as pricing errors, where intercepts different from zero indicates that the model does not explain all variation in the portfolio excess return to the market. We used Jensen's Alpha, a risk-adjusted performance measure representing if the average return of a portfolio is above or below the predicted return of the factor model, given the average beta and average return of the portfolio (Jensen, 1969). Based on CAPM and Jensen's alpha, a portfolio's expected excess return can be explained as follows:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \epsilon_t \tag{4.5}$$

Where:

$R_{i,t}$ - $R_{f,t}$ = Return of portfolio i in excess to the risk-free rate of return at time t

α_i = Jensen's alpha (intercept/portfolio abnormal return)

β_{mrkt} = Exposure to the market risk factor

$R_{m,t} - R_{f,t}$ = Market excess return at time t (benchmark)

ϵ_t = Error term at time t

4.3.2 The Fama-French Three-Factor Model

The CAPM has been subject to further improved model versions (Perold, 2004). We have used three of them in our analysis, and the first one is the Fama-French Three-Factor model. The research done by Nobel laureates Eugene Fama and Kenneth French is an acknowledged contribution in exploring risk factors in the returns of assets. Motivated by the limitations of the single-factor CAPM, Fama and French introduced the Fama-French three-factor model (1993), including two additional risk factors to the market risk, size, and value.

Fama and French (1993) found that portfolios consisting of small-cap companies historically tended to outperform large-cap firms in the long term. The Size factor, denoted as 'Small Minus Big' (SMB), represents the difference between a portfolio consisting of small cap

companies and a portfolio of large cap companies. Moreover, when controlling for book-to-market equity, they found that portfolios of growth companies (lower book-to-market firms) historically tended to be outperformed by portfolios of value companies (high book-to-market companies). The value factor, with notation as 'High Minus Low' (HML), is therefore computed by subtracting the returns of a portfolio with the low book-to-market value from one consisting of high book-to-market firms (Fama & Kenneth, 1993).

The original Fama-French Three-factor model is structured like this:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) \\ + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \epsilon_t \end{aligned} \tag{4.6}$$

Where:

$R_{i,t} - R_{m,t}$ = Expected Return of portfolio i in excess of the market at time t

β_{SMB} = Exposure to the size risk factor *(Small minus big)*

SMB_t = Size premium at time t

β_{HML} = Exposure to the value risk factor *(High minus low)*

HML_t = Value premium at time t

In our factor analysis, however, we ran the regression with the size-adjusted factors in order for our model to align with the fund's constraints and characteristics:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \\ \beta_{SMB} * SMB_t + \beta_{HML_{big}} * HML_{big_t} + \epsilon_t \end{aligned} \tag{4.7}$$

Where:

$\beta_{HML_{big}}$ = Exposure to the size-adjusted value risk factor *(High minus low)*

HML_{big_t} = Size-adjusted value premium at time t

4.3.3 Carhart Four-Factor Model

Mark Carhart developed an extension of the Fama-French three-factor model in 1993. This model suggested an additional risk factor reflecting momentum in the market, as he

found that portfolios of companies that had performed well ('winners') and unsuccessfully ('losers') kept doing so (Carhart, 1997). Hence, the momentum factor (MOM) was computed by subtracting the returns of portfolios of 'losing' companies from portfolios of 'winning' companies in the past(Carhart, 1997). Carhart's four-factor model is built as below:

$$R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML} * HML_t + \beta_{MOM} * MOM_t + \epsilon_t \tag{4.8}$$

Where:

β_{MOM} = Exposure to the momentum risk factor *(Winners minus losers)*

MOM_t = Momentum premium at time t

For this model too, we chose to run the regression with size-adjusted factors:

$$R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t + \beta_{HML_{big}} * HML_{big_t} + _{MOM_{big}} * MOM_{big_t} + \epsilon_t \tag{4.9}$$

Where:

$\beta_{MOM_{big}}$ = Exposure to the size-adjusted momentum risk factor *(Winners minus losers)*

MOM_{big_t} = Size-adjusted Momentum premium at time t

4.3.4 Fama-French Five-Factor Model

In 2013, Fama and French published a revised version of their earlier work (1993), adding two new factors. They found that this model captures the size, value, profitability, and investment patterns better than the three-factor model (Fama & French, 2015). The rationale is that if the model captures all variation in expected returns, the intercept (α) is zero for all securities in portfolio i. The RMW factor is the difference between returns on diversified portfolios of stocks with robust and weak profitability, while the CMA factor does the same with portfolios of low and high investment companies, noted as 'conservative' and 'aggressive'(Fama & French, 2015). The Fama-French Five-Factor

model is constructed as follows:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ + \beta_{HML} * HML_t + \beta_{RMW} * RMW_t \\ + \beta_{CMA} * CMA_t + \epsilon_t \end{aligned} \tag{4.10}$$

Where:

β_{RMW} = Exposure to the profitability risk factor *(Robust minus weak)*

RMW_t = Profitability premium at time t

β_{CMA} = Exposure to the investment risk factor *(Conservative minus aggressive)*

CMA_t = Investment premium at time t

As for the other factor models, we ran the Fama-French five-factor model with the size-adjusted factors:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ + \beta_{HML_{big}} * HML_{big_t} + \beta_{RMW_{big}} * RMW_{big_t} \\ + \beta_{CMA_{big}} * CMA_{big_t} + \epsilon_t \end{aligned} \tag{4.11}$$

Where:

$\beta_{RMW_{big}}$ = Exposure to the size-adjusted profitability risk factor *(Robust minus weak)*

RMW_{big_t} = Size-adjusted profitability premium at time t

$\beta_{CMA_{big}}$ = Exposure to the size-adjusted investment risk factor *(Conservative minus aggressive)*

CMA_{big_t} = Size-adjusted Investment premium at time t

4.3.5 Fama-French Five-Factor Model with Momentum Factor

We also applied the Fama-French Five-Factor Model with Carhart's (1997) momentum factor (MOM), despite the absence of theoretical justification (Fama & French, 2018). We did this in order to see whether we could isolate the performance of the fund in excess to

the benchmark index even more. This original Carhart model looks like this:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ + \beta_{HML} * HML_t + \beta_{RMW} * RMW_t \\ + \beta_{CMA} * CMA_t + \beta_{MOM} * MOM_t + \epsilon_t \end{aligned} \tag{4.12}$$

We ran the regression with the size-adjusted factors:

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ + \beta_{HML_{big}} * HML_{big_t} + \beta_{RMW_{big}} * RMW_{big_t} \\ + \beta_{CMA_{big}} * CMA_{big_t} + \beta_{MOM_{big}} * MOM_{big_t} + \epsilon_t \end{aligned} \tag{4.13}$$

4.3.6 Extended Models with ESG Factor

As introduced in chapter 2.5.3, the Fama-French five-factor model has been used as a basis in several analyses to study ESG-performance's effect on returns. We aim to analyze whether variations in portfolio returns partly are caused by variations in ESG performance and therefore run a factor regression including a hypothetical ESG factor, inspired by Bertolotti and Hoepner (2016), Jin (2018), and Ngo and Nguyen (2020). This factor represents the return difference between portfolios consisting of 'good' companies, minus one consisting of 'bad' companies. The factor captures the portfolio's exposure to companies with a high ESG-score. To isolate the ESG-factor effect, we ran all the models presented above, with and without this additional factor. The regression models are shown below:

The Fama-French Three-Factor Model + ESG risk

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha + \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ + \beta_{HML_{big}} * HML_{big_t} + \beta_{GMB} * GMB_t + \epsilon_t \end{aligned} \tag{4.14}$$

Where:

β_{GMB} = Exposure to the ESG risk factor *(Good minus bad)*

GMB_t = ESG premium at time t

The Carhart Four-Factor model + ESG risk

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha &+ \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ &+ \beta_{HML_{big}} * HML_{big_t} + \beta_{MOM_{big}} * MOM_{big_t} \\ &+ \beta_{GMB} * GMB_t + \epsilon_t \end{aligned} \tag{4.15}$$

The Fama-French Five-Factor model + ESG risk

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha &+ \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ &+ \beta_{HML_{big}} * HML_{big_t} + \beta_{RMW_{big}} * RMW_{big_t} \\ &+ \beta_{CMA_{big}} * CMA_{big_t} + \beta_{GMB} * GMB_t + \epsilon_t \end{aligned} \tag{4.16}$$

The Fama-French Five-Factor model + Momentum + ESG risk

$$\begin{aligned} R_{i,t} - R_{m,t} = \alpha &+ \beta_{mrkt} * (R_{m,t} - R_{f,t}) + \beta_{SMB} * SMB_t \\ &+ \beta_{HML_{big}} * HML_{big_t} + \beta_{RMW_{big}} * RMW_{big_t} \\ &+ \beta_{CMA_{big}} * CMA_{big_t} + \beta_{MOM_{big}} * MOM_{big_t} \\ &+ \beta_{GMB} * GMB_t + \epsilon_t \end{aligned} \tag{4.17}$$

4.4 Factor Model Rationality

We believe using the same models and approach as NBIM did in their analysis of factor and risk-adjusted returns increase the robustness of our factor regressions (Norges Bank Investment Management, 2020b). When NBIM conducted their analysis, they performed several robustness tests to evaluate the effect of replacing the global market portfolio with the fund's benchmark, ensuring model rationality. They did this as the benchmark contains significant region and sector tilts compared to Fama-French global market factor. Moreover, as they considered the benchmark as an alternative and attainable investment opportunity, thus increasing the consistency between the investment mandate and benchmark index, we believe our model's robustness also increases. (Norges Bank Investment Management, 2020b)

Furthermore, NBIM tested if the factors were investable for the manager, which is necessary

for the alpha estimates to be valid performance measures. As they used the constructed size-constrained factors as a robustness test for such investability, we also consider our model as more robust, as we also applied size-constrained factors (Norges Bank Investment Management, 2020b).

Regarding the choice of factor models, we applied the Fama-French three and five-factor models, with and without momentum, and supplied the ESG factor (GMB) to all factor models to increase the complexity of the analysis and the validity of our findings. According to Derwall, Guenster, Bauer and Koedijk (2005), adding more factors can mitigate potential biases. However, even though Fama and French (2018) state that adding the profitability and investment factors improve the three-factor model, they state that adding too many factors might lead to biases. That is the reason why we run tests on several factor models, as well as test these models for potential biases.

4.5 Model Assumptions and Testing

4.5.1 Fixed Effects Models

According to Wooldridge (2012, p. 509), the fixed effects estimator is unbiased if a certain set of assumptions holds. These assume that i) we have a random sample from the cross-section, ii) the explanatory variables change over time and there is no perfect linear relationship between the explanatory variables, iii) for each t, the idiosyncratic error's expected value given the explanatory variables in all periods and the unobserved effect is zero[28], iv) $Var(u_{i,t}|X_{i,t}, a_{i,t}) = Var(u_{i,t}) = \sigma^2_{i,t}$, v) the idiosyncratic error are uncorrelated, and vi) conditional on the independent variable and the $u_{i,t}$ are i.i.d.[29]. The fixed effects model makes room for correlation between the u_i and the explanatory variables.

An important assumption for the fixed effects estimator to not be biased, is the strict exogeneity assumption (Wooldridge, 2012, p. 509). Therefore, it is necessary to evaluate whether there exist unobserved variables that affect i) the ESG score over time and ii) one of the independent variables in a given time period. We cannot know with certainty that this assumption holds, which may lead to uncertainty regarding the exogeneity. However, we found no apparent candidates for this to not hold, thus assumed that it is not violated.

[28]This is the strict exogenous assumption
[29]Independent and identically distributed

4.5.2 Factor Models

When performing multiple linear regressions, there are a set of assumptions in order for the OLS estimator not to be biased for the population parameters: i) linear parameters, ii) no perfect collinearity[30], iii) zero conditional mean, iv) homoskedasticity and v) no autocorrerlation (Wooldridge, 2012, p. 22-58). According to the Gauss-Markov theorem, OLS regressions produce unbiased estimates with the smallest variance of all possible estimators when the classical OLS assumptions are satisfied (Stock, Watson et al., 2012). We wanted this for our OLS estimators, namely that they were the Best Linear Unbiased Estimator (BLUE), i.e., we can guarantee the validity of our models.

We used OLS regressions for all our factor models, thus, the five assumptions must not be violated to ensure robust factor models and BLUE OLS estimators. However, as the assumption of i) linear parameters mainly apply to prediction purposes, we did not find it necessary to test this. Additionally, as the factors we retrieved from Data Library are globally acknowledged and are proven to be significant on security returns, we did not need to test for assumptions i) and ii) as they already are proved to hold (Carhart, 1997). Furthermore, since we followed the same approach with the same data as NBIM did, we expected the traditional factor models applied to be intact with the OLS assumptions. However, since we added both the momentum and ESG factor to the models, we ran some tests anyway.

When we ran a Variance Inflation Factor (VIF) test, we found no indications of perfect collinearity, or multicollinearity, meaning we could conclude that OLS assumption ii) was not violated even after adding the new ESG factor [31]. Furthermore, the other tests ran implied that the assumption of normality and zero conditional mean holds. We also tested the OLS assumptions iv) and v) on homoskedasticity and autocorrelation hold. We want homoskedasticity of the regression error term, i.e., the variance of our regression error term must be constant in the population, as well as to have no autocorrelation of the error terms. If these two assumptions were violated, the OLS estimator would no longer BLUE. We found no signs of heteroskedasticity by checking the factor regressions through a Q-Q plot. Furthermore, Breuch-Godfrey and Durbin-Watson tests implied that our

[30]Multicollinearity

[31]The results of the VIF test is presented in the appendix chapter A2.4

model was clear of autocorrelation. (Wooldridge, 2012)

As all tests signalized no violations of the OLS assumptions, we could, according to the Gauss-Markov theorem, conclude that our factor models are robust.

5 Analysis

In this chapter we present the results of our analysis, seeking to answer our research question:

i) How do companies part of Norway's Government Pension Fund Global perform on ESG relative to the rest of the market, and ii) how does the ESG score relate to financial performance, both at a company level and for the fund as a whole?

We start by presenting our results on how the fund performs on ESG relative to the rest of the market through descriptive statistics, before examining the regression results on whether NBIM's active ownership has any effect on ESG scores. Next, we investigate the regression results from comparing NBIM to non-NBIM companies on various financial metrics and ESG performance. We then present our analysis on the relationship between the fund's return and ESG performance, both through descriptive statistics and Fama French's (1993; 2015) and Carhart's (1997) factor regression models. Finally, through the results of the factor regressions, we explore ESG scores' role in explaining the fund's historical returns relative to the benchmark index.

5.1 Analysis of NBIM's ESG Performance

In this section we present the descriptive statistics of how the constructed NBIM portfolio and companies perform on ESG score relative to the constructed benchmark portfolio and non-NBIM companies on. Next, we shed light on our regression model's suggested relationship between the fund's ownership position in a company and ESG performance, which we ran to test whether NBIM's responsible ownership might have impacted companies towards being more sustainable. Then, to test whether NBIM's responsible ownership might nudge companies towards being more sustainable, we run a regression to catch the relationship NBIM's ownership position has on ESG performance .

5.1.1 Descriptive Statistics of ESG Performance

Table 5.1 presents the descriptive statistics of annual ESG score for (1) all companies, (2) NBIM companies, and (3) non-NBIM companies. Of the results presented in table 5.1

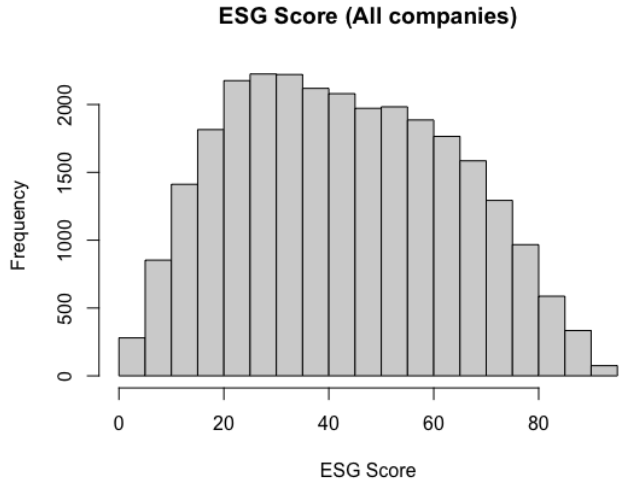
we find that the total sample mean between 2008 and 2020 is 42.834, with a standard deviation of 20.847 implying that most of the ESG scores are spread within two standard deviations on each side of the mean, seeing the ESG score as a whole. When looking at the ESG score for NBIM companies, the mean is 47.916, considerably higher than the mean when seeing all companies under one. Looking at the non-NBIM companies, we see a sample mean of 40.406. Furthermore, we observe no notable differences in the standard deviation when comparing the three groups of companies. Comparing NBIM against non-NBIM companies, a t-test shows a p-value lower than the significance level of 5 % [32], thus we can conclude that NBIM outperforms non-NBIM companies significantly on ESG performance.

Table 5.1: Descriptive statistics for company ESG Scores

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ESG Score_1	27,640	42.834	20.847	0.188	25.858	59.140	94.519
ESG Score_2	8,916	47.935	20.638	0.314	31.577	64.130	94.519
ESG Score_3	18,724	40.406	20.505	0.188	23.712	56.004	93.786

Note: The table presents the mean ESG score of the three company groups from 2008 to 2020: (1) All companies, (2) companies included in Norway's Government Pension Fund Global portfolio, and (3) companies *not* included in the portfolio.

Figure 5.1: ESG scores for all companies in the sample



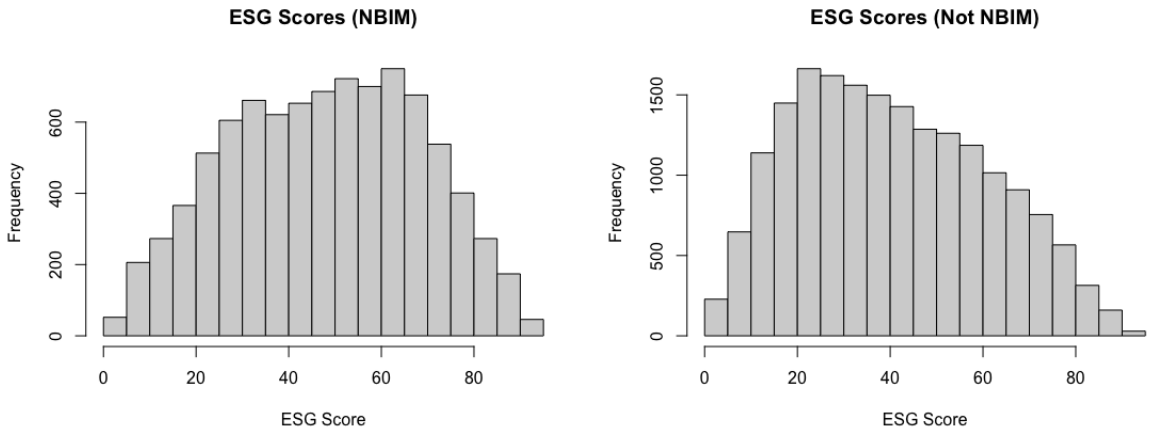
The histogram displays the ESG score distribution and frequency of all companies in our data sample, from 2008 to 2020.

[32] p-value: 2.2e-16 < 0.05

Figure 5.1 shows the distribution and frequency of the ESG scores for all the companies in our sample. We see that the ESG scores are somewhat left-skewed data, indicating that the number of ESG scores on the lower part of the scale is more frequent than higher numbers on the scale. The mean being 42.83 substantiates this line of argument.

Figure 5.2 displays the difference of the (a) NBIM and (b) non-NBIM company groups' ESG score distributions. Figure 5.2a shows that the ESG score distribution for NBIM companies is right-skewed, indicating that higher values for these companies are more frequently occurring. The opposite is the case for the non-NBIM displayed in 5.2b, where the data is left-skewed. This coincide with what we find in table 5.1, namely that 75% of the NBIM companies have an ESG score above 64, and for companies not included in the portfolio, 75% of the ESG score are above 56. Furthermore, the skewness in the figure 5.2a and 5.2b aligns with the trends we see in figure 5.3; NBIM companies have had higher values of ESG score throughout the years. Additionally, the ESG score for NBIM companies has had a faster-growing trend than the other companies from 2008 to 2020.

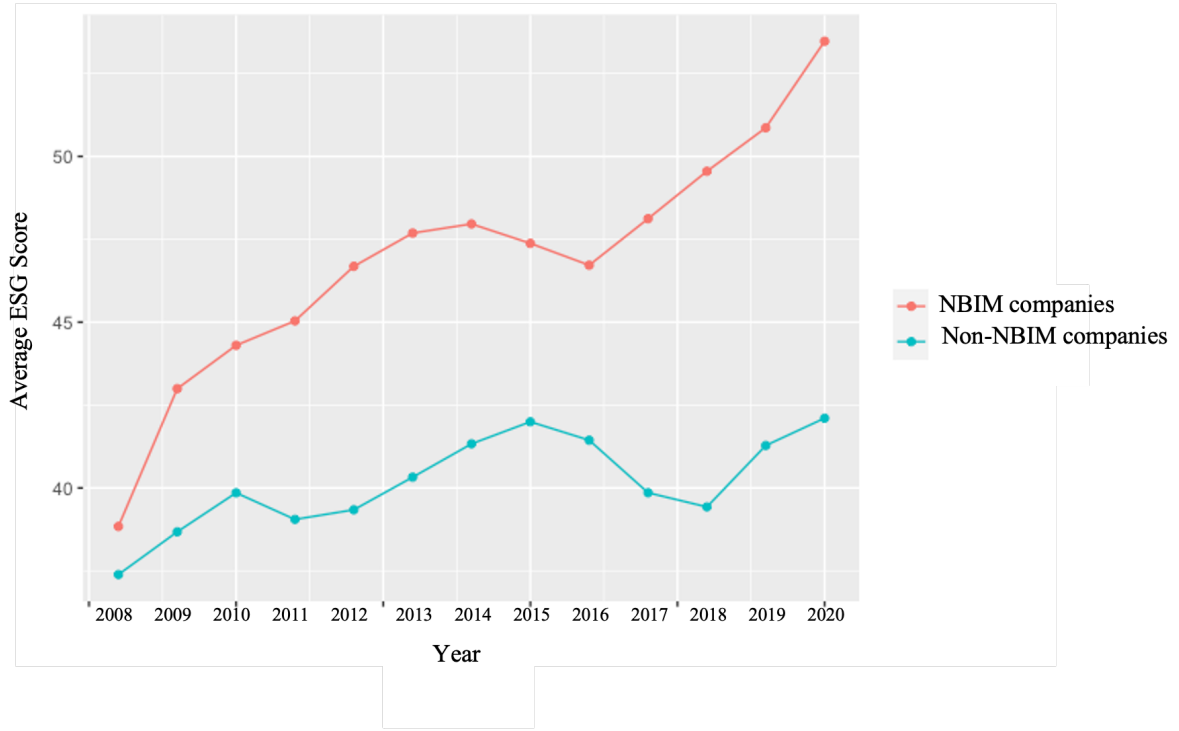
Figure 5.2: Histogram with the ESG score distribution for NBIM companies and non-NBIM companies from 2008 to 2020.



(a) **(b)**

Distribution and frequency of ESG scores for companies both (a) included and (b) not included in the Norwegian Government Pension Fund Global.

Figure 5.3: Display of the ESG score trend for NBIM companies and non-NBIM companies from 2008 to 2020



Trend development in ESG scores for NBIM companies and non-NBIM, from 2008 to 2020.

When comparing the ESG scores between the three constructed portfolios, we find the same as when comparing the ESG score means in the three company groups. After calculating the three portfolios' ESG score by weighting each company's ESG score in the three portfolios, we see that the constructed benchmark, NBIM and non-NBIM portfolio has a score of 42.4, 47.3 and 40, respectively. A t-test reveals that the constructed NBIM portfolio has a statistically higher ESG score than the constructed benchmark portfolio, with a p-value of 8.389e-4.

Table 5.2: Descriptive Statistics: Constructed Portfolio ESG scores

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
ESG Score$_{BM}$	13	42.441	1.555	38.828	41.612	43.358	44.938
ESG Score$_{NBIM}$	13	47.321	3.974	39.799	45.292	49.024	54.678
ESG Score$_{non-NBIM}$	13	40.032	1.167	37.804	39.121	40.971	42.140

Note: The table presents the weighted mean ESG score of the constructed benchmark (BM), NBIM, and non-NBIM portfolio in the period 2008 to 2020.

5.1.2 Regressions Results for ESG Performance

Another part of our analysis is to determine whether or not NBIM's responsible investment activities appear in key sustainability figures, such as a company's ESG score. Figure 5.3 shows the result from regressing the log-transformed ESG score on *Ownership*, intending to show how NBIM's ownership share relates to the ESG scores. We used the log-transformed ESG score as dependent variable, and Ownership as independent variable.

Table 5.3: Regressing Ownership on ESG score

	Dependent variable:
	log(ESG_score)
Ownership	0.115***
	(0.007)
Observations	26,436
R^2	0.012
F Statistic	267.762*** (df = 1; 22721)
Note:	*p<0.1; **p<0.05; ***p<0.01

Note: *p<0.1; **p<0.05; ***p<0.01 *(standard errors in parenthesis).*
The table shows the results from regressing the Norwegian Government Pension Fund Global's ownership on a company's ESG score. The independent variable is the fund's Ownership share, and the dependent variable is the log-transformed ESG score. If a company is not included in the fund's portfolio, the company's observation value for Ownership is zero.

The result indicate that there is a positive, statistically significant relationship between Ownership and the ESG score for a company. The Ownership coefficient indicates that if the fund's ownership position increases by one unit, the company's ESG score increase by 11.5%. Reading into the result, we can draw the conclusion that for companies where the fund's ownership share is higher, ESG scores also tend to be higher. Keeping in mind that the companies where the fund holds no ownership position the observation value of zero, we can interpret these results as if a company is in the fund's portfolio the ESG score is likely to be higher.

5.2 NBIM's ESG Score and Financial Performance

In this section, we elaborate on our results of comparing NBIM companies and non-NBIM companies on how various financial metrics correlate with ESG scores across the three industries to which NBIM is exposed the most. Then, we present the descriptive statistics

of the returns from our constructed NBIM, benchmark and non-NBIM portfolios, as well as the fund's actual returns in excess of the actual benchmark. Finally, we present our findings on how the fund's returns correlate with ESG performance and how ESG score can be considered a risk factor in the factor and risk-adjusted assessment of the fund.

5.2.1 Regression Results of Financial Metrics and ESG Score

Table 5.4 presents results from three different regressions. All three regressions have the log-transformed ESG score as a dependent variable and the following financial metrics as the independent variable; ROE, quick-ratio, debt-to-equity ratio. Additionally, we have included three interaction terms between the independent variables and our NBIM dummy[33]. The difference between the three regressions is that companies are divided into (1) Consumer discretionary (CD), (2) Consumer staple (CS), and (3) Industrial (I). Table 5.4 presents results from the three different regression, presented in chapter 4.2.1

When examining the coefficients for the ROE variable in all three models, we see that it has a negative correlation to the ESG score, with the two coefficients for the consumer discretionary and industrial companies being statistically significant [34]. In comparison, if we look at the interaction term[35] for ROE and the dummy for the consumer discretionary NBIM companies, we see an additional statistically significant positive relationship between an NBIM consumer discretionary company's ROE and the ESG score, implying that an increase in ROE result in a slightly positive increase in ESG score[36]. The same applies to NBIM companies in both the consumer staple and industrial industry, though the coefficients for the interaction term is not statistically significant.

Looking at table 5.4 and the coefficients for quick-ratio, we find that for companies in the consumer discretionary and staples industries in general, the coefficients are statistically significant[37] and indicate a negative relation to the quick-ratio. The relationship is the same for industrial companies, though not statistically significant. However, interpreting the interaction term's[38] coefficients for NBIM and quick-ratio in the consumer discretionary and industrial industry, we find an even more negative relationship to ESG score for NBIM

[33] dNBIM
[34] at a 1 % level
[35] dNBIM:ROE
[36] -0.423 + 4.27 = 0.004
[37] at a 5 % and 1 % level, respectively
[38] dNBIM:Quickratio

companies compared to non-NBIM companies. For the NBIM consumer staple companies, however, the coefficient for the interaction term indicates a less negative relationship between a company's quick-ratio and the ESG score. The only statistically significant [39] interaction term coefficient for quick-ratio and NBIM companies is the one in the model for industrial companies.

Regarding the leverage measure and its relationship with the ESG score, all three of the debt-to-equity ratio coefficients are statistically significant[40] and indicate a positive relationship for companies in our sample. Moreover, for NBIM consumer discretionary companies and industrial companies, the opposite relationship is the case, as we see that it has a slight statistically significant negative effect on ESG score according to the coefficients[41] of the interaction terms[42]. In contrast, for the NBIM companies in the consumer staple industry, the interaction term coefficient indicate a slightly more positive relationship.

We have also included the explanatory variable ownership, representing the fund's ownership shares. The coefficients for each of the industries are, like we found for the regression represented in table 5.3, all positive and statistically significant at a 1% level. Seeing that the highest coefficient value is for Consumer discretionary, followed by the coefficient for the consumer staples companies, and then for industrial companies.

Summing up, the regression results indicate a negative relation between non-NBIM companies and return on equity. For NBIM companies, the relationship is positive. The relation between the quick-ratio and ESG score, it is also negative for the non-NBIM companies. For NBIM companies, the relation is slightly less negative for consumer staples, however more negative for consumer discretionary NBIM companies and industrial NBIM companies. Lastly, the relation between debt-to-equity ratio and ESG score is positive for non-NBIM companies and negative for consumer discretionary and industrial companies. Finally, there is a positive relation between ESG score and ownership for all three industries, with consumer staple companies having the highest coefficient value.

[39] at a 1 % level

[40] at a 1 % level

[41] 0.019 - 0.021 = - 0.002, 0.013-0.015 = -0.002, respectively, for ROEs relationship with a company's ESG score

[42] dNBIM:Debt2EQ

Table 5.4: Regression results from regressing financial metrics and ownership shares on ESG score

	Dependent variable:		
	log(ESG_score)		
	(1: CD)	(2: CS)	(3: I)
ROE	-0.423***	-0.052	-0.074**
	(0.078)	(0.033)	(0.037)
Quickratio	-0.012**	-0.034***	-0.010
	(0.006)	(0.012)	(0.012)
Debt2EQ	0.019***	0.013***	0.013***
	(0.007)	(0.004)	(0.005)
dNBIM:ROE	0.427***	0.091	0.083
	(0.080)	(0.069)	(0.060)
dNBIM:Quickratio	-0.004	0.012	-0.062***
	(0.040)	(0.020)	(0.019)
dNBIM:Debt2EQ	-0.021***	0.004	-0.015**
	(0.007)	(0.009)	(0.007)
Ownership	0.224***	0.149***	0.110***
	(0.029)	(0.017)	(0.012)
Observations	2,637	4,559	6,941
R^2	0.043	0.026	0.021
F Statistic	14.306*** (df = 7; 2234)	14.724*** (df = 7; 3866)	17.853*** (df = 7; 5896)

Note: *p<0.1; **p<0.05; ***p<0.01 *(standard errors in parenthesis).*
The tables show the results for the regression models showing the relationship between a company's ESG score and financial factors, for three industries separately; Consumer Discretionary, Consumer Staples and Industrials. The data for both the dependent variable and the independent variables are retrieved from the Reuters Datastream. The ROE is a measure of a company's profitability, quick-ratio is a measure of a company's liquidity, and debt to equity is a measure of a company's leverage. The interaction terms shows the economic factors in relations to the companies included in the fund's portfolio in order to enhance the differences within the companies in our sample. Thus, the interaction terms is a combination of a binary and a continuous variable. Additionally the coefficent for NBIM's Ownership share is also included.

5.2.2 Descriptive Statistics of Returns

As presented initially, several studies have sought to find the actual relationship between portfolio returns and sustainable performance. We have until now shown that NBIM companies and our constructed portfolio seems to outperform non-NBIM companies and the constructed benchmark on ESG performance and that the fund's ownership position

has positive effect on ESG score. We have also assessed how various financial aspects of a company relate to ESG score and found that the relationship between ESG scores for NBIM and non-NBIM companies differ. According to the fund's current mandate, however, NBIM shall manage the fund to maximize the long-term return with acceptable risk, meaning that being a responsible owner and focusing on ESG integration should not compromise on the fund's returns. Therefore, this section focuses on presenting our findings regarding the fund's returns related to ESG performance.

Table 5.5: Descriptive Statistics: Constructed Portfolio Returns

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Return_{BM}	13	0.160	0.255	−0.398	0.106	0.256	0.659
Return_{NBIM}	13	0.129	0.220	−0.355	0.076	0.235	0.494
$\text{Return}_{Non-NBIM}$	13	0.171	0.271	−0.414	0.115	0.312	0.720

Note: The table presents the portfolio returns of the constructed benchmark (BM), NBIM and non-NBIM portfolio.

First, we assessed the same sample as for the ESG score comparison, looking at the average annual returns in the three sample groups[43] as it is for these we have ESG-scores available. From the descriptive statistics presented in table 5.5, we see that the NBIM companies on average seem to be outperformed by non-NBIM companies and the total sample. Comparing the non-NBIM and NBIM companies through a t-test, the p-value is 3.124e-11, which is less than the significance level of 0.05. Thus, we can conclude that NBIM companies' average annual return is significantly lower than non-NBIM companies between 2008 and 2020. Furthermore, looking at NBIM companies' returns compared to the mean of the whole market, we also find a significantly lower mean return for NBIM companies with a p-value of 2.03e-10 (< 0.05).

When comparing the portfolio returns on our three constructed portfolios [44] we find the same results as for the sample mean returns. Considering that the results of NBIM companies and the constructed portfolio having higher ESG scores, these findings align with earlier studies as Naffa and Fain found that portfolios with high ESG score did not outperform portfolios with no ESG focus, corroborating existing literature findings on neutrality.

[43] 1)NBIM, 2) non-NBIM companies, and 3) all companies in the sample (constructed benchmark)
[44] Non-NBIM portfolio, constructed NBIM portfolio, constructed Benchmark portfolio

However, these results are based on our sample data, and there might be deviations from reality. We also knew that existing literature have proved the opposite, namely that investors does not necessarily need to compromise on risk and return to invest in companies with better ESG performance. Therefore, we used the data we retrieved from NBIM's website with actual portfolio and benchmark monthly equity returns to compare actual, historical returns of the fund in excess to the benchmark index. In this case, we find that the the fund has a higher historical mean return than the benchmark index, yet the results are not statistically significant[45]. Nevertheless, we cannot draw any conclusions on how ESG score relate to the fund's financial performance based on only these descriptive statistics. Hence, in the following, we present our results when applying factor regression models to study the fund's financial performance and how ESG affects it.

5.2.3 Factor Regression Results: ESG Performance and Returns

The objective of the factor regression has been to discover the correlation between NBIM's financial- and ESG performance. We sought to do this by studying how the exposure of high ESG scores affect the fund's returns. By applying eight factor models[46], we were able to investigate the explanatory power of ESG score on the portfolio returns. Four of the eight regressions are traditional, and four have the additional GMB factor. The reason for the chosen approach is that we wanted to assess the effect on adjusted R squared (Adjusted $R\hat{2}$) of adding the additional ESG factor, and compare it to the adjusted R2 in the traditional models, inspired by the analysis by Thi Tam Ngo (2020).

In 2020, NBIM (2020b) conducted an analysis of robustness of alpha estimates and factor exposures through the same factor models we will use. However, they also considered management costs in some of their regressions, which we have include in our dependent variable. Yet, as we have retrieved the same data and do the same factor adjustments, we believe we ensure credibility of our results when adding the ESG factor despite not considering the management costs.

First, as a robustness check, we used the estimated alphas from the factor regressions to explore whether the fund outperforms the benchmark index. Then, before studying the ESG factor and its explanatory power on returns, we interpreted the Fama-French (1993;

[45] p-value $= 0.9251 > 0.05$

[46] Fama-French Three-factor, Carhart's Four-factor and Fama-French Five-factor model, with and without momentum. As all models were ran with and without an ESG factor (GMB-factor).

2015) and Carhart(1997) factor coefficients and how they explain NBIM's returns. To investigate whether the fund outperforms the benchmark, we use a long-short investment strategy where we go long in the fund and short in the benchmark portfolio. Accordingly, the dependent variable used is the monthly portfolio return of the fund excess to the benchmark return. Contrary to the descriptive statistics on returns, we based on NBIM's analysis (2020b) could expect positive alphas. The results are presented in table 5.6 below.

As table 5.6 shows through the constants (alphas), the original Fama-French Three Factor(FF3) and Carhart(CH) models have negative alphas, yet with very small and insignificant margins. This means, that explaining variations in portfolio returns with these two models suggests that the fund under-performs the benchmark portfolio. According to Adam Heyes (n.d.), a negative alpha can indicate that the investment is not optimally diversified. However, considering that the fund is invested in nearly 1.4% of all public listed companies in the world, across markets and industries, these results are hard to justify. All remaining models suggest that the fund generates returns at a higher rate compared to the benchmark index. When proceeding with our analysis we therefore chose to focus on the five factor models[47], with and without momentum and the ESG factor. An additional reason to proceed with these models was that they had higher explanation power compared to the three-factor and Carhart models.

The alphas in the FF5 and FF5M are positive, but not significant. They indicate that the fund outperforms its benchmark as it delivers a monthly abnormal excess return of 1e-5%. For the two models including the ESG risk factor, however, we see a higher alpha on 4e-5% excess returns. These low alphas are reasonable, as the Ministry of Finance has set limits for how far the fund can deviate from the benchmark. The difference in returns between the fund and the benchmark index is therefore expected to be low (Norges Bank Investment Management, n.d.-h).

Looking at the coefficients of the explanatory variables in the proceeded factor models, we see that how they capture the exposure between the fund and the benchmark index differs. The market risk factor (Mkt-RF) is statistically significant at a 5% level. The positive coefficients indicate that the fund historically mainly has consisted of more risky investments than the benchmark, for example, through more exposure to small-cap

[47] FF5, FF5$_{ESG}$, $FF5M$, $FF5M_{ESG}$

Table 5.6: Results of factor regressions on the Norwegian Government Pension Fund Global's monthly returns in excess to the benchmark's returns

	Dependent variable: $Return_{NBIM} - Return_{BM}$							
	FF3	FF3$_{ESG}$	CH	CH$_{ESG}$	FF5	FF5$_{ESG}$	FF5M	FF5M$_{ESG}$
Constant(α)	-0.00002	0.00000	-0.00002	0.00000	0.00001	0.00004	0.00001	0.00004
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
'Mkt-RF'	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***	0.0002***
	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)
SMB	0.0004***	0.0004***	0.0004***	0.0004***	0.0003***	0.0003***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
HML	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001	-0.0001	-0.0001	-0.0001
	(0.00004)	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
MOM			-0.00003	-0.00003			-0.00000	-0.00000
			(0.00004)	(0.00004)			(0.00004)	(0.00004)
RMW					-0.00004	-0.00003	-0.00004	-0.00003
					(0.0001)	(0.0001)	(0.0001)	(0.0001)
CMA					0.0002**	0.0002***	0.0002**	0.0002**
					(0.0001)	(0.0001)	(0.0001)	(0.0001)
GMB		0.0002		0.0003		0.0003*		0.0003*
		(0.0002)		(0.0002)		(0.0002)		(0.0002)
Observations	150	150	150	150	150	150	150	150
R^2	0.420	0.430	0.424	0.434	0.447	0.458	0.447	0.458
Adjusted R^2	0.408	0.415	0.408	0.414	0.428	0.435	0.424	0.431

Note: *p<0.1; **p<0.05; ***p<0.01 *(standard errors in parenthesis).*

The table shows the factor regressions results of the Norwegian Government Pension Fund Global's monthly returns in excess to the benchmark's returns. All models are estimated based on monthly data from 2008 to 2020 retrieved from Norges Bank Investment Management's website. The factors are retrieved and K. French Data Library. The dependent variables are the monthly returns on NBIM's equity management portfolio subtracted the return on the equity management benchmark, $r_{NBIM(act),t} \breve{} r_{bench,t}$. The explanatory variable Mkt-RF is the NBIM-weighted monthly excess return on Fama French's (2015) market proxy, and captures the portfolio's risk relative to the market. SMB (small minus big) reflects the portfolio's exposure to small market cap stocks. HMLbig (high minus low) explains the portfolio's exposure to high book-to-market-stocks. GMB (good minus bad) is a hypothetical ESG factor which captures the portfolio's exposure to companies with a high ESG-score. MOMbig reflects the exposure to previous price movements. RMWbig (robust minus weak) seizes the exposure to firms with robust profitability. CMAbig (conservative minus aggressive) defines the portfolio's exposure to a conservative investment strategy. The constant denotes annual abnormal returns in percentages (monthly alphas). The explanatory variables HML, MOM, RMW and CMA are 'big' factors, meaning they only reflect the top 90% market cap companies, in order to optimize the model's fit to the fund.

stocks or emerging markets (Norges Bank Investment Management, n.d.-h). Considering NBIM's expectations on relative volatility for the fund's investments, these results are reasonable as NBIM expects higher risk for the fund relative to the benchmark index (Norges Bank Investment Management, n.d.-h). Moreover, like in NBIM's analysis (2020b), the FF5 models with and without ESG and momentum factors suggest that the fund loads positively on the size factor (SMB). The positive sign and significance of the coefficient propose that the the historical abnormal return of the fund somewhat can be explained by its exposure to small cap companies, compared to the benchmark.

Regarding the value effect (HML), all regression models propose that the fund historically has been more exposed to low-value stocks, oppositely from what NBIM found in their analysis (Norges Bank Investment Management, 2020b). Yet, the HML coefficients for the 5FF models are not statistically significant. This can be explained by the negative correlation of -0.673 between the value factor and the investment factor (CMA), presented in 5.8. This is consistent with existing theory stating that low value stocks (i.e. growth stocks) tend to have a more aggressive investment approach. According to Wooldridge (2012), the correlated variables might represent their own isolated effects after the CMA factor is added to the model. The CMA coefficient indicates that the fund has a positive and significant exposure to companies with a conservative investment strategy, at a 5% significance level. Furthermore, the regression results for the FF5 and FFM5, with and without ESG factors, suggest that the profitability factor (RMW) loads negatively on the portfolio returns, relative to the benchmark, meaning the fund historically has been more exposed to least profitable companies. When including the ESG factor, however, we find less negative coefficients for RMW than when not considering it. Nevertheless, non of these coefficients are statistically significant. Hence, the interpretation can be ambiguous.

Finally, we examine how ESG performance impact NBIM's financial performance excess to the benchmark. Not surprisingly given our findings in the descriptive statistics analysis of ESG score, all factor models predict that the fund historically has been more exposed to high ESG scoring companies compared to the benchmark. Even more interestingly, the FF5 and FFM5 models show significant coefficients for the ESG factor at a 10% level, thus, we can presume that the fund's historical returns have been attributed to a ESG premium.

5.2.4 Explanatory Power of the ESG Factor (GMB)

When comparing the models with and without the ESG factor, we see an increase in adjusted R^2 compared to all the traditional factor models. I.e., when adding an ESG risk factor to the models, the model's explanation power increases. Therefore, these findings suggests that the models with the additional ESG factor can explain variation in the fund's returns in excess of the benchmark *better* than traditional factor models, as the only difference between the original and ESG models are the GMB factor. The table below summarizes the adjusted R^2 (adjusted R squares) of the regression models presented above.

Table 5.7: Model comparison: Adjusted R^2

	Adjusted R^2		
	Without GMB		With GMB
FF3	0.408	<	0.415
CH	0.408	<	0.414
FF5	0.428	<	0.435
FF5M	0.424	<	0.431

Note: The table presents the explanation power of the eight models, without and with the ESG 'Good Minus Bad' (GMB) factor. All models that include the GMB factor have higher explanation power than those without including it.

Moreover, to provide further insights on how the ESG factor contributes to the model, we take a look at the factor correlations presented in the correlation matrix below.

Table 5.8 shows the correlations between the seven factors we included in our model from 2008 to 2020. The ESG factor (GMB) has a positive correlation with market return, the size (SMB), value (HML), and investment (CMA) factor. The positive relationship between GMB and SMB implies that high ESG firms tend to be smaller companies. The positive correlation between the market factor and GMB indicates that companies with good ESG performance are likely to generate high returns in economic downturns, and lower returns in upward moving markets. The negative relationship between profitability

(RMW) indicates that companies in the NBIM portfolio with high profitability do not seem to have high ESG scores. The momentum factor also negatively correlates to GMB, suggesting that 'winning' companies in the past have been most likely not high ESG score companies.

Nevertheless, the correlations do not indicate any alarmingly high values, giving us reason to believe the ESG factor contributes to additional information. As we found no signs of multicollinearity from the model testing, meaning that all the regressors we added to our multiple regression contain information at the margin, these findings indicate that including the aspect of ESG supply the model with new explanation power.

Table 5.8: NBIM portfolio Factor Correlation

	Mkt_ret	SMB	HML	RMW	CMA	MOM	GMB
Mkt_ret	1						
SMB	0.590	1					
HML	0.132	0.331	1				
RMW	(0.379)	(0.477)	(0.772)	1			
CMA	0.463	0.127	(0.673)	0.470	1		
MOM	(0.292)	(0.342)	(0.388)	0.023	(0.224)	1	
GMB	0.586	0.237	0.272	(0.411)	0.043	(0.209)	1

Note: Numbers in parenthesis indicate negative correlations.

5.3 Model Weaknesses

As previously stated, we have some concerns regarding the applied data sample and methodology, which we have considered when interpreting our results. In addition, the factor models are facing critique which should also be considered.

5.3.1 Multiple Regression with Fixed Effects

When looking at the two models with ESG score as the dependent variable, the low R^2 value for all the four models indicates the explanatory power of the models is low. Despite the models having low explanatory power and thus the independent variables cannot predict the log-transformed ESG score, they can still say something about the relationship. However, this regression model might be improved by adding more explanatory variables.

5.3.2 Factor Regressions with OLS

Although the Carhart and Fama-French models are acknowledged and globally used asset pricing models, they still have room for improvement. For example, Blitz, Hanauer, Vidojevic and Van Vliet (2018) present concerns they believe should be considered for the five-factor model. First, they question the model's correlation between the market beta and return, as several empirical studies find a flat, or sometimes negative, relation. Next, they comment on the ignorance of the momentum factor, despite Fama and French arguing that including the MOM factor might result in correlating regressors. In our case, adding the ESG and MOM factor to the factor models was our largest concern, as we were afraid the variables would correlate and lead to biases. However, Sargis and Wang (2020) found that the ESG factor is distinct from the other factors, which aligns with what we found when we found no critical factor correlations or multicollinearity between factors in our model. Another concern Blitz et al. point out, is whether the investment and profitability factors' are robust and that Fama and French might not have been precise enough when presenting these new factors.

Moreover, Huynh (2018) share their concerns about the factor models. They found that neither the five-factor nor three-factor model passes the Gibbons, Ross, and Shanken's (GRS) test for portfolio efficiency, which seeks to test whether multiple factors increase the explanation power of expected returns (Fama & French, 2018). According to the Huynh, this indicates that the optimal asset pricing model is not yet fully developed, something our findings when adding the ESG factor might also indicate. Of the existing factor models, however, Zaremba and Czapkiewicz concluded that it is the five-factor model which best explains portfolio returns, given the current anomalies.

6 Discussion

The objective of this thesis has been to answer i) how companies part of Norway's Government Pension Fund Global perform on ESG relative to the rest of the market and ii) how ESG score relates to financial performance both at a company level and for the fund as a whole. This chapter embodies a further discussion of our findings presented in the previous chapter.

The first part of our question was investigated and answered by trend graphs and data testing, which interestingly showed that companies part of Norway's Government Pension Fund Global indeed, in terms of the mean of the ESG scores, seemingly have higher ESG performance. Additionally, we observed that there has been an upward trend in the ESG scores for companies part of the fund. In comparison, the non-NBIM companies have experienced weaker ESG scores growth, despite also having experienced a positive trend in ESG score. Consequently, an interesting finding was that the difference in the mean ESG score was smaller in 2008 compared to 2020. In spite of such findings, we cannot say that NBIM's responsible investment activities, elaborated on in chapter 2, led to this difference, especially considering their relatively small ownership shares, limiting their impact potential. However, by looking at the result from the model where we regressed the fund's ownership share in companies on ESG score, we found a positive relationship. Thus, our findings indicate two things: i) that if the fund holds shares in a company, i.e. has a ownership position greater than zero, the company tends to have higher ESG score, and ii) that the larger ownership position the fund holds, the higher the ESG score tends to be. As presented initially, Bennani et al. (2018) found that ESG investors have had a sustainable impact on a macro level, and this in parts coincide with what see with the trend we observe amongst the companies part of the fund.

Concerning financial metrics and ESG score, the key takeaways from analysing the three largest industries in our sample is that for the non-NBIM companies, there is a general negative relationship between ESG and our profitability measure. In contrast, by using the interaction term, and thus isolating NBIM companies' profitability and ESG score relationship, we found that for all three industries, there is a positive relation between profitability and ESG scores. This is in line with Crespi and Migliavacca's study (2020)

indicating that increased profitability enhances the growing ESG trend. However, one might point out that the result refers to a relation between the variables rather than implying causality.

Moreover, the analysis investigated the relationship between ESG score and a company's liquidity and leverage. For a company's ESG score and liquidity, we found a an even more negative relationship for the consumer discretionary and industrial NBIM companies compared to non-NBIM companies. Hence, NBIM companies in the two industries tend to have higher level of ESG score and tighter liquidity. Regarding the finding for the NBIM consumer staple companies, we found a slightly less negative relation, however the difference from non-NBIM companies is small. Moreover, the relationship with a company's ESG score and leverage differ between non-NBIM and NBIM companies in the consumer discretionary and industrial industry: non-NBIM companies have a more positive relationship between leverage and ESG score, while NBIM companies have a negative relationship.

To further investigate how ESG relates to the fund's financial performance, we first compared descriptive statistics on ESG and returns for the different company groups and the three constructed portfolios. These findings indicated that the NBIM companies and constructed portfolio outperform the other on ESG performance but unperformed on financial performance in terms of returns. Thus, looking exclusively at these results, it can seem like the fund's sound ESG performance limits the potential to generate higher returns. These findings align with Naffa and Fain (2021) results, as they found that portfolios with high ESG scores did not outperform portfolios with no ESG focus, corroborating existing literature findings on neutrality. What might justify these results, however, is what Fulton et al. (2012) found in their study, namely that many sustainable investors have failed to capture the potential which lies in such investments. These results can also be explained by their hypothesis about the market recognizing lower risk in high score ESG firms and that the market rewards them accordingly (Fulton et al., 2012).

Yet, since we knew that existing literature also had found the opposite (Friede et al., 2015; Fulton et al., 2012; G. L. Clark et al., 2015; Sargis & Wang, 2020), we investigated our question further by analyzing the fund's ESG and financial performance relationship directly through Fama-French factor regressions, with and without a momentum factor

and ESG factor. By looking at the Fama-French five-factor models, as these coincided the most with the results NBIM got when analyzing alphas in their factor risk-adjusted return analysis, we did some interesting findings. We found a significantly positive relationship between high ESG score exposure and the fund's return in excess of the benchmark, which means that when the exposure to ESG score increases, the mean excess return of the fund tends to increase. These results have positive implications for NBIM's responsible investment management and purpose, as it means that increasing the fund's focus on sustainability does not need to forfeit the fund's financial performance, in fact, on the contrary. This aligns with the conclusion of Sargis and Wang's (2020) recent study on ESG relative to financial performance.

Furthermore, we found that including an ESG factor in the factor models might improve NBIM's understandings of what actually drives the fund's returns. This coincides with earlier studies by Bertolotti and Hoepner (2016), Bennani et al. (2018), Sargis and Wang (2020) and Maiti (2021). One possible explanation for these findings can be the impact sustainable investing has had on financial markets the past decades, and the positive trend in ESG development, as we particularly observed among NBIM companies. Although this is a study of Norway's Government Pension Fund Global, and therefore may not be representable for all investors and portfolios, we still believe these findings add to the growing body of evidence that ESG indeed should be considered when analyzing financial performance, considering that the fund is well-known for being a diversified and global investor. Furthermore, regarding Bennani et al.'s (2018) two criteria for ESG to be an eligible risk factor, we find that these seem to be fulfilled as the factor i) generates extra performance to the fund and ii) adds extra value to the model. On that account, in addition to looking at how the fund's historical exposure to high ESG score companies correlates with the other risk factors in the model, we find no reason to doubt that this factor should be included.

7 Conclusion

This thesis has aimed to conduct an in-depth analysis of how Norges Bank Investment Management relates to the contemporary topic of ESG relative to financial performance. As NBIM manages the Norwegian Pension Fund Global, which is the largest single-owner investor in the global stock market, it has been insightful to evaluate the ESG performance of both the fund and its investee companies. Additionally, it has been interesting to explore how these findings relate to financial performance, taking into account the efforts made by the fund in terms of ESG measures and compliance, which have experienced frequent attention.

NBIM takes several aspects of responsible investment into account in its fund management, with the intent to maximize the fund's long-term financial performance through impacting companies' sustainability approaches. Our analysis showed that companies in which the fund invest tend to score higher on ESG than the rest of the market. Yet, we cannot conclude with certainty that the relatively higher levels of ESG score for companies where the fund has an ownership position are explained by their responsible investment strategy. However, NBIM systematically integrates responsible practices when safeguarding and building financial wealth for generations by establishing principles, exercising ownership, and investing sustainably. Thus, the reason behind the positive trend in ESG scores between 2008 to 2020 for NBIM companies may be the result of their effort to influence.

Moreover, we also shed light on the relationship between the financial metrics for profitability, liquidity, leverage and ESG score. Our model suggests that there exist differences in the relationship between the two company groups within the three sectors. For example, we found that there is a positive relationship between a company's return on equity and the ESG score for NBIM companies, agreeing with what ESGfinIndustry (2020) found. It is also interesting to point out that in general, the relationship between these metrics and ESG scores seem to differ between the companies included in the fund's portfolio and companies not included.

Furthermore, we have contributed to the existing literature on how financial and ESG performance correlates. Our key findings from this part of the analysis add to the mounting evidence of a non-negative relationship between ESG and returns: NBIM's increasing

focus on ESG and sustainable actions does not necessarily compromise the fund's objective to maximize excess returns at moderate risk. These findings align with what Friede et al. (2015), Fulton et al. (2012), G. L. Clark et al. (2015) and Sargis and Wang (2020) found. Supporting the research by Maiti (2021), Bertolotti and Hoepner (2016), Bennani et al. (2018) and Sargis and Wang (2020), our analysis also finds reason to include ESG as a risk factor when analyzing the Fund's performance, as it improves the explanation power compared to previous factor models used by NBIM.

Our study of NBIM prove that systematic work of integrating responsible investment practices into the core of the investment management, might impact investee companies' ESG performance, which in turn might contribute to boost excess portfolio returns. However, we are aware of the mixed findings in existing literature, and that this might be a special case for NBIM. Moreover, seeing how adding an ESG factor to existing asset pricing models improves the model, our findings can interesting to all investors seeking to explain variations in returns.

In sum, we conclude that companies part of the Norwegian Government Pension Fund Global perform stronger on ESG relative to the rest of the market both at a company and portfolio level, that the relationship between financial metrics and the ESG score for NBIM and non-NBIM companies' in our sample differs for the three biggest industries, and that more exposure to higher scoring ESG companies historically has tended to reinforce the fund's financial performance.

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Appendix

A1 Thomson Reuters ESG Score Calculation

We retrieved ESG score data from Thomson Reuters Datastream on more than 9,000 companies. These scores are calculated by Reuters, designed to objectively measure a company's relative ESG performance (Reuters, 2017). We have focused on the overall ESG Score, which is weighted on ten categories. A detailed overview of the score weighting is presented in table A1.1 below.

Table A1.1: Thomson Reuters ESG score calculation

Pillar	Category	Indicators in scoring	Weights
Environmental	Resource Use	20	11%
	Emissions	22	12%
	Innovation	19	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%**

Notes: This table shows the detailed counts and weights for Thomson Reuters ESG Scores. The count of measures per category determines the weight of the respective category (Reuters, 2017).

A1.1 Data Sample's Industry Exposure

The table A1.2 displays an overview of the different industries in our data set. We use The Global Industry Classification Standard (GICS) for classifying the industries in our sample. This standard was created in 1999 by MSCI (MSCI, 2016).

Table A1.2: Total Sample Industry Exposure

Industry	**Frequency 2008 - 2020**	**Sample share**
Industrials	14,985	32.63 %
Consumer Discretionary	9426	20.53 %
Consumer Staples	5576	12.14 %
Materials	4674	10.18 %
Energy	3880	8.45 %
Utilities	3640	7.92 %
Communication Services	1878	4.09 %
Information Technology	1129	2.46 %
Health Care	300	0.65 %
Financials	276	0.60 %
Real Estate	151	0.33 %
TOTAL	45,914	100 %

A2 Model Testing

We have performed various tests to ensure robust models, and thereby valid results. The following presents these tests and what they imply for our models.

A2.1 Hausman Test Results for Panel Data Regression

There are several forms of panel data regression. When determining whether to use a fixed or a random effect model, a Hausman Test is a helpful tool. We choose a fixed effects model if the p-value of the Hausman test < 0.05 (Wooldridge, 2012). Accordingly, the results from table A2.1, we see that we should use fixed effects model regressions for all three of the industries.

Table A2.1: Hausman Test Results

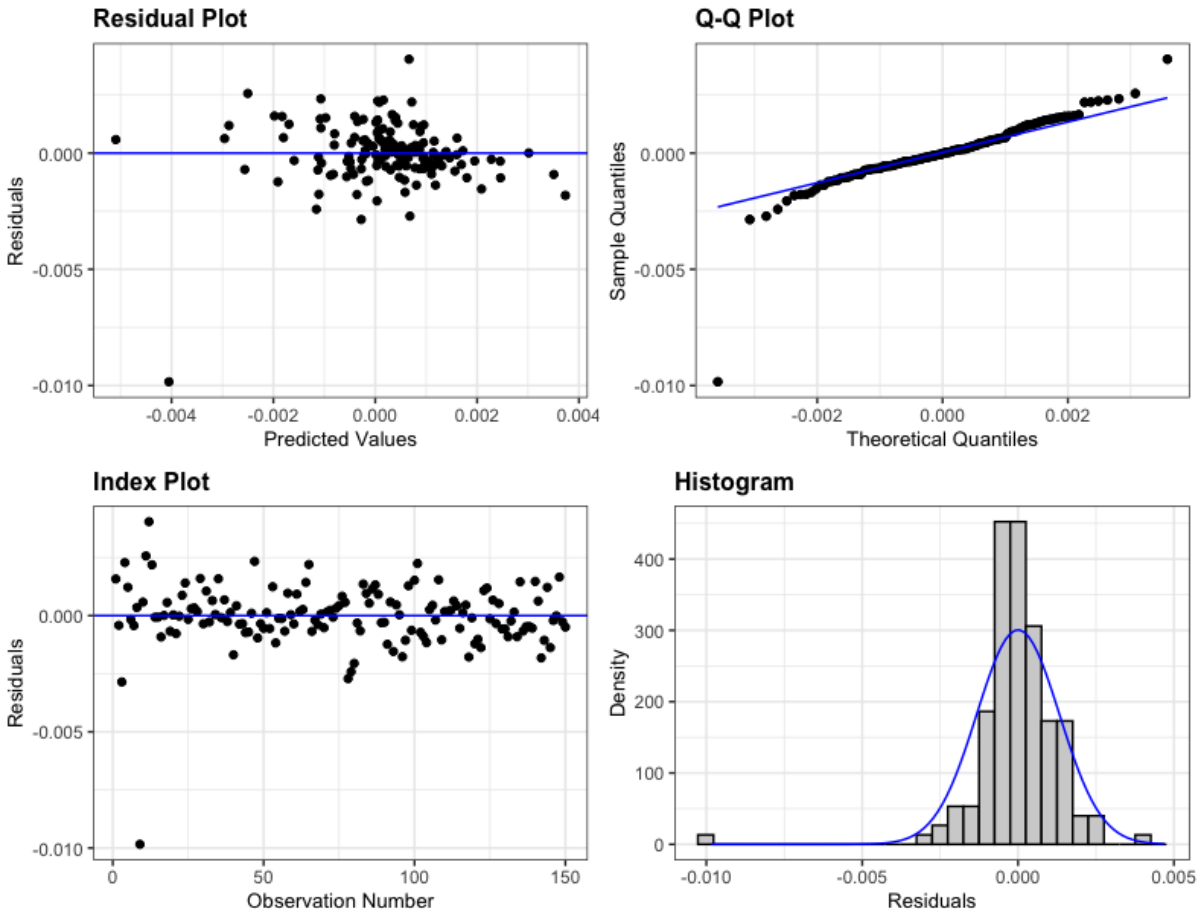
Industry	chisq	df	p-value
CD	13.494	6	0.03583
CS	16.757	6	0.01022
I	45.835	6	3.193e-08

A2.2 Diagnostic Checking the Factor Regressions

Figure A2.1 shows the residual plot, Q-Q Plot, index plot and histogram of the factor models' residuals. We chose only to present the test results of the FF5M + ESG factor model, as this model include all factors and thus also can be representative for the other models ran and because we run all models on the same portfolio. Additionally, our conclusion is mainly based on the five-factor models, with and without the momentum and ESG risk factor.

The residual plot in the upper left corner of Figure A2.1 shows relative symmetrical distributed residuals, clustering towards the middle of the plot. Furthermore, we see no clear patterns. These are both indications of a good model (Qualtrics, 2021). However, we observe an outlier in the left corner. One possible explanation might be deviations in returns in the financial crisis, as our sample period starts in 2008. Further, this explanation can be rationalized as we find the same outlier in the index plot, which orders the residuals chronologically. Moreover, the Q-Q Plot in the upper right corner and the histogram below is run to test for normality. Both the Q-Q Plot and the histogram indicate that assumption

Figure A2.1: Regression diagnostics Five-Factor Model + Momentum + ESG Factor



iv) about zero conditional mean is fulfilled. Additionally, the Q-Q Plot show that the residuals follow a straight line, which further supports the normality and homoskedasticity assumptions for OLS.

Moving to the index plot, which illustrates how the residuals are ordered over the sample period, we might see a tendency for a positive autocorrelation, even though we see no obvious signs of it. To further check for autocorrelation, we run a Breuch-Godfrey and Derbin-Watson test, which is presented in table A2.2. We want zero autocorrelation as it can lead to biased regression results and invalidate inference (?, ?). It is desirable *not* to reject the null hypothesis (H0), as H0 suggest there is no autocorrelation in the data. As table A2.2 reveal, non of the p-values in the two models are significantly small, indicating no sign of autocorrelation. We can thereby conclude with no violation of assumption iv).

A2.3 Test for Autocorrelation

Table A2.2: Breusch-Godfrey and Durbin-Watson test for autocorrelation

	Breuch-Godfrey		**Derbin-Watson**	
	LM	**P-value**	**DW**	**P-value**
Fama-French 5 Factor Model				
Fama-French 5 factor	0.906	0.341	1.842	0.153
Fama-French 5 factor + ESG	0.677	0.411	1.860	0.162
Fama-French 5 Factor Model + Momentum				
Fama-French 5 factor	0.910	0.340	1.842	0.149
Fama-French 5 factor + ESG	0.680	0.410	1.860	0.158

A2.4 Test for Multicollinearity

When running a variance inflation factor (VIF) test we find that multicollinearity is not a problem for our dataset, hence we are not violating OLS assumption ii). If the VIF values are above 10, we have reason to be concerned (Hair, 2009). The VIF test results are presented in below in figure A2.3.

Table A2.3: The Variance Inflation Factor for the Fama-French risk factor

	Variable Inflation Factor (VIF)							
	FF3	**FF3**$_{ESG}$	**CH**	**CH**$_{ESG}$	**FF5**	**FF5**$_{ESG}$	**FF5M**	**FF5M**$_{ESG}$
Mkt-RF	1.3310	1.3581	1.4002	1.4282	1.8557	1.8878	1.8568	1.8889
SMB	1.0540	1.0556	1.0545	1.0561	1.1143	1.1157	1.1202	1.1217
HML	1.3306	1.3310	1.9084	1.9092	4.5584	4.5620	5.4645	5.4680
MOM			1.8340	1.8341			2.0521	2.0521
RMW					4.4257	4.4312	4.4344	4.4399
CMA					1.4784	1.4803	1.6480	1.6499
GMB		1.0354		1.0355		1.0378		1.0379

A3 Explanation of the Multiple Regression Model with Fixed Effects

When using fixed effects in multiple regression, we use fixed effects transformation of the dependent and independent variables. In order to show how the time-demeaned coefficients in our models we show the transformation in general terms:

$$log(ESG\_Score)_{i,t} = \alpha_{i,t} + \beta_1 x_{i,t} + \epsilon_{i,t} \tag{.1}$$

For each company, i, we average this equation over time:

$$\overline{log(ESG\_Score)}_i = \alpha_i + \beta_1 \bar{x_i} + \bar{\epsilon}_i \tag{.2}$$

where $\overline{ESGscore_i}$ =T^{-1} $\sum_{i=1}^{T} ESGscore_{i,t}$

The intercept or alpha is fixed over time, it is the same in each of the equations. Moving on, we subtract equation (2.2) from (2.1):

$$log(ESG\_Score)_{i,t} - \overline{log(ESG\_Score)}_i = (\alpha_i - \alpha_i) + \beta_1(x_{i,t} - \bar{x_i}) + \epsilon_i - \bar{\epsilon}_i \tag{.3}$$

which result in our model equation:

$$Log(\ddot{ESG}\_Score)_{i,t} = \beta_1 \ddot{x} + \ddot{\epsilon}_{i,t} \tag{.4}$$

In equation .4, we have the time-demeaned equitation for both the dependent and independent variables. Because alpha is fixed over time and appears in both .1 and .2, it is zero in .4. When including more explanatory variables variables, the same process applies and will have no difference other than that we have more beta variables. (?, ?, p. 484-485).

A4 Factorset Division

In the following, we present Kenneth French's division of countries into factor sets followed by the country division we apply in our analysis.

A4.1 Kenneth French's Continent Division

Table A4.1: Kenneth French' division of countries into continents

Country	Developed	Developed ex US	Europe	Japan	Asia-Pacific ex Japan	North America
Australia	✓	✓			✓	
Austria	✓	✓	✓			
Belgium	✓	✓	✓			
Canada	✓	✓				✓
Switzerland	✓	✓	✓			
Germany	✓	✓	✓			
Denmark	✓	✓	✓			
Spain	✓	✓	✓			
Finland	✓	✓	✓			
France	✓	✓	✓			
Great Britain	✓	✓	✓			
Greece	✓	✓	✓			
Hong Kong	✓	✓			✓	
Ireland	✓	✓	✓			
Italy	✓	✓	✓			
Japan	✓	✓		✓		
Netherlands	✓	✓	✓			
Norway	✓	✓	✓			
New Zealand	✓	✓			✓	
Portugal	✓	✓	✓			
Sweden	✓	✓	✓			
Singapore	✓	✓			✓	
United States	✓					✓

A4.2 Kenneth French's Emerging Market Countries

Table A4.2: Kenneth French' division of countries into Emerging Markets

Country	Emerging
Argentina	✓
Brazil	✓
Chile	✓
China	✓
Colombia	✓
Czech Republic	✓
Egypt	✓
Greece	✓
Hungary	✓
India	✓
Indonesia	✓
Malaysia	✓
Mexico	✓
Pakistan	✓
Peru	✓
Philippines	✓
Poland	✓
Qatar	✓
Russia	✓
Saudi Arabia	✓
South Africa	✓
South Korea	✓
Taiwan	✓
Thailand	✓
Turkey	✓
United Arab Emirates	✓

A4.3 Assigning Countries to Factor Sets

Table A4.3: Division of countries into Factor Sets

Factor Set	Countries
Asia Ex Japan	Australia, Hong Kong, Israel*, New Zealand, Singapore
Emerging	Argentina, Bahamas*, Bahrain*, Bermuda*, Brazil, British Virgin Islands*, Cayman Islands*, Chile, China (Mainland), Colombia, Curacao*, Czech Republic, Egypt, Hungary, India, Indonesia, Jordan*, Kazakhstan*, Kuwait*, Liberia*, Malaysia, Marshall Islands*, Mauritius*, Mexico, Nigeria*, Oman*, Pakistan, Panama*, Papua New Guinea*, Peru, Philippines, Poland, Puerto Rico*, Qatar, Russia, Saudi Arabia, South Africa, South Korea, Sri Lanka*, Taiwan, Thailand, Turkey, Uganda*, United Arab Emirates, Vietnam*, Zimbabwe*
Europe	Austria, Belgium, Cyprus*, Denmark, Faroe Islands*, Finland, France, Germany, Gibraltar*, Greece, Guernsey*, Iceland*, Ireland, Isle of Man*, Italy, Jersey*, Luxembourg*, Malta*, Netherlands, Portugal, Romania*, Spain, Sweden, Switzerland, United Kingdom
North America	Canada, United States
Japan	Japan

*Note: Countries marked with * indicate that the country is not assigned to a factor set by Kenneth R. French. Accordingly, we made assumptions for these countries based on the UN Country Classification (Nations, n.d.)*

A5 Factor Calculations of Additional Factors

Calculation Size-Adjusted Factors We Chose to follow NBIM's Approach on Factor and Risk-adjusted Return calculation(Norges Bank Investment Management, 2020b) and therefore constructed additional size-based factors as average component returns, only using factor portfolios classified as 'Big' in Kenneth French's data library. This approach corresponds to only focus on the top 90 % of market cap stocks of each region. We used the six portfolios French created on size and operating profitability, size and investment, size and book-to-market and Size and momentum as a basis for the size-adjusted factors. We calculated monthly, size-adjusted factors for all applied factor sets we retrieved from Kenneth French's Data Library (French, 2021a), i.e., the Europe factor set, Asia Ex Japan factor set, Japan factor set, Emerging factor set and North America factor set. In the following we present the calculations of these size-adjusted factors.

High Minus Low 'big' ($\mathbf{HML}_{big}$)

$$HML_{big,t} = 1 * (BIG\_HiBM_t) - 1 * (BIG\_LoBM_t) \tag{.5}$$

Where BIG_HiBM_t is the return on the big value portfolio in month t, and BIG_LoBM_t is the return on the big growth portfolio in month t, retrieved from Data Library. (French, n.d.-b).

Robust Minus Weak 'big' ($\mathbf{RMW}_{big}$)

$$RMW_{big,t} = 1 * (BIG\_HiOP_t) - 1 * (BIG\_LoOP_t) \tag{.6}$$

Where BIG_HiOP_t is the return on the big robust operating profitability portfolio in month t, and BIG_LoOP_t is the return on the big growth portfolio in month t, retrieved from Data Library (French, n.d.-d).

Concervative Minus Aggressive 'big' ($\mathbf{CMA}_{big}$)

$$CMA_{big,t} = 1 * (BIG\_HiINV_t) - 1 * (BIG\_LoINV_t) \tag{.7}$$

Where BIG_HiINV_t is the return on the big conservative investment portfolio, and BIG_LoINV_t is the return on the big aggressive investment portfolio in month t, retrieved from Data Library. (French, n.d.-c).

Winners Minus Losers 'big' ($\mathbf{MOM}_{big}$)

$$MOM_{big,t} = 1 * (BIG\_High_t) - 1 * (BIG\_Low_t) \tag{.8}$$

Where BIG_High_t is the equal-weight average of the returns for the big 'winner' portfolio in month t, and BIG_Low_t is the equal-weighted average of returns of the big 'loser' portfolio in month t, retrieved from Data Library. (French, n.d.-e).

A5.1 Calculation ESG factor

We calculated the ESG factor (GMB) based on the companies in our sample on which we had available ESG scores. As described in section 3.5.3, we constructed the GMB factor based on a 'good' and a 'bad' portfolio, which we created by value-weighting the annual returns of the companies with the top 70 % best ESG scores and bottom 30 % worst ESG scores, respectively. Then, we converted the annual returns for the 'good' and the 'bad' companies into monthly adjusted returns, by using the formula below.

$$r_{annual,t} = (1 + r_{monthly})^{12} - 1 \tag{.9}$$

Where:

r_{annual} = Annual return in year$t$ $r_{monthly}$ = Monthly return

Finally,the GMB portfolio, which constitues the GMB factor was calculated by subtracting the monthly returns of the 'bad' portfolio from the monthly returns of the 'good' portfolio. The calculation is shown in the equation below.

$$GMB_t = r_{G,t} - r_{B,t} \tag{.10}$$

Where:

GMB_t = The GMB factor for month t

$r_{G,t}$ = The value-weighted return of the 'good' portfolio in month t

$r_{B,t}$ = The value-weigthted return of the 'bad' portfolio in month t

A6 ESG and Returns Extra Material

Table A6.1: Hypothetical GMB portfolio average monthly return

Year	GMB return	ESG risk premium
2008	(0.538)	"Yes"
2009	0.409	"No"
2010	(1.249)	"Yes"
2011	(0.486)	"Yes"
2012	0.854	"No"
2013	0.729	"No"
2014	(1.312)	"Yes"
2015	(0.574)	"Yes"
2016	0.451	"No"
2017	0.169	"No"
2018	(0.732)	"Yes"
2019	0.733	"No"
2020	0.101	"No"

Note: Numbers in parenthesis indicate negative returns for the GMB portfolio.