Norwegian School of Economics
Stavanger, Spring 2023

Negative ESG Screening and Investment Returns

A Study of the Norwegian Oil Fund and Excluded Stocks

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Master's Thesis - Economics and Business Administration
Major: Financial Economics & Energy Natural Resources and the Environment

Norwegian School of Economics

Acknowledgments

This thesis represents the culmination of our Master's degree in Economics and Business Administration at the Norwegian School of Economics (NHH), with majors in Financial Economics (FIE) and Energy, Natural Resources and the Environment (ENE).

We found the topic in our thesis an exciting and great opportunity to investigate something fitting for both our majors. We got to utilize our strengths in different parts of our thesis, forming what we consider to be a great partnership. Through the progression of this thesis, we have gained more knowledge within both fields.

First and foremost, we would like to express our gratitude to our supervisor, Svein-Arne Persson, whose guidance and support have been instrumental throughout completing this Master's thesis. Furthermore, we would like to sincerely thank our families and friends for their continuous support and patience. Their encouragement and understanding have been a constant source of motivation throughout this project. We are profoundly grateful for their support.

Lastly, we would like to acknowledge the Norwegian School of Economics (NHH) for providing us with a comprehensive education that has equipped us with the knowledge and skills necessary for our future careers.

To everyone who has played a role, big or small, in completing this Master's thesis and our education, we extend our heartfelt gratitude. Your support, guidance, and encouragement have been indispensable, and we are immensely grateful for your positive impact on this academic journey.

Norwegian School of Economics

Stavanger, June 2023

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Abstract

This thesis investigates whether there is a difference in stock returns for the Norwegian Oil Fund and the companies they exclude from their investment universe due to breaches of their ethical guidelines between 2006 and 2022. We analyze the returns from the excluded companies and the Oil Fund with the Fama-French five-factor model and split the excluded stocks into sub-portfolios to investigate if there is a difference in returns for sectors, markets and reason for exclusion. In addition to previous work, we also investigate if there is a correlation between the yearly returns and the ESG score for the excluded companies and the 100 largest companies in the Oil Fund measured by investment size.

In line with previous research, our findings suggest that the excluded companies have outperformed the Oil Fund between 2006 and 2022. Moreover, eight out of nine sub-portfolios deliver excessive returns compared to the Oil Fund. We find that ESG scores and yearly returns are positively correlated for the excluded companies and negatively correlated for the 100 largest companies in the Oil Fund.

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1.0 Introduction

Climate change and the need to protect our planet and its inhabitants have gained increased attention in recent years. As a result, sustainable business models and Environmental, Social, and Governance (ESG) considerations have become critical practices for evaluating the sustainability of business operations. Companies prioritizing sustainability and demonstrating positive ESG performance are perceived as better positioned for long-term success, as they mitigate risks and capture opportunities arising from shifting consumer preferences and regulatory changes (Henisz et al. 2019).

Nevertheless, it is essential to acknowledge that not every organization adheres to sustainable practices. Particular industries and corporations have been linked to detrimental environmental, social, governance, and ethical consequences. Commonly known as "sin stocks", these companies operate within sectors such as tobacco, alcohol, weaponry, and gambling, and are frequently considered contentious from an ESG standpoint. The Norwegian Government Pension Fund Global (referred to as “the Oil Fund” in this thesis), one of the world's largest sovereign wealth funds, has been a prominent player in the field of ESG investing. The Oil Fund has excluded sin stocks from its investment portfolio based on specific rules and criteria for investing. With this strategy, the Oil Fund ignores the potential financial upsides in sin stocks in favor of the ESG perspective.

The financial performance of sin stocks is a topic of debate. While these companies may be excluded from investment portfolios due to ethical concerns, research suggests they do not necessarily underperform financially (e.g., Eide & Haugen, 2022: Fabozzi et al., 2008). On the other hand, other studies have found that there is a positive correlation between ESG and financial returns and higher value creation (e.g., Friede et al., 2015: Henisz et al., 2019). This raises an important question about the potential trade-offs between ethical considerations and financial performance in the context of negative ESG screening.

The main objectives of this thesis are twofold. Firstly, we aim to investigate the financial performance of the excluded companies from 2006 to 2023 and compare it to the performance of the Oil Fund to find out if their strategy is harmful or beneficiary from a financial point of view. We will conduct this analysis at the sector level and across developed and emerging markets to comprehensively assess the potential financial impact of excluding sin stocks from the investment portfolio. To evaluate the results, we will employ the Fama-French five-factor model, which considers factors such as size, value, profitability, and investments. This model will be used to attribute the returns to various risk factors that may influence the performance of the excluded companies and the Oil Fund. This leads us to our first research question:

Is there a significant difference in financial returns between the Oil Fund and the companies they exclude from their portfolio?

Secondly, we will delve into key financial metrics of the excluded companies and the 100 biggest companies in the Oil Fund based on investment size, including market capitalization, profits, yearly returns, and ESG scores. In our analysis, we will explore the correlations between these financial metrics and ESG scores to gain insights into the factors determining the ESG performance and financial performance of the excluded companies. We also apply the same regression models to a portfolio containing the 100 largest companies in the Oil Fund, measured by investment size. This is done to investigate if there are any different dynamics between these key financial metrics for sin stocks and for large corporate institutions. This analysis will help us better understand the potential relationships between financial metrics and sustainability in the context of negative ESG screening, leading to our second research question:

What is the relationship between ESG scores and returns over time in our portfolios? Is there a difference between the 100 largest companies in the Oil Fund and the excluded companies?

Our thesis seeks to expand the research of Eide and Haugen (2022) and Berle et.al. (2022), both finding excessive returns for the excluded companies from the Oil Fund. We expand their research by examining what might drive the returns and ESG scores of the excluded companies compared to the 100 biggest companies in the Oil Fund. By addressing these two objectives, this thesis aims to provide valuable insights into the financial implications and determinants of negative ESG screening, using the Oil Funds' exclusion of sin stocks as a case study. Through a rigorous examination of financial performance, ESG considerations, and ethical investing, this research seeks to contribute to the growing body of literature on sustainable investing. We aim to provide useful information for investors, policymakers, and other stakeholders interested in incorporating ESG factors into their investment decision-making processes.

2.0 Theory and Background

This chapter will start by presenting the concept of ESG and negative ESG screening. Secondly, we will introduce the Oil Fund and present their strategy for responsible investing in more detail.

2.1 ESG and Responsible Investment

Responsible investment is described by the UN as "considering environmental, social and governance (ESG) issues when making investment decisions and influencing companies or assets (known as active ownership or stewardship). It complements traditional financial analysis and portfolio construction techniques." (United Nations Principles of Responsible Investments, n.d.). In other words, it is a term accounting for non-financial measures that positively affect society and the planet. The idea behind responsible investment has been around for a long time. MSCI (n.d.a) claims that socially responsible investing dates back to the 1960s, when investors excluded companies and entire industries from their portfolios, participating in activities like tobacco production and apartheid in South Africa. Although MSCI is right about the origin of modern time responsible investing, others believe it can be dated back to the 1700s when a religious society abstained from slavery and human trafficking (Corporate Finance Institute, 2023). Although not a new concept, responsible investment has gained significant attention in recent years due to global concerns such as the climate crisis and social issues. The European Union has launched several regulatory measures to drive businesses in a more sustainable direction (EU, n.d.). At the same time, in 2015, the UN adopted the Sustainable Development Goals (SDGs) as a guiding framework toward a more sustainable planet (United Nations Development Programme, n.d.).

As for the financial world, ESG has become an important topic to discuss when making responsible investment decisions. According to PwC (2022), global sustainable assets accumulated 18.4 trillion dollars in 2021, predicted to rise further to 33.9 trillion dollars, 21,5 % of all assets under management in 2026. Bloomberg Intelligence however, states that ESG assets were accumulated to 35 trillion dollars in 2020 and may surpass 50 trillion in 2025 (Bloomberg, 2021).

2.1.1 ESG

ESG is a comprehensive framework that enables stakeholders to gain insight into an organization's management of environmental, social, and governance criteria, which includes both risks and opportunities. Essentially, ESG goes beyond environmental concerns and encompasses a broader sustainability perspective (Peterdy, 2023). According to Forbes (Kell, 2018), the history of ESG can be traced back to 2004 when the UN secretary, Kofi Annan, invited CEOs of over 50 big financial institutions to jointly participate in an initiative launched by the UN Global Compact. The mission of the initiative was to integrate ESG into capital markets. The initiative resulted in the article “Who cares wins”, authored by Ivo Knoepfel (2004), which is considered to be the origin of ESG (Kell, 2018). Since then, the term has become one of the most discussed topics in the financial world. Based on data from Google Trends (n.d.), it is evident that the topic of ESG has gained increased attention since 2004. However, the interest in ESG has notably surged from 2015 and onwards, as demonstrated by a significant spike in online searches related to this topic. Several ESG scoring systems and frameworks have been launched to assess a company's ESG performance. Nevertheless, the lack of standardization is a criticism against ESG, with over 140 companies in the US alone offering ESG scoring, each utilizing different methodologies for calculating scores (Lucas, 2022). Notably, prominent providers such as MSCI, Refinitiv and Bloomberg are recognized for their ESG ratings (Armanino, 2022). This diversity in assessment approaches adds complexity and variability to the field of ESG evaluation.

Although the score providers measure the ESG scores differently, a general approach to evaluating ESG scores involves analyzing an organization’s corporate disclosures, conducting management interviews, and reviewing publicly available information. These steps are taken to produce an unbiased evaluation of the company’s performance (Miller, 2022).

Refinitivs’ ESG rating is described as a “Transparent, data-driven assessment of companies’ relative ESG performance and capacity, integrating and accounting for industry materiality and company size biases”. The scores are calculated by key principles for each letter in the ESG abbreviation and range from 1-100. Under Environmanetal (E), resource use, emissions, and innovation are measured. Social scores (S) are measured by the workforce, human rights, community and product responsibility, while the fundamental principles under Governance (G) are management, shareholders, and CSR strategy (Refinitiv, 2022). A brief overview of this is illustrated in Figure 2.1.

Figure 2.1 ESG Calculation Category Model

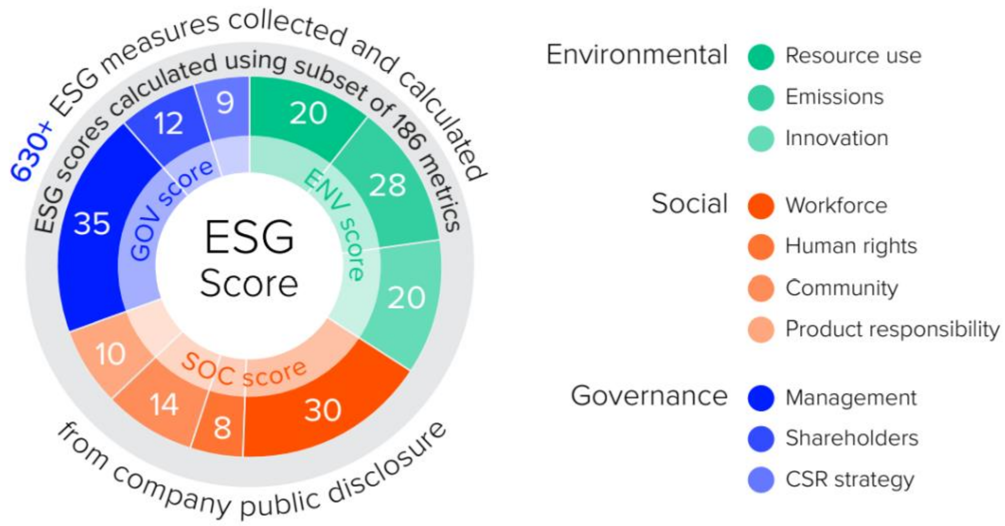


Figure 2.1 shows the Calculation Category model from Refinitiv (2022). This illustration describes the fundamental principles contributing to calculating Refinitiv's ESG Score and how many metrics are within each letter in the ESG abbreviation and the subcategories.

Investors employ various strategies to incorporate ESG factors into their investment decisions. State Street Global Advisors (SSGA) identifies five approaches: positive ESG screening, negative ESG screening, ESG integration, active ownership and impact investing (Kumar et al., 2018). The Oil Fund employs several of these strategies. However, this thesis will focus on the exclusionary screening strategy, wherein the Oil Fund excludes certain companies from their portfolio and reference index. Table 2.1 provides detailed information on the different ESG strategies.

Table 2.1 ESG Strategies

	EXCLUSIONARY SCREENING	POSITIVE SCREENING	ESG INTEGRATION	IMPACT INVESTING	ACTIVE OWNERSHIP
DEFINITION	Excludes, from the investment universe, companies, sectors or countries involved in activities that do not align with the moral values of investors or with global standards around human rights, labor practices, the environment and anti-corruption	Tilts portfolio toward one of following: **Best in class:** companies outperforming peers in ESG measures **ESG momentum:** companies improving ESG measures more quickly than peers **Thematic investing:** companies solving specific ESG challenges (climate change, gender diversity, etc.)	Incorporates ESG data, alongside traditional financial analysis, into the securities selection process	Targets a measurable positive social and/or environmental impact. Investments are generally project specific	Entails engaging with companies and voting company shares on a variety of ESG issues to initiate changes in behavior or in company policies and practices
COMMON OBJECTIVES	**Align** portfolios with investors' moral and ethical values **Mitigate** ESG risks **Influence** a company to change its business model or stop an objectionable practice	**Mitigate** ESG risks **Achieve** higher returns **Support** a business model that aims to solve an environmental or social problem **Improve** or maximize a portfolio's ESG score	**Mitigate** ESG risks **Achieve** higher returns	**Generate** and measure specific social and/or environmental benefits that align with purpose	**Influence** company strategy for long-term value creation **Help** company management capture value by mitigating risk or seeking opportunities **Advance** ESG disclosure and practices
INVESTMENT CONSIDERATIONS	Introduces tracking error and potentially impacts performance	Securities selection is based predominately on ESG scores and ratings. Sourcing quality ESG data remains a challenge	Sourcing quality ESG data remains a challenge. Securities selection is based on quantitative and qualitative assessment of ESG factors, requiring analyst expertise. A long-term mindset is necessary as it is difficult to time the occurrence of a negative event resulting from an ESG issue	Investments may be illiquid and investment returns could aim to be at or above the market rate	A significant ownership stake is needed to exert influence. Substantial resources are also needed to engage with companies. Active ownership is crucial for index strategies
IMPACT CONSIDERATIONS	Generally can't impact companies in which you don't own shares, but well-coordinated divestment campaigns can be effective	Rewards companies that have higher ESG scores with capital. Impact is generally targeted around specific sectors or themes (e.g. climate change, gender diversity, etc.)	No deliberate impact strategy as the primary objective is to achieve higher returns and/or mitigate ESG risks	Impact is highly targeted on specific outcomes	Broad impact due to continued engagement with company management on ESG issues
EXAMPLES	Equity fund that excludes companies that generate more than 5% of their revenue from the sale of tobacco products	Equity fund that invests in oil & gas companies deemed to be least carbon intensive	Actively managed fixed income fund that considers ESG issues during the securities selection process	Community investment fund that provides micro financing to low-income or disadvantaged communities	Could apply to any fund (including those not tagged as ESG funds) where the asset manager or asset owner is committed to active ownership

Table 2.1 presents the five different ESG strategies identified by SSGA (Kumar et al., 2018). It includes the definition of each strategy, common objectives, investment considerations, impact considerations and examples of each strategy.

2.1.2 Negative ESG Screening

The term negative ESG screening is described by Eccles et al. (2022) as "the process of finding and excluding stocks of companies, whose operations are seen as "unsustainable" from an environmental, social and governance (ESG) standpoint". At what point a stock is considered unsustainable by asset managers and investors can differ from one to another, depending on different standards, principles, or other guidelines for responsible investing within the firm. Due to this, it is not agreed on a precise definition of what an unsustainable stock is. However, stocks that are related to or involved in industries such as alcohol, tobacco, gaming, and fossil fuels are typically considered unsustainable stocks, often referred to as sin stocks (Eccles et al., 2022). David Blitz & Laurens Swinkels (2021) also includes the gambling, weapon, and adult entertainment industries as sin stock industries.

2.2 The Norwegian Oil Fund

The Norwegian Government Sovereign Wealth Fund, more commonly known as the Oil Fund, was established to manage the revenues from oil and gas responsibly. The government's objective was to protect the economy from fluctuations in oil revenue, saving for future generations, and build a robust financial reserve (NBIM, 2019a). Given that oil is a non-renewable energy resource, the Oil Fund aims to prepare for the day when oil extraction will eventually cease and safeguard the future economy of Norway. Within its mandate, the Oil Fund is limited to not invest anything within the Norwegian market (Mandat for forvaltningen av Statens pensjonsfond utland, 2010, §2-1), in order to prevent overheating the economy and to avoid a resource curse.[1]

Since its inception in 1996, the Oil Fund has grown to more than 14 000 billion NOK (NBIM, n.d.a), making it the second largest sovereign wealth fund in the world as of December 2022, surpassed only by the China Investment Corporation (Statista, 2022). The Oil Fund is invested in over 9,000 companies worldwide, representing approximately 1.5% of all global stocks (NBIM, 2019a).

The Oil Fund is a significant contributor to the welfare of Norway, funding nearly 20% of the government's annual budget (NBIM, 2019a). However, only 3% of the fund is utilized yearly for this purpose. This is because of "The Budgetary Rule", which was implemented by the government in 2002 to safeguard the fund's real value. This rule dictates that the government should only utilize 3% of the fund annually, in accordance with the expected real returns for that year (Ministry of Finance, n.d.).

2.3 Responsible Investment in the Oil Fund

The Oil Fund states their mission is to "safeguard and build financial wealth for future generations" (NBIM, n.d.b). As part of their responsible investment strategy, they implement a risk-reducing diversification approach involving a broad investment range (NBIM, 2019a). The fund is committed to long-term value creation (LTVC) and actively exercises its voting rights in portfolio companies to ensure responsible business practices (NBIM, 2019b).

[1] "The term resource curse refers to a paradoxical situation in which a country underperforms economically, despite being home to valuable natural resources." (Fernando, 2022).

Additionally, they strive to mitigate the risks associated with their investments' environmental and social practices (NBIM, n.d.b). CEO Nicolai Tangen strongly advocates ESG, referring to it as common sense rather than politics in the Oil Funds annual report on responsible investment for 2022 (NBIM, 2022a).

2.3.1 Standards

The fund follows international standards related to corporate governance and functional markets. They actively participate in developing and enhancing these standards to keep up with the ever-evolving societal demands. The portfolio companies are made aware of these standards, and they are also publicly available on the NBIM website (NBIM, 2022b). These standards are divided into various categories that align with the Sustainable Development Goals (SDGs). The categories encompass various topics, such as climate change, human and child rights, anti-corruption measures and more (United Nations Principles of Responsible Investments, n.d.).

2.3.2 Ethical Guidelines for Exclusion and Observation

Earlier, the Ministry of Finance was responsible for deciding on exclusions from the Oil Funds investment universe. However, since 2015, this authority has been delegated to the executive board of the central bank of Norway. The board receives recommendations from the Council of Ethics, which employs established guidelines to assess relevant companies and form their recommendations. Both the council and the guidelines are established by the Ministry of Finance (NOU 2020:7).

The ethical guidelines aim to prevent the Oil Fund from investing in companies that engage in or support severe breaches of fundamental ethical norms outlined by the Norwegian Government (Regjeringen, 2021). Companies that do not meet these ethical norms can either be excluded from the Oil Funds investment portfolio and reference index or placed on an observation list for further assessment.

Before deciding between observation and exclusion, the executive board of the central bank of Norway conducts a thorough assessment to determine if active ownership can be an effective tool to reduce the risk of further violations of the guidelines (NOU 2020:7, p.4). Through active ownership, the Oil Fund aims to engage with companies and influence them to change their business models or conduct to align with societal ethical norms. As the Oil Fund is a significant investor in the companies they invest in, the risk of being on an observation list or even excluded can serve as a powerful incentive for companies to meet the Oil Fund's expectations (NOU 2020:7, p.4).

The criteria for exclusion and observation are split into two main categories, conduct-based and product-based. Conduct-based exclusions are, for example, based on violation of human rights or rights of individuals in a war or conflict, sale of weapons or military material to states that use this material in ways that conflict with international rules, severe environmental damage and financial crime (Regjeringen, 2021).

Product-based exclusion or observation is applied to companies that, through themselves or entities they control, sell or develop products of categories such as tobacco, cannabis and weaponry that violate fundamental humanitarian principles, and more (Regjeringen, 2021). Additionally, in February 2016, a new rule explicitly targeting coal-producing companies was introduced. The aim was to exclude companies heavily invested in the coal industry from their investment universe. This led to the exclusion of 52 companies in April 2016 (NBIM, 2016). A regulatory adjustment in 2019 led to introducing even more stringent guidelines against coal companies. The rule set specific criteria for exclusion, including companies that derived more than 30% of their income or based more than 30% of their operations on thermal coal. Additionally, companies that extracted more than 20 million tonnes of thermal coal annually or could generate electricity of more than 10 000 MW from thermal coal were also excluded. (NOU 2020:7: pp. 10-11; Regjeringen, 2021)

As of March 2023, 188 companies are on the exclusion list. Twenty-two are currently being observed, while the remaining 166 companies have been excluded from the Oil Fund (NBIM, n.d.c.). Exclusions can be revoked if the companies change their activities and business models to align with the guidelines and standards.

3.0 Literature

The literature chapter presents various studies on the consequences of ESG related investment strategies and the performance of sin stocks. We begin by presenting the proliferation of academic studies that have explored the relationship between ESG and financial performance, with contradictory findings, before we present literature criticizing ESG.

3.1 Effects of Negative ESG Screening

The surge of interest in ESG has led to many academic studies exploring the link between sustainable investing and financial performance. A meta-study conducted by Gunnar Friede et al. (2015) examined over 2000 empirical studies from the early 1970s, exploring the correlation between ESG/CSR (Corporate Social Responsibility) and CFP (Corporate Financial Performance). Approximately 90% of these studies found a non-negative correlation between ESG and CFP, with most indicating a positive correlation (Friede et al., 2015). The researchers utilize two approaches in their analysis: a meta-analysis and a vote count study, which categorized the results by significance (Positive, negative or non-significant). The category with the highest share is considered the "winner". While the vote count methodology is relatively simple compared to more complex methodologies like a meta-analysis, it indicates trends in the findings (Friede et al., 2015). Surprisingly, both approaches yielded comparable results for the researchers, learning them to argue that there is a "business case for ESG investing" (Friede et al., 2015).

The findings from the meta-study are supported by Moinak Maiti's research (2020), which employed a three-factor Fama-French model incorporating ESG as a factor and found that ESG significantly contributes to financial performance. Maiti also constructed models with the letters from the ESG acronym included as stand-alone factors. The environmental and social factors showed significant results, and the governance factor was insignificant. Maiti's study concluded that portfolios formed on higher Sharpe ratios for ESG factors tend to exhibit better financial performance than traditionally formed portfolios (Maiti, 2020). Similarly, other studies by Clark et al. (2015) and Qureshi et al. (2021) have also suggested that ESG can positively impact financial performance.

There are also suggestions Furthermore, Henisz et al. (2019) suggest that ESG leads to higher value creation, arguing that a strong ESG proposition correlates with higher returns, reduced downside risk, lower loans, and higher credit ratings. Additionally, they claim firms that make significant investments for longer-term payoffs (which one can consider ESG investments to be), tend to have future cash flows that are less discounted by investors compared to firms that invest a smaller proportion of their cash into such projects. Based on this, they argue that businesses must prioritize a long-term approach and cater to the requirements of their customers, employees and communities. This can lead to greater employment opportunities, increased tax revenues and an enhanced standard of living (Henisz et al., 2019).

Despite the evidence suggesting a positive relationship between ESG scores and financial performance, some studies present contrasting findings. For instance, Fabozzi et al. (2008) conducted a study in which they created a portfolio of sin stocks and compared its performance to common benchmark indexes across different countries and industries. The portfolio of sin stocks generated an annual return of 19%, outperforming the benchmark indexes (Fabozzi et al., 2008). The researchers argued that firms might find maintaining the standards required for a favorable ESG performance costly. They highlighted that sin stocks could gain economic value by not prioritizing such measures.

Eide & Haugen (2022) conducted a study examining if the excluded companies from the Oil Fund deliver excessive superior returns. They divided the companies into portfolios based on different criteria, finding significant alphas for most portfolios. Their study confirms findings from Berle et al. (2022) which also found significant alphas for the excluded companies.

Similarly, Søren Hvidkjær (2017) published a literature review on ESG investing, concluding that sin stocks tend to outperform benchmarks in the short run, suggesting that screening and exclusion strategies may lower expected portfolio returns. However, Hvidkjær also found that high ESG scores exhibit high future returns in the long run, indicating that ESG performance could positively impact financial performance over time.

Furthermore, a meta study conducted by Whelan et al. (2021) surveyed more than 1000 primary peer-reviewed papers and 27 meta-reviews and found that ESG investing did not outperform other investing strategies on average. Nevertheless, they did not report any negative consequences of ESG investing and suggested that some ESG strategies perform better than others. They found that ESG integration strategies perform better than screening and divesting, and that decarbonization strategies can capture climate risk premiums.

3.2 Effects of Changes in ESG score

A study conducted by Savva Shanaev and Binam Ghimire (2022) examined the effects of changes in ESG ratings on stock returns for publicly traded firms in the US that were rated by MSCI between 2016 and 2021. They used the calendar-time portfolio approach, which involves forming monthly portfolios that include firms affected by an event in the prior month (IGI Global, 2022). In this case, changes in ESG ratings as updated by MSCI monthly. This approach allows assessing the effects of changes in ESG ratings from one month to another.

The study's findings revealed small and sometimes non-significant positive abnormal returns associated with upgrades in ESG ratings, suggesting that when firms experience an improvement in their ESG ratings, their stock returns tend to show a modest positive effect. Furthermore, the study also found that the positive effects of changes in ESG ratings were more substantial for the top-performing firms in terms of ESG performance. This suggests that firms with high ESG performance tend to benefit more from upgrades in ESG ratings. On the other hand, downgrades in ESG ratings were found to lead to negative abnormal returns ranging from -1% to -1.4%, implying that when firms experience a decline in their ESG ratings, their stock returns tend to show a negative impact (Shanaev & Ghimire, 2022).

3.3 Criticism of ESG

Although widely acknowledged as a crucial aspect of sustainable development in the financial sector and in society, ESG has also faced criticism from various groupings. Pérez et al. (2022) delineate four categories of criticism. Some scholars argue that ESG may serve as a distraction, echoing Milton Friedman's famous assertion that "The social responsibility of business is to increase its profits" (1970). These critics believe ESG measures may be seen as peripheral to a company's core strategy, used primarily for branding purposes rather than being integrated into overall business strategies. This view is supported by a survey conducted by Endelman (2021) that revealed that 72% of investors are skeptical about companies fulfilling their ESG commitments, lending credence to the idea of ESG being seen as green-[2] or woke-washing.[3]

Another criticism of ESG is its perceived complexity and implementation challenges. Balancing the goal of maximizing profits and considering ESG measures can create conflicts of interest between shareholders and a broader range of stakeholders. These conflicts may require trade-offs that could result in suboptimal value creation for all stakeholders involved. Moreover, questions arise about allocating ESG resources, as determining the best recipients among customers, suppliers, employees, or environmental causes may present challenges (Pérez et al., 2022).

Furthermore, Pérez et al. (2022) argue that it is not possible to establish a causal relationship between ESG performance and financial performance. They suggest that other factors, such as industry, head- or tailwinds, could explain the correlation between the two. While several meta-studies have suggested a positive correlation, none of these have been able to pinpoint the reasons for the correlation (Pérez et al., 2022). This amplifies their suggestion that there are other irrelevant and external factors that explain the correlation.

Critics also argue that ESG is challenging to measure, especially as an aggregate score. There are numerous ESG frameworks, such as those from the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), the Task Force on Climate-Related Financial Disclosures (TCFD), and the Carbon Disclosure Project (CDP), which all measure ESG in different ways. A study from MIT found that the correlation between six of the largest rating agencies was only around 60% on average. To put this into perspective, credit rating agencies Moody's and S&P correlated at 99% (Stackpole, 2021). In an effort to establish more consistent ways of measuring ESG, MIT has launched the Aggregate Confusion Project, which aims to improve the quality and consistency of ESG measurements (MIT Sloan Sustainability Initiative, n.d.).

[2] "The act of providing the public or investors with misleading or outright false information about the environmental impact of a company's product and operations." (Hayes, 2023)

[3] "Term used to define practices in business that provide the appearance of social consciousness without any of the substance." (Howard, 2021)

4.0 Data Construction and Selection

In this chapter, we present the data used for our analysis. We begin by outlining how we proceed to retrieve the data. Subsequently, we describe how we organize and group the data into sub-portfolios. Additionally, we specify where we collect the data needed to apply the Fama-French five-factor model. Finally, we address the limitations associated with our dataset.

4.1 Retrieving Excluded Firms From The Oil Fund

The initial approach to our data construction and selection is to create a portfolio with the excluded companies from the Oil Fund. We collect a list of the excluded companies from the Oil Funds websites. The list contains the name of the company, date of exclusion and exclusion criteria, and categorizes the exclusions as either product-based or conduct-based (NBIM, n.d.c). The website contains hyperlinks to publications on each excluded company, including recommendation letters from the Council of Ethics. From these letters, we retrieve the size of the investment made by the Oil Fund in the company prior to the exclusion date. The investment size is used to determine the weighting of the portfolios. This method is applied to ensure that we capture the most accurate value of the investments, avoiding a potential investment that was influenced by the process of divesting by the Oil Fund. We are not able to find the investment size for all companies in the recommendation letters. In such cases, we access the website where all portfolios dating back to the origin of the Oil Fund in 1998 are available (NBIM, n.d.d). We collect the last available investment size of the company within these portfolios prior to the exclusion date.

Some excluded companies are removed from our dataset for various reasons, as stated in Appendix A.1. The most prominent reason is that we do not find any historical investment sizes on these companies within the Oil Fund. We do not include them in our portfolio, as it would affect the weighting of the portfolios without accurate investment sizes. We do not consider companies previously excluded from the Oil Fund and later readmitted. We also include companies currently being observed as part of our portfolio because these also can be considered sin stocks. The portfolio will be referred to as the excluded companies even though we add observed companies. Our analysis focuses exclusively on the companies that are excluded as of 31.12.2022.

Once all data is gathered and our portfolio of excluded companies is defined, we collect monthly stock prices for each company from 01.01.2006 to 31.12.2022. We use Refinitivs Workspace, a reliable financial platform that offers a wide range of tools and services for professionals in the finance industry, to gather this data (Refinitiv, 2023). We also gather descriptive information from this database, such as economic sector and country of exchange. Additionally, we collect market capitalization, profits and ESG scores for all companies.

The excluded companies and the corresponding data are added to our portfolio one month after their respective exclusion date from the Oil Fund. We use data from the remaining months of the year of exclusion to calculate annualized averages of the different metrics. For instance, if a company is excluded in September, the yearly averages are calculated based on data from October, November and December. If a company was excluded in December 2011, we do not include data from that year but start collecting data from January 2012 and onwards.

A part of the analysis is to compare the effects ESG Scores and returns have on each other. Moreover, we want to determine if the effect differs for the excluded companies and the Oil Fund. As there are more than 9000 companies in the Oil Fund, we do not collect data for all of them. As a sample, we gathered data for the 100 largest companies in the Oil Fund's holdings. The portfolio of the 100 biggest will only be used in the regression analysis where we investigate the correlation between ESG score and returns. We chose the 100 biggest companies in the Oil Fund instead of 100 random companies to have a sample of companies we know have performed well over the period we analyze. These are mainly companies that are taking their ESG score seriously. We collect yearly returns, market capitalization, profits and ESG scores from 2006 to 2022 for the 100 biggest companies. By comparing a portfolio that has performed financially well and has good ESG scores with the portfolio of excluded companies where we have indications of low ESG scores, we can find answers to if the dynamics between ESG scores and returns are different for the two portfolios.

The Oil Fund bases its benchmark index on indices from the FTSE group and Bloomberg Barclays Indices (NBIM, 2022c). This index will hereafter be referred to as the "Benchmark" or "Benchmark Index". Further, in line with our research question, for the constructed portfolios in this thesis, we will simply use the Oil Fund as the benchmark, as we seek to find excessive returns in these portfolios in relation to the Oil Fund. We retrieved monthly returns for the Oil Fund and the benchmark from the websites of the Oil Fund (NBIM, 2022d).

Our first analysis uses monthly returns and descriptive information as input, while our second analysis uses yearly returns, market capitalization, profits and ESG scores. The portfolio of the excluded companies is applied in both analyses, but the portfolio of the 100 biggest companies is applied only in our second analysis.

4.2 Selection of Portfolios

4.2.1 Sectors

To uncover if excluded sin stocks perform better than the Oil Fund in relation to the benchmark, we create sub-portfolios of excluded companies based on different economic sectors. As a minimum criterion, we require our sub-portfolios to include ten or more companies. All sectors are presented in Table 4.1.

Similar to Eide & Haugen (2022), we base our sectors on the classification system "The Refinitiv Business Classification" (TRBC). TRBC is a market-based classification system, meaning that the classification is tied to the market companies operate in, rather than the product or services offered. Refinitiv exemplifies this by stating that an airline catering company will not be classified as restaurants and catering but rather as an airline service because of the correlation between the financial performance of the company and the market for airline services (Refinitiv, 2020). As described by ETF (2015), this is an appropriate fit for selecting the correct sectors due to a more robust process in determining the company's sector classification compared to its peers (ETF, 2015).

When the companies are sorted into sectors, we find that five of the sectors have less than ten companies. Thus, we do not construct any portfolios on these due to the limitations of minimum ten companies within the portfolio, leaving out consumer cyclicals, financials, healthcare, real estate and technology.

Table 4.1 Sector Distribution

Sector Distribution	
Basic Materials	16
Consumer Cyclicals	8
Consumer Non-Cyclicals	17
Energy	17
Financials	1
Healthcare	6
Industrials	27
Real Estate	2
Technology	2
Utilities	64
Total	**160**

Table 4.1 presents which economic sector the excluded companies are operating in as classified by the TRBC classification system.

4.2.2 Markets, Product- and Conduct-based Portfolios

We create sub-portfolios dividing the companies into either developed or emerging markets. The classification of emerging and developed markets is based on the country of the company and is done in line with the Equity Country Classification of FTSE (FTSE, 2021). We had the option to use the 2022 version instead. However, Russia was removed from the 2022 report, presumably due to the ongoing war with Ukraine. The only other change was that Iceland had been moved from “Frontier” to “Second Emerging” in the 2022 report (FTSE, 2022). As we do not have any companies from Iceland in our portfolios, it does not make a difference if we use the 2021 report.

Lastly, we create sub-portfolios contingent on the exclusion reason, whether it be product- or conduct-based. The classification is found in the exclusion list on the Oil Funds websites (NBIM, n.d.c). All sub-portfolios are presented in Table 4.2.

Table 4.2 Portfolio Distribution of Companies

Portfolio Distribution of Companies	
Market	
Developed Markets	99
Emerging Markets	61
Exclusion Category	
Product-based	46
Conduct-based	114
Sector	
Basic Materials	16
Consumer Non-Cyclicals	17
Energy	17
Industrials	27
Utilities	64

Table 4.2 presents an overview of our different sub-portfolios. Each company is categorized by reason for exclusion as product- or conduct-based. They are also categorized as either developed or emerging markets and categorized by sector. In total there are nine sub-portfolios in addition to the main portfolio containing all excluded companies.

4.3 Construction of Portfolios

To accurately calculate the aggregated returns of the excluded companies, we gather the Oil Fund's last known investment size in the companies prior to the public announcement of exclusion from the Oil Fund. Furthermore, we scale this investment size until the announced exclusion date by factoring in the returns between the last known date of investment size and the official exclusion date. After scaling the investment size for all companies, we create value-weighted portfolios. The weights of the companies are given by formula 4.1.

$$w_{i,t} = \frac{M_{i,t}}{\Sigma_{i=1}^{N} M_{i,t}}, \tag{4.1}$$

where, $M_{i,t}$ is the market cap of asset *i* at time *t*, and $\Sigma_{i=1}^{N} M_{i,t}$ is the sum of the market caps of all companies in the portfolio.

In order to account for the occasional inclusion of new companies to our portfolios, we apply a monthly rebalancing of the portfolios. This not only accounts for the inclusion of new companies when they are excluded from the Oil Fund but also adjusts for the changes in capital returns for the excluded companies. The weights adjusted for returns are given by,

$$w_{i,t+1} = \frac{(M_{i,t} * (1 + r_{i,t}))}{\Sigma_{i=1}^{N} (M_{i,t} * (1 + r_{i,t}))}, \quad (4.2)$$

where, $M_{i,t}$ is the market cap of asset i at time t, $\Sigma_{i=1}^{N} M_{i,t}$is the sum of the market caps of all companies in the portfolio, and $r_{i,t}$ is the returns of asset *i* at time *t*.

Monthly rebalancing will lead to increased transaction costs. However, as we see it, it is nearly inevitable due to how often new companies are included in the exclusion portfolio. Thus, monthly rebalancing can be defended in this view. However, it is worth mentioning that while there is no correct answer on how often one should rebalance a portfolio, this would typically be done in alignment with investment strategies, changes in the market conditions, changes in company fundamentals or other factors. Rebalancing can further help investors stay in line with their mandate regarding weights and risk tolerance, all while staying unemotional and disciplined to their investment strategies (Manning, 2022).

4.4 Fama-French Five-Factor Model

We apply the Fama-French five-factor model (Fama & French, 2015) in this thesis. The model data is constructed by Kenneth French and publicized on his website, which is where we collect the Fama-French data from (French, 2023). The five-factor model is used to describe stock returns by attributing them to different factors. The Norwegian Bank Expert Group in "Principles for Risk and Adjustment of Performance Figures" also recommended using the Fama-French five-factor model when assessing the Oil Funds equity portfolio (Dahlquist et al., 2015). A global version of the Fama-French 5-factor model would be suited for our analysis as the Oil Fund is a broad and diversified portfolio of companies worldwide. The global version covers companies globally, while the other versions, being developed markets, emerging markets, Europe, Asia, et cetera, only cover companies in their respective regions.

4.5 Limitations of Data

One of the challenges encountered during this research was the unavailability of stock prices and other financial data for certain companies excluded from the Oil Funds investment universe. The names of these companies and the reason for omitting them from our analysis can be found in Appendix A.1. Although this may impact the representativeness of our dataset, we remain confident that our overall dataset, consisting of 160 companies, is robust enough and has not been significantly compromised by the removal of 28 companies of the original 188 companies.

After cleaning the data set, our list of excluded companies from the Oil Fund does not align entirely with Eide & Haugen (2022). One possible explanation could be that they had direct contact with Norges Bank Investment Management (NBIM) during their research.

In comparing ESG scores between the excluded companies and the Oil Fund, we use the ESG score of the 100 largest companies in the Oil Funds holdings. Larger companies generally exhibit higher ESG scores (Drempetic et al., 2020), so the sample may have some bias to it and may not be representative of the ESG score of all companies in the Oil Fund. One could argue that we should have drawn 100 random companies instead. However, our primary aim was to examine the differences between sin stocks and well-performing ESG stocks, as well as explore any potential correlation between ESG scores and returns. What makes it interesting to choose the 100 largest is that we can analyze if there are different dynamics in the influence of the ESG scores and returns for two portfolios with broad varieties in ESG scores.

5.0 Methodology

This chapter outlines the methodology employed in the thesis. Firstly, we will present the methodology used for our primary analysis in comparing the returns from the sin stocks with the Oil Funds returns. To address this, we have applied the Fama-French five-factor model and three regression models based on their model, which we will explain in this section. The Fama-French five-factor model is used to compute excessive returns of the respective portfolios we are researching in relation to the Oil Fund returns. For our secondary analysis, looking into how the ESG rating of the portfolios correlates with yearly returns and vice versa, we apply several regression models to examine these similarities. Finally, we will comment on the robustness of our models.

5.1 Fama-French Five-Factor Model

Within finance, the capital asset pricing model (CAPM), is one of the more famous and widely used formulas to calculate the expected return, given the cost of capital and the risk of assets. More recent studies by Eugene Fama and Kenneth French propose expanding on this capital asset pricing model. Their studies suggest that we effectively should try to attribute the returns to different factors, arguing that the factors market risk premium (Mkt-rf), Small-Minus-Big (SMB), High-Minus-Low (HML), Robust-Minus-Weak (RMW) and Conservative-Minus-Aggressive (CMA) are appropriate factors (Fama & French, 2015).

Mkt-rf represents the excess returns of the market portfolio over the risk-free rate. The market portfolio traditionally represents a broad index such as the SP500, and the risk-free rate is often associated with a government bond, like the U.S. 10-year bonds. For our regression analysis with the Fama-French model, we will utilize the monthly figures for market portfolio and risk-free return as provided by Kenneth French (French, 2023).

SMB is a size factor, measuring the return of a portfolio of small stocks in excess of the return on a portfolio of large stocks. A positive SMB coefficient would indicate that the portfolio in our regression model would perform better if small-cap stocks outperform large-cap stocks (Fama & French, 2015).

HML measures the return of a portfolio of stocks with a high book-to-market ratio in excess of the return on a portfolio of stocks with a low book-to-market ratio. A positive HML coefficient indicates that the portfolio in our regression model tends to do better when high book-to-market stocks outperform low book-to-market stocks (Fama & French, 2015).

RMW is a factor measuring the difference between robust and weak companies, measured by their profitability, measuring the spread in returns of the most profitable firms minus the least profitable. A positive coefficient indicates that the portfolio in our regression model tends to do better when robust companies outperform weak companies in terms of profitability (Fama & French, 2015).

CMA is a factor trying to capture the historical excess returns of conservative companies over aggressive companies in terms of investments. Conservative companies are defined as companies that invest less in new projects relative to their total assets. In contrast, aggressive companies reinvest more of their profits into new projects instead of, for example paying dividends or holding cash on book. A positive coefficient in a regression model would indicate that the portfolio in question tends to do better when conservative companies outperform aggressive companies in terms of stock returns (Fama & French, 2015).

5.1.1 Fama-French Factor Analysis

Figure 5.1 shows the cumulative returns for the Global Fama-French five-factor model. The mkt-rf line illustrates the market's excessive returns to the risk-free asset over our study period. The value factor, SMB, shows negative returns over the period, indicating that large-cap stocks have outperformed small-cap stocks. The HML line lies steady at around 100 from 2006 to 2017 before it has a dip towards the end, indicating that at the end of our time span, growth stocks with a low book-to-market ratio outperform value stocks with high book-to-market ratios.

The RMW factor, isolating the profitability premium, indicates that stocks of firms with higher profitability tend to have higher returns than that of their adversaries with lower profitability. We see clearly from Figure 5.1 that the RMW factor has a steady upwards trend, indicating that robust companies with higher profitability show better returns over the research period.

The CMA factor explores the investment effect, showing how firms with a higher grade of expenditures in relation to property, plant and equipment and changes in working capital, for instance, yield greater returns than companies with a lower grade of investments. Figure 5.1 tells us that it varies to some degree. At the start and middle of our study, from 2006 to 2017, it has a steady positive attribution, indicating that conservative companies that invest less have a greater return. While at the end of the study, from 2017-2021, it shifts to aggressive investment companies doing better than conservative investment companies before it again in 2022 tilts back upwards. Finally, we have included the risk-free return rate to illustrate its evolution over the research period.

Figure 5.1 Cumulative Returns Global Fama-French Factors

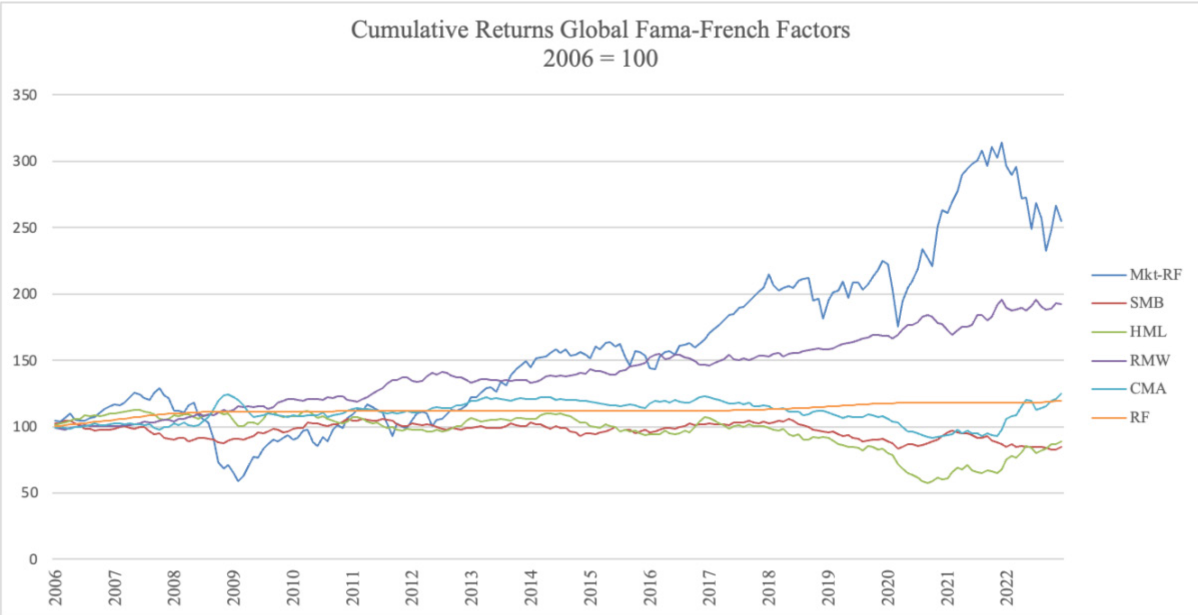


Figure 5.1 briefly covers the cumulative returns for the Global Fama-French factors. Most of the returns are attributed to the Mkt-RF factor. RMW also delivers positive cumulative returns over our time period, while HML and SMB deliver negative cumulative returns.

5.1.2 Fama-French Regression Models

Our analysis consists of three separate Fama-French regression models. Firstly, we want to examine how much of the benchmark index returns are attributed to the Fama-French factors. This is done by using regression equation (5.1). Secondly, as Dahlquist et al. (2015) recommended, we regress the excess returns of the Oil Fund portfolio relative to the benchmark index with equation (5.2). Further, for the sub-portfolios in this thesis, we are looking into the excessive returns with the Oil Fund as a benchmark from equation (5.3). The Oil Fund is not necessarily a logical benchmark for the different sub-portfolios. However, we opt to use it as the benchmark because we want to figure out what the excessive returns of the sub-portfolios are attributed to in relation to the Oil Fund.

The regression equations we employ in our Fama-French regressions are thus the following,

$$r_{bm,t} = \alpha + \beta_1(r_{mkt,t} - r_{rf,t}) + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \varepsilon_t, \quad (5.1)$$

$$r_{oil\ fund,t} - r_{bm,t} = \alpha + \beta_1(r_{mkt,t} - r_{rf,t}) + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \varepsilon_t, \quad (5.2)$$

$$r_{p,t} - r_{oil\ fund,t} = \alpha + \beta_1(r_{mkt,t} - r_{rf,t}) + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \varepsilon_t, \quad (5.3)$$

where, $r_{bm,t}$ is returns of benchmark index at time *t*. $r_{oil\ fund,t}$ is the returns of the Oil Fund portfolio at time *t*. $r_{p,t}$ is the returns of portfolio p at time *t*. α is the alpha/Constant. $r_{mkt,t}$ is the return on the market portfolio at time *t*. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the factor coefficients measuring the sensitivity of the portfolios' excessive returns to the five factors. $r_{bm,t} - r_{rf,t}$ is the excessive market returns in relation to risk-free returns. SMB is the size Factor, HML is the value factor, RMW is the profitability factor, CMA is the investment grade factor, ε_t is the error term/residuals.

5.2 Key Figures and Applied Formulas for Portfolios

In this section, we will briefly describe the key figures along with the formulas used to calculate the key figures we are investigating in the assessment of the portfolios we have constructed. These figures are presented in Table 6.3.

5.2.1 Beta

Beta measures the systematic risk of the asset/portfolio in relation to the benchmark index. It presents a ratio of how much the asset moves in price compared to the benchmark.

$$\beta = \frac{Cov(r_i, r_{bm})}{var(r_{bm})}, \quad (5.4)$$

where, β is the Beta. $Cov(r_i, \mathrm{r_{bm}})$ is the covariance between the asset and the benchmark, and $var(r_{bm})$ is the variance of the benchmark.

5.2.2 Sharpe Ratio

Sharpe ratio is a metric utilized to measure the excess returns per unit of risk for an asset. When comparing investment opportunities, a higher Sharpe ratio is preferred (Fernando, 2023).

$$SR = \frac{E(r_i)-rf}{\sigma_i}, \quad (5.5)$$

where, $E(r_i)$ is the expected returns on asset *i*, rf is the risk-free rate of return and σ_i is the standard deviation of asset *i*.

5.2.3 Alpha

Alpha measures the excess returns when adjusted for the risk, for the portfolios in comparison to the benchmark portfolio it is measured against (Chen, 2023).

$$\alpha_i = r_i - rf - \beta_i(r_i - rf), \quad (5.6)$$

where, α is the Alpha, r_i is returns on asset *i, rf* is risk-free returns and β_i is Beta of asset *i.*

5.2.4 Residual Risk

Residual risk is calculated as the square root of the variance of the stock's returns minus the squared product of the stock's beta (its sensitivity to market movements) and the variance of the market's returns. Residual risk is associated with individual business operations and sector specifics, measuring the risk of excess returns (Døskeland, 2023).

$$\sigma(\varepsilon_i) = \sqrt{\sigma_i^2 - \beta_i^2\sigma_{bm}^2} \quad (5.7)$$

where, σ_i^2 is the variance of asset/portfolio *i, β_i^2* is the beta squared of asset *i*, and σ_{bm}^2 is the variance of the benchmark.

5.2.5 Appraisal Ratio (AR)

Appraisal Ratio (AR) is a measure of signal-to-noise. It is a ratio used to measure the quality of a fund managers investment-picking ability. In a well-diversified portfolio, if we were to add another asset, we could use the appraisal ratio to determine which asset manager delivers the more superior returns compared to the additional risk we take (Døskeland, 2023).

$$AR = \frac{\alpha_p}{\sigma(\varepsilon_p)}, \tag{5.8}$$

where, α is the alpha of portfolio p, and $\sigma(\varepsilon_p)$ is the residual risk of portfolio p.

5.2.6 R-squared

R-squared regarding asset management indicates how the portfolio in question correlates to the benchmark. An R-squared of 1 equals the market portfolio (Døskeland, 2023).

$$R^2 = 1 - \frac{\sigma(\varepsilon_p)^2}{\sigma_p^2}, \tag{5.9}$$

where, $\sigma(\varepsilon)^2$ is the squared residual risk of portfolio p, and σ_p^2 is the variance of portfolio p.

5.3 Linear Regressions Models

In order to analyze our data, a linear regression model is employed. Utilizing a linear regression model is a well-established and powerful statistical technique suitable for analyzing the data in this thesis. This approach allows for examining the relationship between a dependent variable and independent variables. The models provide estimates of the coefficients for each independent variable. These coefficient estimates indicate the strength and direction of their impact on the dependent variable (Beers, 2023). The simplicity of the model facilitates the interpretation and communication of the results to a wide audience, including those with limited statistical proficiency.

5.3.1 Analyzing the Relationship Between ESG Score and Yearly Returns

In our linear regression analysis, we opted to focus on a limited period from 2017-2023. This decision was motivated by our methodology of including companies in the portfolio at the time of exclusion, which means that the sample size of companies prior to 2017 was relatively small. Including such data could potentially undermine the reliability of the models due to the limited sample size, which may not adequately capture the trends and dynamics of the underlying population. By focusing on more recent data with a larger sample size, we aim to improve the robustness and accuracy of our findings to make our results both informative and reliable. Additionally, we believe that limiting the timeframe of our analysis will provide us with a more up-to-date picture of the current market trends and dynamics, which will be more relevant and applicable to our research question. While it is true that this approach may limit the scope of our investigation, we believe that it is a necessary trade-off to ensure the validity of our results.

Our regression models seek to investigate the relationship between ESG and returns as well as other financial metrics included in the datasets. Moreover, we can discover if there is any difference in the relationship between ESG and returns for the excluded companies, sub-portfolios, and the 100 biggest companies in the Oil Fund.

To analyze the ESG scores and yearly returns in our portfolios, we created 11 datasets in R-Studio. These datasets contain financial metrics such as ESG score, yearly returns, market capitalization and profits. Additionally, in the portfolio of all excluded companies and the 100 biggest companies in the Oil Fund, we created lag values of all these metrics, lagging one year backwards. This is to account for the possibility that the metrics from previous years may have an impact on the dependent variable in the models. By running regressions with lagged variables, we can investigate the potential differences compared to regression models without lagged variables. Using these datasets and lagged variables will provide a more detailed and nuanced understanding of the factors that contribute to the financial performance of these companies.

The equations for these regression models are presented below. By conducting these regression analyses, we hope to provide insights into the complex relationship between these variables, shedding light on the drivers of financial performance in the context of ESG scores.

$$ESG\ Score_{i,t} = \beta_0 + \beta_1 Market\ Cap_{i,t} + \beta_2 Profits_{i,t} + \beta_3\ Returns_{i,t} + Year + \epsilon_{i,t}\ , \tag{5.10}$$

$$ESG\ Score_{i,t} = \beta_0 + \beta_1 Market\ Cap_{i,t-1} + \beta_2 Profits_{i,t-1} + \beta_3\ Returns_{i,t-1} + Year + \epsilon_{i,t}\ , \tag{5.11}$$

$$Returns_{i,t} = \beta_0 + \beta_1 Market\ Cap_{i,t} + \beta_2 Profits_{i,t} + \beta_3\ ESG\ Score_{i,t} + Year + \epsilon_{i,t}\ , \tag{5.12}$$

$$Returns_{i,t} = \beta_0 + \beta_1 Market\ Cap_{i,t-1} + \beta_2 Profits_{i,t-1} + \beta_3\ ESG\ Score_{i,t-1} + Year + \epsilon_{i,t} \tag{5.13}$$

where,
$Returns_{i,t}, Returns_{i,t-1}, Market\ Cap_{i,t}, Market\ Cap_{i,t-1}, Profits_{i,t}, Profits_{i,t-1}, ESG\ Score_{i,t}, ESG\ Score_{i,t-1}$ are the financial key figures in our models, $Year$ is a fixed effect variable ranging from 2016 to 2022, $\epsilon_{i,t}$ is the error term and, $\beta_1, \beta_2, \beta_3$ are the factor coefficients.

To enforce the robustness of our regression models, we included year-fixed effects in our analyses. This was done to account for time-invariant factors that may influence the dependent variables but are not directly observed (Farkas, 2005, p.45). With companies from different countries and cultures included in the dataset, there may be variations in regulations or other unobserved factors that could impact the metrics. By including year-fixed effects in our models, we can capture some of these factors, thereby increasing the accuracy of our estimates. Moreover, our models also account for time-specific effects such as policy changes, market shocks and seasonal effects, which the year variable can also capture. The use of fixed effects additionally helps to mitigate the potential bias in the estimators (Collischon & Eberl, 2020).

5.3.2 Robustness of Models

In order to ensure the accuracy and reliability of our models and avoid biases, we utilized the Ordinary Least Squares (OLS) method for both our analyses, which estimates the parameters of a linear regression and finds the best fitting relationship between explanatory variables and a continuous outcome. If the continuous outcome is not met, the model minimizes the sum of squared errors. An error is the deviation between the predicted value and the actual value of the outcome variable (Zdaniuk 2014). The equation for OLS is presented below.

$$\sum_{i=1}^{n} \hat{u}_i^2 = \sum_{i=1}^{n} \left(y_i - \widehat{\beta_0} - \widehat{\beta_1} x_{i1} - \ldots \widehat{\beta_k} x_{i,k}\right)^2 \quad (5.14)$$

where, $\hat{u}$ is the error term, y_i is the dependent variable, $x_{i,k}$ is the independent/explanatory variable, $\widehat{\beta_0}$ is the intercept, $\widehat{\beta_k}$ is the estimated coefficient, k is the integer, n is the number of observations and i is the time factor (Kunze, 2021).

To ensure that the OLS estimates of the regression coefficients are unbiased, efficient and have minimum variance among all linear estimators, five assumptions must be fulfilled. These five assumptions are called the Gauss-Markov assumptions. When all assumptions are fulfilled, we can argue that the OLS estimator is the best linear unbiased estimator (BLUE) and have confidence in the quality of our models (Wooldrigde, 2018, p. 89).

The first assumption is linearity in parameters, meaning the relationship between the dependent and explanatory variables is linear. This linearity assumption asserts that the effect of each explanatory variable on the dependent variable remains constant and does not vary with different values of the variables. It is imperative to note that if this assumption is not satisfied, OLS may not be an appropriate method for estimating the model’s parameters (Wooldrigde, 2018, p.318).

The second assumption is that there is no perfect collinearity among the explanatory variables. Perfect collinearity means that two or more explanatory variables are perfectly correlated, if one parameter changes with one unit, so does the other and vice versa (Wooldridge, 2018, p. 75). We know that none of our metrics are perfectly correlated with another, as several other factors influence the financial data we include in our regression analyses.

The third assumption is the zero conditional mean assumption. The zero conditional mean assumption is a fundamental requirement in econometric analysis to ensure unbiased estimates of regression coefficients. This assumption implies that the error term, denoted as μ at time t, is not systematically correlated with any explanatory variable at any time, meaning that the conditional expectation of the error term given the explanatory variables is zero (Wooldridge, 2018, p. 318). In other words, the errors do not exhibit a consistent correlation pattern with the explanatory variables over time. Violations of this assumption can lead to biased estimates and unreliable inference in econometric models. It is assumed that this assumption and the two above are fulfilled.

The assumption of homoscedasticity in the OLS model requires that the errors of the model have a constant variance over time, which means that the variance of the errors is the same for all levels of the explanatory variables (Kenton, 2022). This assumption is considered sufficient when the error term and the variable are independent. However, if this assumption is not satisfied, the model is said to have heteroskedasticity (Woolrigde, 2018, p.320). In practice, it is often challenging to find homoscedastic data, as most data is, by nature, heteroskedastic (Vaidya, n.d). Heteroskedasticity does not affect the coefficients in the regression model but can lead to biased estimates of the standard error term. We performed a Breusch-Pagan test on the different models to test for heteroskedasticity. The results of the tests are presented in Appendix A.2.

The assumption of no serial correlation, or autocorrelation, is relevant mainly in time series analysis. Autocorrelation refers to the correlation between the error term of a variable in two different periods (Wooldridge, 2018, p.320). In the context of our data, variables such as ESG scores, returns, market capitalization and profits are typical financial numbers that are likely to be correlated with their past values (Taylor, 2023). When autocorrelation exists, the OLS estimators are still unbiased, but the minimum variance is not achieved. Consequently, t-statistics may be overstated, overestimating the significance of the model, leading to potentially incorrect conclusions about the model's quality (Signori, 2022). To test for autocorrelation, we conducted a Breusch-Godfrey test. The results of the test are presented in Appendix A.2.

Our dataset consists of a large amount of financial data that often exhibits time dependence and therefore might be subject to autocorrelation (Yiu, 2021). Seasonality, economic cycles and other time-varying effects are all factors that can lead to autocorrelation. Due to this, autocorrelation in our models would be no surprise. As we are interested in the coefficients and the effects the independent variables have on the dependent variable, potential autocorrelation would not necessarily be as big a problem for our model than it would if we were to make predictions. However, if there is severe autocorrelation, we might have an issue with the quality of the model.

6.0 Results

The following chapter presents the findings of our analysis, providing an extensive examination of the collected data and our regression models.

6.1 Descriptive Analysis

The first part of this chapter will present descriptive results from our analysis. This allows us to summarize and comprehend the main characteristics of our dataset. We will present details about our dataset and portfolios, illustrations and comment on our findings.

We have constructed several portfolios based on the initial investment sizes from the Oil Fund. Figure 6.1 illustrates how frequently companies are excluded from the Oil Fund between 2006 and 2022. The figure shows a significant spike in 2016, mainly due to the new rule targeting the coal industry that was initialized at the beginning of 2016. The frequency of exclusions illustrates the need for monthly rebalancing as companies are excluded consecutively throughout the years. The essence is that if we did not rebalance monthly by default, we would inevitably still have to do it.

Figure 6.1 Excluded Companies

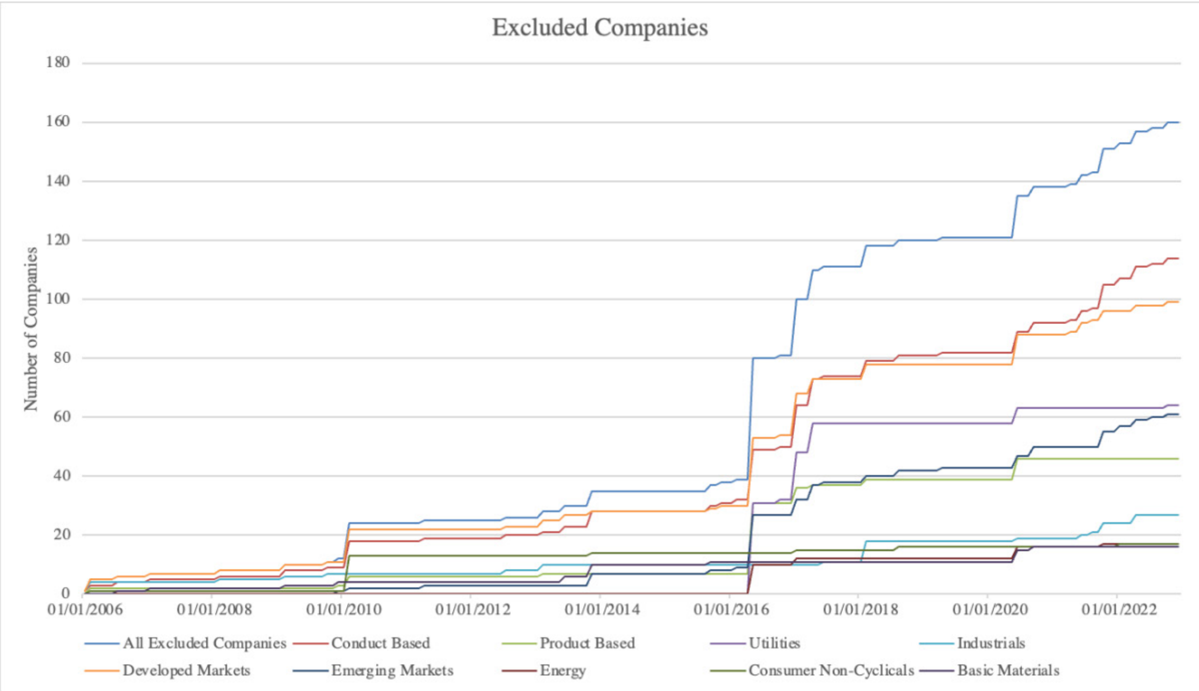


Figure 6.1 shows the distribution of the excluded companies from the Oil Fund from 2006-2022 and the sub-portfolios.

6.1.1 Sector Distribution

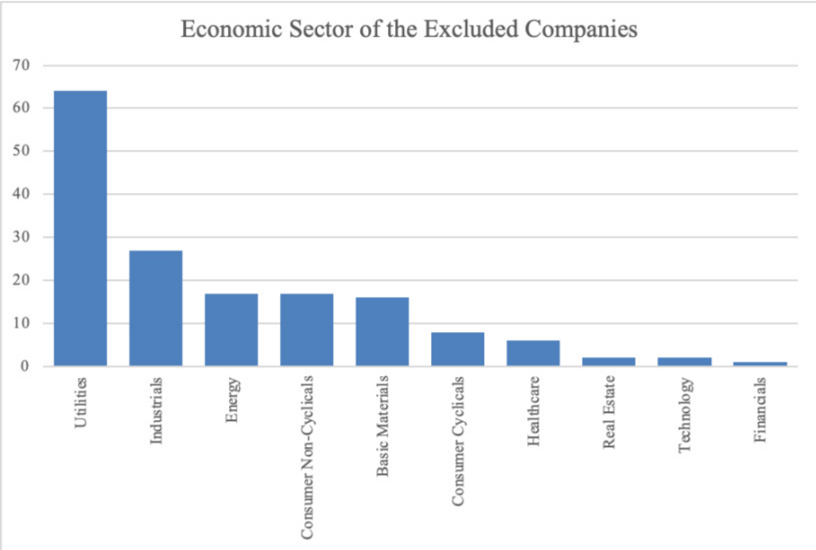


Figure 6.2 Economic Sector of the Excluded Companies

The chart depicted in Figure 6.2 presents the distribution of the excluded companies across different industries as per Refinitiv Workspace. The chart shows that the utilities sector comprises the most excluded companies, followed by industrials and energy. These industries are characterized by heavy energy production and consumption. The findings from the figure are consistent with the results of the Eco Experts' list of the top seven most polluting industries, albeit with different terminologies (Howell, 2023). Although pollution may not be the sole reason for excluding the companies from the Oil Fund, the robustness of our descriptive findings is strengthened when they align with the outcomes of other investigations.

6.1.2 Country and Market Distribution

Figure 6.3 Countries of Excluded Companies

Figure 6.3 illustrates the distribution of excluded companies by country. In addition, the figure is color-coded to display what countries are developed markets (red) and emerging markets (blue).

Figure 6.3 provides an overview of the distribution of excluded companies across different countries. As anticipated, the United States, the largest economy, has the highest number of excluded companies. China and India, also large economies, have the second and third most excluded companies. Notably, only one Russian company is among the excluded companies, although the Norwegian Government has ordered the Oil Fund to sell its Russian stocks (Ministry of Finance, 2022). As of the last publicly available portfolio of companies the Oil Fund invests in, there were 42 Russian companies (NBIM, n.d.d). The Oil Fund struggles to sell its Russian shares due to sanctions against Russia (Hovland, 2023).

6.1.3 ESG Scores and Yearly Returns

Figure 6.4 Mean ESG Scores

Figure 6.4 illustrates the mean ESG score for the excluded companies (red) and the 100 biggest companies in the Oil Fund (blue). The mean ESG value of the excluded companies is not adjusted for the exclusion date, meaning every ESG score for all companies in the given year is the basis for the mean value.

Figure 6.4 depicts the evolution of the mean ESG score for the excluded companies and the 100 largest companies in the Oil Fund from 2006 to 2022. The red field is based on the mean ESG score of all the excluded companies from 2006-2022 and is not adjusted for the exclusion date. It is evident from the figure that the mean ESG score for the 100 largest companies in the Oil Fund is considerably higher than that of the excluded companies, as expected. Nonetheless, both portfolios have exhibited a similar increase in their mean ESG score over the years, although the percentage increase in ESG scores is higher for the excluded companies. This indicates that even though the sin stocks have a reputation for not considering ESG measures, they are improving. There could be several explanations as to why the ESG scores of the excluded companies have improved. One possibility is that they have realized that to survive in the market, they must improve their ESG scores to a certain level to be considered acceptable.

Figure 6.5 Mean ESG Scores Adjusted for Exclusion Date

Figure 6.5 illustrates the mean ESG score for the excluded companies (red) and the 100 biggest companies in the Oil Fund (blue). The mean ESG score of the excluded companies is adjusted for the exclusion date, meaning that the magnitude of the a company in the first years is more significant than in the later years.

Figure 6.5 presents the same as Figure 6.4. However, the mean ESG score for the excluded companies in Figure 6.5 is based on when the company is excluded from the Oil Funds investment universe and included in our portfolio. We see a substantial difference in the mean ESG score, especially between 2008 and 2016. This difference is because few companies were excluded from the Oil Fund in the early years we analyzed, leading to more influence from extreme values. The result is that the mean ESG score for the excluded companies in 2010 was higher than the mean ESG score for the 100 biggest companies in the Oil Fund before dropping until 2016 due to less influence from extreme values with the exclusion of more companies. From 2016 and onwards, the trends are more similar to what we see in Figure 6.4. The large portion of exclusions in 2016 due to the new rules regarding coal production led to the exclusion of more than 50 companies (NBIM, 2016), which makes the sample in the figures more similar than before 2016.

Table 6.1 Summary Stats for The Excluded Companies

Summary Stats - The Excluded Companies									
Year	**ESG mean**	**ESG median**	**ESG max**	**ESG min**	**Returns mean**	**Returns median**	**Returns max**	**Returns min**	**Number of Companies**
2006	41,50	39,89	82,12	10,63	6%	10%	22%	-16%	6
2007	41,95	40,62	78,21	13,67	25%	18%	87%	-16%	7
2008	46,70	44,16	80,71	9,80	-36%	-43%	15%	-76%	8
2009	46,70	48,48	85,90	5,06	60%	26%	229%	-2%	12
2010	49,92	50,07	86,23	6,42	25%	26%	118%	-21%	24
2011	49,36	46,99	85,99	5,55	9%	18%	40%	-43%	25
2012	49,16	47,94	86,67	10,33	12%	10%	47%	-23%	26
2013	49,39	49,46	86,59	5,28	20%	19%	92%	-45%	35
2014	50,03	49,84	86,81	8,13	10%	13%	81%	-67%	35
2015	50,20	52,54	87,20	2,89	5%	8%	53%	-72%	38
2016	50,35	48,60	88,74	3,41	16%	8%	294%	-23%	81
2017	52,68	52,45	90,17	9,38	18%	13%	143%	-44%	111
2018	54,60	55,44	91,78	8,60	-9%	-9%	43%	-57%	120
2019	56,05	57,02	90,10	5,10	14%	6%	219%	-91%	121
2020	57,55	56,83	90,79	9,40	4%	-3%	285%	-47%	138
2021	58,94	61,45	92,33	11,60	32%	18%	289%	-85%	151
2022	61,49	62,16	94,43	19,80	11%	4%	289%	-94%	160

Table 6.1 presents summary descriptive statistics of the ESG score and returns for the excluded companies from 2006 to 2022. It includes mean, median, maximum and minimum values for both metrics in each year.

The table above displays descriptive statistics for the companies excluded from the Oil Fund from 2006 to 2022. Firstly, the mean ESG score for the excluded companies is low. However, both the median and mean ESG scores exhibit a consistent upward trend over time, indicating that these companies are actively improving their ESG performance to address the growing societal emphasis on material ESG issues.

Notably, the ESG max score is high every year, meaning that certain excluded companies achieve high ESG scores, despite being labeled as sin stocks and excluded by the Oil Fund based on ESG criteria. There could be several plausible explanations for this observation. Firstly, a company may demonstrate strong performance across multiple ESG factors, but a single serious violation of the Oil Fund's guidelines could lead to the exclusion. Secondly, it is possible that Refinitivs' ESG scoring system and the Oil Fund's exclusion criteria do not align regarding the areas they cover. For instance, a company involved in tobacco production may have a sustainable business model and receive favorable scores on various ESG parameters assessed by Refinitiv. However, based on specific guidelines, the Oil Fund may exclude all tobacco production from its investment universe. Lastly, it is conceivable that the high scoring excluded companies may engage in practices like green- and woke washing, which are not captured by Refinitivs' ESG scoring system, but are taken into consideration by the Oil Fund when making exclusion decisions.

Table 6.2 Summary Stats for the 100 Biggest Companies in The Oil Fund

Summary Stats - 100 Biggest Companies in The Oil Fund								
Year	**ESG mean**	**ESG median**	**ESG max**	**ESG min**	**Return mean**	**Return median**	**Return max**	**Return min**
2006	52,70	57,35	81,31	14,72	19%	14%	236%	-16%
2007	57,74	60,51	91,85	11,34	16%	6%	135%	-35%
2008	58,78	63,78	91,79	8,10	-25%	-23%	36%	-75%
2009	63,95	69,80	89,47	5,54	33%	20%	226%	-49%
2010	65,07	73,15	91,17	5,13	14%	9%	219%	-26%
2011	65,51	73,20	90,30	9,91	2%	2%	67%	-61%
2012	65,86	72,75	94,08	8,60	20%	17%	101%	-30%
2013	66,51	72,99	93,89	8,41	36%	26%	325%	-19%
2014	65,90	72,23	92,58	7,11	15%	13%	94%	-22%
2015	67,13	73,60	92,28	6,57	10%	5%	129%	-34%
2016	68,39	73,17	92,39	7,59	15%	12%	227%	-35%
2017	69,77	74,63	92,84	6,02	27%	24%	115%	-33%
2018	72,63	77,09	94,28	9,66	-1%	-2%	40%	-40%
2019	74,73	77,42	94,83	20,78	31%	30%	147%	-15%
2020	74,69	78,22	94,04	19,79	23%	14%	696%	-44%
2021	76,25	79,29	95,28	21,38	29%	28%	125%	-49%
2022	77,73	80,12	95,42	28,22	-7%	-8%	87%	-65%

Table 6.2 summarizes descriptive statistics of yearly returns and ESG scores for the 100 biggest companies in the Oil Fund measured by investment size from 2006 to 2022. It includes the mean, median, maximum and minimum values for both metrics for each year.

The table presents descriptive statistics for the 100 biggest companies in the Oil Fund. It is a notable difference in the mean and median ESG scores compared to the excluded companies, which is no surprise. This shows us the difference in taking ESG matters seriously between the two portfolios. Notably, the difference in both maximum and minimum is not that big. It is higher overall for the 100 biggest companies, but not as much of a difference as expected. The fact that we have small minimum values amongst the 100 largest companies in the Oil Fund is another example of missing alignment between Refinitivs' ESG Scoring system and the guidelines for exclusion from the Oil Fund.

Figure 6.6 Yearly Returns 2006-2022 for Selected Portfolios

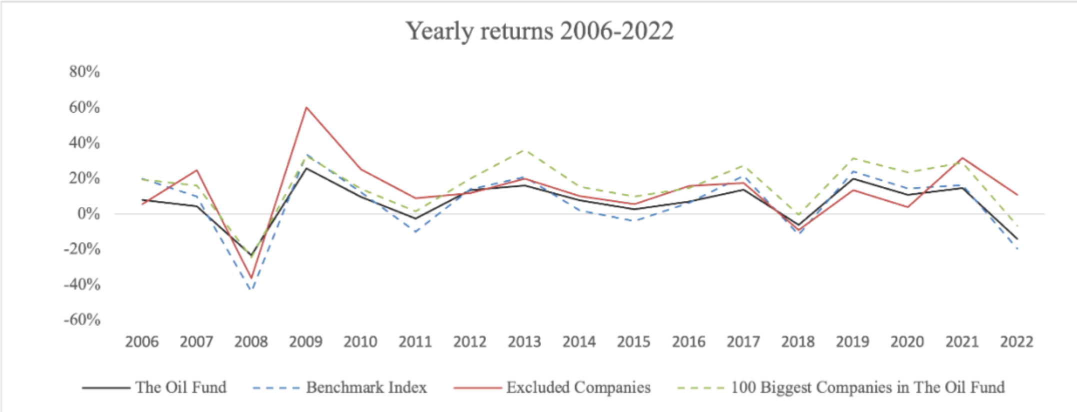


Figure 6.6 illustrates the mean returns of the excluded companies and the 100 largest companies in the Oil Fund (not weighted), together with the yearly returns on equity in the Oil Fund and the benchmark index and from 2006 to 2022. The figure displays the main portfolios in our analysis and gives a brief overview of the dynamics in yearly returns for these portfolios.

Figure 6.6 displays the yearly stock returns for the excluded companies, the 100 biggest companies in the Oil Fund, all stock investments in the Oil Fund, and the benchmark index for the period 2006-2022. The annual returns for the excluded companies and the 100 biggest companies are a mean value of returns for the respective companies in each portfolio and are not weighted portfolios. Comparing the two solid lines representing the excluded companies and all stock assets in the Oil Fund, it is visually notable that the excluded companies, for most of the time, outperform the Oil Fund in terms of yearly returns. The 100 biggest companies have the most stable returns, with the lowest lows and, most of the time above zero. In contrast, the excluded companies seem more volatile but mostly return positive numbers on average and experience the highest average return. However, during the first years, especially until 2016, it is essential to note that the excluded companies only consist of a small sample size as not many companies were excluded from 2005-2016 compared to 2016-2022. Thereof, the magnitude of one company having high returns in one of those years can significantly impact the overall average returns. The Oil Fund and the benchmark index have similar curves throughout, although the Oil Fund seems to perform slightly better on average.

6.2 Key Financial Figures of Portfolios

We have calculated some key figures to compare the portfolios, presented in Table 6.3. As the table tells us, the portfolios have significant variances in expected returns and standard deviations. Looking at the Sharpe ratio, the Emerging markets portfolio shows the best ratio regarding risk and return. It also has the highest appraisal ratio (AR), measuring the signal-to-noise effect, being a ratio used to measure the quality of a fund manager's ability of stock picking. From equation (5.8), the appraisal ratio is calculated by dividing the asset's alpha over the asset's residual risk. If another asset is added to a well-diversified portfolio, the appraisal ratio determines which asset delivers more superior returns with the additional risk taken.

The R-squared in terms of asset management indicates the degree of active asset management in relation to the benchmark, where an R-squared closer to 1 indicates a higher degree of passive asset management. The Oil Fund shows an R-squared of 0,999 in relation to its benchmark, trailing it very closely. For the remaining portfolios, the Oil Fund is the benchmark. The R-squared of these portfolios varies from 0.20 to 0.51, indicating a relatively high degree of active management compared to the Oil Fund.

Table 6.3 Portfolio Key Figures

Portfolio Key Figures								
	Expected returns	Standard deviation	Beta	Sharpe	Alpha	Residual risk	Appraisal Ratio	R-Squared
Benchmark Index *	7,2071%	17,1168%	1,0000	0,3594				
The Oil Fund	7,4601%	17,4134%	1,0168	0,3678	0,1496%	0,56%	0,2664	0,9990
The Oil Fund *	7,4601%	17,4134%	1,0000	0,3678				
All Excluded	11,4074%	16,3877%	0,6647	0,6317	6,0951%	11,60%	0,5254	0,4989
Conduct-based	11,5103%	16,1649%	0,6451	0,6468	6,3234%	11,624%	0,5440	0,4829
Product-based	11,8606%	19,9293%	0,6920	0,5422	6,3732%	15,87%	0,4015	0,3656
Developed Markets	11,1256%	16,6364%	0,6679	0,6054	5,7925%	11,89%	0,4870	0,4888
Emerging Markets	17,9072%	16,5015%	0,4923	1,0213	13,6990%	14,10%	0,9716	0,2699
Utilities	6,9247%	12,8347%	0,4553	0,4574	2,9539%	10,09%	0,2926	0,3815
Industrials	15,6728%	22,4357%	0,9198	0,6516	8,7265%	15,71%	0,5554	0,5096
Energy	18,2042%	29,1529%	0,8683	0,5883	11,5877%	24,93%	0,4649	0,2690
Consumer Non-Cyclica	11,0199%	19,9174%	0,6875	0,5003	5,5616%	15,92%	0,3494	0,3613
Basic Materials	11,6928%	32,7158%	0,8438	0,3252	5,2335%	29,23%	0,1790	0,2017
Rf	1,055%							

***Benchmark Indices**

Table 6.3 displays key figures for our portfolios. It also includes the Oil Fund and its benchmark index. Furthermore, it presents the yearly expected returns, standard deviation, Beta, Sharpe Ratio, Alpha, Residual risk, Appraisal Ratio (AR), and R squared. The table is divided into two parts. First, the Oil Fund and its Benchmark Index, and second, the portfolios of excluded companies, where the Oil Fund acts as the benchmark index.

To better illustrate the differences in returns, we also present the development of the portfolios in Figure 6.7. We find that the portfolio of all excluded companies outperforms the Oil Fund by a significant margin from 2006 to 2022. Additionally, the figure shows that the industrials portfolio delivers the most superior returns amongst the sub-portfolios, closely followed by the emerging markets portfolio. The figure illustrates that all the constructed portfolios lie above the Oil Fund and the benchmark index, except for the risk-free asset and the utilities portfolio. The portfolio for the utilities sector does not include any companies until the year 2016, hence why it is far behind all the other portfolios in the graph. If we adjust the chart to have 2016 as the starting year (2016=100), Utilities will follow the Oil Fund and the benchmark portfolio more closely, still trailing just behind, as portrayed in Figure 6.8.

Figure 6.7 Cumulative Portfolio Returns 2006-2022

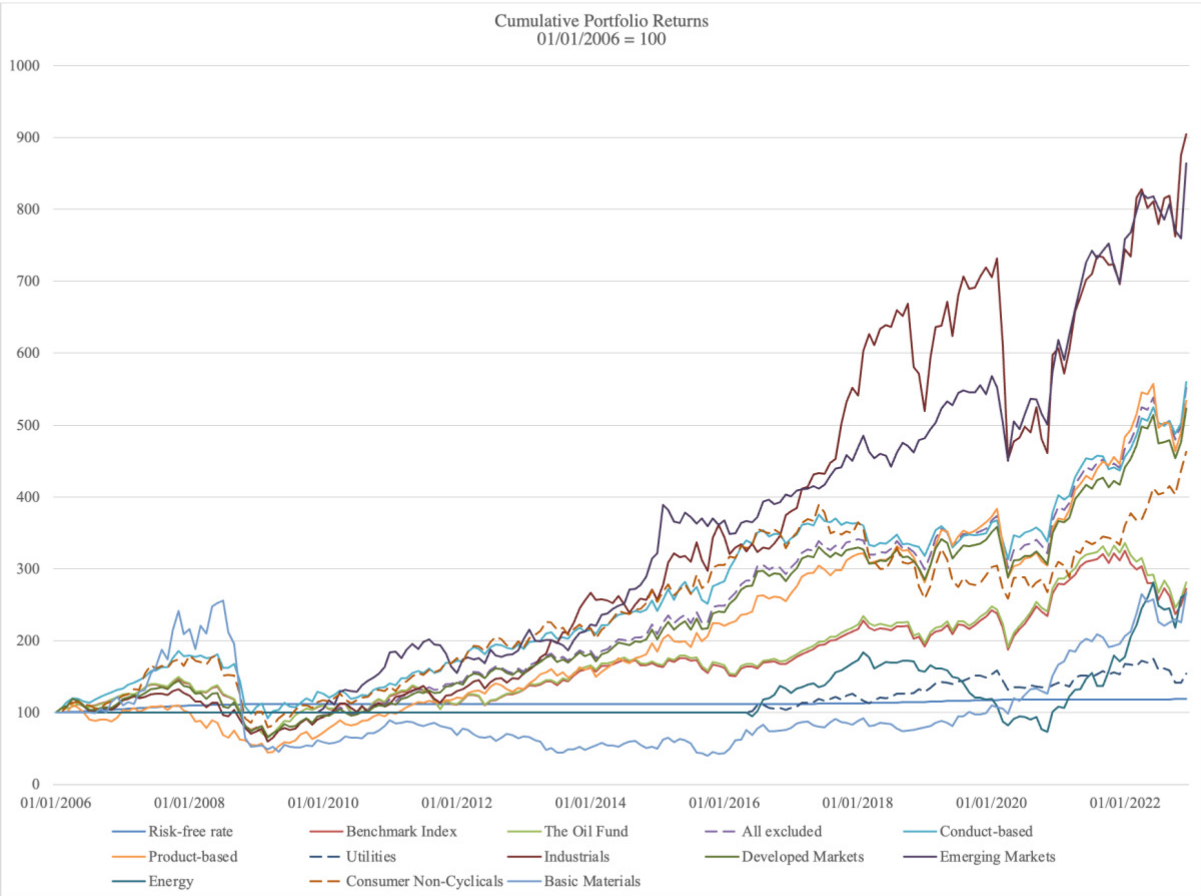


Figure 6.7 displays the cumulative returns for all excluded companies, our sub-portfolios, the entire stock holdings of the Oil Fund, our benchmark index and a risk-free rate. The base year for this graph is 2006, with a value of 100.

Figure 6.8 Cumulative Portfolio Returns 2016-2022

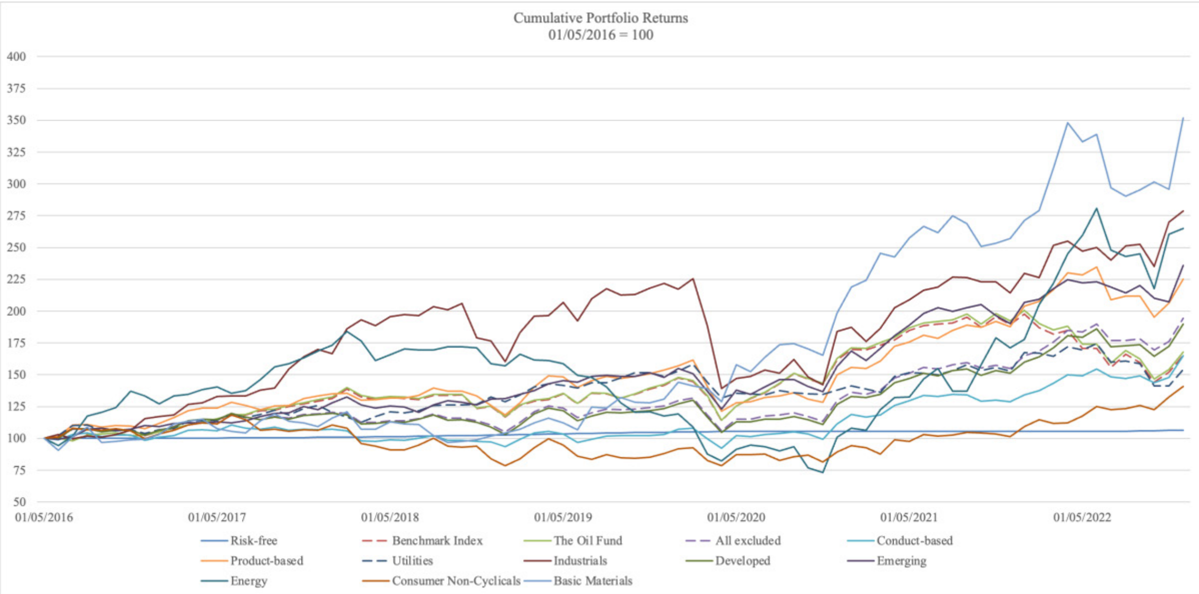


Figure 6.8 shows the cumulative portfolio returns for the different constructed portfolios. In this graph, the base date is 01/05/2016 (starting value of 100), which is the first month in our study where all portfolios are present.

As depicted from the illustrations above in Figures 6.7 and 6.8, we find considerable variations in returns over the different portfolios. To summarize this better, Figure 6.9 below shows the relationship between risk and returns throughout the portfolios. The Capital Allocation Line (CAL) is a line drawn between different combinations of weights in the risk-free asset and the risky asset (Chen, 2020). Our risky asset is the Oil Fund portfolio and the risk-free asset is given as an average of historical risk-free rates in the period 2006-2022 to be in line with our study. As Figure 6.9 illustrates, the exclusion portfolio, including all excluded companies, delivers higher expected returns with a lower standard deviation in relation to the Oil Fund and its benchmark portfolio. Similarly, this applies to all different portfolios we have constructed, except for the basic materials portfolio, which underperforms in relation to the CAL in terms of a risk-return ratio. All portfolios (except for the basic materials portfolio) deliver a higher Sharpe ratio than the Oil Fund, and its benchmark portfolio does, indicating that the returns per extra unit of risk taken are higher.

Figure 6.9 Capital Allocation Line, Expected Returns and Standard Deviation

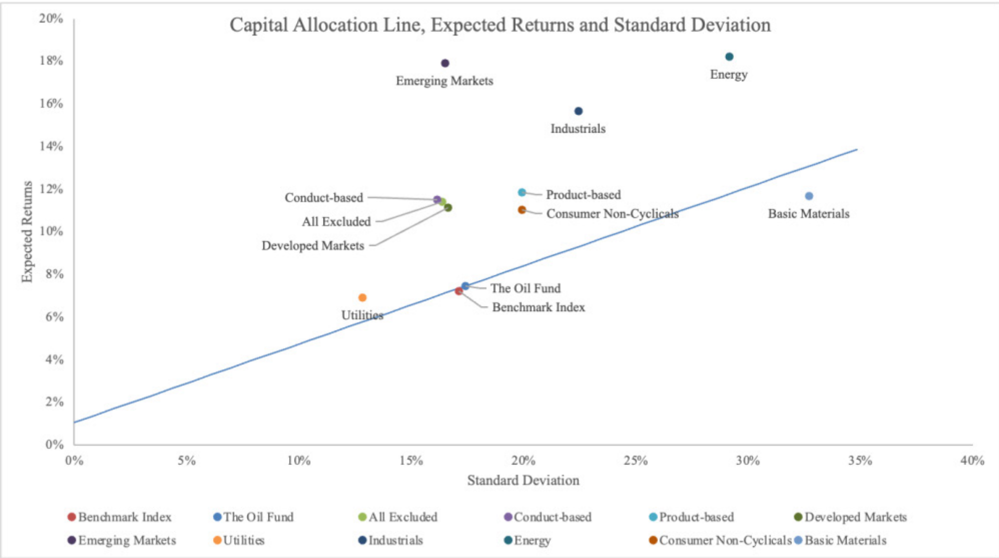


Figure 6.9 illustrates the capital allocation line (CAL) between different combinations of weights in the risk-free asset and the Oil Fund portfolio. The figure illustrate the risk and return relation of the portfolios from Table 6.3.

Further, as illustrated in Figure 6.10, the cumulative excess returns from 2006 to 2022 have been significantly higher for most of the constructed portfolios than the Oil Fund, which is their benchmark. While the Oil Fund is closely linked to its own benchmark index.

Figure 6.10 Cumulative Excessive Returns

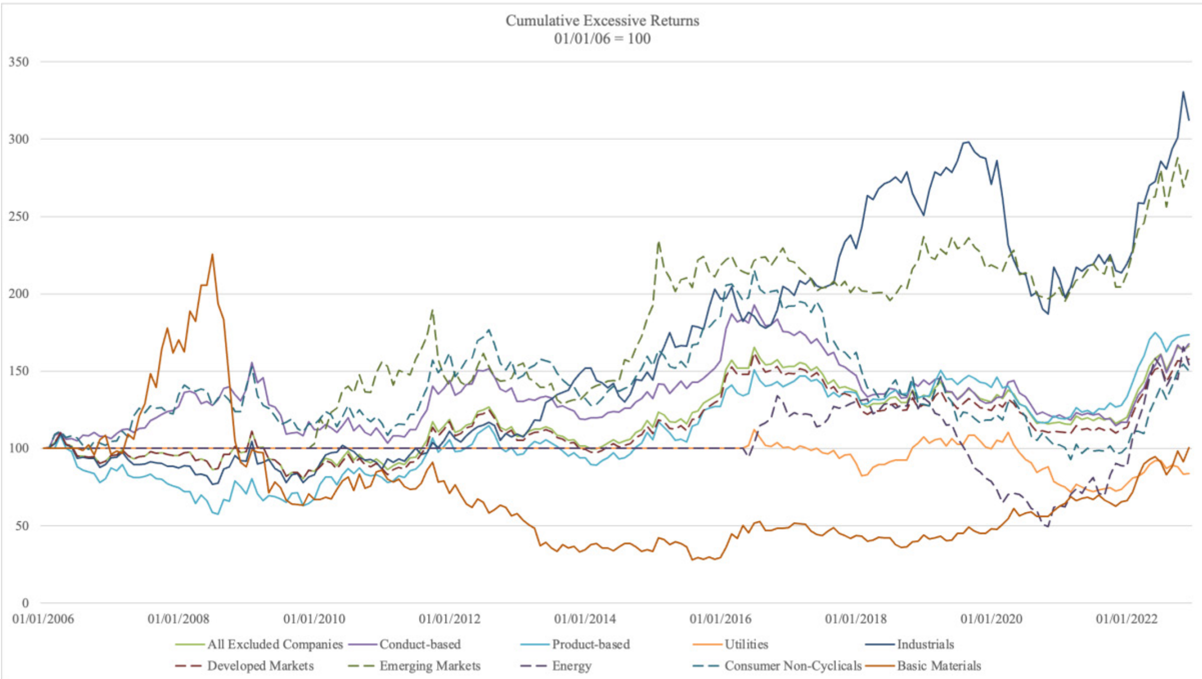


Figure 6.10 shows the cumulative excessive returns in relation to the Oil Fund for the different portfolios constructed in the study. The basis year is 2006, with a starting value of 100.

6.3 Regression Analyses

This chapter presents our findings from the regression analyses we have conducted. We initially found signs of heteroskedasticity in some of our models, so we used robust standard errors. Robust standard errors are an adjusted version of the standard error from a model. It adjusts the standard error by using the difference between the observed outcome and the predicted outcome from the model. Robust standard errors can be applied when heteroskedasticity is present to assess the variability of the estimates better (Mansournia et al., 2021). As we have taken measures to account for heteroskedasticity, we will not comment further on heteroskedasticity in the models. However, Appendix A2, presents tables including a Breusch Pagan test (BP-test) for heteroskedasticity and a Breusch Godfrey test (BG-test) for autocorrelation. The null hypothesis of heteroskedasticity and autocorrelation for both tests can be discarded if the p-value is above 0.05. Additionally, Appendix A.3 shows residual plots and autocorrelation plots (ACF) to control for the findings in the BP and BG tests. These tests are applied to the models before applying robust standard errors. If autocorrelation is present in a model, we will comment on it, and the model will not be a basis for drawing any conclusions as they violate the Gauss-Markov assumptions.

The output we will present in the following section will be model coefficient estimates with robust standard errors. Additionally, we will present the adjusted R-squared from each model, which explains how much the variance of one variable is explained by the variance of another variable (Investopedia, 2022).

When we comment on the results, we mainly comment on coefficient estimates that are significant on a 5% level or less, meaning when the p-value of the test is below 0.05. However, if we comment on coefficient estimates that are significant on a 10% level, we will emphasize that they are significant on a 10% level.

6.3.1 Fama-French Regression Results

The following chapter presents regression models using the Fama-French factors as independent variables. Table 6.4 shows the coefficients that we got from our Fama-French regression model. Each coefficient tells us how sensitive our portfolios are to the five risk factors. We will use tables 6.4 and 6.5 as the foundation for discussing how the risk factors affect the returns of our different portfolios. Table 6.4 consists of our largest portfolios, while Table 6.5 presents our sector-based portfolios. The dependent variable in all regression models is the monthly returns from 01.01.2006 to 31.12.2022 in the respective portfolio. The coefficients are provided as monthly estimates. Column (1) shows the coefficients for the Benchmark Index, with the benchmark returns as the dependent variable. Column (2) provides the coefficients for the Oil Fund's excessive returns, with the excessive returns of the Oil Fund relative to the benchmark as the dependent variable. Column (3) to (7) provides the coefficient estimates with the excessive returns of the portfolios to the Oil Fund as the dependent variable.

Table 6.4 Fama-French Regression Summary Output

	Dependent variable:						
	Benchmark (1)	The Oil Fund (2)	All Excluded (3)	Conduct Based (4)	Product Based (5)	Developed Markets (6)	Emerging Markets (7)
`Mkt-RF`	1.033***	0.011***	-0.285***	-0.325***	-0.243**	-0.272***	-0.542***
	(0.012)	(0.003)	(0.073)	(0.080)	(0.096)	(0.073)	(0.084)
SMB	-0.047	0.031***	-0.245	-0.284*	-0.215	-0.295*	0.608**
	(0.029)	(0.008)	(0.166)	(0.161)	(0.243)	(0.166)	(0.253)
HML	0.067**	0.015*	0.059	-0.026	0.253	0.047	0.219
	(0.033)	(0.008)	(0.148)	(0.175)	(0.204)	(0.151)	(0.210)
RMW	-0.020	-0.002	0.361	0.085	0.733**	0.392*	0.382
	(0.044)	(0.010)	(0.230)	(0.237)	(0.319)	(0.234)	(0.316)
CMA	-0.051	-0.035**	0.309	0.280	0.293	0.336	0.252
	(0.048)	(0.017)	(0.241)	(0.288)	(0.337)	(0.243)	(0.315)
Constant	0.0002	0.0002*	0.003	0.004*	0.002	0.003	0.011***
	(0.0004)	(0.0001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Adjusted R Squared	0.9858	0.3174	0.2126	0.2252	0.1193	0.2075	0.2864
Note:							*p<0.1; **p<0.05; ***p<0.01

Table 6.4 displays results from Fama-French regression models using the benchmark index, the Oil Fund, all excluded companies and four sub-portfolios as dependent variables. Column (1) shows the coefficients for the Benchmark Index, with the benchmark returns as the dependent variable. Column (2) provides the coefficients for the Oil Fund's excessive returns, with the excessive returns of the Oil Fund relative to the benchmark as the dependent variable. Column (3) to (7) provides the coefficient estimates with the excessive returns of the portfolios to the Oil Fund as the dependent variable. It includes information on the influence the Fama-French factors Mkt-RF, SMB, HML, RMW, CMA and Constant variable (alpha) have on the excessive returns of different dependent variables.

6.3.1.1 Benchmark

The Benchmark indicates a strong correlation with the mkt-rf factor, with a coefficient of 1.033. This implies that the excessive monthly returns in the benchmark portfolio are estimated to increase by 1.033 percentage points if the Mkt-RF factor increases by one percentage point. This is expected because the benchmark index should trail very close to the market portfolio.

The HML factor is also significant on a 5% significance level. Thus, we can interpret that for the benchmark portfolio, with an increase of 1 percentage point in the HML ratio, the returns on the benchmark portfolio increase by 0.067 percentage points. The coefficients mean that benchmark returns tend to increase when value stocks outperform growth stocks. The regression model also has an R-squared of 0.986, indicating that most of the variations in the portfolio are explained by the factors in the Fama-French Five Factor model.

6.3.1.2 The Oil Fund

Regressing the excessive returns of the Oil Fund versus its benchmark index with the Fama-French factors, we see that mkt-rf is statistically significant with a coefficient of 0.011. This indicates that when the excessive returns in the market increase by one percentage point, the Oil Fund's excessive returns compared to its benchmark increase by 0.011 percentage points. The coefficient estimate is plausible because the Oil Fund owns around 1.5% of global stocks. Moreover, as we learned from Table 6.1, the Oil Fund has an R-squared of 0.999, indicating it is heavily correlated with its benchmark index. Given that the benchmark index of the Oil Fund correlates strongly with the market, this strengthens the plausibility of the coefficient estimate.

Further, SMB and CMA are statistically significant, with coefficient estimates of 0.031 and -0.035. This indicates that the Oil Fund portfolio tends to perform well when small-cap stocks outperform large-cap stocks and when companies with an aggressive investment tendency outperform those with a more conservative investment tendency.

The value-factor HML is statistically significant at a 10% level with a coefficient of 0.015, indicating that the Oil Fund portfolio tends to perform well when stocks with a high book-to-market outperform those of a low book-to-market ratio.

The constant variable represents the alpha which estimates the excessive returns compared to the models' benchmark. The alpha in this model is significant at a 10% level, indicating that the Oil Fund has excessive returns of 0.02 % compared to its benchmark. The model explains around 31.7 % of the variability in the excessive returns of the Oil Fund.

6.3.1.3 All Excluded

The excessive market return is statistically significant, with a negative coefficient of -0.285. Thus, the portfolio of excluded companies is estimated to have decreasing excessive returns in relation to their benchmark (the Oil Fund) when the market trends upwards. The coefficient also indicates that the excluded companies have an increasing excessive return when the market decreases. This does not imply that the stock returns are positive during market downturns. Instead, it signifies that the stock returns exhibit a relatively higher excess return compared to its benchmark. An explanation could be that the exclusion portfolio consists of companies in industries such as tobacco and energy, being necessities even during economic downturns.

No other Fama-French factors are statistically significant for the exclusion portfolio in explaining the excessive returns. Thus, we cannot draw any conclusions from them. The adjusted R squared indicates this model's explanatory power of 21.26 %.

6.3.1.4 Conduct vs. Product

There are some differences for the portfolios centered on companies excluded due to conduct- versus product-based reasons from the Oil Fund. The model shows that they are both statistically significant in terms of the mkt-rf factor, with a coefficient of -0.325 and -0.243, respectively, for conduct- and product-based. This implies that excessive returns decrease when the market goes up and increase excessive returns when the market goes down. The conduct-based portfolio has a 10% significant SMB coefficient of -0.284, meaning that it estimates the large-cap stocks to outperform the small-cap stocks.

Further, the RMW coefficient for the product-based portfolio is 0.733. When a robust company in terms of high profitability does well, the portfolio is estimated also to yield excessive returns in relation to the benchmark (the Oil Fund).

Lastly, the conduct-based portfolio also yields an alpha of 0.004, as shown in the constant coefficient, which is statistically significant on a 10% level. This indicate that the conduct-based portfolio yields excessive returns compared to the Oil Fund that is not captured by the other factors.

The adjusted R-squared for conduct and product-based portfolios are respectively 0.2252 and 0.1193, indicating that the models do not capture much of the explanation of the variability of the excess returns.

6.3.1.5 Emerging vs. Developed

The Mkt-rf factor is statistically significant for both the emerging and developed portfolios with coefficients of respectively -0.272 and -0.542, indicating increasing excessive returns in a market downturn. The excessive returns for emerging markets are less than for developed markets, which could be reasoned in that developed markets have a higher market cap and are more in line with the index portfolios than emerging markets, which typically have a lower Beta, as shown in Table 6.1. Thus, emerging markets move more than developed markets in terms of returns when the market moves.

Further, the SMB factor is statistically significant with a coefficient of 0.608 for emerging markets portfolio. This means that the excessive returns are estimated to be higher when small-cap stocks outperform large-cap stocks. A potential explanation for this could be that small-cap stocks have a greater growth potential than large-cap stocks in emerging markets, making this a credible estimate.

For the developed markets portfolio, we find a coefficient of -0.295, statistically significant on a 10% significance level, suggesting that when small-cap stocks outperform large-cap stocks, the excessive returns of the portfolio will decrease. It also means that when large-cap stocks outperform small-cap stocks, the excessive returns will increase.

The alpha for emerging markets is also statistically significant, estimated at 0.011. Thus, in this model, the emerging markets portfolio yields an excessive return of 0.011 percentage points the other factors in the models do not capture. The models have adjusted R-squared values of 0.2075 for developed and 0.2864 for emerging markets.

6.3.1.6 All Sectors

Table 6.5 Fama-French Regression Summary Output Sectors

Robust Regression models - Fama French

	Dependent variable:				
	Utilities (1)	Industrials (2)	Energy (3)	Consumer Non-Cyclicals (4)	Basic Materials (5)
`Mkt-RF`	-0.479***	-0.022	0.144	-0.242**	-0.387**
	(0.094)	(0.107)	(0.248)	(0.098)	(0.156)
SMB	-0.322	-0.134	-0.346	-0.414*	0.694
	(0.224)	(0.238)	(0.597)	(0.229)	(0.437)
HML	-0.090	0.337	0.210	0.141	0.596
	(0.227)	(0.218)	(0.586)	(0.218)	(0.542)
RMW	0.753**	0.068	-1.225	0.598**	0.317
	(0.344)	(0.321)	(0.774)	(0.298)	(0.640)
CMA	0.708**	0.225	1.203	0.418	-1.264
	(0.317)	(0.292)	(0.774)	(0.320)	(0.851)
Constant	-0.001	0.006*	0.009	0.002	0.007
	(0.003)	(0.004)	(0.008)	(0.003)	(0.006)
Adjusted R Squared	0.5277	0.0348	0.2394	0.1425	0.0325
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 6.5 displays results from Fama-French regression models. It provides information on the influence of the Fama-French factors Mkt-RF, SMB, HML, RMW, CMA and Constant variable (alpha) on the portfolios' excessive returns. All the dependent variables are the excessive returns of the sector portfolios relative to the Oil Fund.

Table 6.5 shows the Fama-French regression models for the sector portfolios. The table shows that the utilities, energy and basic materials portfolios have statistically significant coefficients for the mkt-rf factor, with coefficients of respectively -0.479, -0.242 and -0.387, indicating that when the market goes downwards, the excessive returns of these portfolios increase.

Secondly, SMB is only statistically significant for the consumer non-cyclicals portfolio on a 10% significance level, with a coefficient of -0.414. Thus, when small-cap stocks outperform large-cap stocks, the consumer non-cyclicals portfolio tends to get negative excessive returns and the opposite when large-cap stocks outperform small-cap stocks. Consumer non-cyclicals companies are companies within the food, beverage, tobacco sector etc., typically larger companies, which could explain its negative coefficient.

As for the RMW factor, the utilities and the consumer non-cyclicals portfolios have a statistically significant relation to this factor, with coefficients of 0.753 and 0.598, respectively. The positive coefficients can be explained by the fact that the companies in these portfolios tend to be robust with steady cash flows. That is, they are likely to have high operating profitability. However, it is important to note that this factor does not necessarily indicate performance during economic downturns but rather a tendency for the portfolios to be associated with firms that exhibit higher profitability relative to the rest of the market.

We find statistical significance in the utilities portfolios for the CMA factor, with a coefficient of 0.708. The positive coefficient can be linked to the fact that companies in this sector tend to be more conservative regarding internal investments, which aligns with the characteristics of the CMA factor. This suggests that the utilities portfolio tends to generate excessive returns in relation to the Oil Fund portfolio when firms that invest conservatively outperform those that invest more aggressively. This sector typically includes well-established, steady-income companies. Thus, they do not necessarily need to invest aggressively.

Lastly, the industrials portfolio has an alpha coefficient of 0.006, indicating excessive returns compared to the Oil Fund that is not captured by the other factors. The alpha coefficient is significant on a 10% significance level.

In summary, we find that all portfolios containing excluded companies except the energy portfolio (which is not significant), have negative Mkt-rf coefficients. This suggests that the excluded companies are operating under different market dynamics than the Oil Fund. They tend to perform better relative to the Oil Fund in a market downturn, but the differences will mitigate in a market uprise. Additionally, it could imply that the risk profiles of the excluded companies are different than the Oil Fund, which is expected.

Emerging markets have significantly larger absolute coefficients than the rest of the portfolios in all factors where it is significant, indicating that this is the sub-portfolio which contributes the most to the excessive returns of the excluded companies.

When interpreting these factors, it is essential to remember that it does not necessarily mean that they have a causal effect on the returns. Instead, the different factors could explain part of the returns. While these factors help explain some of the returns, our R-squared in these models is relatively low, ranging from 0.0325 to 0.3174. Thus, other factors than the ones described in the Fama-French five-factor model could also be introduced to further look into these returns.

6.3.2 Regression Model Analysis - ESG Score and Returns

6.3.2.1 Excluded Companies and the 100 Biggest Companies in the Oil Fund

Table 6.6 Regression Models Excluded vs. 100 Biggest Companies in the Oil Fund

Overview of regression models				
Model	**Portfolio**	**Dependent variable**	**Note**	**Explanatory variables**
1	Excluded companies	ESG		Returns, Market Cap, Profits
2	Excluded companies	Returns		ESG, Market Cap, Profits
3	100 biggest in The oil fund	ESG		Returns, Market Cap, Profits
4	100 biggest in The oil fund	Returns		ESG, Market Cap, Profits
5	Excluded companies	ESG	Lagged explanatory variables	Returns_L1, Marketcap_L1, Profits_L1
6	Excluded companies	Returns	Lagged explanatory variables	ESG_L1, Marketcap_L2, Profits_L2
7	100 biggest in The oil fund	ESG	Lagged explanatory variables	Returns_L1, Marketcap_L1, Profits_L1
8	100 biggest in The oil fund	Returns	Lagged explanatory variables	ESG_L1, Marketcap_L1, Profits_L1

Table 6.6 presents an overview of the regression models utilized to investigate the potential correlation between ESG score and Returns for the excluded companies and the 100 biggest companies in the Oil Fund. It provides an overview of which metrics are the dependent variable and which are explanatory variables in the different regression models.

Table 6.6 provides an overview of the eight regression models presented in this chapter. The first four models (Models 1-4) do not include lagged variables, whereas the last four models (Models 5-8) include lagged variables with a one-year lag.

The following part will comment on the regression models made to investigate the correlation between ESG and returns for the excluded companies and the 100 biggest companies in the Oil Fund. All models include year-fixed effects in addition to the explanatory variables presented in Table 6.6. However, we will not comment further on the coefficients or the significance of these year-fixed effects as they are present in the models to increase the accuracy of the estimates. When commenting, we will mainly focus on the coefficient estimates of returns and ESG and short comments on market capitalization and profits. Further, we will comment on the adjusted R-squared and refer to it as the model's explanatory power.

Model 1

Table 6.7 Regression Output Model 1

Regression Results

	Dependent variable: ESG
MarketCap	0.256***
	(0.029)
Return	0.034**
	(0.014)
Profit	1.032***
	(0.266)
Year2018	2.136
	(2.191)
Year2019	3.551
	(2.193)
Year2020	5.215**
	(2.098)
Year2021	6.237***
	(2.088)
Year2022	8.640***
	(1.978)
Constant	45.508***
	(1.626)
Adjusted R Squared	0.3294
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.7 shows the regression output of a model using ESG as the dependent variable and yearly returns, market capitalization, profits and fixed-year variables as explanatory variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the excluded companies.

Model 1 examines the relationship between the ESG score of the excluded companies and three explanatory variables, yearly return, market capitalization and profits. The results in Table 6.7 shows significant coefficient estimates on a 5% significance level. Returns have a coefficient estimate of 0.034. This suggests that a 1 unit increase in returns (one percentage point) leads to a 0.034 increase in ESG score. Market capitalization and profits are also significant, with coefficient estimates of 0.256 and 1.03, respectively. According to this model, this implies that a 1 unit increase in these metrics (1 billion USD) leads to a 0.256 and a 1.03 point increase in ESG score.

The model has an adjusted R-Squared of 0.3294, meaning the included variables can explain approximately 32.9 % of the ESG score. As the ESG score is influenced by several other factors, an R squared of 0.3294 is considered sufficient explanatory power.

Model 2

Table 6.8 Regression Output Model 2

Regression Results

	Dependent variable: Returns
MarketCap	-0.103
	(0.077)
Profit	-0.196
	(0.695)
ESG	0.246**
	(0.100)
Year2018	-24.172***
	(4.001)
Year2019	-5.495
	(5.668)
Year2020	-15.969***
	(4.524)
Year2021	13.803**
	(5.671)
Year2022	-7.707
	(5.245)
Constant	6.829
	(5.327)
Adjusted R Squared	0.0882
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.8 shows the regression output of a model using Returns as the dependent variable and ESG Score, market capitalization, profits and fixed-year variables as explanatory variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the excluded companies.

Model 2 examines the relationship between the dependent variable, returns and the exploratory variables, ESG score, market capitalization and profits, and year-fixed effects. The results show that only the ESG score and some year fixed effects variables are significant on a 5% significance level. Specifically, a one-point increase in ESG score is associated with a 0.246 percentage point increase in returns. The model has a low R-squared of 0.0882, which is expected given that various external factors beyond the included variables influence returns.

Model 3

Table 6.9 Regression Output Model 3

Regression Results

	Dependent variable: ESG
Return	-0.058***
	(0.016)
Profit	0.134*
	(0.070)
MarketCap	-0.002
	(0.003)
Year2018	0.649
	(2.602)
Year2019	4.263*
	(2.454)
Year2020	3.892
	(2.418)
Year2021	5.974**
	(2.454)
Year2022	4.765**
	(2.353)
Constant	70.852***
	(1.972)
Adjusted R Squared	0.0344
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.9 shows the regression output of a model using ESG as the dependent variable and yearly returns, market capitalization, profits and fixed-year variables as explanatory variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the 100 biggest companies in the Oil Fund.

Table 6.9 presents the results of a regression analysis in which ESG score is the dependent variable, while returns, market capitalization and profits are the dependent variables. The data for this analysis comes from the top 100 companies in the Oil Fund, covering the years 2017 to 2022. The findings reveal that yearly returns and profits are statistically significant. A one percentage point increase in annual returns is associated with a 0.058 decrease in ESG score. One billion increase in profits is estimated to increase the ESG score by 0.134 points.

The model has limited explanatory power, as indicated by its R-squared value being 0.0344, which is much lower than the same regression model for the excluded companies. As of this, the model does not explain much of the variability in the ESG score of the 100 biggest companies. Nonetheless, in conjunction with other tests conducted on this portfolio, this regression analysis can provide insight into how these metrics may influence each other. It is crucial to note that while the coefficients are not necessarily incorrect, the model has limited explanatory power.

Model 4

Table 6.10 Regression Output Model 4

Regression Results

	Dependent variable: Returns
MarketCap	0.004
	(0.005)
ESG	-0.334**
	(0.143)
Profit	-0.093
	(0.154)
Year2018	-28.255***
	(2.987)
Year2019	5.417
	(3.342)
Year2020	-3.528
	(8.670)
Year2021	2.020
	(3.851)
Year2022	-32.687***
	(3.916)
Constant	52.478***
	(10.959)
Adjusted R Squared	0.1446
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.10 shows the regression output of a model using returns as the dependent variable and ESG score, market capitalization, profits and fixed-year variables as explanatory variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the 100 biggest companies in the Oil Fund.

Table 6.10 displays the findings of model 4, which examines the influence of the explanatory variables, including ESG score, on the dependent variable of yearly returns for the top 100 companies in the Oil Fund. Except for fixed effects, only the ESG score is significant on a 5% significance level. The results indicate that a one-point increase in ESG score is associated with a 0.33 percentage point decrease in yearly returns. The model has an explanatory power of around 14.46 % of the return variable, which is much higher than the same model based of the excluded companies (model 2).

Model 5

Table 6.11 Regression Output Model 5

Regression Results

	Dependent variable: ESG
MarketCap_l	0.247***
	(0.037)
profit_l	1.255***
	(0.380)
return_l	0.074***
	(0.016)
Year2019	1.175
	(2.170)
Year2020	2.272
	(2.102)
Year2021	4.677**
	(2.028)
Year2022	5.943***
	(1.930)
Constant	47.235***
	(1.552)
Adjusted R Squared	0.3398
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.11 shows the regression output of a model using ESG as the dependent variable and one-year lagged yearly returns, market capitalization, and profits as explanatory variables together with fixed year variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the excluded companies.

The methods used in Table 6.11 to 6.14 differ from those previously used, as lagged explanatory variables are introduced in these models. The variables used in these models are lagged by one year. This is done to account for the possibility that metrics from one year may not affect the metrics in the same year. Instead, it is more reasonable to assume that changes in ESG scores, for example, might depend more on returns from the prior year.

Model 5 examines whether lagged versions of the explanatory variables return, market capitalization, and profits significantly correlate with ESG scores for the portfolio with excluded companies. The variables are lagged by one year, as these were the variables that gave the model the best fit. In addition, we find it most plausible that a one-year lag in financial metrics makes the most sense. The results indicate that all the mentioned explanatory variables are significant on a 5% significance level. A one percentage point increase in returns one year prior is associated with a 0.074 rise in ESG score. An increase of 1 billion in market capitalization the year prior is estimated to increase the ESG score by 0.247 points, while a 1 billion increase in profits the year prior is estimated to increase the ESG score by 1.255 points. The model explains approximately 34% of the ESG score variable.

Model 6

Table 6.12 Regression Output Model 6

Regression Results

	Dependent variable: Returns
MarketCap_l	-0.170**
	(0.068)
profit_l	0.355
	(0.664)
ESG_l	0.212*
	(0.113)
Year2019	18.112***
	(5.245)
Year2020	3.488
	(4.089)
Year2021	38.850***
	(5.313)
Year2022	17.073***
	(4.864)
Constant	-13.957**
	(5.656)
Adjusted R Squared	0.0991
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.12 shows the regression output of a model using yearly returns as the dependent variable and one-year lagged ESG Score, market capitalization, and profits as explanatory variables together with fixed year variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the excluded companies.

Model 6 uses ESG scores, market capitalization and profits from the previous year as explanatory variables for yearly returns. An increase in ESG score of one point in the prior year is estimated to increase the returns by 0.212 percentage points, while a 1 billion increase in market capitalization decreases returns by 0.17 percentage points. However, the model only has an explanatory power of 9.9%.

Model 7

Table 6.13 Regression Output Model 7

Regression Results

	Dependent variable: ESG
MarketCap_l	0.0001
	(0.004)
profit_l	0.108
	(0.085)
return_l	-0.056***
	(0.021)
Year2019	-0.025
	(2.422)
Year2020	1.832
	(2.382)
Year2021	2.856
	(2.296)
Year2022	4.697**
	(2.328)
Constant	73.315***
	(1.931)
Adjusted R Squared	0.0255
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.13 shows the regression output of a model using ESG as the dependent variable and one-year lagged yearly returns, market capitalization, and profits as explanatory variables together with fixed-year variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the 100 biggest companies in the Oil Fund.

The results presented in Model 7 demonstrate how ESG is related to lagged variables for the largest 100 companies in the Oil Fund. Out of the explanatory variables, only returns are statistically significant, and the model can explain 2.5% of the variability of the ESG score variable. An increase of 1 percentage point in returns the year prior is associated with a decrease of 0.056 points in ESG score.

Model 8

Table 6.14 Regression Output Model 8

Regression Results	Dependent variable: Returns
MarketCap_l	0.004 (0.007)
profit_l	-0.113 (0.182)
ESG_l	-0.316 (0.203)
Year2019	32.662*** (2.851)
Year2020	25.564*** (9.104)
Year2021	31.371*** (3.718)
Year2022	-4.427 (3.728)
Constant	22.222 (15.227)
Adjusted R Squared	0.1354
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 6.14 shows the regression output of a model using yearly returns as the dependent variable and one-year lagged ESG score, market capitalization and profits as explanatory variables together with fixed year variables. The metrics are from 2016 - 2022, and the portfolio analyzed is the 100 biggest companies in the Oil Fund.

Model 8 in Table 6.14 is a model that focuses on the relationship between lagged explanatory variables and returns as the dependent variable. The model uses one year lagged variables as independent variables and has an explanatory power of around 13.5%. In this model, no explanatory variables are significant on a 5% significance level.

Table 6.15 Regression Output Summary Models 1 to 8

Regression Model Summaries - Excluded vs 100 Biggest in the oil fund

	Dependent variable:							
	ESG (1)	Returns (2)	ESG (3)	Returns (4)	ESG (5)	Returns (6)	ESG (7)	Returns (8)
MarketCap	0.256***	-0.103	-0.002	0.004				
	(0.029)	(0.077)	(0.003)	(0.005)				
Return	0.034**		-0.058***					
	(0.014)		(0.016)					
Profit	1.032***	-0.196	0.134*	-0.093				
	(0.266)	(0.695)	(0.070)	(0.154)				
ESG		0.246**		-0.334**				
		(0.100)		(0.143)				
Year2018	2.136	-24.172***	0.649	-28.255***				
	(2.191)	(4.001)	(2.602)	(2.987)				
MarketCap_l					0.247***	-0.170**	0.0001	0.004
					(0.037)	(0.068)	(0.004)	(0.007)
profit_l					1.255***	0.355	0.108	-0.113
					(0.380)	(0.664)	(0.085)	(0.182)
return_l					0.074***		-0.056***	
					(0.016)		(0.021)	
ESG_l						0.212*		-0.316
						(0.113)		(0.203)
Year2019	3.551	-5.495	4.263*	5.417	1.175	18.112***	-0.025	32.662***
	(2.193)	(5.668)	(2.454)	(3.342)	(2.170)	(5.245)	(2.422)	(2.851)
Year2020	5.215**	-15.969***	3.892	-3.528	2.272	3.488	1.832	25.564***
	(2.098)	(4.524)	(2.418)	(8.670)	(2.102)	(4.089)	(2.382)	(9.104)
Year2021	6.237***	13.803**	5.974**	2.020	4.677**	38.850***	2.856	31.371***
	(2.088)	(5.671)	(2.454)	(3.851)	(2.028)	(5.313)	(2.296)	(3.718)
Year2022	8.640***	-7.707	4.765**	-32.687***	5.943***	17.073***	4.697**	-4.427
	(1.978)	(5.245)	(2.353)	(3.916)	(1.930)	(4.864)	(2.328)	(3.728)
Constant	45.508***	6.829	70.852***	52.478***	47.235***	-13.957**	73.315***	22.222
	(1.626)	(5.327)	(1.972)	(10.959)	(1.552)	(5.656)	(1.931)	(15.227)
Adjusted R-Squared	0.3294	0.0882	0.0344	0.1456	0.3398	0.0991	0.0255	0.1354
Note:						*p<0.1; **p<0.05; ***p<0.01		

Table 6.15 presents an overview of all the regression models from Table 6.7 to Table 6.14. It includes the coefficient estimates and an indication of whether it is significant or not (market with 1-3 dots (*)). It also includes the R-squared for each model and the standard deviation of every coefficient estimate. Columns 1,2,5 and 6 represents the excluded companies, while column 3,4,7 and 8 represents the 100 biggest companies in the Oil Fund. Column 5-8 is models using lagged independent variables.

Table 6.15 presents a summary of models 1-8. By consolidating them into a single table, it becomes easier to identify patterns and draw conclusions from the analysis. Models 1-2 and 5-6 are based on the excluded companies' portfolios, while models 3-4 and 7-8 are from the 100 biggest companies in the Oil Fund. We will compare the models that use the same variables as dependent variables and explanatory variables but with different portfolios.

Before comparing models, we can identify models that have severe autocorrelation. The table in Appendix A.2 shows that the BG test indicates autocorrelation in models 1, 5, and 7. Additionally, the Auto Correlation Function (ACF) plots in Figure A.2 confirm the BG test findings. These models will not be a base for conclusions as the Gauss-Markov assumptions seem to be violated. However, they will still be used for comparison to look for trends among all models.

Models 1 and 3 are based on the portfolios of the excluded companies and the 100 biggest companies in the Oil Fund, respectively. Notably, the returns variable, which is significant in both models, appears to affect the ESG score in opposite directions. For the excluded companies, returns have a positive effect on ESG scores, while for the 100 biggest companies in the Oil Fund, returns have a negative impact. Additionally, market capitalization and profits are significant factors, and they seem to have a larger effect on the excluded companies than on the 100 biggest companies in the Oil Fund. The explanatory power of model 1 is substantially larger than model 8.

Models 2 and 4 are based respectively on the excluded companies and the 100 biggest companies in the Oil Fund. Both models have reasonably low R-Squared values and no autocorrelation or heteroskedasticity issues. As for models 1 and 3, the relationship between ESG scores and returns goes in opposite directions.

Models 5 and 7 feature ESG score as the dependent variable and lagged explanatory variables from one year prior. The results show a consistent pattern where returns positively affect the ESG score for the excluded companies but have a negative effect on the ESG score for the 100 largest companies in the Oil Fund. However, it should be noted that both models suffer from severe autocorrelation, which can reduce their precision and accuracy compared to other models.

Models 6 and 8 have returns as the dependent variable and lagged explanatory variables. In model 6, ESG one year prior is estimated to influence returns positively, while in model 8, no coefficient estimate is significant. It agrees with what we found in models 2 and 4, where ESG positively affects returns, also when lagged, for the excluded companies.

In summary, models 1-8 reveal a consistent trend across the models. ESG and returns seem to be positively correlated for the excluded companies and negatively correlated for the 100 biggest companies in the Oil Fund. We find no significant difference between lagged variables and not lagged variables.

Our findings might seem counterintuitive, as the excluded companies are performing well financially as seen in figure 6.8, but with low ESG scores. However, accounting for relative growth in ESG scores, it seems more plausible. It is reasonable to assume that one of the reasons for the excluded companies' lower ESG scores is the fear of investing in a more sustainable business model. They might fear losing their competitive advantage operating in a business with methods and models that do not consider sustainability issues. Therefore, these findings could incentivize them to work towards a better ESG score. Our models seem to be better at explaining the variability of the ESG score than the annual returns for the excluded companies and better at explaining the annual returns for the 100 biggest in the Oil Fund, which is reflected in the adjusted R-squared of the models.

On the contrary, the results for the 100 biggest companies in the Oil Fund reveal that higher ESG scores can lead to a decrease in returns. This finding also may seem counterintuitive. One possible explanation for this phenomenon is that once a company has taken actions to improve its ESG score and reach a certain level, the marginal cost of further improvements in ESG score may outweigh the benefits they provide in the short term. As industry leaders, these companies are also responsible for acting as role models for other companies and society. They may undertake measures guided by this responsibility, even if they do not immediately translate into financial returns. However, it is reasonable to assume that such actions will ultimately benefit the company in the long run, as Henisz et al. (2019) argued.

Shanaev & Ghimire (2022) suggests that changes in ESG score are correlated with positive returns. Our findings on the excluded companies agree with theirs, while our findings on the 100 biggest companies in the Oil Fund disagree.

The models containing autocorrelation agree with the findings of the models with no autocorrelation. Even if we do not base our analysis on these models, the fact that they support the findings from the models with no autocorrelation can be seen as an amplifying factor.

Overall, our findings suggest that ESG score is a factor for investors to consider when evaluating the potential returns of companies. However, it is essential to note that the explanatory power of these models is limited, which suggests that there are likely external factors that we have not accounted for in our analysis. While we anticipated that there would be external factors influencing the relationship between ESG and returns, we were surprised by the low R-squared values in our models.

6.3.2.2 Sub-portfolios

Table 6.16 Regression Model Output Sub-portfolios - ESG Score Dependent Variable

Regression Model Summaries - ESG dependent variable

	Dependent variable:								
	Product	Conduct	Developed	Emerging	Utilities	Industrials	Energy	Consumer Non Cyclicals	Basic Materials
MarketCap	0.296***	0.370***	0.290***	1.033***	0.603***	0.349***	0.689***	0.069	0.494***
	(0.050)	(0.045)	(0.031)	(0.116)	(0.127)	(0.073)	(0.169)	(0.064)	(0.069)
Profit	0.699*	2.239***	1.984***	-1.046*	1.653	2.529**	-1.162	3.820***	2.697**
	(0.392)	(0.595)	(0.360)	(0.575)	(1.347)	(0.965)	(0.902)	(0.820)	(1.168)
Return	0.037	0.054**	0.047	0.080***	0.038*	0.087	0.062	0.078	0.076
	(0.025)	(0.022)	(0.030)	(0.024)	(0.021)	(0.055)	(0.038)	(0.079)	(0.069)
Year2018	2.637	2.406	0.682	5.767	1.961	-2.484	9.441	4.393	3.157
	(3.514)	(3.538)	(3.180)	(4.630)	(3.166)	(8.122)	(7.802)	(9.012)	(13.226)
Year2019	4.617	2.878	2.376	5.409	2.809	-6.126	15.615**	4.065	4.027
	(3.531)	(3.612)	(3.185)	(4.687)	(3.284)	(8.421)	(7.176)	(8.786)	(13.181)
Year2020	7.601**	4.771	4.777	8.171*	4.735	-6.197	16.200**	8.855	3.296
	(3.344)	(3.454)	(3.071)	(4.467)	(3.157)	(8.290)	(6.429)	(8.957)	(11.787)
Year2021	8.246**	2.523	2.009	6.617	4.907	-10.313	12.197*	9.437	4.079
	(3.387)	(3.602)	(3.255)	(4.773)	(3.328)	(8.421)	(6.736)	(9.272)	(12.145)
Year2022	10.808***	6.382*	4.237	13.812***	9.606***	-2.842	12.138*	13.998	0.809
	(3.093)	(3.466)	(3.198)	(4.388)	(3.234)	(7.713)	(7.033)	(8.495)	(12.373)
Constant	44.142***	32.637***	41.168***	24.546***	35.733***	43.544***	29.360***	35.420***	30.587***
	(2.666)	(2.602)	(2.375)	(3.336)	(2.495)	(6.169)	(5.407)	(7.166)	(10.171)
Adjusted R-Squared	0.3599	0.2743	0.3100	0.2620	0.2363	0.2531	0.2028	0.3693	0.4085
Note:									*p<0.1; **p<0.05; ***p<0.01

Table 6.16 presents an overview of regression models investigating the relationship between ESG score and yearly returns for the excluded companies, split into different sub-portfolios. The model uses ESG score as the dependent variable. The table includes the coefficient estimates and an indication of whether it is significant or not (market with 1-3 dots (*)). It also includes the r-squared for each model and the standard deviation of every coefficient estimate.

Table 6.16 presents all regression models for our different sub-portfolios using ESG score as the dependent variable.

In the portfolio of product-based excluded companies, market capitalization is significant at a 5% significance level, indicating that a 1 billion increase in market cap raises the ESG score by 0.296 points. The model has an explanatory power of around 36%.

The conduct-based portfolio has significant coefficient estimates of returns, profits and market capitalization. A one percentage point increase in returns influences the ESG score by 0.05 points. A 1 billion increase in market cap is estimated to increase the ESG score by 0.37 points, while a 1 billion increase in profits is estimated to increase the ESG score by 2.24 points. The model has an explanatory power of 0.27.

For the developed markets, market capitalization is estimated to increase the ESG score by 0.29 points with an increase of 1 billion. In comparison, profits are estimated to increase the ESG score by 1.98 points if it increases by a billion. The model explains 31 % of the variability in ESG score and has no heteroskedasticity or autocorrelation.

In the emerging markets model, a one percentage point increase in returns increases the ESG score by 0.08 points. An increase of 1 billion in market capitalization is estimated to increase ESG scores by 1.03 points, while an increase of 1 billion in profits decreases the ESG score by 1.05 points. The model has an explanatory power of 0.26.

In the utilities portfolio, the ESG score is estimated to be increased by 0,04 points if returns increase by one percentage point, while 1 billion more in market cap increases the ESG score by 0.6 points. However, the ESG score is only significant on a 10 % significance level. The explanatory power of the model is 0.24.

The returns coefficient estimate is insignificant for the remaining sector portfolios, industrials, energy, consumer non-cyclicals and basic materials. As this is the coefficient we are mainly interested in, we won't comment anything more on these models.

Overall, only three of the models find significant coefficient estimates on the returns variable. All three models confirm the findings from the regressions made in excluded companies and the 100 biggest companies that the ESG score is estimated to increase if the returns variable increases, ranging from 0.04 points to 0.08 points. Moreover, market capitalization seems to have a significant positive effect on all models except consumer non-cyclicals.

According to the tests in Appendix A.2 we find autocorrelation in the models of the emerging market portfolio and the basic material portfolio. However, there are not a lot of signs of autocorrelation in the ACF plot in Figure A.3 for these portfolios. There might be a potential breach of the Gauss-Markov assumptions in these two models. Still, they point in the same direction as the other models with no autocorrelation, namely that ESG score positively correlates with returns.

Table 6.17 Regression Model Output Sub-portfolios – Returns Dependent Variable

Regression Model Summaries - Returns dependent variable

	Dependent variable:								
	Product	Conduct	Developed	Emerging	Utilities	Industrials	Energy	Consumer Non Cyclicals	Basic Materials
MarketCap	-0.262	0.032	0.009	-0.775**	-0.211	-0.079	-0.148	0.036	-0.079
	(0.159)	(0.066)	(0.057)	(0.337)	(0.207)	(0.162)	(0.500)	(0.115)	(0.151)
Profit	0.816	-1.503*	-0.775	1.687	0.011	-0.301	-2.374	-1.595	-0.607
	(1.025)	(0.873)	(0.672)	(1.415)	(2.313)	(2.013)	(2.604)	(1.482)	(1.322)
ESG	0.256*	0.176**	0.136*	0.388***	0.182*	0.237	0.365*	0.098	0.232
	(0.153)	(0.073)	(0.077)	(0.131)	(0.100)	(0.188)	(0.204)	(0.103)	(0.182)
Year2018	-26.163***	-27.250***	-22.982***	-34.504***	-6.237	-39.458***	-54.667***	-28.114***	-69.787***
	(6.164)	(4.532)	(4.067)	(7.442)	(4.115)	(8.196)	(12.474)	(6.843)	(17.721)
Year2019	-13.020*	-1.154	-0.016	-13.679	2.862	11.712	-57.677***	9.860	-37.613*
	(6.990)	(6.998)	(5.560)	(10.787)	(6.997)	(13.540)	(13.788)	(11.981)	(19.576)
Year2020	-25.181***	-9.383	-15.091***	-15.045*	-12.554***	-5.593	-45.390***	-13.483**	4.103
	(6.326)	(6.216)	(5.358)	(8.716)	(4.278)	(16.366)	(12.695)	(5.400)	(26.342)
Year2021	12.445	14.280**	2.003	32.842***	27.618***	12.985	11.119	10.414	-19.067
	(9.531)	(6.535)	(4.355)	(11.716)	(9.285)	(14.536)	(12.956)	(7.235)	(18.372)
Year2022	-7.431	-7.855	-5.409	-15.055*	-11.838***	-9.774	36.924*	3.021	-39.171**
	(9.752)	(5.164)	(5.671)	(8.144)	(4.505)	(9.353)	(21.663)	(8.465)	(19.450)
Constant	13.681*	8.848*	10.871**	10.903	2.074	7.715	30.634**	12.105**	33.629*
	(7.719)	(4.877)	(4.560)	(7.805)	(4.746)	(10.869)	(12.752)	(5.306)	(19.809)
Adjusted R-Squared	0.1171	0.0772	0.0543	0.1699	0.1080	0.1008	0.4163	0.1678	0.1665
Note:									*p<0.1; **p<0.05; ***p<0.01

Table 6.17 presents an overview of regression models investigating the relationship between ESG score and yearly returns for the excluded companies, split into different sub-portfolios. The models use returns as the dependent variable. The table includes the coefficient estimates and an indication of whether it is significant or not (market with 1-3 dots (*)). It also includes the r-squared for each model and the standard deviation of every coefficient estimate.

Table 6.17 displays all regression models for our different sub-portfolios using returns as the dependent variable. As for the other similar regression models, we are only commenting on the financial metrics. ESG score is significant on a 10% significance level for all sub-portfolios except industrials, consumer non-cyclicals and basic materials. If the ESG score increases by 1 point, the returns variable is estimated to increase in a range of 0.14 to 0.39 percentage points in the different models. The market capitalization coefficients are significant in the emerging market portfolio, estimating that a 1 billion increase leads to a decrease in the returns by 0.78 percentage points. The explanatory power of the models with significant coefficient estimates ranges from 7.7% to 17%.

According to the tests in Appendix A.2, we find autocorrelation in the energy portfolio and the basic materials portfolio. Still, according to the ACF plots in Figure A.4, there are limited signs of it. Nonetheless, as for the regression models using ESG as the dependent variable, the ESG score seems to be positively correlated with yearly returns.

7.0 Limitations

Our study is subject to certain limitations. Firstly, some of our regression models suffer from both heteroskedasticity and autocorrelation. We have applied robust standard errors to account for the potential bias in the estimates of the standard errors. As for autocorrelation, it might affect the significance of the coefficient estimates in our models, potentially overestimating the significance of the model. However, our findings in all models with autocorrelation have coefficient estimates pointing in the same direction as those with no autocorrelation; that ESG scores and returns are positively correlated for the excluded companies and negatively correlated for the 100 biggest companies. We have no signs of autocorrelation in the Fama-French regression models.

The adjusted R-squared of some of our models is small. In our Fama-French regressions, especially the models where the industrials sector and the basic material sector are dependent variables, it is as low as 0.0350 and 0.0325, which indicates that it fails to capture almost 97% of the variability in the excess returns of these portfolios. For the rest of the portfolios, it varies from around 0.12 to 0.53, suggesting that there are external factors affecting the excess returns of the different portfolios. In the regression analyses where the relationship between ESG score and returns is assessed, the explanatory power varies from as low as 0.02 to 0.41, meaning some of the models do not explain much of the variability in ESG score and returns.

The chosen time span used in the regression models analyzing the relationship between ESG scores and returns is from 2017-2022, even though we have data from 2006. We opted to wait until the number of excluded companies surpassed 100 companies to have a large enough sample size to be comparable to the 100 largest companies in the Oil Fund. However, by running the regression based on six years, the dataset the models are based on is smaller and may be less representative. On the other hand, by including more years, the magnitude of the returns and ESG score of extreme outliers could have also hurt the quality of the models.

Aside from the Oil Fund portfolio and the benchmark, the portfolios analyzed in the Fama-French regressions vary significantly in size. The smallest sample size is the portfolio for Basic Materials with 16 companies, and the largest is the portfolio with all the excluded companies with 160 companies. The portfolio sizes might implicate the results to some degree. Consequently, when interpreting the results of these analyses, one should use a degree of caution due to the sample sizes. A small sample size is more exposed to extreme outliers affecting the average returns in the portfolio.

Future researchers should consider creating models that capture more of the variability in the dependent variables. When analyzing excessive returns with Fama-French models, it could be beneficial to add even more independent variables to increase the explanatory power of the models and remove external factors not captured. The same could be said when analyzing the relationship between ESG scores and returns. These metrics are complex, and adding more explanatory variables could contribute to making models with a better fit. Additionally, researchers could gather the ESG score of all companies within the Oil Fund in order to get a more nuanced picture of the dynamics between ESG scores and returns. However, this requires a thorough and excessive data collection process. Researchers could also apply a similar analysis on other funds, benchmarks, sectors and markets to discover if the findings from analyzing the Oil Fund are representative of the broader financial landscape.

8.0 Conclusion

The first objective of our thesis was to find if the returns of excluded companies from the Oil Fund have higher returns than the Oil Fund itself. As part of this objective, we also investigated if certain categories of excluded firms, divided into sub-portfolios, perform better than others based on stock returns to see if there are certain sectors or markets driving the excessive returns of the excluded companies. Our second research question seeks to determine if the relationship between ESG scores and stock returns differs for the excluded companies and the 100 biggest companies in the Oil Fund.

The reason for combining these two objectives is first to determine if there is a difference in the returns of the excluded companies and those in the Oil Fund. If such a difference is found, we wanted to uncover if the ESG score could help explain why the two portfolios perform differently. We also wanted to investigate if the relationship between ESG scores and returns, is different for the excluded companies and the Oil Fund.

Our findings suggest that the excluded companies outperform the Oil Fund by quite a large margin, as found by Eide & Haugen (2022) and Berle et al. (2022) confirming the theories of Hvidkjær (2017) and Fabozzi et al. (2008). Most of the sub-portfolios of excluded companies outperform the Oil Fund from 2006 to 2022, apart from the utilities portfolio. The basic materials portfolio just recently surpassed the Oil Fund regarding cumulative returns. These are all small sample portfolios compared to the Oil Fund, which is more volatile and less differentiated than the Oil Fund. This is presumably part of the explanation as to why they have higher returns. Despite the superior returns, these portfolios are exposed to significant negative returns when more volatile.

Our Fama-French regressions indicate that the market risk premium is the most significant among the different portfolios in terms of excessive returns. Suggesting that the excessive returns of the excluded companies can be explained by their lower correlation to the market, in contrast to the higher correlation between the Oil Fund and the market. Excluded companies perform differently from the Oil Fund, with better performance in market downturns, but less excessive returns in relation to the Oil Fund in market upswings, suggesting different risk profiles. The emerging market portfolio is found to be the most prominent contributor to the excessive returns.

Moreover, our second analysis finds a positive relationship between ESG scores and returns for the excluded companies. The models based on the excluded companies are generally better at explaining the ESG scores than the returns. This is reflected in the adjusted R-squared, suggesting that firms with low ESG scores could benefit from increasing their ESG score. For the 100 biggest companies, the case is totally different. Our findings indicate a negative correlation between ESG scores and returns, and the models where returns are the dependent variable have the highest adjusted R-squared. One explanation might be that the marginal cost of increasing a high ESG score could be higher than the marginal cost of increasing a low ESG score.

Our findings both agree and disagree with Shanaev and Ghimire (2022), who found that positive changes in ESG ratings lead to a modest increase in returns. For the excluded companies, we find similar answers. However, Shanaev and Ghimire (2022) suggest that companies with higher ESG scores had a more substantial increase in returns than companies with low ESG scores. This is contrary to our findings, where ESG scores and returns are negatively correlated for the 100 biggest companies in the Oil Fund. One possible explanation for the different findings can be that they utilized the ESG rating system of MSCI, which have fewer grades (8 different grades) than the number-based scoring system from Refinitiv (1-100) (MSCI, n.d.b). If a company has an ESG score of 80 and BBB in ESG rating, a small change would be visual in Refinitiv's scoring system going from 80 to 81, while the change might not be enough to change the rating from BBB to A in MSCI's ESG rating system.

This thesis contributes in several ways to existing literature. It confirms the findings of Fabozzi (2008), suggesting that sin stocks outperform benchmarks and generate abnormal returns. Additionally, our study agrees with the findings of Eide & Haugen (2022) supporting the notion that negative ESG screening in the Oil Fund harms the fund's financial returns, given the historically higher returns of excluded companies. Moreover, our study sheds additional light on the relationship between ESG scores and returns for excluded companies, suggesting potential financial benefits by incorporating measures to enhance their ESG performance. In conclusion, our findings provide valuable insight into the market dynamics of sin stocks, the effects of negative ESG screening, and the importance of considering ESG scores for financial performance.

9.0 References

Armanino. (2022, September 13). *ESG Scores & Rating Agencies.* Armanino. https://www.armanino.com/articles/esg-scores/

Beers, B. (2023, March 31). *What is Regression? Definition, Calculation, and Example.* Investopedia. https://www.investopedia.com/terms/r/regression.asp

Berle, E. C., He, W., & Ødegaard, B. A. (2022). The expected returns of ESG excluded stocks. The case of exclusions from Norway's oil fund. *The Case of Exclusions from Norway's Oil Fund (April 15, 2022)*. https://dx.doi.org/10.2139/ssrn.4095395

Blitz, D., & Swinkels, L. (2021). Does excluding sin stocks cost performance?. *Journal of Sustainable Finance & Investment*, 1-18.https://doi.org/10.1080/20430795.2021.1972789

Bloomberg. (2021, July 21). *ESG Assets Rising to $50 Trillion Will Reshape $140,5 Trillion of Global AUM by 2025, Finds Bloomberg Intelligence.* Bloomberg. https://www.bloomberg.com/company/press/esg-assets-rising-to-50-trillion-will-reshape-140-5-trillion-of-global-aum-by-2025-finds-bloomberg-intelligence/

Chen, J. (2020, March 25). *What Is Capital Allocation Line (CAL) Line? How to Calculate.* Investopedia. https://www.investopedia.com/terms/c/cal.asp

Chen, J. (2023, May 25). *Alpha: What It Means in Investing, With Examples. Investopedia.* https://www.investopedia.com/terms/a/alpha.asp

Clark, G. L., Feiner, A., & Viehs, M. (2015). From the stockholder to the stakeholder: How sustainability can drive financial outperformance. https://dx.doi.org/10.2139/ssrn.2508281

Collischon, M., & Eberl, A. (2020). Let's talk about fixed effects: Let's talk about all the good things and the bad things. KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie, 72(2), 289-299. https://doi.org/10.1007/s11577-020-00699-8

Corporate Finance Institute (2023, March 10). *Socially Responsible Investment (SRI).* Corporate Finance Institute.https://corporatefinanceinstitute.com/resources/esg/socially-responsible-investment-sri/

Dahlquist, M., Polk, Christopher., Priestly, R. & Ødegaard, Bernt Arne. (2015, November 16). *Norges Bank's Expert Group on Principles for Risk Adjustment of Performance Figures – Final Report.* Retrieved from https://www.nbim.no/contentassets/f04b97db0e704572bfbda10525a6a3fc/expert_group_final_report_nov_2015.pdf

Drempetic, S., Klein, C., & Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, *167*, 333-360.https://doi.org/10.1007/s10551-019-04164-1

Døskeland , T. (2023, March 6). *FIE426 Kapitalforvaltning: Evaluation* [Power Point Slides]. Norwegian School of Economics.

Eccles, R. G., Rajgopal, S., & Xie, J. (2022). Does ESG negative screening work?.https://dx.doi.org/10.2139/ssrn.4150524

Eide, S. & Haugen, S. (2022). *Doing well while doing what?* [Master's Thesis, Norwegian School of Economics]. NHH Brage. https://openaccess.nhh.no/nhh-xmlui/bitstream/handle/11250/3051827/masterthesis.pdf

Endelman (2021, November 17). *2021 Trust Barometer Special Report: Institutional Investors.* Edelman. https://www.edelman.com/trust/2021-trust-barometer/investor-trust

ETF. (2015). *Selecting Sector Benchmarks.* Refinitiv. https://www.refinitiv.cn/content/dam/marketing/en_us/documents/white-papers/selecting-sector-benchmarks-white-paper.pdf

EU. (n.d.). *Sustainable Finance.* European Comission. https://commission.europa.eu/business-economy-euro/banking-and-finance/sustainable-finance_en

Fabozzi, F. J., Ma, K. C., & Oliphant, B. J. (2008). Sin stock returns. *The Journal of Portfolio Management*, *35*(1), 82-94. http://gyanresearch.wdfiles.com/local--files/alpha/JPM_FA_08_FABOZZI.pdf

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of financial economics*, *116*(1), 1-22.https://doi.org/10.1016/j.jfineco.2014.10.010

Farkas, G. (2005). Fixed-Effect Models. In K. Kempf-Leonard (Ed.), *Encyclopedia of Social Measurement* (pp. 45-50). Elsevier.

Fernando, J. (2022, September 29). *Resource Curse: Definition, Overview and Examples.* Investopedia.https://www.investopedia.com/terms/r/resource-curse.asp

Fernando, J. (2023, May 11). *Sharpe Ratio Formula and Definition With Examples. Investopedia*https://www.investopedia.com/terms/s/sharperatio.asp

French, Kenneth R. (2023). *Current Research Returns.* Kenneth French Data Library. https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of sustainable finance & investment*, *5*(4), 210-233.https://doi.org/10.1080/20430795.2015.1118917

Friedman, M. (1970, September 13). *A Friedman Doctrine – The Social Responsibility Of Business Is to Increase Its Profits.* The New York Times. https://www.nytimes.com/1970/09/13/archives/a-friedman-doctrine-the-social-responsibility-of-business-is-to.html

FTSE Russell. (2021, September 30). *FTSE Equity Country Classification September 2021 Annual Announcement*. FTSE Russell. https://research.ftserussell.com/products/downloads/FTSE-Country-Classification-Update-2021.pdf

FTSE Russell. (2022, September 29). *FTSE Equity Country Classification September 2022 Annual Announcement.* FTSE Russell. https://research.ftserussell.com/products/downloads/FTSE-Country-Classification-Update-2022.pdf

Google Trends. (n.d.). *ESG.* Retrieved from (2023, February 16).https://trends.google.com/trends/explore?cat=7&date=all&q=esg

Hayes, A. (2023, March 31). *What is Greenwashing? How it Works, Examples and Statistics.* Investopedia. https://www.investopedia.com/terms/g/greenwashing.asp

Henisz, W,. Koller, T. & Nuttall, R. (November, 2019). *Five ways that ESG creates Value.* McKinsey. https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Strategy%20and%20Corporate%20Finance/Our%20Insights/Five%20ways%20that%20ESG%20creates%20value/Five-ways-that-ESG-creates-value.ashx

Hovland, K, M. (2023, January 31.). *Oljefondet Fikk en Avkastning på Minus 1.637 mrd.* E24. https://e24.no/boers-og-finans/i/mQ8yl1/oljefondet-fikk-en-avkastning-paa-minus-1637-mrd

Howard, V. (2021, June 15). *Woke-Washing, The Glass Cliff And The Need For A Better Answer In Diversity Leadership.* Forbes. https://www.forbes.com/sites/forbestechcouncil/2021/06/15/woke-washing-the-glass-cliff-and-the-need-for-a-better-answer-in-diversity-leadership/

Howell, B. (2023, February 15). *Top 7 Most Polluting Industries in 2023.* The Eco Experts. https://www.theecoexperts.co.uk/blog/top-7-most-polluting-industries

Hvidkjær, S. (2017). *ESG Investing: A Literature Review.* Dansif. https://dansif.dk/wp-content/uploads/2019/01/Litterature-review-UK-Sep-2017.pdf

IGI Global. (2022) *What is Calendar-Time Portfolio.* Igi Global. https://www.igi-global.com/dictionary/alternative-study-designs/110546

Investopedia. (2021, June 11). *GARCH Model: Definition and Uses in Statistics.* Investopedia. https://www.investopedia.com/terms/g/garch.asp

Investopedia. (2022, February 11). *R-Squared vs. Adjusted R-Squared: What's the Difference?* Investopedia. https://www.investopedia.com/ask/answers/012615/whats-difference-between-rsquared-and-adjusted-rsquared.asp

Kell, G. (2018, July 11). The Remarkable Rise of ESG. *Forbes.* https://www.forbes.com/sites/georgkell/2018/07/11/the-remarkable-rise-of-esg/

Kenton, W. (2022, December 31). *Homoskedastic: What Means in Regression Modeling, With Example.* Investopedia. https://www.investopedia.com/terms/h/homoskedastic.asp

Knoepfel, I. (2004). *Who Cares Wins.* Retrieved from https://www.unepfi.org/fileadmin/events/2004/stocks/who_cares_wins_global_compact_2004.pdf

Kumar, R., Dayaramani, N. & Rocha, J., D. (2018). *Understanding & Comparing ESG Terminology.* https://www.ssga.com/investment-topics/environmental-social-governance/2018/10/esg-terminology.pdf

Kunze, A. (2021, August 31). *The multiple linear regression model.* [Power Point Slides]. Norwegian School of Economics.

Liston, D. P. (2016). Sin stock returns and investor sentiment. *The quarterly review of economics and finance*, *59*, 63-70. https://doi-org.ezproxy.nhh.no/10.1016/j.qref.2015.08.004

Lucas, J. (2022, October 8). *What are ESG Scores? Benefits, Limitations, and More.* Urban Footprint. https://urbanfootprint.com/blog/in-the-news/esg-scores-meaning/

Maiti, M. (2020). Is ESG the succeeding risk factor?. *Journal of Sustainable Finance & Investment*, *11*(3), 199-213. https://doi.org/10.1080/20430795.2020.1723380

Mandat for forvaltningen av Statens pensjonsfond utland - SPU. (2010). *Mandat for forvaltningen av Statens pensjonsfond utland* (LOV-2010-11-08-1414). Lovdata. https://lovdata.no/dokument/INS/forskrift/2010-11-08-1414/KAPITTEL_1#KAPITTEL_1

Manning, L. (2022, July 12). *Rebalancing: Definition, Why its Important, Types and Examples.* Investopedia. https://www.investopedia.com/terms/r/rebalancing.asp#toc-advantages-and-disadvantages-of-rebalancing

Mansournia, M. A., Nazemipour, M., Naimi, A. I., Collins, G. S., & Campbell, M. J. (2021). Reflection on modern methods: demystifying robust standard errors for epidemiologists. *International Journal of Epidemiology*, *50*(1), 346-351. https://doi.org/10.1093/ije/dyaa260

Miller, N. (2022, December 14). *ESG Score.* Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/esg/esg-score/

Ministry of Finance. (2022, Februrary 28). *Statens pensjonsfond utland skal ut av Russland.* Regjeringen. https://www.regjeringen.no/no/aktuelt/statens-pensjonsfond-utland-skal-ut-av-russland/id2902556/

Ministry of Finance. (n.d.). *Handlingsregelen.* Regjeringen. https://www.regjeringen.no/no/tema/okonomi-og-budsjett/statsbudsjett/ord-og-begreper-i-statsbudsjettet/handlingsregelen/id2860044/

MIT Sloan Sustainability Initiative. (n.d.). *The Aggregate Confusion Project.* MIT Management Sloan School. https://mitsloan.mit.edu/sustainability-initiative/aggregate-confusion-project

MSCI (n.d.a). *The Evolution of ESG Investing.* MSCI. https://www.msci.com/esg-101-what-is-esg/evolution-of-esg-investing

MSCI. (n.d.b) *ESG Ratings.* MSCI. https://www.msci.com/our-solutions/esg-investing/esg-ratings

NBIM. (2016, April 16). *Exclusion of coal companies from the fund.* Norges Bank Investment Management. https://www.nbim.no/en/the-fund/news-list/2016/exclusion-of-coal-companies-from-the-fund/

NBIM. (2019a, February 2). *About the Fund.* Norges Bank Investment Management. https://www.nbim.no/en/the-fund/about-the-fund/

NBIM. (2019b, June 18). *Eierskapet.* Norges Bank Investment Management. https://www.nbim.no/no/oljefondet/ansvarlig-forvaltning/eierskapet/

NBIM. (2020, May 12). *Exclusion and Observation og coal companies.* Norges Bank Investment Management. https://www.nbim.no/en/the-fund/news-list/2020/exclusion-and-observation-of-coal-companies/

NBIM. (2022a). *Responsible Investment Goverment Pension Fund Global 2022.* Retrieved from https://www.nbim.no/contentassets/5804b35ea1e24063a79fca44a945e390/gpfg_responsible-investment-2022.pdf

NBIM. (2022b, August 19). *Principles.* Norges Bank Investment Management. https://www.nbim.no/en/the-fund/responsible-investment/principles/

NBIM. (2022c, August 17). *Referanseindeksen.* Norges Bank Investment Management. https://www.nbim.no/no/oljefondet/slik-er-fondet-investert/referanseindeksene/

NBIM. (2022d, March 03). *Årsrapport 2021.* Norges Bank Investment Management. https://www.nbim.no/no/publikasjoner/rapporter/2021/arsrapport-2021/

NBIM. (n.d.a). *Oljefondets markedsverdi.* Norges Bank Investment Management. Retrieved from (2023, April 25) https://www.nbim.no/no

NBIM. (n.d.b) *The purpose of responsible investment.* Norges Bank Investment Management https://www.nbim.no/en/the-fund/responsible-investment/responsible-investment/

NBIM. (n.d.c.). *Observation and exclusion of companies.* Norges Bank Investment Management. Retrieved from (2023, March 30) https://www.nbim.no/en/the-fund/responsible-investment/exclusion-of-companies/

NBIM. (n.d.d). *Alle Investeringene.* Norges Bank Investment Management. Retrieved from (2023, February 12). https://www.nbim.no/no/oljefondet/investeringene/

NOU 2020: 7. (2020) *Verdier og ansvar - Det etiske rammeverket for Statens pensjonsfond utland.* Finansdepartementet. https://www.regjeringen.no/contentassets/86dac65c22384dda9584dc2b1a052a91/en-gb/pdfs/nou202020200007000engpdfs.pdf

Pérez, L., Hunt, V., Samandari, H., Nuttall, R., & Biniek, K. (2022 August 10). *Does ESG really matter—and why?* The McKinsey Quarterly. https://www.mckinsey.com/capabilities/sustainability/our-insights/does-esg-really-matter-and-why

Peterdy, K. (2023, February 22). *ESG (Environmental, Social and Governance).* Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/esg/esg-environmental-social-governance/

PWC. (2022, October 10). *ESG-focused Institutional Investments Seen Soaring 84% to US $33,9 Trillion in 2026, Making up 21,5 % of Assets Under Management: PWC Report.* PWC. https://www.pwc.com/gx/en/news-room/press-releases/2022/awm-revolution-2022-report.html

Qureshi, M. A., Akbar, M., Akbar, A., & Poulova, P. (2021). Do ESG endeavors assist firms in achieving superior financial performance? A case of 100 best corporate citizens. *Sage Open*, *11*(2), 1-18. https://journals.sagepub.com/doi/pdf/10.1177/21582440211021598

Refinitiv. (2020, September). *The Refinitiv Business Classification Methodology.* Refinitiv. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/trbc-business-classifcation-methodology.pdf

Refinitiv. (2022). *Environmental, Social and Governance Scores from Refinitiv.* Refinitiv. https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf

Refinitiv. (2023). *Refinitiv Workspace.* Refinitiv.

Regjeringen. (2021, November, 19). *Guidelines for Observation and Exclusion of companies from the Government Pension Fund Global (GPFG).* Regjeringen. https://www.regjeringen.no/contentassets/9d68c55c272c41e99f0bf45d24397d8c/guidelines-for-observation-and-exclusion-of-companies-from-the-gpfg-19.11.2021.pdf.pdf

Rhinehart, C. (2022, May 13). *What is Market Sentiment? Definition, Indicator Types and Example.* Investopedia. https://www.investopedia.com/terms/m/marketsentiment.asp

Shanaev, S., & Ghimire, B. (2022). When ESG meets AAA: The effect of ESG rating changes on stock returns. *Finance Research Letters*, *46*, 102302. https://doi.org/10.1016/j.frl.2021.102302

Signori, D. (2022, November 17). *Serial Correlation*.[Power Point Slides]. https://www.sfu.ca/~dsignori/buec333/lecture%2017.pdf

Stackpole, B. (2021, December 6). *Why Sustainable Business Needs Better ESG Ratings.* MIT Management Sloan School. https://mitsloan.mit.edu/ideas-made-to-matter/why-sustainable-business-needs-better-esg-ratings

Statista. (2023, February 16). *Largest Sovereign Wealth Funds Worldwide as of December 2022, by Assets Under Management.* Statista https://www.statista.com/statistics/276617/sovereign-wealth-funds-worldwide-based-on-assets-under-management/

Taylor, S. (2023, March 9). *Autocorrelation.* Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/data-science/autocorrelation/

United Nations Development Programme. (n.d.). *The SDGS in Action.* United Nations. https://www.undp.org/sustainable-development-goals

United Nations Principles of Responsible Investments. (n.d.). *What is Responsible Investment?* United Nations. https://www.unpri.org/introductory-guides-to-responsible-investment/what-is-responsible-investment/4780.article

Vaidya, D. (n.d.). *Heteroskedasticity.* Wall Street Mojo. https://www.wallstreetmojo.com/heteroskedasticity/

Whelan, T., Atz, U. & Clark, C. (2021). ESG And Financial Performance. *Uncovering the Relationship by Aggregating Evidence from 1000 Plus Studies Published between 2015-2020.* 1-19. https://sri360.com/wp-content/uploads/2022/10/NYU-RAM_ESG-Paper_2021-2.pdf

Wooldrigde,J. M. (2018). *Introductory to Econometrics. A Modern Approach.* (6th ed.) Cengage Learning.

Yiu, T. (2021, August 20). *Understanding Autocorrelation.* Towards data science. https://towardsdatascience.com/understanding-autocorrelation-ddce4f0a9fda

Zdaniuk, B. (2014). Ordinary Least-Squares (OLS) Model. In: Michalos, A.C. (eds) Encyclopedia of Quality of Life and Well-Being Research. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-0753-5_2008

A.0 Appendix

A.1 Excluded Companies Not Included In Our Dataset

Table A.1 Excluded Companies Not Included In Our Dataset

List of excluded companies from The Oil Fund not included in our dataset	
Company Name	**Reason for exclusion from our dataset**
Berkshire Hathaway Energy Co	Not listed - Subsidiary of Berkshire Hathaway
Great River Energy	Member Owned Cooperative/ No data found
MidAmerican Energy Co	Not listed - Subsidiary of Berkshire Hathaway
Tri-State Generation and Transmission Association Inc	Member Owned Cooperative/ No data found
Danya Cebus Ltd	Subsidiary of African Israel Investments/ No data found for the latter
Airbus Finance BV	No historical figures of investment size found
PT Hanjaya Mandala Sampoerna Tbk	No historical figures of investment size found
Scandinavian Tobacco Group A/S	No historical figures of investment size found
Aurora Cannabis Inc.	No historical figures of investment size found
Canopy Growth Corporation	No historical figures of investment size found
Cronos Group Inc	No historical figures of investment size found
Tilray Brands Inc	No historical figures of investment size found
Eastern Co SAE	No historical figures of investment size found/ Only in benchmark index of the oil fund
Washington H. Soul Pattionson and Company Limited	No historical figures of investment size found
Evergy Inc	No historical figures of investment size found
Peabody Energy Corporation	No data pre may 2017/ Exclusion revoked later
Vedanta Limited	No historical figures of investment size found
Posco International Corporation	No historical figures of investment size found
Pacificorp	No historical figures of investment size found
PT Gudang Garam Tbk	No historical figures of investment size found
Aerojet Rocketdyne Holdings Inc	No historical figures of investment size found
Safran SA	No historical figures of investment size found/ Has been split into two different companies (SAGEM and SNECMA)
AviChina Industry & Technology Co Ltd	Excluded from the oil fund after December 2022
Bharat Electronics Ltd	Excluded from the oil fund after December 2022
Cognyte Software Ltd	Excluded from the oil fund after December 2022
PTT Oil and Retail Business PCL	Excluded from the oil fund after December 2022
PTT PCL	Excluded from the oil fund after December 2022

Table A.1: Table A.1 presents a list of companies that are excluded from the Oil Fund, but not included in our portfolio of excluded companies. The table presents the name of the respective company and a reason for omitting it from our dataset.

A.2 Breusch-Pagan and Breusch-Godfrey Tests

Fama-French Regressions

Table A.2 Fama-French Regressions BP & BG Tests

Breusch Pagan and Breusch Godfrey tests of Fama-French Regressions			
Test	**Model**	**P Value**	**Model fit**
BP Test	Excluded companies	0,0039	
BG Test	Excluded companies	0,1108	*
BP Test	The Oil Fund	0,0007	
BG Test	The Oil Fund	0,5021	*
BP Test	Benchmark	0,1357	*
BG Test	Benchmark	0,0796	*
BP Test	Conduct Based	0,0036	
BG Test	Conduct Based	0,6390	*
BP Test	Product Based	0,0006	
BG Test	Product Based	0,1664	*
BP Test	Utilities	0,4666	*
BG Test	Utilities	0,4227	*
BP Test	Industrials	0,4146	*
BG Test	Industrials	0,2590	*
BP Test	Energy	0,6872	*
BG Test	Energy	0,5948	*
BP Test	Consumer Non-Cyclicals	0,0072	
BG Test	Consumer Non-Cyclicals	0,9917	*
BP Test	Basic Materials	0,2882	*
BG Test	Basic Materials	0,7507	*
BP Test	Developed Markets	0,0055	
BG Test	Developed Markets	0,1311	*
BP Test	Emerging Markets	0,8406	*
BG Test	Emerging Markets	0,3516	*

Table A.2: Table A.2 present a Breuch Pagan test for heteroskedasticity and a Breusch Godfrey test for autocorrelation of the models made in the Fama-French regressions. The table specifies the model (portfolio/sub-portfolio) that were analyzed and the corresponding p-value from the test conducted. It also provides a dot if the p-value is >0,05, indicating that the model has no heteroskedasticity and/or autocorrelation. If there is no dot next to the p value, the model has signs of heteroskedasticity and/or autocorrelation.

Regressions ESG Scores and Returns - Excluded Companies and 100 Biggest Companies of the Oil Fund

Table A.3 Model 1 to 8, BP & BG Tests

Table A.3: Table A.3 present a Breuch Pagan test for heteroskedasticity and a Breusch Godfrey test for autocorrelation of the models made to investigate the relationship between ESG score and yearly returns for the excluded companies and the 100 biggest companies in the Oil Fund. The table specifies the model number that were analyzed and the corresponding p-value from the test conducted. It also provides a dot if the p-value is >0,05, indicating that the model has no heteroskedasticity and/or autocorrelation. If there is no dot next to the p value, the model has signs of heteroskedasticity and/or autocorrelation.

Regressions ESG and Returns – Sub-portfolios, ESG dependent variable

Table A.4 Sub-portfolios ESG Dependent, BP & BG Tests

Breusch Pagan and Breusch Godfrey tests of regression models based of subportfolios. ESG Score dependent variable			
Test	**Model**	**P Value**	**Model fit**
BP Test	Product	0,4609	*
BG Test	Product	0,1085	*
BP Test	Conduct	0,1003	*
BG Test	Conduct	0,0690	*
BP Test	Developed	0,4054	*
BG Test	Developed	0,3072	*
BP Test	Emerging	0,0011	
BG Test	Emerging	0,0509	*
BP Test	Utilities	0,0003	
BG Test	Utilities	0,0000	
BP Test	Industrials	0,5533	*
BG Test	Industrials	0,6745	*
BP Test	Energy	0,2318	*
BG Test	Energy	0,4128	*
BP Test	Consumer Non Cyclicals	0,0160	
BG Test	Consumer Non Cyclicals	0,1074	*
BP Test	Basic Materials	0,6236	*
BG Test	Basic Materials	0,0389	

Table A.4: Table A.4 present a Breuch Pagan test for heteroskedasticity and a Breusch Godfrey test for autocorrelation of the models made to investigate the relationship between ESG score and yearly returns for the different sub-portfolios of the excluded companies, using ESG score as the dependent variable. The table specifies the sub-portfolio that were analyzed and the corresponding p-value from the test conducted. It also provides a dot if the p-value is >0,05, indicating that the model has no heteroskedasticity and/or autocorrelation. If there is no dot next to the p value, the model has signs of heteroskedasticity and/or autocorrelation.

Regression models ESG Score and Returns – Sub-portfolios, Returns Dependent Variable

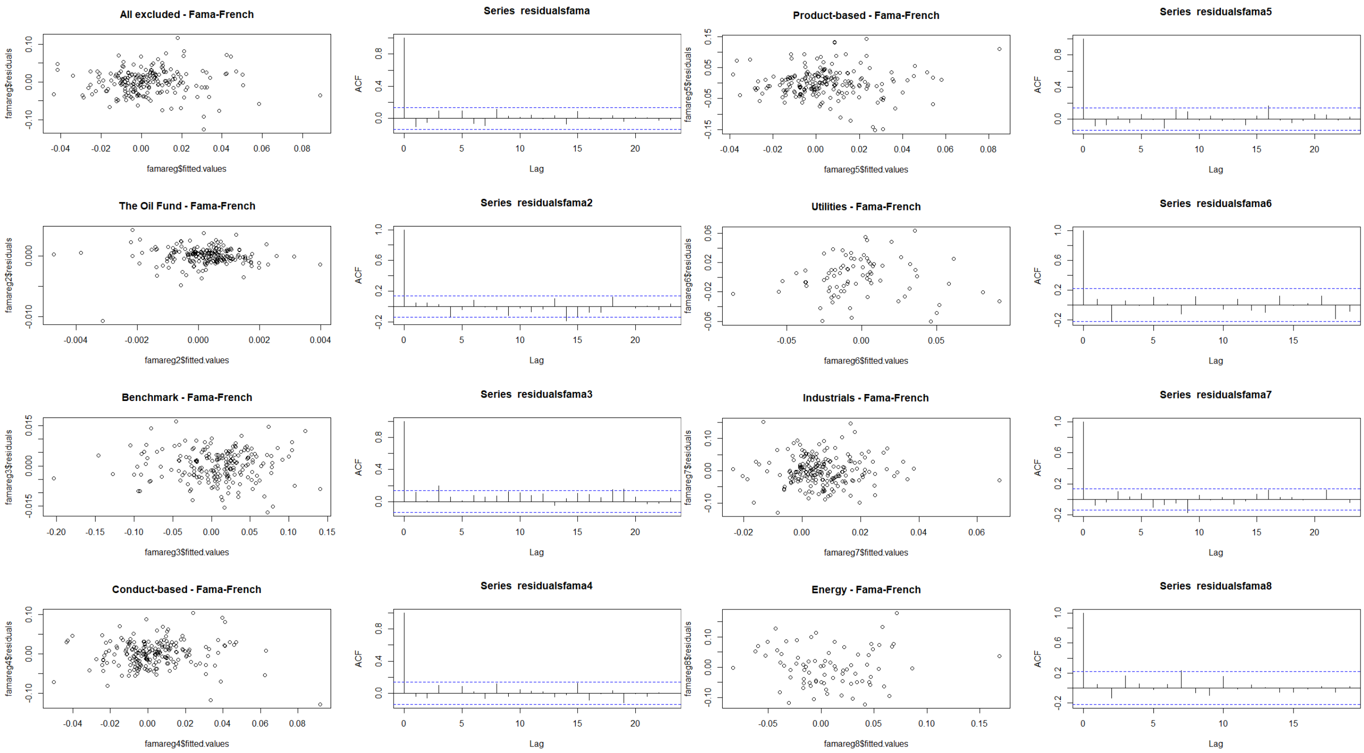
Table A.5 Sub-portfolios Returns Dependent, BP & BG Tests

Breusch Pagan and Breusch Godfrey tests of regression models based of subportfolios. Returns dependent variable			
Test	**Model**	**P Value**	**Model fit**
BP Test	Product	0,5150	*
BG Test	Product	0,7803	*
BP Test	Conduct	0,1003	*
BG Test	Conduct	0,0690	*
BP Test	Developed	0,0021	
BG Test	Developed	0,5069	*
BP Test	Emerging	0,0001	
BG Test	Emerging	0,0537	*
BP Test	Utilities	0,5780	*
BG Test	Utilities	0,0847	*
BP Test	Industrials	0,0114	
BG Test	Industrials	0,2309	*
BP Test	Energy	0,4091	*
BG Test	Energy	0,0069	
BP Test	Consumer Non Cyclicals	0,0017	
BG Test	Consumer Non Cyclicals	0,0926	*
BP Test	Basic Materials	0,2780	*
BG Test	Basic Materials	0,0240	

Table A.5: Table A.5 present a Breuch Pagan test for heteroskedasticity and a Breusch Godfrey test for autocorrelation of the models made to investigate the relationship between ESG score and yearly returns for the different sub-portfolios of the excluded companies, using returns as the dependent variable. The table specifies the sub-portfolio that were analyzed and the corresponding p-value from the test conducted. It also provides a dot if the p-value is >0,05, indicating that the model has no heteroskedasticity and/or autocorrelation. If there is no dot next to the p value, the model has signs of heteroskedasticity and/or autocorrelation.

A.3 Residual Plots and ACF Plots

Figure A.1 Residual & ACF Plot - Fama-French Regression Models



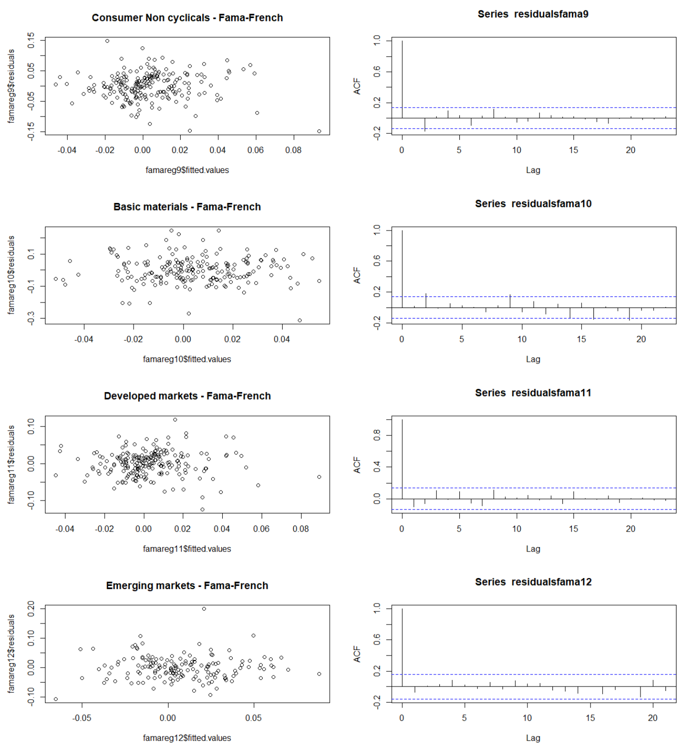


Figure A.1: The figures displays the residual plots and the ACF plots for the 12 Fama-French regression models. The tables are presented in pairs with the residual plot at the left and the ACF plot at the right. For the residual plots, signs of heteroskedasticity can be seen as a cone shape among the observations. In the ACF plots, autocorrelation is indicated by the vertical lines passing the blue horisontal line. The four pairs at the top left represents the portfolios of : All excluded companies, the Oil Fund, The benchmark, conduct-based. The four pair at the top right represent the portfolios of: Product-based, utlitities, industrials and energy. The bottom four pairs represent the portfolios of: Consumer non-cyclicals, Basic materials, Developed markets and Emerging markets.

Figure A.2 Residual & ACF Plot - Excluded vs. 100 Biggest Companies

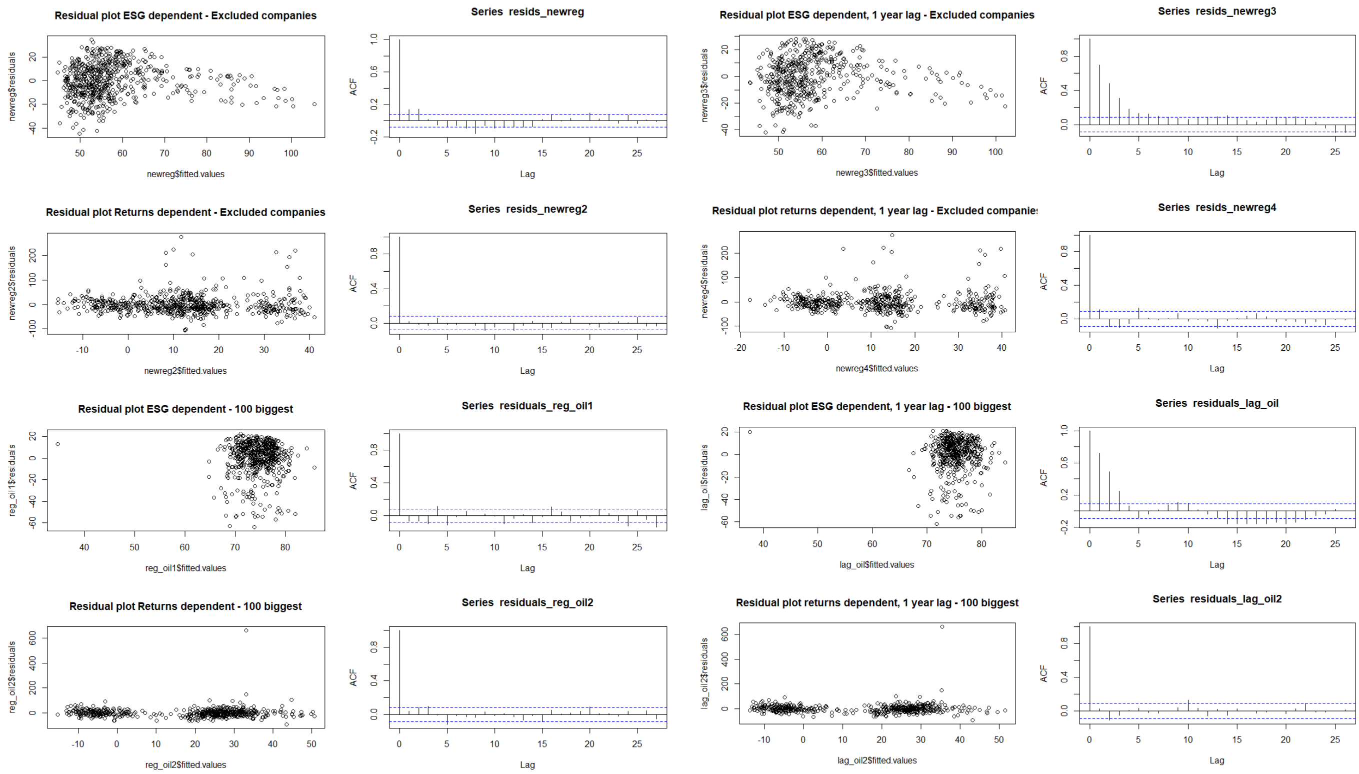


Figure A.2: The figure displays the residual plots and the ACF plots for the eight regression models comparing the excluded companies and the 100 biggest companies in the Oil Fund. The tables are presented in pairs with the residual plot at the left and the ACF plot at the right. For the residual plots, signs of heteroskedasticity can be seen as a cone shape among the observations. In the ACF plots, autocorrelation is indicated by the vertical lines passing the blue horisontal line. At the left, the models using no lagged variables are presented. At the right, the models using lagged independent variables are presented.

Figure A.3 Residual & ACF Plot - Sub-portfolios, ESG Dependent

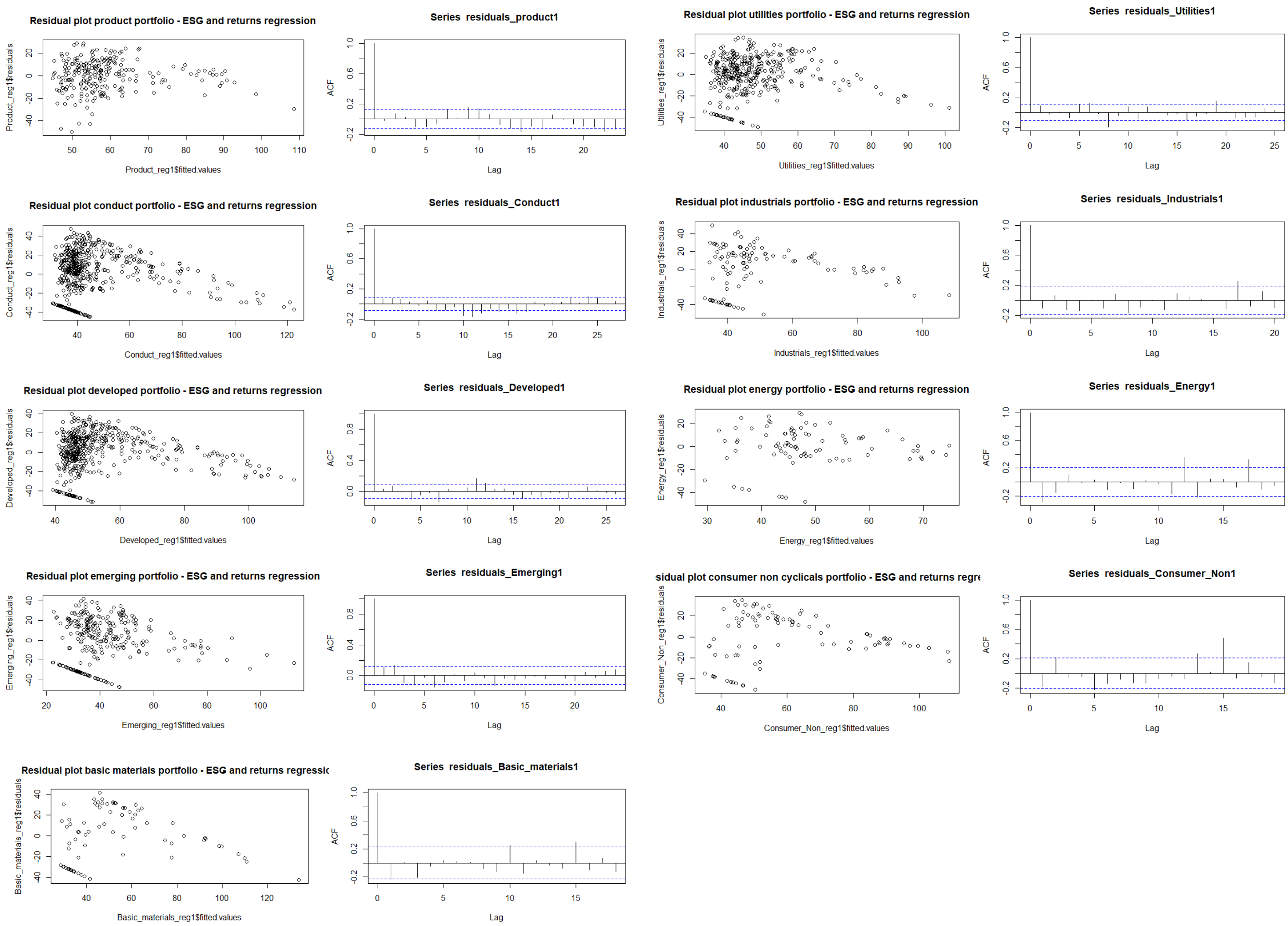


Figure A.3: The figure displays the residual plots and the ACF plots for the regression models where we analyze the relationship between ESG score and returns in the sub-portfolios. In these regression models, ESG score is the dependent variable. The tables are presented in pairs with the residual plot at the left and the ACF plot at the right. For the residual plots, signs of heteroskedasticity can be seen as a cone shape among the observations. In the ACF plots, autocorrelation is indicated by the vertical lines passing the blue horisontal line. The five pairs at the left represents the following portfolios: Product-based, conduct-based, developed markets, emerging markets and basic maerials. The four pairs at the right represents the following portfolios: Utilities, industrials, energy and consumer-non cyclicals.

Figure A.4 Residual & ACF Plot - Sub-portfolios, Returns Dependent

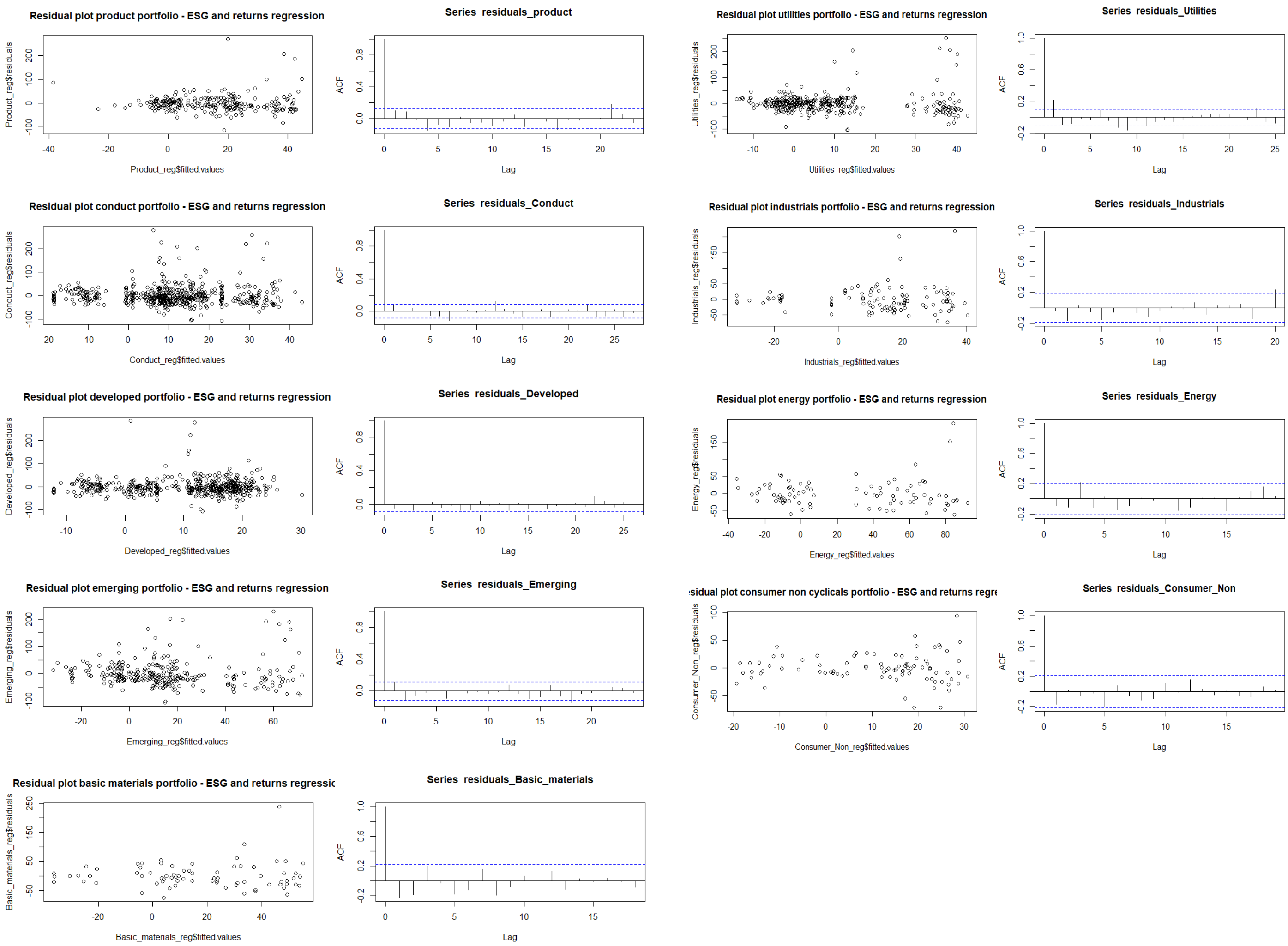


Figure A.4: The figure displays the residual plots and the ACF plots for the regression models where we analyze the relationship between ESG score and returns in the sub-portfolios. In these regression models, Return is the dependent variable. The tables are presented in pairs with the residual plot at the left and the ACF plot at the right. For the residual plots, signs of heteroskedasticity can be seen as a cone shape among the observations. In the ACF plots, autocorrelation is indicated by the vertical lines passing the blue horisontal line. The five pairs at the left represents the following portfolios: Product-based, conduct-based, developed markets, emerging markets and basic maerials. The four pairs at the right represents the following portfolios: Utilities, industrials, energy and consumer-non cyclicals.

A.4 List of All Excluded Companies From the Oil Fund

Table A.6 All Excluded Companies From The Oil Fund

*Table A.6**:** The table presents a list of all excluded companies that are used in our analysis. It displays the name of the company, market, sector, country, reason for exclusion, category of excclusion and the date of exclusion. It is sorted in alphabetical order by country.*