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Institutional Ownership and ESG Performance

How does Norges Bank Investment Management impact the ESG performance of firms in its equity portfolio?

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Abstract

This paper assesses whether institutional ownership impacts the environmental, social, and governance (ESG) performance of firms worldwide. To study this issue, we analyze financial metrics and ESG scores on 5444 companies owned by the Government Pension Fund Global managed by Norges Bank Investment Management. Our findings reveal that the ESG score of companies owned by NBIM is significantly higher than that of the average of all companies in the Refinitiv database. However, further analysis indicates that NBIM ownership has no statistically significant effect on ESG performance. The effect of exclusion by NBIM on the ESG score of a company is also insignificant according to our analysis. This implies that NBIM screens firms for ESG performance to display their commitment to sustainability. We theorize that the observed results could be attributed to inadequate ownership stakes, thereby restricting NBIM's impact on company ESG scores.

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1. Introduction

This thesis investigates whether institutional ownership (IO) impacts the environmental, social, and governance (ESG) performance of firms. To study this issue, we analyze financial metrics and ESG scores of companies owned by one of the largest institutional investors in the world, Norges Bank Investment Management (NBIM). As this data has become more widely available in recent years, we have collected financial metrics and ESG scores of companies in this portfolio from 2015 to 2021, yielding a dataset of 5444 companies.

The relationship between IO and ESG performance is ambiguous, as previous research has found both positive, negative, and inconclusive results (Velte, 2020). The mixed empirical evidence can be explained by the fact that not all institutional investors are alike. Thus, our thesis will examine the impact of a specific type of IO exhibiting IO nature such as long-term investment horizon and high level of engagement. These two attributes are known to have a positive impact on ESG performance, rendering this type of IO noteworthy of examination considering the conflicting empirical findings[1]. We use the NBIM portfolio in our analysis because of its long-term investment horizon and level of engagement as evidenced by its management dialogue, voting guidelines, and expectation documents (NBIM, 2020). Current literature on how IO impacts ESG performance focuses primarily on the IO ratio, nature, and type separately, thus disregarding the complementary effects of these elements. In this paper, we fill this gap in the research by assessing how a specific type of institutional investor with a long-term investment horizon and high level of engagement impacts the ESG performance of its firms.

To create a baseline for further analysis, we first use hypothesis testing and regression to assess whether companies owned by NBIM have a significantly higher ESG score than the average of all companies in the Refinitiv database in 2021. Based on these results, we analyze whether the findings observed in this year are related to ownership activities by NBIM, or if they simply select companies with greater ESG scores. As the NBIM portfolio and ESG scores are drawn from a non-random sample, the risk of a selection bias and other biases induced by omitted variables is present. To determine a causal relationship between NBIM ownership and ESG

[1] Impact of long-term investment horizon: Long-term impact: Meng & Wang, 2020; Erhemjamts & Huang, 2019; Fu et al., 2019; Gloßner, 2019; Kim et al., 2019.
Impact of engagement: Dyck et al., 2019; Alda, 2019; Dimson et al., 2015; Pucheta-Martinez & Lopez-Zamora, 2018

score, we perform fixed effects regression and conduct a comparative observational study by using propensity score matching and Difference-in-Difference estimation. Additionally, we explore what impact exclusion by NBIM has on firms by using a similar approach.

Our motive for studying how IO impact on ESG performance is based on the growing influence of large institutional investors and the active monitoring function they play within the corporate governance system to drive societal change (Velte, 2020). Extensive research discusses the potential these investors have in influencing ESG performance, whereas our paper seeks to investigate this possibility empirically.

Our thesis is organized as follows: First, we review the literature on ESG in investment decisions, ESG ratings, institutional investors & ESG, and how IO impacts ESG performance. Drawing from these insights, we formulate our hypotheses in the following section. Next, we describe our data and sample collection process followed by an outline of our research methodology. We then present our findings in the analysis section and subsequently discuss the results. Lastly, we provide a conclusion based on our initial hypotheses, findings, and discussion.

2. Literature Review

2.1 ESG in Investment Decisions

ESG considerations are increasingly becoming more important in the decision-making processes of investors worldwide. According to Chartered Financial Analyst Institute's ESG Survey 2021, nearly 79% of investment professionals explicitly consider ESG factors in the investment process (CFA, 2021). This reflects the greater integration of ESG measures in business operations of the last decades in response to greater demands from investors, regulatory bodies, and the public to address societal issues.

Various causes have led to the widespread implementation of ESG in investment decisions. One motive for including ESG factors is risk. Investors have grown more aware of how corporate exposure to environmental, social, and governance issues constitute risks that affect firm value over the long-term (Matos, 2020). High-profile examples of ESG-related incidents include the 2001 Enron Corporation accounting fraud, the 2015 Volkswagen emissions test cheating, and the 2018 Facebook data privacy scandal. Examining the ESG performance of firms provides a more holistic view of their business and can thus mitigate the information asymmetry between managers and investors (Kim & Park, 2022). Companies that perform better on ESG metrics are associated with lower risk and stronger reputations (Fulton et al., 2012). The inclusion of these factors can therefore allow investors to mitigate the non-financial risks of their portfolios. Investors also have financial incentives to consider ESG factors in investment decisions. Most of the studies conducted on the relationship between incorporating ESG and financial performance find a positive correlation[2]. Thus, integrating ESG dimensions in investment decisions may lead to superior returns.

Another reason for investors to incorporate ESG is the changing expectation towards the purpose of a firm. The traditional view put forward by Friedman (1970) is that the sole social responsibility of a firm is to maximize shareholder value. Thus, corporate social responsibility (CSR) and ESG initiatives are only considered if it aligns with maximizing shareholder value. In recent decades, however, other stakeholders beyond shareholders have demanded greater transparency, accountability, and responsibility from firms (Matos, 2020). This has led to the

[2] Friede et al., 2015 and Clark et al., 2021

wider adoption of the stakeholder theory introduced by Freeman (1984) which states that firms must attend to the interest of all its stakeholders, not only the shareholders. According to this broader interpretation of CSR, managers should take actions that benefit all stakeholders even if those actions do not maximize shareholder value. This theory builds on the notion that firms have relationships with many constituent groups that both affect and are affected by the actions of a firm (Kitzmueller & Shimshack, 2012). In addition, the stakeholder view represents an emerging model for the strategic vision of a firm, implying that ESG metrics can be used to assess and measure company performance relevant for a broader set of stakeholders in the same way that financial metrics traditionally have assessed company performance for shareholders (Kay et al., 2020). Another reason for the swift implementation of ESG factors is the changes in the regulatory landscape. American policymakers have reduced earlier constraints on pension funds looking to incorporate ESG issues in their process. In Europe, the EU's Non-Financial Reporting Directive requires companies of certain criteria to report ESG information on an annual basis (Eccles et al., 2017).

Although the wider integration of ESG in financial markets is viewed as a positive development, critics have raised concerns regarding its mainstream adoption. In the asset management industry, where active management faces competitive pressure from index investing, ESG strategies have been the bright spot in terms of new funds being launched and inflows received (Hale, 2020). This has raised concerns over potential "greenwashing" – the act of providing the public or investors with misleading or outright false information about the environmental impact of a product or service for financial gain (Matos, 2020). Financial managers can exploit the ESG label to attract capital without intending to invest with any ESG factors in mind. Another concern is the agency problems that arise when managers can exploit ESG considerations to pursue their interests at the expense of their clients. This stance is premised on the principle-agent relationship of corporations, wherein the interests of managers and shareholders differ, resulting in shareholders being forced to contribute to causes they do not support (Cornell & Shapiro, 2020). Focusing solely on ESG can also distort managerial focus on other important intangible assets. Aspects such as management quality, corporate culture, and innovative capability can be just as important for the long-term financial and social returns of a firm (Edmans, 2022). Hence, the allocation of resources towards ESG initiatives may have potentially yielded higher value if directed towards other causes within the firm.

2.2 ESG Ratings and Determinants

Professional rating agencies have developed several metrics to quantify ESG performance across environmental, social, and governance dimensions. The agencies collect information from numerous sources, culminating in a single ESG score for each individual company, typically on a scale from 0 to 100. The ESG score is normally a weighted average of the underlying performance on indicators related to each of the three dimensions (Duque-Grisales & Aguilera-Caracuel, 2021). The environmental component covers a firm's business actions in terms of environmental responsibility. This generally involves indicators related to emissions reduction, product innovation, and resource consumption reduction. The social dimension reflects a firm's commitment to both internal and external stakeholders. Examples of such are employees, customers, and the community in which the firm operates. The governance score measures to what extent a company's systems and processes ensure that its managers operate in the best interest of its shareholders. Governance-related indicators include aspects such as board structure, executive compensation, transparency, corporate ethics, and shareholders' rights.

ESG ratings have enriched the investor landscape by providing investors with a more holistic view of firms in investment decisions. Quantifying actual firm ESG performance across these three dimensions enables stakeholders to hold firms accountable for their actions to a greater extent (Capucci, 2018). ESG scores provide a simplified means for comparison between companies and differences in methodology between the rating agencies offers investors the choice to select the ratings that best reflect their values and investment philosophy. Moreover, increased transparency and insight into non-financial performance reduce the information asymmetry between managers and investors (Healy & Palepu, 2001). From a company perspective, ESG scores also provide managers with a tool to better measure and manage material ESG risks.

On the other hand, ESG ratings have also attracted considerable criticism. The underlying quality of the data used to compile ESG scores has been questioned as these metrics can be hard to quantify accurately (Doyle 2018; Drempetic et al.,2020). There is also skepticism regarding the credibility of ESG metrics as scores have shown a general upward drift in ratings over time (Larcker et al., 2022). This is further supported by the fact that ESG scores differ significantly between agencies due to differences in the conceptualization of ESG components and their weights to compile scores (Chatterji et al., 2016; Semenova & Hassel, 2015). The

literature argues that this can be attributed to a lack of standardization in the industry, conflicting incentives among market players, and the intangible nature of ESG making them difficult to measure[3].

A rich body of academic literature explores the wide array of determinants for ESG performance proxies such as ESG ratings and ESG disclosure. Drawing on the fragmented literature on determinants of ESG ratings, the relevant firm-specific characteristics include total assets, book-to-market ratio, firm age (Di Giuli & Kostovesky, 2014), sales per employee, ROA, and stock return (Dimson et al., 2021), capital expenditure and R&D costs (Jensen & Meckling, 1976), dividends, cash holding, and leverage (Hong et al., 2012), advertising intensity (Tamayo & Servaes, 2013), analyst coverage (Hong & Kacperczyk, 2009), political values (Hong & Kostovetsky, 2012), and institutional ownership[4].

In terms of ESG disclosure, the main determinants can be categorized by firm, country, and temporal factors (Crespi & Migliavacca, 2020). Looking specifically at firm-related characteristics and ESG disclosure, the most relevant explanatory variables are firm size, profitability, industry profile, CEO duality, and board size[5]. Firm size is a common proxy for visibility, which dictates the level of scrutiny a firm is under from its stakeholders. Profitability is relevant as it determines what freedom and flexibility of a firm in terms of exposing its CSR practices to its stakeholders. Furthermore, the nature of the industry impacts both the willingness and need for CSR disclosure depending on the externalities of business practices and proximity to end consumers. CEO duality of firms is also significant as the practice may limit the transparency level of a company to both inside and outside stakeholders. Finally, board size also impacts the ESG considerations of firms as it enhances the monitoring of CSR and leads to a wider exchange of innovative ideas and experience. Other seemingly relevant explanatory variables such as diversity of the board, number of board meetings, and financial leverage are not statistically significant to the extent of CSR disclosure (Giannarakis, 2014).

As for country-specific factors, studies also find a significant relationship. Societal systems such as political orientation, labor policies, and cultural norms play an important role, as claimed by institutional theory (Baldini et al., 2018). Also, the legal frameworks of a country

[3] Walter, 2020; Dorfleitner et al., 2015 and Eccles & Stroehle, 2018
[4] Dyck et al., 2019; Gibson et al., 2022; Chen et al., 2020
[5] Giannarakis, 2014 and Elsakit & Worthington, 2014

together with social and economic development are important determinants of ESG performance (Crespi & Migliavacca, 2020). In terms of temporal factors, studies found a strong positive trend of ESG scores over time. The effect of the factors identified may not be stable over time, especially during financial turmoil, and may vary according to firm-specific and country-related factors (Crespi & Migliavacca, 2020).

2.3 Institutional Investors and ESG Factors

Institutional investors play an increasingly crucial role in the capital allocation of modern capital markets. The ascendance of these investors has significantly altered the paradigm of the decentralized shareholder ownership model (Berle & Means, 1932), with most public corporations now having a substantial proportion of their shares held by a small number of institutional investors. As of 2019, institutional investors' share of equity holdings has increased to 41% worldwide and 65% across developed countries (OECD, 2019). This share is expected to rise even further due to aging, reduction of social security, and increased wealth (Darvas & Schoenmaker, 2018).

In recent years, there has been a major increase in the integration of ESG considerations into the decision-making processes among these investors. This is evidenced by the adoption of various ESG metrics such as the Dow Jones Sustainability Index or the FTSE4Good Index, and the introduction of the Principles for Responsible Investment (PRI) guidelines developed by the United Nations (Dyck et al., 2019). This development does not only reflect the current trends of the financial market but is also related to the nature of institutional ownership. Due to the size of their shareholder stakes, strategic goals, and financial experience and expertise, institutional investors have the potential to fulfill an important monitoring role in the corporate governance system (Bebchuk et al., 2017).

Institutional investors' ability to impact the ESG performance of firms relies on their engagement level. Some institutional investors actively manage their portfolios while others passively invest by matching their portfolio weightings of corporations to those of an underlying equity index (Bebchuk et al., 2017). In the US equity market, passive fund ownership of US stocks has recently overtaken active for the first time in history (FT, 2022). The rise of passive institutional investors has led to an unprecedented concentration of ownership and voting power. This has sparked concerns regarding their incentives and ability to actively exert shareholder power and thus impact ESG factors. Passive investors have little

incentives to be concerned with firm-level governance performance because they simply aim to replicate the performance of a group of firms (Fichtner et al., 2017). Also, their shareholder power is limited because they cannot "exit" a certain company, implying selling off their holdings.

Active institutional investor on the other hand exerts greater influence over the companies within their portfolio. These investors selectively choose companies and actively engage with management incentivized by achieving superior returns. There are mainly three mechanisms through which they can impact the ESG performance of firms. First, they can participate directly in the decision-making process by submitting shareholder proposals and voting at annual general meetings. In a situation of dispersed and fragmented ownership, the voting power of each individual shareholder is rather limited but institutional investors usually have substantial holdings. Ownership positions above five percent are considered highly influential blockholders and a 10 percent stake qualifies for insider status to the firm under U.S. law (Fichtner et., 2017). Thus, controlling a significant number of votes mitigates the principle-agent problem typical for firms with many retail investors, each of whom operates independently and is subject to the free-rider problem (Grossman & Hart, 1980).

Second, investors can leave the company by selling shares, commonly known as "exit". Selling off a considerable number of shares negatively impacts the stock price of a company and puts pressure on management. Threats to leave can also be used as leverage by institutional investors to put pressure on management as long as the threat is credible. To maintain power in the competition for corporate control, management teams thus have the incentive to make sure their decisions are appreciated by their largest shareholders (Fichtner et al., 2017).

Third, institutional investors can influence corporate decisions by direct engagements and "voice" their concerns directly to management. This includes informal dialogue with both management and board members in triggering change or more formal measures such as expectation documents or guidelines on how to address certain societal issues. More recently, institutional investors have also sought to reduce the free-rider problem inherent in governance activity by establishing networks that amplify their collective voice. Examples of such are the United Nations Principles for Responsible Investment (PRI), as well as more designated networks, such as the International Corporate Governance Network (ICGN) (Jahnke, 2019). In these forums, investors can find common ground on which to engage with corporations on ESG issues. Collaboration between institutional investors via collective principles and

frameworks increases their overall influence on firms relative to their individual influence (Kordsachia et al., 2022). Thus, investor collaboration can be an effective tool in improving the ESG performance of firms.

Nevertheless, institutional investors' ability to influence ESG has also been questioned. In terms of governance, institutional investors might increase the distance between savers and companies, adding a longer chain of parties between the provider of capital and the ultimate user of capital. These long and complicated investment chains mean that incentives are distorted, the investment horizon gets shorter with each extra party in the chain, and meaningful information is lost along the chain (Shoenmaker & Schramade, 2019). In that regard, increased IO can amplify the principal-agent problem and lead to conflicts of interest, as fund managers may prioritize their own goals over the objectives of their shareholders.

2.4 Institutional Ownership and ESG Performance

Extensive research exists on the impact of IO on ESG performance, but the results show mixed empirical evidence on what role it plays. Patrick Velte (2020) conducted an extensive literature review on the topic covering 81 papers from 1994-2020. In addition to providing an overview of the results, his paper more importantly remarks that the impact on ESG performance varies not only by the share of ownership (IO ratio) but also on the characteristics of IO (IO nature) and the sort of institutional investor (IO type). This categorization of IO is critical for identifying the pivotal factors that drive ESG performance.

A great number of papers are devoted to the IO ratio and its importance in impacting ESG performance in companies. Several studies find a positive relationship between the IO ratio and ESG performance, citing that higher ownership results in better performance on financially material ESG issues (Chen et al., 2020). Improved ESG performance is mainly the result of a reduction in CSR concerns, indicating that higher institutional ownership generally focuses on controlling negative corporate externalities to reduce portfolio risk rather than on increasing positive social activities (Chen et al., 2020). Contrary to these findings, other papers suggest a negative relationship between the IO ratio and ESG performance. Companies with higher levels of institutional ownership exhibit lower investment in CSR and the IO ratio declines when firms improve their ESG scores (Borghesi et al., 2014; Gillan et al., 2010). CSR investment is lower for firms with greater scrutiny from institutional investors who presumably tend to the interest of shareholders, but higher for firms with more scrutiny from

the media tending to the interest of all stakeholders. However, a substantial number of studies on this topic found an insignificant link between the IO ratio and ESG performance[6]. The large number of insignificant results implies that the IO ratio alone is not an accurate predictor of ESG performance.

In terms of IO nature, various papers find that specific investor practices and preferences strengthen the ESG performance of firms. Most significantly, a long-term investment horizon indicates improved ESG performance[7]. Long-term investors are more inclined towards ESG factors because such practices might have financial benefits only in the long term. This is further supported by other papers finding that short-term IO decreases ESG performance[8]. There is also empirical evidence that sustainable responsible investors (SRI) increase the ESG performance of firms, encouraging proactive behavior towards environmental practices driven by both financial and social returns (Dyck et al., 2019; Alda, 2019). Similarly, Pucheta-Martinez and Lopez-Zamora (2018) relied on pressure-resistant (active) investors in their research and found a positive influence on ESG performance. Active investors are more likely to engage with companies to address ESG issues that can impact the firm financially. This is further supported by Dimson et al. (2015) who established that the action of institutional investors increases target firms' ESG activities. In contrast, Wegener et al. (2013), found that institutional investors were not successful at altering the behavior of firms that are heavy polluters. This might imply that institutional investors have a limited impact on ESG performance if it involves major changes to current business practices, e.g., pollution.

Moreover, specific types of institutional investors have a different impact on ESG performance. Some studies find a positive relationship between pension funds and ESG performance (Kim et al., 2019; Oh et al., 2011), citing their long-term investment horizons and active monitoring. The impact of mutual funds and investment funds however was insignificant (Panicker, 2017; Mallin et al., 2013). These findings are in line with the IO nature of these funds, suggesting this might be a more precise determinant of ESG performance than the IO type.

[6] Chung et al., 2019; Boubaker et al., 2017; Lopatta et al., 2017; Dam & Scholtens, 2012; Walls et al., 2012; Barnea & Rubin, 2010; Li & Zhang, 2010
[7] Meng & Wang, 2020; Erhemjamts & Huang, 2019; Fu et al., 2019; Gloßner, 2019; Kim et al., 2019
[8] Lamb & Butler, 2018; Boubaker et al., 2017; Neubaum & Zahra, 2006

The divergent and inconclusive findings regarding IO's impact on ESG can be attributed to the substantial heterogeneity that exists among institutional investors[9]. To exemplify this, the purpose of a pension fund is vastly different from that of a hedge fund even though both are considered institutional investors. These funds typically differ in terms of investment horizon, investor preferences, and level of engagement. Thus, long-term versus short-term investors, SRI versus purely financial investors, and active versus passive institutions fulfill heterogeneous investment strategies (Velte, 2020). Consequently, it depends on the nature and type of institutional investors to determine whether IO is significantly related to ESG performance or not.

[9] Brickley et al., 1988; Almazan et al., 2005; Starks et al., 2017, Hong & Kacperczyk, 2009

3. Hypotheses

Drawing upon the insights from the literature review, the mixed evidence of IO impact on ESG performance implies that institutional investors are not homogenous. Thus, examining IO without differentiating between different institutional investors will not likely generate any meaningful results. As such, our paper focuses on a specific sort of IO. The literature review find that investment horizon and level of engagement were the factors determining the impact on ESG performance. Therefore, assessing institutional investors emphasizing these aspects is more likely to yield significant results.

To fulfill these criteria, we have selected Norges Bank Investment Management (NBIM) as the subject of our analysis. NBIM is a prominent institutional investor with a long-term investment horizon and a high level of engagement relative to the size of its portfolio. The Government Pension Fund Global of Norway, which NBIM manages, is worth more than 1300 billion dollars and holds ownership positions in over 9000 companies worldwide (NBIM, 2023). The fund is actively managed based on investment principles, ownership practices, and sustainability considerations. More specifically, NBIM engages with companies through management dialogue, voting guidelines, and expectation documents (NBIM, 2020). However, engaging with this number of companies regularly is not feasible, making its active ownership ambitions rather idealistic. NBIM is however more engaged than other funds of comparable size which often are more inclined towards passive investing. Therefore, an analysis of companies owned by NBIM can offer valuable insights into the role of institutional ownership in promoting ESG performance.

The currently available literature on how institutional ownership impact ESG performance is fragmented, and the results are ambiguous. Most papers focus on the IO ratio, nature, and type separately, thus disregarding the complementary effects these elements have on each other. In this paper, we fill this gap in the research by assessing how a specific type of institutional investor with a long-term investment horizon and high level of engagement impacts the ESG performance of its firms.

3.1 Hypothesis 1: NBIM's Portfolio of Companies Has a Higher Average ESG Score Than the Market

Our discussion in the literature review highlighted the importance of longer investment horizons and a high level of engagement for IO to impact ESG performance. As NBIM practice both of these characteristics, we hypothesize that the ESG scores of companies owned by NBIM are higher than the market average. To test this, we analyze the average ESG score of companies owned by NBIM and compare it to the average ESG score of all companies in the Refintiv database.

3.2 Hypothesis 2: Ownership by NBIM Improves a Company's ESG Performance

The literature review showed that the relationship between IO and ESG performance is ambiguous, clearly justifying further empirical research on this topic. Given NBIM's long-term investment horizon and high level of engagement, our second hypothesis is that NBIM ownership fosters greater ESG performance. The rationale is that their ownership incentivizes the companies in their portfolio to prioritize ESG initiatives. The purpose of this is to test whether NBIM ownership practices improve ESG scores or if they simply select companies with greater ESG scores. We examine this hypothesis by comparing companies owned by NBIM to a control group of similar companies by using Difference-in-Difference estimation to identify the effect of ownership on the development of ESG score.

3.3 Hypothesis 3: Exclusion by NBIM Deteriorates a Company's ESG Performance

Our third hypothesis is based on the exclusion practices of institutional investors and how this impacts ESG performance. The research on this topic is limited and the actual impact of this practice is yet to be determined. Given the level of engagement NBIM shows, one would expect that companies perform worse on ESG dimensions when they are no longer under scrutiny from NBIM. We therefore hypothesize that exclusion by NBIM will deteriorate the ESG performance of the excluded company. To test this hypothesis, we assess how the ESG score of excluded companies develop in the period following their exclusion from NBIM's portfolio by using a similar approach as when analyzing the effect of NBIM ownership.

4. Data and Sample Description

4.1 NBIM Portfolio Data

As part of their commitment to transparency in their investments, NBIM provides the public with access to details on their ownership in all equities since their first investment was made in 1998 (NBIM, 2020). We choose to restrict our analysis to include the years 2015 – 2021. The year 2015 was significant in terms of the increasing awareness of climate change as a long-term risk to the global economy, evidenced by the COP21 Paris Agreement (United Nations, 2023). NBIM had also intensified efforts in sustainability leading up to 2015. Examples include adjusting their benchmark for external fund managers, tracking of carbon footprint, publishing voting intentions on climate reporting, and conducting dialogues with companies about their plans for transitioning to less emission-intensive energy systems (NBIM, 2021). Thus, we argue that their strategy of responsible investments was firmly in place from 2015 and onwards. The last report was published for the year 2021 and we must therefore restrict our analysis to end there.

4.1.1 NBIM Ownership Data

NBIM publish reports that details their portfolio at the end of each year. From their pages, we download data on their portfolio each year from 2015 to 2021. The dataset contains several columns of information on the company, including industry, region, HQ country, company name, and ticker. In addition, the dataset also contains columns with information detailing NBIM's stakes in the companies. This includes the market value of ownership stake in both USD and NOK, as well as the ownership stake in percent of the company.

4.1.2 NBIM Excluded Companies

From NBIM's pages, we download an exhaustive list of companies that are either excluded or put on observation for potential exclusion in the future. The dataset contains 185 companies of which 163 are excluded and 22 are put under observation. We remove all companies that were either excluded or put under observation before 2015. The dataset contains the company name, ticker, category of exclusion/observation, criterion of exclusion/observation, decision of exclusion/observation, publish date for the decision, and year of decision.

The category of exclusion/observation is split into product-based and conduct-based. The product-based exclusion criteria relate to companies involved in specific sectors or activities deemed unethical or unsustainable. If the category is conduct-based, there has been a specific incident leading to the exclusion/observation. The criterion of exclusion/observation is a further specification of the category variable that specifies the type of sector or activities they are involved in, or the type of conduct they were involved in.

4.2 ESG and Financial Data

Throughout the study, ESG scores are utilized as a proxy for ESG performance in companies. Among all the different ESG rating agencies, we chose Refinitiv because their scoring data is based on objective metrics. Moreover, their scoring methodology is transparent allowing us to validate the underlying framework and thus enhance the credibility of our findings. Refinitiv also offers a comprehensive dataset suitable for assessing changes in ESG performance over time. In addition to a comprehensive database on ESG metrics, Refinitiv provides historical and real-time financial data for various financial instruments. The service offers a wide range of data including time series data, end-of-day data, reference data, as well as news and events data. The complementarity between the ESG data and financial data in the Refinitiv database makes it particularly suitable for our analyses.

As a way of objectively quantifying a company's performance on ESG-related issues, Refinitiv has developed a proprietary method of scoring companies (Refinitiv, 2023). Refinitiv's methodology for creating these ESG scores is based on a combination of quantitative and qualitative data, including company-reported and third-party data sources. Refinitiv uses a normalization process to ensure that the data is comparable across companies and industries. The data is then weighted to create an overall score for each company. The scores are presented on a scale of 0-100, with higher scores indicating better performance.

The ESG score is composed of three main components: Environmental, Social, and Governance. Each component is made up of several sub-components and indicators. The environmental component includes indicators related to carbon emissions, energy use, and waste management. The social component includes indicators related to labor practices, human rights, and community relations, while the governance component has indicators related to board structure, corporate governance, and executive pay.

4.2.1 Refinitiv ESG Dataset

From the Refinitiv database, we download a dataset that contains ESG scores for public companies with a market capitalization higher than USD 10 million in the period 2015-2021. The limitation on market capitalization is mainly due to few observations of ESG scores for smaller companies in the Refinitiv database. The dataset contains data on 43,013 different companies. The presence of limited or nonexistent observations of ESG scores for several companies represents a potential selection bias in our analyses that must be accounted for.

4.2.2 Refinitiv Financial Dataset

In addition to the ESG dataset, we download financial data on the companies. The dataset contains a price-to-book value per share, total debt to enterprise value, EBITDA margin in percent, and company market capitalization for each year in the period. In addition, the dataset contains the year of the initial public offering of the company.

4.3 Dataset Construction

The data we obtain from NBIM's pages and the Refinitiv DataStream database is originally in a wide format. Due to the nature of the dataset and our analysis, the dataset requires conversion into panel data in a long format. Panel data consists of several observations/rows for the same individual, in this case company, but at different points in time. Our final data frame contains data for 9,435 unique companies with ESG scores and ownership data for the years 2015-2021. 3,991 companies were not owned by NBIM in the period, and the remaining 5,444 have been in NBIM’s portfolio for at least one year during the period.

Initially, we combine all the NBIM yearly portfolios into one dataset containing the annual ownership stake for the companies owned in the period 2015-2021. The identifiers for the companies are their tickers, and the time variable is the year. We use the data on excluded companies to include a dummy variable that takes the value of one for the year the company was excluded, and every year after. We also created a time-invariant column showing the total amount of years NBIM had an ownership share larger than zero in the given company. As an example, if NBIM owned a company for three years total, the value for this column would be three for every row for that specific company in the panel data.

After creating this dataset with all companies owned by NBIM in the period, we merge it with the dataset from Refinitiv DataStream containing ESG scores for all companies, and the dataset containing financial data. This provides us with ESG scores from 2015-2021 for all the companies owned by NBIM, along with relevant company data in the same period. The dataset we are left with has observations of all NBIM-owned companies for each year, identified by tickers, with the columns ESG score, exclusion status, number of years owned, and ownership share. Subsequently, we add the same columns for all additional companies available in the Refinitiv database. This dataset is added to the NBIM dataset but with the ownership variable equal to zero. The panel data contains 66,045 rows of observations of 9,435 unique companies, where 5,444 are NBIM-owned companies and the remaining 3,991 companies are not.

In addition, we create a subset of the panel data set that only contains the companies that have ESG scores for every year in the analysis period. We suspect that there are differences between companies that have ESG scores for all years and those that do not. The reason is that the ESG score from Refinitiv in many cases uses an element of self-reported data by companies. The presence of ESG reporting in companies is arguably in many cases an indication of a focus on ESG in general and can entail a better performance. We remedy this bias by using the panel data set with observations of ESG scores for every year for every company in the analysis.

5. Research Methodology

To investigate our three hypotheses, we use ESG scores along with characteristics for companies in combination with ownership data from NBIM for the years 2015-2021. Hypothesis testing, visual comparison, and fixed effects regression is used to establish a baseline of higher ESG scores among NBIM companies compared to other companies in 2021. Similar methods are used to evaluate the ESG scores of companies that have been excluded by NBIM in the period. As we are unable to make causal inferences from this analysis, we utilize Difference-in-Difference (DiD) estimation to create several comparative observational studies to evaluate the effect of NBIM ownership and exclusion on ESG scores.

We create a control group that strengthens the parallel trends assumption by utilizing propensity score matching on covariates found through logistic regression to significantly impact the probability of ownership and exclusion. We perform one DiD estimation with staggered treatment to evaluate the effect of NBIM ownership on ESG scores. We then perform two different DiD estimations to evaluate the effect of exclusion on ESG scores. One estimation with staggered treatment for all excluded companies in the period, and one estimation with simultaneous treatment representing a quasi-exogenous shock resulting from product-based exclusion criteria on coal introduced by NBIM in 2016.

5.1 ESG Score for the NBIM Portfolio vs. the Market

Hypothesis testing is employed in our analysis as a way of establishing a baseline of higher ESG scores for NBIM-owned companies against companies that are not owned by NBIM. We utilize t-tests to examine whether there is a significant difference in ESG scores between these two groups of companies. We also employ variance tests to assess the homogeneity of variances to determine which t-test to use.

We begin by testing the difference in average ESG scores for companies owned by NBIM against all companies in the dataset, and against companies that are not owned by NBIM. We later perform the same analysis for companies that have been excluded and check whether the average ESG score for these companies is significantly different from companies that have not been excluded.

Through hypothesis testing, we establish differences in ESG scores for the year 2021. To evaluate whether the same relationship exists for the remaining years of the analysis period, we employ a two-way fixed effects regression with time and entity fixed effects. As we are not attempting to establish a causal relationship, this method is suitable for our purpose as it accounts for unobserved heterogeneity among the subjects and thereby reduces potential omitted variable bias. This allows us to estimate the effect of NBIM ownership and NBIM exclusion on ESG scores in the period. We emphasize that this is not done to causally interpret NBIM ownership and exclusion but to establish whether they seem to influence ESG scores for companies.

We perform two fixed effects regressions in this part of the analysis. First, we regress NBIM ownership on the ESG score, and then NBIM exclusion on the ESG score. Before performing the regressions, we use the Durbin-Wu-Hausman (DWH) test to choose between fixed or random effects models. In both tests, the fixed effects model is preferred over the random effects model. The control variables are winsorized at the 99% level to deal with outliers. The mathematical equations for the models are included below.

Model for NBIM Ownership:

$$ESG\ Score_{i,t} = \beta 1 * Ownership\ Share_{i,t} + \log(Market\ Cap_{i,t}) + EBITDA_{i,t} + \frac{P}{B_{i,t}} + \frac{D}{EV_{i,t}} + \mu_i + \mu_t + \varepsilon_{i,t}$$

Model for NBIM Exclusion:

$$ESG\ Score_{i,t} = \beta 1 * Excluded_{i,t} + \log(Market\ Cap_{i,t}) + EBITDA_{i,t} + \frac{P}{B_{i,t}} + \frac{D}{EV_{i,t}} + \mu_i + \mu_t + \varepsilon_{i,t}$$

Where:

$$\boldsymbol{i} = Refers\ to\ a\ specific\ company\ i$$

$$\boldsymbol{t} = Refers\ to\ a\ specific\ year\ t$$

$$\boldsymbol{\mu_i} = Entity\ fixed\ effects\ for\ company\ i$$

$$\boldsymbol{\mu_t} = Time\ fixed\ effects\ for\ year\ t$$

$$\boldsymbol{Ownership\ Share} = Continuous\ variable\ of\ NBIM's\ ownership\ share\ in\ company\ i\ at\ time\ t\ in\ \%$$

$$\boldsymbol{Excluded} = Dummy\ variable\ that\ equals\ 1\ if\ company\ i\ is\ excluded\ in\ year\ t$$

$$\boldsymbol{Market\ Cap} = The\ sum\ of\ market\ value\ for\ all\ relevant\ instrument\ level\ share\ types, January\ 1st$$

$$\boldsymbol{EBITDA} = Earnings\ before\ interest, taxes\ and\ depreciation\ in\ percent\ of\ revenue, January\ 1st$$

$$\frac{\boldsymbol{P}}{\boldsymbol{B}} = The\ companys\ latest\ closing\ price\ divided\ by\ its\ book\ value\ per\ share, January\ 1st$$

$$\frac{\boldsymbol{D}}{\boldsymbol{EV}} = The\ companys\ short\ and\ long\ term\ debt\ divided\ by\ its\ enterprise\ value, January\ 1st$$

***Equation 1**: Model Equation for Fixed Effects Regression, Within, Two-way: Regressing on ESG score*

We use several control variables in our regressions to separate the effect of NBIM ownership and NBIM exclusion. The variables are Price-to-Book Value per Share, Total Debt to Enterprise Value, EBITDA Margin Percent, and Company Market Capitalization. The variable selection is based on the literature review on factors that are determinants for ESG scores and performance in section 2.2, as well as an evaluation of the data quality on these variables in Refinitiv DataStream.

As these variables are all financial figures that can covariate, we check for multicollinearity in our models by estimating the variance inflation factor (VIF). To calculate the VIF in fixed effects models, we demean the data. This process allows for the application of OLS-based VIF calculations while maintaining consistency with the fixed effects estimation. A VIF value of one signifies no multicollinearity, while values greater than 2.5 can indicate issues with multicollinearity (Johnston et al., 2017). None of the fixed effects models show signs of multicollinearity, with VIF values for all variables close to one.

5.2 Effect of NBIM Ownership and Exclusion

5.2.1 Matching

A vital part of our approach is to argue for the parallel trend assumption. To create groups that are expected to have similar development over time, the control group must have similar covariate distributions to the group of treated companies (Stuart, 2010). We use a combination of exact matching and propensity score matching to create companies that are similar in several characteristics. Before applying logistic regression to identify the characteristics that align with companies, we first carefully consider which variables might be influential and relevant to include. This consideration is grounded in previous research on the subject as discussed in the literature review, ensuring that our selection is informed and relevant. After the selection of variables, we then employ logistic regression to assess the impact of the selected variables on the likelihood of treatment, either NBIM ownership or exclusion.

Based on the logistic regressions, we select the following variables: Market capitalization, price-to-book ratio, age of the company, sector, and region. The regression results show that these are variables that influence the probability of both ownership and exclusion. We thereby use these variables to create a control group for companies owned by NBIM and for companies excluded by NBIM. Control variables are winzorized at the 99% level to avoid outliers. Other variables were found not to have an impact on the probability of treatment and thus not considered for the matching. These include EBITDA, debt-to-enterprise-value ratio, and debt-to-equity ratio. Model equations and regressions for these are included in the appendix.

When matching the companies on significant variables, we use exact matching on sector and region, and propensity score matching on the logarithm of market capitalization, price-to-book ratio, and age of the company. We run logistic regressions for the variables alone, as well as together to test their significance. Model equations are illustrated below.

Model:

$$logit(treat) = \alpha + \beta 1 * \log(Market\ Cap_{2015}) + \beta 2 * \frac{P}{B_{2015}} + \beta 3 * \text{Age}_{2015} + \beta 4 * factor(Sector) + \beta 5 * \text{factor(Region)} + \varepsilon$$

Where:

$$\boldsymbol{treat} = Dummy\ variable\ that\ equals\ 1\ if\ company\ is\ owned\ by\ NBIM$$

$$\boldsymbol{Market\ Cap} = The\ sum\ of\ market\ value\ for\ all\ relevant\ instrument\ level\ share\ types, January\ 1st$$

$$\frac{\boldsymbol{P}}{\boldsymbol{B}} = The\ companys\ latest\ closing\ price\ divided\ by\ its\ book\ value\ per\ share, January\ 1st$$

$$\boldsymbol{Age} = Years\ since\ the\ initial\ public\ offering\ of\ the\ company$$

$$\boldsymbol{Sector} = String\ variable\ that\ lists\ the\ sector\ a\ company\ operates\ in$$

$$\boldsymbol{Region} = String\ variable\ that\ lists\ the\ geographical\ region\ a\ company\ operates\ in$$

Equation 2: *Model Equations for Logistic Regressions to Determine Covariates*

After the matching, we test the balancing of covariates to ensure that the results from the matching are satisfactory. Covariates are considered adequately balanced after matching when there is no significant difference in their distributions between the treatment and control groups. To test this, we utilize standardized mean differences (SMD). A common benchmark is to achieve an SMD below 10% or 0.1 for each covariate, indicating that the differences in means between the treatment and control groups are small (Zhang et al., 2019). As we are conducting several separate comparative observational studies, we need to construct different control groups for different treated groups. We perform the operations described above to construct control groups for the following treated groups:

- Companies owned by NBIM in different parts of the period 2015-2021 to test whether ownership by NBIM influences the growth in ESG scores.
- Companies that were excluded by NBIM at different points in time in the period 2015-2021 to test whether the exclusion affects growth in ESG scores.
- Coal companies that were all excluded by NBIM in 2016 due to the implementation of a product-based criteria of exclusion.

5.2.2 Difference In Difference Estimation

By examining the interaction between the treatment status (NBIM investment or NBIM exclusion) and the pre-and post-investment periods, the DiD approach is meant to isolate the causal effect of treatment on ESG score growth. In our regressions, we incorporate time and entity-fixed effects. In DiD estimation, fixed effects control for both time-invariant unobserved heterogeneity across units and common shocks affecting all units over time. By including fixed effects, we can mitigate potential biases arising from omitted variables and better isolate the causal impact of NBIM ownership. Along with the initial matching of the firms on important characteristics, these measures allow us to interpret the results causally.

The analysis of the effect of NBIM ownership is performed separately from the two analyses on the effect of NBIM exclusion. Models 1, 2, and 3 use ESG Score as the dependent variable. "Model 1" is a pooled OLS regression without fixed effects. "Model 2" includes firm fixed effects, capturing unobserved time-invariant differences between companies. "Model 3" is estimated with both firm and time-fixed effects, accounting for unobserved time-invariant differences between companies and time-specific effects that impact all companies similarly. The model is described in mathematical notation below.

Model:

$$ESG\ score_{i,t} = \beta 1 * NBIM_{i,t} + \beta 2 * After_{i,t} + \beta 3 * \left(NBIM_{i,t} * After_{i,t}\right) + \mu_i + \mu_t + \varepsilon_{i,t}$$

Where:

$$\boldsymbol{i} = Refers\ to\ a\ specific\ company\ i$$

$$\boldsymbol{t} = Refers\ to\ a\ specific\ year\ t$$

$$\boldsymbol{\mu_i} = Entity\ fixed\ effects\ for\ company\ i$$

$$\boldsymbol{\mu_t} = Time\ fixed\ effects\ for\ year\ t$$

$$\boldsymbol{NBIM} = Dummy\ variable\ that\ equals\ 1\ if\ company\ i\ is\ owned\ by\ NBIM\ in\ year\ t$$

$$\boldsymbol{After} = Dummy\ variable\ that\ equals\ 1\ if\ the\ company\ i\ is\ owned\ by\ NBIM\ in\ year\ t$$

Equation 3: *Model Equations for DiD-estimation Output for NBIM Ownership*

We perform two separate analyses to test for the effect of exclusion by NBIM on the growth in ESG score for the company. The first analysis is performed by using a dataset containing all companies NBIM excluded in the period 2015-2021. The second analysis can be described as a quasi-experiment, taking advantage of a quasi-endogenous shock introduced due to a product-based criteria of exclusion for all companies involved in coal. These two analyses in combination allow us to make causal inferences on the effect exclusion by NBIM has on the ESG score of the companies. The regressions we utilize are the same three models as for NBIM ownership. "Model 1" is a pooled OLS regression without fixed effects. "Model 2" includes firm-fixed effects, and "Model 3" is estimated with both firm and time-fixed effects as described below. The model is described through mathematical notation below.

Model:

$$ESG\ score_{i,t} = \beta 1 * Excluded_{i,t} + \beta 2 * After_{i,t} + \beta 3 * \left(Excluded_{i,t} * After_{i,t}\right) + \mu_i + \mu_t + \varepsilon_{i,t}$$

Where:

$$\boldsymbol{i} = Refers\ to\ a\ specific\ company\ i$$

$$\boldsymbol{t} = Refers\ to\ a\ specific\ year\ t$$

$$\boldsymbol{\mu_i} = Entity\ fixed\ effects\ for\ company\ i$$

$$\boldsymbol{\mu_t} = Time\ fixed\ effects\ for\ year\ t$$

$$\boldsymbol{Excluded} = Dummy\ variable\ that\ equals\ 1\ if\ company\ i\ is\ excluded\ in\ year\ t$$

$$\boldsymbol{After} = Dummy\ variable\ that\ equals\ 1\ if\ the\ company\ i\ is\ excluded\ in\ year\ t$$

Equation 4: *Model Equations for DiD-estimation output for Excluded Companies*

6. Analysis

6.1 Baseline ESG-Performance – NBIM Ownership

6.1.1 ESG Scores for 2021

As a starting point, we want to uncover whether there is a significant difference between ESG scores for companies that are owned by NBIM and companies that are not owned by NBIM for the year 2021. As NBIM has had a significant focus on sustainability in their investment strategies for several years, we expect to see that companies in their portfolio are outperforming other companies on average.

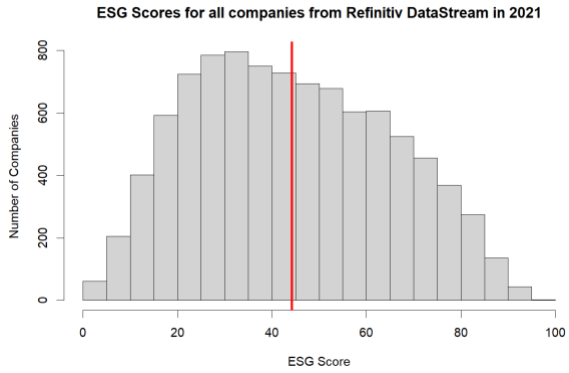

***Figure 1**: ESG Scores for All Companies from Refinitiv DataStream in 2021*

Figure 1 shows the distribution of the ESG scores for all companies in the Refinitiv DataStream dataset for the year 2021. From the figure, we see that the distribution is somewhat skewed to the left. This indicates more frequent observations of companies with an ESG score toward the lower end of the scale. The mean ESG score for all companies in total, illustrated by the red line, is 44.19.

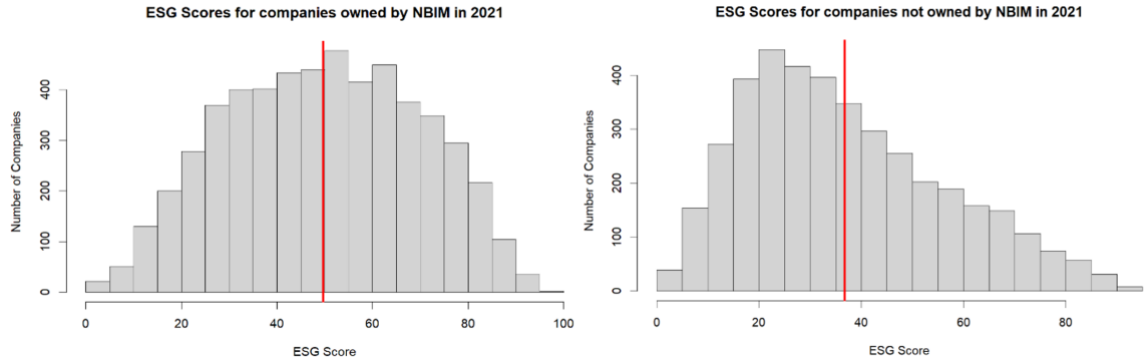

***Figure 2:** ESG Scores for Companies Owned by NBIM vs. Not Owned by NBIM in 2021*

The first graph in Figure 2 shows the distribution of ESG scores for all companies that were owned by NBIM in 2021. In this graph, observations of ESG scores for companies seem to be evenly distributed. The companies show a mean ESG score of 49.65, as illustrated by the red line. The second graph shows the distribution of ESG scores for companies in the dataset that were not owned by NBIM in 2021. As expected, there is a skew, and most companies have ESG scores toward the lower end of the scale. The mean ESG score for companies not owned by NBIM is 36.75.

To test the assumption that NBIM's portfolio on average has better ESG scores than the market in general, we use hypothesis testing. We initially performed an F-test to check if the variance for the two samples were equal. The results show that we can reject the hypothesis of equal variance; $F(9434,5443) = 1.0757$, $p = 0.00254$. We then performed a Welch two-sample t-test, assuming unequal variance. Results show that ESG scores for companies in the market are significantly lower ($M = 44.19$, $SD = 20.81$) than companies in the NBIM portfolio ($M = 49.65$, SD: 20.06); $t(11697) = -15.756$, $p = 2.2e\text{-}16$.

6.1.2 ESG-Scores from 2015 to 2021

In the previous section, we were able to find a clear positive relationship between NBIM ownership and a higher ESG score for the year 2021. In this section, we perform a visual inspection and a fixed effects regression to find out if the relationship we see in the data for the year 2021 is also evident in the companies that were owned by NBIM from 2015 to 2021.

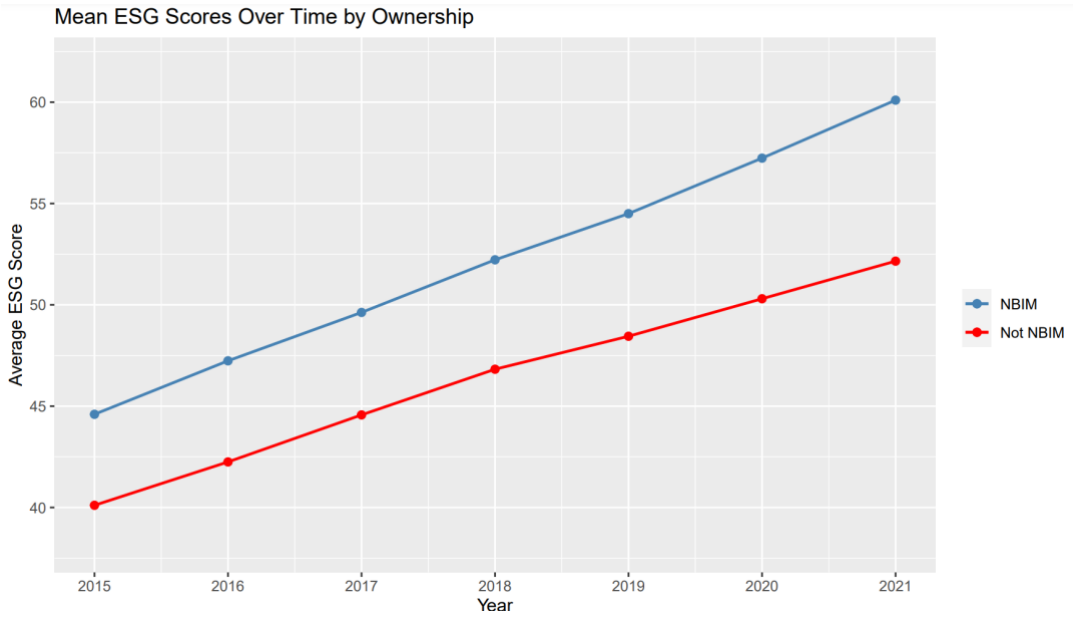

Figure 3: *Mean ESG Scores Over Time by NBIM Ownership*

From a visual inspection of the data, displayed in Figure 3, it seems that there is a clear relationship between NBIM ownership and higher mean ESG scores for companies. The difference between the mean ESG score between NBIM companies and other companies is 4.55 in 2015 and 7.87 in 2021. Not only do NBIM companies seem to have a higher mean ESG score every year, but the ESG score also seems to grow at a faster pace. There seems to have been a change in the growth rate in ESG scores for companies in 2018 that are not owned by NBIM. We believe this to be a result of an increasing number of companies receiving ESG scores toward the end of the period, and not necessarily because the growth rate declined. However, we will have to evaluate the results of further analyses to investigate this. To test for significance in the difference between ESG scores, we perform a fixed effects regression.

Initially, we performed a Durbin-Wu-Hausman (DWH) test to decide between the use of random or fixed effects. The result of the DWH test is a very low p-value, $p = 2.2e\text{-}16$, indicating strong evidence against the null hypothesis. The differences between the estimates obtained using fixed and random effects are therefore not negligible, and we should use the fixed effects model for our analysis.

The reasoning behind using fixed effect regression with both time and firm fixed effects stems from our assumption that there could be company-specific influences that differ between companies but remain consistent over time. In addition, we believe there to be time-dependent factors that change over time but are consistent among companies. Potential examples of company-specific influences might include industry-specific regulations or macroeconomic patterns. Simultaneously, macroeconomic tendencies may also generate variations over time that are constant for all companies.

Fixed individual effects for companies mean that we presume that there are characteristics that are inherent to the specific company that does not change over time. For some variables, this is not the case, as companies regularly change aspects such as management, financial leverage, etc. We therefore add a series of controls to our regression. The controls are based on previous literature that has found these variables to influence ESG scores as described in 2.2. We employ robust standard errors to address potential issues related to serial correlation and heteroscedasticity when analyzing panel data. The regression output is included below.

Regressing Ownership Share on ESG Score

	Dependent variable:
	ESG Score
Ownership Share	0.288**
	t = 2.330
Log of Market Cap	1.532***
	t = 8.969
EBIDTA	0.004
	t = 0.261
P/B	-0.027***
	t = -2.776
D/EV	1.734***
	t = 3.688
Model	OLS
Time FE	Yes
Firm FE	Yes
Observations	40,291
Note:	*p**p***p<0.01

Table 1: *Fixed Effects Regression, Within, Two-way: Regressing Ownership Share on ESG Score*

From the regression results in Table 1, we see that the coefficient for "Ownership Share" is 0.288 and is statistically significant at the 1% level. The results suggest that for every percentage-point increase in NBIM's ownership in a company, the ESG score is expected to increase by 0.288 units. These results are consistent with what we found through hypothesis testing in the previous section. The results also indicate that NBIM ownership is correlated with a higher ESG score for the other years in the period 2015-2021, consistent with our interpretation of the visual inspection. In this analysis, all VIF values are close to one, suggesting that multicollinearity does not pose a substantial concern.

Given that ownership by NBIM is not randomly allocated, we have issues with endogeneity when performing this analysis. We therefore keep in mind that there is no evidence of causality of NBIM ownership in the regression estimates. It is however apparent that if NBIM owns a company, the ESG score for the company tends to be higher than for other companies. Our objective in the next parts of the analysis is to determine whether what we observe is a result of NBIM's ownership activities, or if they simply invest in companies with better ESG scores.

6.2 Baseline ESG-Performance – NBIM Exclusion

6.2.1 Excluded Companies

In this section, we analyze the properties of the companies in the dataset on companies that have been excluded from NBIM's portfolio since the year 2015. We want to uncover whether the same patterns we have found for NBIM companies and other companies in general are the same. 48.10% of the companies were owned by NBIM before they were excluded.

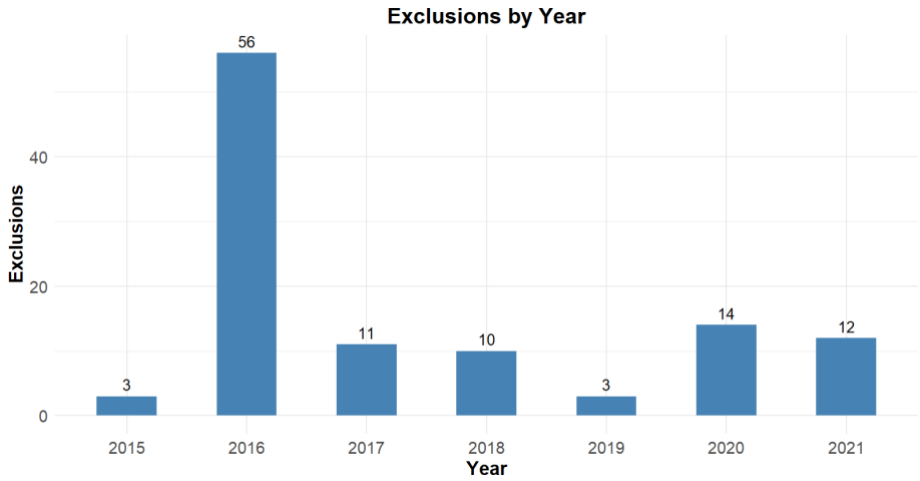

Figure 4: *Number of Excluded Companies by Year*

Figure 4 shows the number of companies that were excluded by NBIM from the year 2015 through 2021. We see a significant spike in exclusions in the year 2016. This is due to the introduction of product-based coal criteria. The new guideline resulted in the exclusion of 54 coal companies in the year 2016 (NBIM, 2016).

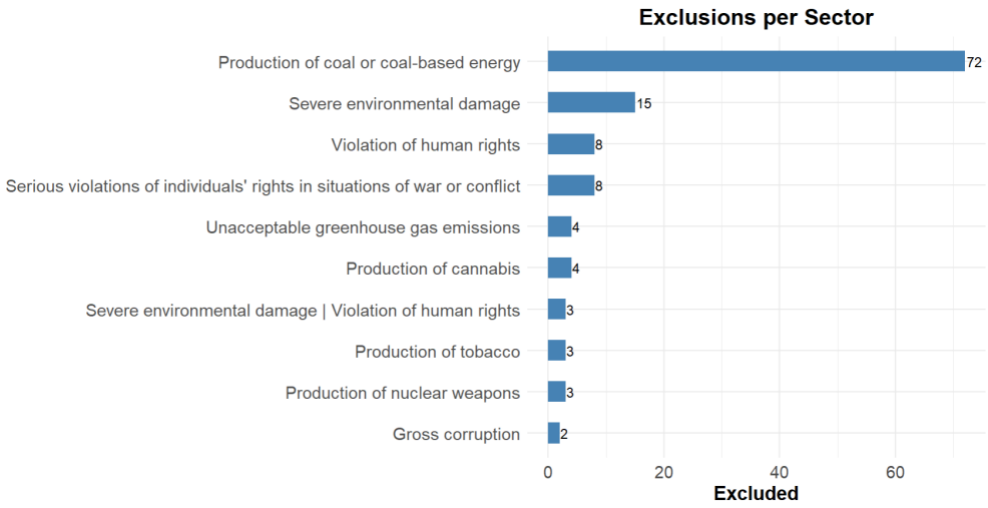

Figure 5: *Number of Excluded Companies by Sector*

Figure 5 shows the sectors from which the excluded companies belong to. As expected because of the product-based coal criteria introduced in 2016, we see that a large portion of the excluded companies are involved in the production of coal or coal-based energy. The remaining exclusions are related to unacceptable violations of ESG-related issues, such as environmental damage, human rights violations, and ethical concerns like the production of cannabis, tobacco, and nuclear weapons.

6.2.2 ESG Scores for 2021

From Figure 6 we see the distribution of ESG scores for the excluded companies in the year 2021. There seems to be a higher concentration of companies on both the higher and lower side of the scale with fewer companies in the middle range of the scale. The mean ESG score for excluded companies is 55.92, illustrated by the red line. In comparison, the mean ESG score for NBIM companies in 2021 is 49.65 as depicted in Figure 2.

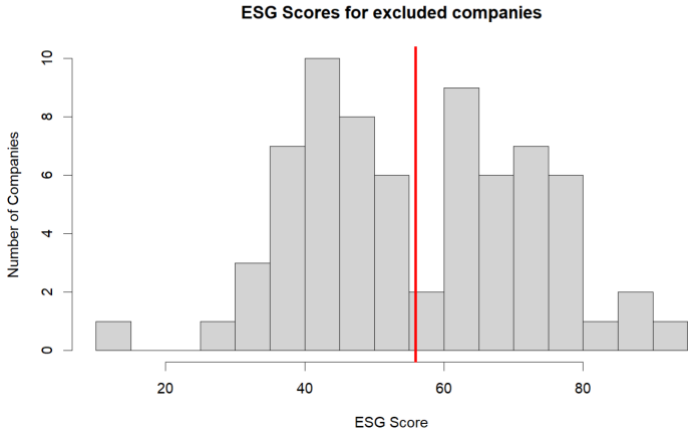

Figure 6: *ESG Scores for Excluded Companies in 2021*

We check whether the ESG scores for excluded companies were different from the ESG scores for NBIM-owned companies in the year 2021. We initially perform an F-test to check if the variance for two samples is equal. The results show that we can reject the hypothesis of equal variance; $F(69,5443) = 0.69274$, $p = 0.04947$. We then performed a two-sample t-test, assuming unequal variance. Results show a statistically significant difference at the 1% level in ESG score between companies that have been excluded ($M = 55.92$, $SD = 16.70$) and companies in the NBIM portfolio ($M = 49.65$, $SD = 20.06$); $t(71.585) = 3.1138$, $p = 0.002655$. Perhaps a bit surprising is the fact that ESG scores for excluded companies are significantly higher than ESG scores for NBIM companies on average.

NBIM owned 48.10% of the companies that were eventually excluded in the period 2015-2021. We have found that NBIM-owned companies tend towards a higher ESG score on average, and we want to uncover whether the same relationship exists for excluded companies that were previously owned by NBIM. We start by performing an F-test to check if the variance for the two samples is equal. The results show that we are unable to reject the hypothesis of equal variance; $F(33,35) = 1.5334$, $p = 0.2157$. We therefore performed a two-sample t-test, assuming equal variance, to test whether average ESG scores for excluded companies that were owned by NBIM are significantly different from ESG scores for excluded companies that were not. Results are statistically significant on a 10% level with a p-value of just over 5%. This indicates that ESG scores for companies that were owned by NBIM ($M = 59.93$, $SD = 18.04$) are higher than for companies that were not owned by NBIM ($M = 52.13$, $SD = 14.57$); $t(68) = 1.9933$, $p = 0.05025$. The distribution of scores based on NBIM ownership is illustrated below in Figure 7.

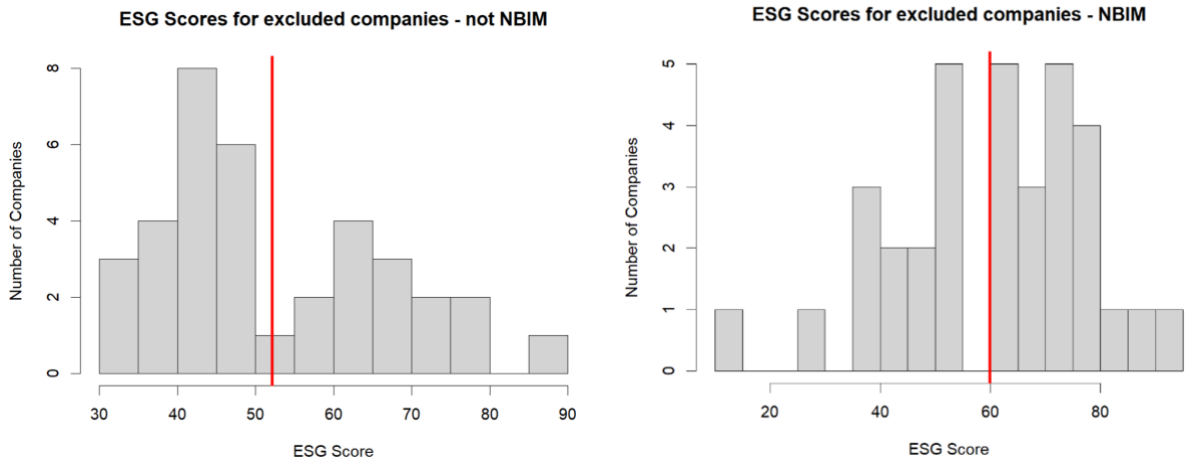

Figure 7: *ESG Scores for Excluded Companies Based on NBIM Ownership*

In the subsequent stage of our analysis, the objective is to investigate whether the same pattern is evident for companies that have been excluded exists in the years from 2015-2021. Within our panel dataset, we incorporate a column featuring a binary variable that denotes the exclusion of firms. In instances where a company was excluded by NBIM in 2016, the binary variable assumed a value of one for all subsequent observations in the dataset, given that no companies were removed from the exclusion list post-exclusion. Subsequently, we employ a fixed effects regression model with both time and entity fixed effects to examine the relationship between the exclusion variable and the ESG scores of the respective companies. The same control variables as in the previous regression are included to separate the effect of

exclusion. We employ robust standard errors to address potential issues related to serial correlation and heteroscedasticity when analyzing panel data. The regression output is included in Table 2 below.

Regressing Exclusion Dummy on ESG Score

	Dependent variable:
	ESG Score
Excluded	-1.744
	t = -1.182
Log of Market Cap	1.562***
	t = 9.153
EBIDTA	0.004
	t = 0.270
P/B	-0.027***
	t = -2.785
D/EV	1.731***
	t = 3.680
Model	OLS
Time FE	Yes
Firm FE	Yes
Observations	40,291
Note:	*p**p***p<0.01

Table 2: *Fixed Effects Regression, Within, Two-way: Regressing Exclusion on ESG Score*

The results from the regression show no statistically significant relationship between the exclusion of a company and its ESG score. The results suggest that exclusion impact companies' ESG score negatively, however, given that the results are not statistically significant, NBIM exclusion seems to have no effect. NBIM exclusion, like NBIM ownership, is not randomly allocated, meaning that we have endogeneity issues with the estimation. All VIF values are close to one, signifying that multicollinearity is not a concern in the model.

6.3 Comparative Observational Study - NBIM Ownership

We have established a positive relationship between NBIM ownership and ESG score and an ambiguous relationship between NBIM exclusion and ESG score. We will now address our endogeneity concerns, and test if these differences can be attributed to the ownership activities of NBIM, or if they simply select companies to invest in that are better at ESG.

6.3.1 Propensity Score Matching – NBIM Ownership

As NBIM is meticulous in its selection of companies, the decision to invest in a company is not randomly assigned. We therefore need to create a group of companies that can work as a control group for the companies in their portfolio. A challenge is that we are only able to use observable characteristics of firms to create the control group, while NBIM in addition relies on other types of information that are not readily observable. For instance, their decision to invest in a company could be influenced by positive management dynamics, a factor that extends beyond what is measurable through data. However, we believe that by constructing a control group based on observable characteristics, we can capture some of the unobservable characteristics as well. It is unlikely that NBIM has unobservable data on all companies they invest in, and even more unlikely that this is the main reason for investment.

Our choice of confounding variables is market capitalization, price-to-book ratio, age of the company, sector, and region. We run logistic regressions to estimate the effect of these variables on the probability of NBIM ownership and exclusion. The output of the regressions is in the appendix. There is no statistical significance for all industries nor regions included in the model, nor the price-to-book ratio. However, when it comes to propensity score matching, the primary goal is to balance the distribution of confounding variables between treated and control groups, rather than to establish significance for treatment assignment (Stuart, 2010). Therefore, we find it reasonable to include the variables.

The matching is done with exact matches for both region and sector and through propensity score matching for the remaining variables. 975 control observations are matched to 975 treated observations, meaning that 1524 control observations and 42 treated observations from the dataset are not matched. We provide each treated firm with only one match due to the large number of total observations in the dataset as well as difficulties obtaining a good balance with two matches. To evaluate the matching, we check the balancing of covariates between the

treated and control groups. The variables sector and region were exactly matched and are thus perfectly balanced with an absolute standardized mean difference (ASMD) of 0. The test for market capitalization shows that the ASMD between the treated and control groups is 0.1296, just above the commonly accepted threshold of +-0.1 (Zhang, Kim, Lonjon, & Zhu, 2019). The matching was made on the logarithm of market capitalization, meaning that the ASMD for actual market capitalization for the companies is smaller than what is reported in the balance statistics. ASMD for age and the price-to-book ratio are -0.0043 and 0.0549 respectively. The overall balance between treated and control groups is therefore acceptable, even with a slightly higher ASMD for the logarithm of market capitalization. Balance plots for the variables are in the appendix along with means and t-test for each variable distribution.

6.3.2 Difference-in-Differences – NBIM Ownership

NBIM acquires shares in companies at multiple different points in time throughout the period. As a result, we have a staggered treatment effect that makes our findings more robust. Because several firms are treated at different points in time, there is little reason to believe that the treatment coincides with some unobserved event that could have caused the effect that we see. In addition, the matching of companies strengthens the assumption of parallel trends, and we can argue that which of the companies NBIM chose to invest in is as-if randomly assigned between the firms in the two groups.

Figure 8: *Average ESG Scores for NBIM Firms vs. Control Firms*

Figure 8 captures the trajectory of average ESG scores for both NBIM-acquired and control firms three years before and after the acquisition event. The x-axis represents the years around the event, with negative numbers indicating the years leading up to acquisition and positive numbers marking the years after. NBIM firms and control firms both display a similar trend in ESG scores. However, post-acquisition, a slight divergence is noted. In the first and second years following the acquisition, the average ESG scores for NBIM firms increase at a slower pace compared to the control firms, suggesting a potential short-term negative impact from the acquisition. However, this trend seems transient, as in the third-year post-acquisition, the ESG scores for NBIM firms surpass the control firms again. This suggests a possibility of the long-term beneficial effect of the acquisition on the ESG scores of NBIM firms. It's important to highlight that this graph depicts raw averages and doesn't account for firm-specific fixed effects or common time trends. We also keep in mind that we do not have data for three years before and after for all companies, meaning that the group of companies we are averaging ESG scores for is changing from year to year. Additional analysis is required to accurately determine the true impact of NBIM ownership on ESG scores.

To perform the DiD analysis, we use the matched companies from the previous section to create a control group for the treated companies. An example from the matching matrix is these two companies, represented by their tickers: A2B.AX (Company A) and CRR_u.TO (Company B). NBIM acquired an ownership stake in company A in 2018 and maintained a share throughout 2021. NBIM never owned company B, but as it is the match for company A, the after-variable is 1 for the years 2018 through 2021 for company B as well. This allows us to estimate the DiD effect. We employ robust standard errors to address potential issues related to serial correlation and heteroscedasticity when analyzing panel data. Mathematical equations for the three models are described in the methodology, and the regression output is included below in Table 3.

DiD Estimation for Ownership Variable

	Dependent variable:		
	ESG Score		
	Model 1	Model 2	Model 3
Treated*After	-1.111	-0.521	-0.521
	t = -0.499	t = -0.474	t = -0.494
Treated	2.200		
	t = 0.923		
After	6.286***	8.712***	1.018
	t = 3.753	t = 10.465	t = 1.264
Constant	45.468***		
	t = 25.932		
Model	OLS	OLS	OLS
Time FE	No	No	Yes
Firm FE	No	Yes	Yes
Observations	2,464	2,464	2,464
Note:			*p**p***p<0.01

Table 3: *DiD Estimation Output for NBIM Ownership*

The regression output from Table 3 shows the results from the three models: Model 1 (Pooling), Model 2 (Individual Fixed Effects), and Model 3 (Individual and Time Fixed Effects). The "Treated" coefficient in Model 1 is not statistically significant, meaning there is no evidence of a significant difference in ESG scores between the treated and control groups before the treatment. Considering that we previously found significant differences in ESG scores for NBIM companies and non-NBIM companies, we believe that the propensity score matching has indeed contributed to the creation of a more representative control group.

The coefficients for “Treated*After” are the main coefficients of interest, as it captures the DiD estimate of the treatment effect. It represents the additional change in ESG scores for treated companies compared to the control group companies after the treatment. As opposed to the regression results from section 6.1.2, the coefficients for all three models indicate a negative relationship between NBIM ownership and ESG score. However, the results are not statistically significant and indicate that NBIM ownership has no clear effect in either direction on the ESG score of the companies they own.

6.4 Comparative Observational Study - NBIM Exclusions

6.4.1 Propensity Score Matching – NBIM Exclusions

We utilize the same approach as with the effect of NBIM ownership for the effect of their exclusions. First, we create a control group of companies that have the same probability of being excluded as the excluded companies. Logistic regression shows statistical significance in the same pattern as the logit models for NBIM ownership for the variables market capitalization, sector, and region. We know that sector is particularly important, given that NBIM practices exclusions based on certain product-based criteria. Sector and region are matched exactly, while the market capitalization is matched with propensity score matching. The age of the company and price-to-book ratio was left out of the matching because we were unable to obtain a satisfactory balance when including these variables in the matching.

50 companies from the control group were matched to 50 excluded firms. ASMD for the sector and region are 0 due to exact matching, and ASMD for the logarithm of market capitalization fell below the threshold of +-0.1. As a result, the matching created a satisfactory balance between the groups. Balance plots for the variables are reported in the appendix along with t-test results and the difference in means between market capitalization for the control group and the treated group. Satisfactory balancing allows us to estimate the effect of NBIM's exclusion criteria on the companies causally.

6.4.2 Difference-in-Differences – NBIM Exclusions

As in the ownership data, the exclusion data also have a staggered treatment effect, and control companies are matched to treated companies in the same way as in the previous analysis. We can thereby estimate the DiD effect. Despite the treatment being staggered, we can analyze the effect of exclusion visually by setting the year of exclusion equal to time zero as illustrated below.

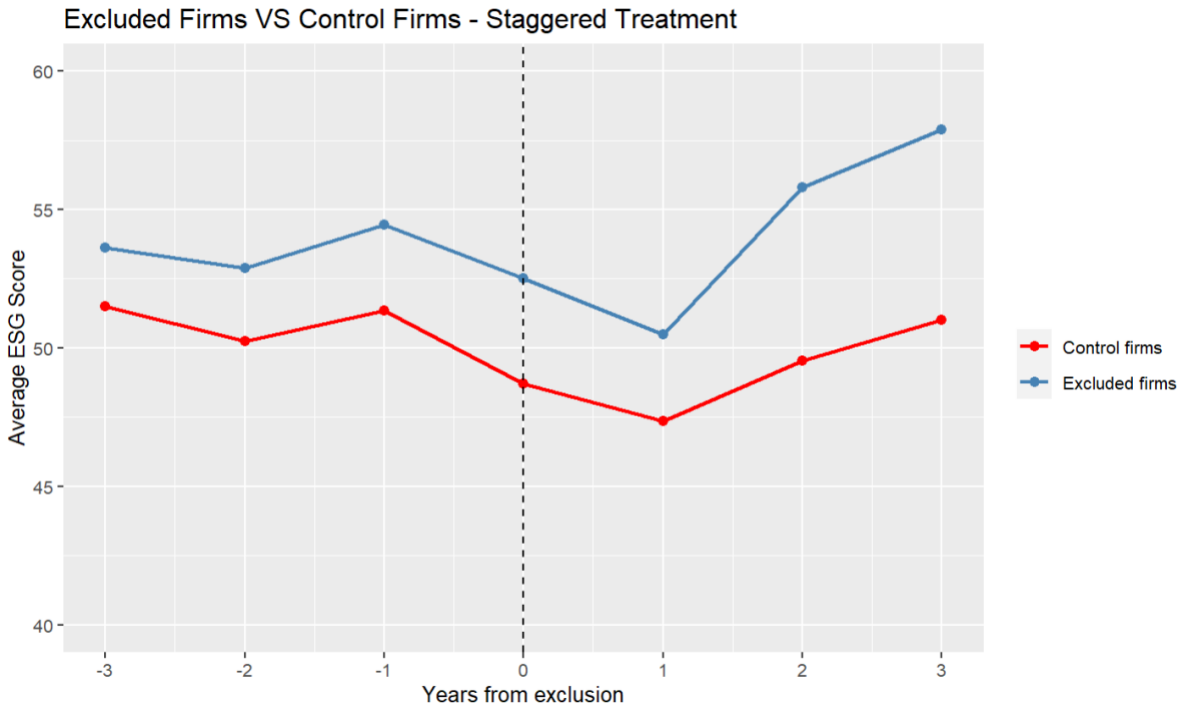

***Figure 9**: Average ESG Scores for Excluded Firms vs. Control Firms*

Figure 9 represents the evolution of average ESG scores for firms, categorized into 'excluded' and 'control' groups, for a period spanning three years before and after the event of exclusion. Negative and positive numbers on the x-axis indicate years before and after the event, respectively. The graph suggests that the excluded firms have marginally higher ESG scores than the control firms before and after the exclusion. Excluded companies seem to have a larger decrease in ESG scores on average than the control group for the year following the exclusion. For year two and three, however, the excluded group seem to have a larger increase. We do not have data for three years before and after exclusion for all companies, meaning that the groups we are averaging are changing from year to year. Furthermore, given that this graph represents raw averages without controlling for firm-specific fixed effects or common time trends, further regression analysis is needed to discern the true effect of exclusion on ESG scores.

DiD Estimation for Excluded Variable

	Dependent variable:		
	ESG Score		
	Model 1	Model 2	Model 3
Treated*After	-3.423	-0.033	-0.033
	t = -0.838	t = -0.016	t = -0.016
Treated	5.596		
	t = 1.218		
After	2.450	6.912***	1.815
	t = 0.914	t = 5.013	t = 1.189
Constant	48.988***		
	t = 15.994		
Model	OLS	OLS	OLS
Time FE	No	No	Yes
Firm FE	No	Yes	Yes
Observations	700	700	700
Note:			*p**p***p<0.01

Table 4: *DiD Estimation Output for Excluded Companies*

Table 4 presents the results from the three models: Model 1 (Pooling), Model 2 (Individual Fixed Effects), and Model 3 (Individual and Time Fixed Effects). The "Treated" coefficient in Model 1 is 5.596 but it is not statistically significant. As in the previous DiD analysis, this means that there is no evidence of a significant difference in ESG scores between the treated and control groups before the treatment. We know there were significant differences between the ESG scores for excluded companies and other companies prior to the propensity score matching, which gives us confidence that the control group is representative.

“Treated*After” capture the treatment effect in the three models. It represents the additional change in ESG scores for excluded companies compared to the control group companies after the exclusion. The coefficients from all models are negative but not statistically significant. The coefficient from the model exhibits a stronger effect in the negative direction than models 2 and 3 where both coefficients are very close to zero and not at all statistically significant. This indicates that there is no impact on ESG scores for a company in either direction following an exclusion by NBIM. Although the fixed effect regression in section 6.1.3 shows a more convincing relationship in a negative direction, the results are not significant either. The results from the analysis are consistent with our previous findings of no effect.

6.4.3 Difference-in-Differences – NBIM Coal-Criteria 2016

NBIM introduced a new product-based criteria for the exclusion of coal companies in 2016. The guideline resulted in NBIM excluding a total of 54 companies from future investment. This event very much resembles an experimental design. Given that we can argue for the parallel trend assumption by matching with comparable control firms, we can look at the effect of exclusion by NBIM more specifically than what we DiD in the previous section. Despite the insignificant results from the previous sections, we expect to see a decline in the average company ESG score for the excluded companies after 2016.

Due to the lower number of treated companies in this analysis, we create a control group consisting of two control companies per treated firm. We use the same confounding variables that we found to be significant in the logit regressions in the previous sections: market capitalization, price-to-book ratio, sector, and region. We use exact matching on both region and sector and propensity score for market capitalization and price-to-book ratio. ASMD is satisfactory for all variables. Balance plots for all variables are reported in the appendix along with the distribution of means and t-tests. After the matching we were left with 30 treated companies along with 53 control firms, totaling 83 companies. Simultaneous treatment as opposed to staggered treatment allows for an easier visual inspection of the data. The average ESG scores for excluded firms and control firms are illustrated in Figure 10 below.

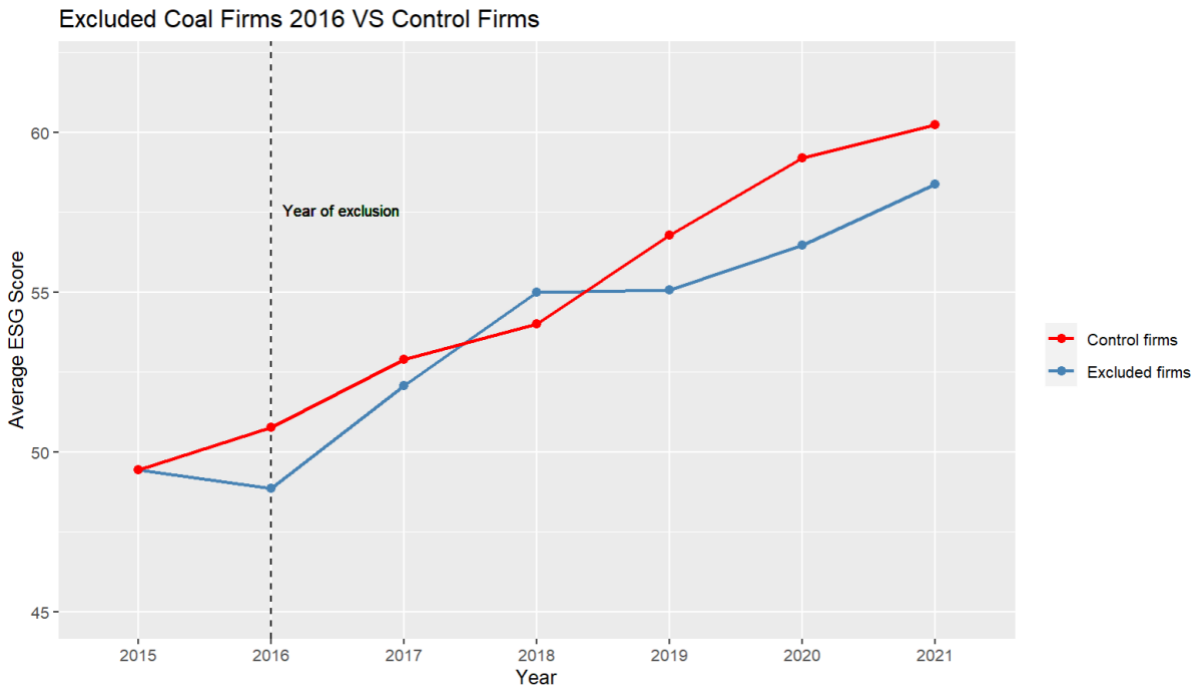

Figure 10: *Average ESG Scores for Excluded Coal Firms in 2016 vs. Control Firms*

From the visual inspection, we observe that the average ESG score for treated companies and control companies seem to behave similarly. As Refinitiv updates the ESG scores for companies on a weekly basis and the exclusion happened in April of 2016, the effect on ESG scores in the excluded companies might already be evident in the data for 2016. The decline we observe in ESG scores for excluded firms we see from 2015 to 2016 might therefore be a result of the exclusion. In the long term, it seems that the gap between ESG scores is getting larger between treated and control firms. In 2015, excluded firms had a difference of 0.001 points lower ESG scores on average, while the gap in 2021 was 1.9. To test whether there is a significant effect, we run the DiD estimation. The regression is included in Table 5 below.

DiD Estimation for Excluded Variable - Coal Experiment 2016

	Dependent variable:		
	ESG Score		
	Model 1	Model 2	Model 3
Treated*After	-1.337	-1.337	-1.337
	t = -0.463	t = -0.463	t = -0.463
Treated	0.001		
	t = 0.0002		
After	6.212***	6.212***	
	t = 3.656	t = 3.656	
Constant	49.437***		
	t = 16.718		
Model	OLS	OLS	OLS
Time FE	No	No	Yes
Firm FE	No	Yes	Yes
Observations	462	462	462
Note:			*p**p***p<0.01

Table 5: *DiD Estimation Output for Coal Companies Excluded in 2016*

We perform a DiD analysis in the same manner as with all excluded companies in the previous section. From the visual inspection of the data, there appears to be a slight negative relationship between the exclusion and average ESG score. We see the same results in the regression from Table 5. The "Treated*After" coefficient is negative for all three models, indicating a negative relationship. However, the results are not significant, and we are not able to conclude that the exclusion by NBIM in 2016 had a significant impact on ESG scores.

6.5 Limitations

To provide a more comprehensive understanding of our research, we outline the main limitations of our analysis. Our use of NBIM as representative of an institutional investor limits the generalization of our results. Even though they are classified as an institutional investor, several aspects of their mandate and the characteristics of the fund differentiates them from other institutional investors. In addition, the companies we analyze will have other institutional investors among their shareholders, which we do not account for in our analysis. This means that we occasionally compare a company owned by NBIM to a company owned by another institutional investor with a comparable impact on the company. Our contribution to existing research is therefore limited to IO similar to that of NBIM.

The use of ESG scores as a proxy for ESG performance is also a significant limitation. Several studies criticize the use of ESG scores (Doyle 2018; Drempetic et al. 2019). While our choice of Refintiv DataStream is based on their data-driven way of objectively quantifying ESG performance, studies have found a low degree of correlation in ESG scores between several recognized providers (Larcker et al., 2022). Replicating our analysis with another provider might therefore yield different results. Ideally, we would like to perform the analysis with a concrete measure of ESG performance. We encourage others to conduct the same analysis with such a measure, if possible, in the future.

Another limitation is that the period in which we are conducting the analyses might not provide a long enough period for the effect to be evident. The year 2015 was chosen as the start of the period because we can argue that NBIM's strategy of responsible investments was firmly in place by then. In the DiD analyses, we are only looking at changes in companies that they acquired a share in from 2016 onward. Given that NBIM is a long-term investor, we might have seen a greater effect with a longer time horizon.

While matching has been employed to create more representative control groups for our DiD analyses, there are unobserved variables that affect both the treatment status and the outcome of interest. While fixed effects models control for unobserved time-invariant factors, there may be time-varying confounding factors that we are unable to measure that influence both NBIM's decision to invest in a company, as well as the company's ESG performance. There might therefore be differences between the treated group and control group that violate the parallel trends assumption as it is impossible to obtain true as-if random treatment allocation.

7. Discussion

7.1 Higher ESG Scores Characterize the NBIM Portfolio

As presented in section 6.1, the results of our hypothesis testing indicate that companies in NBIM's portfolio have higher ESG scores on average than the market as a whole in 2021. Similarly, a fixed-effects analysis of companies owned by NBIM from 2015-2021 yields the same results. Based on these findings, we accept the validity of our hypothesis stating that the ESG scores of NBIM's portfolio are higher than that of the market average.

These findings are in line with previous research discussed in the literature review. Institutional owners with longer investment horizons tend to invest more in firms with higher ESG scores and behave more patiently toward firms scoring high on ESG metrics (Starks et al., 2018). Long-term investors are more inclined towards ESG factors because such practices might have financial benefits only in the long run. Also, institutional investors appear to be selective as they are indifferent to the presence of positive E and S indicators, but underweight stocks with negative ES indicators (Nofsinger et al., 2019). ESG factors are important in risk management and greater performance on these dimensions might reduce costs associated with regulatory fines, reputational damage, and operational disruptions. Thus, institutional investors have a financial incentive to select companies that exhibit greater ESG scores. Institutional investors also face social pressure from stakeholders to push for E&S performance in firms (Dyck et al., 2019). Holding a portfolio with high ESG scores thus mitigate the scrutiny from these stakeholders and signal a greater emphasis on ESG factors improving their reputation. As such, social pressure can incentivize investment managers to invest in companies with higher ESG scores.

The fact that the NBIM portfolio scores significantly higher on ESG raises doubts as to whether their responsible investment strategy is more based on negative screening rather than their high level of engagement on ESG issues. Simply selecting companies with higher ESG scores reduces the overall ESG impact of the fund by leaving out the companies with the most potential to improve. Investing in companies with lower ESG scores could thus better serve the non-financial objectives of the fund. On the other hand, NBIM's commitment to companies with higher ESG can have a signaling effect in the sense that it attracts other investors to invest in these companies as well (Vasudeva et al., 2018). This lowers the cost of capital for these firms, thus incentivizing companies to improve on ESG dimensions.

7.2 No Impact on ESG Scores from NBIM Ownership

The DiD analyses seeking to estimate the treatment effect of NBIM ownership on ESG scores shown in Table 3 yield insignificant results. Coefficients for the treatment effect indicate an insignificant relationship between NBIM ownership and ESG score growth compared to a matched control group. This suggests that NBIM ownership does not affect the growth of ESG scores in the companies they own. We must therefore reject the hypothesis of a positive effect on company ESG scores due to the insignificance of the results.

Our results are similar to most of the research papers presented in the literature review, most of which find no significant relationship between IO and ESG performance. A potential explanation for this is the heterogeneity concerns implying that ownership alone is not an accurate predictor of ESG performance. However, considering other aspects of NBIM's ownership such as its long-term investment horizon, level of engagement, and being a PRI signatory, the results contradict prior research. Most significantly, long-term investment horizons improve the ESG performance of firms over time[10]. NBIM clearly states that its fund has a long-term investment horizon and its consecutive ownership of some of the largest companies in the world over the recent decades is proof of this. In addition, a higher level of shareholder activism also improves the ESG ratings of companies[11]. NBIM engages with companies through company dialogue, voting guidelines, and expectation documents, but these efforts are not visible in the ESG score of its companies. Moreover, institutions that are part of the PRI network also exhibit better ESG performance, with most of the effect coming from differences in the governance score (Gibson et al., 2019). NBIM is one of the founding members of PRI and incorporates its initiatives and guidelines in its investment strategy which would imply enhancing the ESG score of companies in its portfolio. No such effect can be observed in NBIM's portfolio, suggesting that the implantation of these principles cannot be credited to the development of ESG scores.

Several reasons can explain the limited impact of the measures NBIM has taken to be considered a responsible investor. Firstly, the NBIM ownership share of each company is low, typically varying between 0.1% and 3%. This ownership share limits any institutional investors' impact on a company regardless of investment strategy. As such, NBIM lacks the

[10] Meng & Wang, 2020; Erhemjamts & Huang, 2019; Fu et al., 2019; Gloßner, 2019; Kim et al., 2019
[11] Dyck et al., 2019; Alda, 2019; Dimson et al., 2015; Pucheta-Martinez & Lopez-Zamora, 2018

influence to manifest its responsible investment strategy in the companies of its portfolio. Increased ownership shares or greater collaboration with other institutional investors could increase the influence of NBIM, thus yielding a different outcome than presented in this paper. Secondly, the engagement of NBIM might not be sufficient to drive positive change in the ESG dimensions of firms. Actual active ownership requires regular dialogue with management, proposing shareholder resolutions, and exercising voting rights at every shareholder meeting. Considering that NBIM owns over 9000 companies in different industries worldwide, exercising such ownership seems both unfeasible and unlikely given its current resources. Another reason might also be that NBIM's main priority is still financial performance in accordance with its mandate. When financial considerations take precedence over non-financial factors, NBIM can be inclined to prioritize returns over initiatives and improvements related to ESG in the companies of its portfolio.

7.3 Company ESG Score is Unaffected by NBIM Exclusion

Our findings in section 6.4 show no statistical significance in the DiD analysis on NBIM exclusions. Although the regression seems to suggest a negative correlation between exclusion and ESG score, these results are not conclusive. We find similar evidence in the quasi-experimental approach resulting from the exclusion of coal companies in 2016. These findings indicate that exclusion by NBIM has no impact on ESG scores. We must therefore reject our hypothesis of deterioration in ESG score following exclusion by NBIM.

NBIM excludes companies based on both product-based and conduct-based criteria. It seems reasonable that serious ESG-related incidents that lead to exclusion by NBIM, are reflected in the ESG scores regardless of the exclusion. It may therefore be that the negative coefficients we observe in our regression are unrelated to the exclusion by NBIM. It may also be due to exclusion by other investors and the like, as we have not controlled for this.

To our knowledge, there is no prior research on the non-financial effect of exclusion or divestment by institutional investors. Comparing our results to prior studies is therefore difficult. The findings are however consistent with our conclusion that NBIM ownership does not impact the ESG score of the firms in its portfolio. Consequently, the same reasons can potentially explain the insignificant effect of exclusion as well. The modest ownership shares, the limited effect of company engagement, and their primary objective of financial performance all entail that exclusion by NBIM has no noteworthy effect on ESG performance.

8. Conclusion

Our initial analysis indicates that NBIM's portfolio on average has better ESG scores than the market as a whole. Hypothesis testing and regression reveal a positive relationship between NBIM's ownership share and ESG scores while controlling for factors known to influence ESG scores. Furthermore, ESG scores for excluded companies are significantly higher compared to NBIM-owned companies. However, regression results do not show a statistically significant relationship between company exclusion and ESG scores.

The comparative observational study aims to measure the unique causal effects of both NBIM ownership and NBIM exclusion on ESG scores while addressing the issues of endogeneity in the previous parts of the analysis. When examining the effect of NBIM ownership on ESG score growth, the treatment effect coefficient is insignificant across all models, suggesting that NBIM ownership does not seem to influence ESG scores. Similarly, when assessing the impact of NBIM exclusion on ESG scores, none of the analyses on exclusion by NBIM show any statistical significance. This suggests that being excluded by NBIM does not have any effect on a company's ESG score either.

As NBIM predominantly holds stakes ranging from 0.1% to 3% in companies in their portfolio, their capacity to exert influence remains limited. This might be a contributory factor as to why we see no statistical significance. If their ownership stakes were more substantial, or if they pursued collaborative efforts with other institutional investors, the outcomes of our study might have varied. Therefore, our results encourage further research. First and foremost, a study that utilizes a more concrete measure of ESG performance for companies would be beneficial. It would also be relevant to study the effect of collaborative efforts between institutional investors or to study institutional investors with larger ownership shares.

In conclusion, this thesis underscores the complexity of the relationship between institutional ownership and ESG performance. While there is evidence to suggest that NBIM's portfolio companies have higher ESG scores than the market average, the impacts of NBIM ownership and exclusion on a company's ESG performance seem to be inexistent and warrant further investigation. Our results indicate that NBIM screens companies for performance on ESG to signal their commitment to sustainable investment principles. However, these findings may be attributed to an ownership stake in each company that is insufficiently substantial to exert the necessary influence to affect changes that could be reflected in a company's ESG performance.

9. Appendices

9.1 Appendix A - Matching for NBIM Ownership

	Dependent variable:
	treat
log(Market_cap_15.x)	0.226***
	(0.025)
Price_book_15	0.001
	(0.009)
company_age	-0.008***
	(0.003)
factor(Region)Americas	0.252
	(0.312)
factor(Region)Asia	0.346
	(0.312)
factor(Region)Europe	-0.023
	(0.316)
factor(Region)Oceania	1.277***
	(0.347)
factor(Sector)Alternative Energy	0.079
	(0.631)
factor(Sector)Automobiles and Parts	0.247
	(0.420)
factor(Sector)Banks	-0.490
	(0.374)
factor(Sector)Beverages	0.075
	(0.495)
factor(Sector)Chemicals	0.418
	(0.397)
factor(Sector)Closed End Investments	-2.030*
	(1.078)
factor(Sector)Construction and Materials	0.131
	(0.385)
factor(Sector)Consumer Services	0.456
	(0.529)
factor(Sector)Electricity	-0.630
	(0.413)
factor(Sector)Electronic and Electrical Equipment	-0.202
	(0.448)
factor(Sector)Finance and Credit Services	0.126
	(0.468)
factor(Sector)Food Producers	-0.319
	(0.401)
factor(Sector)Gas, Water and Multi-utilities	0.173
	(0.469)
factor(Sector)General Industrials	-0.060
	(0.430)
factor(Sector)Health Care Providers	0.210
	(0.490)
factor(Sector)Household Goods and Home Construction	0.821*
	(0.473)
factor(Sector)Industrial Engineering	-0.239
	(0.432)
factor(Sector)Industrial Materials	-0.179
	(0.550)
factor(Sector)Industrial Metals and Mining	0.309

	(0.387)
factor(Sector)Industrial Support Services	0.032
	(0.410)
factor(Sector)Industrial Transportation	-0.101
	(0.390)
factor(Sector)Investment Banking and Brokerage Services	0.301
	(0.388)
factor(Sector)Leisure Goods	0.663
	(0.472)
factor(Sector)Life Insurance	-0.528
	(0.635)
factor(Sector)Media	0.092
	(0.427)
factor(Sector)Medical Equipment and Services	0.248
	(0.418)
factor(Sector)Mortgage Real Estate Investment Trusts	-0.521
	(0.859)
factor(Sector)Non-life Insurance	-0.126
	(0.456)
factor(Sector)Oil, Gas, and Coal	-0.814**
	(0.396)
factor(Sector)Open End and Miscellaneous Investment Vehicles	-13.163
	(882.743)
factor(Sector)Personal Care, Drug and Grocery Stores	-0.207
	(0.463)
factor(Sector)Personal Goods	0.112
	(0.481)
factor(Sector)Pharmaceuticals and Biotechnology	0.617
	(0.376)
factor(Sector)Precious Metals and Mining	-0.441
	(0.512)
factor(Sector)Real Estate Investment and Services Development	0.105
	(0.393)
factor(Sector)Real Estate Investment Trusts	0.399
	(0.389)
factor(Sector)Retailers	0.008
	(0.398)
factor(Sector)Software	Computer Services
	(0.375)
factor(Sector)Technology Hardware	Equipment
	(0.383)
factor(Sector)Telecommunications Equipment	0.319
	(0.446)
factor(Sector)Telecommunications Service Providers	0.020
	(0.435)
factor(Sector)Tobacco	-13.972
	(260.173)
factor(Sector)Travel and Leisure	-0.130
	(0.408)
factor(Sector)Waste and Disposal Services	1.238
	(0.832)
Constant	-5.778***
	(0.696)
Observations	3,516
Log Likelihood	-1,988.918
Akaike Inf. Crit.	4,081.836

Note: *p**p***p<0.01

Table A.1: *NBIM Ownership - Logistic Regression for Matching*

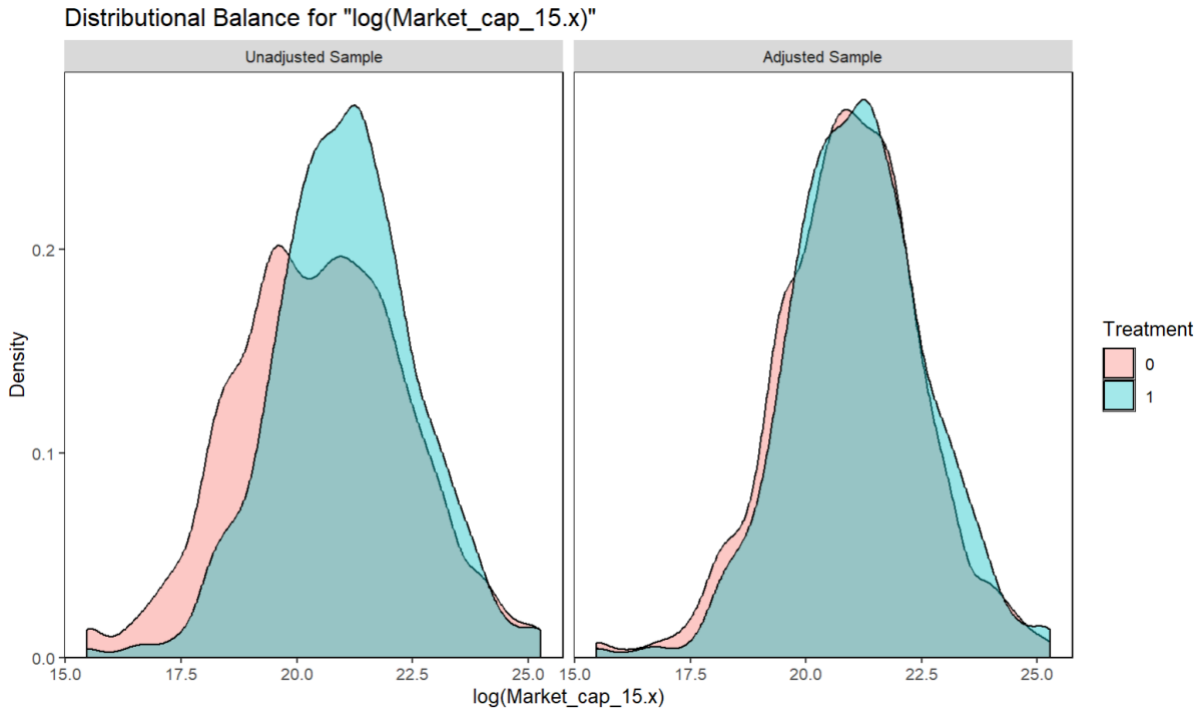

Figure A.1: *NBIM Ownership - Distributional Balance for Market Cap*

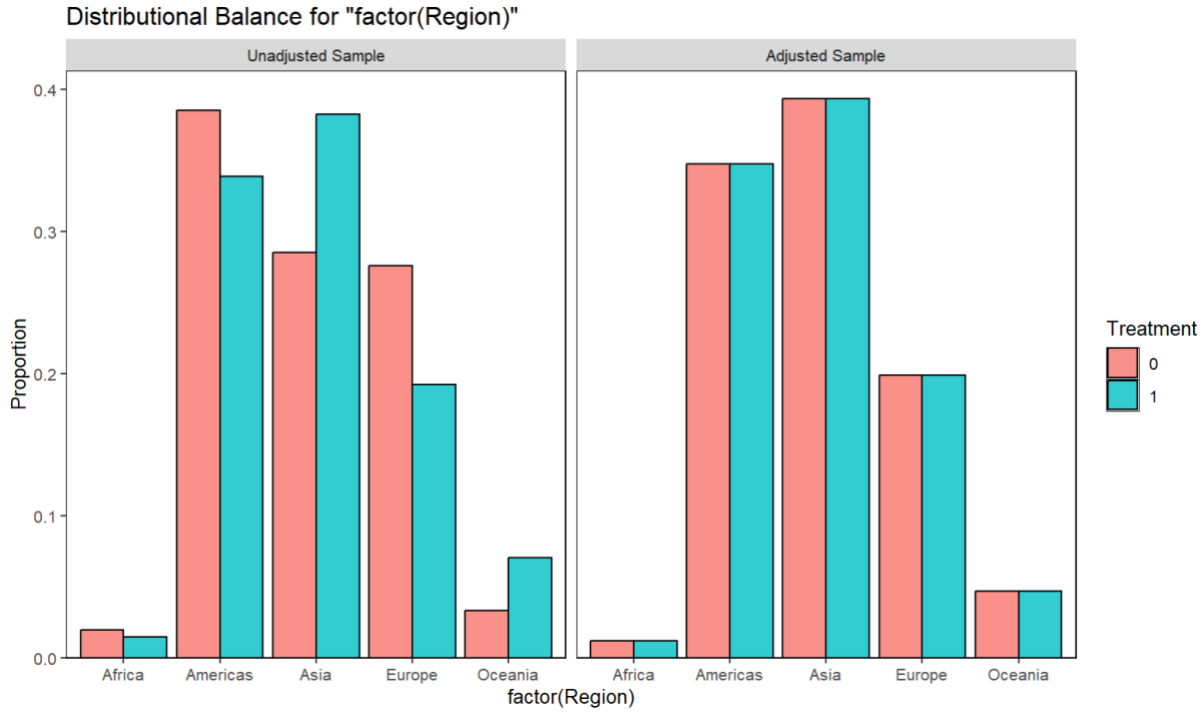

Figure A.2: *NBIM Ownership - Distributional Balance for Region*

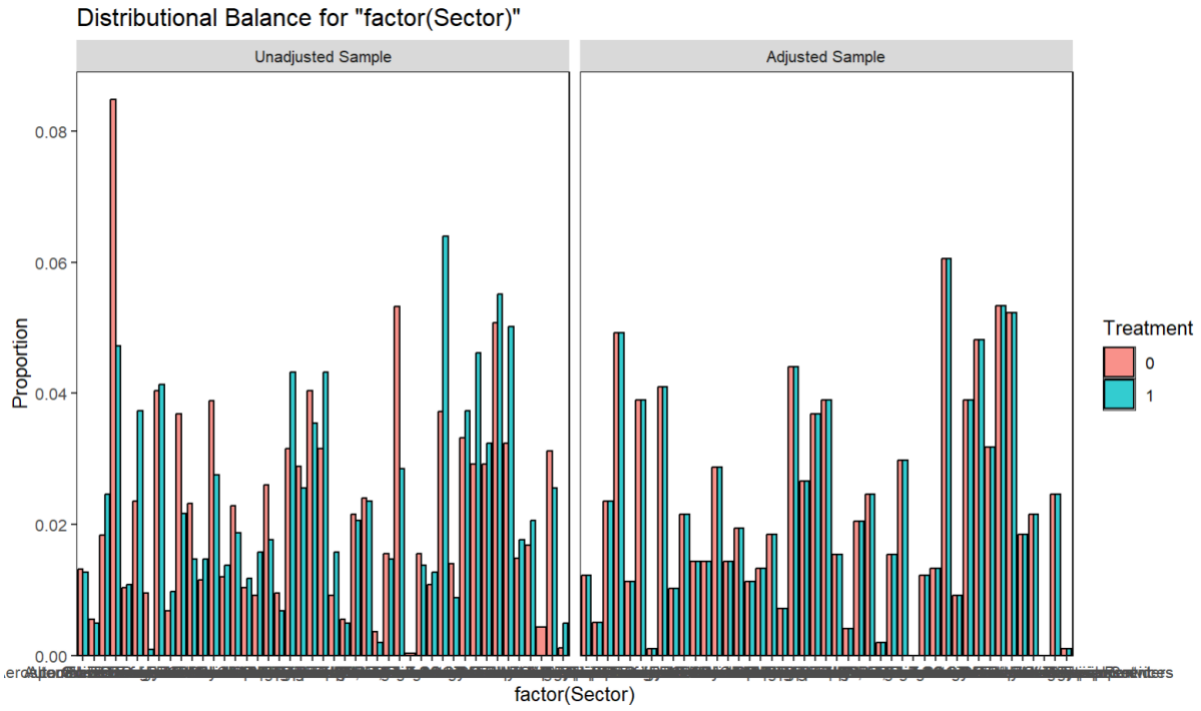

Figure A.3: *NBIM Ownership - Distributional Balance for Sector*

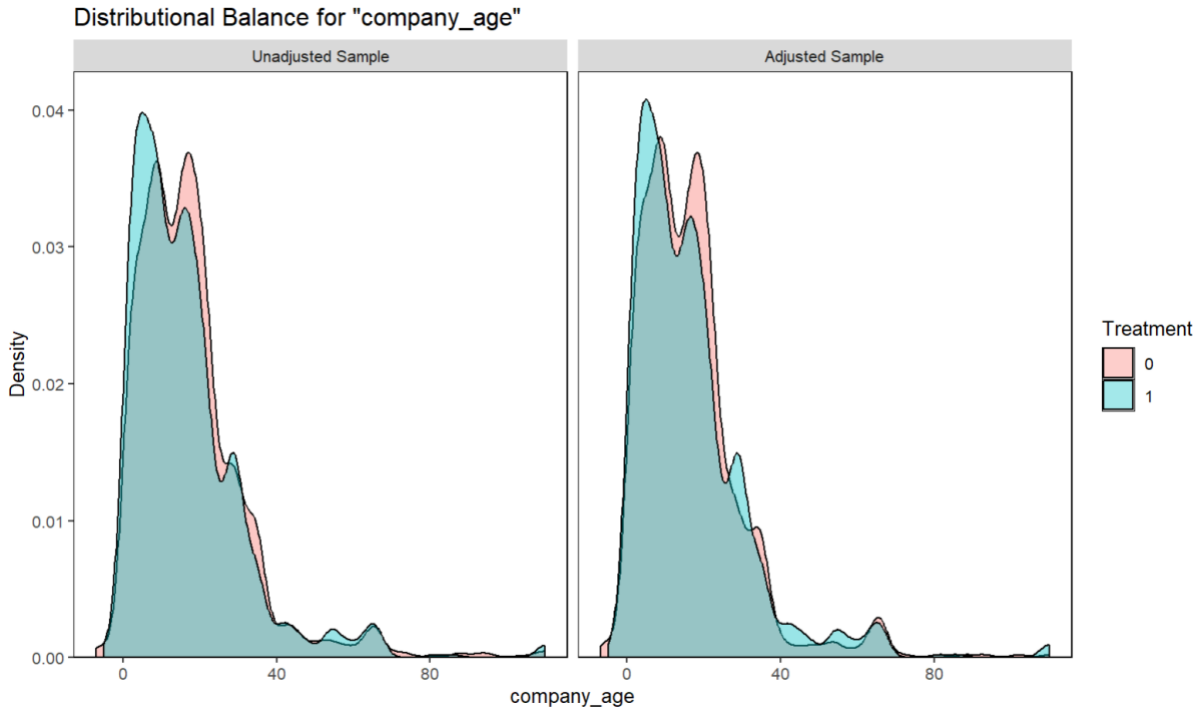

Figure A.4: *NBIM Ownership - Distributional Balance for Company Age*

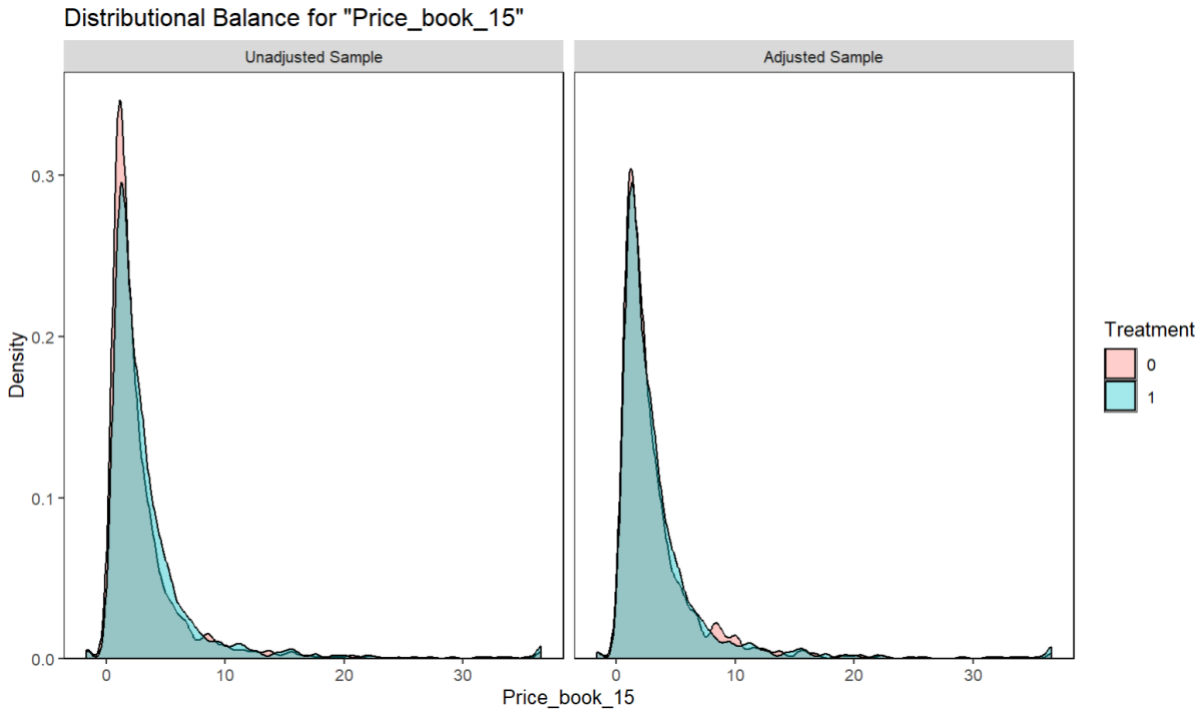

Figure A.5: *NBIM Ownership - Distributional Balance for Price/Book-Ratio*

The table below shows the difference in means as well as the p-value for t-tests conducted to check the difference in means between the groups for the different variables. Sector and region are not included as they are matched exactly and thus have no difference in means.

Variable	Treated	Untreated	Difference	P-value
Market Cap	4,627,276,555	3,799,597,220	827,679,335	0.065
Company Age	16.40	16.46	-0.065	0.921
P/B ratio	3.58	3.32	0.257	0.193

Table A.2*: NBIM Ownership - Means Table for Matched Variables*

We performed other regressions when evaluating potential variables for matching. The regression below shows the regression results for these other potential variables. As they had no significant impact on the probability of treatment, we left them out of the model.

Model:

$$logit(treat) = \alpha + \beta 1 * Ebitda\_15 + \beta 2 * Debt\_enterprise\_15 + \beta 3 * Debt\_equity\_15 + \varepsilon$$

Where:

$$\boldsymbol{treat} = Dummy\ variable\ that\ equals\ 1\ if\ company\ is\ owned\ by\ NBIM$$

$$\boldsymbol{IPO\_year} = The\ year\ of\ the\ company\ initial\ public\ offering$$

$$\boldsymbol{Ebitda\_15} = Earnings\ before\ interest, taxes\ and\ depreciation\ in\ percent\ of\ revenue, January\ 1st\ 2015$$

$$\boldsymbol{Price\_book\_15} = The\ companys\ latest\ closing\ price\ divided\ by\ its\ book\ value\ per\ share, January\ 1st\ 2015$$

$$\boldsymbol{Debt\_enterprise\_15} = The\ companys\ short\ and\ long\ term\ debt\ divided\ by\ its\ enterprise\ value, January\ 1st\ 2015$$

Equation A.1: *NBIM Ownership - Model Equation for Unused Variables*

	Dependent variable:
	treat
Ebitda_15	0.008
	(0.013)
Debt_enterprise_15	-0.153
	(0.150)
Debt_to_equity_15	-0.003
	(0.005)
Constant	-0.856***
	(0.053)
Observations	3,516
Log Likelihood	-2,113.868
Akaike Inf. Crit.	4,235.736
Note:	*p**p***p<0.01

Table A.3: *NBIM Ownership - Logistic Regression for Unused Variables*

9.2 Appendix B – Matching for NBIM Exclusion

	Dependent variable:
	treat
log(Market_cap_15.x)	0.226***
	(0.025)
Price_book_15	0.001
	(0.009)
company_age	-0.008***
	(0.003)
factor(Region)Americas	0.252
	(0.312)
factor(Region)Asia	0.346
	(0.312)
factor(Region)Europe	-0.023
	(0.316)
factor(Region)Oceania	1.277***
	(0.347)
factor(Sector)Alternative Energy	0.079
	(0.631)
factor(Sector)Automobiles and Parts	0.247
	(0.420)
factor(Sector)Banks	-0.490
	(0.374)
factor(Sector)Beverages	0.075
	(0.495)
factor(Sector)Chemicals	0.418
	(0.397)
factor(Sector)Closed End Investments	-2.030*
	(1.078)
factor(Sector)Construction and Materials	0.131
	(0.385)
factor(Sector)Consumer Services	0.456
	(0.529)
factor(Sector)Electricity	-0.630
	(0.413)
factor(Sector)Electronic and Electrical Equipment	-0.202
	(0.448)
factor(Sector)Finance and Credit Services	0.126
	(0.468)
factor(Sector)Food Producers	-0.319
	(0.401)
factor(Sector)Gas, Water and Multi-utilities	0.173
	(0.469)
factor(Sector)General Industrials	-0.060
	(0.430)
factor(Sector)Health Care Providers	0.210
	(0.490)
factor(Sector)Household Goods and Home Construction	0.821*
	(0.473)
factor(Sector)Industrial Engineering	-0.239
	(0.432)
factor(Sector)Industrial Materials	-0.179
	(0.550)
factor(Sector)Industrial Metals and Mining	0.309
	(0.387)
factor(Sector)Industrial Support Services	0.032

	(0.410)
factor(Sector)Industrial Transportation	-0.101
	(0.390)
factor(Sector)Investment Banking and Brokerage Services	0.301
	(0.388)
factor(Sector)Leisure Goods	0.663
	(0.472)
factor(Sector)Life Insurance	-0.528
	(0.635)
factor(Sector)Media	0.092
	(0.427)
factor(Sector)Medical Equipment and Services	0.248
	(0.418)
factor(Sector)Mortgage Real Estate Investment Trusts	-0.521
	(0.859)
factor(Sector)Non-life Insurance	-0.126
	(0.456)
factor(Sector)Oil, Gas, and Coal	-0.814**
	(0.396)
factor(Sector)Open End and Miscellaneous Investment Vehicles	-13.163
	(882.743)
factor(Sector)Personal Care, Drug and Grocery Stores	-0.207
	(0.463)
factor(Sector)Personal Goods	0.112
	(0.481)
factor(Sector)Pharmaceuticals and Biotechnology	0.617
	(0.376)
factor(Sector)Precious Metals and Mining	-0.441
	(0.512)
factor(Sector)Real Estate Investment and Services Development	0.105
	(0.393)
factor(Sector)Real Estate Investment Trusts	0.399
	(0.389)
factor(Sector)Retailers	0.008
	(0.398)
factor(Sector)Software	Computer Services
	(0.375)
factor(Sector)Technology Hardware	Equipment
	(0.383)
factor(Sector)Telecommunications Equipment	0.319
	(0.446)
factor(Sector)Telecommunications Service Providers	0.020
	(0.435)
factor(Sector)Tobacco	-13.972
	(260.173)
factor(Sector)Travel and Leisure	-0.130
	(0.408)
factor(Sector)Waste and Disposal Services	1.238
	(0.832)
Constant	-5.778***
	(0.696)
Observations	3,516
Log Likelihood	-1,988.918
Akaike Inf. Crit.	4,081.836
Note:	*p**p***p<0.01

Table B.1: *NBIM Exclusion - Logistic Regression for Matching*

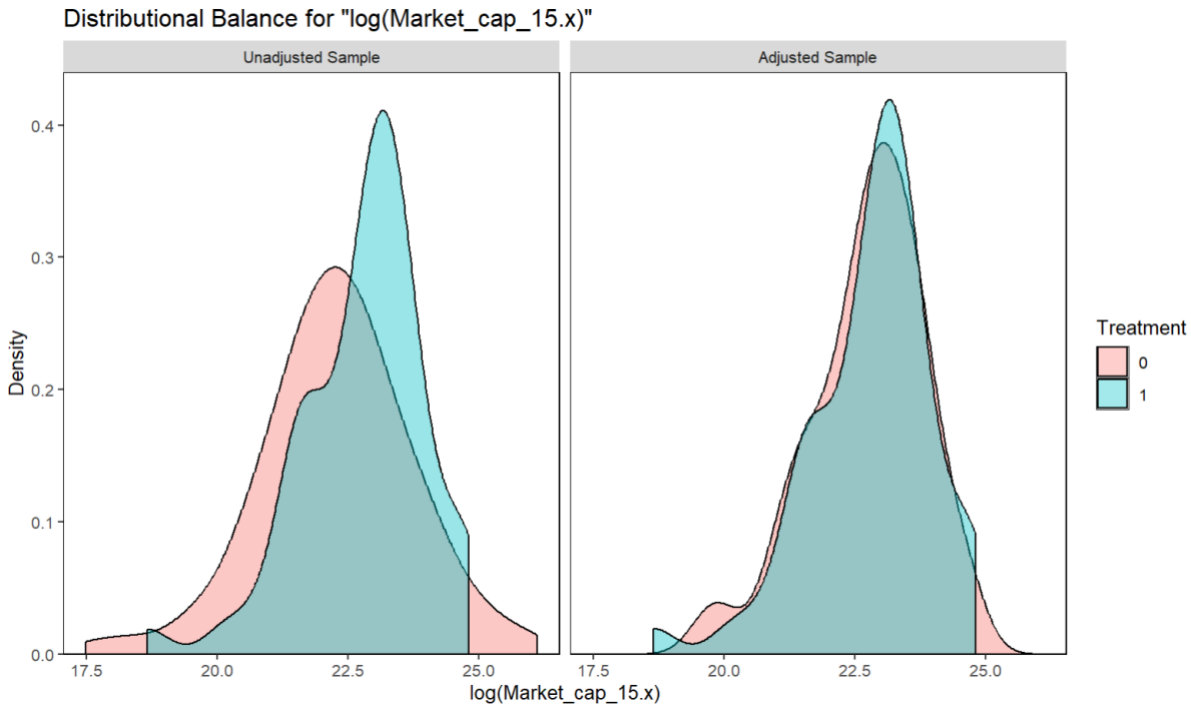

Figure B.1: *NBIM Exclusion - Distributional Balance for Market Cap*

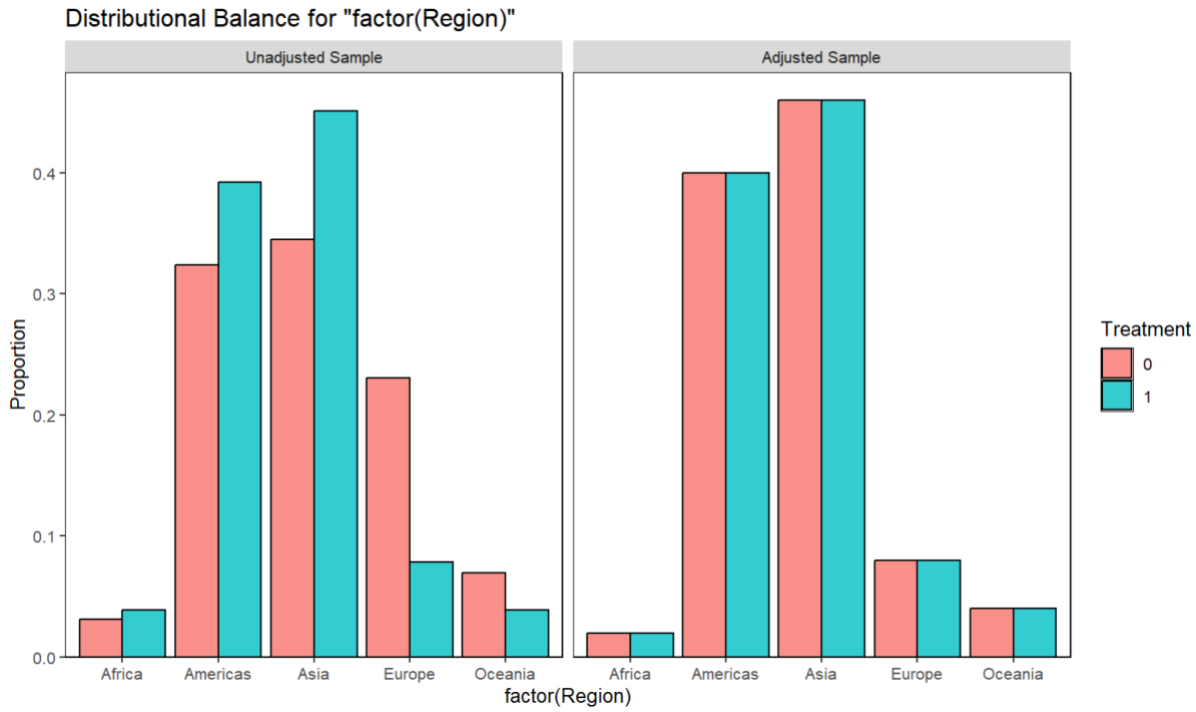

Figure B.2*: NBIM Exclusion - Distributional Balance for Region*

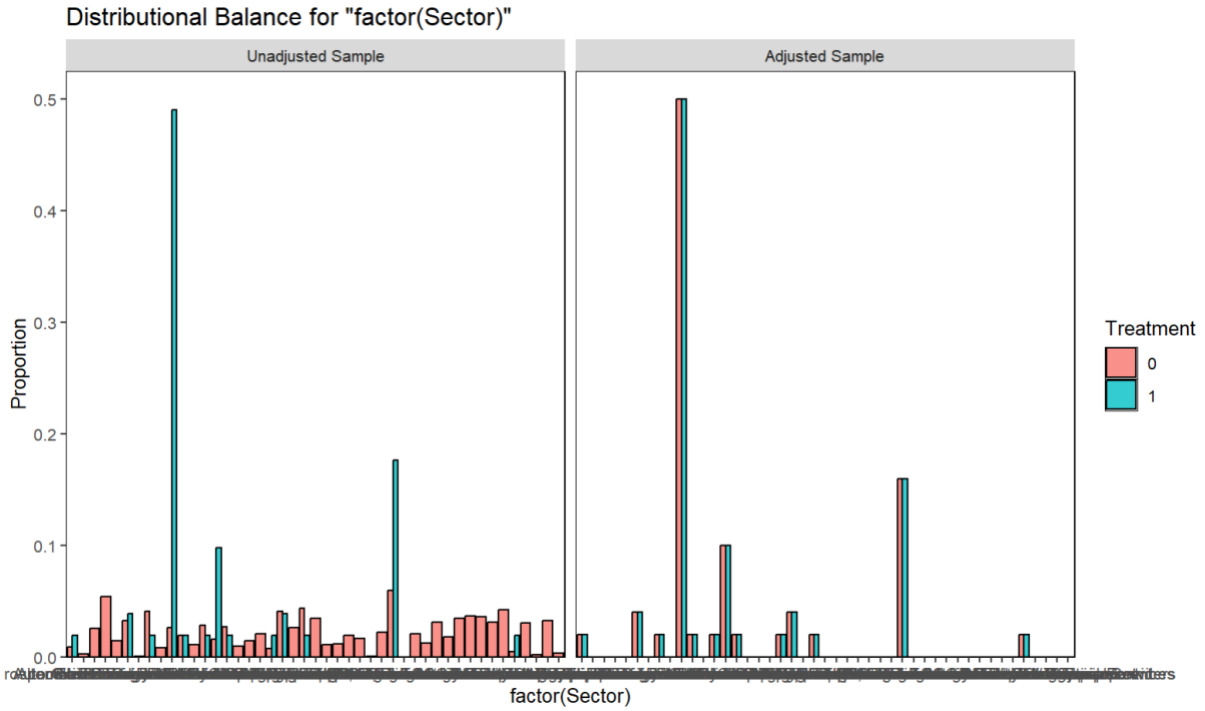

Figure B.3: *NBIM Exclusion - Distributional Balance for Sector*

The table below shows the difference in means as well as the p-value for a t-test conducted to check the difference in means between the groups for market cap. Sector and region are not included as they are matched exactly and thus have no difference in means.

Variable	Treated	Untreated	Difference	P-value
Market Cap	13,695,911,994	11,912,679,106	1,783,232,888	0.490

Table B.2: *NBIM Exclusion - Means Table for Matched Variables*

We performed other regressions when evaluating potential variables for matching. The regression below shows the regression results for these other potential variables. As they had no significant impact on the probability of treatment, we left them out of the model.

Model:

$$logit(treat) = \alpha + \beta 1 * Ebitda\_15 + \beta 2 * Debt\_enterprise\_15 + \beta 3 * Debt\_equity\_15 + \varepsilon$$

Where:

$$\boldsymbol{treat} = Dummy\ variable\ that\ equals\ 1\ if\ company\ was\ excluded\ by\ NBIM$$

$$\boldsymbol{IPO\_year} = The\ year\ of\ the\ company\ initial\ public\ offering$$

$$\boldsymbol{Ebitda\_15} = Earnings\ before\ interest, taxes\ and\ depreciation\ in\ percent\ of\ revenue, January\ 1st\ 2015$$

$$\boldsymbol{Price\_book\_15} = The\ companys\ latest\ closing\ price\ divided\ by\ its\ book\ value\ per\ share, January\ 1st\ 2015$$

$$\boldsymbol{Debt\_enterprise\_15} = The\ companys\ short\ and\ long\ term\ debt\ divided\ by\ its\ enterprise\ value, January\ 1st\ 2015$$

***Equation B.1**: NBIM Exclusion - Model Equation for Unused Variables*

	Dependent variable:
	treat
Ebitda_15	0.008
	(0.013)
Debt_enterprise_15	-0.153
	(0.150)
Debt_to_equity_15	-0.003
	(0.005)
Constant	-0.856***
	(0.053)
Observations	3,516
Log Likelihood	-2,113.868
Akaike Inf. Crit.	4,235.736
Note:	*p**p***p<0.01

***Table B.3:** NBIM Exclusion - Logistic Regression for Unused Variables*

9.3 Appendix C – Matching for Coal Experiment

The control group for the experiment on excluded coal companies in 2016 was matched on the same variables that showed to have a significant effect on treatment for excluded companies. We therefore just include the balance plots for the matching:

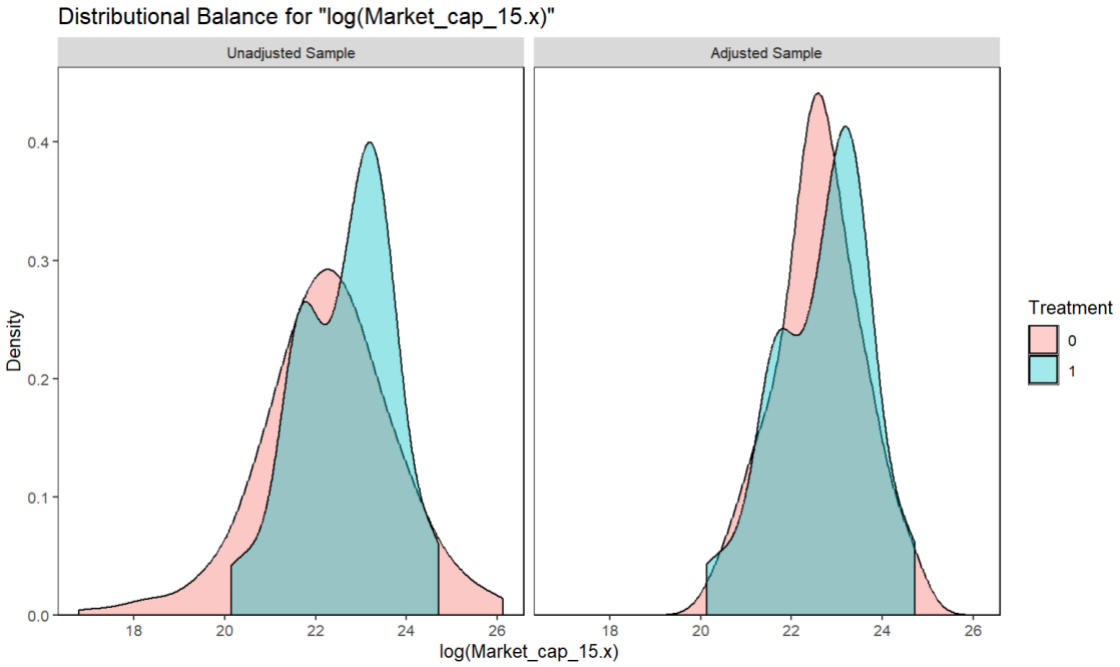

Figure C.1: *NBIM Coal Experiment - Distributional Balance for Market Cap*

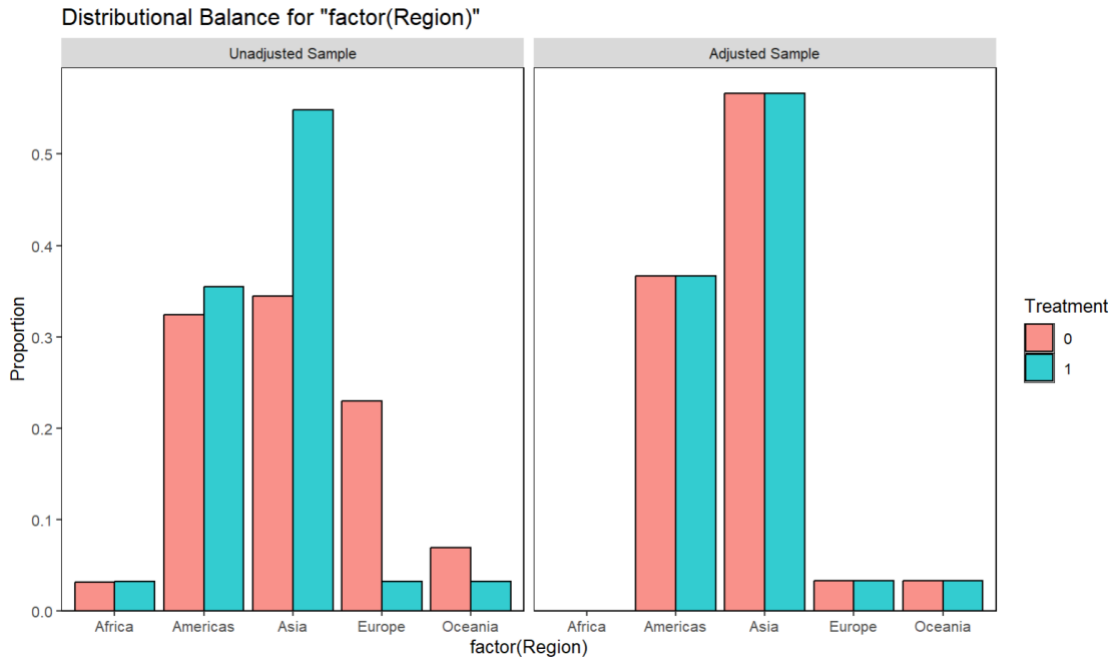

Figure C.2*: NBIM Coal Experiment - Distributional Balance for Region*

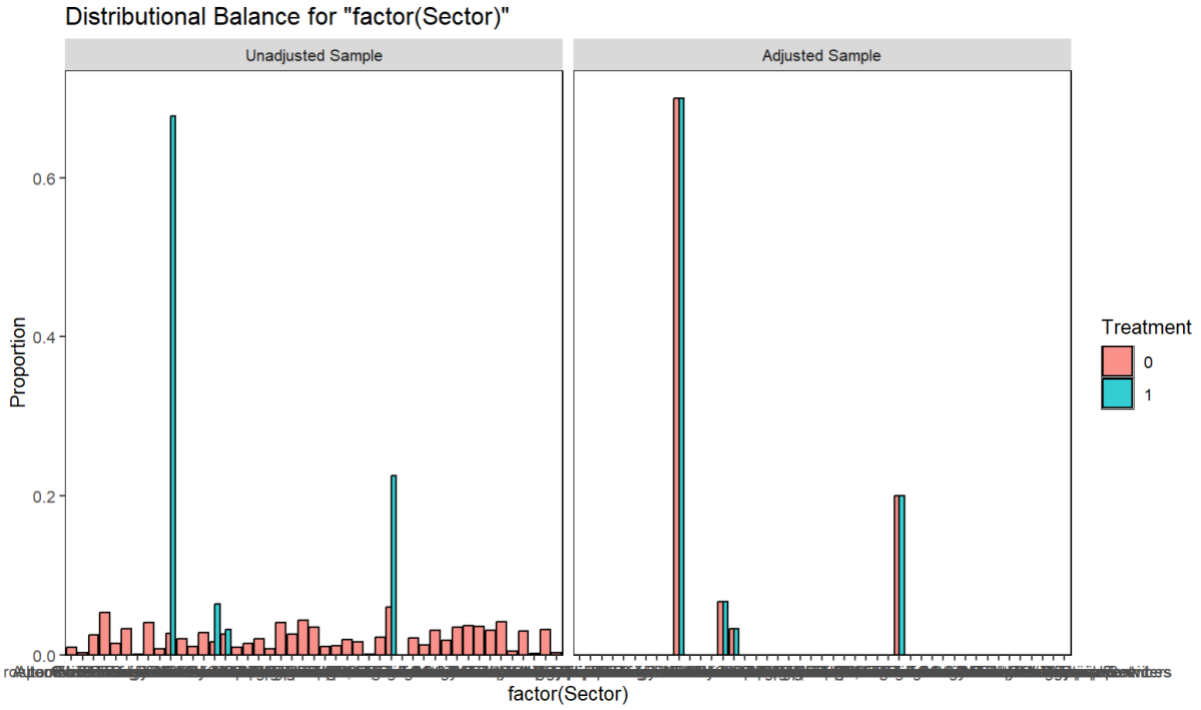

Figure C.3: *NBIM Coal Experiment - Distributional Balance for Sector*

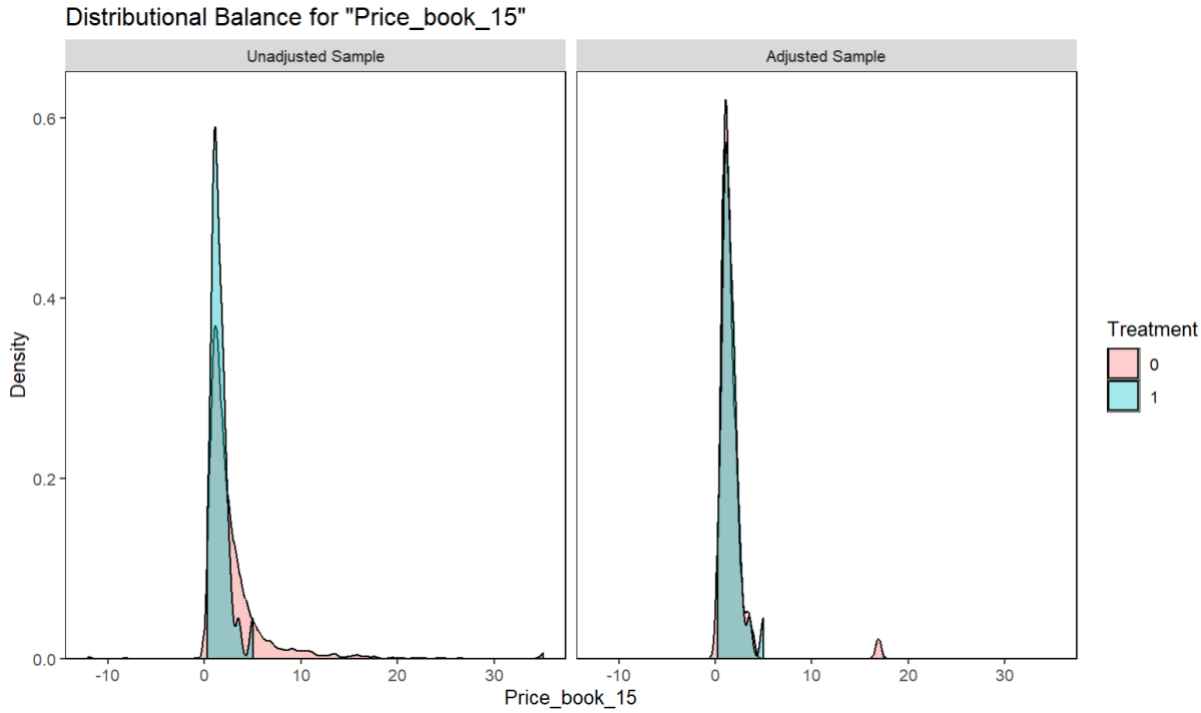

Figure C.4: *NBIM Coal Experiment - Distributional Balance for Price/Book-Ratio*

The table below shows the difference in means as well as the p-value for t-tests conducted to check the difference in means between the groups for market cap and P/B ratio. Sector and region are not included as they are matched exactly and thus have no difference in means.

Variable	Treated	Untreated	Difference	P-value
Market Cap	11,272,722,256	10,663,484,205	609,238,050	0.812
P/B ratio	1.566	1.683	-0.117	0.742

Table C.1: *NBIM Coal Experiment - Means Table for Matched Variables*

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