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Do fossil fuel divestments from large capitalization fossil fuel firms lead to a change in emissions and returns?

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Abstract

How should asset managers deal with the issue of divesting or engaging with fossil fuel companies? By looking at the effect divesting has on variables that are important to the fund and its owners. In this debate, we argue that the return and emissions caused by the company are the issues most relevant for an asset manager. Through panel data regression models containing information on divestments, monthly return, emissions and risk factors, and a thorough review of ownership data on a large number of international fossil fuel companies, conclusions on the best course of action can be made to ensure more profitable funds and a healthier planet.

Keywords – Divestment, Engagement, ESG, Sustainable Finance

Contents

1 Introduction

The question of whether the asset managers and funds should divest their holdings from producers of fossil fuel or engage with them to encourage green initiatives is getting increasingly relevant as we approach 2030 and 2050. Our thesis aims to capture and measure the effect divestments have on a fossil fuel company's emission in the time after the investment, as well as serve as a baseline and inspiration for future research within environmentally driven divestments. The thesis contains two hypotheses: a company that has been divested from has a lower monthly return than other companies within the same sector due to increased cost of capital. Secondly, a company that has been divested from has higher emissions compared to companies within the same sector due to changes in ownership. Utilizing panel data regressions, our paper highlights the long-term effects institutional divestment announcements of large capitalization fossil fuel firms have on stock performance and company emissions. We find a statistically significant effect on prices when regressing monthly stock return on earnings per share, debt-to-equity and a divestment dummy variable, with a coefficient of -0.4% per month. Further, we find statistically significant results when regressing emissions on divestment announcements compared to the non-divested companies, controllig for variables and controls such as public emission goals and Paris agreement alignment, with a coefficient of -0.455 C02 equivalents per dollar in revenue.

The scientific community agrees that there is a direct link between human activity and global warming (NASA, 2022; IPCC, 2014). When manufacturing and delivering products and services for consumption, businesses release greenhouse gases (GHG) that raise global temperatures and temperature variability. Further, environmental disasters are becoming more frequent, temperatures and the ocean is rising, and people are getting forced away from their homes as a result of climate change. This, combined with Covid-19, has affected the most vulnerable groups in society disproportionately, and if action is not taken soon, the effects will only increase. The focus on sustainable, social, economic and environmental growth and development has been more in the spotlight as a result of the increasing temperatures around the globe.

The private sector, as they both produce and consume fossil fuels harmful to the

environment, are morally obliged in helping the transition towards a net zero society. However, as we know, moral obligations are not necessarily enough to convey profit-driven companies to contribute to the transition. A shift is happening, however. People, and therefore also shareholders, are becoming more demanding than ever to hold companies accountable for their actions against the climate, and sustainably responsible investing has seen a remarkable rise in the last years. Further, a large majority of executives are concerned about climate change, roughly 30% are reporting operational setbacks due to climate-related disasters and 25% are experiencing resource scarcity in their value chains. The case for sustainable initiatives is therefore shifting from a moral and externality-driven one, to one that is directly connected to classical profit-maximizing stakeholders.

Businesses, therefore, are now incentivized to reduce their carbon footprint. Shareholders are demanding action to be taken, and ESG-related funds and green financial products are entering the market in a more dominant way. The market for ESG funds and sustainably responsible investments are now in excess of 30 trillion USD, and growing quickly, with some estimates claiming that the market will exceed 50 trillion USD by 2025 (Bloomberg, 2021). Demand for green products is therefore already present, and certainly rising. Problems arise, however, in the classification of what is considered sustainable and what is considered not sustainable. ESG ratings differ widely and are in some cases directly negatively correlated, as well as scientific disputes regarding the most optimal way of reaching net zero or being sustainable. Perhaps the most debated and most challenging aspect of this tradeoff for asset managers lies within the tradeoff in divesting or refusing to invest in certain types of companies and staying invested, keeping their proxy votes, whilst trying to push the company in question down a more sustainable path.

This tradeoff is essential in determining the future that we have – in order to reach a society in which net-zero emissions are a reality, we have to allocate capital to the people who are capable of using that capital in the most efficient manner possible.

Our main contribution to the issue will therefore be to analyze the effects divestment has on both returns of a stock as well as the effect it has on the emissions of the company which has been excluded by asset managers. By doing this, more empirical data is available to asset managers, so they can make more informed decisions than before. The thesis finds statistically significant results for regressions made on both monthly returns and

total emissions, however due to limitations within both the models and available data, we cannot conclude with a causal relationship between divestments and our dependent variables. This is due to the high likelihood of omitted variable bias. The omitted variables we believe exist are listed, and are not possible to include due to a lack of data.

2 Theoretical Framework

2.1 Engagement

2.1.1 Arguments in favor of engagement

ESG engagement, as opposed to divestments, is a long-term dialogue between investors and companies on ESG issues. Engaging with the company you are invested in allows the shareholders to potentially alter the course of the company and with the aim to reduce sustainability risk currently affecting the company. Active engagement in companies that are not traditionally considered sustainable is a strategy employed by some of the biggest asset managers and sovereign wealth funds in the world, such as BlackRock and the Norwegian Oil Fund with a combined 8.8 trillion USD AUM.

Large funds are able to impact leadership decisions through votes given by their shareholder position. In turn, a sovereign wealth fund wanting to reduce their overall carbon emissions, can use their position as a major shareholder and influencer to align the companies' values with the values of the fund itself. An example of this would be the oil company Equinor, where the Norwegian state is the majority shareholder. Whilst still maintaining their main revenue stream from oil and gas production, Equinor has pledged to reach net-zero emissions by the end of 2050, largely impacted by the government and the people of Norway. Had a divestment strategy been implemented instead, who would have forced Equinor to go through with this pledge? How could one control the motives and wishes of the new majority shareholders?

Furthermore, there is compelling evidence that the largest innovators in the world are not startups and growth-companies (Chen et al., 2019). Rather, it is the research and development divisions within larger companies that produce the newest and most cutting-edge technology. The economic reasoning behind this is also robust. Disruptive, new technologies can render old business models useless, and thus the risk of disruptive companies for large companies is a constant threat to their market position. Therefore, as a hedging measure, large companies usually invest a lot of capital into research and development to prevent up and coming companies taking market shares. When it comes to the oil and gas industry, this means that large companies are forced to develop, innovate

and invest in new technology to reduce shareholder risk.

The Capital Asset Pricing Model (CAPM) is a financial model that calculates the expected rate of return of an asset or investment. The theory states that the optimal portfolio lies on the efficient frontier and contains all the different stocks within that portfolio, like an index of the market. The market portfolio is therefore the optimal portfolio. If an asset manager decides to engage with a company within the market instead of divesting from that company, it will not affect the optimal portfolio choice of the asset manager. Divesting from the company for any reason however, limits the number of companies within the portfolio, leading to an inefficient portfolio composition. Therefore, engagement is preferable to divestment or exclusion purely from a theoretical, financial standpoint.

2.1.2 Arguments against engagement

There are drawbacks to consider when remaining invested in a company that is influencing the environment negatively as well as there are positives.

Incentives within the asset management business are riddled with agent-principal problems, where the incentives of the asset managers are not the same as the interest of the people who have allocated their money to the manager. These agent-principal issues mostly focus on the issues arising from fees collected versus monetary returns for the investor, but they do also apply when it comes to engaging with companies who are impacting the environment negatively.

For instance, the opposing stance of engagement is exclusion or divestment. Many people now choosing which fund or asset manager to pick are utilizing ESG criteria when picking where to allocate their capital. This, in and of itself, is absolutely fine. However, we are seeing more and more demand in the market for ETF and index funds which exclude companies that pollute the atmosphere or are in other ways violating social or governance demands from the investors. An asset manager, who is incentivized primarily by maximizing their management fees, would notice market demand, and see him or herself forced to exclude companies from their portfolios, whilst being fully aware that doing so might not optimize returns, nor improve company policies within sustainability or reaching a net zero society. Some might argue that the reasoning behind this is that exclusion feels like an immediate measure and a way for investors to feel good about their sustainable

choice of capital allocation, whereas engagement is a long and tiresome process, which can only happen through prolonged cooperation, partnership and discussion. Furthermore, the funds also face the dangers of reputational risks as well. If they decide to not divest, or pledge to divest within a given time-frame, the threat of protests from investors and the public can be sufficient to warrant a pledge for divestmetn.

For other investors, it is simply a moral issue: profiting off of businesses whose revenue streams are still largely coming from for example fossil fuel production. If the investor feels that this is wrong, one might choose to allocate capital elsewhere, even though the optimal choice for the environment might be lying elsewhere.

Prolonged engagement from several large institutional investors might lead to some unintended consequences for the optimal portfolio choice as well. In 2015, Ivar Kolstad at the Norwegian School of Economics, argued that if institutional investors engage actively with companies within their portfolio, an unnatural homogenization occurs within the market (Kolstad, 2015). Homogenization is not desirable when talking about a market portfolio, as homogenization leads to homogenization of risk factors, thus not allowing the investor to diversify his risk as well as he could in the original market. Given the sentiment around engagement for asset managers and institutional investors are heavily in favor of engagement, this is an effect we could see increase as companies become more and more alike.

2.2 Divestment

2.2.1 Arguments in favor of divestment

Divestment is a form of economic sanction that aims to pressure a company or industry to change its practices (Ansar and Caldecott, 2016). Divestment from fossil fuels refers to institutions' sale (or blacklisting) of financial assets in the fossil fuel sector for at least partly non-financial (moral, social, political, reputational) reasons. Divestment initiatives, however, are used by people and organizations as geo-economic instruments rather than being imposed by governments. These organizations withhold capital from businesses that engage in activities that is judged objectionable by society and deemed socially unacceptable. The organizations can engage in divestment by, for example, selling debt,

private equity assets, or shares. The campaigns have the potential to impact laws and policies more broadly. Campaigns to divest from companies with ties to apartheid South Africa, the tobacco, munities, adult services, and gambling industries were all targeted in the 20th century. This will in turn lead to an increased cost of capital, as capital is not as easily available to company operating within an industry that is deemed not environmentally friendly, or otherwise not socially responsible (Oikonomou et al., 2011; Chava, 2014; Bauer and Hann, 2010; Gen and Liu, 2015; Sharfman and Fernando, 2008). This can indicate that divestments can lead to direct effects on a company's financial costs and ability to go through with otherwise profitable projects.

The proponents of divestment campaigns in fossil fuel cite three main justifications. The first is that divesting from fossil fuel corporations is a moral imperative. The second is that doing so encourages vital societal and political change. The third is that is not financially prudent to invest in fossil fuel corporations. Failure to divest could have a detrimental impact on the reputation of the investors.

According to Ryan and Marsicano (2019), as of 2 May 2020, 1195 schools has made complete or partial divestiture commitments with a combined value of $14.14 trillion, where Hampshire College in the US became the first institution of higher education to do so. Divesting from fossil fuels is a decision made by many institutions for a variety of reasons, including alignment with the institution's values, showing support for environmental initiatives, positive reputational effects, a desire to play a leadership role, the moral obligation to avert catastrophic climate change, and the long-term stability and reduced volatility of the investment portfolio (Grady-Benson and Sarathy, 2015). Furthermore, divestment from fossil fuels is frequently justified by reputational reasons (Ansar et al., 2013; Ayling and Gunningham, 2017).

Others offer justifications for climate legislation based on evolving societal norms and building political pressure. Conversely, institutional investors that have chosen not to divest frequently cite financial costs or risk, as well as the notions that divestment is ineffective in comparison to other courses of action. Further, they argue that divestment is hypocritical for institutions that continue to use fossil fuels, and that the capital should not be used as a political tool (Healy and Debski, 2017).

The extraction, transportation, refinement, and sale of fossil fuels to customers create

revenue for fossil fuel corporations, who primarily raise new investment capital through bonds and banks rather than shares (Clews, 2016). Although some national oil corporations (NOCs) issue bonds that investors purchase, these corporations are rarely fully listed, hence investors rarely own shares of NOCs. Because this is where most new project financing comes from and because the bond market includes NOCs (who possess most of the fossil fuel deposits), an investor may have a greater impact through debt restriction than by selling shares. Banks are also a crucial component of the energy transition because they provide the majority of new funding for fossil fuels.

There is evidence that divesting from fossil fuel corporations has had some effect. Although divestment does not appear to have an immediate impact on public stock holdings, it may already have an influence on the cost of new capital (debt); (Oikonomou et al., 2011; Chava, 2014; Bauer and Hann, 2010; Gen and Liu, 2015; Sharfman and Fernando, 2008). This effect might become more apparent if the divestment campaign concentrates more on the banking industry, which provides the majority of new financing for fossil fuels (Cojoianu et al., 2019). Additionally, by reducing investors' confidence in the fossil fuel industry and bringing climate change to the forefront as a responsible investing issue, divestment may have influenced the financial sphere.

A divestment mandate may have a stronger impact on investments in new companies because early-stage investments offer higher additionality (Ormiston et al., 2015). Additionality can be defined as the impact each additional dollar of investment has in the real economy. Furthermore, these investments act as seeds for other investors to purchase in the ecosystem of green investments. Divestment efforts or shareholder engagement have not yet been able to significantly alter the expenditure or operations of fossil fuel firms. This is not to say that shareholder engagement will never be successful; in fact, there have been recent encouraging signs regarding its future potential (Barkó et al., 2017). However, based on historical data, it does not seem to be a sufficient strategy on its own for the magnitude and rate of change necessary to decarbonize the fossil fuel industry.

There is evidence that the top five oil and gas companies still use trade organizations to lobby against climate-friendly laws, and in some situations attempt to influence them directly (InfluenceMap, 2019). Some fossil fuel companies have reviewed a limited number

of their trade association memberships, and in some cases, they have abandoned them if they did not get their proposals carried out. These types of steps are to be applauded, and they should be expanded to include all direct and trade association-led anti-climate lobbying.

A study by Dordi and Weber (2019) written in 2016 set out to measure the impact of divestment events from 2012 to 2015, including endorsements, divestment campaigns and pledges from institutional investors. The study included the top 200 fossil fuel firms, where the firms were ranked based on their potential emissions given complete usage on their fossil fuel reserves. The effect was compared against a baseline group of other related events on stranded assets, carbon budgeting and carbon taxes.

The study used both multi-day and single-day event windows and found statistically significant negative abnormal returns for both event windows. Dordi demonstrated therefore that the market does in fact react to divestment announcements, which resulted in a worse performance for the fossil fuel firms after the announcement. Cojoianu et al. (2019) measured the effect of commitments from institutional investors on the flow of capital to the oil and gas sector from 2000 to 2015, covering in total 33 countries. According to the analysis, divestiture promises have resulted in significantly reduced capital flows to oil and gas corporations. However, this effect is greatly determined by the regulatory environment of the nation in question, and it is lessened in nations that extensively subsidize fossil fuels.

Kappou and Oikonomou (2016) investigated how changes to or deletions from the renowned social stock index MSCI KLD 400 will affect companies' financial and operational performance. The signaling effect on the market is similar, even though this study is conducted on an index rather than the investment portfolio of a particular fund, and their conclusions are also applicable to this study. For stocks that were added to the index, they did not discover statistically significant results, but they did find statistically significant negative abnormal returns for stocks that were removed from the index. The analysis also reveals that operational performance suffered after exclusion and that trade volume increased noticeably.

2.2.2 Arguments against divestment

The share and strategic importance of the listed firms are sufficiently high for a change in their business model to have an influence, even though successful climate mitigation would necessitate decarbonization by both NOCs and publicly traded fossil fuel companies. Although it is impossible to foresee how NOCs would respond to a decline in activity, it is likely that they would raise their own production to make up for any decline in that of the publicly listed companies. The medium- and long-term outcomes, however, could be different if the listed companies' decrease in oil and gas activity is accompanied by an increase in alternative energy spending that hastens the displacement of internal combustion engines and gas-powered plants by renewables and energy storage.

According to McGlade and Ekins (2015), in order to stay below a safe warming threshold between 2010 and 2015, the vast majority of proven fossil fuel reserves would need to be kept in the ground. This includes a third of oil reserves, half of gas reserves, and 80% of coal reserves. Research suggests that the carbon budget needed to maintain a 66% chance of staying below 1.5°C would already by exceeded by existing fossil fuel infrastructure, in addition to that which is currently planned, authorized, or under construction (Tong et al., 2019). However, other research suggests that the target can be met by phasing out existing fossil fuel infrastructure at the end of its intended life and avoiding expansion (Smith et al., 2019).

2.2.3 Financial arguments for divestment

A study from Cambridge contains a comprehensive assessment of earlier studies on the effects of divestment on investment returns. According to the available evidence, divesting from fossil fuels would not have made much of a difference to returns during the last 118 years for investors who held the entire market through an index fund. Over the time periods examined by the Cambridge scholars, coal had the lowest performance over those 118 years in the US, whereas oil slightly outperformed the market in both the UK and the US at the same time period (Atta-Darkua et al., 2018). However, there have been both long and brief periods of under- and outperformance during the specified time period. Therefore, the conclusions of the pertinent studies rely greatly on the selected time period. While all research covering the period from 2010 and onward show fossil

fuels underperforming, studies looking at returns from the preceding 50 years typically indicate that fossil fuels outperform the market.

In 2020, Bassen, Kaspereit, and Buchholz conducted an analysis of the impact of Blackrock's announcement to sell its thermal coal holdings. 318 companies from various links in the coal supply chain made up their final sample of companies. Most of the studied companies did not see any abnormal returns, but the largest coal mining companies did, and the study reveals that this effect was strongest for companies with US headquarters (Bassen et al., 2020).

However, historical research may downplay divestment's system-level consequences. According to a working paper model, a 10-20% penetration of "moral investors" in the market would be sufficient to cause the valuations of fossil fuel corporations to fall, leading to portfolio outperformance for the moral investors (Ewers et al., 2019). The authors also discover that divesting would have little impact on the share prices of fossil fuel businesses in liquid markets because neutral investors would take the position of the socially conscious investors.

2.3 Sustainable Finance Theory

2.3.1 Carbon risk

In recent time, institutional investors made a commitment to divest $11 trillion USD in assets from fossil fuel companies (350.org, 2019). Further, numerous jurisdictions have implemented carbon pricing, and many more are anticipated to do so in the future, in an effort to lower GHG emissions and mitigate the hazards associated with a warming globe (World Bank, 2022). For carbon-intensive companies, a price on carbon emissions with expected future increases, combined with institutional divestment, should result in lower share prices and higher expected returns to make up for their added risk: carbon risk. This new class of risk encompasses, in general, all positive and negative effects on business values resulting from uncertainty in the process of switching from a brown to a green economy. Thus, quantifying carbon risk encompasses not only carbon emissions but also a company's overall strategic and operational exposure to unanticipated changes in the process of moving towards a green economy. Despite the aforementioned facts, only

a small number of research have discovered a connection between company returns and carbon risk.

A recent study by Gorgen et al. (2019) attempt to find out how carbon risk affects stock prices globally. The authors analyze return discrepancies between brown and green firms, thus creating a measure of carbon risk using databases that are used throughout the sector. Two conflicting trends are observed: Brown firms have higher average returns while firms with lesser levels of greenness have lower announcement returns. In order to comprehend carbon risk via the perspective of a factor-based asset pricing model, they created a carbon risk factor-mimicking portfolio. They found that carbon risk provides a good explanation for systematic return volatility, but the existence of a carbon risk premium is not supported by the data. This is demonstrated because (1) brown firms' prices have moved in the opposite direction from greener firms' prices, and (2) carbon risk is linked to unpriced cash-flow changes rather than priced discount-rate changes.

Bolton and Kacperczyk (2021) provide insights if and how investors do care about carbon risk measured by different carbon emission intensity scopes. They examined the impact of carbon emissions on a variety of US stock returns to determine whether investors care about the risk of climate change. According to their findings, there is an association between institutional investors' exclusionary screening and direct emission intensity (the ratio of total emissions to sales), but only for the oil and gas, utilities, and automotive industries. Only scope 1 emissions, or the direct emissions from production, are correlated, and research indicates that institutional investors had much lower stakes in businesses with high scope 1 emissions intensity. Aside from the oil and gas, utility, and automotive industries, this association between divestment and emission intensity is not found to be significant in other industries.

2.3.2 Transition vs physical risk

The risks of climate change can be divided into two categories: *physical* and *transition* risks. The physical risks are risks resulting from climatic events, such as wildfires, storms, and floods, whereas transition risks result from policy action taken to transition the economy off of fossil fuels (Boushley et al., 2021).

A working paper series written by Bua et al. (2022) for the European Central Bank

investigate whether physical and transitional climate risk premiums exist in the equities markets of the euro area. In order to achieve this, the methodology is based upon two brand-new text-based physical and transition risk indicators that are utilized to detect the presence of risk premiums related to climate change. The findings imply that during the time of the Paris Agreement, the climate risk premia have risen for both physical and transitional climate risk. Additionally, it is investigated which criteria that investors might use to approximate a firm's exposure to either physical risk or transition risk by constructing portfolios based on the most popular firm-specific climate measurements and calculate how sensitive these portfolios are compared to the risk indicators. In order to determine if investors might simply categorize companies into the industry they operate in, the study compare the results from these firmlevel proxies to much simpler sectoral classifications. In contrast to sectoral classifications, it is found that firm level information tends to be employed as a gauge for transition risk, particularly since 2015. However, sectoral classification can be used to assess the overall physical risk exposures of businesses.

According to a study by Engle et al. (2019), physical climate risks impact asset prices, are costly to hedge, and systematic. Therefore, understanding physical climate is central to the pricing of assets. By constructing a climate news series based on textual analysis of high-dimensional data on newspaper coverage of climate change, they demonstrate that a hedging strategy produces industry-balanced portfolios that excel at hedging changes in climate news both in-sample and out-of-sample. The resulting hedging portfolios in the study perform better than alternative hedging strategies that primarily take advantage of industry tilts.

A paper by Choi et al. (2020) underlines the importance of physical risk by showing that high-carbon firms underperform low-carbon firms during extreme heat events. The authors looked into instances of unusually high local temperatures and the volume of Google searches connected to climate change to study financial performance in relation to attention to global warming. Google searches about climate change surged during periods of unusually high temperatures, and carbon-intensive companies did worse on the financial markets than companies with low carbon emissions. The analysis also reveals that individual investors, not institutional investors, were the actors selling the firms, and that returns were unlikely to be attributable to improvements in fundamentals.

2.4 Ownership structure

We assume that the number of sustainably responsible investors within the market is set and does not change significantly during our time frame. Furthermore, we argue that a fund who chooses to divest despite almost all financial theory indicates that this is sub-optimal for the financial performance of the fund, is an investor who is a sustainably responsible investor.

When a sustainably responsible investor or fund chooses to divest from their position, they need to sell their shares to a buyer in the same market. The contemplation is that as the fund divesting is a sustainably responsible investor, and that the pool of sustainably responsible investors is constant, the relative share of sustainably responsible investors within the divested firm will decrease. Therefore, the new investors will have a higher probability of being less environmentally conscious compared to the previous owner, and therefore demand higher returns with lower regards to the environmental consequences. By abandoning their shares in the company, they leave the voting power in the hands of less environmentally conscious investors.

There does not seem to be an abundance of theory available on this subject, however, the argument and logic still remains.

3 Hypothesis

Our thesis aims to capture and measure the effect divestments have on a fossil fuel company's emission in the time after the investment. Divestments, as stated earlier, lead to a loss of ownership and control for the divesting party. The nature of divesting involves selling shares to a different party, often an unknown party, provided through and by a market-maker. As the pool of responsible investors divest from a given company, the share of responsible investors left within the company diminishes. Thus, the company's new shareholders might have lower requirements for ESG-initiatives and standards and demand projects to be undertaken regardless of the potentially higher emissions. We further argue that the effects of divesting as a form of activism takes longer to give an effect, as it aims to inspire multiple stakeholders to change their viewpoints and regulations towards a certain type of company.

Therefore, the main hypothesis for our thesis is:

"A large capitalization fossil fuel company that has been divested from will have greater emissions than a company that has not been divested from."

Furthermore, we have a secondary hypothesis arguing that the companies that have been divested from will experience lower returns than their counterparts. If the divestment leads to a loss of key assets, contracts, or revenue streams, it can negatively impact the company's future profitability and, consequently, its rate of return. Further, divestments can influence a company's cost of capital(Oikonomou et al., 2011; Chava, 2014; Bauer and Hann, 2010; Gen and Liu, 2015; Sharfman and Fernando, 2008). If a company experiences a higher cost of capital as a result of divestment, it may face challenges in accessing affordable financing, which can affect its profitability and, consequently, its rate of return. On the other hand, companies that are not subject to divestment may not experience the same reduction in in its rate of return due to these factors, and will therefore be more profitable relative to their divested counterparts.

Therefore, our secondary hypothesis is as follows:

"A large capitalization fossil fuel company that has been divested from will have lower returns than a company that has not been divested from."

4 Identification Strategy

4.1 Panel data regression methodology

The field of finance relies heavily on analyzing data to understand the relationships between variables and uncover key insights into financial markets and economic behavior. Traditional regression analysis techniques often overlook important dimensions, such as cross-sectional and temporal variations, which are crucial for capturing the complexities of financial phenomena. Panel data regression models, also known as longitudinal data analysis, offer a powerful framework to address these limitations and provide a more comprehensive understanding of the dynamics at play.

In recent years, the use of panel data regression models has gained more popularity in finance research. By combining both cross-sectional and time-series data, these models allows reserachers to control for unobserved heterogeneity and capture the dynamics of change over time.

The data to be analyzed in our case fits the panel data regression models well, as the data we wish to collect is in a panel data format, a combination of cross-sectional and time-series data including both prices of the underlying assets, emissions data, risk factors, financial ratios and other control variables, wheres some evolve over time, and is thus well suited for a panel-data regression model.

Furthermore, in the panel data literature, several studies suggest a specific set of regression tests to obtain reliable estimates of the effects of independent variables on the dependent variable (Ferreira and Vilela, 2003; Opler et al., 1999; Pinkowitz and Williamson, 2001; Subramaniam et al., 2011). These recommended methods include:

1. Pooled OLS model
2. The Fixed Effects Model or the Random Effects model

To improve the reliability of our results, we will be analyzing our data using all of the three above-mentioned methods. The choice between the FEM and REM model comes down to the result of a Hausmann test and a brief discussion regarding the two models, which will give us an indication for which model is preferable to use in this case.

4.1.1 Panel data regression models - Pooled OLS

Pooled OLS regression is referred to as a pooled time-series cross sectional regression. In the regression we provide, all the cross-section data are pooled into one large cross-section (panel) data. The panel data combined with the standard OLS regression is used to estimate the pooled data. Further, the pooled OLS regression disregards the heterogeneity between the units and the impact of the data's time variation (Wooldridge, 2013). By combining observations from many time periods, the pooled OLS regression has the benefit of expanding the sample size.

4.1.2 Panel data regression models - Fixed effects

The panel data regression model with fixed effects is a specific approach within panel data analysis. It takes into account the presence of individual-specific or entity-specific effects that are constant over time. These fixed effects capture the unobserved heterogeneity across entities that may influence the dependent variable.

4.1.3 Panel data regression models - Random effects

Panel data regression models with random effects are widely used in empirical research to analyze data that involves both cross-sectional and time series dimensions. These models allow for the estimation of time-invariant unobserved heterogeneity at the individual level, capturing unobserved factors that are constant over time but vary across individuals. Random effects models provide efficient estimates by explicitly modeling the correlation structure of the panel data, accounting for both within-individual and between-individual variation. This approach is particularly useful when the unobserved heterogeneity is assumed to be uncorrelated with the observed variables, making random effects estimation consistent and unbiased. Moreover, random effects models are suitable for exploring how individual-specific characteristics influence the relationships between variables over time, providing valuable insights into dynamic processes.

4.2 Hausmann Test

The Hausman test is a statistical test used in econometrics to determine whether the random effects or fixed effects model is more appropriate for panel data analysis. It is named after its developer, Jerry Hausman. The test helps researchers make an informed decision regarding the presence of endogeneity and the appropriate model specification.

The primary purpose of the Hausman test is to compare the consistency and efficiency of parameter estimates between the random effects and fixed effects models. The underlying assumption is that random effects models assume no correlation between the individual-specific effects and the independent variables, while fixed effects models allow for such correlation.

The test involves estimating both the random effects and fixed effects models and then calculating the difference between their coefficient estimates. This difference is referred to as the "Hausman statistic." If the individual-specific effects are uncorrelated with the regressors, the Hausman statistic will follow a chi-square distribution. In this case, the random effects model is considered more efficient. However, if the individual-specific effects are correlated with the regressors, the Hausman statistic will be significantly different from zero, indicating the superiority of the fixed effects model in terms of consistency.

The interpretation of the Hausman test results depends on the significance level. If the Hausman statistic is statistically significant, it suggests that the random effects model is inconsistent, and the fixed effects model should be preferred. On the other hand, if the Hausman statistic is not statistically significant, it implies that the random effects model is consistent, and the fixed effects model may be overly stringent.

Researchers often employ the Hausman test to assess the presence of endogeneity in panel data models and to choose between random effects and fixed effects specifications. By selecting the appropriate model, we can enhance the reliability and validity of our estimates and draw more accurate conclusions from our panel data analysis.

5 Data collection and sampling

5.1 Data selection – Funds

For the identification strategy to work, we need to extract data on the companies that have been divested from, as well as the rest of the industry, in order to analyze the difference in the group of divested companies compared to the group of non-divested companies.

The best form of science is with a perfect experiment, however, these rarely happen in the real world. As a result, most financial scientific literature must therefore make do with quasi-exogenous explanatory variables. This is therefore reflected in the data collection and sampling for this thesis. In order for the divestment group to be chosen as randomly as possible, the divestment group consists of funds that have all chosen to divest from all, or some, sources of fossil fuel producing companies. As they do not discriminate within the industry on which companies to divest from, we argue that our divestment group and data-sample is quasi-exogenous and can thus be used reliably in a panel data regression framework.

In order to gather data on which institutional investors and funds have divested from fossil fuel companies, we reached out to a NGO called 350.org. They have collected information and sources on more than 1500 institutional investors, endowments and pension funds who have pledged to divest their assets from fossil fuel companies (Nikkei, 2022).

When selecting the data sample, some criteria and filters where used in order to narrow down the funds used for our data.

1. AUM (Assets under management)
2. Divestiture purpose and aim

First off, filtering on a certain amount of AUM was necessary in order to reduce the amount of firms for us to analyze further. For smaller investors who had pledged to divest, with AUM of less than 100 MUSD, we argue that the effect on the firm that was divested from would not significantly affect the management decisions in the future. Therefore, no funds with less than 100 MUSD have been included in our treatment group.

One could argue that these firms, however small, would still affect the ownership structure

and signal their distrust of the company to the market to a certain degree, and thus should also be included in our data sample. We agree that this is the case. However, for the scope of our analysis to be limited to a certain degree, we have chosen to simplify the data collection. Additionally, we could also see that based on our ownership data collected from Thomson Reuters, the smaller funds are generally more difficult to find information on in regards to ownership.

Secondly, verification of divestment having taken place needs to be completed. The list is comprised of investors who have pledged to divest, where most of the assets are pledged to be divested in the future. Therefore, we needed to comprise a list of institutional investors who had already divested for them to be relevant for the study. We therefore need ownership data on all of selected large capitalization fossil fuel firms in order to have a valid divestment variable in our regression.

Lastly, the divestments need to meet our criteria for quasi-exogeneity. Once again, there was no easy way around identifying which companies had divested for what reasons. Therefore, all divestment announcements were read and ensured that the fund had divested for purpose- or customer-related reasons, thus they had to divest from all companies within their portfolios. By ensuring that this is the case, the quasi-exogeneity is ensured as well.

Furthermore, we have also been supplied by 350.org with a list of containing "purpose" behind the divestment. This has also been used as a measure to identify which funds have divested from most or all possible fossil fuel firms.

After going through these criteria, we ended up with the following list of funds who had:

1. AUM $>$ 100MUSD
2. Divested for purpose/customer-reasons

5.2 Data selection – Fund ownership and stocks

The next step to construct the treatment group consisting of divested fossil fuel firms is to identify at what time the funds divested from the fossil fuel companies in their portfolios. Two steps are to be completed in this section:

1. Which fossil fuel companies were in their portfolios before divestment took place
2. When did the fund exit the position, i.e., when did the company no longer show up on the ownership charts

In order to find the ownership in all the companies within the fossil fuel sector, we chose to use Refinitiv Eikon, formerly Thomson Reuters, who are known to have the most extensive amount of ownership data available in the world. Refinitiv Eikon offers a range of features and tools related to ownership analysis. These features allow its users to access and analyze data on institutional ownership, insider trading, shareholder voting, and other ownership-related information. Due to Refinitiv Eikon's sheer amount of information and scope of data, the platform was chosen as the data provider in this study.

Refinitiv Eikon allows data selection based on, among other filters, industry, financials, and ownership. Thus, the data selection for our data sample was based on companies in either:

1. Oil & Gas Refining and Marketing
2. Oil & Gas Exploration and Production
3. Integrated Oil & Gas
4. Coal

They all have a revenue of more than 100 million US dollars. Furthermore, we chose to extract data on current and previous ownership, in order to identify which funds had divested from what companies.

Furthermore, we also extracted the name of all the shareholders for each company for every year ranging from 2012 to 2022. By doing this, we can match the name of the company's shareholders to our list of funds, and thus find the exact year a divestment actually took place. We are then able to create our divestment variable, which will be used in our panel data regression as a dummy variable. Furthermore, by extracting ownership information on all the companies in the given timeframe, we can also create a size-component of the divestment. In other words, if a large fund divests from a given company, we hypothesize that this will be more influential than a small fund divesting from the same company. Therefore, we have implemented a beta variable that will vary in size based on whether

the sum of divestments made to the given company has been small or large. By doing this, the effect of the divestment should be captured to a larger extent rather than simply creating a dummy variable. Our method of scaling the divestment variable is to identify the percentage share which was divested at a given time, and then multiply the sum of the divested percentage with the dummy variable, thus creating a linearly scaled variable, trying to capture both the effect of changes in ownership structure as well as negative demand due to the divestment announcement.

The reason this thesis has been thorough and tedious in its collection and processing of ownership data, is due to the incentive structure large funds have when it comes to divestments. There have been several demonstrations where participants demand certain funds to divest from their positions in fossil fuel firms, and generally the public perception of funds divesting has been good (Cohen, 2021). After all, they are no longer only profit-seeking cynics, they are also thinking about the globe.

This leads to an incentive to announce a funds divestment from the fossil fuel sector. As an example, quite recently, a Florida pension fund divested from one of the largest asset managers in the world, BlackRock (Kerber, 2022). BlackRock announced their divestiture from the coal industry in 2020 and received public appraisal for leading by example, as they are the largest asset manager in the world by far with over 10 trillion USD under management. People, as they often do, did not read the fine print – only companies with 30% or more of revenue stemming from coal extraction was divested from. Conveniently for the asset manager, only 6% of BlackRock's coal positions were divested from.

Due to these recent examples, extensive due diligence and source use has been used for this study, where finding actual divestiture through ownership data is one of the measures taken to ensure proper data quality.

5.3 Data selection – Company emissions

Obtaining company emissions data was done through Refinitiv Eikon as well, who has comprehensive greenhouse gas (GHG) emissions reports obtained from companies, as well as models estimating emissions on both direct and indirect scopes. First, we utilized the "screener" function in Eikon. After trying to use the screener function to extract both the ownership data, emissions data and more, our data request to Refinitiv Eikon ran

out, and we were forced to use other methods of acquiring the data. After evaluating all options, we downloaded an open API library for R, which allows for greater amounts of data to be requested.

We have extracted data on all 3 scopes of emission:

1. Scope 1: Direct Emissions
2. Scope 2: Indirect Emissions
3. Scope 3: Indirect Emissions
4. Total Emissions

Due to both incomplete data, and for the sake of the results, we have chosen to use Total emissions for our analysis. As direct emissions only account for the pollution caused directly by the company in the extraction of fossil fuels, we argue the analysis will provide more insight if the total emissions are considered. Whilst direct and indirect emissions could be interesting to analyze on their own, total emissions are what ultimately matter when it comes to the environmental issue - not direct emissions.

5.4 Data selection – Independent Variables

For the choice of independent variables selected to be part of our panel data regression model, we need to identify which variables can affect our dependent variable. In our case, the variables explaining the movement in price within fossil fuel firms and movement in total emissions are therefore of interest.

When considering movement in price, or returns, there are several independent variables which can explain the movement in price. These include, but are not limited to, trading volume - which can be thought of as demand for the stock, macroeconomic indicators such as inflation, the risk-free rate and unemployment levels or industry specific factors driving the price. Furthermore, there are many risk factors one could look at to further explain the movements in price, such as the Fama French risk factors.

For the purpose of this thesis, the selection of independent variables has been made while keeping in mind the dataset we are analyzing. As we have companies from mainly two industries - oil and gas and coal, including an industry variable as an independent variable

will not be suitable in this case.

Furthermore, looking to the Fama French 3 factor model, we argue that size and book to market values are irrelevant in our case. As we are looking into fossil fuel companies, and more specifically large capitalization fossil fuel companies, these risk factors become illogical to include due to the homogeneity of size. All of the firms are large, and therefore will the size risk factor become redundant to include, and may lead to a false conclusion that size accounts for the returns of our stocks. The size factor in the Fama-French model captures the historical tendency of small-cap stocks to outperform large-cap stocks. When there is little variation in firm size, the size factor may not provide meaningful differentiation in expected returns, reducing its relevance.

The Fama-French factors, including size and book-to-market, are designed to capture systematic risk factors that explain the variation in stock returns. However, when there is little dispersion in returns due to homogeneity in firm size and book-to-market ratios, the explanatory power of these factors may be diminished, which leads to limited dispersion of returns. In such cases, other factors or variables that capture different dimensions of risk or expected returns may provide better explanatory power. Similarly, as all of the companies are within the same general industry, they all have relatively comparable book to market values, making the addition of this variable non-sensical.

After extracting the data we want, we end up with the following data to be used in our panel data regression model:

	CO2 Emissions Total	EPS	Monthly Return	Paris Agreement Aligned	Company Match
X	Min. : 0.00	Min. :-22128.41	Min. :-0.1023146	Min. :0.00000	Min. :0.0000
X.1	1st Qu.: 0.00	1st Qu.:-15784.41	1st Qu.:-0.0344828	1st Qu.:0.00000	1st Qu.:0.0000
X.2	Median : 0.00	Median :-15784.41	Median : 0.0000000	Median :0.00000	Median :1.0000
X.3	Mean : 0.07	Mean : -8290.61	Mean : 0.0009899	Mean :0.03242	Mean :0.5673
X.4	3rd Qu.: 0.01	3rd Qu.: 0.71	3rd Qu.: 0.0375113	3rd Qu.:0.00000	3rd Qu.:1.0000
X.5	Max. :129.03	Max. : 91394.53	Max. : 0.1023146	Max. :1.00000	Max. :1.0000
X.6	NA's :41423				

6 Empirical findings and results

The following section of our study will present the empirical results and findings, as well as a brief discussion and interpretation of each result. We will begin by presenting our findings from the regression done for monthly returns of large capitalization fossil fuel firms, and then present our findings on emissions afterwards.

6.1 Panel data regression - Monthly Return

We find statistically significant negative effects for the Company Match dummy variable. This is the result we hypothesized would happen - a company that has been divested from will perform financially worse than a company which has not been divested from. We find the same results for both pooled OLS, fixed effects and random effects, with statistically significant results in all panel data regression models.

6.2 Panel data regression - Emissions

We also find statistically significant negative coefficients for the divestment dummy variable company match for CO2 equivalents in tonnes per dollar in revenue. This is the opposite of our initial hypothesis, which stated that we believed that a divested company would have higher CO2 equivalents per dollar in revenue, meaning they polluted more for every dollar they turned over.

6.3 Hausman Test

In order to decide whether to analyze the results of the fixed effects or random effects panel data regression, a Hausmann test was also performed to confirm which model to analyze.

Test Statistic	Value
Hausman	10.9934
p-value	0.0266

Based on the p-value of the Hausman test, we reject the null-hypothesis, and we therefore analyze the results of the random effects model.

Table 6.1: Panel Data Regression Results

	Dependent variable:		
	Monthly Return		
	(FE)	(RE)	(POLS)
EPS	0.00000	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
Debt to Equity	0.00000	0.00000	−0.00000
	(0.00000)	(0.00000)	(0.00000)
CO2 Equivalent Emissions Total	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Company Match	−0.004***	−0.004***	−0.004***
	(0.001)	(0.001)	(0.001)
Constant	0.005***	0.005***	
	(0.002)	(0.002)	
Observations	68,583	68,583	68,583
R^2	0.0005	0.0005	0.0005
Adjusted R^2	0.0004	0.0004	−0.021
F Statistic	30.607***	30.607***	7.993***
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6.2: Panel Data Regression Results - Emissions

	Dependent variable:		
	CO2 Equivalent Emissions Total / Revenue		
	(FE)	(RE)	(POLS)
EPS	0.00001***	0.00001***	0.00001***
	(0.00000)	(0.00000)	(0.00000)
Debt to Equity	−0.00004	−0.00004	−0.00005
	(0.00004)	(0.00004)	(0.00004)
Paris Aligned	0.041	0.041	0.041
	(0.034)	(0.034)	(0.034)
Company Match	−0.455***	−0.455***	−0.512***
	(0.038)	(0.038)	(0.040)
Constant	0.458***	0.458***	
	(0.050)	(0.050)	
Observations	39,709	39,709	39,709
R^2	0.004	0.004	0.004
Adjusted R^2	0.004	0.004	0.004
F Statistic	37.397*** (df = 4; 39704)	149.587***	42.913*** (df = 4; 39695)
Note:			*p<0.1; **p<0.05; ***p<0.01

6.4 Interpretation of findings

We find statistically significant results for the dummy variable company match, our divestment variable, for both emissions and price development. However, only one of the hypotheses originally stated have been confirmed.

The development in share price for divested companies are significantly lower than for the companies who has not been divested from. The explanatory power of the model however is extremely poor, and therefore the likelihood of severe limitations to the model is therefore present.

There are most likely several different mechanisms at play that go into the divestment dummy variable, and not all of them have been captured. First of all, when a fund divests from a given company, and especially for larger funds, this creates weaker demand for the stock, which can cause the return of the given stock to go down. As there could potentially be more shares for sale than there are willing buyers in the market when a large fund divests, the natural consequence will be a decrease in price.

Another mechanism that could be at play is negative media attention and coverage. If a company has been on an exclusion list and refuses to engage with the fund on environmental issues, it forces the fund to liquidate its position in that company. This could lead to negative media coverage, which in turn further decreases demand for the stock.

A mechanism that could be in favor of higher returns is the change in ownership structure. When a fund liquidates its position in a divested company, those share are sold to a counterparty. Given rational investors who have access to all information, these investors will know that the fund has deemed the position too risky to hold, or too environmentally damaging from a moral point of view. As one could argue that the financial fundamentals of the company has not changed since the divestment, these investors can buy the stock at a discount, given that they are willing to take the regulatory and environmental risk that comes along with owning that company. These risk-taking investors will be able to engage with the divested company through their shareholder voting power. If we assume that the large funds are risk-neutral in their investment decisions, the new shareholders are by definition risk seeking. Therefore, when voting on new projects, they will be voting

more in favor of riskier and potentially more profitable projects.

If the above argument holds, however, there is always going to exist a risk premium for taking on projects that have higher risk. This will be accounted for when discounting future cash-flows, and thus the company valuation will go down.

Based on this discussion, there are too many potential mechanisms which have not been sufficiently concretized to argue for a causal relationship between the divestment dummy variable and price development.

Secondly, we have the regression model performed on the emissions of the company. In this case, we observe a statistically significant coefficient for our divestment variable again, but this time with a different sign than that of the hypothesis.

To discuss this discrepancy, we once again need to look for the underlying mechanisms that could lead to higher or lower emissions for a large capitalization fossil fuel company.

First of all, we argue that the mechanism of changing ownership structure is a strong one. As more institutional investors divest from positions within fossil fuel companies, we argue strongly that the share of sustainably responsible investors remaining within the firm will ultimately decrease drastically. This will in shift the dynamics of the board room meetings and decisions made, and we argue that the decisions made by a company reflects that of its shareholders. Therefore, if the shareholders are less environmentally conscious, the company they own will follow suit.

Our regression model however indicates that there exists other mechanisms which draw the results in the other direction, that is to say that companies who have been divested from pollute less than their counterparts who have not been divested from. There could be different reasons for this.

There are actually two variables which together creates the dependent variable - both CO2 and revenue, to account for the size of the companies analyzed. A company with higher revenue will naturally pollute more than a company with lower revenue, and therefore adjusting for the size of the company we can compare apples to apples. However, adjusting the emissions in this way creates a potential problem. If a company has been divested from, their cost of capital might increase. Therefore, previously profitable projects might not be profitable anymore, and might now not be followed through, leading to a decrease

in CO2 due to inability to perform the same projects as previously possible. This has not been accounted for in the regression model, and could be a mechanism that makes divested companies pollute less than their counterparts.

Same as with monthly return, due to the likelihood of omitted variable bias and a model that explains very little of the variation seen in the data set, we cannot conclude with a causal relationship between the divestment of a fossil fuel company and the result it has on the company's emissions.

6.5 Limitations of study

Omitted variable bias is an important limitation in the panel data regression that might affect the results. There are many tradeoffs when considering divestment from the firms, which leads to uncertainty regarding the conclusion that only divestments are the reason for the development in price and emissions. Furthermore, omitted variable bias is more likely to occur if there are important covariates that are not included in the regression model. These omitted variables can be time-invariant (e.g., unobservable individual characteristics) or time-varying (e.g., time-specific shocks or policy changes). One of those variables might be the ownership structure, with respect to the owner of the remaining shares. If the remaining owners were indifferent to emissions, that effect will be strengthened after the fact that divestment has occurred.

One variable that might amplify the results can be media attention and perceived reputational risk. In recent years, the divestment campaign has gotten intensified in the media, which means that the remaining owners might consider the campaign more strongly. Additionally, there are most likely variables that we could further decompose the divestment variable in the regressions. All of the aforementioned factors might lead to biased and inconsistent estimates of the included variables, impacting the interpretation and validity of the results.

Another limitation might be due to incomplete data on many emissions, which can introduce biases and affect the representativeness of the sample. We have used missing data by inferring data from existing points - that is, if no emissions were documented in 2018, but there were in 2017 and 2019, we employed an existing technique that takes the average of those values. Even though this is a known method for dealing with missing

data points and an unbalanced data panel, it may also have led to incorrect analysis and conclusions.

7 Conclusion

7.1 Conclusion

This thesis tried to assess the impact divestment has had on emissions and return of large capitalization stocks within the fossil fuel industry through changes in ownership structure and cost of capital for the divested companies, and found statistically significant results for both monthly return and emissions.

However, due to the potential of omitted variable bias and lack of explanatory power of our models, we cannot conclude with causal relationships based on our panel data regression models. This, unfortunately, lead to our two hypotheses remaining unanswered from a causal point of view.

We hope that the thesis serves as inspirations for others to continue further research into the topic, as we believe it to be vital for a better future.

7.2 Suggestions for future research

As global warming continues to be an issue humanity struggles to overcome, research into sustainable finance will always be important. The reason for the choice of topic for this study is particularly due to our belief that without proper financing, the issue of climate change can never be solved. In order to reach goals set in the various COP meetings and the Paris agreement, the need for efficiently and effectively moving capital to the best place for the globe is ever increasing.

The dialogue on divesting and engagement has long been held, however we believe that the data for a study as we have tried to conduct in this paper is not sufficient to gain any meaningful results. Therefore, we strongly suggest that in about 5 years time, more scientific literature is created on this topic, hopefully in a time where more data is available both on divested companies as well as emissions data which will be more reliable.

Furthermore, we have not yet found any rigorous literature on the effect divestment has as a symbolic statement whose ripple effects are claimed to be large. With the availability of consumer data and search trends, a study based on event study methodology utilizing

divestment announcements as key words would be interesting to see.

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