

Master's Thesis

# Power to the Owner : Institutional Investors' Influence on Corporate Environmental Performance

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## **Abstract**

Increasing climate change and the effects of global warming raise concerns in societies. Literature has shown the role of institutional investors in socially responsible investments and investor activism to change firm behavior. This study examines the role of institutional investors in portfolio selection strategies and engagement activities towards corporate carbon emission reduction. Using a sample of U.S. and European firms between 2009 and 2018, the results indicate that institutional investors use the proposed best-in-class screening method regarding corporate emissions, and also engage in corporate carbon emission improvement among firms in their portfolios. A difference-in-difference analysis on the Paris Climate Convention generates causal inference that the engagement of institutional investors strengthens when climate change awareness increases. Finally, tests on the motivations of institutional investors confirm the presence of financial motivations.

*Keywords: Socially Responsible Investment, SRI, Institutional Investors, Corporate Carbon Emission, Investor Activism, CSR, Investor Behavior*

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*The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.*

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# 1 Introduction

For the past few years, there has been a rise in institutional investor involvement regarding climate-related shareholder proposals. Exxon Mobile, one of the largest carbon-emitting firms in the world, has endured multiple shareholder proposals on the transparency and setting of their emission targets. Where most proposals used to be initiated by sustainable investment funds and other climate action groups, more ‘mainstream’ institutional investors have started to join. For one of the most recent Exxon Mobile climate target-setting proposals, one of the principal shareholders involved was the New York State Pensionfund.<sup>1</sup> Not only Exxon Mobile experiences institutional shareholder pressures. Last year, BP was successfully pressured by investors like HSBC and the Church of England, to become more transparent on how its strategy will align with the Paris Climate Agreement.<sup>2</sup>

Institutional investors are becoming not only more aware of their role in the climate crisis, but they are also pressured into acting on it. Very recently, BlackRock, the world’s largest investment manager with \$7 trillion assets under management, has announced to focus its investment strategy towards more sustainable investments. In addition to raising their sustainable investments from \$ 90 billion to \$ 1 trillion within ten years, they pledged to cut firms which revenue originates from thermal coal for 25% or higher.<sup>3</sup>

The US Social Investment Forum finds that Environmental, Social, and Governmental screening incorporation by institutional investors has increased from \$2.5 billion assets in 2012 to \$5.6 billion in 2018. Especially climate change and carbon emissions have become one of the top criteria for Institutional investors.<sup>4</sup> The United Nation’s Principle of Responsible Investment checks to which extent their signatories pursue ethical and sustainable investments. Though being a signatory is voluntary, the number of signatories has increased from 865 in 2014 to 2,697 by the end of 2019. These signatories include world-leading asset managers like BlackRock, Vanguard Group, UBS, Fidelity Investments, JP Morgan, Goldman Sachs, and many other asset owners, financial service providers, and asset managers.<sup>5</sup>

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<sup>1</sup> As found in this Forbes article, including the Exxon Mobile investment proposal example: <https://www.forbes.com/sites/kensilverstein/2019/07/26/institutional-investors-have-more-power-than-governments-to-shape-climate-future/#6912fa830d10>

<sup>2</sup> As mentioned by The Guardian: <https://www.theguardian.com/business/2019/feb/01/bp-to-explain-how-business-chimes-with-paris-climate-agreement>

<sup>3</sup> Derived from a Financial Times article on January 14 2020: “BlackRock shakes up business to focus on sustainable investing” <https://www.ft.com/content/57db9dc2-3690-11ea-a6d3-9a26f8c3cba4>

<sup>4</sup> The United State’s Social Investment Forum (US SIF) tracks sustainable investments in the United States. They provide yearly reports on financial sustainability investments. Numbers mentioned are derived from the 2018 Annual Report, found at <https://www.ussif.org/annualreports>.

<sup>5</sup> A list with all UN PRI signatories can be found at <https://www.unpri.org/>.

Over the years, it has become clear that carbon and other greenhouse gas emissions emitted by corporations have an impact on climate change.<sup>6</sup> The evidence found on the effects of climate change indicates that these greenhouse gas emissions are a threat to both natural and human ecosystems. (UN IPCC, 2019). In addition to the evidence on climate change itself, society is becoming more aware of the effects and causes of climate change. Leiserowitz et al. (2018) provide evidence on an increasing trend regarding American societies' concerns about climate change. The UN IPCC (2014) report also shows that the main contributors to greenhouse gas emissions are corporates from energy (heat and electricity), oil, transportation, and other industrial industries. Of all greenhouse gas emissions, mostly carbon dioxide (CO<sub>2</sub>) is emitted (76%). The scientific reporting of carbon emission provides valuable and easily comparable data across industries and firms in terms of their ethical, environmental behavior.

As many of the largest emitting firms in the U.S. heat and electricity industry invest heavily in corporate lobbying against climate mitigation regulation (Bénabou & Tirole, 2010; Climate Majority Project, 2019), it seems that instead of governments, institutional investors can play a significant role in the environmental performance of these firms.

The combination of society's concerns about climate change (often in the media referred to as 'the climate crisis'), and the increasing role of institutional investors as sustainable investment managers, raises the following research question: *To what extent do institutional investors take the environmental performance of their portfolio firms into account?*

Though a substantial part of the existing literature does not find evidence on consistent improved financial performance due to increased Corporate Social Responsibility (CSR) activity, shareholders are still willing to invest in firms with high CSR intensities. Also, the statistics provided by the US SIF and UN PRI show an exponential increase in both CSR and, in particular, environment-related investments.

Dyck et al. (2019) show that institutional investors can have a positive effect on Environmental, Social, and Governance investments, including environmental performance ratings of firms (using data up to 2013). Hsu, Liang, and Matos (2017) find that state-owned firms have higher environmental performance, including higher emission reductions. However, to the best of my knowledge, whether institutional investors take corporate carbon emissions

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<sup>6</sup> The United Nation's Intergovernmental Panel on Climate Change (IPCC) publishes various (independent) reports on the causes and effects of Climate Change. Information on climate change is derived from their most recent report AR (Assessment Report) 5. This report covers research on climate data from 2007 (when AR4 was published) up to 2014. The next report AR 6 is expected in 2021/2022. More information can be found at <https://www.ipcc.ch/>.

into account when selection their stocks, as well as their engagement towards emission reduction, has not been investigated.

This paper contributes to the existing literature as it focusses on the motivations behind environmental performance improvement apart from any social or governance performance. It also extends the existing literature by using more recent data in years with increasing climate concerns. Next to contributing to the existing literature on investor behavior, this paper also provides valuable insights for the battle against climate change and altering corporate emission behavior.

In this study, both the stock selection and engagement of institutional investors towards corporate carbon emission are investigated. For stock selection, best-in-class and negative screening strategies are examined. For the best-in-class measure of corporate emission, an industry-benchmarked Emission Reduction Score from Thomson Reuters' ESG database is used. The negative screening strategy is tested using a direct CO<sub>2</sub> and CO<sub>2</sub> equivalent emissions to assets measure. Results show that institutional ownership is positively related to the Emission Reduction Score, indicating that institutional investors take best-in-class selection into account when selecting their stocks based on corporate emissions. As institutional investors could find the exclusion of stocks undesirable, their engagement towards portfolio firms is also examined. This test confirms that institutional investors engage in improving the industry-benchmarked emission score. A Granger Causality test and a test with an awareness shock of the Paris Climate Convention in November 2015, confirm the causal relation. An important note is that for a subsample of top-emitting firms (10% of the sample, responsible for 90% of carbon emissions), results are not significant for both stock selection and investor engagement tests. Finally, this research examines the motivations of institutional investors in relation to corporate emission reduction engagement. The results presented in this paper indicate that especially long-term financial benefits are present. In addition, in the case of the U.S. the active reversal of climate mitigating laws seems to strengthen the relation of institutional ownership and corporate emission reduction.

The remainder of this paper is organized as follows: first the existing literature will be reviewed in chapter two. Next in chapter three, the hypothesis development is discussed. In chapter four the data collection and methodology are presented. In chapter 5 the results from the statistical analysis are presented. In chapter 6 the regression results are discussed, and limitations are addressed. Finally, the concluding remarks are presented in chapter 7.

## 2 Literature Review

For the past decades, researchers have investigated the screening of investments, such as ethically ‘good’ and ‘bad’ investments. These screenings vary on an extensive set of topics, from environmental issues and animal welfare to war and violence-related investments and corporate governance. Not only is previous research diverse, it also has entirely different outcomes.

The first part of this section reviews the existing literature on the concepts of corporate social responsibility and socially responsible investment. In the second part, more background on environmental policy and performance will be provided. Next, a section addresses the social norms theory. And finally, the literature on institutional shareholder activism will be discussed.

### 2.1 What is Corporate Social Responsibility and Socially Responsible Investment?

#### *2.1.1 Corporate Social Responsibility*

The decision of a firm to improve its impact on climate change originates from Corporate Social Responsibility (CSR). Though this does contribute to stakeholder value, it does not necessarily increase shareholder value.<sup>7</sup> The general economic theory of economists like Friedman (1970) and Jensen (1976), emphasizes that a corporation’s primary responsibility is to increase shareholder wealth through value maximization (Bénabou & Tirole, 2010). This capitalistic view separates a firms’ financially motivated actions from any responsibilities other than value maximization (Freeman et al., 2010). Where stakeholder wealth maximization could decrease shareholder value, it is instead the responsibility of governments rather than corporations, to maximize such wealth (Friedman, 1970; Bénabou & Tirole, 2010; Kitzmueller & Shimshack, 2012; Liang & Renneboog, 2017). Thus, if the firm’s owners are solely interested in value maximization towards the shareholders (themselves), investments made to contribute to stakeholder welfare seems irrational behavior. Earlier literature is based on the shareholder value maximization principle and does not take motivations to increase stakeholder welfare (at the cost of shareholder value) into account. However, since the end of the 20th century and the early 2000s, more theories regarding firms contributing to stakeholder welfare have emerged. Kitzmueller and Shimshack (2012) explain that throughout the years, the question of whether CSR should exist in economic theory has shifted towards an acceptance of the CSR activities. However, this results in more questions on ‘how’ and ‘why.’ Though CSR

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<sup>7</sup> Liang and Renneboog (2017) mention that though other researchers (like Bénabou and Tirole, 2010) define CSR as a trade-off between financial profit and stakeholder value, they prefer a more extensive definition assuming that CSR activity does not necessarily harm financial profit.

has been widely accepted as an economic aspect, there are still many questions on why and how CSR is implemented. Notably, the exponential increase in CSR activity remains unexplained (Kitzmueller & Shimshack (2012).

Throughout the extensive literature on CSR, there seems no clear definition or description of the concept of CSR. Many researchers argue about its core components and how it occurs (Crane et al., 2008). Based on their review of previous literature and definitions, Kitzmueller and Shimshack (2012) provide two essential aspects to define CSR. First of all, CSR is referred to as some outcome in terms of social or environmental related Corporate Social Performance (CSP). Secondly, these outputs exceed regulatory output levels or standards. The motivations on why these exceeding CSP levels exist could be strategic, but other motives are not excluded. Liang & Renneboog (2017) use a more straightforward definition by referring to it as ‘stakeholder-oriented behavior.’

Next to inconsistent definitions, the literature is also unsure what motivates CSR activity. In the CSR literature, two different theories on the reason why firms participate in CSR activities exist: “Do well by doing good” and “Do good by doing well” (Liang & Renneboog, 2017). “Doing well by doing good” is explained as CSR having a positive effect on firm performance, while “Doing good by doing well” suggests that only good performing firms invest in CSR.

If CSR does have a positive effect on firm performance, then differences in CSR investing activities and intensities among similar or same-industry firms cannot be explained. The “Doing good by doing well” argument does not explain differences on the country level (Liang & Renneboog, 2017).

It seems that the existing literature is unable to agree on whether CSR creates value (Crane et al., 2008) or if it is undesirable and decreases shareholder value. Some researchers find evidence that CSR can enhance firm value (Dowell, Hart & Yeung, 2000; Deng, Kang, and Low, 2013; Dyck et al., 2019). CSR decisions can be motivated through strategic or reputational (image improvement) motives, or as a form of relationship management towards governments and regulators (Del Guercio & Hawkins, 1999; Renneboog, Ter Horst & Zhang, 2008). Evidence on increased sales following CSR initiatives support such claims (Flammer, 2015).

Others, opposing the financial benefit of CSR, think of CSR as an agency problem (Bénabou & Tirole, 2010; Masulis & Reza, 2015). Ferrell, Renneboog & Zhang (2008) explain that this agency problem occurs due to the lack of proper incentives: stakeholders have a way of incentivizing management to (over)invest in CSR at the cost of shareholder value. Cheng,

Hong, and Shue (2016) support this explanation in their research on the private benefits managers obtain through social investments. The proponents of the agency problem theory see CSR activity as undesirable and find negative returns resulting from CSR improvements (Di Giuli & Kostovestky, 2014; Masulis & Reza, 2015; Cheng, Hong & Sue, 2016).

As to why firms should increase their CSR, the existing literature has investigated an extensive set of explanations. Lins, Servaes, and Tamayo (2017) find that firms having high CSR intensities outperform firms with low CSR intensities only in times of low market trust, like a financial crisis. They argue that it is financially beneficial for firms to invest in CSR, as they will profit from these investments during times of low market trust. DiGiuli & Kostovetsky (2014) find that politics affect social investment: they find that Democratic-leaning companies have higher CSR intensities than Republican-leaning companies. Besides, materialistic CEO's set lower CSR intensities than non-materialistic CEO's (Davidson, Dey & Smith, 2011). Also, a firm's country legal origin affects a firm's CSR performance. Firms originating in Civil Law countries tend to have higher CSR ratings than firms from Common Law regions (Liang & Renneboog, 2017).

Though researches use different definitions and characteristics for CSR, most literature mentions a type of risk involved. This is usually referred to as reputational or legal risk, or even trust. Goss and Robers (2011) show that the cost of capital is affected for firms with low CSR levels. As they do not find evidence for firms with high CSR levels being rewarded with lower lending rates, they do suggest that firms with low CSR levels face retribution due to increased interest spreads.

Research also distinguishes between the short-term (direct) and long-term (indirect) effects of CSR on financial performance. Bénabou and Tirole (2009) explain the "Doing well by doing good" principle as a win-win situation. However, the profits for stakeholders and shareholders are not simultaneously realized. They suggest that when a CSR activity is initiated, this could temporarily harm short term profits. Also, if the CSR activity is not initiated or shut down, this increases short-term profits but could harm long-term performance due to increased risk of lawsuits, boycotts, or other reputational damage. Deng, Kang & Low (2013) support this view and find a long term (post-merger) performance effect, suggesting that potential financial benefits from CSR are not immediately incorporated in the stock price. Therefore, engaging in corporate environmental performance can be linked to a long-term investor's perspective. Where efforts to decrease pollution and mitigate climate change can be very costly, short-term investment perspectives will not benefit from high CSR activities.

### 2.1.2 Socially Responsible Investment

Where corporates can set CSR levels and make CSR-related investments, investors can take these CSR activities into account when constructing their investment portfolios. Socially Responsible Investment (SRI) relates to investors who take social responsibility standards of corporations into account. Renneboog, Ter Horst, and Zhang (2008) define SRI as “an investment process that integrates social, environmental, and ethical considerations into investment decision making.” They further explain that these investment decisions rely on different ‘responsible’ perspectives: ecological (environmental), social, or governance. These three different screening topics are usually referred to as ESG in the existing literature.

An investor has various ways to take socially responsible investing into account. When selecting securities and corporate stocks, an investor can choose different screening strategies: positive, negative, and combined screening strategies. Positive screening is the most selective screening strategy: an investor selects the firms with very high performance on the selected topics (depending on the focus and preferences, for environmental, social, or governance areas). This results in the exclusion of all lower CSR performing firms, being the most restrictive screening strategy. A negative screening strategy excludes only the worst-performing firms in the ESG scopes. This could result in entire industries being excluded from a portfolio. This usually involves stocks from tobacco, gambling, firearms, or alcohol industries. Finally, a combined screening strategy involves “best-in-class” selection, where the best CSR performing firms within a specific industry are selected. This strategy is the least restrictive (Cox, Brammer & Millington, 2004; Renneboog, Ter Horst & Zhang, 2008; 2011).

The main question in the SRI literature remains whether these responsible investment decisions are driven by financial or non-financial motivations (Renneboog, Ter Horst and Zhang, 2008). Despite the increasing trend of applying socially responsible screens on one’s investment portfolio, the results of research on the returns of SRI seem mixed. Also, due to different definitions of socially responsible investment and the use of different investment screens, results are difficult to compare. Some researchers find positive results for a premium on SRI stocks (Kempf & Osthoff, 2007), others find either negative, lower or non-significantly different returns of socially responsible investments (Bauer, Koedijk, & Otten, 2005; Heinkel, Kraus, & Zechner, 2001; Renneboog, Ter Horst, & Zhang, 2008). On the other hand, research like Hong & Kacperczyk (2009) investigates the opposite of socially responsible investment: sin stock investment. Their research shows that institutional investors shun sin stocks (stocks from unethical industries like tobacco, gambling, alcohol, and weapon industries). As these sin stocks outperform their non-sin peers, they conclude that this investment behavior results from

social norm pressures. By excluding these ‘bad’ investments with positive stock returns, investors harm the returns of their portfolio. Besides, these sin stocks mostly originate from entire sin industries, like tobacco, gambling, alcohol, weapon, and defense industries. According to basic portfolio theory (Fama & French, 1993; Lintner, 1975; Markowitz, 1991; Sharpe, 1964), a well-diversified portfolio would eliminate firm-specific risk, only resulting in market (systematic) risk. The returns from these portfolios would result in the ultimate risk-return trade-off, where the highest returns with the lowest possible risk can be obtained. Thus, excluding entire industries from one’s portfolio could increase risk, unrelated to return: the investor is exposed to a higher level of risk but not necessarily to a higher amount of return.

## **2.2 Environmental Investment and Carbon Disclosure**

When addressing the environmental performance of firms, it is important to take any related regulations or governmental policies into account. Since the early 2000s, the raising concerns about climate change have led to global and national protocols, agreements, and other regulations to mitigate environmental pollution. The largest global agreements are the Kyoto Protocol (active from 2005) and the Paris Climate Agreement.<sup>8</sup> The Kyoto Protocol’s essential aspects include the reporting and mitigation of greenhouse gasses and international emissions trading for industrialized nations. The Paris Climate Agreement (2016) tries to bind all nations with a clear goal of keeping overall global warming below 1.5 – 2.0 degrees Celsius. All participating nations are required to commit to a Nationally Determined Contribution (NDC), specifying their efforts. The United States, one of the most polluting countries, did not participate in the Kyoto Protocol.<sup>9</sup> Though the U.S. was a participant in the Paris Climate Agreement, President Donald Trump announced in 2017 that the U.S. would withdraw from the agreement. The country will still need to report up to November 2020. However, the Trump administration has already started on reversing and retracting various climate regulations on both the national and state level.<sup>10</sup>

If there is limited regulation on corporate environmental disclosure and the effect of a firm on climate change, then why do firms disclose at all? Stanny and Ely (2008) provide evidence

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<sup>8</sup> Information on the Kyoto Protocol and Paris Climate Agreement is derived from the United Nation’s Climate Change department: <https://unfccc.int/>

<sup>9</sup> The U.S. dropped out in 2001, before the actual installment of the protocol.

<sup>10</sup> Harvard University’s Environmental & Energy Law Program and Columbia University’s Sabin Center for Climate Change both keep track of climate deregulation by the Trump Administration. All reversed laws can be found at: <https://ceelp.law.harvard.edu/regulatory-rollback-tracker/> or <https://climate.law.columbia.edu/climate-deregulation-tracker>. A summary is provided in an article by the New York Times: <https://www.nytimes.com/interactive/2019/climate/trump-environment-rollbacks.html>

that the more pressure an institutional investor exercises, the more likely a firm will disclose its environmental performance towards these investors. It seems that though governmental policy on climate change can be non-existent or ineffective, institutional investors are still able to address corporate behavior.

As to the reason behind altering corporate environmental behavior by institutional investors, two explanations exist. Either the investor is subject to social norms, or there is a form of risk associated with environmental performance. Dyck et al. (2019) report that after the BP Deepwater Horizon oil spill in 2010, institutional ownership effectively resulted in environmental improvement for oil and gas industry firms in the subsequent years. In this case, the environmental disaster can be perceived as a risk; not only the actual costs of the disaster itself (for example, clean-up costs) but also reputational damage can have a severe impact on the value of a firm. Sharfman & Fernando (2008) and Nofsinger, Suaileman, and Varma (2019) also propose that ESG can be viewed as a measure of risk rather than “doing good.”

It is also argued that increased environmental performance correlates with cash-flows due to potential litigation costs (lawsuits) or increased spending due to environmental regulation (Renneboog, Ter Horst, & Zhang, 2008). This suggests a rational explanation for environmental investment is in place. However, the authors also stress that very few research takes this cash-flow related explanation into account. Finally, Renneboog et al. (2008) also suggest that environmental performance is a proxy for good corporate governance. This is in line with Deng, Kang & Low’s (2013) theory on implicit contracts: High CSR activities are implicit contracts and commitments towards stakeholders. This type of good corporate governance leads to a higher reputation and trust regarding commitment and honesty, affecting implicit and explicit contractors.

Nandy & Lodh (2012) researches loan contracts provided by banks related to the environmental scores of firms. They find that firms with higher environmental performance receive more favorable loan contracts, including lower lending rates. Assuming that banks are less subject to social norms in their lending and cannot push environmental performance like equity-stakeholders, these results suggest that environmental performance is rather a risk measure than a behavioral phenomenon (Chava, 2014).

Fernando, Sharfman, and Uysal (2010) address an essential issue in the definition of environmental performance. They differentiate between firms who try to limit their effect on climate change and firms who go against climate change entirely (“mitigating negative environmental performance”). In addition, the authors also stress that it is important to distinguish between three different types of environmental stocks: green stocks with positive

environmental performance, toxic stocks with negative environmental performance, and ‘neutral’ stocks. They find that for both positive and negative environmental performance, stocks are less held by institutional investors and have more shareholders. This could explain why the existing literature has found seemingly contradicting results in the attractiveness of both sin and green stocks.

When assessing the financial benefits related to environmental performance, it is important to note that there is a difference between short-term and long-term financial performance. Delmas, Nairn-Birch & Lim (2015) find that though the market has a short-term negative reaction towards environmental improvement, increased Tobin’s q suggests positive long-term financial performance. Moreover, these results are based on initial stages in the environmental performance improvements. In these stages, any legislative or regulatory consequences are still highly uncertain. This suggests that there is limited litigation risk involved in these investment decisions. Superior financial performance related to improved environmental performance is also supported by Dowell, Hart, and Yeung (2000) in their research on multinationals. Though there is some evidence suggesting that increasing a firm’s environmental performance could also result in financial benefits, there are still gaps in the literature. For socially responsible investment, there has been an exponential interest for the past ten years. As this SRI is still developing, using data from the early 2000s can include different perspectives of risk, climate change, and emission reporting.

### **2.3 Social Norms Motivation**

As explained before, there are multiple explanations on the motivations behind SRI. In the literature, it is addressed that in the absence of financial motivations, institutional investors can be driven by social norm motivations.

Different from moral (ethical) and legal norms, social norms are derived from the opinions and beliefs of a community (Elster, 1989). Legal norms are enforced by law, and moral norms are not subject to the approval of others. As social norms differ from rationality, actions can be both influenced by rationality and norms. This suggests a trade-off between rational benefits and costs endured from going against these norms. Thus, if norms are strong enough, investors will make more norm-influenced investment decisions. It is important to note that social norms are different from altruism and more likely to be aligned with reputational motivations. In their framework, Hong & Kacperczyk (2009) identify a social norm with the threat of (financial) costs from going against a community’s beliefs or opinions. It is important to note that social

norms can significantly differ among regions, countries, and communities (Elster, 1989; Levitt & List, 2007; Dyck et al., 2019).

Hong & Kacperczyk (2009) show that institutions not only hold fewer sin stocks in their portfolio, they also miss out on positive excess returns resulting from these investments. In addition, they find that these stocks are less covered by analysts, reacting to the preference of institutional investors. Though this evidence shows that there can be other motivations besides financial performance, it seems very difficult to distinguish social norms from other motivations. Dyck et al. (2009) similarly attempt to distinguish between financial and social motivations by examining differences across investor types and countries in relation to ESG performance. It seems that investors who are more sensitive to public scrutiny not only invest more in high ESG performance but also tend to exclude sin stocks (Hong & Kacperczyk, 2009; Dyck et al., 2019). In an experiment, Riedl and Smeets (2017) try to isolate altruism from financial motivations. They use a social signaling explanation, where investors could seek improvement in their reputation by investing more socially. Here, it still can be difficult to distinguish altruism from other motivations like strategic reputation or social image. Through an experimental game, linked to the individual investor's investment behavior, they find that investors who behave more social in the game are more likely to also invest in an SRI fund. Also, they find that investors who are more talkative about their investment/portfolio are more likely to participate in socially responsible investments, confirming social motivations being linked to reputation.

Despite any social motivations, financial motivations can still be present in the investment behavior of individual investors. Riedl & Smeets (2017) find that socially responsible investors not only expect to obtain lower financial returns than from conventional investments, but investors also tend to pay higher management fees. They conclude that investors are rather socially than financially motivated. Research shows that some investors are willing to sacrifice financial returns (they both expect lower performance compared to conventional funds and are willing to pay higher management fees), by doing "good." However, if investors expect negative returns instead of lower positive returns, SRI can be unattractive to even social investors.

## **2.4 Institutional Investors**

As mentioned in the previous sections, institutional investors like pension funds, mutual funds, insurance companies, banks, and hedge funds, seem to be subject to social norms and take ethical investment into account. It is not only interesting to assess differences among

institutional investors and their strategies, but the activism from institutional investors has also been subject to various researches.

#### 2.4.1 Institutional Investors types and social norms

As Dyck et al. (2019) find, institutional investors, engage in ESG improvement dependent on their type and country origin. For example, pension funds tend to engage in corporate ethical improvement regardless of their country. However, more independent investors are more likely to engage in ethical corporate behavior if they are from a country with higher environmental and social values.<sup>11</sup>

Usually, CSR or environmental investment is long-term oriented, where short-term investment results in less profit from these types of engagements (Delmas et al., 2015; Starks et al., 2017 via Chen, Dong & Lin, 2020). Besides, investors with shorter investment horizons have less monitoring and bargaining power (Gaspar, Massa & Matos, 2005). Also, Riedl & Smeets (2017) find that individual investors who invest in SRI have longer investment horizons and tend to hold larger portfolios. Dyck et al. (2019) support this with evidence of institutional investors with longer investment horizons being more engaged in ESG improvement. However, Delmas et al. (2015) suggest that the lack of environmental investment could be the result of a short-term focus on financial performance. Based on the fraction of SRI in an investor's portfolio, Riedl and Smeets (2017) find that more selfish investors with a signal motivation, hold a rather small (of minimal) amount of SRI in their portfolio. This could explain why most institutional investors do invest in socially responsible stocks but do not abstain from investing in bad performing stocks.

Next to differences in long- and short-term investment perspectives, institutional investors can differ in their type of portfolios. Next to actively managing portfolios, institutional investors also provide index funds, tracking industries, exchanges, or other groups of assets. Index mutual funds and index exchange-traded funds have an increasing share in the fund market. For the U.S., total index investments accounted for 18% of all invested assets in 2008. As for 2018, this has increased to 36%. Actively managed funds have decreased from 82% to 64% for the past ten years (Investment Company Institute, 2019). Taking social norms and ethical investment into account seems more difficult for index investing; it is not possible to use negative or positive screening strategies if the investor is bound to a set of firms within an index. Schmidt and Fahlenbrach (2017) find that firms' corporate governance is negatively

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<sup>11</sup> Based on certain topics within the World Values Survey (WVS)

affected by increased passive institutional ownership. For example, management seems to have more power instead of shareholders. The evidence also shows that most shareholder proposals come from more active (institutional) owners, confirming the passiveness of index-tracking investors. Opposing the negative effect of passive ownership, Appel, Gormley, and Keim (2016) argue that passive ownership has more benefits due to the lack of ‘voting with their feet’. Investors cannot walk away if a firm performs bad and are, therefore, more incentivized to engage.

#### 2.4.2 Institutional Investors Activism

Throughout the literature, various types of engagements of investors towards corporate policies arise. Gillan and Starks (2007) define shareholder activism as trying to make changes without changing the control (management) when they are not satisfied with a certain issue. One way to show dissatisfaction is by the previously mentioned “voting with their feet” thus, by shelling their shares. However, since the 1990s, researches have found evidence of more engagement from investors rather than walking away from their investment. Though most research is focussed on investor activism through shareholder proposals, investors also effectively engage in private negotiations. Carleton, Nelson, and Weisbach (1999) find that these types of engagements are highly effective.

As being very large investors, often holding a large proportion of shares, institutional investors seem to have a strong monitoring role and can discipline firms (Smith, 1996). Evidence shows that institutional shareholders pursue activism in their corporate holdings, which is even more present for larger firms (Smith, 1996). This is backed by Gillan and Starks (2000), who find evidence on the power of institutional investors. They find that proposals that are backed by institutional investors tend to receive more votes and thus have a higher chance of passing through. Especially pension funds are perceived as more activist investors (Smith, 1996; Del Guercio & Hawkins, 1999), though there has been a rise in more entrepreneurial private investors activism from hedge funds seeking financial improvement (Gillan & Starks, 2007; Klein & Zur, 2009). However, both the objectives pursued and the activism strategies used significantly differ among investors and target companies (Chen, Harford & Li, 2007). Del Guercio & Hawkins (1999) investigate differences between highly indexed and more actively managed funds. Especially actively managed funds tend to change their holdings around shareholder proposals. Though the activism from institutional investors seems effective, no evidence is found on financial benefits resulting from these proposed and

implemented objectives (Karpoff, Malatesta & Walkling, 1996; Del Guercio & Hawkins, 1999).

Usually, environmental performance improvement is requested by the investor through private letters or emails to executives or directors instead of proposals in shareholder meetings. It is also found that though activism is more aimed at lower ESG performing firms, activism is most successful for already higher-performing ESG firms (Barko, Cremers & Renneboog, 2018). Mccahery, Sautner & Starks (2016) also find in their survey among institutional investors that these investors do express their preferences for CSR activities towards their investees. 'Behind-the-scenes' interventions are mostly used, and only followed by an exit if this intervention does not lead to the desired result. For the amount of intervention, the investor's investment horizon plays an important role: long-term investors are more engaged. The results also indicate that the actual 'threat of exit' is more effective for investors with longer investment horizons and large positions in the specific firm.

### 3 Hypothesis development

In summary, past research argues that corporates can act on their role towards society and various stakeholders through corporate social responsibility. Institutional investors are subject to social norms and seem to take the exclusion of sin-industry stocks and ESG screening into account (Hong & Kacperczyk, 2009; Dyck et al., 2019). Climate change is an increasing concern among society, in which corporates are substantial contributors through their carbon emissions. Through the direct link between corporate carbon emissions and social norms regarding environmental impact, institutional investors are therefore expected to take carbon emissions into account when selecting their portfolio stocks. This results in the first hypothesis that firms with higher carbon emissions have lower institutional ownership and vice versa.

This first hypothesis takes the general correlation between institutional ownership and corporate carbon emissions into account. Institutional ownership can be defined as the proportion of corporate shares held by institutional investors (similar to Hong & Kacperczyk, 2009; Hsu, Liang & Matos, 2017; Dyck et al., 2019). For this first hypothesis, carbon emissions scores can be approached through different screening methods. Institutional investors can use a negative screening strategy by excluding firms with high direct carbon emissions. However, as high corporate carbon emission is directly linked to specific industries (UN IPCC, 2014), investors would exclude entire industries from their portfolio. As shown by Hong and Kacperczyk (2009) and supported by portfolio diversification theory (Fama & French, 1993; Lintner, 1975; Markowitz, 1991; Sharpe, 1964), institutional investors face a trade-off between the financial benefit from including sin-stocks and the social gain from excluding these stocks. Thus, the loss of financial benefits through the exclusion of high emitting firms could be larger than the social gain. Institutional investors can therefore use the less restrictive combined screening approach. Through this so-called “best-in-class” approach, investors can select the lowest emitting firms among its industry peers. Taking the trade-off into account, it can be expected that institutional investors are more prone to using best-in-class selection rather than the negative screening approach, using total carbon emissions criteria. Hsu et al. (2017) and Dyck et al. (2019) both find evidence that institutional investors take these industry benchmarked ESG scores into account. Also, Riedl and Smeets (2017) show supporting evidence on best-in-class selection but find no evidence on investors abstaining from unethical or ‘sin’ stocks. Therefore, the first hypothesis can be specified more carefully in terms of a best-in-class selection strategy:

*H1: Firms with higher carbon emissions relative to their industry peers, have lower institutional ownership.*

Again, reasoning from the diversification perspective, it is not always desirable for institutional investors to exclude entire industries. Besides, due to the rise of passive investments and index funds, investors are not able to select their stocks for a substantial proportion of their portfolio. Finally, the longer investment horizon of institutional investors makes engagement in environmental performance possible and perhaps more desirable. Taking the extensive evidence on institutional shareholder engagement into account, the following second hypothesis can be derived:

*H2.1: Firms having higher institutional ownership results in lower corporate carbon emission relative to their industry peers.*

This second hypothesis (*H2.1*) addresses a causal relation between institutional ownership and an industry benchmarked corporate emission score. One issue that arises in assessing this causal relation is reverse causality. It could be that institutional owners pick stocks with higher emission improvement potential, rather than engage in any emission improvement themselves. Therefore, further tests are necessary in order to prove a causal relation. Previous literature addresses this issue using specific shocks. For example, Dyck et al. (2019) show institutional owner engagement for the oil industry after an oil spill disaster. While using a disastrous shock could be very useful to support the causal relation, it is rather difficult to find a disaster directly linked to corporate carbon emissions. Though, there is a proven relation between carbon emissions and increased natural disasters, climate change slowly evolves over time. As natural disasters cannot solely be explained by climate change and carbon emissions. Hsu et al. (2017), approach this shock differently by using an ‘awareness’ shock. This shock involved the United Nation’s 2009 Copenhagen Accord, a climate accord following the Kyoto Protocol. Though this shock does raise awareness and was pledged by large countries, it was at an early stage based on the awareness and concerns among society (Leiserowitz et al., 2018). During the 2016 Paris Climate Convention, for the first time, all participating countries addressed the common cause of mitigating and fight against climate change. The voluntary commitment to limit global warming to 1.5 - 2.0 degrees Celsius, based on UN IPCC’s (2014) extensive research on climate change, addresses the large concern among world leaders. This awareness shock can be used to support the causal relation between institutional ownership and corporate emission

improvement. Thus, institutional investors being pressured by social norms are more motivated to engage in emission improvement after an awareness shock like the Paris Climate Convention:

*H2.2: After the Paris Climate Convention, firms having higher institutional ownership results in lower corporate carbon emissions relative to industry peers.*

Finally, the motivations of institutional investors seem to be an interesting puzzle. Where some researchers find evidence of a financial motivation, potentially related to risk (Delmas et al., 2015), others oppose the financial motivations and propose a social norm motivation instead (Hong & Kacperczyk, 2009). Also, potential litigation risks or costs are considered (Renneboog et al., 2008). Or, both financial and social motivations can be present (Dyck et al., 2019). Though determining the existence of specific motivations seems very difficult, it can be interesting to isolate any motivations involved. Though social norms are very difficult to measure, both financial and legislative norms can be examined. From a more exploratory perspective, it is interesting to look into the existence of any financial benefits and the effects of the political shift on institutional investors' engagement towards corporate carbon emissions.

## 4 Data and Methodology

### 4.1 Data and Variables

In this section, the compilation of the dataset and its key variables are described. First, the key variables, corporate carbon emissions, and institutional ownership are discussed. Next, more details on the sample, data cleansing procedures, and the used control variables are provided. Finally, the summary statistics and correlation matrix are presented.

For this research, three different datasets are combined in order to construct a complete panel dataset. Similar to most related papers, this research focuses on a sample covering (western) developed countries, thus the U.S. and European countries.

#### *4.1.1 Dependent variable: Corporate Emissions*

One of the most used and extensive datasets on ESG data is provided by Thomson Reuter's ESG, former ASSET4, database available through Datastream. This database provides independent ratings on a wide set of ethical topics, covering more than 6,000 globally listed companies going back up to 2002. Data is collected from various information sources like annual reports, filings, and company websites, and standardized to make country, industry, and company comparisons (Hsu et al., 2017). Most related studies of Hsu et al. (2017) and Dyck et al. (2019) also use variables from the ESG database. The Environmental, Social, and Governance scores are each divided into three or four categories, in turn, composed of more than 400 different metrics. The Environmental Score consists of an emission, resource use and innovation category.

The emission reduction category (TRESGENERS) is a percentile score, based on measures related to carbon and other greenhouse gas emissions. The score is constructed as an industry benchmark, where a high Emissions Score indicates low carbon emissions related to industry peers (indicating a positive environmental performance score). This emissions score provides a useful, standardized and industry benchmarked measure for corporate emissions, where firms from different industries can be compared. However, it is more difficult to fully capture the environmental impact of a firm. A firm of a low emitting industry can have the same industry benchmarked value as a firm from a very high emitting industry. Therefore, in addition, a measure for total carbon and carbon equivalent emissions from Thomson Reuters ESG is used. This measure provides a company's total direct carbon and carbon equivalent emissions in tons. Unfortunately, only half of all firms in the database report on CO<sub>2</sub> emissions data. Therefore, the ENER123 measure is used, as this measure provides estimated carbon emissions when

emissions are not reported by the company itself.<sup>12</sup> Similar to Hsu et al. (2017), the CO2 emissions are adjusted to a company's total assets. In addition, the more general Environmental Score (also a percentile score compared to industry peers) compiled for a robustness check.

Using the ESG database constituent lists for the U.S. and European countries, a total of 3,718 firms are included in the initial sample. Most coverage is complete for the most recent three to five years, though there is substantial coverage from 2009 onwards. In line with similar research, a sample of approximately ten years of yearly observations is constructed. Therefore, firms are included with data points between 2009 and 2018. Any observations with missing values are deleted from the sample.

#### 4.1.2 Independent variable: Institutional Ownership

The variable for institutional ownership is derived from Factset's Ownership Database. Though Orbis or Thomson Reuter's 13f filings database are more detailed, they are either limited to U.S. investors only or do not provide access to historical data. Factset provides worldwide ownership data on equity and fixed income securities back to 1999. In the U.S., institutions like banks, pension funds, and insurers need to file form 13f, showing their equity holdings larger than \$100 million (Lemke & Lins, 1988). For U.S. institutional investors, the mandatory quarterly 13f filings are used. For other countries, various tools like stakes-based sources and sums of underlying fund positions are used.<sup>13</sup> The institutional ownership measure provided by Factset is the number of shares held by institutional investors divided by the total amount of shares outstanding. This results in a percentage value from 0 to 100%. Because institutional investors have different filing dates or due to the presence of short selling, the percentage could exceed 100%. For the observations that have institutional ownership exceeding 100%, institutional ownership is capped at 100%.

#### 4.1.3 Control Variables

A set of common firm-level control variables is used like total assets, leverage, tangibility, and return on assets, similar to Dyck et al. (2019). Hsu et al. (2017) also propose a market to book value as a control variable and is therefore also derived. Values in U.S. dollar are collected from Worldscope and Datastream. A detailed description of all variables, including any computations, can be found in Appendix A. To make sure that the variables are distributed

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<sup>12</sup> Detailed descriptions of Carbon Data estimation models can be found at: <https://refinitiv.com/esg>

<sup>13</sup> More information on Factset Ownership database can be found at: <https://insight.factset.com/resources/at-a-glance-factset-ownership-standard-datafeed>

more normally and in order to reduce the effect of any outliers, Tobin's Q, tangibility, total assets and market to book value are log-transformed. As leverage and return on assets already show a proper distribution, they are not log-transformed. However, outliers are removed through winsorizing at the 5<sup>th</sup> and 95<sup>th</sup> percentile. For some variables, any unusual negative values are dropped. This includes negative values of total CO2 emissions, net plant property and equipment, book value and liabilities. In addition, any observations with missing values are dropped.

#### 4.1.4 Summary Statistics

After merging all variables and datasets, firms with fewer than two yearly observations are dropped. The final sample after merging and data cleaning consists of 3,205 firms, with a total of 20,053 firm-year observations. In Table 1 panel A the basic descriptive statistics for the full sample are shown. One thing to note is that for the Emission Reduction Score and the Environmental Score, mean and standard deviation are difficult to interpret, as these percentile Emiscores are evenly distributed. It is therefore expected that the mean is around 50(%) and the standard deviation around 25(%). The sample of firms included in the ESG database has a slight sample bias towards size (Hsu et al., 2017). Though, as Hsu et al. (2017) argue, larger firms also have a larger environmental impact and could therefore be more of interest for institutional investors. In Panel B of table 1, the mean values of the Emission Reduction Score, Institutional Ownership, and the CO2 to Assets ratio are shown for different industries. As expected, the mean of ERS is around 50 for each industry. One thing to note is that for some industries, few firms are included in the sample. For these industries, the ERS could be substantially different from zero. The sample seems to be biased to the manufacturing, finance and services industries. Though previous papers like Hsu et al. (2017) use slightly different industry identifiers, the industry distribution seems similar. In addition, it can be expected that for the population, some industries have substantially more (listed) firms. For institutional ownership, there seem to be no substantial differences across industries: institutional ownership is around 60% for most industries. Taking this distribution into account, it could indicate that institutional investors do not particularly favor or dislike specific industries. Right column in the table displays the CO2 to total assets ratio for each industry. Here large differences between industries exist. As CO2 emissions are directly linked to industries, this indicates that institutional investors do not use negative screening approaches for high carbon emission industries. In appendix B, a similar table can be found with descriptive statistics for the sample split in different countries. As the Emission Reduction Score is a global industry benchmark,

differences in scores between countries for the same industries can occur. French companies have a relatively high Emission reduction score of 80, while the U.S. companies have one of the lowest percentile scores on average of 45. As for institutional ownership, U.K. and U.S. companies have substantially higher institutional ownership. Most of the sample firms also originate from the U.S. or the U.K (roughly 65%). This could be explained by company size and most globally traded equities for U.S. and U.K. markets (Hsu et al., 2017). For the country averages of the Assets ratio, Poland, Luxembourg, Portugal, and Spain have a higher average. This can be explained by the small number of firms for that specific country included in the sample, as higher emitting firms or industries could be overrepresented.

**Table 1: Descriptive statistics**

This table reports descriptive statistics of Emission Reduction Score, Institutional Ownership, and other control variables. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The full sample covers yearly observations from 2009 up to 2018. U.S. and European firms are included. Variables are log-transformed or winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. For Panel A, the mean, standard deviation, minimum, median and maximum value of each variable across the full sample is reported. For Panel B, the sample is split into industries based on their SIC codes. For each industry, the number of firm year observations (Obs), total firms, and mean values of Emission reduction score (Emission RS), Institutional Ownership (IO) and CO2 to Assets are shown.

PANEL A: Full Sample						
Variable Name	Obs	Mean	St. Dev.	Min	Median	Max
Emission Reduction Score	20,065	53.64	28.87	0.08	55.28	99.92
Institutional Ownership (IO)	20,065	0.64	0.29	0	0.72	1
Log Tobin's Q	20,065	0.48	0.54	-1.27	0.36	4.51
Log Tangibility	20,065	-2.13	1.64	-10.72	-1.78	0.53
Log Total Assets	20,065	15.55	1.75	7.41	15.42	21.80
Leverage	20,065	0.59	0.21	0.20	0.59	0.92
Return on Assets (ROA)	20,065	5.26	6.24	-9.13	4.91	17.95
Log Market to Book Value	20,065	-6.03	0.89	-12.46	-6.10	0.43
Environmental Score	20,065	53.20	23.49	2.83	52.98	99.52
Log CO2 to Assets	20,065	-4.09	2.32	-16.22	-3.93	3.06

PANEL B: Summary statistics by Industry						
Industry	Sic Codes	Obs	Firms	Emission RS	IO	CO2 /Assets
Agriculture, Forestry & Fishing	0100 - 0999	12	4	34.70	0.63	0.13
Mining	1000 - 1499	1,051	144	52.71	0.63	0.25
Construction	1500 - 1799	483	70	54.14	0.60	0.08
Manufacturing	2000 - 3999	7,236	1143	53.62	0.66	0.17
Transportation	4000 - 4799	759	117	56.60	0.61	0.29
Communication	4800 - 4899	682	94	56.52	0.47	0.02
Gas & Electric	4900 - 4999	946	127	62.92	0.53	0.73
Wholesale Trade	5000 - 5199	480	79	49.46	0.76	0.21
Retail Trade	4200 - 5999	1,299	197	56.40	0.69	0.06
Finance, Insurance & Real Estate Services	6000 - 6999	4,306	710	52.52	0.61	0.01
Services	7000 - 8999	2,799	520	50.59	0.71	0.05
Total Sample		20,065	3,205	53.64	0.64	-4.09

## 4.2 Methodology

In this section, the methodology for testing the hypothesis is explained. This also included the regression models used. The statistical analysis is composed of four different sections. In the first part, the baseline regression for the first hypothesis (the correlation) will be discussed. Next, the causal effect of institutional ownership on corporate emissions will be addressed using lagged regression models, similar to Hsu et al. (2017) and Dyck et al. (2019). In the third paragraph, the reverse causality issue will be addressed using both a Granger Causality test and an environmental awareness shock (the Paris Climate Conference). Finally, the case of institutional investors affecting U.S. corporate emissions during the Obama and Trump administration will be discussed.

### 4.2.1 Baseline Regression

The baseline regression model, following the hypothesis of institutional investors selecting stocks with lower corporate emissions, can be expressed as follows:

$$\text{Corporate Emissions}_{it} = \alpha + \beta_0 IO_{it} + \gamma' Y_{it} + \Lambda + \varepsilon_{it} \quad (1)$$

As discussed in the hypothesis development section, corporate emissions can be interpreted in two different ways. The dependent variable, corporate emissions, can either be defined as the ratio of a company's total carbon and carbon equivalent emissions to size (for this size measure total assets is used), or as a benchmarked score relative to industry peers. Therefore, the baseline regression can be specified into two separate regression models:

$$\text{Emission Reduction Score}_{it} = \alpha + \beta_0 IO_{it} + \gamma' Y_{it} + \Lambda + \varepsilon_{it} \quad (1.1)$$

$$\text{Carbon to Assets}_{it} = \alpha + \beta_0 IO_{it} + \gamma' Y_{it} + \Lambda + \varepsilon_{it} \quad (1.2)$$

For model 1.1, the dependent variable is the corporate *Emission Reduction Score* in order to test the best-in-class selection of institutional investors. Though higher carbon emissions are negative for the environment and induce climate change, a higher Emission Reduction percentile score indicates that a firm has a better (lower) corporate emission. The dependent variable of interest, Institutional Ownership (*IO*), is the percentage of total shares outstanding owned by institutional investors. In this model, *i* is identified as the firm and *t* the year of the observation. *Y* comprises a set of firm-level control variables and is the same across all regressions performed in this paper: Tobin's *q*, total assets, asset tangibility, leverage, and profitability. These control variables are similar to research from Dyck et al. (2019). Tobin's *q*

is a widely used measure for a company's value, calculated as the total of market cap and liabilities divided by total assets. Total assets (log-transformation) reflects company size. Dyck et al. (2019) also take asset tangibility and leverage into account in order to predict a company's financial slack as proposed by Hong, Kubik, and Scheinkman (2012). Tangibility is calculated as the ratio of net plant, property, and equipment to total assets and reflects financial liquidity. Leverage is computed as total liabilities, relative to size (total assets), and reflects credit constraints due to debt. Finally, profitability is measured as return on assets, calculated as net income relative to size (total assets). Hsu et al. (2017) do not use asset tangibility as a control variable. Also, instead of Tobin's q as a measure for company valuation, the company's market-to-book ratio is used. Hong and Kacperczyk (2009) also use the market-to-book ratio as a control variable, affecting institutional ownership. As an additional check, the market-to-book ratio is also included in an extended model.  $\Lambda$  covers year, country fixed effects, to account for yearly and country-level effects, not accounted for in the specified models. Though the Emission Reduction Score is an industry benchmarked score, additional regressions will be performed to also account for industry fixed effects, especially for the control variables. Following hypothesis 1.1, parameter estimates of  $\beta_0$  should be positive and significantly different from zero if institutional ownership is positively related to the corporate Emission Reduction Score. Thus, the null hypothesis entailing that parameter estimates of  $\beta_0$  are significantly not different from zero should be rejected.

The second model (1.2), uses the *carbon to assets* ratio as a measure for corporate emissions. Carbon to assets is measured as the log of direct CO2 and CO2 equivalent emissions, relative to size (total assets). This measure is more fit to check for any negative screening strategies by institutional investors. All dependent variables are identical to the Emission Reduction Score model (1.1), including  $\Lambda$  indicating year, country, and industry fixed effects. As higher carbon emission results in a negative environmental impact, the estimator parameter  $\beta_0$  should be negatively related to Institutional Ownership.

#### 4.2.2 Lagged Regression

For the second hypothesis, a causal relation of institutional ownership affecting corporate emissions is examined. Inspired by the baseline regressions of Hsu et al. (2017) and Dyck et al. (2019), a one- and two-year lagged regression model is used:

$$Emission\ Reduction\ Score_{it} = \alpha + \beta_0 IO_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it} \quad (2.1)$$

$$Emission\ Reduction\ Score_{it} = \alpha + \beta_0 IO_{it-2} + \gamma' Y_{it-2} + \Lambda + \varepsilon_{it} \quad (2.2)$$

Similar to the baseline regression, the Emission Reduction Score is the dependent variable. To test the causal effect of institutional ownership, Institutional Ownership is lagged with one (or two) years. Thus, previous Institutional Ownership for firm  $i$  in year  $t-1$  would positively explain the Emission Reduction Score today for firm  $i$  in year  $t$ . All control variables are also lagged one (or two) years in line with Institutional Ownership.

Though Hsu et al. (2017) and Dyck et al. (2019) both only examine a one-year lag, as Delmas et al. (2015) argue that ESG performance is usually motivated by a more long-term investment perspective. Therefore, a two-year lag is also included.

Where shareholders can influence the socially responsible activities of a company, this is different for sin stocks. As these companies are ‘bad’ by nature, it seems difficult for investors to change their undesired behavior. For high carbon-emitting firms, their operational activities can be directly linked to these high carbon emissions. Reasoning from this, it could be expected that institutional investors do not engage in emission improvement for firms from high carbon-emitting industries. In addition, there is little evidence on investor activism contributing to specific environmental improvement, especially severe pollution behavior. While already ‘good’ firms are proved to be pushed to be better (Dyck et al., 2019), it is unknown if the ‘bad’ firms are pushed to become ‘good’ (or at least, less bad). From a climate change perspective, it is important to look into the influence of institutional shareholders towards the most polluting firms.

#### 4.2.3 Causality Tests

Multiple researchers address a reverse causality issue on the potential relation between corporate social responsibility or ESG performance and firm value or stock selection (Deng, Kang & Low, 2013; Hsu et al., 2017; Dyck et al., 2019). As mentioned in the hypothesis development, it could be that institutional investors (intentionally or unintentionally) select stocks with already expected environmental performance improvement, rather than engage in environmental performance improvement. In order to test the hypothesis of the directional relation (H2.1), further testing is necessary. A first step is to use a Granger Causality test, also used by similar researchers (Hsu et al., 2017; Dyck et al., 2019). Though the interpretation and usage of a Granger Causality test should be performed with caution (Dyck et al., 2019), it could provide additional supporting evidence to further tests.

$$ERS_{it} = \alpha + \beta_0 IO_{it-1} + \beta_1 ERS_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it} \quad (2.3)$$

$$IO_{it} = \alpha + \beta_0 IO_{it-1} + \beta_1 ERS_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it} \quad (2.4)$$

For the Granger Causality test, two regressions are performed. The first model (2.3) is similar to the lagged regression model, where the Emission Reduction Score is the dependent variable. Next to the independent variable lagged Institutional Ownership ( $IO$ ), the model also controls for a lagged Emission Reduction Score ( $ERS$ ). In the second model (2.4), the relation is reversed: Institutional ownership for firm  $i$  in year  $t$  is explained by the lagged Emission Reduction Score, controlled for lagged Institutional Ownership. In order to provide some intuition on the direction of the relationship, the first model (2.3) should provide statistically significant different from zero parameter estimates of  $\beta_1$  and  $\beta_2$ . In addition, the parameter estimates of  $\beta_2$  for model 2.4 should not be significantly different from zero.

As stressed by other researchers, the existence of a directional relationship should not solely be derived from the Granger Causality test. As addressed in the hypothesis development, a climate change awareness shock is used to provide additional evidence of a causal relation. For this shock, the Paris Climate Convention in December 2016, after which the Paris Climate Agreement was established, is used. The following regression model as a difference-in-difference analysis is used:

$$ERS_{it} = \alpha + \beta_0 IO_{it-1} * Post\ Paris_t + \beta_1 IO_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it} \quad (3)$$

In this model,  $ERS$  is the Emission Reduction Score for firm  $i$  in year  $t$  and  $IO$  is the Institutional Ownership for firm  $i$  in year  $t-1$ .  $Post\ Paris$  is a dummy variable being equal to one if year  $t$  is 2016 or onward and zero if year  $t$  is 2015 or before. The interaction term  $IO * Post\ Paris$  indicates whether there is a stronger relationship after the Paris Climate Convention, indicating increased climate change awareness among society and institutional investors. Therefore, the parameter coefficient of interest  $\beta_0$ , should be positive and significantly different from zero.

#### 4.2.4 Institutional Investors' Motivations

Both Hong and Kacperczyk (2009) and Dyck et al. (2019) argue that institutional investors are pressured by social norms in selecting their stock portfolio. However, it seems very difficult to distinguish the true motivations of institutional investors. Various researchers have suggested financial or legislative motivations. Using the 2008 financial crisis as a shock, Dyck et al. (2019) find that firms with higher institutional ownership report higher E&S performance. As

financial values were lower during and right after the crisis, Dyck et al. conclude that financial motivations are related to institutional investors engagement in E&S performance. Other researchers use various accounting and valuation measures to identify financial benefits resulting from SRI of institutional investor engagement (Dowell et al., 2000; Delmas et al., 2015; Barkó et al., 2017). Similar to previous research, potential financial benefits can be distinguished by examining the relation between firm profitability and corporate emissions. In particular, similar to research of Delmas et al. (2017), the directional relation between profitability and previous corporate emissions could indicate any financially driven motivations. Similar to equation 2.1 and 2.2, the following lagged regression models can be specified:

$$\text{Return on Assets}_{it} = \alpha + \beta_0 \text{ERS}_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it} \quad (4.1)$$

$$\text{Return on Assets}_{it} = \alpha + \beta_0 \text{ERS}_{it-2} + \gamma' Y_{it-2} + \Lambda + \varepsilon_{it} \quad (4.2)$$

To measure a firm's performance, Return on Assets (ROA) is used as the dependent variable. The independent variables Emission Reduction Score (ERS) and the control variables are lagged with one or two years. This accounting measure indicates a firm's net income to total assets. This measure isolates a firm's profitability, relative to size and is unrelated to any market valuation or fluctuations.

## 5 Results

For the regressions in this paper, Ordinary Least Squares (OLS) regression models are performed. Despite the panel being unbalanced, this should not be a problem for the statistical analysis. In the Appendix, a yearly distribution of firms in the sample can be found. First, the use of the appropriate model is assessed. A Hausman test confirms that a fixed effects regression is preferred over a random effects regression.<sup>14</sup> To account for time-variant effects, yearly effects are used in every regression. In addition, country and/or industry fixed effects are used in order to control for country- and/or industry-specific differences. Despite the log-transformations used in order to provide improved distributional properties, heteroskedasticity seems to be present. This is confirmed with a Breusch-Pagan test. In order to account for heteroskedasticity, robust standard errors are used. These are clustered at the firm-level, to account for heteroskedasticity across firms.

### *5.1 Baseline Regression*

Table 2 Panel A reports the regression coefficients of the baseline regression model. The first column displays the baseline regression with standard control variables. The second column adds the market-to-book value as proposed by Hong and Kacperczyk (2009) and Hsu et al. (2017). As it does not seem to be a substantially improved model, the market-to-book value will not be used as a control variable for further tests. Despite the Emission Reduction Score being an industry benchmarked score, industry fixed effects are included to account for industry-level differences for the other tested variables. Finally, the Emission Reduction Score is replaced by the broader Environmental Score, a broader percentile score to indicate a firm's environmental performance. All regression estimates are positive and significantly different from zero, indicating that institutional ownership is higher for firms with higher Emission Reduction Scores. As Institutional Ownership is a percentage (from 0 to 1) and the Emission Reduction Score is a percentile score from 0 to 100, the coefficient can be interpreted as percentage points. For a 1% increase in Institutional Ownership, the Emission Reduction Score increases with 0.07 points. This means that a standard deviation change in Institutional Ownership (0.29), relates to a 1.9-point increase in the Environmental Reduction Score. As the coefficients are significantly different from zero at the 0.01 level, the null hypothesis that

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<sup>14</sup> For the Hausman test, the H0 suggests the use of a random effects model. As the test indicated that the test statistic is significantly different from zero, the H0 can be rejected.

Institutional Ownership is not related to industry benchmarked emission score, is rejected. It seems that institutional ownership is positively associated with best-in-class emission selection.

As discussed in the hypothesis development, it is not expected that institutional ownership has a statistically significant relation to direct carbon emissions, due to the loss of diversification benefits. Regressions of carbon to assets on Institutional Ownership provide some evidence of an inverse relationship: for the baseline regression without industry fixed effects, carbon to assets increases with 0.025 if Institutional Ownership increases with 1%. However, when industry fixed effects are included, the parameter coefficient is no longer significant. Interestingly, it seems that this significant effect only exists for U.S. firms. The table with regression estimates can be found in Appendix E.

**Table 2: Baseline Regressions**

This table reports regression estimates of Emission Reduction Score and the Environmental Score on institutional ownership and other control variables for the full sample, using year, country and/or industry fixed effects. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. In Panel A the baseline regression for the full panel are presented. For Panel B the sample is split into a high emitters group (top 10%) and the rest (bottom 90%), based on a firm's carbon to assets ratio. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

PANEL A: Baseline Regressions Full Sample				
Variables	(1) Emission Reduction Score	(2) Emission Reduction Score	(3) Emission Reduction Score	(4) Environmental Score
Institutional Ownership (IO)	6.698*** (1.914)	6.253*** (1.907)	5.732*** (1.920)	6.282*** (1.495)
Log Tobin's Q	9.417*** (0.776)	1.711 (1.492)	8.128*** (0.817)	9.206*** (0.614)
Log Tangibility	1.731*** (0.247)	1.463*** (0.252)	1.279*** (0.300)	1.951*** (0.194)
Log Assets	8.832*** (0.273)	9.044*** (0.274)	9.045*** (0.274)	8.015*** (0.217)
Leverage	-9.014*** (2.190)	-17.26*** (2.666)	-8.372*** (2.259)	-8.096*** (1.768)
Return on Assets (ROA)	0.0124 (0.0516)	-0.0274 (0.0514)	0.0246 (0.0516)	-0.126*** (0.0393)
Market to Book Value		5.364*** (0.869)		
Constant	-83.62*** (4.029)	-46.09*** (7.317)	-87.10*** (4.038)	-70.34*** (3.132)
Observations	20,053	20,053	20,053	20,053
Adjusted R-squared	0.328	0.334	0.335	0.401
F-statistic	207.06	186.97	214.42	271.59
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	No

PANEL B: Baseline Regression: sample split by top 10% carbon emitting firms				
Variables	(1) Emission RS <i>Bottom 90% Emitters</i>	(2) Emission RS <i>Bottom 90% Emitters</i>	(3) Emission RS <i>Top 10% Emitters</i>	(4) Emission RS <i>Top 10% Emitters</i>
Institutional Ownership (IO)	7.338*** (1.973)	6.239*** (1.986)	2.153 (6.125)	-0.163 (6.144)
Log Tobin's Q	9.521*** (0.788)	8.249*** (0.834)	5.486 (4.090)	3.228 (4.275)
Log Tangibility	1.405*** (0.255)	1.124*** (0.304)	3.354 (2.216)	2.962 (2.380)
Log Assets	8.618*** (0.284)	8.870*** (0.286)	10.77*** (0.970)	11.25*** (0.982)
Leverage	-9.739*** (2.254)	-9.311*** (2.324)	10.42 (7.741)	12.76 (7.954)
Return on Assets (ROA)	0.0617 (0.0530)	0.0666 (0.0532)	-0.299* (0.168)	-0.331** (0.163)
Constant	-81.64*** (4.123)	-85.10*** (4.136)	-117.0*** (16.01)	-124.4*** (16.54)
Observations	18,057	18,057	1,996	1,996
Adjusted R-squared	0.330	0.336	0.385	0.399
F-statistic	185.35	193.98	28.92	29.03
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

As specific industries have substantially higher corporate carbon emissions, institutional investors would need to exclude entire industries based on the negative screening approach. Dyck et al. (2019) find that institutional ownership positively affects environmental and social (E&S) performance for firms with already higher E&S performance. They do not find statistically significant results for the lower E&S performing firms. This raises the question of whether institutional investors actually use the best-in-class screening method for high emitters. When assessing the data, it seems that the top 10% carbon-emitting firms are responsible for 90% of total carbon emissions. A graph displaying the sample distribution for corporate carbon emissions can be found in Appendix D. Reasoning from a sin-industry perspective: if an institutional investor chooses to buy stocks within a high emitting industry, does it need to take best-in-class screening into account? Therefore, the sample is split into two different groups: the top 10% of emitters based on direct CO<sub>2</sub> and CO<sub>2</sub> equivalent emissions, and the bottom 90%. The results can be found in Table 2 Panel B and confirm that for the bottom 90%, being responsible for 10% of total emissions, best-in-class screening methods are used by institutional investors. However, for the top-emitting group, being responsible for 90% of total emissions in this sample, there are no significant results.

## 5.2 Lagged Regression

The first step to a causal relation between institutional ownership and corporate emission improvement is the examination of a lagged effect. In Table 3 Panel A the regression coefficients of equation 2.1 (columns 1 and 2) and 2.2 (columns 3 and 4) are reported. The parameter coefficient of the variable of interest, Institutional Ownership, is significant at the 0.01 level for all regressions. This indicates that Institutional Ownership in both year  $t-1$  and  $t-2$ , is positively related to the Emissions Reduction Score. It can be assumed that corporate emission reduction can take time to improve, and institutional investors are more motivated to engage for longer investment horizons. This is confirmed by a larger coefficient for the two-year lag regressions.

**Table 3: Lagged Regressions**

This table reports regression estimates of Emission Reduction Score on lagged institutional ownership and other lagged control variables for the full sample, using year, country and/or industry fixed effects. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. In Panel A the baseline regression for the full panel are presented. For Panel B the sample is split into a high emitters group (top 10%) and the rest (bottom 90%), based on a firm's carbon to assets ratio. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

PANEL A: Regression using 1 and 2 year lagged models				
Variables	(1) Emission RS 1-year lag	(2) Emission RS 1-year lag	(3) Emission RS 2-year lag	(4) Emission RS 2-year lag
Institutional Ownership (IO)	7.498*** (2.035)	6.621*** (2.039)	8.912*** (2.298)	8.100*** (2.302)
Log Tobin's Q	10.05*** (0.848)	8.946*** (0.893)	10.09*** (0.977)	9.265*** (1.025)
Log Tangibility	1.833*** (0.265)	1.447*** (0.325)	1.955*** (0.294)	1.682*** (0.363)
Log Assets	8.911*** (0.288)	9.121*** (0.290)	8.935*** (0.319)	9.152*** (0.321)
Leverage	-8.425*** (2.364)	-8.030*** (2.443)	-8.107*** (2.647)	-8.166*** (2.743)
Return on Assets (ROA)	0.00956 (0.0558)	0.0149 (0.0562)	0.0379 (0.0632)	0.0303 (0.0638)
Constant	-84.36*** (4.289)	-87.61*** (4.297)	-84.10*** (4.855)	-87.10*** (4.861)
Observations	16,748	16,748	13,486	13,486
Adjusted R-squared	0.323	0.329	0.307	0.313
F-statistic	190.95	196.41	154.22	158.39
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

PANEL B: 1-Year Lagged Regression CO2 Emission Subsamples				
Variables	(1) Emission RS <i>Bottom 90% emitters</i>	(2) Emission RS <i>Bottom 90% emitters</i>	(3) Emission RS <i>Top 10% emitters</i>	(4) Emission RS <i>Top 10% emitters</i>
Institutional Ownership (IO)	7.498*** (2.035)	6.621*** (2.039)	4.255 (6.357)	1.602 (6.378)
Log Tobin's q	10.05*** (0.848)	8.946*** (0.893)	6.043 (4.291)	2.950 (4.482)
Log Tangibility	1.833*** (0.265)	1.447*** (0.325)	3.862 (2.390)	3.192 (2.557)
Log Assets	8.911*** (0.288)	9.121*** (0.290)	10.45*** (1.062)	10.99*** (1.066)
Leverage	-8.425*** (2.364)	-8.030*** (2.443)	9.434 (8.260)	10.41 (8.455)
Return on Assets (ROA)	0.00956 (0.0558)	0.0149 (0.0562)	-0.385** (0.175)	-0.400** (0.169)
Constant	-84.36*** (4.289)	-87.61*** (4.297)	-110.4*** (17.40)	-117.9*** (17.77)
Observations	16,748	16,748	1,696	1,694
Adjusted R-squared	0.323	0.329	0.367	0.383
F-statistic	190.95	196.41	23.14	23.40
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

Similar to the baseline regression, the sample is split into the top 10% emitters and the lower emissions group (90%). Where the baseline addresses the best-in-class selection of institutional investors for the top polluting firms, this lagged regression investigates institutional investor engagement for the top polluting firms. Though the baseline regression confirms that institutional investors do not use best-in-class screening methods for top-emitting firms, they could push for emission reduction related to their industry peers. From a climate change perspective, this would be most meaningful for reducing global carbon emissions. Unfortunately, the regression results presented in Table 3, Panel B show no statistically significant estimates for Institutional Ownership. This is in line with earlier research, which argues that institutional shareholder engagement mainly affects firms with a rather good ESG level in improving these ESG levels (Dimson, Karakas & Li, 2015; Barko et al., 2018; Dyck et al., 2019).

### 5.3 Causality Tests

In order to support the causal relationship suggested by the lagged regressions (hypothesis 2.1), further tests are conducted. As a first step toward causality, a Granger Causality test is performed by interchanging the independent variable Institutional Ownership and the Emissions Reduction Score, thus testing two different directions. In order to indicate a causal

**Table 4: Granger Causality Test**

This table reports regression estimates of a Granger Causality Test. For column 1 and 2, Emission Reduction Score is regressed on lagged institutional ownership, lagged Emission Reduction Score and other lagged control variables, using year, country and/or industry fixed effects. For column 3 and 4, institutional ownership is regressed on lagged Emission Reduction Score, lagged institutional ownership and other lagged control variables. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Granger Causality Test				
Variables	(1) Emission Reduction Score	(2) Emission Reduction Score	(3) IO	(4) IO
Institutional Ownership (IO)	1.822*** (0.453)	1.769*** (0.458)	0.889*** (0.00542)	0.888*** (0.00553)
Emission Reduction Score	0.885*** (0.00418)	0.884*** (0.00421)	1.19e-05 (2.39e-05)	4.56e-06 (2.39e-05)
Log Tobin's Q	1.813*** (0.232)	1.821*** (0.241)	0.00700*** (0.00165)	0.00612*** (0.00170)
Log Tangibility	0.226*** (0.0563)	0.209*** (0.0716)	-0.00205*** (0.000401)	-0.00168*** (0.000483)
Log Assets	0.996*** (0.0735)	1.022*** (0.0751)	-0.00320*** (0.000517)	-0.00284*** (0.000525)
Leverage	-1.075** (0.512)	-1.079** (0.529)	0.00645* (0.00387)	0.00577 (0.00393)
Return on Assets (ROA)	-0.0411** (0.0184)	-0.0394** (0.0188)	-0.000715*** (0.000130)	-0.000728*** (0.000130)
Constant	-8.297*** (1.048)	-8.676*** (1.060)	0.122*** (0.00863)	0.120*** (0.00855)
Observations	16,748	16,748	16,748	16,748
Adjusted R-squared	0.858	0.858	0.944	0.944
F-statistic	12,371.44	12,109.39	4055.19	3738.64
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

relation, Institutional Ownership at time  $t-1$  should have significantly different from zero parameter estimates when Emission Reduction Score at time  $t$  is the dependent variable, controlling for an Emission Reduction Score at time  $t-1$ . However, Emission Reduction Score at time  $t-1$  should not have significantly different from zero parameter estimates when Institutional Ownership at time  $t$  is the dependent variable, controlling for Institutional Ownership at time  $t-1$ . Regression results are presented in Table 4. The Granger Causality test confirms the direction of the relationship between institutional ownership and corporate carbon emissions. The parameter estimates of Institutional Ownership are significantly different from zero at the 0.01 level for columns 1 and 2. The opposite direction, where a lagged Emission Reduction Score explains Institutional Ownership does not have statistically significant

**Table 5: Paris Climate Convention**

This table reports regression estimates of Emission Reduction Score or CO2 to Assets on lagged institutional ownership and other lagged control variables for the full sample, using year, firm and country fixed effects. Paris Climate Convention is a dummy variable equal to 1 if year  $t$  is equal to or after 2016, and zero otherwise. The parameter estimate of IO x Paris Climate Convention indicates the change in effect of institutional ownership after the Paris Climate Convention during the end of 2015. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Casualty Test: Paris Climate Convention			
Variables	(1) Emission RS <i>Full Sample</i>	(2) CO2 Assets <i>Full Sample</i>	(3) Emission RS <i>US Sample</i>
IO x Paris Climate Convention	2.309* (1.385)	-0.169*** (0.0563)	5.828** (2.949)
IO	-0.285 (2.078)	0.0719 (0.0826)	-3.563 (3.077)
Log Tobin's Q	2.060** (0.853)	-0.0366 (0.0339)	0.266 (1.101)
Log Tangibility	1.065* (0.547)	0.139*** (0.0450)	0.512 (0.886)
Log Assets	6.384*** (0.776)	-0.179*** (0.0316)	5.360*** (1.057)
Leverage	1.817 (2.513)	0.316*** (0.105)	-0.660 (3.341)
Return on Assets (ROA)	0.0952*** (0.0364)	-0.000474 (0.00154)	0.110** (0.0502)
Constant	-44.75*** (11.87)	-1.131** (0.477)	-33.82** (16.20)
Observations	16,396	16,396	9,321
Adjusted R-squared	0.838	0.956	0.844
F-statistic	13.05	11.21	5.61
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	No
Firm Fixed Effects	Yes	Yes	Yes

parameter estimates for the Emission Score. For this test, the first null hypothesis indicating that regression coefficients for Institutional Ownership in year  $t-1$  affecting the Emission Reduction Score in year  $t$  are not significantly different from zero, can be rejected. The null hypothesis indicating that the parameter estimates for Emission Reduction Score in year  $t-1$ , affecting Institutional Ownership in year  $t$ , cannot be rejected. As many researchers stress that the Granger Causality test should be interpreted with caution, further tests are necessary in order to confirm a causal relation.

In Table 5, the regression results of the difference-in-difference analysis for the Paris Climate Conference are reported. The first regression (column 1) represents equation 3. The estimator parameter of interest, IO x Paris Climate Convention has a positive coefficient,

significant at the 1% level. This interaction term indicates that after the Paris Climate Convention, the effect of Institutional Ownership on a firm's Emission Reduction Score becomes stronger. In order for the difference-in-difference model to hold, a parallel trend prior to the event needs to be present. This entails that the treated and control groups within the regression should not have substantial differences before the event in order to compare the groups differences after the event. Though Institutional Ownership is a continuous variable, the sample is split into a treated and control group based on the institutional ownership levels prior to the Paris Climate Agreement. The graph displayed in Appendix I suggests the presence of a parallel trend in the three years prior to the event.

As a robustness check, the Assets is also used. Interestingly, this regression reports a significant (0.01 significance level) negative coefficient, indicating that institutional owners engaged in lower carbon emission (relative to firm size). Finally, the sample is split into U.S. firms only. This provides already intuitive results on the effect of social norms on institutional investors for U.S. firms, as the reaction effect seems stronger (5.828) than for the full sample, including European firms (2.309).

The results of the post-event effect of the Paris Climate Convention, together with the Granger Causality test, provide convincing evidence that the relation between institutional investors engaging in Emission Reduction Score improvement is directional. In other words, it seems that firms with higher Institutional Ownership are pushed to improve their carbon emissions relative to industry peers. Though evidence on the motivations of institutional investors is mixed, it seems that after an awareness shock like the Paris Climate Convention, institutional investors are more motivated to push for corporate emission improvement.

#### 5.4 Institutional Investors' Motivations

To answer both the questions whether institutional investors are financially motivated and if emission reduction practices increase financial performance, the relation of firm profitability to the Emission Reduction Score can be examined. As discussed in the literature review, researchers find contradicting evidence of environmental improvement investments either harming profits or resulting in increased financial performance. One of the important issues is the timing of the investments. Bénabou and Tirole (2009), Deng et al. (2013) both find that though investments can harm short term financial performance, long-term financial benefits also seem present. Similar to research performed by Delmas et al. (2015), Return on Assets (ROA) is regressed on the lagged Emission Reduction Score and control variables in order to test the relation between corporate emission improvement and financial profitability.

**Table 6: Lagged Regressions related to Firm Profitability**

This table reports regression estimates of Return on Assets on the lagged Emission Reduction Score and other lagged control variables for the full sample, using year, country and/or industry fixed effects. Return on Assets is a ratio of a firm's net income in year  $t$ , to a firm's total assets. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Institutional Ownership is capped at 100%. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. In columns 1 and 2 a 1-year lag is used, for columns 3 and 4 this is a 2-year lag. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Lagged regression of Return on Assets on Emission Reduction Score and control variables				
Variables	(1) Return on Assets 1-year lag	(2) Return on Assets 1-year lag	(3) Return on Assets 2-year lag	(4) Return on Assets 2-year lag
Emission Reduction Score	0.00136 (0.00268)	0.00159 (0.00264)	0.00615** (0.00279)	0.00517* (0.00273)
Institutional Ownership (IO)	2.002*** (0.382)	1.720*** (0.379)	1.563*** (0.412)	1.203*** (0.402)
Log Tobin's Q	5.931*** (0.222)	5.958*** (0.226)	5.841*** (0.235)	5.775*** (0.236)
Log Tangibility	0.554*** (0.0492)	0.705*** (0.0591)	0.421*** (0.0501)	0.586*** (0.0587)
Log Assets	0.610*** (0.0617)	0.614*** (0.0634)	0.348*** (0.0651)	0.386*** (0.0664)
Leverage	-2.452*** (0.469)	-2.879*** (0.468)	-2.072*** (0.497)	-2.553*** (0.492)
Constant	-5.690*** (0.923)	-5.028*** (0.929)	-1.849* (0.991)	-1.519 (0.994)
Observations	16,757	16,757	13,494	13,494
Adjusted R-squared	0.283	0.301	0.277	0.298
F-statistic	240.33	195.57	205.01	166.69
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

The results reported in Table 6 cover both a 1-year lag (columns 1 and 2) and a 2-year lag (columns 3 and 4) of the Emission Reduction Score and the control variables. Based on the results reported in columns 1 and 2, the Emission Reduction Score does not seem to be significantly related to Return on Assets. This suggests that corporate emission improvement is not related to profitability in the next year. Thus, it neither harms nor improves financial performance. However, when examining the 2-year lagged regressions in columns 3 and 4, there seems to be a significant positive effect. This indicates that firms have increased financial profitability two years after corporate emission reduction related to industry peers.

Though Return on Assets reflects true financial performance directly resulting from emission reductions, it does not incorporate market valuations. Especially because CSR and environmental improvement is perceived as a long-term investment, the market's beliefs about long-term performance should also be taken into account (Bénabou & Tirole, 2009; Deng et

al., 2013; Delmas et al., 2015; Riedl & Smeets, 2017). In addition, it is unclear if increased profitability is also financially beneficial for the investors through dividends or increased stock returns. Therefore, researchers propose the market-based measure Tobin's q to investigate the market's long-term perspectives on increased financial performance (Dowell et al., 2000; Delmas et al., 2015). In a subsequent regression, ROA is replaced by Tobin's q. The results are presented in Appendix J. For both the 1-year and 2-year lagged regressions, the estimator parameters of the Emission Reduction Score are positive and statistically different from zero. This suggests that improved corporate emissions are positively related to long-term financial performance. Taking the results of both the accounting-based Return on Assets and market-based Tobin's q regressions into account, institutional investors could be financially motivated when engaging in corporate emissions improvements.

As previously mentioned, instead of being motivated by social norms, institutional investors can be motivated by litigation risks (Renneboog et al., 2008). Hsu et al. (2017) find evidence of government changes affecting environmental improvement for state-owned firms. This suggests that institutional investors could be rather motivated by laws and governmental policy than directly by social norms. To test this, the U.S. is an interesting case to examine. The U.S. experienced a turnaround in environmental protection policy due to the installment of the Trump administration. President Trump reversed more than 100 environmental protection laws and was strongly against mitigating climate change during his campaign and the first months in office (Hejny, 2018; Popovich, Albeck-Ripka & Pierre-Louis, 2018). If institutional investors are truly motivated by social norms, they could increase their efforts to engage in corporate emission reduction due to the lack of governmental regulation. Using a similar difference-in-difference model as the Paris Climate Convention regression, the strengthened (or weakened) effect of Institutional Ownership on the Emission Reduction Score after the installment of the Trump administration can be examined. Regression results of the difference-in-difference analysis of the Emission Reduction Score on the interaction term  $IO \times Trump\ Administration$  are presented in Appendix K. The positive coefficient of the interaction terms indicates that after the installment of the Trump administration, the relation between lagged Institutional Ownership and Emission Reduction Score has strengthened. As the test is very similar to the Paris Climate Convention regression, the sample is narrowed to a 2-year event window, in an attempt to isolate the effect of the governmental policy change. Though the coefficient slightly decreases, it remains positive and statistically different from zero at the 1% level. Thus, it seems that institutional investors reacted by engaging in emission improvement.

## 6 Discussion & Limitations

### 6.1 Discussion

For activism towards ethical or socially responsible improvements, research has shown the vital role of institutional investors. Investors either vote with their feet (Hong & Kacperzcyck, 2009; Dyck et al., 2019; Nofsinger et al., 2019) or actively pursue changes in firm's CSR policies (Fernando et al., 2010; Dyck et al., 2019; Chen, Dong & Lin, 2020). In this paper, both institutional investors' screening strategies in selecting more carbon emission friendly stocks and their engagements in improving corporate carbon emissions have been addressed.

Regarding the screening strategies performed by institutional investors, both the best-in-class and the negative selection screening strategies have been assessed. Contra intuitively, there is weak evidence of institutional investors selecting stocks with a somewhat higher carbon to assets ratio. As addressed in previous sections, this could be explained by diversification and thus, financial benefits. It could be that for institutional investors, the financial benefits of including highly pollutive firms in their portfolio exceeds the cost of excluding these firms. However, one should interpret the carbon to assets regression results with caution, as this measure is not properly benchmarked. The results mainly suggest that institutional investors do not pursue negative screening strategies when selecting their stocks. For the best-in-class screening strategy, the Emission Reduction Score is used, indicating a firm's commitment and efforts in reducing its carbon emissions, relative to industry peers. This percentile score variable makes it possible to compare different industries. Though, as carbon emissions are related to specific industry types, it does not fully capture the effect of institutional investors selecting lower emission stocks. Heinkel et al. (2001) find that excluding polluting companies from an investor's portfolio leads to lower stock returns due to the decreased risk-sharing among investors. This could incentivize these polluting companies to alter their behavior towards a more socially responsible way. In order for the findings to be meaningful in terms of climate change, the group of high carbon emitters should also be subject to institutional investor selection. Unfortunately, this does not seem to be the case. The top emitters subsample, representing 10% of total firms in the sample, is responsible for 90% of total carbon emissions in the sample. When performing the baseline regression for this subsample, the coefficients do not turn out to be significantly different from zero. The first hypothesis, stating that firms with higher carbon emissions relative to their industry peers have lower institutional ownership can therefore be partially confirmed. Though the hypothesis holds for 90% of the sample, the part of the sample that has the most significant effect on climate change does not experience

exclusion from institutional investor portfolios. One could suggest that, if the institutional investor chooses to invest in highly pollutive industries, it does not take best-in-class selection into account as it already selected a ‘sin-full’ industry. In other words, the institutional investor does not try to select the ‘best’ of the ‘worst’ group, as it has already chosen to invest in the ‘worst’ group.

Contrary to the ‘voting with their feet’ approach, institutional investors can also engage in corporate carbon emission improvements. Rather than excluding a firm from one’s portfolio, thereby losing diversification benefits, an investor could be more motivated to push for environmental improvement. The lagged regression results provide evidence of institutional investors engaging in carbon emission improvement, relative to industry peers. Previous research argues that institutional investor engagement is related to a longer investment horizon. In line with this, results show a stronger effect for a two- instead of one-year lag. Thus, institutional investors drive carbon emission improvement on the long-term. Similar to the stock selection regressions, institutional investor engagement is examined for the top 10% highest emission firms. Also, for the lagged effect regression, the coefficients do not seem to significantly differ from zero. In addition to the lack of best-in-class screening strategies for this group, institutional investors do not seem to push for carbon emission improvements.

As the lagged regression models are subject to the reverse causality issue, further testing is necessary to partially confirm a causal relation. In addition to a Granger Causality test, a shock of climate change awareness is introduced. The Paris Climate Convention displays a strengthened effect of institutional ownership engagements towards industry benchmarked emission reduction and carbon emission relative to size reduction. This provided further supporting evidence of a causal relation of institutional ownership towards corporate emission improvements. The second hypothesis indicated a causal relationship where higher institutional ownership results in lower corporate carbon emissions relative to industry peers. Taking the lack of significant results for the top 10% emitters into account, the hypothesis (H2.1) is partially confirmed.

As an extension to the research of the effects of social norms on institutional investors, true motivations of institutional investors are examined. Used both an accounting and market valuation measure, results indicate the presence of a financial motivation. Especially for long-term performance, both firm profitability and firm valuation are improved related to corporate emission reductions. In an attempt to distinguish between social norms and legislative norms, the government policy change for the U.S. is examined. The regression results suggest that after the installment of the Trump administration, the engagement of institutional investors

strengthened. Taking into account the severe policy change for the U.S., where President Trump clearly advocates for reversing environmental protection laws, these results provide meaningful evidence of the role of institutional investors in reducing corporate carbon emissions. As this final part of the paper is of a more exploratory approach, further testing is necessary to truly capture motivations of institutional investors. Suggestions for further research are provided in the concluding remarks of this paper.

## 6.2 Limitations

Despite the best efforts to conduct the research carefully, several limitations to the paper exist.

To start with, it seems that there is some selection bias present due to the reporting of emissions. As addressed in the data section of this paper, the sample is composed using the constituent lists of the Thomson Reuters ESG Database. The sample is dependent on the firms covered by Thomson Reuters, which are mainly large firms. Though Thomson Reuters stresses that many firms are added to the sample, the data available for earlier years (before 2014) seems to be limited. Taking the sample distribution into account (Appendix G), the years 2015 up to 2018 seem to be overrepresented in the sample.

In addition to the selection bias, there are various reporting standards for corporate emissions between countries and firms. Despite of the rise of corporate emission reporting laws, (especially U.S.) firms report their carbon emissions on a voluntary basis. This leads to a certain bias towards firms being more transparent in their corporate carbon emissions. However, Thomson Reuters explains that if emissions are not reported, carefully estimated models are used in order to provide firm's carbon emissions. Though, this does rely on the transparency of a firms reporting and is subject to estimation biases. Also, if a firm voluntarily chooses to report its emissions, there is no standardized reporting approach (Doda et al., 2016; Stanny, 2018). Stanny (2018) finds that most U.S. electric utility sector firms do not verify their estimated greenhouse gas emissions with a third party. She suggests that one should be cautious in relying on and interpreting voluntary emission disclosures. Thomson Reuters attempts to standardize corporate emissions, using the Greenhouse Gas Protocol standard<sup>15</sup>. If the careful research, estimations, and calculations of Thomson Reuters are reliable and accurate, there are still issues in assigning carbon emissions to a particular firm. For the direct carbon emissions, scope 1 CO<sub>2</sub> emissions are used. This entails that only emissions from a firm's operations and production are taken into account. The standardized approach of the

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<sup>15</sup> More information about the Greenhouse Gas Protocol can be found at: <https://ghgprotocol.org/about-us>

Greenhouse Gas Protocol assigns a corporation's emissions to scope 1, 2, or 3. As mentioned, scope 1 includes carbon emissions resulting from operational and production activities. Scope 2 includes carbon emissions from used (or purchased) electricity, steam, heat, and cooling. Finally, scope 3 also takes carbon emissions resulting from up- and downstream activities in the value chain into account. For example, for Boeing, a large aircraft manufacturer, scope 1 includes the carbon emissions from producing an aircraft, scope 2 includes the emissions due to generated electricity in order to run the production facilities. Lastly, scope 3 includes the emissions of suppliers, shipping of parts, waste generated in both up and downstream processes, employee travel, emission of the product itself, and more. Thus, for Boeing, the production of the aircraft could result in relatively low carbon emissions (included in scope 1), whilst the products itself produce a large number of carbon emissions once it is sold and taken into use by airlines (included in scope 3). Therefore, it is debatable what the actual impact of a firm on carbon emissions and climate change is. In addition, taking into account all the up- and downstream processes, calculation scope 3 emissions can be very complex.

For the past approximately five years, the amount of socially responsible investments has made an exponential increase (US SIF, 2018). As media are beginning to report more on climate change, natural disasters seem to occur more often, and global warming starts to become more visible.<sup>16</sup> With the initiation of the Climate Paris Agreement at the end of 2016, it seems that climate change and the global fight to reduce carbon emissions is still at an early stage. To investigate the long-term engagement of institutional investor towards corporate emission behavior, more observations are necessary. As global warming slowly evolves over time, and the climate change moment becomes stronger, time will tell the long-term role of institutional investors. As stressed in this paper, environmental engagement requires a long-term investment strategy. A lagged window of 3 or 5 years would be preferred over 1 or 2 years, which implies that the sample window needs to increase. In addition, any shocks directly linked are difficult to find. Natural disasters also occur in the absence of rising temperatures. Besides, it can be challenging to observe a trend in rising temperatures as outliers could be present.

Finally, in an attempt to separate social norm motives from legal norms, this paper finds that institutional investor engagement increases after a change in environmental laws. As this is the particular case for one country, in one governmental change, the external validity of the

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<sup>16</sup> As addressed in the New York Times and Nature: <https://www.nytimes.com/2020/03/04/climate/australia-wildfires-climate-change.html> & <https://www-nature-com.eur.idm.oclc.org/articles/d41586-020-00627-y>

results is debatable. In addition, it remains difficult to isolate the motivations of institutional investors. Though the evidence suggests presence of financial motivations and for the case of the U.S. lack of legislative motivations, the true social motivations of investors cannot be confirmed. Previous research does suggest the existence of a social norm motivation for institutional investors, financial motivations cannot be ruled out.

## 7 Conclusion

Climate change is an increasing concern among society. Where corporates are contributors to this climate change through their carbon emissions, its owners can influence and mitigate their environmental impact. As for activism towards ethical or socially responsible improvements, research has shown the critical role of institutional investors. Through various motivations, whether this is financial or social normative, institutional investors take ethical objectives into account when selecting their stocks. This paper addresses the extent to which institutional investors take environmental objectives into account and push corporates to improve their environmental performance.

In this paper, both the stock selection and engagement of institutional investors towards corporate emissions have been examined. For the stock selection of institutional owners, both best-in-class selection and negative screening strategies have been taken into account. The results found in this paper indicate that institutional investors pursue a best-in-class selection strategy rather than a negative screening method. Thus, institutional investors seem to select firms with the best industry performance in terms of emission reductions. However, for the decision of including or excluding a stock from an investment portfolio, institutional investors face a trade-off between financial benefits and social costs. Therefore, institutional investors can be motivated to engage in corporate emission improvement. Results from this paper indicate that there is a causal relationship between institutional ownership and corporate emission reduction engagements. However, for both institutional ownership engagement and stock selection, this does not seem to be applicable for the top 10% emitting firms, being responsible for 90% of total emissions. Though this paper does display the role of institutional investors in the battle for climate change, their efforts do not extend to the group with the largest impact on climate change. In an attempt to distinguish social norms from financial and legislative motivations, the profitability resulting from emission improvement and the change in governmental policy have been assessed. There seems to be a financial benefit related to increased corporate emission performance. However, the results in this paper suggest that institutional investors are not motivated by legislation and governmental policy. Where countries do not always take lead in battling climate change, for the case of the U.S., institutional investors could play an important role in improving corporate emissions.

This research builds on existing literature of Hong & Kacperczyk (2009), Hsu et al. (2017) and Dyck et al. (2019), providing insights into institutional investor behavior and their effects on corporate environmental behavior. It also supports evidence found on socially responsible

investments, the implementation of investment screens, and institutional investor activism. The results found in this paper are not only meaningful from an economic perspective, but it is also meaningful regarding to show the efforts of institutional investors towards climate change and global warming.

For future research, it is important to address some of the limitations of this paper. As standardized reporting methods are developed, and carbon emission reporting becomes more mandatory, institutional investors have better access to corporate emission behavior information. As social norms change over time and climate change becomes a large concern among society, this research was conducted in a rather early stage. When more data becomes available and reported values become more standardized and accurate, the role of institutional investors can be further assessed. Also, long-term performance incentives need to be addressed. The existing literature provides very mixing results on the financial versus social motivations of institutional investors. Future research can extend the literature and try to separate the financial from social norms motivations. For example, a survey among institutional investor portfolio managers could expose the social norms they experience and take into account when selecting their stocks.

As a final note, environmental investment behavior and social norms can also be examined from a game-theoretical perspective. Where a stable climate (without the effects of climate change) can be perceived as a public good, it is in the interest of everyone to cooperate by reducing emissions and mitigating the damage already done.<sup>17</sup> In an experimental game with public goods, participants can choose their investment simultaneously. At the first stage of the game, participants choose a substantial amount of investment in order to contribute to the public good. However, when repeating the game, the amount invested by participants goes down to zero as they learn that other participants invest less in the public good, resulting in higher private profits (Croson, 2007). This is an example of the prisoner's dilemma: it is in the best interest of participants to cooperate. However, participants can deviate from the investment and still profit from the public good. This results in the equilibrium that no one contributes to the public good (Ledyard, 1995 via Croson, 2007; Levitt & List, 2007). This prisoner's dilemma could explain why individuals, corporates, and nations do not fully commit to emission reduction: as long as others benefit without bearing the costs, why should you bear the costs yourself?

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<sup>17</sup> According to Cronson (2007) public goods can be defined as “nonrival”, everyone can consume the good at the same time and “Nonexcludable”, one cannot be excluded from consuming the good.

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## 8 Appendix

### Appendix A: List of Variables and Variable Descriptions

<i>Emission Reduction Score</i>	Percentile score from 0 to 100 on the Greenhouse gases (including Carbon) emission reduction. It measures a company's commitment and effectiveness toward reducing environmental missions in the production and operational processes. A high score indicates higher emission reduction and thus positive environmental performance. The score is an industry benchmarked score. Also written as "Emission RS" or "ERS", retrieved from Thomson Reuters' ESG database through Datastream.
<i>Co2 over Assets</i>	Calculated as a ratio of Carbon (CO <sub>2</sub> ) and Carbon equivalent emissions, measured in tons to total assets (in U.S. dollars). Includes 1 <sup>st</sup> scope emissions, i.e. direct emissions from production and operational processes.
<i>Environmental Score</i>	Percentile score from 0 to 100 on the Environmental performance Pillar, composed of the Emission, Resource Use and Innovation categories. A high score indicates positive environmental performance. The score is industry benchmarked, retrieved from Thomson Reuters' ESG database through Datastream.
<i>Institutional Ownership</i>	Percentage of the number of shares held by institutional investors, relative to the total amount of shares outstanding (end of year). Retrieved from Factset Ownership (LionShares).
<i>Tobin's Q</i>	Calculated as the sum of market capitalization and total liabilities, divided by total assets. For analysis, the variable is log-transformed. Market capitalization, total liabilities and total assets are reported in thousands of U.S. Dollar, retrieved from Worldscope and Datastream.
<i>Total Assets</i>	Represents the sum of total assets of the company, reported in thousands of U.S. Dollar. For analysis, the variable is log-transformed. Retrieved from Datastream.
<i>Tangibility</i>	Asset Tangibility is used to predict financial slack. Calculated as the ratio of a company's net plant property and equipment to total assets. For analysis, the variable is log-transformed. Retrieved from Worldscope and Datastream.
<i>Leverage</i>	Calculated as the ratio of total liabilities to total assets. Winsorized at the 5 <sup>th</sup> and 95 <sup>th</sup> percentile. Retrieved from Worldscope and Datastream
<i>Return on Assets</i>	Represents the ratio of a company's net income to total assets. Winsorized at the 5 <sup>th</sup> and 95 <sup>th</sup> percentile. Retrieved from Worldscope and Datastream.
<i>Market to Book Value</i>	Calculated as the ratio of a company's market value (market capitalization) to book value of equity. For analysis, the variable is log-transformed. Retrieved from Worldscope and Datastream.

## Appendix B: Descriptive Statistics by Country

This table reports descriptive statistics of Emission Reduction Score, Institutional Ownership and other control variables for each country in the sample. For each country, the amount of firm year observations (obs), total firms, and mean values of Emission Reduction Score (Emission RS), Institutional Ownership (IO) and CO2 over Assets are provided. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The "other" country category includes colonial countries under the United Kingdom and are treated as separate countries in further analysis. The full sample covers yearly observations, from 2009 up to 2018. U.S. and European firms are included. Variables are log-transformed or winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile.

Table: Summary statistics by Country					
Country	Obs	Firms	Emission RS	IO	CO2 /Assets
Austria (AT)	126	14	60.81	0.21	0.20
Belgium (BE)	229	27	59.06	0.21	0.12
Switzerland (CH)	519	59	61.34	0.33	0.10
Czech Republic (CZ)	33	4	52.97	0.18	0.35
Germany (DE)	797	101	66.04	0.34	0.18
Denmark (DK)	228	26	59.58	0.29	0.11
Spain (ES)	406	48	75.47	0.23	0.44
Finland (FI)	228	25	71.07	0.39	0.11
France (FR)	825	97	80.24	0.32	0.09
United Kingdom (GB)	2,439	296	64.32	0.74	0.13
Greece (GR)	150	18	58.22	0.16	0.41
Hungary (HU)	36	4	72.83	0.31	0.13
Ireland (IE)	110	13	61.11	0.52	0.15
Italy (IT)	407	52	61.22	0.20	0.18
Luxembourg (LU)	43	6	60.00	0.38	0.60
The Netherlands (NL)	314	41	67.02	0.42	0.08
Norway (NO)	160	20	69.40	0.37	0.18
Poland (PL)	238	32	43.74	0.31	0.41
Portugal (PT)	71	9	69.90	0.19	0.78
Sweden (SE)	447	61	65.91	0.40	0.09
Turkey (TR)	235	30	56.80	0.15	0.19
United States (US)	11,836	2,196	45.61	0.79	0.12
Other (UK)	176	26	51.65	0.48	0.10

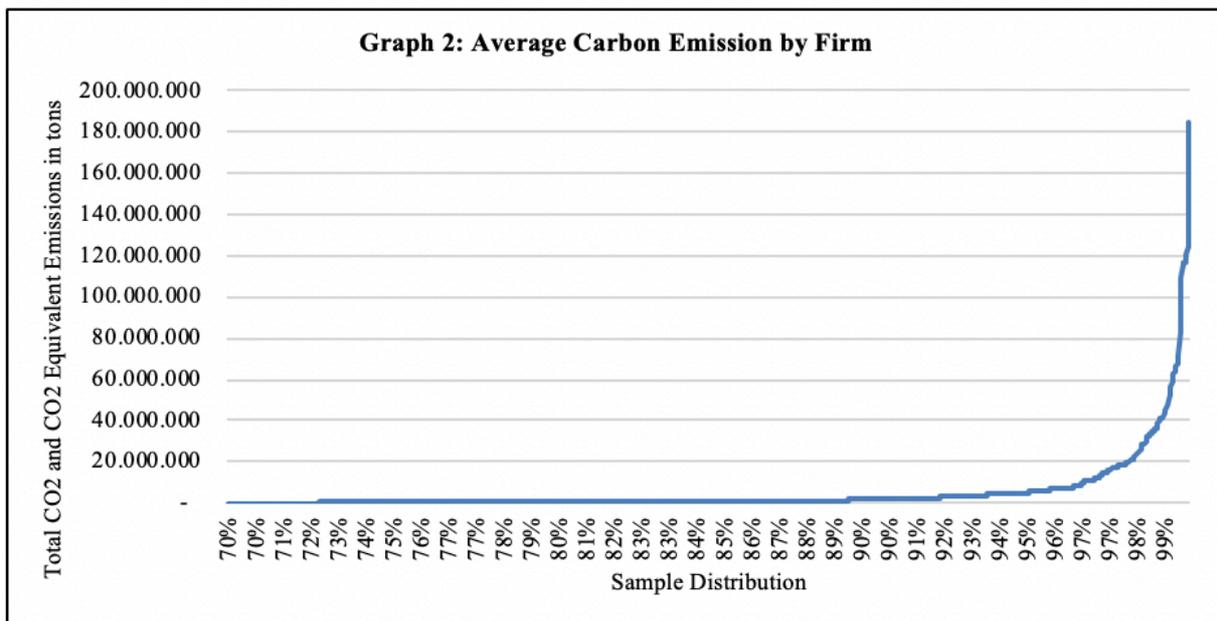
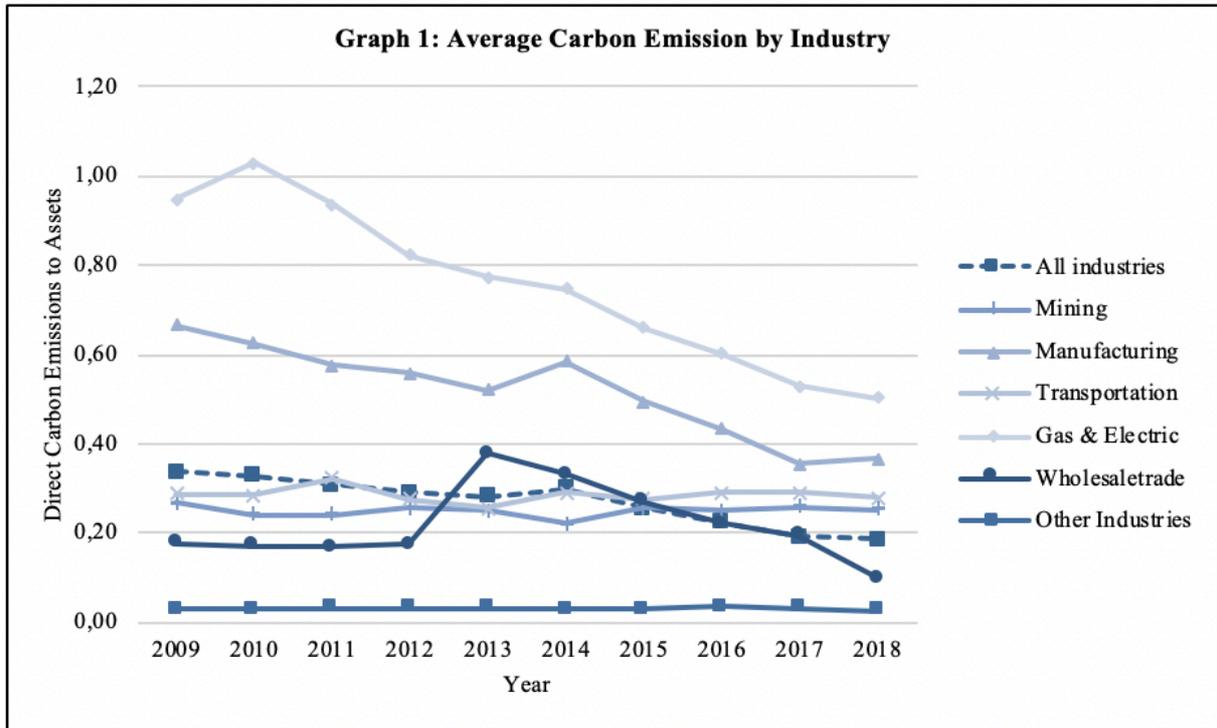
### Appendix C: Correlation Coefficients

This table reports Pearson correlation coefficients of Emission Reduction Score, Institutional Ownership and other control variables for the full sample. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. The Environmental Score and log-transformation of the CO2 to Assets ratio are also used as dependent variables in some regressions. The full sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Correlation Matrix	Emission Score	IO	Log Tobin's Q	Log Tangibility	Log Total Assets	Leverage	Return on Assets	Market to Book Value	Environ. Score	Log CO2 to Assets
Emission Score	1									
Institutional Ownership (IO)	-0.1725***	1								
Log Tobin's Q	-0.0762***	0.2035***	1							
Log Tangibility	0.0178**	0.0246***	0.0228***	1						
Log Total Assets	0.4278***	-0.1822***	-0.4313***	-0.1651***	1					
Leverage	0.1230***	-0.1055***	-0.3026***	-0.2477***	0.4804***	1				
Return on Assets (ROA)	0.0759***	0.0906***	0.3947***	0.1572***	-0.0719***	-0.2344***	1			
Log Market to Book Value	-0.0334***	0.2289***	0.8393***	0.0484***	-0.3162***	0.0095	0.3370***	1		
Environmental Score	0.8893***	-0.2037***	-0.0859***	0.0409***	0.4759***	0.1386***	0.0560***	-0.0481***	1	
Log CO2 to Assets	-0.0254***	0.0582***	0.0981***	0.7081***	-0.2099***	-0.2316***	0.1674***	0.1256***	0.0116*	1

## Appendix D: Carbon Emission Graphs

Graph 1 shows the average corporate carbon emission to assets over time, by industry. In addition, the total sample average is provided (“All industries”). Direct Carbon Emissions to Assets can be defined as an industry’s average of corporate direct CO<sub>2</sub> and CO<sub>2</sub> equivalent emissions in tons, relative to company size, measured in total assets. For simplicity, agriculture, forestry and fishing; construction; communication; retail trade; finance & real estate; and services industries are combined in an “other industries” category. These industry averages are included in the total sample average. Graph 2 displays average corporate carbon emissions for the top 30% of firms in the full sample. The full sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms.



## Appendix E: Baseline regression with Carbon to Assets ratio

This table reports regression estimates of the logarithm of the Carbon to Assets ratio on Institutional Ownership and other control variables for the full sample, using year, country and/or industry fixed effects. The log Carbon to Assets ratio is calculated as firm  $i$ 's total CO<sub>2</sub> and CO<sub>2</sub> equivalent emissions, divided by total assets as a measure for carbon emissions related to size. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. In columns 1 and 2 the baseline regression of Carbon to Assets (log) on Institutional Ownership and control variables for the full sample are presented. In columns 3 and 4 regional sub samples are presented. Year, country and/or industry are used. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Baseline Regression Full Sample CO <sub>2</sub> and CO <sub>2</sub> Equivalent Emissions to Assets				
Variables	(1) CO <sub>2</sub> to Assets Full Sample	(2) CO <sub>2</sub> to Assets Full Sample	(3) CO <sub>2</sub> to Assets US Sample	(4) CO <sub>2</sub> to Assets Europe Sample
Institutional Ownership (IO)	0.254* (0.143)	0.0590 (0.114)	0.222* (0.124)	-0.182 (0.229)
Log Tobin's Q	0.142** (0.0588)	-0.161*** (0.0491)	-0.146*** (0.0506)	-0.0993 (0.106)
Log Tangibility	0.964*** (0.0217)	0.649*** (0.0181)	0.658*** (0.0208)	0.602*** (0.0305)
Log Assets	-0.118*** (0.0196)	-0.0858*** (0.0162)	-0.0897*** (0.0188)	-0.0825*** (0.0306)
Leverage	-0.0476 (0.157)	0.530*** (0.129)	0.444*** (0.135)	0.536** (0.251)
Return on Assets (ROA)	0.0128*** (0.00336)	0.0216*** (0.00278)	0.0268*** (0.00315)	0.00417 (0.00539)
Constant	-0.466 (0.297)	-1.758*** (0.249)	-1.740*** (0.286)	-1.814*** (0.473)
Observations	20,053	20,053	11,836	8,217
Adjusted R-squared	0.525	0.701	0.703	0.711
F-statistic	500.36	280.97	271.30	84.63
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	Yes	Yes

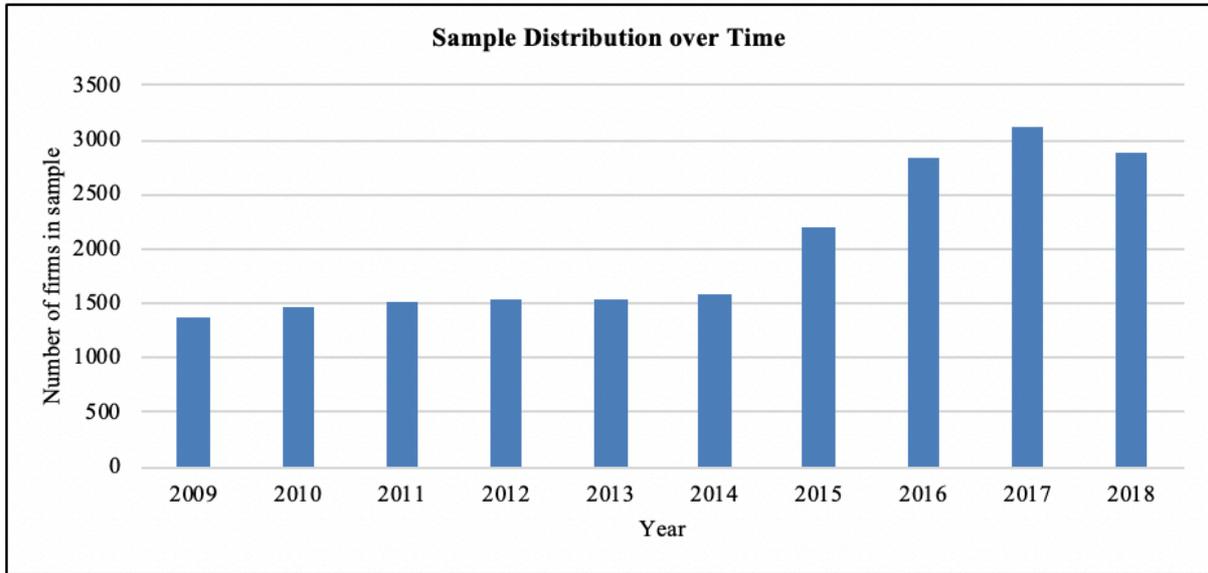
## Appendix F: Baseline regression with region subsamples

This table reports regression estimates of the Emission Reduction Score on Institutional Ownership and other control variables for the regional subsamples, using year, country and/or industry fixed effects. Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. Institutional Ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. Columns 1 and 2 use the European sample, column 3 reports coefficient estimates for the U.S. sample. Year, country and/or industry are used. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Baseline Regression Region Subsamples			
Variables	(1) Emission RS Europe	(2) Emission RS Europe	(3) Emission RS U.S.
Institutional Ownership (IO)	10.55*** (3.239)	10.79*** (3.265)	1.623 (2.373)
Log Tobin's Q	6.246*** (1.289)	6.268*** (1.377)	9.141*** (1.032)
Log Tangibility	1.063*** (0.347)	0.983** (0.431)	1.610*** (0.416)
Log Assets	6.935*** (0.390)	7.046*** (0.409)	10.55*** (0.362)
Leverage	-3.602 (3.614)	-4.836 (3.710)	-10.92*** (2.884)
Return on Assets (ROA)	0.0742 (0.0925)	0.0655 (0.0909)	-0.0534 (0.0661)
Constant	-47.30*** (6.015)	-48.57*** (6.264)	-113.0*** (5.234)
Observations	8,217	8,217	11,836
Adjusted R-squared	0.249	0.253	0.271
F-statistic	62.89	58.04	174.77
Year Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	No
Industry Fixed Effects	No	Yes	Yes

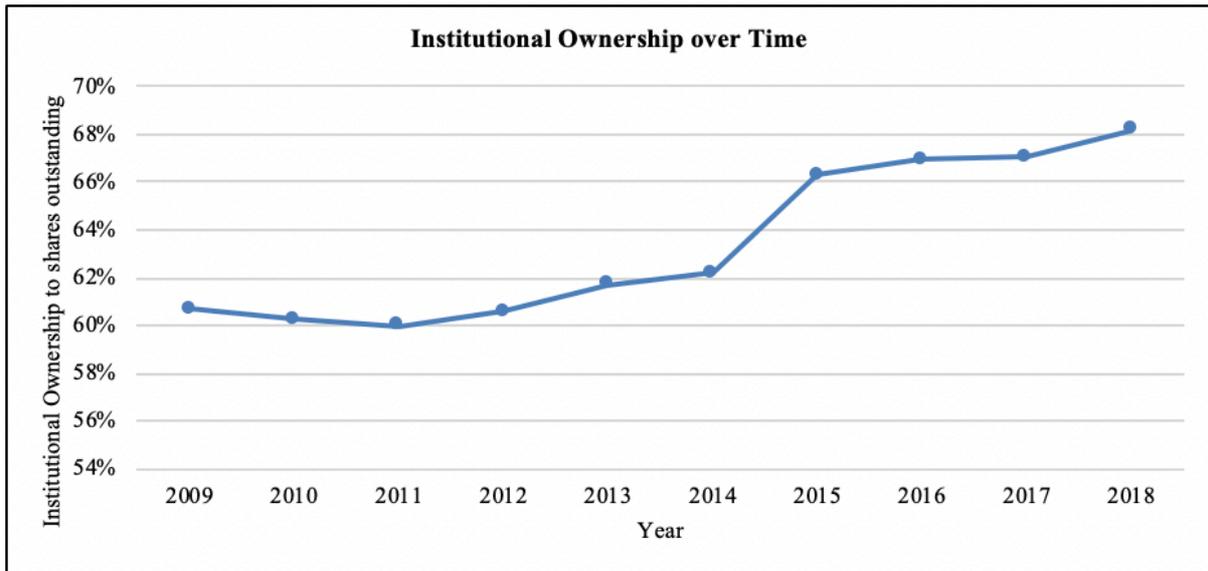
### Appendix G: Sample Distribution Graph

This graph shows the number of firms included in the sample over time. The full sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Sample is based on the Thomson Reuters ESG database constituents lists for the U.S. and Europe. Firms with fewer than two yearly observations or missing observations for one of the included variables are excluded from the sample.



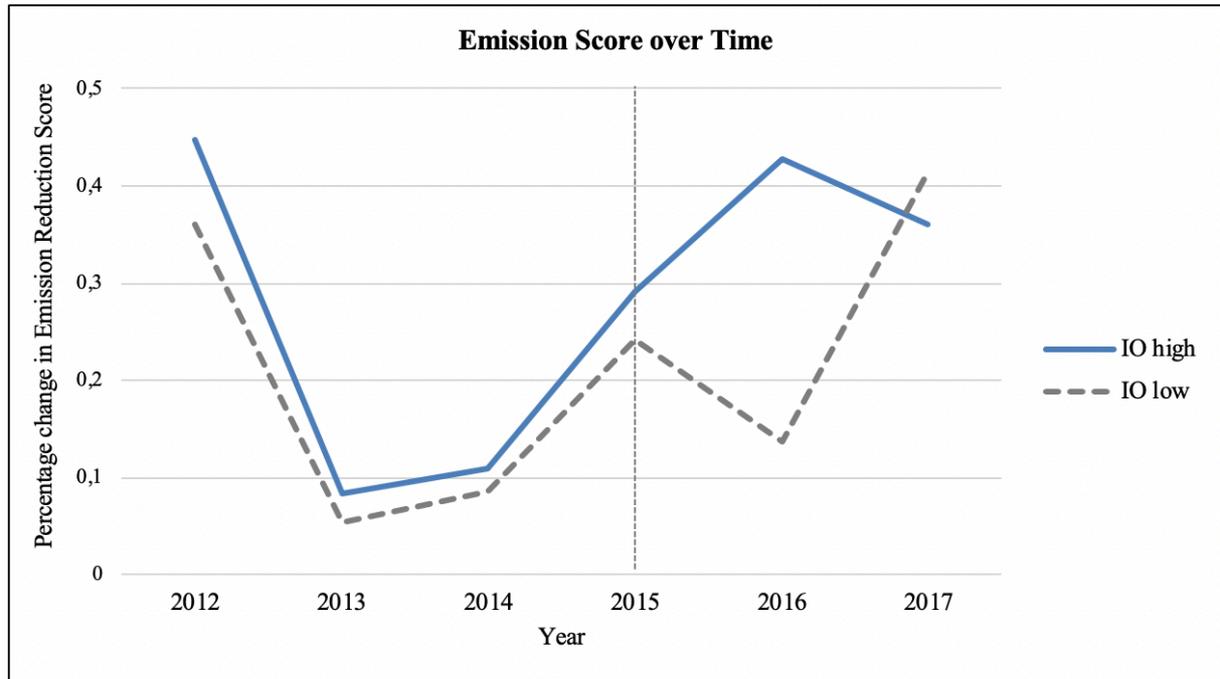
### Appendix H: Institutional Ownership over Time

This graph shows the average Institutional Ownership in the sample over time. Institutional Ownership is calculated as the number of shares held by institutional investors, divided by the number of total shares outstanding. The full sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. The sample is based on the Thomson Reuters ESG database constituents lists for the U.S. and Europe. Firms with fewer than two yearly observations or missing observations for one of the included variables are excluded from the sample.



## Appendix I: Parallel Trend Paris Climate Conference

This graph shows the percentage change in the Emission Reduction Score between the treated (IO high) and control (IO low) groups over time. Institutional Ownership is calculated as the number of shares held by institutional investors, divided by the number of total shares outstanding. For assigning firms to the treated and control groups, a firm's institutional ownership standardized to its country's average institutional ownership in 2013 is used. Firms in the fourth quartile (top 25%) are assigned to the treated "IO high" group. All other firms, having Institutional Ownership in the bottom 75%, are assigned to the control "IO low" group. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. For this graph the percentage change in the score (counting from 0 to 100) is used. The full sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. For this window, only observations between 2012 and 2017 are used. Firms with no observations for 2013 are excluded from this particular analysis.



## Appendix J: Financial Motivations using Tobin's q

This table reports regression estimates of Tobin's q on the lagged Emission Reduction Score and other lagged control variables for the full sample, using year, country and/or industry fixed effects. Tobin's q is the log-transformation of the sum of a firm's market capitalization and total liabilities, divided by its total assets in year t. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. The control variables, Tangibility, Total Assets, and Market to Book value are log-transformed. Institutional Ownership is capped at 100%. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. In columns 1 and 2 a 1-year lag is used, for columns 3 and 4 this is a 2-year lag. The sample covers yearly observations, from 2009 up to 2018 for U.S. and European firms. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Lagged regression of Tobin's q on Emission Reduction Score and control variables				
Variables	(1) Tobin's q 1-year lag	(2) Tobin's q 1-year lag	(3) Tobin's q 2-year lag	(4) Tobin's q 2-year lag
Emission Reduction Score	0.00276*** (0.000266)	0.00218*** (0.000257)	0.00252*** (0.000288)	0.00198*** (0.000278)
Institutional Ownership (IO)	0.00438 (0.0379)	-0.0367 (0.0373)	0.00275 (0.0417)	-0.0357 (0.0412)
Tangibility	-0.0388*** (0.00475)	-0.0505*** (0.00538)	-0.0360*** (0.00519)	-0.0465*** (0.00606)
Assets	-0.135*** (0.00676)	-0.111*** (0.00673)	-0.124*** (0.00767)	-0.102*** (0.00759)
Leverage	-0.102** (0.0494)	-0.0552 (0.0480)	-0.0577 (0.0539)	-0.0265 (0.0525)
Return on Assets	0.0304*** (0.00156)	0.0280*** (0.00155)	0.0323*** (0.00175)	0.0292*** (0.00173)
Constant	2.239*** (0.0891)	1.888*** (0.0887)	2.053*** (0.104)	1.727*** (0.102)
Observations	16,757	16,757	13,494	13,494
Adjusted R-squared	0.379	0.430	0.383	0.434
F-static	218.04	120.79	172.91	96.42
Year Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	No	Yes	No	Yes

## Appendix K: Governmental Policy Change

This table reports regression estimates of Emission Reduction Score or Assets on lagged institutional ownership and other lagged control variables for the full sample, using year and firm fixed effects. Trump Administration is a dummy variable equal to 1 if year  $t$  is equal to or after 2017, and zero otherwise. The parameter estimate of IO x Trump Administration indicates the change in effect of institutional ownership after the installment of the Trump Administration in January 2017. The Emission Reduction Score is a percentile score where a company's emission reduction is benchmarked against industry peers. institutional ownership is the percentage of total shares owned by institutional investors. The control variables Tobin's Q, Tangibility, Total Assets, and Market to Book value are log-transformed. Leverage and Return on Assets are only winsorized at the 5<sup>th</sup> and 95<sup>th</sup> percentile. The sample covers yearly observations of U.S. firms, from 2009 up to 2018. For the regression in column two, the event window is reduced to 1 year before and after the event. Robust standard errors are clustered at the firm-level. Significance levels in the form of P-values are indicated as follows: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Political test: U.S. change in government and environmental policy			
Variables	(1) Emission RS <i>Full Sample</i>	(2) Emission RS <i>2-year window</i>	(3) CO2 to Assets <i>Full Sample</i>
IO x Trump Administration	5.660*** (2.128)	4.118*** (1.485)	0.0503 (0.0584)
IO	-2.712 (2.787)	-4.495 (4.740)	0.0270 (0.0739)
Log Tobin's Q	0.253 (1.103)	-1.095 (2.052)	0.0473 (0.0324)
Log Tangibility	0.514 (0.888)	1.685 (2.732)	0.186*** (0.0342)
Log Assets	5.359*** (1.060)	3.053 (1.923)	-0.0928*** (0.0312)
Leverage	-0.553 (3.340)	-1.651 (6.707)	0.0816 (0.0824)
Return on Assets	0.110** (0.0503)	0.0158 (0.0654)	-0.000427 (0.00143)
Constant	-33.83** (16.23)	9.615 (27.67)	-2.265*** (0.481)
Observations	9,321	2,566	9,321
Adjusted R-squared	0.844	0.915	0.968
F-statistic	6.11	1.75	8.15
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes