CSR Responses amid Changing Regulations: Evidence from the U.S. Exit from the Paris Agreement

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Abstract

In 2017, U.S. President Donald J. Trump announced his intention to withdraw the U.S. from the Paris Agreement, a move that experts forecasted would substantially impede the overall decline in US greenhouse gas emissions. Interestingly, we find that the corporate social responsibility (CSR) performance of firms in carbon-intensive sectors significantly increased compared to firms in other US sectors following the announcement. We further document that our findings are concentrated among large firms, suggesting that sizeable firms reacted to increased public scrutiny. Overall, we theorize that the US departure from the Paris Agreement provided an opportunity for large public US firms to signal their unequivocal commitment to mitigate CO_2 emissions and conclude that booming public concerns over the US exit may have been mostly unwarranted.

Keywords: Corporate social responsibility; Environment; Paris Agreement

JEL Classification: G14, G18, G30, M14

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1. Introduction

On June 1, 2017, U.S. President Donald J. Trump announced his intention to withdraw the U.S. from the Paris Agreement, arguing that the Obama administration's pledge to cut carbon emissions under the current deal is unfair and would "hurt the competitiveness" of the United States.[1] Subsequently, the Trump administration formally notified the United Nations in early 2019 and began the process to withdraw from the agreement.[2] The U.S. exit from the Paris Agreement presents a unique opportunity to study a firm's corporate social responsibility (CSR) reporting behavior amid increasing public expectations and a changing regulatory environment.[3] This study focuses on the sectors most responsible for greenhouse gas emissions in the U.S., and examines the impact of the U.S. exit on the environmental efforts of the associated firms.[4]

The U.S. exit from the Paris accord produced substantial public criticism, especially concerning a potential increase in the U.S. emission space and a decrease in mitigation costs. Alongside, climate experts voiced their concerns about firms hindering the decline in greenhouse gas emissions in the U.S. over an undercut of global climate governance. Exante, it is unclear whether this macroeconomic event 1) adversely affected U.S. firms, and 2) if so, which firms reacted more strongly. Given the lack of empirical evidence in literature, we are motivated to examine whether public firms adversely changed their CSR behavior following the U.S. withdrawal from the Paris agreement.

Contrary to what one might expect, we hypothesize that the CSR performance of carbon-intensive firms relative to non-carbon-intensive firms continued to increase even after the Trump

[1] https://trumpwhitehouse.archives.gov/briefings-statements/statement-president-trump-paris-climate-accord/
[2] https://2017-2021.state.gov/on-the-u-s-withdrawal-from-the-paris-agreement/index.html
[3] The more general term "ESG" (environmental, social, and governance) has been used in literature to include corporate governance. In this paper, the terms CSR and ESG are used interchangeably.
[4] We are aware that the Paris Agreement is a country-level commitment and does not directly impact firms. However, it can be considered a way of aggregating the impact of individual environmental regulations in the U.S.

administration's announcement of the U.S. withdrawal.[5] Given the substantial compliance costs associated with increased CSR reporting, this htpothesis may seem counterintuitive at first. We provide the following explanations. First, carbon-intensive firms likely established emission-reducing initiatives many years ago. It would be too costly, and short-sighted, to change course due to the announcement to exit the Paris Agreement. For example, in 2015, former U.S. President Barack Obama announced that the U.S. would reduce its carbon pollution by approximately 26% from its current level by the year 2025 via the Clean Power Plan, a set of Environmental Protection Agency regulations (Davenport, 2017). Firms that were already undertaking changes to reduce emissions to comply with these regulations had no reason to discontinue their current course of action.

Second, maintaining a positive public image is paramount for the success of a firm with high customer awareness (Servaes and Tamayo, 2013; Krüger, 2015). Besides, the nature of corporate reputation is indubitably volatile (Cabral, 2016) while ambiguous sincerity could even hurt a firm's reputation (Yoon et al., 2006). The social and political climate in the U.S. has become increasingly more sensitive to environmental concerns, causing especially carbon-intense firms to increase their efforts to reduce pollution. This phenomenon has been exacerbated in recent years as social media has become ubiquitous among consumers. Lastly, CSR activities can serve as a 'signal' of product quality that are not directly observable for customers (Fisman et al., 2008). For carbon-intensive firms, investing in emission-reduction activities oprovides them opportunities to signal their CSR efforts more effectively to outside stakeholders.

We adopt a quasi-experimental difference-in-differences (DID) research design to examine relative differences in firms' environmental performance in the years before and after the

[5] We follow Hoel (1996) in defining carbon-intensive industries. Those include *Mining, quarrying,* and *oil and gas extraction, utilities, transportation, construction,* and *manufacturing*.

announcement, specifically the period between 2015 and 2018. This study is timely because of the passing of sufficient time since the Trump administration announced the exit to the Paris Agreement that allows us to conduct a statistically robust DID analysis. To measure a company's CSR performance and effectiveness, our study utilizes Thomson Reuters ESG Scores.[6] These scores are based on a company's public disclosures across ten main themes (e.g., emissions, human rights) and published annually. Because prior research indicates that firms are scrutinized more heavily based on the CSR dimension most relevant to their industry (Sharfman, 1996; Capelle-Blancard and Petit, 2017), we focus on environment-related performance dimensions of those firms. These dimensions include critaria, such as the reduction in carbon dioxide (CO_2) emissions and finding eco-efficient solutions related to operating activities.

This article contributes to the extant body of literature on CSR in multiple ways. First, we document that macroeconmic events (e.g., the Paris Agreement Exit) affect individual firm behavior when it comes to the CSR dimensions most closely related to the firm's industry. Taking into account that consumers generally display less-favorable attitudes toward firms in environmentally sensitive industries (Zeng and Mourali, 2016), our findings help mitigate investors' general concerns about U.S. firms' commitments on CO_2 emission reduction.

We also compare carbon-intensive U.S. sectors to their European counterparts and measure the relative differences in environmental CSR performance before and after the Paris Agreement Exit. While European firms did *not* change their CSR investment in response to the U.S. exit, we confirm our primary findings suggesting that U.S. firms in carbon-intensive industries used the U.S. exit from the Paris Agreement as an opportunity to signal their unambiguous commitment to

[6] These scores were known as ASSET4 ESG ratings until Thomson Reuters' acquisition in 2009.

reduce their carbon footprint.[7] In addition, we find that our main finding is more pronounced among large firms. This is most likely because large firms tend to have fewer financial constraints than smaller firms and stronger incentive to maintain CSR initiatives due to greater public exposure (Godfrey et al., 2008; Green and Peloza, 2014; Wickert et al., 2016).[8] Our study confirms a positive relationship between firm size and CRS performance among U.S. *utilities* and *transportation* firms – especially when examining the CSR performance related to emissions reduction.

The remainder of this paper is organized as follows. Section 2 provides a review of the extant literature on CSR. Section 3 presents the descriptive statistics of our sample. Section 4 presents impact of Paris Agreement exit on U.S. firms CSR investments while Section 5 shows an additional analysis: the comparison between large U.S. firms and small U.S. firms. Section 6 concludes this study.

2. Background

2.1 The Paris Agreement and the U.S. exit

Aiming at combating global climate change, the Paris Agreement was adopted by 196 countries at the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015. It is the world's first comprehensive climate accord and requires that each country determine, plan, and regularly report on the contribution to mitigate global warming. Initiatives of the Paris Agreement include reducing greenhouse gas emissions, increasing renewable energy, improving energy efficiency, and providing support in assisting developing countries with the

[7] We document that European firms show overall higher CSR scores than US firms throughout the sample period, consistent with prior literature examining the disclosure of CSR activities by firms in state-led economies (Gallego-Álvarez and Quina-Custodio, 2017).

[8] CSR is often incongruent with economic objectives for especially small firms as CSR initiatives can be driven by external forces (Zeng and Mourali, 2016).

ultimate goal of keeping the global temperature rise during the 21st century to a maximum of two degrees Celsius above pre-industrial levels. The U.S. was deliberately a key participant in the development of this global framework. Business and investment leaders loudly denounced the Trump administration's decision, signing petitions, making public announcements, and signaling their continued support for the Paris Agreement.

From the firms' perspectives, implementating the Paris Agreement and obligatory compliance efforts result in substantial costs, particularly for firms in carbon-intensive industries. For example, as of 2018, no less than 27 countries implemented carbon taxes on firms to lessen greenhouse gas emissions (Metcalf et al., 2019).[9] Besides, nearly 90% of CO_2 emissions in the U.S. are attributable to those carbon-intensive sectors. If the withdrawal from the Paris agreement affects U.S. firms' CSR behavior, the impact must be more prominent among those carbon-intensive firms.

2.2 Development of firms' social responsibility

Using traditional financial theory, Milton Friedman (1970) argues that the social responsibility of firms is to maximize profits and the wealth of their stockholders. Empirical findings are mixed on whether investments in CSR ultimately translate into increased stockholders value. For example, Lins et al. (2017) show that firms with high "social capital" experience stock returns of 4-7 percentage points higher than firms with low social capital during the 2008 financial crisis. On the contrary, Servaes and Tamayo (2013) find no evidence of a direct link between CSR and firm value while Masulis and Reza (2015) find that shareholders reduce their valuation of cash holdings as corporate philanthropy increases.

[9] While prior studies have shown that a carbon tax offers a potentially cost-effective means of reducing emissions, this will to a large extent be counteracted by increased production in the countries that have no climate policy (Hoel, 1996). The Paris Agreement is arguably a superior solution to this issue because of its global scope.

In recent years, the corporate and political landscape has imposed firms to consider *all* stakeholders – including investors, employees, communities, and even the environment. It is also known that CSR reporting will increase during periods of high corporate or societal tension (Hooghiemstra, 2000). The developments in social norms over time have modified the goal of the firm to maximize the wealth of all stakeholders rather than solely focusing on shareholder value maximization (Elhauge, 2005; Hart and Zingales, 2017). Furthermore, individuals have become more considerate and attentive to environmental concerns such as sustainability, natural disasters, and global warming. Resultingly, the concept of CSR has received increased attention over the years, and its importance varies considerably depending on the nature of the firm, its ownership structure, and stakeholder interests. Psychological influences further propel this "CSR movement" among investors, consumers, and workers as their prosocial behavior is driven by a complex set of mutually interdependent motives (Bénabou and Tirole, 2010).

2.3 CSR and maintaining public relations

It is widely known that participation in CSR activities reduces a firm's legal risks (Godfrey et al., 2009; Minor, 2015; Hong et al., 2019) or systematic risk (Albuquerque et al., 2019). However, the most significant benefit of CSR activities perhaps is to promote a firm's public image. The rise of social media and the ubiquity of smartphones over the last two decades has caused firms to prioritize maintaining good public relations as news disseminates rapidly among stakeholders. Increased public exposure continues to bring sustainability issues to the forefront. Besides, the preponderance of social enterprises in recent years, such as *Toms Shoes*, *Charity: Water*, and *Warby Parker*, has created a newfound public appreciation for firms that maximize their social impact alongside shareholder wealth.

Consequentially, maintaining an appropriate public image is paramount to a firm's success. Du et al. (2010) find that firms can generate positive stakeholder attitudes through CSR activities by building a positive public image. Likewise, Kitzmueller and Shimshack (2012) state that CSR activity may produce higher welfare than other public goods provision channels. When studying the role that CSR plays on customer awareness as proxied by advertising expenditures, Servaes and Tamayo (2013) find that CSR and firm value are positively related to high customer awareness. On the other hand, Yoon et al. (2006) find that CSR activities can hurt a firm's image when consumers do not attribute sincere motives. They suggest that this effect can be overcome by spending more on CSR actions (i.e., tobacco firms donating to national cancer groups) than on advertising CSR.

Firms with positive reputations for environmentally-friendly business practices can benefit from promotional campaigns that tout CSR initiatives. For example, Toyota Motor Company – known for energy-efficient cars – created six lofty environmental goals in its recently launched "Toyota Environmental Challenge 2050" campaign to create a net-positive impact on the planet and society by the year 2050.[10] Brammer and Pavelin (2006) investigate corporate reputation and find variation across and within sectors on the reputational effect of social performance. Their results indicate the importance of 'fit' in whether CSR activities will improve or damage reputation. Krüger (2015) documents that investors value positive CSR news concerning firms with a history of poor stakeholder relations. Their finding suggests that companies with a negative reputation for environmental concerns can use CSR efforts to repair their reputation by publicizing sustainability initiatives.

[10] https://www.toyota.com/usa/environmentreport/feature-the-real-challenge-in-challenge-2050.html

2.4 CSR and firm size

CSR activities are closely related to firm size. Using a set of comprehensive interviews, Green and Peloza (2014) find that consumers have more trust and significantly lower expectations for CSR engagement for small firms. Similarly, Zeng and Mourali (2016) show that consumers perceive higher authenticity for small firms' CSR activities. On the other hand, large firms have stronger incentives to maintain CSR initiatives due to greater public exposure. Godfrey et al. (2008) find that, for an adverse event, the mitigating value of CSR is greater for larger firms as compared to smaller firms. Schreck and Raithel (2018) show that size and visibility independently affect CSR reporting. Firm size is also assictaed with a firm's visibility. Li and Morris (2018) show that CSR rating and firm size are negatively related among low visibility firms and positively related among high visibility ones.

3. Data and Hypotheses

3.1 Measurs of CSR performance

To measure a firm's CSR performance, our study utilizes the Thomson Reuters ESG Scores from its DataStream system (TR ESG Scores). The TR ESG Scores cover more than 400 different firm-level metrics of public companies worldwide, and are classified into three major categories and a total of 10 subcategories within them: environmental (emissions, environmental product innovation, and resource use), social (workforce, human rights, community, and product responsibility) and corporate governance (management, shareholders, and CSR strategy).[11] The Score is assigned to a firm under each of the subcategories and ranges from 0 to 100 to indicate the level of the firm's CSR performance. Our sample period is between 2015 and 2018.

[11] Table A1 provides the description of each of the subcategories.

3.2 Carbon-intensive sectors

The Joint Research Centre of the European Commission and the Netherlands Environmental Assessment Agency (JRC/PBL, 2016) indicates that 86.7% of the total greenhouse gas emissions in the U.S. during 2012 can be attributed to CO_2 emissions.[12] Consequently, we focus on the sectors that notably contribute to CO_2 emissions in the U.S. during our sample period. According to CAIT Climate Data Explorer, the sectors related to electricity and heat production contribute to 44.78% of CO_2 emissions in the U.S. during 2016 (CAIT, 2019).[13] In terms of the first two digits of the NAIC code, this is closely associated with the firms in the *mining, quarrying, and oil and gas extraction* sector (NAIC 21) and the *utilities* (NAIC 22).[14] The operations of these firms involve electricity generation, combined heat and power generation, heat plants, petroleum refineries, manufacture of solid fuels, coal mining, and oil and gas extraction. Another group of carbon-intensive firms is the *transportation* sector (NAIC 48), which is responsible for 35.71% of CO_2 emissions in the U.S. in 2016.[15] In addition, the data shows that 9.05% of CO2 emissions in the U.S. is attributable to *manufacturing* (NAIC 31-33) and *construction* (NAIC 23) sectors.

Since these firms combined comprise of nearly 90% of the total CO_2 emissions in the U.S., we focus our analysis on this subset of firms. This is also consistent to Hoel's (1996) definition of the carbon-intensive industries. In the reminder of this paper, firms are divided into three groups: the extraction and the utilities sectors (NAIC 21 and 22), the transportation sector (NAIC 48), and the manufacturing and the construction sectors (NAIC 23, 31-33). To avoid any statistical bias, we include only those firms that have TR ESG Scores available for the entire sample period, yielding a final sample of 1,017 U.S. firms and 820 European firms.

[12] Methane (NO_2) and nitrous oxide (HC_4) account for 8% and 5%, respectively.
[13] https://ourworldindata.org/grapher/co-emissions-by-sector?time=earliest..latest&country=~USA
[14] Emission from heating and lighting in commercial and residential buildings is also included in this number.
[15] Emissions from cars, trucks, buses, and motorcycles is also included in this number.

Table 1 reports the TR ESG Scores from 2015 to 2018 by region, sector, and category. Panel A and Panel B show the average scores of U.S. firms and European firms, respectively. European countries comprise of 28 member states of the European Union (E.U.) plus Iceland, Norway, and Switzerland. We use the sector classification by the North American Industry Classification System (NAICS), and *Code* represents the first two digits of the NAICS code. *Social* equals the average of the *workforce*, *human rights*, *community*, and *product responsibility* scores. *Corporate governance* equals the average of *management*, *shareholders*, and *CSR strategy* scores. The total ESG score corresponds to the average of all ten scores.

[Insert Table 1 around here]

3.3 Firm characteristics

We collect the financial statement data of U.S. firms and European firms from the Compustat North America and Compustat Global databases, respectively. We convert the financial data of European firms to U.S. dollars based on the average of the daily exchange rates of the respective local currencies during the sample period. We incorporate a set of firm-level control variables into our regression models and present descriptive statistics of these variables by region and sector in Table 2.

[Insert Table 2 around here]

Size equals a firm's total assets in millions of dollars. *Tobin's q* corresponds to the ratio of a firm's total debt plus market capitalization to total assets. *Tangibility* equals a firm's property, plant, and equipment (PP&E) divided by total assets. *Leverage* equals a firm's total debt divided by total assets. We include *Tobin's q* to capture long-run profitability while *Tangibility* and *Leverage* proxy for financial constraints.

3.4 Hypotheses

In this article, several testable hypotheses are examined. CSR investment is in general very costly for firms. If there is *not* sufficient reputational effect of social performance to justify the CSR costs and firms no longer expect additional regulations associated with the Paris Agreement requirements, they could reduce CSR investment in order to increase cash flows for other uses (e.g., different investment strategies, return to owners). Given this notion, we first hypothesize that U.S. firms overall reduced or held steady their investment in CSR after the announcement of the Paris Agreement Exit.

> ***Hypothesis 1*** (impact of Paris Agreement Exit): After the Trump administration's 2017 announcement of the U.S. departure from the Paris Agreement, U.S. firms overall reduced or slowed the pace of their environment-related investments.

An alternative hypothesis is that many of the U.S. firms actually increased their investment in CSR after the Trump administration's announcement. Although the public generally supports firms that are engaged in CSR activities, they can only infer CSR activities from disclosed information (Green and Peloza, 2014). Moreover, firms tend to heighten their CSR commitment during periods of high corporate or societal tension (Hooghiemstra, 2000) while the U.S. withdrawal from the Paris Accord was highly publicized and generated social tension. Since the Paris Accord mandated lower emissions and encouraged alternative energy sources, it can be predicted that the impact of the U.S. departure is particularly stronger for the carbon-intensive sectors. This would be consistent to the finding of Brammer and Pavelin (2006). We therefore expect firms in the sectors closely tied to the key provisions in the Paris Accord to invest more in CSR, even if they do not fully advertise this fact.

Hypothesis 2 (carbon-intensive vs. non-carbon-intensive U.S. firms): The increase in environment-related investments by carbon-intensive U.S. firms outpaced those by non-carbon-intensive U.S. firms after the Trump administration's 2017 announcement of the U.S. departure from the Paris Agreement.

Since the Paris Agreement is a country-level commitment, it does not impact individual firms directly. However, if the U.S. no longer intends to meet the Paris Agreement requirements, it certainly would impact the regulations to be proposed or implemented in the country, where U.S. firms are mainly subject to them. In addition, as shown in Table 1, the environment-related CSR performance of European firms have been at higher levels than their U.S. countarparts, especially in the carbon-intensive sectors. We believe that prospective environmental regulations in the U.S. have more impact on carbon-intensive U.S. firms than their European counterparts although it is unknown which direction. We hypothesize as following.

Hypothesis 3 (U.S. vs. European firms): In each of the carbon-intensive sectors, the increase in environment-related investments by U.S. firms outpaced those by their European counterparts after the Trump administration's 2017 announcement of the U.S. departure from the Paris Agreement.

Lastly, large firms tend to have greater public exposure than smaller firms (Godfrey et al., 2008; Green and Peloza, 2014; Wickert et al., 2016) and are therefore expected to react to increased public scrutiny. Large firms also have fewer financial constraints. Our fourth hypothesis is as following.

Hypothesis 4 (size effect): In each of the carbon-intensive sectors in the U.S., large firms outpaced smaller firms on their increase in environment-related investments after the Trump administration's 2017 announcement of the U.S. departure from the Paris Agreement.

Each of these hypotheses is examined empirically in Sections 4 and 5.

4. Paris Agreement Exit and Firms' Environmental Performance

4.1. Impact of Paris Agreement Exit

First, we examine whether President Trump's announcement to withdraw the U.S. from the Paris Agreement adversely affected U.S. firms in general. This is formulated as *Hypothesis 1* in Subsection 3.4, and we estimate the following regression model to see how a firm's CSR effort changed after the announcement in 2017.

$$\ln\left(ESG_{it}\right) = \alpha + \beta Post_t + \gamma' Y_{it} + \mathbf{\Lambda} + \varepsilon_{it} \quad (1)$$

$\ln(ESG_{it})$ is the natural logarithm of the ESG score within a certain category (e.g., emissions score) with respect to firm *i* in year *t*. $Post_t$ takes on a value of '1' for the year 2018 and beyond, and '0' otherwise.[16] Y_{it} represents a set of firm-specific control variables as described in Subsection 3.3. $\mathbf{\Lambda}$ includes year and industry fixed effects. The result of our regression analysis is presented in Table 3. The dependent variable represents the ESG score in one of the environmental categories: Emission (second column), Environmental Innovation (third column), and Resource Use (fourth column).[17] All of the firms included in this analysis meet the conditions described in Subsection 3.2.

[Insert Table 3 around here]

Notable findings in this table are as following. First, regardless of the environmental category, we document a positive and statistically significant relationship between firm size and environmental performance. For example, the second column of the table shows the log of the Emission score of a U.S. firm increases by on average 0.275 for a unit increase in the log of the firm's total assets. In contrast, the significance levels of other control variables vary greatly by

[16] President Trump announced the exit from the Paris Agreement in June 2017.
[17] We use the logs of ESG scores to mitigate the impact of outliers, but our conclusions remain unaffected when using the raw ESG scores.

ESG category. Second, U.S. firms significantly increased their effort in the Emissions and the Environmental Innovation categories after 2017. The coefficient estimate of *Post* in the third column indicates that the log of the Emission score of a U.S. firm in higher by on average 0.170 in the pst period.

4.2. Carbon-intensive vs. non-carbon intensive U.S. firms

The primary objective of this article is to examine the variation, across sectors, in the responses by U.S. firms to the Paris Agreement Exit. This question is formulated as *Hypothesis 2* in Subsection 3.4. We utilize the difference-in-differences (DID) regression analysis, which allows us to examine the CSR performance of the carbon-intensive firms before and after the U.S. exit. In each of the test, the treatment group includes the U.S. firms that belong to one of the carbon-intensive sectors (e.g., utilities). The control group comprises of all of the non-carbon-intensive U.S. firms. We estimate the following DID regression model.

$$\ln\left(ESG_{it}\right) = \alpha + \beta_1 Post_t + \beta_2 Treatment_i + \beta_3 Post_t \times Treatment_i + \gamma' Y_{it} + \mathbf{\Lambda} + \varepsilon_{it} \quad (2)$$

The dependent variable and all of the control variables are the same as in the models in Subsection 4.1. $Treatment_i$ takes on a value of '1' if firm *i* belongs to one of the carbon-intensive sectors, and '0' if it is a non-carbon-intensive firm. We present results for the regression analysis in Table 4. In this table, the dependent variable represents the ESG score in one of the environmental categories: Emission (Panel A), Environmental Innovation (Panel B), and Resource Use (Panel C).

[Insert Table 4 around here]

We are interested in how the difference in environmental performance between firms in the carbon-intensive sectors and the rest of the U.S. firms changed following the U.S. exit from

the 2015 Paris Agreement. We capture this effect by examining the interaction term *Post* × *Treated*. While the coefficient estimate of *Post*, by itself, represents the effect of the exit for the control group, the coefficient estimate of *Post* × *Treated* measures the marginal effect observed for the treatment group. We include industry-specific and year-specific dummy variables to each of our regression models to capture industry and year fixed effects. Since the treatment is assigned at the sector level, standard errors are clustered at the sector level in all of the regression models.[18]

The table shows that the difference in environmental performance between carbon-intensive and non-carbon intensive U.S. firms significantly widened after the 2017 announcement of the exit from the Paris Agreement. For example, the coefficient estimate of *Post* in the third column in Panel A indicates that the log of the Emission score of a non-carbon intensive U.S. firm increases by on average 0.161 after 2017. With respect to the U.S. firms in the utility sector, on the other hand, the increase in a firm's CSR performance after the U.S. exit is on average 0.252 (= 0.161 + 0.091) as indicated by a positive and statistically significant coefficient estimate on *Post* × *Treated*. To get a sense of its magnitude, this is roughly equivalent to 69% of one standard deviation of the year-to-year changes in Emission scores.[19]

The treatment effect is even more prominent for U.S. *transportation* firms. The fourth column of Panel A indicates that the increase in the CSR performance by U.S. utilities is on average 0.403 (= 0.162 + 0.241) after the U.S. exit. In the post-exit period, these firms demonstrated more effort to reduce environmental emissions than the non-carbon-intensive firms. The coefficient estimate of the interaction term is almost unchanged when the control variables or fixed effects are excluded. While our findings may be contrary to what one would expect, they

[18] We assume error independence across sectors while the errors for industries within a sector might be correlated with one another. Moreover, some sectors are intentionally excluded from the control group.
[19] In our sample, the within standard deviation of the year-to-year changes in the Emission scores in the U.S. utility sector is 0.363.

highlight that CSR is an essential investment for today's corporations, regardless of regulatory requirements.

Panel B shows a significant negative treatment effect among firms in the *utilities* sector. While the log of the Environmental Innovation score increases slightly by 0.032 for the non-carbon-intensive firms following the announcement to exit the Paris Agreement, the same score for firms in the *utilities* sector dropped by on average 0.022. This suggests that relatively high regulatory costs in the *utilities* sector prevent firms from allocating their capital in the areas directly leading to innovation. Panel C pertains to the Resource Use score, which measures a firm's effort in reducing the use of materials and finding eco-efficient solutions. Following the announcement of the Paris Agreement exit, carbon-intensive U.S. firms overall made a greater effort in this area than non-carbon-intensive firms.[20]

Lastly, we visually examine whether the parallel-trend assumption holds. Figure 1 illustrates the Emission scores of the U.S. *utilities* sector (Panel A) and the U.S. *transportation* sector (Panel B) relative to non-carbon-intensive U.S. sectors between 2015 and 2018. As shown in the figure, the difference between the CSR scores of a carbon-intensive sector and the non-carbon-intensive sectors preceding the announcement of the U.S. exit must be relatively constant. This supports the parallel-trend assumption.

[Insert Figure 1 around here]

4.3. U.S. firms vs. European firms in carbon-intensive sectors

Next, we examin *Hypothesis 3* described in Subsection 3.4. Specifically, we compare the environmental performance of U.S. and European firms before and after the U.S. exit from the

[20] Even prior to the announcement, the construction and manufacturing U.S. firms have shown far more effort in this category than the non-carbon-intensive firms.

Paris Agreement. We once again estimate difference-in-differences (DID) regressions as described in Equation (2). For each of the carbon-intensive sectors, $Treatment_i$ takes on a value of '1' if firm *i* is a U.S. firm, and '0' if it is an European firm. We include country-specific and year-specific dummy variables to each model to capture fixed effects. Standard errors are also clustered at the country level.

[Insert Table 5 around here]

Table 5 shows that the environmental performance of the European firms is virtually unchanged in the post-2017 period with respect to most of the carbon-intensive sectors, namely *mining and extraction*, *utilities*, and *transportation*. On the other hand, there are sizable increases in ESG scores of the *transportation* firms in the U.S. relative to their European counterparts after 2017. Panel A shows that, prior to the announcement on the U.S. exit of the Paris Agreement, the log of the Emission score of the U.S. *transportation* firms is on average 0.695 lower than their European counterparts. Following the announcement, the score for the U.S. *transportation* firms is on average 0.401 (= 0.023 + 0.378) higher than that of their European counterparts. Similar results are observed with respect to U.S. *utilities* and U.S. *manufacturers*. Meanwhile, the environmental performance of U.S. *mining and extraction* firms relative to their European counterparts was virtually unchanged after the announcement.

The table also shows very similar results concerning all of the carbon-intensive sectors based on the Environmental Innovation score (Panel B) and the Resource Use score (Panel C), indicating that our findings are consistent across the ESG categories. The relatively unchanged ESG scores among European firms are reasonable since the U.S. exit from the Paris Agreement should not have impacted the environmental regulations in Europe. In addition, the ESG scores of European firms were already at higher levels than those of U.S. firms, possibly due to tighter

regulations. Our findings once again confirm that CSR has become a critical factor for stakeholders, and U.S. firms are compelled to increase their effort even without external force, such as environmental regulations.

5. Firm Size and Environmental Performance

As shown in the preceding section, there is a positive relationship between firm size and ESG scores related to environmental performance. Given higher public expectations for large firms concerning CSR activities, this result is quite reasonable. As an additional analysis, we further investigate whether the 'size effect' on environmental performance is particularly strong in carbon-intensive sectors in the U.S. We implement the following regression model to examin *Hypothesis 4* described in Section 3.

$$\ln\left(ESG_{it}\right) = \alpha + \beta_1 Treatment_i + \beta_2 \ln\left(Size_i\right) + \beta_3 Treatment_i \times \ln\left(Size_i\right) + \gamma' Y_{it} + \mathbf{\Lambda} + \varepsilon_{it} \qquad (3)$$

$\ln(ESG_{it})$ is the natural logarithm of the Emission score of firm i in year t. $Treatment_i$ takes on a value of '1' if firm *i* is in one of the carbon-intensive sectors, and '0' if it is a non-carbon-intensive firm. $\ln(Size_i)$ is the natural logarithm of a firm's total assets. While $\ln(Size_i)$ indicates the effect of firm size on the Emission score of firm *i* when $Treatment_i = 0$, $Treatment_i \times \ln(Size_i)$ captures the additional effect of firm size for the treated group. Y_{it} and $\mathbf{\Lambda}$ are as described in the previous subsections.

[Insert Table 6 around here]

Panel A of Table 6 indicates a positive association between firm size and the Emission score across all sectors, consistent with our results in Section 4.2. Interestingly, we find that the size effect is significantly greater in certain carbon intensive sectors, namely *utilities* and *transportation*. The third column of Panel A shows the coefficient estimate of ln(*Size*) is 0.244.

This indicates that the log of the Emission score of a non-carbon intensive U.S. firm is higher by on average 0.371 if the log of the total assets is higher by 1.512 (i.e., one standard deviation among these firms). On thee other hand, the coefficient estimate of the *Treated* × ln(*Size*) is 0.272. One standard deviation increase in firm size among U.S. utilities (= 1.022) improves the firm's CSR performance by 0.527. This is 1.45 times higher than one within standard deviation of the year-to-year changes in the ESG scores in the sector (i.e., 0.363). Likewise, the size effect on the Emission score among the U.S. *transportation* firms is significantly higher than the average increase for the non-carbon-intensive firms. Our findings support the notion that a firm tends to be scrutinized more closely based on the CSR dimension most relevant to their industry (Sharfman, 1996; Capelle-Blancard and Petit, 2017). In contrast, there is no statistically significant marginal effect of firm size with respect to the *mining and extraction* and the *manufacturing* sectors. Figure 2 graphically presents positive relations between firm size and Emission scores in the *utilities* and *transportation* sectors.

[Insert Figure 2 around here]

Finally, we implement the following model to examine whether the size effect on the Emission score with respect to U.S. *utilities* and *transportation* firms changed notably after the year 2017.

$$\ln\left(ESG_{it}\right) = \alpha + \beta_1 Post_t + \beta_2 \ln\left(Size_i\right) + \beta_3 Post_t \times \ln\left(Size_i\right) + \gamma' Y_{it} + \mathbf{\Lambda} + \varepsilon_{it} \quad (3)$$

While $ln(ESG_{it})$ indicates the effect of firm size on the Emissions score of firm *i* when $Post_t$ = 0, $Post_t \times \ln(Size_i)$ captures the additional effect of firm size on the Emission score after Trump's announcement. Y_{it} and $\mathbf{\Lambda}$ are as described in the previous subsections. Panel B of Table 6 shows a significant decrease in the size effect in the sectors of interest following the announcement. In

contrast, we observe no significant increase or decrease in the effect after the announcement with respect to the other sectors.

6. Concludig Remarks

The negative shock of the U.S. departure from the global initiatives outlined in the Paris Agreement provided an opportunity for U.S. firms to signal their continued commitments on environmental sustainability. Our study shows that, even after the Trump administration's announcement in 2017, carbon-intensive U.S. firms outpaced non-carbon-intensive firms in their increase in environment-related investment. Nevertheless, there are variations in the level of CSR investment across sectors, depending on the benefit salience. Firms with higher benefit salience try to show their sincerity by investing more in CSR in relevant areas. These sector differences are predicated in Yoon et al (2006) and support our findings. We analysis also shows positive associations between environmental efforts and firm size. We find that the relation is particularly stronger among the utilities and the transportation companies. The public has higher expectations for CSR engagements of large firms, which have fewer financial constraints and greater consumer awareness.

Investors today monitor issues beyond traditional financial measures. Despite non-trivial costs, firms continue to carry out various initiatives to improve their standards in environmental, social, and corporate governance areas. With growing concern over global warming, a firm's effort to reduce CO_2 emissions draws significant public attention. At the same time, publicity from any CSR-related event allows certain firms to strengthen their corporate reputation. Our findings provide relevant and timely insights to not only researchers but also practitioners and policy makers.

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TABLE 1: Average ESG Scores of U.S. and European Firms by Sector

Below we present the average ESG scores by category and sector from 2015 to 2018. *Code* represents the first two digits of the North American Industry Classification System (NAICS) code. *Social* is the average of the workforce, human rights, community, and product responsibility scores. *Corporate governance* is the average of management, shareholders, and CSR strategy scores. *Total* is the average of all ten scores. The European countries in Panel B include 28 member states of the European Union (E.U.), Iceland, Norway, and Switzerland. Our regression analysis includes an additional 17 U.S. firms that belong to sectors other than those listed below.

Panel A: U.S. Firms

			Environmental score					
NAIC sector	Code	# of firms	Emissions	Resource use	Innovation	Social	Corporate governance	Total
Mining, quarrying, and extraction	21	46	50.93	50.20	43.00	50.73	62.91	53.54
Utilities	22	30	57.98	48.32	41.99	51.46	72.00	56.32
Construction	23	17	46.03	31.14	42.68	44.05	49.71	43.66
Manufacturing	31-33	346	46.37	48.47	49.80	53.83	55.75	51.41
Wholesale trade	42	25	46.85	41.64	37.06	43.59	50.54	44.63
Retail trade	44-45	19	47.12	40.69	48.68	50.14	54.25	47.73
Transportation	48	28	41.89	34.95	42.64	46.83	53.22	46.02
Information	51	113	39.14	39.33	44.02	45.42	42.77	43.23
Finance and insurance	52	182	39.03	37.81	40.15	48.02	48.70	44.65
Real estate and rental and leasing	53	114	47.84	44.11	47.08	49.45	53.56	50.28
Prof., scientific, and technical services	54	23	54.71	54.86	48.29	58.42	52.12	53.85
Admin. support and waste manage	56	18	49.42	42.27	41.95	43.58	49.57	45.65
Health care and social assistance	62	14	31.10	45.94	48.72	52.98	58.74	54.17
Accommodation and food services	72	25	52.31	59.44	49.32	58.20	55.24	55.23
Total/average		1,000	45.02	44.36	45.67	50.44	53.07	48.93

TABLE 1 (cont.)

Panel B: European Firms

NAIC sector	Code	# of firms	Environmental score			Social	Corporate governance	Total
			Emissions	Resource use	Innovation			
Mining, quarrying, and extraction	21	31	63.06	66.37	48.80	61.47	54.14	58.22
Utilities	22	33	74.01	70.70	61.61	67.12	57.64	64.42
Construction	23	33	70.43	76.37	56.03	61.85	55.63	61.02
Manufacturing	31-33	293	67.31	71.95	64.10	68.28	55.74	64.06
Wholesale trade	42	21	60.18	59.72	52.54	56.46	51.62	55.91
Retail trade	44-45	48	70.54	70.42	61.85	60.26	54.22	60.90
Transportation	48	23	65.27	73.05	66.14	66.26	57.06	62.70
Information	51	66	69.25	67.29	58.49	63.04	50.85	60.69
Finance and insurance	52	150	68.73	66.33	63.19	57.10	48.62	58.35
Real estate and rental and leasing	53	51	68.16	67.67	63.65	53.71	48.71	57.06
Prof., scientific, and technical services	54	31	67.39	73.80	59.90	67.20	59.20	64.22
Admin. support and waste manage	56	18	74.28	63.89	47.80	62.74	54.72	60.65
Health care and social assistance	62	6	70.15	76.23	61.09	55.99	45.42	58.36
Accommodation and food services	72	16	70.84	75.68	59.71	71.04	49.35	64.14
Total/average		820	68.21	69.82	61.45	63.32	53.37	61.44

TABLE 2: Summary of Characteristics of U.S. and European Firms by Sector

Below we present the average values of the control variables, sorted by region and sector, between 2015 and 2018. *Code* represents the first two digits of the North American Industry Classification System (NAICS) code. *Size* equals a firm's total assets in millions of dollars. *Tobin's q* equals the ratio of a firm's total debt plus market capitalization to total assets. *Tangibility* corresponds to a firm's PP&E divided by total assets. *Leverage* equals a firm's total debt divided by total assets. The European countries in Panel B comprise 28 member states of the European Union (E.U.), Iceland, Norway, and Switzerland. Our regression analysis includes an additional 17 U.S. firms that belong to sectors other than those listed below.

Panel A: U.S. Firms

NAIC sector	Code	# of firms	Size	Tobin's Q	Tangibility	Leverage
Mining, quarrying, and oil and gas extraction	21	46	12,158	1.296	0.765	0.528
Utilities	22	30	25,966	1.222	0.695	0.714
Construction	23	17	6,219	1.345	0.053	0.526
Manufacturing	31-33	346	11,488	2.712	0.189	0.557
Wholesale trade	42	25	6,721	1.961	0.170	0.569
Retail trade	44-45	19	15,151	2.267	0.269	0.678
Transportation	48	28	11,176	1.749	0.609	0.546
Information	51	113	19,730	2.850	0.123	0.595
Finance and insurance	52	182	84,338	1.419	0.027	0.781
Real estate and rental and leasing	53	114	6,816	1.593	0.185	0.585
Professional, scientific, and technical services	54	23	4,186	3.242	0.082	0.595
Administrative support and waste management	56	18	5,233	2.710	0.127	0.653
Health care and social assistance	62	14	11,933	1.577	0.271	0.670
Accommodation and food services	72	25	6,830	3.128	0.450	0.946
Total/Average		1,000	25,090	2.183	0.212	0.624

Panel B: European Firms

NAIC sector	Code	# of firms	Size	Tobin's Q	Tangibility	Leverage
Mining, quarrying, and oil and gas extraction	21	31	13,234	1.802	0.531	0.553
Utilities	22	33	38,269	1.073	0.509	0.653
Construction	23	33	11,578	1.356	0.127	0.622
Manufacturing	31-33	293	20,751	2.317	0.229	0.540
Wholesale trade	42	21	4,081	1.685	0.143	0.568
Retail trade	44-45	48	13,728	1.872	0.339	0.596
Transportation	48	23	18,642	1.590	0.414	0.620
Information	51	66	18,913	1.859	0.176	0.637
Finance and insurance	52	150	234,297	1.258	.011	0.650
Real estate and rental and leasing	53	51	7,893	1.080	0.079	0.449
Professional, scientific, and technical services	54	31	5,507	2.279	0.137	0.622
Administrative support and waste management	56	18	4,292	1.768	0.085	0.750
Health care and social assistance	62	6	17,078	1.347	0.355	0.475
Accommodation and food services	72	16	6,280	2.001	0.474	0.675
Total/Average		820	56,652	1.827	.0214	0.586

TABLE 3: Impact of Paris Agreement Exit Announcement on U.S. Firms

The table reports the coefficient estimates based on 1,017 U.S. firms across all carbon-intensive and non-carbon-intensive sectors, and the corresponding standard errors are in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable equals the natural logarithm of firms' ESG scores associated with the indicated category. *Post* takes on a value of 1 for the years 2018 and after, and 0 otherwise. *ln(Size)* corresponds to the natural logarithm of a firm's total assets. *Tobin's q* equals the ratio of a firm's total debt plus market capitalization to total assets. *Tangibility* equals a firm's PP&E divided by total assets. *Leverage ratio* corresponds to a firm's total debt divided by total assets. We include industry-specific and year-specific dummy variables in each of our regression models. Standard errors are clustered at the sector level.

ESG Category	Emissions	Environmental Innovation	Resource Use
Post	0.170 ***	0.037	0.133 ***
	(0.016)	(0.022)	(0.020)
ln(Size)	0.275 ***	0.101 ***	0.274 ***
	(0.016)	(0.028)	(0.021)
Tobin's q	0.054 **	0.020 *	0.030 **
	(0.022)	(0.010)	(0.011)
Tangibility	-0.372	-0.066	-0.328
	(0.219)	(0.139)	(0.195)
Leverage ratio	0.070	-0.141	-0.052
	(0.100)	(0.107)	(0.069)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
R-squared	0.319	0.249	0.447
Size	1,017	1,017	1,017

TABLE 4: Carbon-Intensive vs. Non-Carbon Intensive U.S. Firms after Paris Agreement Exit

The table reports the coefficient estimates based on 1,017 U.S. firms across all carbon-intensive and non-carbon-intensive sectors, and the corresponding standard errors are in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable equals the natural logarithm of firms' ESG scores associated with the indicated category. *Post* takes on a value of 1 for the years 2018 and after, and 0 otherwise. *Treated* takes on a value of 1 for firms in the treatment group, and 0 otherwise. *Post* × *Treated* captures the differential treatment effect across the two groups and is our variable of interest. *ln(Size)* corresponds to the natural logarithm of a firm's total assets. *Tobin's q* equals the ratio of a firm's total debt plus market capitalization to total assets. *Tangibility* equals a firm's PP&E divided by total assets. *Leverage ratio* corresponds to a firm's total debt divided by total assets. We include industry-specific and year-specific dummy variables in each of our regression models. Standard errors are clustered at the sector level.

ǂ CO_2 emissions (%) is for NAIC sectors 21 and 22 combined.

Panel A: Emissions score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	0.155 ***	0.161 ***	0.162 ***	0.141 ***	0.138 ***
	(0.020)	(0.019)	(0.019)	(0.015)	(0.014)
Treated	0.458 ***	0.381 ***	0.678 ***	0.619 ***	0.614 ***
	(0.086)	(0.123)	(0.055)	(0.026)	(0.025)
Post × Treated	-0.006	0.091 ***	0.241 ***	0.054 ***	0.064 ***
	(0.012)	(0.010)	(0.012)	(0.016)	(0.020)
ln(Size)	0.245 ***	0.255 ***	0.254 ***	0.266 ***	0.275 ***
	(0.012)	(0.015)	(0.015)	(0.014)	(0.015)
Tobin's q	0.054 ***	0.060 ***	0.063 ***	0.051 **	0.054 **
	(0.018)	(0.017)	(0.018)	(0.022)	(0.022)
Tangibility	-0.421	-0.466 *	-0.519 *	-0.333	-0.372
	(0.260)	(0.260)	(0.262)	(0.252)	(0.219)
Leverage ratio	-0.007	-0.012	0.004	0.064	0.070
	(0.123)	(0.139)	(0.139)	(0.101)	(0.100)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.285	0.282	0.289	0.307	0.319
Size of treated firms	46	30	28	363	467
Size of control firms	550	550	550	550	550
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

TABLE 4 (cont.)

Panel B: Environmental Innovation score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	0.035 **	0.032 *	0.037 **	0.046 ***	0.037 **
	(0.015)	(0.017)	(0.014)	(0.012)	(0.014)
Treated	1.314 ***	1.119 ***	1.942 ***	0.280 ***	0.273 ***
	(0.064)	(0.075)	(0.051)	(0.020)	(0.021)
Post × Treated	-0.016	-0.054 ***	0.015	0.002	-0.002
	(0.017)	(0.012)	(0.013)	(0.044)	(0.037)
ln(Size)	0.102 ***	0.107 ***	0.105 ***	0.100 ***	0.101 ***
	(0.031)	(0.030)	(0.031)	(0.031)	(0.028)
Tobin's q	0.018	0.018	0.018	0.020 *	0.020
	(0.015)	(0.016)	(0.015)	(0.010)	(0.010)
Tangibility	-0.148	-0.224	-0.063	0.022	-0.066
	(0.114)	(0.167)	(0.126)	(0.128)	(0.139)
Leverage ratio	-0.259 **	-0.273 **	-0.266 **	-0.151	-0.141
	(0.099)	(0.105)	(0.103)	(0.110)	(0.107)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.329	0.291	0.338	0.257	0.249
Size of treated firms	46	30	28	363	467
Size of control firms	550	550	550	550	550
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

Panel C: Resource Use score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	0.101 ***	0.098 ***	0.103 ***	0.104 ***	0.097 ***
	(0.013)	(0.014)	(0.013)	(0.015)	(0.015)
Treated	-0.267 *	-0.622 ***	0.083	1.965 ***	1.961 ***
	(0.129)	(0.151)	(0.065)	(0.026)	(0.026)
Post × Treated	0.043 **	0.009	0.182 ***	0.070 ***	0.072 ***
	(0.016)	(0.010)	(0.014)	(0.018)	(0.018)
ln(Size)	0.233 ***	0.239 ***	0.237 ***	0.263 ***	0.274 ***
	(0.013)	(0.018)	(0.017)	(0.020)	(0.021)
Tobin's q	0.023	0.026	0.026	0.027 **	0.031 **
	(0.023)	(0.023)	(0.022)	(0.011)	(0.010)
Tangibility	-0.375	-0.265	-0.175	-0.284	-0.328
	(0.286)	(0.248)	(0.244)	(0.202)	(0.195)
Leverage ratio	-0.065	-0.088	-0.095	-0.085	-0.052
	(0.091)	(0.087)	(0.083)	(0.059)	(0.069)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.479	0.461	0.498	0.444	0.447
Size of treated firms	46	30	28	363	467
Size of control firms	550	550	550	550	550
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

FIGURE 1: Changes in Emission Scores Between 2015–2018

We present below the Emission scores of the U.S. *utilities* (Chart A) and *transportation* firms (Chart B) compared to non-carbon-intensive U.S. firms between 2015 and 2018. All values are raw scores.

Chart A: U.S. *utilities*

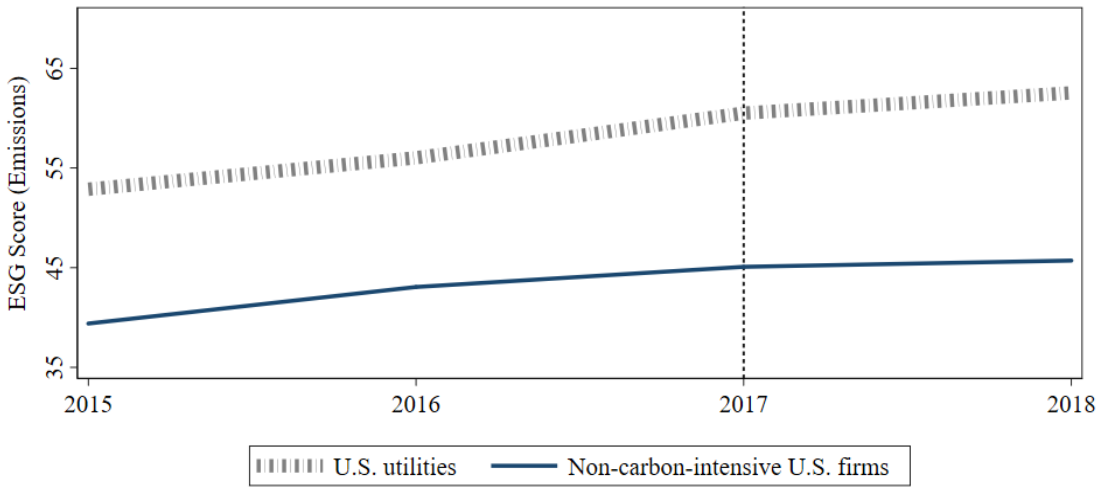

Chart B: U.S. *transportation*

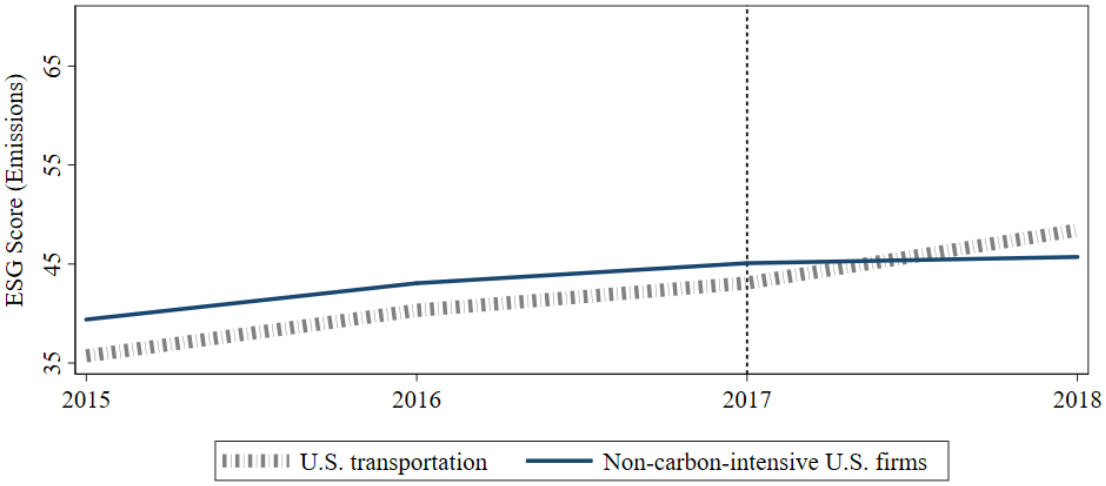

TABLE 5: Impact of Paris Agreement Exit on U.S. Firms vs. European Firms

The table reports the coefficient estimates based on 880 U.S. and European firms across the carbon-intensive sectors, and the corresponding standard errors are in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variables are the natural logarithm of firms' ESG scores associated with the indicated category. *Post* takes on a value of 1 for the years 2018 and after, and 0 otherwise. *Treated* takes on a value of 1 for the firms in the treatment group, and 0 otherwise. *Post* × *Treated* captures the differential treatment effect across the two groups and is our variable of interest. *ln(Size)* corresponds the natural logarithm of a firm's total assets. *Tobin's q* equals the ratio of a firm's total debt plus market capitalization to total assets. *Tangibility* equals a firm's PP&E divided by total assets. *Leverage ratio* corresponds to a firm's total debt divided by total assets. We include industry-specific and year-specific dummy variables in each of our regression models. Standard errors are clustered at the country level.

ǂ CO_2 emissions (%) is for NAIC sectors 21 and 22 combined and only pertains to the U.S. firms.

Panel A: Emissions score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	0.028	0.044	0.023	0.094 ***	0.082 ***
	(0.023)	(0.059)	(0.079)	(0.027)	(0.024)
Treated	-0.139 *	-0.444 ***	-0.695 ***	-0.508 ***	-0.485 ***
	(0.067)	(0.028)	(0.167)	(0.006)	(0.005)
Post × Treated	0.017	0.101 **	0.378 ***	0.060 **	0.080 ***
	(0.027)	(0.046)	(0.059)	(0.021)	(0.016)
ln(Size)	0.206 ***	0.321 **	0.327 ***	0.187 ***	0.198 ***
	(0.032)	(0.106)	(0.066)	(0.032)	(0.033)
Tobin's q	-0.033	0.911	0.217 ***	0.001 ***	0.000 ***
	(0.099)	(0.451)	(0.061)	(0.000)	(0.000)
Tangibility	-0.368	-0.326	-0.713	-0.111	-0.056
	(0.221)	(0.228)	(0.744)	(0.118)	(0.076)
Leverage ratio	-0.085	0.260	1.230 *	0.106 *	0.105
	(0.293)	(0.179)	(0.601)	(0.054)	(0.061)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.303	0.515	0.400	0.231	0.233
Size of treated firms	46	30	28	363	467
Size of control firms	31	33	23	326	413
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

TABLE 5 (cont.)

Panel B: Environmental Innovation score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	0.119	-0.358	-0.033 *	0.067 **	0.030
	(0.117)	(0.265)	(0.017)	(0.023)	(0.027)
Treated	0.063	-0.502 ***	-0.273 ***	-0.163 ***	-0.176 ***
	(0.035)	(0.078)	(0.027)	(0.006)	(0.005)
Post × Treated	-0.097	0.248	0.056 ***	-0.029	-0.007
	(0.083)	(0.212)	(0.016)	(0.019)	(0.022)
ln(Size)	0.070 **	0.048	0.103 ***	0.045 **	0.050 ***
	(0.025)	(0.041)	(0.028)	(0.016)	(0.015)
Tobin's q	-0.045 **	-0.381 **	0.102 ***	0.000 ***	0.000 ***
	(0.018)	(0.127)	(0.011)	(0.000)	(0.000)
Tangibility	-0.225 *	-0.912	-0.346 *	0.125	-0.167 **
	(0.109)	(0.543)	(0.178)	(0.144)	(0.075)
Leverage ratio	0.092	-0.085	0.179	0.154	0.120
	(0.151)	(0.493)	(0.402)	(0.118)	(0.111)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.234	0.488	0.454	0.076	0.076
Size of treated firms	46	30	28	363	467
Size of control firms	31	33	23	326	413
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

Panel C: Resource Use score

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Post	-0.002	-0.002	-0.031	0.112 ***	0.086 ***
	(0.030)	(0.050)	(0.079)	(0.023)	(0.025)
Treated	-0.474 ***	-0.573 ***	-0.977 ***	-0.527 ***	-0.542 ***
	(0.054)	(0.030)	(0.019)	(0.006)	(0.005)
Post × Treated	0.147 ***	-0.030	0.328 ***	0.044 **	0.067 ***
	(0.032)	(0.045)	(0.078)	(0.017)	(0.018)
ln(Size)	0.224 **	0.317 **	0.314 ***	0.165 ***	0.174 ***
	(0.068)	(0.108)	(0.072)	(0.044)	(0.048)
Tobin's q	-0.034	0.885 **	0.192 ***	0.000 **	0.000 **
	(0.087)	(0.334)	(0.016)	(0.000)	(0.000)
Tangibility	-0.173	-0.287	-0.058	-0.285	-0.279
	(0.344)	(0.258)	(0.240)	(0.204)	(0.162)
Leverage ratio	0.502 **	-0.005	0.532	0.159	0.188
	(0.211)	(0.440)	(0.265)	(0.097)	(0.082)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.376	0.561	0.622	0.320	0.322
Size of treated firms	46	30	28	363	467
Size of control firms	31	33	23	326	413
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

TABLE 6: Effect of Firm Size on Emission Performance of U.S. Firms

The table reports the coefficient estimates based on 1,017 U.S. firms across all carbon-intensive and non-carbon-intensive sectors, and the corresponding standard errors are in parentheses. The asterisks represent the significance level of 1% (***), 5% (**), and 10% (*). The dependent variable is the natural logarithm of a firm's Emission score. *ln(Size)* corresponds to the natural logarithm of a firm's total assets. *Tangibility* equals a firm's PP&E divided by total assets. *Leverage* equals a firm's total debt divided by total assets. *Tobin's q* corresponds to the ratio of a firm's total debt plus market capitalization to total assets. In Panel A, *Treated* takes on a value of 1 for the firms in the treatment group, and 0 otherwise. *Post* takes on a value of 1 for the years 2018 and after, and 0 otherwise. *Treated* × *ln(Size)* and *Post* × *ln(Size)* are interactions and our variables of interest. We include industry-specific and year-specific dummy variables in each of our regression models. Standard errors are clustered at the industry level.

Panel A: Marginal effect of firm size for carbon-intensive sectors

Sector(s)	Extraction	Utilities	Transportation	Mfg. & const.	Combined
Treated	0.396	-2.047 ***	-1.641 **	0.169	0.064
	(0.372)	(0.305)	(0.802)	(0.301)	(0.298)
ln(Size)	0.244 ***	0.244 ***	0.245 ***	0.242 ***	0.243 ***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Treated × ln(Size)	0.007	0.272 ***	0.309 ***	0.056	0.069 *
	(0.040)	(0.031)	(0.102)	(0.036)	(0.035)
Tobin's q	0.054 **	0.057 **	0.061 **	0.052 **	0.055 **
	(0.022)	(0.023)	(0.024)	(0.022)	(0.023)
Tangibility	-0.420 *	-0.442 *	-0.557 **	-0.349	-0.383 *
	(0.234)	(0.237)	(0.244)	(0.212)	(0.195)
Leverage ratio	0.008	0.014	-0.002	0.054	0.058
	(0.123)	(0.133)	(0.132)	(0.117)	(0.113)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
R-squared	0.285	0.286	0.292	0.308	0.321
Size of treated firms	46	30	28	363	467
Size of control firms	550	550	550	550	550
CO_2 emissions (%)	45.99% ǂ	45.99% ǂ	33.40%	8.66%	88.05%

Panel B: Impact of the Paris Agreement exit on the effect of firm size

Sector(s)	Utilities and transportation	Other carbon-intensive sectors	Non-carbon-intensive sectors
Post	1.858 (0.400)***	0.344 (0.126)***	0.178 (0.116)
ln(Size)	0.525 (0.046)***	0.295 (0.027)***	0.245 (0.027)***
Post × ln(Size)	-0.169 (0.036)***	-0.023 (0.013)*	-0.002 (0.013)
Tobin's q	0.559 (0.217)**	0.050 (0.031)	0.055 (0.023)**
Tangibility	-0.839 (0.642)	-0.137 (0.295)	-0.455 (0.245)*
Leverage ratio	0.809 (0.806)	0.119 (0.149)	0.004 (0.132)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
R-squared	0.533	0.351	0.275
Number of firms	58	409	550
CO_2 emissions (%)	45.99%	33.40%	11.95%

FIGURE 2: Firm Size on Emission Performance of U.S. Firms

Below we present the Emission scores of the U.S. *utilities* (Chart A) and *transportation* firms (Chart B). *Emission score* is a raw score while *firm size* is the natural logarithm of a firm's total assets.

Chart A: U.S. *utilities*

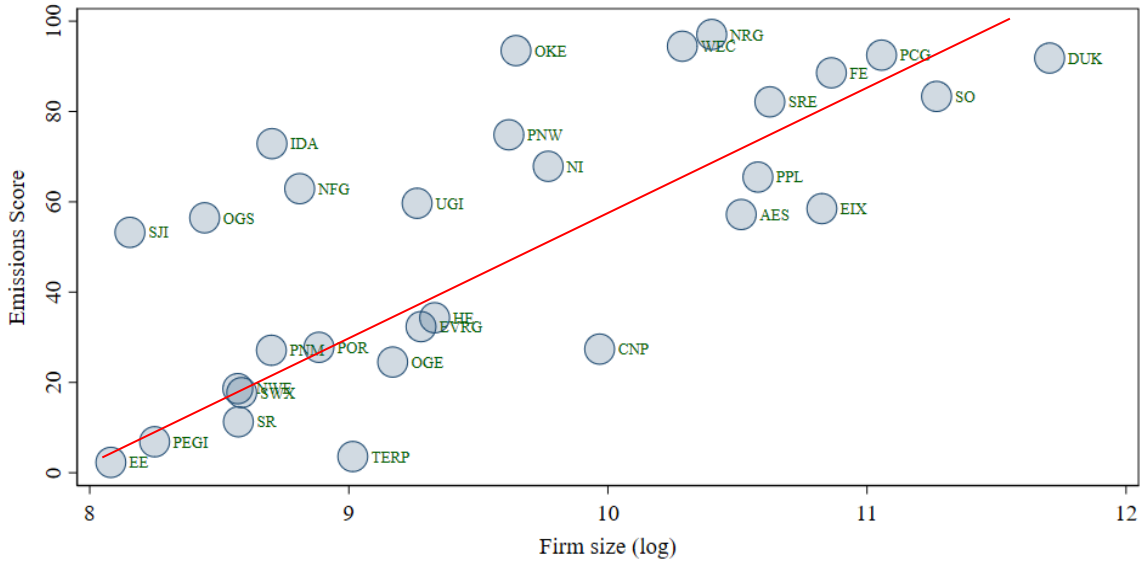

Chart B: U.S. *transportation*

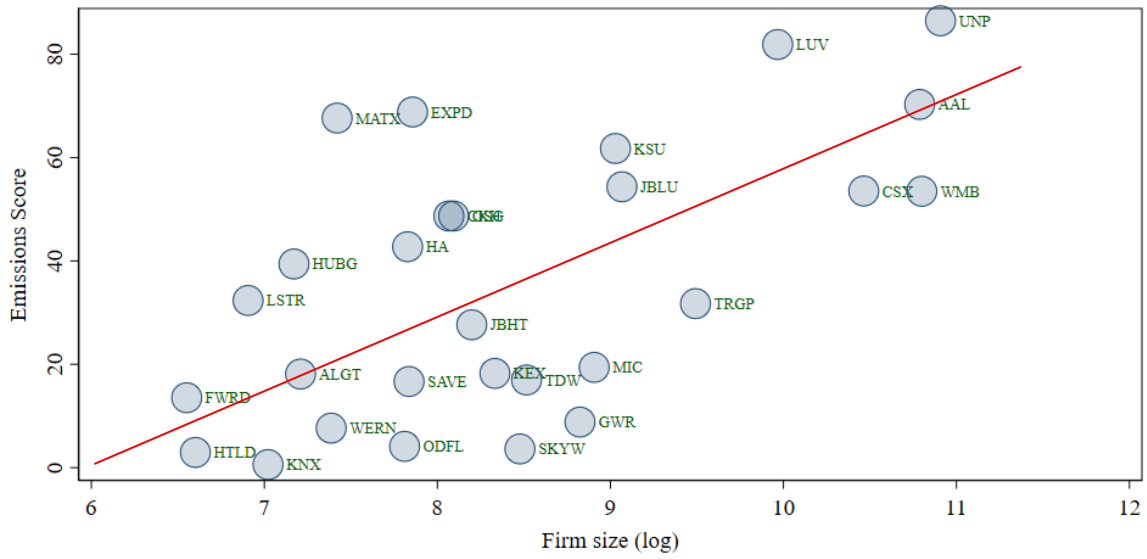

TABLE A1: Descriptions of TR ESG Scores

Each category of Thomson Reuters ESG Scores consists of a different number of indicators. *Weights* represents the proportion of each category of the TR ESG Scores to formulate the total ESG score. *Description of score* indicates the area(s), in which a firm's commitment, capacity, effectiveness, and performance are measured for the corresponding TR ESG Score.

Pillar/Category	# of indicators	Weights	Description of score
Environmental			
Emissions	22	12.0%	Reducing environmental emission in production and operational processes
Environmental innovation	20	11.0%	Reducing the environmental costs and burdens for its customers
Resource use	19	11.0%	Reducing the use of materials and finding eco-efficient solutions via supply chain management
Social			
Workforce	29	16.0%	Job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, etc.
Human rights	8	4.5%	Respecting the fundamental human rights conventions
Community	14	8.0%	Being a good citizen, protecting public health and respecting business ethics
Product responsibility	12	7.0%	Producing quality goods and services, incorporating the customer's health and safety, and data privacy
Corporate Governance			
Management	34	19.0%	Following best practice corporate governance principles
Shareholders	12	7.0%	Equal treatment of shareholders and the use of anti-takeover devices
CSR strategy	8	4.5%	Economic/financial, social, and environmental dimensions in its day-to-day decision-making processes
	178	100.0%	
Total score			Overall score based on the environmental, social, and corporate governance scores shown above
Controversies score			Exposure to environmental, social and governance controversies and negative events reflected in media
Combined score			Total score with a Controversies overlay