Governance Externalities of Climate-Related Disclosures: Evidence from Facility Emissions

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November 2021

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*Corresponding author. We gratefully acknowledge funding from the Della Suantio Fellowship, Lee Kong Chian Fellowship and the School of Accountancy Research Center (SOAR) at Singapore Management University.

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Abstract

We examine governance externalities of a geographic peer's climate-related disclosures on local emissions. We expect a firm's local plants to emit a lower amount of greenhouse gases when its geographic peer provides climate-related disclosures and attracts local attention to environmental issues. Using plant-level emissions data and a generalized difference-in-differences research design, we find that local plants decrease their emissions after another firm with plants in the same county initiates climate-related disclosures. We also find that this effect is stronger for plants in counties with higher income and higher education levels and for plants of firms with higher risk exposure to climate issues and lower transient institutional ownership. These results are robust to several tests that alleviate the concern that omitted local economic factors may lead local plants to reduce their emissions. Overall, our results are consistent with a monitoring effect of voluntary disclosures on local peers.

JEL Classification: G20; D83: M41

Keywords: Disclosure, Emissions, Governance, Peer effects, Geography, Sustainability

I. Introduction

The demand for information about firms' climate risks and sustainability has led to a rise in climate-related voluntary disclosures in the last few years.[1] The U.S. Securities Exchange Commission (SEC) has recently announced it will propose by the end of 2021 a new set of rules requiring companies to disclose the risks they face from climate changes.[2] Regulators and standard setters around the world are also considering reporting mandates on climate risk in the hope that such requirements can help achieve broader climate and sustainability objectives. While climate-related disclosures are motivated to help investors be more informed and better allocate their financial capital, such disclosures can also facilitate the monitoring of greenhouse gas emissions. For example, Matsumura, Prakash, and Vera-Muñoz (2014) report that the market penalizes firms by $212,000 for every additional thousand metric tons of carbon emissions upon disclosure.

Moreover, consistent with informed stakeholders exerting meaningful pressure on firms to alter the firms' sustainability behavior (Christensen, Hail, and Leuz 2021), several recent papers document real effects of such disclosure, where firms reduce emissions after they are mandated to disclose the amount of greenhouse gas emissions (e.g., Jouvenot and Krueger 2020; Tomar 2021; Downar et al. 2021). However, to the extent that a firm's disclosure entails governance externalities to neighboring firms through the pressure from common stakeholders, such as local activists and residents, we argue that the monitoring benefits of climate-related disclosures are not

[1] According to the 2020 KPMG survey of sustainability reporting, approximately one third of the 250 largest worldwide companies include a section on climate-related risks in their primary financial report or publish a separate climate risk report https://assets.kpmg/content/dam/kpmg/be/pdf/2020/12/The_Time_Has_Come_KPMG_Survey_of_Sustainability_Reporting_2020.pdf).

[2] https://www.bloomberg.com/news/articles/2021-07-28/gensler-says-sec-climate-risk-rules-will-be-proposed-by-year-end

limited to the disclosing firm but are extended to other firms whose plants are located in the same neighborhood.

We predict that a firm will reduce its emissions of greenhouse gases after its geographic peer initiates climate-related disclosures and attracts the attention of local activists and residents to climate risk issues. Extant research in finance and economics provides evidence of persistent geography-fixed differences in firm decisions, suggesting that firms with close proximity are likely to experience similar corporate outcomes (e.g., Pirinsky and Wang 2006; Barker and Loughran 2007; Kedia and Rajgopal 2009; Moretti 2010; Greenstone, Hornbeck, and Moretti 2010; Dougal, Parsons, and Titman 2015). The within-geography similarities are attributed not only to the location's exogenous attributes and political environment (such as weather, infrastructure, or tax rates) but also to endogenous interactions of community residents creating information spillovers or knowledge diffusion.[3] Therefore, if a firm's initiation of climate-related disclosures increases local residents' awareness of climate risk issues through social interactions within the community or local media featuring the firm's climate-related disclosure, it would prompt local activists to take actions and monitor the emissions of greenhouse gases from local plants located in the neighborhood.[4] Consequently, due to enhanced monitoring from the locals, we expect to see a decline in the amount of greenhouse gas emissions from local plants, including those not belonging to the disclosing firm.[5]

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[3] Prior studies also suggest that the endogenous interactions of local residents can create technology spillovers and consumer externalities, leading to geographic similarities in corporate behavior (Jaffe, Trajtenberg, and Hendersen 1993; Glaeser, Kolko, and Saiz 2001).

[4] Residents in the same geographic areas are likely to watch the same local TV programs, listen to the same local radio programs, or read the same local newspapers featuring local environmental issues (Arcury and Christianson 1993), which is likely to amplify the information spillover of climate-related disclosures.

[5] In an untabulated analysis, we find that a firm emits a lower amount of greenhouse gases after the firm initiates its own climate-related voluntary disclosures, confirming a monitoring role of corporate disclosures (consistent with Jouvenot and Krueger (2020)). However, whether a firm's public disclosure of climate-related information creates governance externalities is not easily inferred from the literature and hence the focus of our study.

To examine the effect of public disclosures on governance externalities to local peers, we define geographic peers as firms whose plants are located in the same county. For example, consider a firm, Company X, that operates two plants, XA and XB, located in counties A and B, respectively, and initiates disclosing climate-related information in year t. Also, consider another firm, Company Y, that operates two plants, YA and YC, located in counties A and C, respectively, and does not provide climate-related disclosures. Then X and Y are considered geographic peers to each other since residents in county A are their common stakeholders. We predict that Company X's disclosure in year t leads to a reduction in greenhouse gases emitted from plant YA while expecting no change in the emissions from plant YC in years subsequent to year t. Hence, our approach is equivalent to a difference-in-differences analysis, where we regard YA (YC) as a treated (control) sample.[6] When there is a third firm, Company Z, that operates its plants in counties other than A and B, all of Z's plants are also used as controls as they are not affected by Company X's disclosure.

To identify a firm that initiates climate-related voluntary disclosures, we use S&P Trucost. While the database allows researchers to access firm-level data on climate-related risks (including firm-level greenhouse gas emissions), it also provides information on its data sources. Hence, we consider a firm a voluntary discloser of climate-related information if the data vendor collects the information from public sources, such as CSR reports or environmental disclosures, where the firm voluntarily releases a wide range of qualitative and quantitative information related to climate change and sustainability issues. In addition, to measure our outcome variable at each plant level,

[6] Our assumption is that Company X's disclosure initiation is quasi-exogenous to Company Y's decision to reduce emissions in plant YA. To the extent that this assumption does not hold (e.g., both Companies X and Y are under the same environmental regulatory pressures or common economic shock), our inference is not valid. However, the unit of our analysis is a plant, not a firm, and hence common pressure at the firm-level cannot explain a differential change in emissions between plants YA and YC. We discuss and address this concern in more detailin section three.

we use the data compiled and provided by the U.S. Environmental Protection Agency (EPA). In 2009, the U.S. EPA announced the Greenhouse Gas Reporting Program (GHGRP) which requires firms to report annually the amount of greenhouse gases emitted directly from their facilities located in the U.S. beginning in 2010 if the facility emits at least 25,000 metric tons of CO_2 equivalents a year. Hence, if a firm is required to report their plant-level emissions to EPA but does not provide climate-related disclosures, its facilities are still included in our sample.[7]

Using 6,304 plant-year observations between 2010 and 2019, we find a significant decrease in the amount of greenhouse gases emitted from local plants after an initiation of climate-related voluntary disclosures by a geographic peer firm (defined as a firm with at least one plant located in the same county as the local plants in our sample). The reduced emissions are not attributable to the firm's own disclosure as disclosing firms are excluded from the sample and thus not included in the analysis.[8] This result is also not explained by emission-related time trends since we include a control sample of plants located in counties not affected by the peers' disclosures during the same period. In particular, we confirm that the emissions from sibling plants located in unaffected counties remain unchanged in a separate test, suggesting that our result reflects a locational, not a firm-wide, effect. Overall, our result is consistent with a firm's initiation of climate-related disclosure creating governance externalities to geographic peers through common stakeholders, and thereby reducing emissions from plants in the same neighborhood.

However, to the extent that time-varying county-specific factors can play an important role in local plant emissions, the lower emissions we observe can also be attributable to factors other

[7] A "facility" is defined broadly in the GHGRP as "any physical property, plant, building, structure, source, or stationary equipment located on one or more contiguous or adjacent properties in actual physical contact or separated solely by a public roadway or other public right-of-way and under common ownership or common control." We use plants and facilities interchangeably throughout this paper.

[8] Using the example illustrated above, we exclude Company X from our main sample to isolate the effect of Company X's disclosure on Company Y's behavior, Also, if Company Y discloses climate-related information in a subsequent year, we no longer include Company Y in the sample from that year.

than geographic peer disclosure. For example, the election of an environment-friendly politician in the community can induce a local firm to initiate climate-related disclosures and, at the same time, pressure local plants in the same county to reduce greenhouse gas emissions. Under this scenario, due to county-specific common shocks, significant reductions in greenhouse gases would occur simultaneously with disclosures. While we include a county's population and unemployment as controls in our main specification, we also conduct a dynamic analysis where we use the year when the peer's disclosure is initiated as a benchmark to further address this concern. The result of this analysis indicates no difference in the emissions between the years prior to disclosure initiation and the year of disclosure initiation. However, we find a significant reduction in the emissions during the post-disclosure years relative to the emissions in the year when the disclosure is initiated, mitigating the concern that our result is attributable to a location-wide common shock.[9]

We conduct several cross-sectional tests to strengthen our inferences. First, as argued in our study, if the information spillover among common stakeholders, such as local activists and residents, results in an improvement in the monitoring of greenhouse gas emissions for local plants, the magnitude of the governance externalities to local peers triggered by a climate-related disclosure should be stronger when the community residents are more sensitive to environmental issues. Arcury and Christianson (1993) suggest that variations in environmental attitudes and knowledge across different regions are explained by the residents' characteristics, such as income and education, suggesting that wealthier and more educated individuals can better process and interpret climate-related information (disseminated by corporate disclosures or by local media). Hence, we predict that a geographic peer's climate-related disclosure generates stronger

[9] Relatedly, a change in local economics or local investment opportunities can also affect a local firm's disclosure policy and greenhouse gas emissions simultaneously. However, an increase in investment opportunities would increase both disclosures and greenhouse gas emissions, which is opposite to what we find.

monitoring of greenhouse gas emissions by local residents when community residents are more sensitive to environmental issues, i.e., when they earn higher income and have higher education. Consistent with this prediction, we find that the reduction in local plant emissions after a geographic peer's initiation of climate-related disclosure is more pronounced in counties where the residents have higher income and higher education.

We also examine whether our result varies with firm characteristics. While local residents pressure firms to reduce greenhouse gas emissions for a common cause, shareholders also have incentives to monitor the emissions from local plants. In particular, given the pressure from local residents, firms are more likely to engage in sustainability activities if investors perceive a higher risk from climate issues. Therefore, we expect that the effect on emissions of monitoring spillovers from a climate-related disclosure will be stronger for firms with higher exposure to climate risks, where shareholders are likely to be more sensitive to the value implications of the firms' sustainability activities. On the other hand, we expect the effect from monitoring spillovers to be weaker if investors have short investment horizons with little interest in long-term sustainability. Managers are also likely to be more myopic when investors are focused on short-term earnings at the expense of long-term sustainability. We measure a firm's exposure to climate risk based on the number of times that bigrams related to climate change appear in conference call transcripts (Sautner, van Lent, Vilkov, and Zhang 2020) and measure the investors' investment horizon using transient institutional ownership (Bushee and Noe 2000; Bushee 2001). Consistent with our expectation, we find that the reduction in local plant emissions after a geographic peer's initiation of climate-related disclosure is more pronounced for firms with higher exposure to climate risks and for firms with lower transient institutional ownership.

In an additional analysis, we further examine whether our result is extended to facilities operated by private firms. Unlike public firms, private firms are not subject to capital market pressure. Given that we suggest the monitoring of common stakeholders, such as local activists and residents, is the primary channel of governance externalities, using a set of private firms without capital market incentives would be a more stringent test for our hypothesis. Hence, to the extent that we find a similar result using private firms, we can better attribute our result to the pressure from local activists and residents, rather than from capital market participants. We consider a firm a private firm if the firm reports the emissions from its facilities to the EPA but is not covered by Compustat. After controlling for the county's population and unemployment rate (in addition to facility and year fixed effects), we find that private firms also reduce their emissions from local plants after their geographic peers initiate climate-related disclosures, suggesting that governance externalities are created even in the absence of capital market pressure.

This study makes the following contributions to the literature. First, we contribute to the research on climate-related disclosures by providing evidence on their real effects. While recent research suggests that a firm's disclosure of greenhouse gas emissions is effective in curbing the firm's own emissions (e.g., Jouvenot and Krueger 2020; Tomar 2021; Downar et al. 2021), we extend this prior work and find that climate-related disclosures, in general, can create governance externalities and hence reduce carbon emissions even for non-disclosers.[10] Given that regulators around the world are considering whether and how to mandate climate-related disclosures for sustainability purposes, we believe our study is timely and important. Moreover, due to the costs

[10] For example, using the US EPA's Greenhouse Gas Reporting Program (GHGRP) as an identification strategy, Tomar (2021) examines the effect of disclosure on facility-level emissions and finds that facilities reduce emissions by 7.9% following disclosure. Downar et al. (2021) also find that firms affected by a carbon disclosure mandate in U.K. reduce emissions about 8% (with no change in their gross margins) relative to a control group of European firms. The findings from our study suggest that the voluntary nature of climate-related disclosure at the firm level has an incremental effect on geographic peer emissions.

of disclosure regulation, the findings of our study can potentially inform regulators when they set the scope of the disclosure requirements.

We also provide novel evidence on governance externalities created by peer disclosures. The disclosure literature has so far documented the presence of information externalities generated by industry peers or by firms along the supply chain (e.g., Olsen and Dietrich 1985; Baginski 1987; Han, Wild, and Ramesh 1989; Kim, Lacina, and Park 2008; Pandit, Wasley, and Zach 2011; Cho, Kim, and Zang 2020). While the literature generally suggests that corporate disclosures can serve a monitoring role and thus improve managerial decision-making (e.g., Bushman and Smith 2001; Lambert, Leuz, and Verrecchia 2007), little is known about how they can improve the monitoring of peer firms' behavior through governance externalities. Specifically, governance externalities of public disclosure can occur if a firm's disclosure results in the monitoring of non-disclosing peer firms by common stakeholders. By focusing on local activists and residents as common stakeholders shared by geographic peers, we document the presence of governance externalities of voluntary disclosures.

Lastly, our paper contributes to the studies on geographic peer effects in finance and economics. This research generally suggests that firms with close geographic proximity are likely to experience similar outcomes due to information transfers and the sharing of resources (e.g., Pirinsky and Wang 2006; Barker and Loughran 2007; Kedia and Rajgopal 2009; Moretti 2010; Greenstone et al. 2010; Dougal et al. 2015). We add to this line of research by documenting the effects of a geographic peer's disclosure. In particular, our study is related to a recent study by Matsumoto, Serfling, and Shaikh (2021), which finds that firms are sensitive to disclosure choices of geographic peers due to capital market incentives created by local investors. Our study extends the understanding of the role that peer disclosures can play as it affects not only a firm's disclosure choice but also the firm's general operating decisions, such as greenhouse gas emissions.

The remainder of the paper is organized as follows. We review the literature on climate-related disclosures and develop the hypotheses in section two. In section three, we describe the sample and empirical design. Sections four and five present the results from our analyses. Finally, section six concludes.

II. Literature Review and Hypotheses Development

2.1 Institutional Context of Climate-Related Disclosures

Firms around the world face increasing pressure from various stakeholders, including investors and regulators, to provide information about the impact of their operations on the environment and the extent to which their operations are affected by climate change. Consistent with this increasing pressure over time, the percentage of S&P 500 firms that publish sustainability reports has increased from 20% in 2011 to 90% in 2019.[11] However, the voluntary nature of these disclosures and the complexity of climate change has resulted in inconsistencies across reports, prohibiting users from comparing one firm's performance with that of another. For example, among the 402 companies that responded to a survey conducted by the Carbon Disclosure Project on the reporting of greenhouse gas emissions, only 35% use the GHG Protocol to measure and monitor their emissions inventory while another 22% use "other" methodologies that may not represent or contain methodologies for preparing GHG emission results.[12]

In 2015, upon the request of G20 Finance Ministers and Central Bank Governors, the Task Force on Climate-related Financial Disclosures (TCFD) was established to help stakeholders

[11] https://www.bsr.org/en/our-insights/report-view/five-steps-to-good-sustainability-reporting
[12] https://www.cdsb.net/sites/default/files/the-case-for-consistency-in-climate-change-related-reporting.pdf

identify the information needed to assess and price climate-related risks and opportunities.[13] The TCFD issued their final recommendations on climate-related financial disclosures in 2017, providing a reporting framework that can be adopted by organizations in various sectors and be included in firms' financial filings. To date, approximately one in five companies around the world report in line with the TCFD recommendations (KPMG Survey of Sustainability Reporting 2020). More recently, the SEC put out a request for public input on climate disclosures and received close to six thousand comments within ninety days of their statement, including calls to formally adopt the TCFD framework. Currently, the SEC is planning to propose mandatory reporting requirements for climate disclosures by the end of 2021. While the Commission has not disclosed any details on the proposed requirements, it emphasized that the reports should be consistent and comparable across firms to inform economic decision-making. Our study is, therefore, timely and important, as it can potentially inform regulators about the scope of the disclosure requirements.

Prior research on climate disclosures finds a negative association between carbon emissions and firm value. Using a sample of S&P 500 firms that voluntarily disclosed their carbon emissions from 2006 to 2008, Matsumura, Prakash, and Vera-Muñoz (2014) find that for every additional thousand metric tons of carbon emissions, firm value decreases by $212,000. Moreover, controlling for the act of voluntary disclosure, they find that the median market value of firms that disclose carbon emissions is about $2.3 billion higher than that of their non-disclosing peers. This finding suggests that while disclosing firms are penalized for their emissions, they are penalized less than those that choose not to disclose.

[13] The task force is chaired by Michael Bloomberg and consists of 31 international members representing both preparers and users of financial reports. The backgrounds of the members are also very diverse, with seventeen experts from the financial sector, eight from the non-financial sector, and six from other fields.

Consistent with informed stakeholders exerting meaningful pressure on firms to alter the firms' sustainability behavior (Christensen, Hail, and Leuz 2021), several recent papers document real effects of climate-related disclosures (e.g., Jouvenot and Krueger 2020; Tomar 2021; Downar et al. 2021). For example, using the US EPA's Greenhouse Gas Reporting Program (GHGRP) as an identification strategy, Tomar (2021) examines the effect of disclosure on facility-level emissions and finds that facilities reduce emissions by 7.9% following disclosure. Downar et al. (2021) find that firms affected by a carbon disclosure mandate in U.K. reduce emissions about 8% with no change in their gross margins. Similarly, Jouvenot and Krueger (2020) find that firms reduce their emissions by 16% after the mandatory disclosure requirement in U.K. They also find that institutional investors increased their holdings in firms disclosing lower emissions. While the results from these studies are consistent with a governance role of disclosure, we extend their work by examining governance externalities of disclosure on peer firms.[14]

2.2 Hypotheses Development

Extant research in finance and economics provides evidence of geographic peer effects in firm decisions, where firms located within close proximity are likely to experience similar corporate outcomes. Pirinsky and Wang (2006) find that stocks of firms with nearby headquarters have strong comovement and that the comovement decreases when a firm relocates headquarters. Moreover, they show the comovement is related to local economic and demographic characteristics, where the effect is more pronounced for smaller firms with more individual investors and regions with less financially sophisticated investors. Kedia and Rajgopal (2009) show there are location fixed effects in firms' broad-based option grants, where a firm is more

[14] A separate and growing stream of research on climate change in finance examines the pricing implications of climate risk (e.g., Hong, Li, and Xu 2019; Bolton and Kacperczyk 2020; Ilhan, Sautner, and Vilkov 2020; Aswani, Raghunandan, and Rajgopal 2021, etc.).

likely to grant options to their rank-and-file employees if another firm in the same region does so as well. Further analyses show that this effect is driven by both tightness in local labor markets and a firm's social interactions with neighboring firms. Dougal, Parsons, and Titman (2015) find a firm's investment is sensitive to that of another firm nearby even when they are not in the same industry. Furthermore, they show this effect is not attributable to the firms' common response to local shocks (e.g., a sudden increase in labor supply or natural disasters) but rather to their endogenous interactions.

The endogenous local effects discussed above give rise to agglomeration economics and are also well-documented in the urban economics literature (Jaffe, Trajtenberg, and Hendersen 1993; Glaeser, Kolko, and Saiz 2001). Specifically, these studies suggest that the endogenous interactions of local residents can generate technology spillovers and consumer externalities. For example, an employee of firm A may learn new skills and share them with an employee of firm B through social interactions, leading to the diffusion of technology. Likewise, as firm A grows and its employees have more disposable income to spend on luxury goods, it will bring down the cost of such goods due to economies of scale, generating consumption externalities for employees of firm B. In sum, the combined evidence from this prior research suggests that the endogenous interactions of locals play an important role in geographic peer effects.

Given the importance of social interactions in geographic peer effects and the governance role of climate disclosure, we expect a firm to reduce greenhouse gas emissions when its geographic peer initiates climate disclosures. For example, a local shareholder of firm A may read the firm's climate disclosure and share it with other local residents. This may raise their awareness about the environmental impact of local facilities, leading them to take action against peer firms with facilities in the same county. Moreover, residents in the same geographic areas are likely to watch the same local TV programs, listen to the same local radio programs, or read the same local newspapers featuring local business and environmental issues (Arcury and Christianson 1993). Therefore, endogenous interactions of local stakeholders can lead to monitoring externalities if a firm's climate-related disclosure raises residents' awareness of climate issues through their interactions within the community or common information sources such as local media, prompting them to take actions and monitor the greenhouse gas emissions of local plants in the neighborhood. This leads us to our main hypothesis, stated in alternative form, as follows:

H1: A firm will reduce its greenhouse gas emissions from its local plants after its geographic peer initiates climate-related voluntary disclosures.

We also present cross-sectional hypotheses to reinforce our inference. First, we expect the effect of the governance externalities as discussed above to be more pronounced in counties where local residents are more likely to be aware of and concerned about environmental issues. Arcury and Christianson (1993) find that differences in environmental knowledge and actions across different regions are explained by residents' education and income levels (while they find little difference in environmental attitudes between rural and urban residents), suggesting that wealthier and more educated individuals can better process and interpret climate-related information (disseminated by corporate disclosures or by local media), resulting in higher interest, knowledge, and understanding of environmental issues. Therefore, to the extent that the governance externalities are generated by local residents more sensitive to environmental issues, we hypothesize that the monitoring spillover of a geographic peer's climate-related disclosure would be more pronounced when the county is populated with residents with higher income and education levels. This leads us to our second hypothesis, stated in alternative form, as follows:

H2a: The reduction in greenhouse gas emissions as stated in H1 will be greater when county residents have higher income levels.

H2b: The reduction in greenhouse gas emissions as stated in H1 will be greater when county residents have higher education levels.

We also expect the effect of the governance externalities to vary with firm characteristics. Given the pressure from local residents, firms are more likely to engage in sustainability activities if investors perceive a higher risk from climate issues. Hence we hypothesize that the effect on emissions of monitoring spillovers from a climate-related disclosure will be stronger for firms with higher exposure to climate risks, where shareholders are likely to be more sensitive to the value implications of the firms' sustainability activities. We measure a firm's exposure to climate risk based on the number of times that bigrams related to climate change appear in conference call transcripts (Sautner et al. 2020). However, we expect the effect to be weaker if investors have short investment horizons with little interest in long-term sustainability. Managers are also likely to be more myopic when investors are focused on short-term earnings at the expense of long-term sustainability. Therefore, we hypothesize that the effect on emissions of monitoring spillovers from a geographic peer's climate-related disclosure will be less pronounced when investors have a shorter investment horizon, as measured by transient institutional ownership (Bushee and Noe 2000; Bushee 2001). This leads us to our third hypothesis, stated in alternative form, as follows:

H3a: The reduction in greenhouse gas emissions as stated in H1 will be greater for firms with higher exposure to climate risks.

H3b: The reduction in greenhouse gas emissions as stated in H1 will be smaller for firms with higher transient institutional ownership.

III. Research Design

3.1 Data and Sample Construction

Starting from 2010, the US EPA's (the United States Environmental Protection Agency) GHGRP (Greenhouse Gas Reporting Program) mandates firms to report the annual amount of greenhouse gas emissions for facilities located in the U.S. that emit at least 25,000 metric tons of CO_2 equivalent. The primary purpose of the EPA's GHGRP reporting rule is "to gather greenhouse gas information to assist the EPA in assessing how to address emissions and climate change under the Clean Air Act." Using the information disclosed in the EPA's GHGRP website, we obtain the amount of greenhouse gases emitted by each facility along with the location of the facility and the name of companies that operate the reporting facilities. We show in Figure 1 a time trend of the emission amount of greenhouse gases at the facility level during our sample period. The figure shows that while the emission amount of greenhouse gases on average peaked in 2010 at 654,317 tons of CO_2 equivalent, it has decreased modestly over time. We merge this data from the EPA with Compustat for financial characteristics measured at the firm level.

[Insert Figure 1]

We further merge this data with S&P Trucost. Similar to the EPA's GHGRP, S&P Trucost also provides the data on the emission of greenhouse gases, but it provides the emissions data at the firm level, not at the facility level. While prior research mainly uses S&P Trucost for the amount of greenhouse gases emitted by firms (e.g., Dawkins and Fraas 2011; Bolton and Kacperczyk 2021), we do not use this dataset to measure the emission variable (as our focus is on the emission at the facility level). Instead, we use S&P Trucost to identify firms that issue a climate-related voluntary disclosure. We consider a firm a voluntary discloser of climate-related information if the data vendor collects the emission amount from public sources, such as CSR reports or environmental disclosures, issued voluntarily by firm.[15] When firms disclose greenhouse gas emissions, the disclosure usually includes a broader discussion of environmental and sustainability issues. To illustrate, Appendix B presents an excerpt from Ford Motor Company's 2021 Sustainability and Financial Report. The excerpt shows that the company aims to achieve carbon neutrality to respond to global climate change and create a positive impact on the local ecosystem. In its full report, the company discloses the amount of greenhouse gas emissions and specific plans to meet the greenhouse gas target in the future.[16]

Given that our focus is on a change in a firm's behavior before and after its peer's climate-related disclosure, for a firm's facility to be in the sample, we require the facility to have at least one observation both before and after the peer's disclosure. Moreover, to isolate the effect of the peer's disclosure from the firm's own disclosure, we require a firm not to issue climate-related disclosures to remain in the sample. Hence, if a firm starts to issue its climate-related disclosure (as identified by S&P Trucost), we exclude the firm's facilities from the sample in and after the year of the initial disclosure (while keeping the firm's facilities prior to the year of the initial disclosure). As outlined in Table 1, after removing observations with missing values for firm- and county-level characteristics, our final sample consists of 6,304 firm-facility-years located across 636 counties between 2010 and 2019. Given that the sample has 1,461 firm-years, an average firm in our sample runs 4.3 facilities.

[Insert Table 1]

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[15] S&P Trucost provides information on its data sources, allowing us to determine whether or not the emission amount is from a public source. While it collects the emissions data mostly from public sources, it can also collect the data through a private channel, such as the vendor's private communication with corporate managers. The data vendor can also use a proprietary model to estimate the amount of greenhouse gas emissions when the emission amount is not publicly available. Note that S&P Trucost does not list the EPA' GHGRP as its data source. While it provides firm-level emissions aggregated across all facilities (including those in foreign countries), EPA's GHGRP covers part of the facilities in the U.S. whose emissions exceed 25,000 metric ton of CO2 equivalent.
[16] This report is available from the website of Ford Motor Company (https://corporate.ford.com/microsites/integrated-sustainability-and-financial-report-2021/index.html).

3.2 Measure of Peer Disclosure

To examine the effect of disclosures issued by a geographic peer on non-disclosing firms, we create a binary variable, *Peer Disclosure*, which equals one for a county (and thus all facilities located in the county) in the post-disclosure period and zero otherwise. A county belongs to the pre-disclosure period if none of the firms operating facilities in the county has started to issue climate-related voluntary disclosures and the post-disclosure period if at least one of those firms already initiated climate-related voluntary disclosures. Hence, the initial year of the post-disclosure period is different across facilities in our sample depending on which county they are located in, allowing us to implement a generalized difference-in-differences research design.

To be more specific, Appendix C illustrates the construction of this variable. Consider county A which has two facilities, belonging to firms X and Y each. County B also has two facilities, belonging to firms Y and Z each. Assuming that firms Y and Z have yet to issue climate-related voluntary disclosures, if firm X is the first to issue such disclosures in 2014, *Peer Disclosure* takes a value of zero for all facilities in years from 2010 to 2014 (i.e., the pre-disclosure period). However, this variable takes a value of one for firm Y's facility in county A in years 2015 to 2019 (i.e., the post-disclosure period) while it continues to take a value of zero for firm Y's facility in county B unless firm Z initiates its climate-related disclosure in a subsequent year. Firm X's facility is excluded from our analysis to isolate the effect of a peer's disclosure from the firm's own disclosure. If firm Y initiates a climate-related disclosure later during the post-disclosure period, the firm Y's facility is also excluded from the analysis.

Panel A of Table 2 shows the yearly distribution of the number of counties and facilities affected by an initiation of a geographic peer's climate-related voluntary disclosure. For example, in 2010, 40 counties (and thus 122 facilities located in those counties) were affected by the initiation of a climate-related disclosure by geographic peers. Hence, for these 122 facilities, *Peer Disclosure* takes a value of zero in 2010, but a value of one in years subsequent to 2010. Also, in 2018, 131 counties (and thus 234 facilities located in those counties) were affected by the initiation of a geographic peer's climate-related disclosure, suggesting that *Peer Disclosure* takes a value of zero in years prior to 2019 but a value of one in 2019. Therefore our approach is analogous to designs with staggered treatments, where each facility is affected by a geographic peer's climate-related disclosure at different points in time. Panel B of Table 2 shows the yearly number of counties and facilities in our sample used in our analyses. Consistent with more and more firms beginning to disclose climate-related information over time, we find more counties and facilities in the pre-disclosure (post-disclosure) period in the earlier (later) part of our sample period.

[Insert Table 2]

Figure 2 shows the geographical distribution of counties affected by peer disclosures in different time periods. The counties are partitioned into three groups depending on the year when the disclosure is initiated, i.e., counties with initiation years in 2010-2012, 2013-2015, and 2016-2018, respectively. This figure suggests that affected counties are evenly spread out and does not seem to be clustered around certain regions in each time period.

[Insert Figure 2]

3.3 Regression Model

We use a generalized difference-in-differences design by running the following regression model, where we estimate the effect of a geographic peer's climate-related voluntary disclosure on a focal firm's facility-level emissions:

$$Emission_{i,t} = \alpha + \beta Peer\ Disclosure_{c,t} + \gamma Firm\text{-}level\ Controls_{j,t-1} + \delta County\text{-}level\ Controls_{c,t-1} + Fixed\ Effects + \varepsilon_{i,t} \quad (1)$$

In Equation (1), the subscript *i*, *j*, *c*, and *t* refer to facilities, firms, counties, and years, respectively. The dependent variable is *Emission*, the amount of greenhouse gases emitted from a facility. We follow Shive and Foster (2020) and measure this variable as the natural log transformation of one plus total greenhouse gas emissions reported by EPA's GHGRP (as in metric tons of CO_2 equivalent). The main explanatory variable of interest is *Peer Disclosure*. As described above, this variable equals one for a county (and thus all facilities located in the county) for the post-disclosure period and zero for the pre-disclosure period. A negative coefficient on this variable would be consistent with H1. Note that while a facility cannot be located in two different counties, a firm can operate two (or more) facilities located in two different counties. Thus a firm can have a facility in a county affected by peer disclosure and at the same time another facility in a different county which has not been affected by peer disclosure. Since we are conducting our analyses at the facility level, not the firm level, we can control for the effect of firm-specific factors potentially affecting a firm's greenhouse gas emissions.

Nonetheless, we further control for various firm-level characteristics that could influence the amount of greenhouse gas emissions. In particular, because firms are likely to adjust operating activities in response to perceived risk, we include in the regression model an array of variables that proxy for a firm's exposure to overall risk as measured at the beginning of the period: *Total Assets*, defined as the natural logarithm of total assets; *ROA*, defined as operating income after depreciation scaled by the average total assets; *Leverage*, defined as long-term debt scaled by total assets; *Sales Growth*, defined as changes in sales scaled by sales in the previous year. We also include *Tangible Assets*, defined as property, plant, and equipment, net of accumulated depreciation, scaled by total assets, because tangible assets are more likely to generate greenhouse gases compared to intangible assets. In contrast, firms with more intensive R&D activities are less likely to emit greenhouse gases if R&D expenditures capture investments in intangible assets. Hence we further include *R&D Expenses*, defined as R&D expenses scaled by sales, in our regression model.

In addition to firm characteristics, we also control for the characteristics of the county in which the firm's facilities are located. First, we include *Population*, defined as the natural log transformation of one plus the county's population. Counties with greater populations are more likely to have higher economic activities, potentially suffering from greater emissions from local plants. We obtain the data on each county's time-varying population from the U.S. Bureau of Economic Analysis (BEA). In a similar spirit, we also include *Unemployment*, defined as an unemployment rate in a county each year, obtained from the U.S. Bureau of Labor Statistics (BLS). To the extent that employment captures the strength of a county's local economic activities, we expect counties with higher unemployment to have lower emissions from local facilities.

We include facility and year fixed effects as required under a generalized difference-in-differences research design. Facility fixed effects control for time-invariant facility-level characteristics, such as the location of a facility or the type of regulatory permit required to operate a factory. Further, facility fixed effects subsume county fixed effects and hence mitigate the effect of locality characteristics that vary little over time in a facility's neighborhood. Year fixed effects control for temporal effects (e.g., the awareness of environmental issues or the enactment of new regulations that restrict environmentally harmful economic activities). To allow for potential variation in time trends across different industries, we also estimate the regression model with industry-year (combination) fixed effects in place of year fixed effects. We cluster standard errors at the industry-year level to account for the potential correlation of economic activities that emit greenhouse gases at the industry level over time. Appendix A provides the variable definitions in detail.

3.4 Descriptive Statistics

Panel A of Table 3 reports the summary statistics for variables used in the above regression model. *Emission (Raw)* refers to the amount of greenhouse gases emitted by facilities before taking log-transformation. The mean of this variable is 519,580, suggesting that facilities in our sample, on average, emit 519,580 metric tons of CO_2 equivalent annually. When this variable is log-transformed, the mean of *Emission* is 11.49.[17] *Peer Disclosure* has a mean of 0.43, suggesting that 43% (57%) of the facilities in our sample are in the post-disclosure period (the pre-disclosure period) as determined by their geographic peers' climate-related voluntary disclosures. The mean of *Total Assets* is 9.53, equivalent to 13,760 million dollars of total assets. The average firm in our sample has *ROA* of 0.03, *Leverage* of 0.35, and *Sales Growth* is 0.08. The average firm also has *Tangible Assets* equal to 56% of total assets and *R&D expenses* amounting to 1% of sales revenue. The mean of *Population* is 11.45, equivalent to a population of 93,900 for an average county. The mean of *Unemployment* is 7.31, suggesting that counties with facilities in our sample have an average 7.31% unemployment rate.

Panel B of Table 3 reports the distribution of sample facilities by industry based on the Fama-French 12 industry classification. The utility industry comprises the largest number of sample facilities, followed by other, energy, and manufacturing industries. Not surprisingly, facilities in utility industries, on average, emit the largest amount of greenhouse gases, followed by those in energy, other, and chemical industries. Facilities in the consumer durables industry on average emit the smallest amount of greenhouse gases.

[17] Exp(11.49) - 1 = 97,733, which is a lot smaller than 519,580, suggesting that the emission amount is highly skewed before log-transformation.

[Insert Table 3]

IV. Empirical Analyses

4.1 Governance Externalities of Peer Disclosure

Table 4 presents the results of the regression analysis estimating Equation (1). In column (1), when we include facility fixed effects and year fixed effects, we find that the coefficient on *Peer Disclosure* is -0.107, significantly negative at the 5% level, consistent with facilities in our sample emitting a lower amount of greenhouse gases in years subsequent to the initiation of climate-related disclosures by geographic peers (relative to other facilities in the sample located in unaffected counties during the same period). The coefficient of -0.017 suggests a 10.1% reduction in greenhouse gas emissions (i.e., exp(-0.107) – 1 = -0.101) when switching from the pre-disclosure period (when none of the geographic peers has yet to initiate such disclosures) to the post-disclosure period (when at least one of their geographic peers has initiated such disclosures). In column (2), where we replace year fixed effects with industry-year (combination) fixed effects, the coefficient on *Peer Disclosure* is -0.127, significantly negative at the 1% level. Again, the coefficient of -0.127 suggests an 11.9% reduction in greenhouse gas emissions (i.e., exp(-0.127) – 1 = -0.119) for a facility in an affected county from the pre-disclosure period to the post-disclosure peers. Overall, the results from this analysis provide support for H1.

When it comes to control variables, we find a significantly positive coefficient on ROA. The coefficient on this variable is 0.478 ($p<0.01$) and 0.345 ($p<0.10$) in columns (1) and (2), respectively, suggesting that facilities in firms with better performance tend to emit a greater amount of greenhouse gases. We also find a significantly positive coefficient of 0.270 ($p<0.10$) on *Leverage* in column (1), indicating that facilities in firms with higher leverage tend to have greater emissions. Furthermore, consistent with plant operations being positively correlated with a region's economic activity, we find a significantly positive coefficient of 1.24 ($p<0.01$) on *Population* in column (1). We also find a significantly negative coefficient on *Unemployment*. The coefficient on this variable is -0.024 ($p<0.01$) and -0.03 ($p<0.01$) in columns (1) and (2), respectively. Overall, these results suggest that a firm and its county's economic activities are important determinants of plant emissions.

[Insert Table 4]

4.2 Placebo Test

To strengthen our inference, we conduct a placebo test, where we replace *Peer Disclosure* in Equation (1) with *Peer Disclosure* ^{Placebo}. *Peer Disclosure* ^{Placebo} is an indicator variable that equals one for a facility if it is located in a county that has not been affected by climate-related disclosures while at the same time at least one of the sibling facilities belonging to the same firm is located in affected counties, and zero otherwise. To illustrate, let us assume that facilities A and B belong to firm X, and facility C belongs to firm Y. If *Peer Disclosure* equals one for facility A and zero for facilities B and C in year *t*, *Peer Disclosure* ^{Placebo} equals one for facility B and zero for facilities A and C in year *t*. Therefore, to the extent that the result from the main analysis is attributable to a firm-wide effect on facility emissions, rather than a location-specific governance externalities, we would find a significantly negative coefficient on *Peer Disclosure* ^{Placebo}.[18]

Table 5 presents the results from this analysis. We find that the coefficient on *Peer Disclosure* ^{Placebo} is 0.029 and 0.050 in columns (1) and (2), respectively. Both are not significantly different from zero, suggesting that our result from the main analysis reflects a locational, not a

[18] Our inference does not change in following alternative designs: 1) We define *Peer Disclosure* ^{Placebo} to equal one for facility B and zero for facility C in year t after removing facility A from the sample; and 2) we define *Peer Disclosure* ^{Placebo} to equal one for facilities A and B and zero for facility C in year t.

firm-wide, effect. In addition, similar to the result from the main analysis, we continue to find a significantly positive coefficient of 0.485 and 0.358 on *ROA* in columns (1) and (2), respectively, suggesting that facilities in firms with better performance have higher emissions. Also, consistent with plant operations being positively correlated with a region's economic activity, we continue to find a significantly positive coefficient of 1.24 ($p<0.01$) on *Population* in column (1). We also find a significantly negative coefficient of -0.024 ($p<0.01$) and -0.03 ($p<0.01$) on *Unemployment* in both columns (1) and (2), respectively. Overall, the result from this analysis mitigates the possibility that our result from the main analysis is due to firm-wide factors likely affecting all facilities belonging to the same time simultaneously.

[Insert Table 5]

4.3 Dynamic Effects of Peer Disclosure

To the extent that time-varying county-specific factors can play an important role in local plant emissions, the lower emissions we find from the main analysis can be attributable to factors other than geographic peer disclosure. For example, the election of an environment-friendly politician in the community can induce a local firm to initiate climate-related disclosures and, at the same time, pressure local plants in the same county to reduce greenhouse gas emissions. Under this scenario, due to county-specific common shocks, significant reductions in greenhouse gases would occur simultaneously with disclosures. Hence, to address this concern, we conduct a dynamic analysis where we use the year when the peer's disclosure is initiated as a benchmark. More specifically, we estimation the following regression model:

$$\begin{aligned} Emission_{i,t} = \alpha &+ \beta_1 Peer\ Disclosure^{Pre\text{-}3}{}_{c,t} + \beta_2 Peer\ Disclosure^{Pre\text{-}2}{}_{c,t} + \beta_1 Peer\ Disclosure^{Pre\text{-}1}{}_{c,t} \\ &+ \beta_4 Peer\ Disclosure^{Post+1}{}_{c,t} + \beta_5 Peer\ Disclosure^{Post+2}{}_{c,t} \\ &+ \gamma Firm\text{-}level\ Controls_{j,t-1} + \delta County\text{-}level\ Controls_{c,t-1} \\ &+ Fixed\ Effects + \varepsilon_{i,t} \qquad (2) \end{aligned}$$

Peer Disclosure $^{Pre\text{-}3}$, *Peer Disclosure* $^{Pre\text{-}2}$, and *Peer Disclosure* $^{Pre\text{-}1}$ are indicator variables that equal one if a facility-year observation is three or more years, two years, and one year before the initiation of a climate-related disclosure issued by its geographic peer, respectively, and zero otherwise. Similarly, *Peer Disclosure* $^{Post+1}$ and *Peer Disclosure* $^{Post+2}$ are indicator variables that equal one if a facility-year observation is one year and two or more years after the initiation of a climate-related disclosure issued by its geographic peer, respectively, and zero otherwise.

The results from this analysis are presented in Table 6. In column (1) with facility and year fixed effects, we find that the coefficients on *Peer Disclosure* $^{Post+1}$ and *Peer Disclosure* $^{Post+2}$ are -0.120 and -0.139, respectively, significantly negative at the 5% levels. Given that the coefficients on these variables capture the incremental amount of greenhouse gases relative to those emitted in the year when the peer's disclosure is initiated, this result mitigates the possibility that any concurrent local events, such as a political or economic shock to a local county, induce the peer to initiate disclosures and simultaneously local plants to reduces emissions.[19] Moreover, the coefficients on *Peer Disclosure* $^{Pre\text{-}3}$, *Peer Disclosure* $^{Pre\text{-}2}$, and *Peer Disclosure* $^{Pre\text{-}1}$ are all insignificant; hence we do not find any noticeable time trend of decreased emissions during the years leading up to the peer's disclosure initiation. In column (2) with facility and industry-year (combination) fixed effects, we also find similar results. The coefficients on *Peer Disclosure* $^{Post+1}$ and *Peer Disclosure* $^{Post+2}$ are -0.132 and -0.141, respectively, significantly negative at the 5% levels. Moreover, the coefficients on *Peer Disclosure* $^{Pre\text{-}3}$, *Peer Disclosure* $^{Pre\text{-}2}$, and *Peer Disclosure* $^{Pre\text{-}1}$ are all insignificant, again, suggesting that there is no difference in the emissions

[19] To the extent the result from our main analysis is attributable solely to a county-wide local shock (affecting both the disclosure and emissions), we would not find a significant reduction in the emissions during the first year in the post-disclosure period relative to the emissions during the year when the peer initiated its disclosure.

from local facilities during the pre-disclosure period, particularly between the years prior to the peer's disclosure and the year when the peer's disclosure is initiated.

[Insert Table 6]

In Figure 3, we plot the coefficients on disclosure variables together with confidence intervals we obtain from the analysis in Table 6 (i.e., *Peer Disclosure* $^{Pre\text{-}3}$, *Peer Disclosure* $^{Pre\text{-}2}$, *Peer Disclosure* $^{Pre\text{-}1}$, *Peer Disclosure* $^{Post+1}$, and *Peer Disclosure* $^{Post+2}$). Panels A and B present the coefficients from columns (1) and (2) of Table 6, respectively, where t=0 refers to the year when the geographic peer's climate-related disclosure is initiated. With the emissions in the year t=0 as a benchmark, it is noticeable from both panels that there is no decreasing trend of greenhouse gas emissions until the first year in the post-disclosure period (i.e., t+1). Overall, Figure 3 shows that the reduction in emissions begins only after the initiation of the peer's disclosure, consistent with a geographic peer's climate-related voluntary disclosures entailing a monitoring spillover effect on local facilities of non-disclosing firms.

[Insert Figure 3]

V. Additional Analyses

5.1 Cross-Sectional Test Based on County-level Characteristics

H2 suggests that the monitoring spillover from a geographic peer's climate-related disclosure should be more pronounced when local residents have higher income and higher education levels. To test H2, we obtain the average personal income for each county from the Bureau of Economic Analysis (BEA), and the proportion of county population with higher education from the United States Department of Agriculture's (USDA) Economic Research Service (ERS). We then partition our sample into two groups based on the median value of county characteristics, such as *Income* (i.e., the county residents' average income) and *Education* (i.e., the proportion of county population with a high school diploma or higher), and estimate the following regression model.

$$Emission_{i,t} = \alpha + \beta_1 Peer\ Disclosure^{High}_{c,t} + \beta_2 Peer\ Disclosure^{Low}_{c,t} + \beta_3 High_{c,t} + \gamma Firm\text{-}level\ Controls_{j,t-1} + \delta County\text{-}level\ Controls_{c,t-1} + Fixed\ Effects + \varepsilon_{i,t} \quad (3)$$

Peer Disclosure ^{High} (*Peer Disclosure* ^{Low}) is defined as the product of *Peer Disclosure* and *High* (*Low*), where *High* (*Low*) is an indicator variable that equals one if a facility in our sample is located in a county where the partitioning variable, such as *Income* or *Education*, is above (below) the sample median and zero otherwise.

Table 7 presents the results of this analysis. In Panel A, when we partition our sample based on the median of *Income* (i.e., *High* refers to *High Income*), in column (1), we find that the coefficient on *Peer Disclosure*$^{High\ Income}$ is -0.171, significantly negative at the 1% level. However, the coefficient on *Peer Disclosure*$^{Low\ Income}$ is negative but not significantly different from zero. Moreover, the result from an F-test on the difference in these coefficients suggests that the coefficients on *Peer Disclosure*$^{High\ Income}$ and *Peer Disclosure*$^{Low\ Income}$ are significantly different at the 0.051 level. We also find similar results in column (2). The coefficient on *Peer Disclosure*$^{High\ Income}$ is -0.206, significantly negative at the 1% level, but the coefficient on *Peer Disclosure*$^{Low\ Income}$ is, again, negative but not significantly different from zero. The p-value of the F-test on the difference in these coefficients is 0.021, suggesting that the effect of a geographic peer's climate-related disclosures is significantly greater in counties where local residents have higher income levels.

In Panel B, we report the result when we partition our sample based on the median of *Education* (i.e., *High* refers to *High Education*). Note that the main effect of *High Education* is subsumed by fixed effects because our measure of education (i.e., the proportion of county population with higher education) has no variation across time.[20] In column (1), we find that the coefficient on *Peer Disclosure*$^{High\ Edu.}$ is -0.218, significantly negative at the 1% level. However, the coefficient on *Peer Disclosure*$^{Low\ Edu.}$ is negative but not significantly different from zero. Moreover, the result from an F-test on the difference in these coefficients suggests that the coefficients on *Peer Disclosure*$^{High\ Edu.}$ and *Peer Disclosure*$^{Low\ Edu.}$ are significantly different at the 0.015 level. We also find similar results in column (2). The coefficient on *Peer Disclosure*$^{High\ Edu.}$ is -0.256, significantly negative at the 1% level, but the coefficient on *Peer Disclosure*$^{Low\ Edu.}$ is, again, negative but not significantly different from zero. The p-value of the F-test is 0.005, suggesting that the effect of a geographic peer's climate-related disclosures is significantly greater when county residents have higher education levels.

Overall, the results in Table 7 are consistent with H2, suggesting that a geographic peer's climate-related disclosure creates governance externalities to local plants of non-disclosing firms primarily in counties where residents are more sensitive to environmental issues. These results thus provide further support for our main hypothesis as they illuminate the role of local residents as an underlying mechanism of monitoring spillover triggered by a geographic peer's climate-related disclosure.

[Insert Table 7]

5.2 Cross-Sectional Test Based on Firm-level Characteristics

H3 suggests that the monitoring spillover from a geographic peer's climate-related disclosure would be more pronounced for firms with higher exposure to climate risks, but less pronounced for firms with more short-term investors. To test H3, we first measure a firm's exposure to climate risk, *Climate Change Exposure*, based on the number of times that bigrams

[20] USDA's ERS provides the proportion of county population with high school diploma or higher as an averaged figure over five years between 2015 and 2019.

related to climate change appear in conference call transcripts (Sautner et al. 2020). We also measure a firm's transient institutional investor ownership, *Transient Institution*, as a proxy for the extent to which the firm's investors are short-term oriented (Bushee and Noe 2000; Bushee 2001). We then split the sample into two groups based on the median value of these firm-level variables and estimate Equation (3) again. For this analysis, *Peer Disclosure* ^{High} (*Peer Disclosure* ^{Low}) is re-defined as the product of *Peer Disclosure* and *High* (*Low*), where *High* (*Low*) is an indicator variable that equals one if a facility in our sample belongs to a firm where the partitioning variable, such as *Climate Change Exposure* or *Transient Institution*, is above (below) the sample median and zero otherwise.

Table 8 presents the results of this analysis. In Panel A, when we partition our sample based on the median of *Climate Change Exposure* (i.e., *High* refers to *High Exposure*), in column (1), we find that the coefficient on *Peer Disclosure* $^{High\ Exposure}$ is -0.186, significantly negative at the 1% level. However, the coefficient on *Peer Disclosure* $^{Low\ Exposure}$ is negative but not significantly different from zero. Moreover, the result from an F-test on the difference in these coefficients suggests that the coefficients on *Peer Disclosure* $^{High\ Exposure}$ and *Peer Disclosure* $^{Low\ Exposure}$ are significantly different at the 0.049 level. We also find similar results in column (2). The coefficient on *Peer Disclosure* $^{High\ Exposure}$ is -0.179, significantly negative at the 1% level, but the coefficient on *Peer Disclosure* $^{Low\ Exposure}$ is, again, negative but not significantly different from zero. The p-value of the F-test on the difference in these coefficients is 0.064, suggesting that the effect of a geographic peer's climate-related disclosures is significantly greater for firms with greater exposure to climate change risks.

In Panel B, we report the result when we partition our sample based on the median of *Transient Institution* (i.e., *High* refers to *High Transient*). In column (1), we find that the coefficient on *Peer Disclosure*$^{High\ Transient}$ is not significantly different from zero. However, the coefficient on *Peer Disclosure*$^{Low\ Transient}$ is -0.209, significantly negative at the 1% level. Moreover, the result from an F-test on the difference in these coefficients suggests that the coefficients on *Peer Disclosure*$^{High\ Transient}$ and *Peer Disclosure*$^{Low\ Transient}$ are significantly different at the 0.013 level. We also find similar results in column (2). We find that the coefficient on *Peer Disclosure*$^{High\ Transient}$ is not significantly different from zero, but the coefficient on *Peer Disclosure*$^{Low\ Transient}$ is -0.232, significantly negative at the 1% level. The p-value of the F-test on the difference in these coefficients is 0.005, suggesting that the effect of a geographic peer's climate-related disclosures is significantly smaller for firms with more myopic investors.

Overall, the results in Table 8 are consistent with H3, suggesting that a geographic peer's climate-related disclosures create governance externalities to local plants of non-disclosing firms primarily in firms with a higher climate risk exposure and those with fewer myopic investors. Taken together, these results strengthen our inference from the main analysis as they indicate that the monitoring spillover from a peer's disclosure is greater for firms more vulnerable to climate issues particularly when investors care more about the firms' sustainability and long-term value.

[Insert Table 8]

5.3 Analyses Using Emissions Data from Private Firms

Not only public firms but private firms are also mandated to report the amount of greenhouse gases emitted from their facilities by the EPA if the facility emissions are at least 25,000 metric tons of CO_2 equivalent. However, merging with Compustat does not allow us to use the emissions data from facilities belonging to private firms, raising the possibility that our inference is biased for public firms. While private firms are not subject to capital market pressure, public firms are under additional pressure from the capital market to meet the expectations of market investors for socially responsible corporate behavior. Hence, to the extent that we find a similar result using a sample of private firms, we can better attribute our result to the pressure from local activists and residents rather than from capital market participants.

We thus estimate Equation (1) using the emissions data from the EPA not matched with Compustat (i.e., presumably the emissions from facilities in private firms) to examine whether our result is robust to a setting where capital market incentives do not exist. Since we cannot obtain firm characteristics for private firms reporting emissions to the EPA, we only include *Population* and *Unemployment* of the county where the facilities are located. However, given that a facility continues to belong to the same firm over time, we include facility fixed effects to control for time-invariant unmeasurable firm and facility factors. We also include year fixed effects (or industry-year (combination) fixed effects) to control for macroeconomic factors. The result of this analysis is reported in Table 9. Consistent with the result from the main analysis, we find that the coefficient on *Peer Disclosure* is significantly negative at the 1% level, -0.083 and -0091 in both columns (1) and (2), respectively. These results suggest that a geographic peer's climate-related disclosure create governance externalities through the pressure from local activists and residents even in the absence of capital market incentives.

[Insert Table 9]

5.4 Other Robustness Tests

As reported in Panel B of Table 3 (sample distribution by industry), facilities from the utility industry represent approximately one-third of our sample and emit the greatest amount of greenhouse gases per facility. To mitigate a concern that our result is driven mainly by facilities in the utility industry, in an untabulated analysis, we estimate Equation (1) after removing utility firms from our sample. We find that our result is robust to excluding utility firms, suggesting that our inference is generalizable to firms in non-utilities industries. In addition, as facility fixed effects subsume firm fixed effects, in another untabulated analysis, we replace facility fixed effects with firm fixed effects. We find similar results, suggesting that our results are robust to controlling for unobservable time-invariant firm-fixed factors.

VI. Conclusion

We examine governance externalities of a geographic peer's climate-related disclosure on local emissions. While climate-related disclosures are motivated to help investors be more informed and better allocate their financial capital, such disclosures can also facilitate the monitoring of greenhouse gas emissions. Consistent with disclosures serving a monitoring role, prior research finds that the mandated disclosure of greenhouse gas emissions leads firm to reduce greenhouse gas emissions. However, to the extent that a firm's disclosure entails governance externalities to neighboring firms through the pressure from local activists and residents, the monitoring benefits of climate-related disclosures can be extended to other non-disclosing firms whose plants are located in the same neighborhood.

Using plant-level emissions data and a generalized difference-in-differences design, we find that local plants reduce greenhouse gas emissions after a geographic peer initiates climate-related disclosures and attracts common stakeholders, such as local activists and residents, to environmental issues. We also find that the reduction in emissions is stronger when local residents have higher income and education levels, consistent with the interaction among and the pressure from the locals being an underlying mechanism of the monitoring spillover. Moreover, we find that the effect is stronger when the firm has higher risk exposure to climate issues but weaker when the firm's investors have shorter investment horizons.

Overall, our results suggest that climate-related voluntary disclosures have real effects that extend to a firm's geographic peers. By focusing on local activists and residents as common stakeholders shared by firms, we document the presence of governance externalities of voluntary disclosures. While recent research suggests that a firm's disclosure of greenhouse gas emissions is effective in curbing the firm's own emissions, we extend this prior work and find that climate-related disclosures can reduce carbon emissions even for non-disclosers. This finding should be of interest to regulators and standard setters in light of the recent developments in sustainability reporting requirements around the world.

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Appendix A Definition of Variables

Variable	Definition
Variables for Main Analyses	
Emission	= The natural log transformation of one plus total greenhouse gas emissions, measured in metric tons of CO_2 equivalent, reported by the EPA's Greenhouse Gas Reporting Program (GHGRP).
Peer Disclosure	= An indicator variable that equals one for a county (and thus all facilities located in the county) in the post-disclosure period and zero otherwise. A county belongs to the pre-disclosure period if none of the firms operating facilities in the county has started to issue climate-related voluntary disclosures and the post-disclosure period if at least one of those firms already initiated climate-related voluntary disclosures.
Total Assets	= The natural log transformation of total assets.
ROA	= Operating income after depreciation scaled by the average of total assets at the previous and current year-ends.
Leverage	= Long-term debt scaled by total assets.
Sales Growth	= Change in sales scaled by sales in the previous year.
Tangible Assets	= Property, plant, and equipment, net of accumulated depreciation, scaled by total assets.
R&D Expenses	= R&D expenses scaled by sales.
Population	= The natural log transformation of one plus county-level population.
Unemployment	= County-level unemployment rate (in percent).
Variables for Placebo Test	
Peer Disclosure ^{Placebo}	= An indicator variable that equals one for a facility if it is located in a county that has not been affected by climate-related disclosures while at the same time at least one of sibling facilities belonging to the same firm is located in affected counties, and zero otherwise.
Variables for Cross-Sectional Tests	
County Income	= The average dollar amount of county-level personal income.
County Education	= The proportion of the county-level population with a high school diploma or higher, averaged over a five-year window between 2015 and 2019.
Climate Change Exposure	= Exposure to climate change, measured as the relative frequency of bigrams related to climate change in the transcript of analyst conference calls. Specifically, the number of bigrams related to climate change is divided by the total number of bigrams in the transcript of analyst conference calls, averaged across the four conference calls each year, and multiplied by 10^3 (Sautner et al. 2020).
Transient Institution	= The proportion of shares outstanding held by transient institutional investors (Bushee 2001).

Appendix B Example of Voluntary GHG Disclosures

Environment Overview

We're aiming to achieve carbon neutrality by 2050.

Climate change is a global challenge that affects us all. Its implications are profound, so we've set ourselves a long-term ambition to achieve carbon neutrality for our vehicles, facilities and suppliers by 2050, aligned with approved science-based targets. We are the only full-line U.S. automaker to stand with California in seeking stronger greenhouse gas (GHG) standards and to align our carbon reduction targets with the Paris Agreement.

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

We're leading the electrification revolution.

We are doubling our planned investment in electrification and offering electrified versions of our most popular nameplates, including our new, all-electric Mustang Mach-E launched in late 2020, our E-Transit coming in 2021 and an all-electric F-150 in mid-2022. We have recently announced that by 2030, our passenger vehicles in Europe will be all-electric, while two-thirds of commercial vehicle sales are expected to be all-electric or plug-in hybrid.

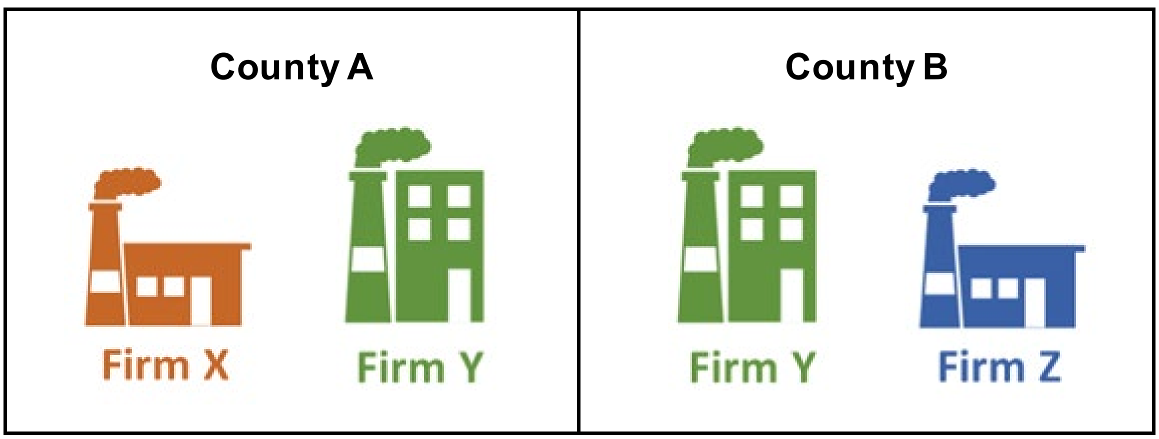
We're positively impacting the world around us.

Our operations will seek to create a positive impact in the local ecosystem. We are managing energy responsibly and moving toward 100 percent local, renewable

An excerpt from Ford 2021 Integrated Sustainability and Financial Report.

Appendix C Illustration of Identification Strategy

Consider county A which has two facilities, belonging to firms X and Y each. County B also has two facilities, belonging to firms Y and Z each. Assuming that firms Y and Z have yet to issue a climate-related voluntary disclosure, if firm X issues such disclosure for the first time in 2014, *Peer Disclosure* takes a value of zero for all facilities in years from 2010 to 2014 (i.e., the pre-disclosure period). However, this variable takes a value of one for the facility of firm Y in county A in years from 2015 to 2019 (i.e., the post-disclosure period) while it continues to take a value of zero for the same firm's facility in county B until firm Z initiates a climate-related disclosure in any of the subsequent years. The facility of firm X is excluded from our analysis to isolate the effect of a peer's disclosure from the firm's own disclosure. If firm Y initiates a climate-related disclosure later during the post-disclosure period, the facility of firm Y is also excluded from the analysis.



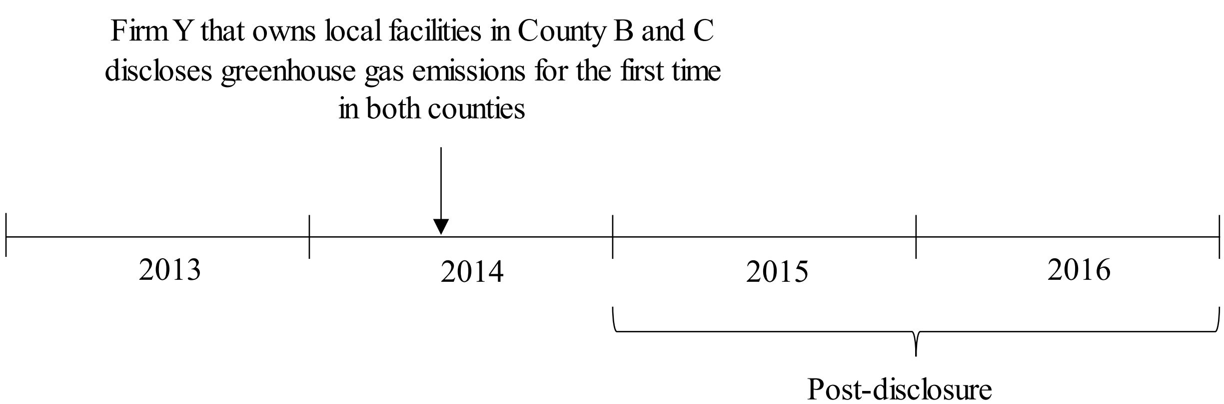


Figure 1 Time Trend of Greenhouse Gas Emissions

This figure shows the average amount of facility-level greenhouse gas emissions each year during our sample period.

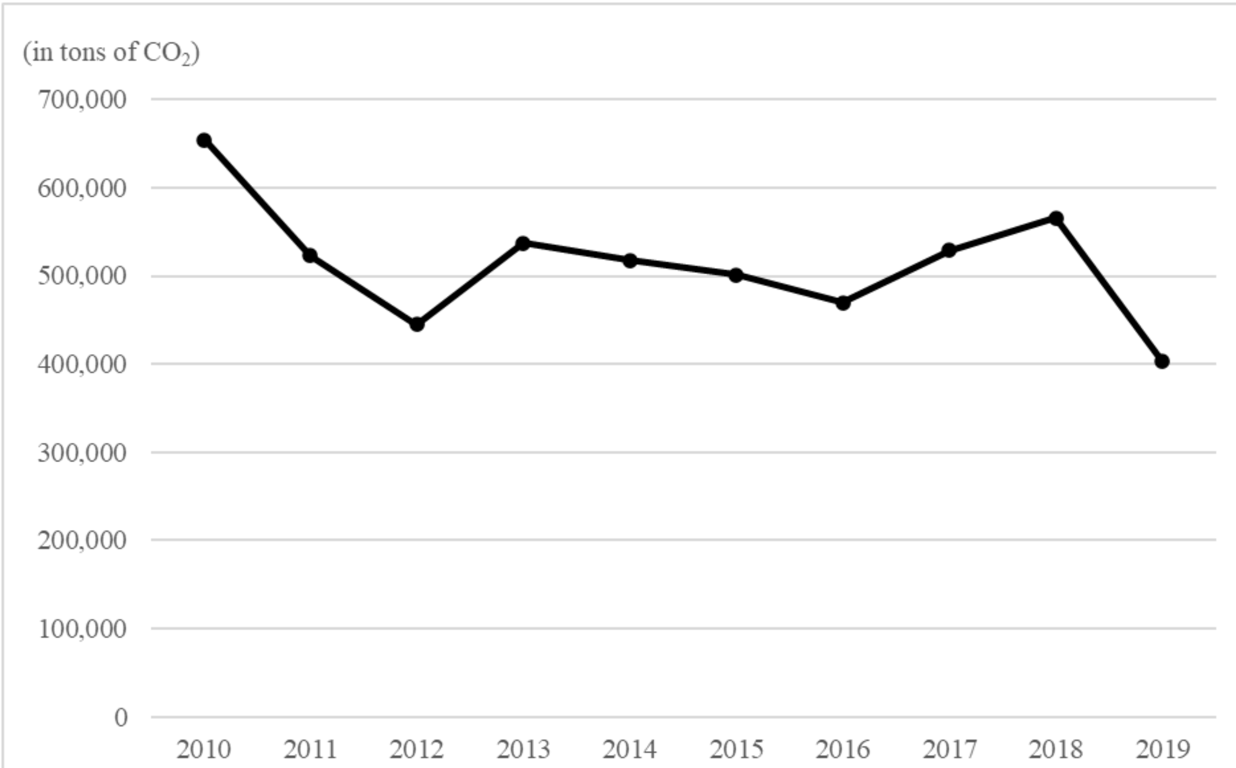


Figure 2 Geographical Distribution of Climate-Related Disclosures

This figure shows the geographical distribution of U.S. counties affected by a geographic peer's climate-related disclosure. The counties are partitioned into three groups depending on the year when the disclosure is initiated, i.e., counties with the initiation years of 2010-2012, 2013-2015, and 2016-2018.

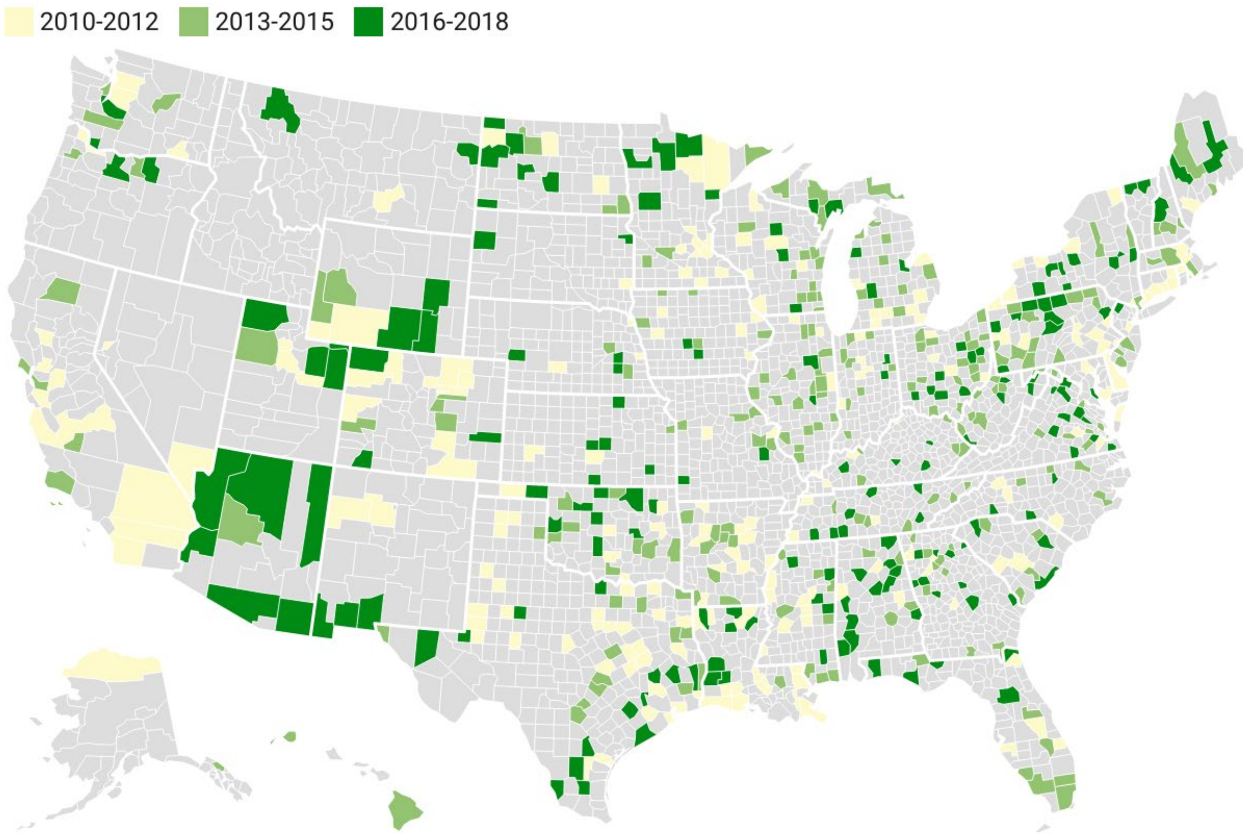
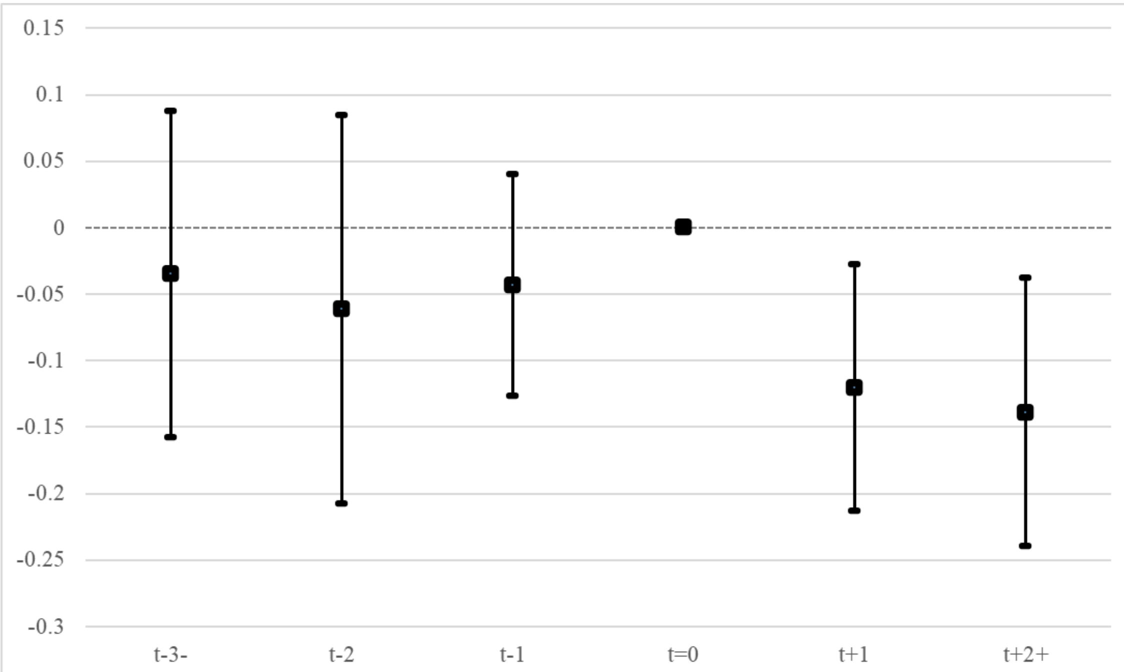


Figure 3 Dynamic Effects of Voluntary GHG Disclosures

This figure shows the results from the dynamic analysis. Panels A and B plot the coefficients on *Peer Disclosure* in columns (1) and (2), respectively, of Table 6.

Panel A



Panel B

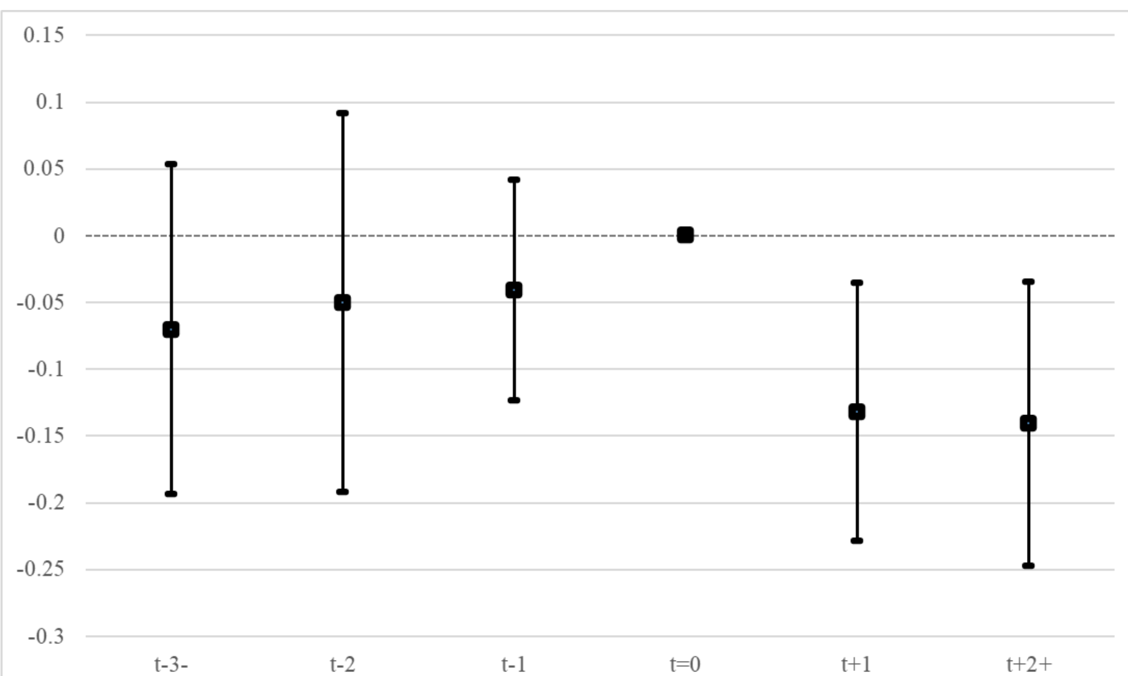


Table 1 Sample Selection

This table reports the sample selection process. We require at least one observation in the pre- and post-disclosure periods. The final sample consists of 636 unique counties, 1,461 firm-years, and 6,304 facility-years.

	The number of unique counties	The number of firm-years	The number of facility-years
Compustat-EPA-S&P Trucost (2010-2019)	706	2,195	11,493
Exclude firms with missing firm-level characteristics	(0)	(44)	(93)
Exclude facilities with missing county-level characteristics	(14)	(22)	(118)
Exclude facilities owned by firms with voluntary GHG disclosures	(56)	(668)	(4,978)
Final Sample	636	1,461	6,304

Table 2 Yearly Distribution of Sample Facilities

This table reports the yearly distribution of sample facilities. Panel A reports the number of counties and facilities in our sample affected by the initiation of a geographical peer's climate-related voluntary disclosure, respectively. Panel B reports the yearly number of counties and facilities in our sample used in our analyses.

Panel A Number of Counties and Facilities Affected by a Geographic Peer's Disclosure Initiation

Year	Number of affected counties	Number of affected facilities
2010	40	122
2011	105	304
2012	77	244
2013	169	372
2014	12	36
2015	46	94
2016	6	12
2017	50	92
2018	131	234
2019	-	-
Total	636	1,510

Panel B Number of Counties and Facilities in Each of Pre- and Post-Disclosure Period

	Pre-Disclosure Period (*Peer Disclosure* = 0)		Post-Disclosure Period (*Peer Disclosure* = 1)	
Year	Number of counties	Number of facilities	Number of counties	Number of facilities
2010	443	838	0	0
2011	444	814	32	63
2012	352	627	97	204
2013	200	323	122	281
2014	143	214	193	404
2015	174	279	185	366
2016	153	239	214	381
2017	140	214	208	380
2018	25	27	179	296
2019	0	0	232	354
Total	2,074	3,575	1,462	2,729

Table 3 Descriptive Statistics

This table reports descriptive statistics. Panel A reports the summary statistics of the variables used in our analyses. Panel B reports the sample distribution by industry and the average amount of greenhouse gas emissions in each industry (based on the Fama-French 12 industry classification). See Appendix A for variable definitions.

Panel A Summary Statistics

Variable	N	Mean	Std Dev	25th Pctl	50th Pctl	75th Pctl
Variables for Main Analyses						
Emission (Raw)	6,304	519,580	1,475,868	35,268	71,600	250,272
Emission	6,304	11.49	1.88	10.47	11.18	12.43
Peer Disclosure	6,304	0.43	0.50	0.00	0.00	1.00
Total Assets	6,304	9.53	1.53	8.53	9.76	10.65
ROA	6,304	0.03	0.08	0.01	0.03	0.05
Leverage	6,304	0.35	0.17	0.25	0.35	0.43
Sales Growth	6,304	0.08	0.52	-0.07	0.04	0.12
Tangible Assets	6,304	0.56	0.20	0.45	0.56	0.73
R&D Expenses	6,304	0.01	0.10	0.00	0.00	0.00
Population	6,304	11.46	1.51	10.35	11.41	12.46
Unemployment	6,304	7.31	2.85	5.20	7.00	9.00
Variables for Placebo Test						
Peer Disclosure^{Placebo}	6,304	0.44	0.50	0.00	0.00	1.00
Variables for Cross-Sectional Tests						
County Income	6,304	40,852	10,102	34,326	39,055	45,058
County Education	6,304	0.87	0.05	0.85	0.88	0.91
Climate Change Exposure	5,291	3.18	4.71	0.60	1.19	3.25
Transient Institution	5,950	0.07	0.06	0.02	0.06	0.09

Table 2 (Continued)

Panel B Sample Distribution by Industry

Industry description	The number of facility-years	The average amount of greenhouse gas emissions
Business Equipment	122	69,838
Chemicals	375	365,731
Consumer Durables	30	30,640
Energy	950	444,961
Health	14	89,039
Manufacturing	803	210,571
Finance	128	99,548
Consumer Non-Durables	169	153,086
Others	1,607	376,013
Shops	86	332,032
Utilities	2,020	922,959
Total	6,304	519,580

Table 4 Main Test: Peer Disclosure and Facility Emissions

This table reports the results from the estimation of Equation (1). Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure	-0.107**	-0.127***
	(0.046)	(0.048)
Total Assets	0.054	0.010
	(0.049)	(0.075)
ROA	0.478***	0.345*
	(0.169)	(0.181)
Leverage	0.270*	0.287
	(0.152)	(0.201)
Sales Growth	0.003	0.000
	(0.035)	(0.032)
Tangible Assets	0.066	-0.139
	(0.341)	(0.394)
R&D Expenses	0.063	-2.066
	(0.652)	(1.643)
Population	1.240***	0.722
	(0.460)	(0.545)
Unemployment	-0.024***	-0.030***
	(0.007)	(0.008)
Observations	6,304	6,304
R-squared	0.886	0.889
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 5 Placebo Test

This table reports the results from the placebo test. *Peer Disclosure*^{Placebo} is an indicator variable that equals one for a facility if it is located in a county that has not been affected by climate-related disclosures while at the same time at least one of sibling facilities belonging to the same firm is located in affected counties, and zero otherwise. Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure ^{Placebo}	0.029	0.050
	(0.040)	(0.031)
Total Assets	0.056	0.015
	(0.050)	(0.076)
ROA	0.485***	0.358*
	(0.171)	(0.184)
Leverage	0.271*	0.286
	(0.154)	(0.202)
Sales Growth	0.003	-0.000
	(0.034)	(0.032)
Tangible Assets	0.081	-0.118
	(0.337)	(0.393)
R&D Expenses	0.095	-2.055
	(0.641)	(1.638)
Population	1.240***	0.726
	(0.461)	(0.548)
Unemployment	-0.025***	-0.031***
	(0.007)	(0.008)
Observations	6,304	6,304
R-squared	0.886	0.888
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 6 Dynamic Effects of Climate-related Disclosure

This table reports the results from the dynamic analysis, where we allow the coefficient on *Peer Disclosure* to vary by year. Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure $^{Pre-3}$	-0.035	-0.070
	(0.074)	(0.075)
Peer Disclosure $^{Pre-2}$	-0.061	-0.050
	(0.089)	(0.086)
Peer Disclosure $^{Pre-1}$	-0.043	-0.041
	(0.051)	(0.050)
Peer Disclosure $^{Post+1}$	-0.120**	-0.132**
	(0.057)	(0.059)
Peer Disclosure $^{Post+2}$	-0.139**	-0.141**
	(0.061)	(0.064)
Total Assets	0.053	0.008
	(0.050)	(0.075)
ROA	0.481***	0.341*
	(0.172)	(0.181)
Leverage	0.272*	0.290
	(0.153)	(0.196)
Sales Growth	0.003	0.000
	(0.035)	(0.032)
Tangible Assets	0.068	-0.135
	(0.336)	(0.389)
R&D Expenses	0.066	-2.106
	(0.654)	(1.670)
Population	1.242***	0.745
	(0.463)	(0.548)
Unemployment	-0.025***	-0.030***
	(0.007)	(0.008)
Observations	6,304	6,304
R-squared	0.886	0.889
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 7 Cross-sectional Tests using County-level Characteristics

This table reports the results from the cross-sectional tests using county-level characteristics. Panels A and B show the results based on county-level income and education, respectively. Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A County-level Income

	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure $^{High\ Income}$	-0.171***	-0.206***
	(0.059)	(0.066)
Peer Disclosure $^{Low\ Income}$	-0.045	-0.051
	(0.054)	(0.052)
High Income	0.009	0.023
	(0.053)	(0.055)
Total Assets	0.050	0.007
	(0.049)	(0.074)
ROA	0.477***	0.342*
	(0.167)	(0.179)
Leverage	0.277*	0.291
	(0.155)	(0.203)
Sales Growth	0.001	-0.003
	(0.035)	(0.032)
Tangible Assets	0.066	-0.125
	(0.338)	(0.387)
R&D Expenses	0.089	-2.205
	(0.659)	(1.726)
Population	1.386***	0.855
	(0.488)	(0.577)
Unemployment	-0.024***	-0.028***
	(0.008)	(0.008)
Observations	6,304	6,304
R-squared	0.886	0.889
P-value of *Disclosure* $^{High\ Income}$ = *Disclosure* $^{Low\ Income}$	0.051	0.021
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 7 (Continued)

Panel B County-level Education

Dependent Variable =	(1) *Emission*	(2) *Emission*
Peer Disclosure $^{High\ Edu.}$	-0.218***	-0.256***
	(0.071)	(0.079)
Peer Disclosure $^{Low\ Edu.}$	-0.016	-0.021
	(0.052)	(0.045)
Total Assets	0.054	0.014
	(0.048)	(0.069)
ROA	0.473***	0.325*
	(0.164)	(0.174)
Leverage	0.261*	0.278
	(0.150)	(0.197)
Sales Growth	0.002	-0.002
	(0.033)	(0.030)
Tangible Assets	0.069	-0.111
	(0.329)	(0.376)
R&D Expenses	0.202	-2.090
	(0.657)	(1.718)
Population	1.443***	0.900
	(0.480)	(0.560)
Unemployment	-0.023***	-0.028***
	(0.007)	(0.008)
Observations	6,304	6,304
R-squared	0.886	0.889
P-value of *Disclosure* $^{High\ Edu.}$ = *Disclosure* $^{Low\ Edu.}$	0.015	0.005
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 8 Cross-sectional Tests using Firm-level Characteristics

This table reports the results from the cross-sectional tests using firm-level characteristics. Panels A and B show the results based on exposure to climate change and transient institutional ownership, respectively. Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A Exposure to Climate Change

	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure $^{High\ Exposure}$	-0.186***	-0.179***
	(0.062)	(0.065)
Peer Disclosure $^{Low\ Exposure}$	-0.004	-0.027
	(0.065)	(0.054)
High Exposure	0.121	0.130*
	(0.075)	(0.072)
Total Assets	0.090	0.162*
	(0.073)	(0.088)
ROA	0.492**	0.250
	(0.208)	(0.215)
Leverage	0.286*	0.235
	(0.156)	(0.161)
Sales Growth	0.034	0.011
	(0.038)	(0.035)
Tangible Assets	0.373	0.498
	(0.346)	(0.423)
R&D Expenses	-2.378	-7.436
	(5.280)	(6.067)
Population	1.818***	1.000*
	(0.603)	(0.514)
Unemployment	-0.028***	-0.032***
	(0.011)	(0.012)
Observations	5,291	5,291
R-squared	0.885	0.888
P-value of *Disclosure* $^{High\ Exposure}$ = *Disclosure* $^{Low\ Exposure}$	0.049	0.064
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 8 (Continued)

Panel B Transient Institutional Ownership

Dependent Variable =	(1) *Emission*	(2) *Emission*
Peer Disclosure $^{High\ Transient}$	-0.045	-0.061
	(0.047)	(0.040)
Peer Disclosure $^{Low\ Transient}$	-0.209***	-0.232***
	(0.066)	(0.071)
High Transient	-0.051	-0.073
	(0.048)	(0.056)
Total Assets	0.077	0.031
	(0.048)	(0.064)
ROA	0.552***	0.427**
	(0.187)	(0.200)
Leverage	0.326*	0.334
	(0.173)	(0.227)
Sales Growth	-0.008	-0.009
	(0.031)	(0.027)
Tangible Assets	-0.011	-0.280
	(0.339)	(0.393)
R&D Expenses	-2.793	-6.522**
	(4.068)	(3.182)
Population	1.190**	0.779
	(0.492)	(0.599)
Unemployment	-0.022***	-0.029***
	(0.007)	(0.008)
Observations	5,950	5,950
R-squared	0.886	0.889
P-value of *Disclosure* $^{High\ Transient}$ = *Disclosure* $^{Low\ Transient}$	0.013	0.005
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes

Table 9 Analyses Using Emissions Data from Private Firms

This table reports the results using emissions data from private firms (i.e., facilities in firms reporting to EPA but not matched with Compustat). Column (1) reports the results with facility and year fixed effects and column (2) reports the results with facility and industry-year (combination) fixed effects. See Appendix A for variable definitions. All p-values are two-sided and are calculated based on standard errors adjusted for industry-year clustering. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Including facilities not matched with Compustat *	
	(1)	(2)
Dependent Variable =	*Emission*	*Emission*
Peer Disclosure	-0.074***	-0.082***
	(0.025)	(0.026)
Population	0.470	0.263
	(0.295)	(0.262)
Unemployment	0.003	0.004
	(0.007)	(0.007)
Observations	14,634	14,634
R-squared	0.847	0.850
Facility FE	Yes	Yes
Year FE	Yes	No
Industry-Year FE	No	Yes