Transmission Effect of Insurers' Climate Risk Disclosures on Their Corporate Bond Investees' Environmental Friendliness

Jiang Cheng
Lingnan University
jiangcheng@ln.edu.hk

Jia Guo
The Hong Kong Polytechnic University
jia-gina.guo@connect.polyu.hk

Xiaohui Li
The Hong Kong Polytechnic University
xiaohui-fiona.li@polyu.edu.hk

Jeffrey Ng*
The University of Hong Kong
jeffngty@hku.hk

Nan Yang
The Hong Kong Polytechnic University
nyang@polyu.edu.hk

ABSTRACT

We investigate how insurers' mandatory climate risk disclosure affects their corporate bond investees' environmental friendliness using the U.S. insurance industry's adoption of the Climate Risk Disclosure Survey (CRDS). We find that adoption reduces investees' carbon emissions intensity if CRDS-affected insurers are significant owners of the investees' bonds, consistent with the mandated disclosure having an insurer-to-investee transmission effect on investees' environmental performance. The reduction is more pronounced when insurers and/or their investees experience more climate-related public pressure, when insurers likely monitor their investees more closely, when investees depend more on insurer financing, and when insurers have less underwriting competition.

Keywords: mandatory climate risk disclosure; environmental performance; carbon emissions; investor-to-investee transmission effects

JEL Classification: G11; G22; G28; G30; Q54

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1. Introduction

Climate risk is rapidly growing in importance for corporate decision-making, as is the demand for information about firms' exposure to climate risk. Currently, most of this information is disclosed voluntarily, raising concerns about its comparability and verifiability (Bernow, Godsall, Klempner, and Merten, 2019; Christensen, Hail, and Leuz, 2021). In consequence, many jurisdictions are considering mandating climate risk disclosure. On June 5, 2021, the G7 nations expressed their support for mandatory climate-related financial disclosure, stating that it would provide consistent and useful information to market participants (John, 2021). In March 2022, the U.S. Securities and Exchange Commission (SEC) released a proposal about the mandated disclosure of climate-related risks for U.S. public firms (SEC, 2022). In his June 14, 2021 letter to the SEC concerning this proposal, Mike Kreidler, the Insurance Commissioner for Washington state, stated, "For 12 years, my fellow state insurance regulators and I have been requiring the largest insurers operating in the United States to report annually on the financial implications of climate change to their businesses…As the SEC considers putting rules in place regarding public company disclosure of risks related to climate change, I encourage you to review the experience that U.S. insurance regulators have already garnered with the insurance industry, given our decade-long disclosure requirements along the lines that SEC is now contemplating." (Kreidler, 2021).

In 2010, the National Association of Insurance Commissioners (NAIC), an association of state insurance regulators, introduced the Climate Risk Disclosure Survey (CRDS) as a tool that state insurance regulators could use to monitor insurers' management and assessment of climate risk. The CRDS is presently required by some, but not all, U.S. states. The survey comprises eight questions about how insurers factor climate risk into their risk management, mitigation, and investment plans. This disclosure requirement applies to both public and private insurers and insurers' disclosures are publicly available on the California Department of

Insurance's website.[1]

In this paper, we investigate the effect of insurers' mandatory climate risk disclosure on their corporate bond investees' carbon emissions. In addition to helping individuals and businesses mitigate risk by underwriting insurance policies, the insurance industry, via its investment of insurance premiums, also finances economic development. Since 1945, insurers have been the largest institutional investors in the U.S. corporate bond market (Koijen and Yogo, 2022), holding more than a quarter of U.S. corporate bonds (Ge and Weisbach, 2021). According to NAIC, bonds account for 61.4% (i.e., $4.9 trillion) of U.S. insurer investment portfolios as the end of 2021, and 56.4% of them are corporate bonds (NAIC, 2022). Returns on bond holdings constitute a significant portion of insurers' financial performance and funding for business operations (Ge and Weisbach, 2021). Hence, insurers would be concerned about any adverse conditions, including those arising from climate risk, that would affect their corporate bond investments. Moreover, as the largest institutional investor group, insurers' concerns are likely to impact the behavior of their bond investees. Krueger, Sautner, and Starks (2020) provide survey-based evidence that institutional investors, including insurance companies, believe that climate risk has material financial consequences for their investees. Consistent with this evidence, Seltzer, Starks, and Zhu (2022) find that a high carbon footprint tends to worsen a firm's credit rating and widen its bond yield spreads.

The CRDS setting provides us with a valuable opportunity for investigating the transmission effect of investors' mandatory climate risk disclosure on their corporate bond investees' environmental friendliness. We posit that the affected investees (i.e., those with significant bondholders that are also CRDS-affected insurers) will be pressured to be more environmentally friendly, for two reasons: i) insurers' engagement with their corporate bond investees on the topic of climate change and ii) insurers' corporate bond investment strategy,

[1] Section 2 discusses the CRDS in more detail.

which considers the impact of investees' activities on the climate. With regard to the first consideration, corporate bonds are typically long-term investments, with bond investors monitoring their investees. As part of this monitoring, insurers may increase their engagement with investees and pressure them to be more environmentally friendly. In addition, affected insurers, relative to unaffected ones, are likely to be more inclined to shift their corporate bond portfolios so that the portfolio includes more environmentally friendly investees. This inclination is likely driven by the public nature of insurers' corporate bond (and other) investments: insurers are required to disclose their investment holdings. NAIC then provides the disclosures to any interested party for a fee.[2]

Using a difference-in-differences (DID) research design, we examine the transmission effect of the insurance industry's CRDS adoption on the environmental performance of property and casualty (P&C) insurers' corporate bond investees.[3] We determine whether an investee is in the treatment group based on whether affected insurers hold a high percentage of the investee's public corporate bonds. We find that compared to the control group, the treatment investees significantly reduce their carbon emissions intensity, i.e., carbon emissions per unit of revenue, after CRDS adoption. This decrease is economically significant: compared to the control investees, the treatment investees reduce their carbon emissions intensity by 16.3%. These results indicate that insurers' mandatory climate risk disclosure has a significant transmission effect on their investees' environmental performance. Furthermore, a parallel trend assumption test offers no evidence that the difference in the carbon emissions intensity

[2] In Section 2, we further detail our hypothesis about the effect of CRDS adoption on corporate bond investees' environmental friendliness.

[3] Our study focuses on P&C insurers because climate risk directly affects their business. A 2008 survey by Ernst & Young of insurance industry analysts indicated that climate change is the number one risk facing P&C insurers (Ernst & Young, 2008). Obersteadt (2012) documents that P&C insurers, compared to life and health insurers, provide more comprehensive survey responses and view climate risk as a primary concern. According to a comprehensive analysis of the CRDS results by Ceres (2013, 2014, 2016), a non-profit organization advocating sustainability leadership, P&C insurers have a better understanding of the risk that climate change poses to their business and they are further ahead in developing the necessary tools to manage it. In contrast, life and health insurers display a lack of concern about climate risk in their core business lines.

for the treatment and control investees arises from a pre-existing trend. Specifically, we observe that compared to that of the control investees, the treatment investees' carbon emissions intensity only starts to decrease during the post-CRDS adoption period. This outcome indicates that the CRDS mandate is the likely cause of the observed reduction in carbon emissions intensity.

We then conduct various analyses of the heterogeneity in the transmission effect of insurers' mandatory climate risk disclosure on their investees' carbon emissions intensity. First, we expect the effect of mandatory public climate risk disclosure to be more pronounced if the public is more likely to use the disclosures to pressure insurers and/or insurers' investees to be more environmentally friendly. Consistent with this expectation, we find that the effect of CRDS adoption on investees' carbon emissions intensity is more pronounced when investees or their affected insurer investors are headquartered in a state with a strong public attitude about climate risk. These results suggest that public climate risk pressure is an important factor in disclosure regulations' effectiveness in pushing firms to be more environmentally friendly.

Our analysis also reveals that the positive effect of CRDS adoption on investees' environmental performance is amplified when insurers are more likely to actively monitor their investees, consistent with adoption inducing insurers to scrutinize and influence the investees' environmental friendliness. We also find that the CRDS has a positive effect when investees rely on them more for financing, suggesting that investees' dependence on their investors is an important factor in a strong transmission effect from investors to investees. Taken together, the evidence implies that both of these considerations are in play.

We also find that the positive effect of mandated climate risk disclosure on investee environmental performance decreases when insurers' underwriting competition is intense. We attribute this finding to intense competition shrinking underwriting profit margins, which gives insurers greater incentives to earn higher returns from investing in the bonds of

environmentally unfriendly investees that might yield higher returns, so they can demonstrate an overall better performance and, relatedly, strengthen their balance sheet and boost their regulatory capital. Moreover, these insurers have less incentive to engage their investees in potentially costly but long-term, pollution-reducing projects.

Finally, we demonstrate the robustness of our primary finding of CRDS adoption's transmission effect on corporate bond investees' environmental performance via alternative research designs. These designs include: (i) an alternative event window using different pre- and post-CRDS adoption periods, (ii) an alternative definition of the treatment and control investees based on the affected insurers' holdings in different years, and (iii) an alternative measure of investees' environmental friendliness using the monetary value of their carbon emissions intensity.

Our study contributes to the literature in several ways. We first add to the recent literature on the effect of mandatory climate risk disclosure in the context of investment relationships. Mésonnier and Nguyen (2020) and Ilhan, Krueger, Sautner, and Starks (2023) are two concurrent studies that exploit a mandatory climate disclosure law in France that requires French institutional investors to disclose the climate risk of their portfolio assets. Mésonnier and Nguyen (2020) find that institutions that are subject to the new law reduce their fossil fuel firm financing. Ilhan et al. (2023) provide survey evidence of institutional investors valuing and demanding climate risk disclosures; they also document empirical evidence that shows a significantly positive association between climate-conscious institutional ownership and firm-level climate risk disclosure. Our research differs from these two studies because we investigate the transmission effect of insurers' mandatory climate risk disclosure on their corporate bond investees' environmental friendliness in terms of carbon emissions. We address the challenge of identifying a causal effect by utilizing the CRDS framework in the U.S.

insurance industry, which mandates climate risk disclosure for certain insurers.[4]

Second, our study contributes to the literature on the relation between institutional investors and firms' ESG policies. Azar, Duro, Kadach, and Ormazabal (2021) find a negative relation between carbon emissions and institutional equity ownership by the Big 3 index investors (BlackRock, Vanguard, and State Street). Dyck, Lins, Roth, and Wagner (2019) and Chen, Dong, and Lin (2020) show that institutional equity ownership is positively associated with firms' environmental and social performance. Starks, Venkat, and Zhu (2023) find that equity institutional investors with a long-term horizon invest more in firms with better ESG profiles. Our study complements and contrasts with these papers by examining the transmission effects of mandated climate risk disclosure regulations in the corporate bond market. By taking advantage of a unique climate risk disclosure mandate in the insurance industry, we are the first to show that the requirement for insurers to publicly disclose how their investment strategy takes into account the climate risk impact of their investees affect investees' carbon emissions. We also document some novel heterogeneity in the insurance industry's transmission effect. For example, we find that the transmission effect is weaker when insurers have more underwriting competition. From this we infer that when insurers face more difficulties in their underwriting business, they place less emphasis on pushing their investees to be more environmentally friendly.

Last, our findings demonstrate the potential consequences of mandatory climate risk reporting and offer useful lessons for those seeking to extend these requirements. Notably, we show that high-level, qualitative mandatory climate risk disclosures that target insurers can have a positive insurer-to-investee transmission effect on investees' environmental performance. Our evidence on the effects of CRDS adoption can inform policymakers both in

[4] Identifying a causal effect is a major challenge in disentangling the consequences of disclosure from those of underlying, disclosure-related activities, especially when both are voluntary (Christensen et al., 2021).

the U.S. and elsewhere as they consider mandating climate risk disclosure across industries. Overall, our study highlights that the transmission effects of such disclosures should be carefully considered.

The remainder of the paper is organized as follows. Section 2 introduces the institutional background and develops our hypothesis. Section 3 describes the sample and the empirical specification. Section 4 presents the empirical results of the baseline regression, the robustness checks, and the cross-sectional analyses. Section 5 details the results of the additional analyses and Section 6 discusses our conclusions.

2. Background on the CRDS and Hypothesis Development

2.1 Background on the CRDS

As we note earlier, insurance companies constitute the largest group of institutional investors in the U.S. corporate bond market. At the same time, corporate bonds comprise the largest component of insurers' asset holdings. Given the importance of insurance companies to the corporate bond market and the attention they give to their investees' climate risk, the CRDS setting offers us an opportunity to explore whether insurers' mandated climate risk disclosure can have a transmission effect on their investee firms.

Starting in 2010, NAIC began requiring the largest insurance companies operating in the U.S. to respond to an annual survey, the CRDS, about their approach to climate risk. The survey's questions cover a range of topics, including insurers' investment strategies with respect to climate risk, and responses to it are publicly available on the California Department of Insurance's website.[5] Initially, California was the only state to administer the CRDS, and it only required insurance groups with nationwide direct premiums of over $500 million (in 2010) and $300 million (in 2011) to respond. However, in 2012, New York and Washington also

[5] The website is at https://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ClimateSurvey/index.cfm.

mandated the disclosure for individual insurance firms that write more than $300 million in nationwide direct premiums and that operate in any of the participating states, regardless of their headquarters location. These states also made the survey responses available to the public. In 2013, the premium threshold was further lowered to $100 million, and the mandating states expanded to include Connecticut and Minnesota. In 2014, Illinois, Maryland, and New Mexico followed, though Illinois and Maryland revoked the mandate in 2015. The six mandating states remained the same from 2015 to 2020. In 2021, the CRDS was joined by nine more states/jurisdictions. As a result, there were 15 members mandating the CRDS: California, Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, Minnesota, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. According to the California Department of Insurance (n.d.), in 2021, "more than 1,400 companies responded, capturing nearly 80% of the entire U.S. insurance market, allowing regulators, insurance companies and interested members of the public the ability to identify trends, vulnerabilities, and best practices by the insurance industry with respect to climate change."[6]

Appendix B presents two examples of insurers' survey responses, from the Zurich American Insurance Company in 2018 and the AIG Property Casualty Company in 2019. The survey consists of eight questions asking insurers to describe how they factor climate risk into their mitigation, risk management, and investment plans. For example, the second survey question asks whether the insurer has a climate change policy for risk management and investment management. The fifth survey question asks whether the insurer takes into account the impact of climate change on its investment portfolios and whether it alters its investment strategy in response to these considerations. The seventh survey question asks the steps the

[6] In an email correspondence with NAIC, we learned that while affected insurers are required to submit a NAIC CRDS, there is no penalty for not completing the survey. However, the response rate is very high due to broad insurer adoption of the CRDS and participating states and jurisdictions' engagement with any outstanding insurers. The NAIC also offers many capacity-building webinars to support insurers during the reporting period.

insurer has taken to engage its key constituencies on the topic of climate change.

Below is a quote from Zurich American Insurance Company's response to the fifth survey question:

> Zurich is making continued progress in integrating ESG factors, including climate change, into security and asset selection processes across its investment portfolio. Zurich is also thoroughly assessing responsible investment practices of its asset managers as part of its manager selection and monitoring processes.
>
> In addition to Zurich's established 'business-as-usual' ESG integration practices we have launched, during 2018 we:
>
> • worked with a variety of partner organizations on methodologies that allow for comprehensive assessment of exposure to physical and transition climate risk for equities, corporate bonds, real estate and infrastructure investments;
>
> • updated our macroeconomic climate risk scenarios;
>
> • actively voted on shareholder resolutions regarding climate change disclosures or actions of investee companies;
>
> • reviewed our asset managers' climate position;
>
> • divested all equity holdings and put into run off fixed income investments from companies that generate >50% of their revenues from thermal coal mining or use >50% of coal in their energy generation mix;
>
> • advocated for the transition to a low-carbon economy and for the introduction of an economically viable carbon price;
>
> • as part of its impact investing program, Zurich has also invested over USD 3bn carbon and climate resilient investments on a global basis to help communities adapt to and mitigate climate change.

2.2 Hypothesis about the Transmission Effect of Insurers' Climate Risk Disclosures on Their Corporate Bond Investees' Environmental Friendliness

Corporate bond investments comprise the largest share of insurers' investments. NAIC also subjects these investments to risk-based capital requirements. These circumstances give insurers strong incentives to monitor and collect timely information about their corporate bond investee firms. The monitoring incentive is further intensified, because investment portfolios that are highly correlated across insurers impose great risk. The value of the insurer's holdings could be affected by a common sale in the wake of an adverse event, including events related to climate risk (Girardi, Hanley, Nikolova, Pelizzon, and Sherman, 2021). Using insurers' transaction data in the secondary bond market, prior studies discover informed trading prior to material events (e.g., class action lawsuits, M&As, and earnings announcements) that can impede the investee firms' ability to service debt obligations (e.g., Billings, Klein, and Zur, 2011; Kedia and Zhou, 2014; Wei and Zhou, 2016). These findings suggest that insurance companies monitor their investee firms. In addition, Cao, Gang, Wermers, Zhan, and Zhou (2023) find that insurance companies decrease their holdings of a bond if the tone of the issuer's earnings conference call is negative or is related to default information, consistent with debt investors, especially insurers, demanding timely information from their investees.

Insurers could impact their corporate bond investees' environmental friendliness through the mechanisms of engagement and investment (e.g., Shleifer and Vishny, 1986; Admati and Pfleiderer, 2009; Edmans and Manso, 2011). We emphasize that it is not a foregone conclusion that insurers' mandatory climate risk disclosure will definitely affect their corporate bond investees' environmental friendliness. Such disclosure is qualitative in nature and is not audited, creating potential for greenwashing and renders it less clear whether requiring insurers to make climate risk disclosures would induce a transmission effect on an insurer's investee's environment friendliness.

The details of our hypothesis are as follows. First, we posit that mandating the CRDS would pressure affected insurer investors to engage with their corporate bond investees. As we note earlier, the CRDS includes questions about how insurers would be adversely affected by their investees' climate risk, and it requires them to disclose their climate change engagement with key constituencies. Given that insurers are the largest corporate bond investors and corporate bond investment forms the largest part of their investment portfolios, bond investees are a key constituency. Azar, Duro, Kadach, and Ormazabal (2021) find a negative relation between carbon emissions and institutional equity ownership by the Big 3 index investors, namely Blackrock, Vanguard, and State Street. They determine that this finding is consistent with the probability that these three investors' engagement is higher if the target firm exhibits a higher level of carbon emissions in the previous year.

Some anecdotal evidence suggests that institutional investors might view "invest and engage" as more effective than divestment as a means of addressing climate-related problems at investee firms (Condon, 2020; Krueger et al., 2020). According to Wallace (2019), Zurich Insurance Group's chief investment officer explains that his fund prefers to lobby for change rather than to divest: "[Divestment] is not the solution – it does not change the physical world as far as emissions are concerned." According to BlackRock's report of the survey of 370 senior executives in the global insurance industry, "Company engagement produced the clearest consensus, with over 90% of insurers saying that they would probably increase the number of issuers with which they engage." (BlackRock, 2022, p. 26). BlackRock, Exxon's largest shareholder, voted against the re-election of two board members at the firm's 2017 annual meeting in protest of a "non-engagement" policy that precluded directors from talking to shareholders about the company's strategic response to climate change (BlackRock, 2017). Following the vote, Exxon reconsidered its opposition to climate risk disclosure and permitted directors to meet with shareholders going forward. In addition, the earlier illustration of the

CRDS response by Zurich American Insurance Company includes a statement about the company's active record of voting on shareholder resolutions about climate change disclosures or actions of investee companies.

Second, we posit that mandating the CRDS would put pressure on affected insurer investors to take their corporate bond investees' environmental friendliness into account as a component of their investment strategy, especially given that insurers must provide details about how climate risk considerations affect their investment strategy. As noted earlier, insurers are major investors in the corporate bond market. Divesting the bonds of environmentally unfriendly investees can adversely affect bond prices and consequently increase the investees' cost of capital. Insurers' potential or actual sales of these bonds may result in other investors reconsidering their own holdings.[7] Thus, this "walk" threat could serve as an ex-ante mechanism through which insurers could influence investee firms' carbon emissions decisions (Bharath, Jayaraman, and Nagar, 2013).

Investee firms are also likely to be concerned that if they do not improve their environmental profile, future bond issuances will not be able to draw affected insurers' interest, resulting in weaker demand for the investees' bonds and/or a higher cost of bond issuances. This concern is likely to be significant: insurers are the largest corporate bond investors; many large insurers are already required to respond to the CRDS; and as more states adopt the survey, it affects an increasing number of insurers. Recent evidence suggests that institutional investors invest based on investees' ESG profiles. Using the 2015 Paris Agreement, which increases climate-related regulatory risk, Seltzer et al. (2022) present evidence that insurers reduce their investment in investee firms that have a poor environmental profile. Mésonnier and Nguyen

[7] Secondary bond market prices reveal forward-looking information that anticipates issuers' default risk and ratings downgrades (Han and Zhou, 2014; Badoer and Demiroglu, 2019), and mitigate banks' information risk in debt contracting (Chy and Kyung, 2022). In particular, bond markets incorporate value-relevant negative information more quickly than do stock markets (DeFond and Zhang, 2013; Bittlingmayer and Moser, 2014; Wei and Zhou, 2016). Nanda, Wu, and Zhou (2019) note that as major investors in corporate bonds, insurers' investment commonalities subject investors to fire sale risk when there is widespread divestment of a bond.

(2020) find that in the wake of a 2015 French law that requires French institutional investors (except banks) to report their climate-related exposure and policies, affected institutional investors reduce their holdings in fossil energy securities.

Insurers' CRDS responses also indicate that insurers are considering climate risks in their investment strategies. For example, Zurich American Insurance Company's CRDS response states that it was making continued progress in integrating ESG factors, including climate change, into its security and asset selection processes across its investment portfolio. It also stated that it divested all equity holdings and put into run off fixed income investments from companies that generate more than 50% of their revenues from thermal coal mining or that use more than 50% of coal in their energy generation mix.

In sum, the aforementioned mechanisms of climate-risk-related engagement and investment strategy by the affected insurers allow us to hypothesize that CRDS adoption has a positive transmission effect on the environmental friendliness of the affected insurers' corporate bond investees.[8] Specifically, these investees will be more environmentally friendly because of pressure from their insurer investors, which themselves face pressure, via the CRDS, to monitor their investees.

Nevertheless, we note that some tension is inherent in the above hypothesis. The possibility of divesting from environmentally unfriendly investees might reduce insurers' incentives to engage with their investees on climate risk issues. This possibility might then weaken engagement as a mechanism for a positive transmission effect. In addition, there is the potential for greenwashing by both insurers and investees. Information related to climate risk is largely qualitative and not audited, making it difficult to verify. Insurers might disclose that their investment strategy involves environmentally unfriendly firms and then invest in these

[8] These mechanisms are obviously not mutually exclusive. Some insurers might emphasize engagement, some might emphasize investment strategy, and some might pursue both.

firms. Investees might greenwash, making themselves more attractive to insurers by claiming that they are or have become more environmentally friendly.

3. Sample and Regression Specification

3.1 Sample

3.1.1 Determination of the pre- and post-CRDS adoption windows

We use an extended adoption window from 2012 to 2015 and a single-shock DID research design. The pre-adoption window spans from 2008 to 2011, and the post-adoption window is from 2016 to 2019. We choose this specification because during the adoption window, adoption was clustered among states, a change occurred in the nationwide underwriting premium threshold for mandatory CRDS reporting, and some states only adopted the CRDS for only one year.

Prior to 2012, only California required insurance groups to respond to the CRDS. In 2012, the requirement was applied to individual insurers (as opposed to insurance groups in 2010 and 2011) that had nationwide direct written premium exceeding $300 million, and New York and Washington state also adopted the survey. In 2013, the premium threshold requirement was further reduced to $100 million, and Connecticut and Minnesota also adopted the CRDS. In 2014, Illinois, Maryland, and New Mexico required insurers to respond to the survey, although Illinois and Maryland dropped the requirement from 2015 onwards. An extended adoption window allows us to treat Illinois and Maryland as non-CRDS-adopting states during our sample period (i.e., 2008 to 2011 and 2016 to 2019).[9] The reporting criteria for the CRDS remained the same from 2016 to 2019. Specifically, during this period, individual insurers with nationwide direct written premiums exceeding $100 million and with business in

[9] In other words, insurers that were required to respond to the CRDS because they had operations in Illinois and Maryland are treated as control insurers from 2016 to 2019. In 2021 (outside our sample period), Maryland rejoined the CRDS; Illinois did not.

any of the six CRDS-participating states (i.e., California, Connecticut, Minnesota, New Mexico, New York, and Washington) were required to respond to the CRDS.[10]

3.1.2 Determination of the treatment and control groups for corporate bond investees

Our study focuses on the transmission effect of P&C insurers' mandatory climate risk disclosures. Insurers' data (e.g., nationwide direct premiums and direct premiums by each state) are obtained from the NAIC Annual Statement Database. As noted earlier, California implemented the CRDS for insurance groups prior to 2012 and a few groups provided responses. To avoid confounding effects from these early disclosures, we exclude observations from individual insurers in these groups.[11] We then identify insurers that are required to respond to the CRDS as those that meet the compulsory disclosure criteria in 2015 (after that year, the reporting criteria for the CRDS have remained the same). These criteria require insurers to respond to the CRDS if they write more than $100 million in nationwide direct premiums and have business in any of the six participating states in 2014. We exclude 45 of the 582 insurers that are required to respond but that did not have their CRDS disclosures on the California Department of Insurance's website in 2015.[12] The above steps leave us with 537 affected insurers. 1,837 insurers are not affected; they are not required to respond to CRDS and do not voluntarily do so.

Because our investigation focuses on the carbon emissions intensity of insurers' investees, our primary analysis is at the investee level; we use investee-year observations in the analysis. To construct our sample, we begin with the firm-year observations of U.S. firms in the Compustat database for the pre- and post-adoption windows of 2008 to 2011 and 2016

[10] Appendix C summarizes the CRDS adoption pattern across states.

[11] The California Department of Insurance's website reports only a few responses: 20 in 2010 and 31 in 2011. The responses also disclose the individual insurers within the insurance groups. We use this disclosure to remove 27 individual P&C insurers. Note that some insurance groups have no P&C insurers.

[12] Because our hypothesis is based on public pressure resulting from the disclosure of the CRDS responses, it is important that insurers that are required to respond to the CRDS make their responses publicly available. Appendix C presents the number of CRDS responses for each year from 2010 to 2019, which we obtain from the California Department of Insurance's website.

to 2019, respectively. We exclude firms in the financial industry, as their carbon emissions data are unlikely to reflect their actual carbon emissions.

We construct our treatment and control investees based on insurers' corporate bond holdings in 2011, the year immediately before the CRDS was mandated for individual insurers. We require the observations to be from firms with outstanding public corporate bonds in 2011. We obtain corporate bond data from the Mergent Fixed Income Securities Database (FISD).[13] Insurers' quarterly bond holdings data are from the eMAXX database. We use each bond's CUSIP to identify the bonds issued by an investee. We require a firm's bonds to be held by at least one affected or unaffected insurer because our study examines insurer-to-investee CRDS transmission effects. We then use affected insurers' holdings to determine whether an investee is in the treatment or control group. Specifically, for each investee-quarter observation in 2011, we compute the amount of the investee's public bonds that are held by the affected insurers as a percentage of the investee's total amount of outstanding public bonds. To determine what percentage of an investee's public bonds are held by affected insurers in 2011, we take the average of the quarterly numbers. Following Agarwal, Vashishtha, and Venkatachalam (2018) and Sani, Shroff and White's (2021) method of classifying investees into treatment and control groups, we determine whether an investee is a treatment (control) investee if the percentage in 2011 is above or at (below) the investee median for the whole sample.

For each investee, we obtain annual carbon emissions data from the S&P Global Trucost database for each year of our pre- and post-CRDS adoption windows.[14] To be included in the sample, an investee-year observation is required to have non-missing data for carbon emissions and for the control variables used in our primary regression specification (see Equation (1) below). The final sample for the baseline analysis includes 3,472 investee-year

[13] FISD contains detailed information about public corporate bonds at the time of issuance; it also provides historical records of the amounts outstanding.
[14] In the S&P Global Trucost database, "greenhouse gas emissions" and "carbon emissions" are synonymous terms.

observations. Of these, the control group includes 1,707 observations and the treatment group 1,765 observations. Table 1 reports the sample distribution. Panel A presents the distribution by year, with observations almost equally distributed between the two groups for each year of our sample period. Panel B reports the distribution with regard to the six-digit Global Industry Classification (GIC 6). Oil, Gas & Consumable Fuels (GIC 6 = 101020), Chemicals (GIC 6 = 151010), and Machinery (GIC 6 = 201060) are the most represented industries.

[Insert Table 1 here]

3.2 Regression Specification

To test the transmission effect of insurers' mandatory climate risk disclosure on their corporate bond investees' carbon emissions, we implement a standard DID research design that allows us to compare respective changes in the treatment and control investees' carbon emissions intensity around CRDS adoption. Specifically, we estimate the following regression using an ordinary least squares model:

$$Carbon\ Intensity_{i,t} = \beta_0 + \beta_1 Treat_i \times Post_t + \gamma X_{i,t/i,t-1} + \theta_i + \delta_{j,t} + \varepsilon_{i,t}, \quad (1)$$

where i, t, and j respectively index the investee, year, and industry (based on the GIC 6 industry classification).

Following Bolton and Kacperczyk (2021) and Kacperczyk and Peydró (2022), we measure a firm's environmental friendliness based on its carbon emissions. As noted earlier, we obtain our carbon emissions measures from the S&P Global Trucost database, which has categories of carbon emissions measures based on different scopes. This categorization schema is based on the Greenhouse Gas Protocol, which seeks to provide a framework that businesses, governments, and other entities can use to measure and report their greenhouse gas emissions in ways that support their mission and goals. The Greenhouse Gas Protocol categorizes a firm's carbon emissions as: 1) Scope 1 emissions, direct emissions from establishments that the company owns or controls, such as all emissions from the fossil fuels used in production; 2)

Scope 2 emissions, which are from the generation of the heat, steam, and electricity that the company purchases and consumes; and 3) Scope 3 emissions, which are caused by the company's operations and products but that derive from sources that the company does not own or control, such as emissions from the production of purchased materials, product use, waste disposal, and outsourced activities.

We focus on Scope 1 emissions because a firm can directly manage them by changing its own production processes. In contrast, Scope 2 and 3 emissions are generated from the firm's consumption of goods and services produced by other firms and which are more difficult for the firm to control or influence. We obtain from the S&P Global Trucost database the measure of a firm's Scope 1 carbon emissions intensity, which is the ratio of its Scope 1 emissions (in tons) to its revenue (in millions). This measure has a right-skewed distribution for our sample, leading us to construct our dependent variable by performing a log transformation of the ratio, *Carbon Intensity*$_{i,t}$.[15] Specifically, *Carbon Intensity*$_{i,t}$, is the natural logarithm of one plus the ratio. [16]

Treat$_i$ is an indicator variable that takes a value of one for a treatment investee, and zero for a control investee. *Post*$_t$ is an indicator variable that equals one when the investee-year observation is in the post-adoption period (i.e., 2016-2019), and zero when it is in the pre-adoption period (i.e., 2008-2011). The terms θ_i and $\delta_{j,t}$ represent investee fixed effects and industry-year fixed effects, respectively. We include investee fixed effects to control for time-invariant investee-level variables that affect the investee's carbon emissions and industry-year fixed effects to control for carbon emissions intensity changes that are common to all investees in a specific industry-year. The coefficient of interest, β_1, captures, relative to the control investees, the change in the carbon emissions intensity of the treatment investees, which are

[15] In an untabulated analysis, we find that the mean, median, standard deviation and skewness of the ratio are 450.7, 25.4, 1327.6 and 5.506, respectively.
[16] We add 1 because the minimum ratio in our sample is 0.

under pressure from insurer investors that are affected by CRDS adoption. A negative and significant β_1 would indicate that the affected insurers' CRDS disclosure contributes to the reduction in their investees' carbon emissions intensity.

As the literature offers us little theoretical guidance on the determinants of firms' carbon emissions level and intensity, we follow the few empirical studies on firms' carbon emissions (e.g., Bolton and Kacperczyk, 2021) and include the following set of investee-level variables as controls ($X_{i,t/i,t-1}$). The first, firm size (*Size*), is the natural logarithm of total assets. The market-to-book ratio (*MB*) is the market value of equity divided by the book value of equity. The return on assets (*ROA*) is income before extraordinary items divided by total assets. Leverage (*Leverage*) is the total debt divided by the total assets. Capital expenditures (*Capex*) is capital expenditures scaled by total assets. Property, plant, and equipment (*PPE*) is the natural logarithm of the gross property, plant, and equipment. Sales growth (*SalesGr*) is the change in the annual total sales scaled by the previous year's total sales. EPS growth (*EPSGr*) is the change in the annual earnings per share scaled by the equity price. Diversification (*HHI*) is the Herfindahl concentration index of firms with respect to different business segments, based on each segment's revenues.

We also control for the following set of variables, which the ESG literature commonly uses as determinants of ESG performance. Institutional ownership (*InstOwn*) is the fraction of the firm's outstanding shares held by institutional investors. Cash holdings (*CashHold*) is cash holdings scaled by total assets. Dividend payout (*Dividend*) is an indicator variable that equals one if the firm has a non-zero dividend and zero otherwise. R&D intensity (*R&D Exp*) is R&D expenses scaled by total sales. Advertising intensity (*AdvExp*) is advertising expenses scaled by total sales.

All control variables are measured in year *t-1*, except for *HHI*, *SalesGr*, and *EPSGr*. Following Bolton and Kacperczyk (2021), we construct these three variables for year *t* to reflect

the fact that they may have a non-trivial contemporaneous effect on firms' carbon emissions in year *t*. See Appendix A for detailed variable definitions. All continuous variables are winsorized at the top and bottom 1% levels. We also adopt heteroscedasticity-robust standard errors clustered at the investee level.

Table 2 provides the summary statistics for the main variables in the analysis. The mean value of *Carbon Intensity* is 3.861.[17] The mean value of *Treat* is 0.508, indicating that the sample sizes for the treatment and control groups are quite balanced. The mean value of *Post* is 0.499, indicating that the sample sizes for our pre- and post-adoption windows are also quite balanced. The summary statistics for the control variables are generally similar to those documented in prior studies (e.g., Chen et al., 2020; Bolton and Kacperczyk, 2021). Our mean values for *Size* and *MB* are 9.484 and 2.997, respectively, which are slightly higher than the mean values of 2.013 and 7.352 in Chen et al. (2020). This discrepancy suggests that our sample consists of relatively large firms. The mean value of *ROA* for our sample is 0.047, which is lower than the mean value of 0.113 in Chen et al. (2020). The mean values of *Leverage* and *Capex* in our sample are 0.321 and 0.055, respectively, which are comparable to the respective mean values of 0.224 and 0.05 in Chen et al. (2020). The mean values of *PPE* and *SalesGr* are 8.049 and 0.058, respectively, slightly higher than the mean values of 6.22 and 0.02 in Bolton and Kacperczyk (2021). The mean values of *HHI* and *InstOwn* for our sample are 0.447 and 0.647, respectively, both of which are slightly lower than their counterparts of 0.82 and 0.768 in Bolton and Kacperczyk (2021). Finally, the respective mean values of *R&DExp* and *AdvExp* are 0.025 and 0.012, which are comparable to the mean values of 0.036 and 0.012 in Chen et al. (2020).

[Insert Table 2 here]

[17] Note that *Carbon Intensity* is the natural logarithm of one plus the ratio of tons of emissions to revenue. In an untabulated analysis, we find that our sample investees on average produce 5.385 million tons of emissions. The mean value of the ratio of emission tons to revenue indicates that the investees produce, on average, 450.7 tons of emissions for every million in revenues earned.

4. Empirical Results

4.1 Baseline Analysis

Using Equation (1), we perform a regression analysis of the transmission effect of insurers' mandatory climate risk disclosure on their corporate bond investees' carbon emissions intensity. Table 3 reports the regression results. In column (1), we find that the coefficient on *Treat* × *Post* is negative and significant at the 5% level.[18] The result suggests that after the CRDS mandate, the treatment investees' carbon emissions intensity significantly decreases relative to that of the control investees. In terms of the economic significance, the magnitude of the coefficient is -0.163, suggesting that the post-CRDS adoption carbon emissions intensity diminishes by 16.3% for the treatment investees. This result is economically significant relative to findings in related studies.[19] For example, Kim et al. (2022) find a 25% reduction in public firms' carbon emissions intensity following the SEC's 2010 rule on climate change risk reporting in 10-Ks. In her study on ESG disclosure regulations, Wang (2023) documents a 13.51% improvement in borrowers' environmental and social performance in response to a one-standard-deviation increase in borrowers' exposure to banks that are subject to these regulations.

The key assumption of our DID model is that in the absence of CRDS adoption, the average change in carbon emissions intensity should be the same for both the treatment and control groups. To validate this assumption, we conduct a parallel trend analysis, which allows us to investigate trends in the carbon emissions intensity for the two groups prior to CRDS adoption. Specifically, we first generate a series of dummy time variables, *T2009*, *T2010*, *T2011*, *T2016*, *T2017*, *T2018*, and *T2019*, which respectively equal one if the observation occurs during the years 2009, 2010, 2011, 2016, 2017, 2018, and 2019, and zero otherwise. To

[18] In an unreported analysis, the coefficient on *Treat* × *Post* remains largely unchanged in a specification that does not include the control variables.

[19] We caution that findings from related studies are not exactly comparable; different studies use different settings and/or examine different outcomes.

estimate Equation (1) using 2008 as the benchmark year, we interact each of these dummies with *Treat* and we replace *Treat* × *Post* with the resulting interaction terms.

Table 3, column (2) presents the outcomes. We find that the coefficients on *Treat* × *T2009*, *Treat* × *T2010*, and *Treat* × *T2011* are small and not significant, implying that prior to adoption, there is no material difference in carbon emissions intensity for the treatment and control investees. Furthermore, we find differences in the treatment and control investees' respective carbon emissions intensities only after CRDS adoption. Specifically, *Treat* × *T2016*, *Treat* × *T2017*, *Treat* × *T2018*, and *Treat* × *T2019* are all significantly negative, suggesting that after adoption, the treatment investees begin to reduce their carbon emissions intensity.[20]

In columns (3) and (4), we investigate whether our findings hold for an alternative sample period using a five-year pre-CRDS adoption window (2007-2011) and a five-year post-CRDS adoption window (2016-2020). Column (3) shows that the coefficient on *Treat* × *Post* is negative and significant at the 5% level. The magnitude of the coefficient is -0.170, qualitatively the same as the one in column (1). In column (4), we generate a series of dummy time variables, *T2008*, *T2009*, *T2010*, *T2011*, *T2016*, *T2017*, *T2018*, *T2019*, and *T2020*, which respectively equal one if the observation is in the years 2008, 2009, 2010, 2011, 2016, 2017, 2018, 2019, and 2020, and zero otherwise. We then interact each of these dummies with *Treat* and we replace *Treat* × *Post* with these interaction terms to estimate Equation (1) using 2007 as the benchmark year. We continue to observe that insurers' mandatory climate risk disclosures have a negative, statistically significant impact on their investees' carbon emissions intensity after CRDS adoption. In particular, the coefficients on *Treat* × *T2008*, *Treat* × *T2009*, *Treat* × *T2010*, and *Treat* × *T2011* are small and not significant, while the coefficients on *Treat* × *T2016*, *Treat* × *T2017*, *Treat* × *T2018*, *Treat* × *T2019*, and *Treat* × *T2020* are all negatively

[20] It also seems unlikely that insurance regulators will consider how CRDS adoption will affect investees' operations when deciding whether to adopt CRDS. Publicly listed investees may not headquarter or incorporate in CRDS adoption states. More importantly, the operations of the investees are likely to be all over the country or even the world.

significant. For parsimony, subsequent tables report the results for the analyses using only with the four-year pre- and post-windows. We note that the results using the five-year pre- and post-windows are qualitatively the same.

Collectively, the results in the baseline analysis show that after CRDS adoption, treatment investees' carbon emissions intensity significantly decreases relative to that of the control investees. The findings are consistent with our hypothesis that insurers' mandatory climate risk disclosure has a transmission effect on their corporate bond investees' carbon emissions intensity.

[Insert Table 3 here]

4.2 Cross-Sectional Tests

Thus far, our results suggest that insurers' mandatory climate risk disclosures lead to a reduction in their corporate bond investees' carbon emissions intensity, consistent with investors' mandatory climate risk disclosures having a positive transmission effect on their investees' environmental friendliness. In this section, we perform a cross-sectional analysis to delve more deeply into the heterogeneity in this transmission effect. Specifically, we explore whether the effect varies with (i) the extent to which the affected insurer investors and/or investees experience strong public pressure about climate risk issues, (ii) the extent to which investees are likely to be monitored by affected insurer investors, (iii) the extent to which investees' financing is dependent on affected insurer investors, and (iv) the extent of their exposure to affected insurer investors that face intense underwriting business competition.

4.2.1 The extent to which affected insurer investors and/or investees experience strong public pressure about climate risk

A key objective in making climate risk disclosures mandatory for investors is to motivate them to monitor and/or influence their investees' environmental friendliness, thereby creating a positive transmission effect. When disclosures are made public, public pressure is

likely to play an important role in how effective these disclosures are in changing behaviour. To capture heterogeneity in the level of pressure, we examine how climate-risk-related public pressure on insurers and/or investees affects the insurers' mandatory climate risk disclosures and their investees' carbon emissions intensity. To proxy for state-level public pressure about climate risk issues, we collect data from the Yale Program on Climate Change Communication website, which offers state-level estimates of the percentage of adults who are somewhat or very worried about global warming.[21] We classify a state as capable of strong public pressure about climate risk when the percentage of adults who are worried about global warming in that state is above the cross-state median. Using this classification, we can examine whether the transmission effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity varies depending on the level of public pressure in the state where the insurers and/or their investees are located.

First, we expect that the transmission effect of insurers' mandatory climate risk disclosures on their investees' carbon emissions intensity will be stronger for investees when their insurer investors are more affected by public pressure about climate risk. Such investors will in turn put more pressure on their investees. We regard insurers that are headquartered in a state with a strong public attitude about climate risk as being under strong pressure. For each investee, we measure the pressure the investee receives from investors as the number of affected insurer investors experiencing high pressure divided by the total number of insurer investors in 2015. Using the sample median for this measure, we divide our sample into two investee subgroups, one with affected insurer investors that experience weak public pressure and one for which the public pressure is strong. We then estimate Equation (1) for each

[21] The Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication conduct a comprehensive national survey to estimate variation in Americans' climate change beliefs, risk perceptions, and policy support at the state, congressional district, metro area, and county levels. The survey data, which reflect public perceptions about and attitudes toward climate risk, are available at: https://climatecommunication.yale.edu/visualizations-data/ycom-us/.

subgroup. Table 4, columns (1) and (2) report the results. In column (1), we find an insignificant coefficient on *Treat* × *Post* for investees when their affected insurer investors face weak public pressure. In column (2), when the affected insurer investors are under strong public pressure, we document a significantly negative coefficient on *Treat* × *Post* for their investees. Following Cleary (1999), we employ a bootstrap methodology to determine the significance level of the observed differences in the coefficient estimates on *Treat* × *Post* for these two subsamples; we find that the difference is statistically significant at the 5% level.

We also expect the transmission effect to be stronger for investees that themselves experience more public pressure about climate risk due to their headquarters location. We consider an investee to be under strong public pressure if, in 2015, it is headquartered in a state with a strong public attitude about climate risk. We then divide our sample into two subgroups, investees experiencing weak public pressure and those under strong public pressure. We estimate Equation (1) for these subgroups. Table 4, columns (3) and (4) report the results. In column (3), we document an insignificant coefficient on *Treat* × *Post* when the public pressure on investees is weak. In column (4), we document a significantly negative coefficient on *Treat* × *Post* for strongly pressured investees. The difference between the coefficients in these columns is significantly significant at the 10% level.

Moreover, we expect the transmission effect to be stronger when both the insurers and the investees experience more public pressure about climate risk. To examine this likelihood, we combine the approaches used in the previous two analyses. We consider an investee to be under strong pressure if it is receiving that level of pressure from affected insurer investors, based on whether the investors' headquarters are located in states with a strong public attitude about climate risk and if the investee's own headquarters is also in a strong-attitude state. We then estimate Equation (1) for the two subgroups of investees, one under weak and the other under strong public pressure. Table 4, columns (5) and (6) report the results. In column (5), we

document an insignificant coefficient on *Treat* × *Post* for investees under weak pressure. Column (6) documents a significantly negative coefficient on *Treat* × *Post* for investees under strong pressure. The difference between the coefficients in these two columns is statistically significant at the 1% level.

Overall, the results in Table 4 suggest that the positive transmission effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity is more pronounced when investees experience more public pressure about climate risk issues either directly, based on their headquarters locations, and/or indirectly, based on the headquarters locations of their affected insurer investors.

[Insert Table 4 here]

4.2.2 The likely extent of affected insurer investors' monitoring of investees

We argue that CRDS adoption induces insurers to enhance their investee monitoring, leading to a reduction in the investees' carbon emissions intensity. Therefore, we propose that the transmission effect will be stronger when insurers more closely monitor their investees. To test the role that insurer monitoring plays, we use three approaches that proxy for the extent to which investees are likely to be monitored by their affected insurer investors.

First, we posit that if the affected insurers are geographically proximate to their investees, they will have stronger incentives and abilities to monitor and influence the investees' actions. Prior literature highlights that close geographic proximity facilitates communication and information exchange between the insurer and the investee, making it easier for the insurer to monitor and influence the investee's behaviour (Giroud, 2013; Levine, Lin, Peng, and Xie, 2020). For each investee-insurer pair, we calculate their geographic distance in kilometres based on their zip codes. We obtain investee and insurer zip codes from the Augmented 10-X

Header Data and the NAIC Annual Statement databases, respectively.[22] We calculate the weighted average geographic distance between each investee and its affected insurer investors. The weight for an affected insurer investor is determined by the amount of bonds the affected insurer investor holds as a percentage of the total amount of all public bonds issued by the investee. We divide our sample into two subgroups using the median value of this distance, and we estimate Equation (1) for each subgroup. Table 5, columns (1) and (2) report the results. In column (1), we document an insignificant coefficient on *Treat* × *Post* for investees that are geographically distant from their affected insurer investors. In column (2), we document a significantly negative coefficient on *Treat* × *Post* for investees that are close to their affected insurer investors. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 5% level.

Second, we posit that insurers that have a good environmental performance are more likely to pay more attention to the environmental friendliness of their investees. Furthermore, an insurer with a good environmental performance may be more likely to have expertise in environmental issues, making it better equipped to monitor and support investees. Therefore, we expect the transmission effect to be stronger for an investee that has corporate bonds that are owned by environmentally friendly affected insurers. We obtain an insurer's environmental performance score from the Refinitiv ESG database. An insurer is regarded as being environmentally friendly if its environmental performance score is above the median for all insurers in 2015. For each investee, we calculate the ratio of the number of its affected, environmentally friendly insurer investors to the total number of its insurer investors. We then divide our sample into two subgroups using the ratio's median value and we estimate Equation (1) for each subgroup. Table 5, columns (3) and (4) reports the results. In column (3), we

[22] We thank Bill McDonald for making the Augmented 10-X Header Data available online: https://sraf.nd.edu/data/augmented-10-x-header-data/.

document an insignificant coefficient on *Treat* × *Post* for investees that are less exposed to environmentally friendly affected insurer investors. Column (3) shows a significantly negative coefficient on *Treat* × *Post* for more exposed investees. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

Public companies are subject to greater scrutiny and pressure from stakeholders, including shareholders, analysts, the media, and regulators (Bradley et al., 2022; Chen et al., 2020; Liang et al., 2022) and are thus more likely to act in a socially responsible and sustainable manner. For this reason, we posit that insurers with public parent companies are more likely to prioritize environmental issues and to monitor and encourage their investees to reduce their carbon emissions intensity. We first identify insurers' parent companies using the ownership details from the NAIC Annual Statement database and we manually cross-check the data with *Best's Insurance Reports, Property/Casualty Editions*.[23] We then match the insurers' parent company names to firm names in the CRSP/Compustat Merged database to identify those insurers with a parent that is a publicly listed company. When matching names, we perform extensive checks using firms' SEC filings and websites. We calculate the ratio of each investee's number of affected insurer investors with a publicly listed parent company to the total number of insurer investors. We then divide our sample into two subgroups using the median value of this ratio and we estimate Equation (1) for each subgroup. Table 5, columns (5) and (6) reports the results. In column (5), we document an insignificant coefficient on *Treat* × *Post* for investees that are less exposed to affected insurer investors with a publicly listed parent company. Column (6) documents a significant coefficient on *Treat* × *Post* for investees more exposed to affected insurer investors with a publicly listed parent company. The

[23] These reports are provided by A.M. Best Company, a global credit agency, news publisher, and data analytics provider specializing in the insurance industry.

difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

Taken together, the results in Table 5 suggest that the positive transmission effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity is more pronounced when affected insurer investors are likely to monitor investees.

[Insert Table 5 here]

4.2.3 The extent of investees' financing-related dependence on affected insurer investors

We then investigate how investees' degree of dependence on affected insurer investors for financing impacts the relation between insurers' mandatory climate risk disclosures and their investees' carbon emissions intensity. We propose that more financially dependent investees are more likely to be strongly influenced by affected insurer investors, and that insurers' mandatory climate risk disclosures have a stronger positive transmission effect on the investees' carbon emissions intensity.

We use three approaches to proxy for the extent of this dependence. First, we collect the debt constraints measure from Hoberg and Maksimovic (2015).[24] Using a textual analysis of the Management's Discussion and Analysis (MD&A) section in firms' 10-Ks, Hoberg and Maksimovic (2015) begin by identifying relatively small training samples of firms. They identify firms that are financially constrained and that also plan to issue debt (presumably to address their liquidity challenges). Hoberg and Maksimovic (2015) then construct an index for all firms by computing the cosine similarity between the text in each firm's 10-K and the text used by the firms in the training sample. Firms with a higher index value are more likely to be dependent on debt financing. We then divide our sample into two subgroups using the median

[24] We thank Hoberg and Maksimovic (2015) for making their financial constraint data available online: https://faculty.marshall.usc.edu/Gerard-Hoberg/MaxDataSite/index.html.

value of the debt constraints index and estimate Equation (1) for each subgroup. Table 6, columns (1) and (2) report the results. In column (1), we document an insignificant coefficient on *Treat* × *Post* for investees that are less dependent on debt financing. In column (2), the coefficient on *Treat* × *Post* is significantly negative for investees with more dependence on debt financing. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

Next, we obtain the total amount of an investee's outstanding public bonds from the FISD and its total assets from Compustat. We calculate an investee's bond dependence ratio as the percentage of the total outstanding bonds to its total assets. We then divide our sample by the median value of the bond dependence ratio and estimate Equation (1) for each subgroup. Columns (3) and (4) of Table 6 present the results. In column (3), we document an insignificant coefficient on *Treat* × *Post* for investees with a low bond dependence. In column (4), we find a significantly negative coefficient on *Treat* × *Post* for high bond dependence investees. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

Our third approach relies on the notion that investees with fewer unaffected insurer investors in their headquarters state may rely more on affected insurer investors in that state for financing, which gives the affected investors more influence over the investees. We calculate each investee's ratio of the number of affected insurers in its headquarters state to the total number of insurers in that state. A higher ratio indicates a greater dependence on affected insurer investors for financing. We divide our sample based on the median value of this ratio and then estimate Equation (1) for the subgroups. Table 6, columns (5) and (6) report the results. In column (5), we document an insignificant coefficient on *Treat* × *Post* for investees with a low percentage of affected insurers in the investee's headquarters state. Column (6) shows a significantly negative coefficient on *Treat* × *Post* for investees with a high percentage of

affected insurers in the headquarters state. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

These results suggest that insurers' mandatory climate risk disclosure's positive transmission effect on their corporate bond investees' carbon emissions intensity is stronger when investees depend more for financing on bond investors that are also affected insurers.

[Insert Table 6 here]

4.2.4 The extent of investees' exposure to affected insurer investors with intense underwriting business competition

Finally, we examine how underwriting business competition factors into the relation between insurers' mandatory climate risk disclosures and investees' carbon emissions intensity. Competition in the underwriting business may dampen insurers' monitoring incentives. Intense competition can shrink underwriting profit margins because insurers have to offer better insurance terms to attract customers. As a result, they have greater incentives to earn higher investment returns so they can demonstrate a better overall performance and, relatedly, strengthen their balance sheets and boost regulatory capital.

Prior research shows that investments in environmentally unfriendly firms might yield higher returns compared to investments in environmentally friendly ones (Hong and Kacperczyk, 2009; Bolton and Kacperczyk, 2021). Thus, if insurers have incentives to earn higher investment returns, it might be difficult to simply walk away from these firms. Moreover, in encouraging their investees to reduce their carbon emissions intensity, insurers may have to sacrifice their short-term returns on investment if the investees can only become more environmentally friendly if they incur large upfront fixed costs. Therefore, insurers that have intense product market competition may be more reluctant to walk away from environmentally unfriendly investees that might offer higher investment returns or to otherwise engage with

their investees about climate-related activities.[25] We expect the transmission effect to be more evident for investees that have affected insurers with less competition.

We measure an investee's exposure to insurers with a high/low level of competition using two steps. First, we measure the level of competition that an insurer faces by measuring the level of insurer competition in each state and then assigning that competition level to an insurer based on the extent of the insurer's underwriting business in that state (Cheng, Qian, and Reeb, 2020). Second, we determine an investee's exposure to high-competition insurers based on the extent to which the investee is owned by such insurers.

Specifically, our first measure of the competition relies on the notion that at the state level, rivalry between insurers increases with the number of insurers operating in the state. Therefore, we proxy for state-level competition using the weighted number of insurers underwriting in each state and year (Cheng et al., 2020). To account for insurers of differing size, we assign a weight to each based on its share of written premiums in that particular state relative to the insurer's total written premiums across all states in that year. This methodology allows us to give a higher weight to insurers that have a more significant share of their total underwriting business in the state. We then measure the competition an insurer faces as the weighted aggregation of the insurer's competition across all states; the weight is the insurer's written premiums in that state as a percentage of its total written premiums across all states. An insurer is considered to be in a highly competitive environment if its competition is above the median for all insurers in 2015. For each investee, we calculate the ratio of the number of affected insurer investors with high competition to the total number of insurer investors. We then divide our sample into two subgroups using the ratio's median value, and we estimate Equation (1) for each subgroup. Table 7, columns (1) and (2) detail the results. In column (1),

[25] Consistent with our arguments, Xiong (2020) shows that firms with high product market competition may deliberately opt for short-termism and hence forgo investments that pay off over the long run.

we document a significantly negative coefficient on *Treat* × *Post* for investees that are less exposed to affected insurer investors with high competition. In contrast, column (2) shows that the coefficient on *Treat* × *Post* is insignificant for investees with high exposure to affected insurer investors in a highly competitive environment. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 1% level.

Second, our second measure of competition applies the canonical Herfindahl-Hirschman index to determine the concentration of underwriting insurers in a state (Cheng et al., 2020). To calculate the concentration of underwriting insurers, we first square the market shares of each insurer in the state. The market share is equal to the insurer's written premiums in the state divided by the total written premiums for the state. We measure the state-level concentration as the sum of these squared market shares and competition as the inverse of the concentration. Next, we measure an insurer's competition as the weighted aggregation of the insurer's competition across all states; the weight is the insurer's written premiums in that state as a percentage of its total written premiums across all states. An insurer is considered to be in a highly competitive environment if its competition is above the median for all insurers in 2015. For each investee, we calculate the ratio of the number of affected insurer investors with high competition to the total number of insurer investors. We then divide our sample into two subgroups using the ratio's median value, and we estimate Equation (1) for each subgroup. Table 7, columns (3) and (4) report the results. Column (3) shows a significantly negative coefficient on *Treat* × *Post* for investees with less exposure to affected insurer investors with high competition. In contrast, column (4) shows an insignificant coefficient on *Treat* × *Post* for investees with more exposure to affected insurer investors that also face high competition. The difference between the coefficients on *Treat* × *Post* in the two columns is statistically significant at the 10% level.

Overall, the results suggest that the transmission effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity is stronger for investees that have fewer affected insurers investors with high product market competition.

[Insert Table 7 here]

4.3 Further Analyses

4.3.1 Alternative research designs

To further determine the robustness of our primary finding of a positive insurer-to-investee transmission effect on investees' environmental performance, we consider alternative research designs. Table 8 details the results.

We examine our findings' sensitivity to alternative methods of identifying the treatment and control groups. In our main analysis, we classify the treatment and control investees according to the affected insurers' bond holdings in 2011, the year before the CRDS was introduced for insurers. We use 2011 to avoid the possibility that affected insurers might change their bond holdings in the years before our post-adoption period. Here, we examine the robustness of our results to classifying the treatment and control investees based on affected insurers' bond holdings in 2015, the year immediately prior to the post-adoption period. In addition, we examine the robustness of our results to identifying the treatment and control investees based on affected insurers' bond holdings in both 2011 and 2015. This more stringent classification results in a smaller sample. Table 8, columns (1) and (2) show that our primary finding is robust to the above alternative ways of classifying the treatment and control investees.

[Insert Table 8 here]

4.3.2 Other outcomes related to investees' carbon emissions

The S&P Global Trucost database provides measures of other outcomes that relate to carbon emissions. In this section, we consider the effect of insurers' mandatory climate risk disclosure on these outcomes by replacing the dependent variable in Equation (1).

First, we obtain from the database the environmental cost of a firm's carbon emissions, *Carbon Cost*. *Carbon Cost* is the natural logarithm of one plus an investee's external cost of carbon emissions in a year.[26] The external cost is the estimated monetary value of the damage caused by the release of carbon emissions into the air through the firm's consumption of fossil fuels and the production processes that it owns or controls. In the absence of a market price, Trucost derives the monetary value of the cost of carbon emissions from academic journals, government studies, and established environmental economic techniques. It then determines the social environmental cost of specific quantities of carbon emissions. Table 9, column (1) reports the results, showing that the environment cost of the treatment investees' carbon emissions, compared to that of the control investees' carbon emissions, is lower after CRDS adoption. The coefficient on *Treat* × *Post* is -0.169, which indicates a 16.9 percentage reduction in the cost of investees' environmental damage.

Next, we obtain measures of a firm's Scope 2 and Scope 3 carbon emissions intensity from the database. We discuss these types of emissions in Section 3.2: they are more difficult for the firm to control or influence because they essentially arise from its consumption of goods and services that other firms produce. *Carbon Intensity S2* is the natural logarithm of one plus the ratio of an investee's Scope 2 carbon emissions (in tons) to its revenue (in millions) in a year. Similarly, *Carbon Intensity S3* is the natural logarithm of one plus the ratio of an investee's Scope 3 carbon emissions (in tons) to its revenue (in millions) in a year. Table 9, columns (2) and (3) respectively present the results of the regressions that examine the effect of insurers' mandatory climate risk disclosures on Scope 2 and 3 carbon emissions intensities. The insignificant coefficients on *Treat* × *Post* indicate that insurers' mandatory climate risk disclosures have no effect on investees' Scope 2 and 3 carbon emissions intensities. One

[26] The external cost of carbon emissions is a measure developed by Trucost. In this measure, "carbon emissions" refers to direct emissions, including the GHG Protocol's Scope 1 emissions, plus any other emissions derived from a wider range of GHGs that are relevant to a company's operations.

interpretation of these findings is that the positive transmission effect of insurers' mandatory climate risk disclosures does not extend to emissions that are not within the control of their corporate bond investees. Another interpretation of the insignificant finding with Scope 3 carbon emissions is that our investee firms reduce their own carbon emissions by outsourcing them to other parties in their supply chains (Li and Zhou, 2017; Ben-David et al., 2021).

[Insert Table 9 here]

5. Conclusion

In the U.S., many insurers are subject to mandatory climate risk disclosures as a result of NAIC's adoption of the CRDS. In this paper, we study the transmission effect of insurers' mandatory climate risk disclosure on their corporate bond investees' environmental friendliness. We use a DID research design to find that after CRDS adoption, there is a significant reduction in carbon emissions intensity for the treatment investees relative to the control investees. This outcome is consistent with investors' mandated climate risk disclosure having an insurer-to-investee transmission effect on investees' environmental performance. We also observe that the reduction in carbon emissions intensity is more pronounced when insurers, investees, or insurer-investee pairs experience greater public pressure about climate risk issues. Furthermore, we find that the transmission effect is stronger when insurers' monitoring of investees is more robust and when investees rely more on insurer financing. Finally, the transmission effect is more pronounced when insurers' product market competition is less fierce.

Overall, our study presents new causal evidence that imposing mandatory climate risk disclosure on investors can have a significant transmission effect on their investees' environmental friendliness. We also determine that heterogeneity is present in the effect in that the conditions around the investors and/or the investees can affect the effect's extent. We believe that our study furthers the nascent research on the real effects of climate risk disclosure

while also shedding light on the implications of policies such as the CRDS, which pressures investors to encourage their investees to be more environmentally friendly.

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Appendix A: Variable Definitions and Sources

Variable	Definition	Source
Dependent variables		
Carbon Intensity	The natural logarithm of one plus the ratio of an investee's Scope 1 carbon emissions (in tons) to its revenue (in millions) in a year. Scope 1 carbon emissions are direct emissions from establishments that are owned or controlled by the company, such as all emissions from the fossil fuels used in production	Trucost
Carbon Cost	The natural logarithm of one plus an investee's external cost of carbon emissions in a year. The external cost is the estimated monetary value of the damage caused by the release of carbon emissions into the air as a result of the consumption of fossil fuels and the production processes that the firm owns or controls. The calculation assumes that the cost of maintaining an environmental benefit is a reasonable estimate of its value.	Trucost
Carbon Intensity S2	The natural logarithm of one plus the ratio of an investee's Scope 2 carbon emissions (in tons) to its revenue (in millions) in a year. Scope 2 carbon emissions are emissions from the generation of the purchased heat, steam, and electricity consumed by the company.	Trucost
Carbon Intensity S3	The natural logarithm of one plus the ratio of an investee's Scope 3 carbon emissions (in tons) to its revenue (in millions) in a year. Scope 3 carbon emissions are emissions caused by the company's operations and products but that occur from sources that the company does not own or control, such as emissions from the production of purchased materials, product use, waste disposal, and outsourced activities.	Trucost
Independent variables		
Treat	Indicator variable that equals one if the firm is identified as a treatment firm and zero otherwise.	NAIC, California Department of Insurance's website, eMAXX, FISD
Post	Indicator variable that equals one if the observation is in the post-adoption period (i.e., 2015-2019) and zero otherwise.	-
T2008, T2009, T2010, T2011, T2015, T2016, T2017, T2018, and *T2019*	Indicator variables that respectively equal one if the observation is in the years 2008, 2009, 2010, 2011, 2015, 2016, 2017, 2018, and 2019, and zero otherwise.	-
Size	The natural logarithm of total assets.	Compustat
MB	Market value of equity divided by the book value of equity.	Compustat
ROA	Income before extraordinary items divided by total assets.	Compustat
Leverage	Total debt divided by total assets.	Compustat
Capex	Capital expenditures scaled by total assets.	Compustat
PPE	The natural logarithm of gross property, plant, and equipment.	Compustat
SaleGr	Change in the annual total sales scaled by last year's total sales.	Compustat
EPSGr	Change in the annual earnings per share scaled by the equity price.	Compustat
HHI	The Herfindahl–Hirschman Index measuring the concentration of a firm's business, determined using the revenues of each of the firm's business segments.	Compustat

InstOwn	Institutional ownership, which is the fraction of the firm's outstanding shares held by institutional investors.	Thomson-Reuters Institutional (13f) Holdings
CashHold	Cash holdings scaled by total assets.	Compustat
Dividend	Indicator variable that equals one if the firm has a non-zero dividend and zero otherwise.	Compustat
R&DExp	R&D expenses scaled by total sales.	Compustat
AdvExp	Advertising expenses scaled by total sales.	Compustat

Appendix B: Examples of Insurers' Responses to the CRDS

Example 1: Zurich American Insurance Company's 2018 CRDS Response

Survey Details

< Return to Search Results

NAIC Number: 16535
Company Name: Zurich American Insurance Company
Line Of Business: Property & Casualty
Group Filing: Y
Group Number: 0212
Group Name: Zurich American Insurance Company and Affiliates

Question 1:

Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations? If yes, please summarize.

Yes/No response question 1: Y

Written response question 1:

Certain statements in this document are forward-looking statements, including, but not limited to, statements that are predications of or indicate future events, trends, plans or objectives. Forward-looking statements include statements regarding our understanding of general economic, financial and insurance market conditions and expected developments. Undue reliance should not be placed on such statements because, by their nature, they are subject to known and unknown risks and uncertainties and can be affected by other factors that could cause actual results and plans and objectives of Zurich American Insurance Company, a New York domestic insurance company, and its pooled companies (collectively, the "Company") to differ materially from those expressed or implied in the forward looking statements (or from past results). Factors such as (i) general economic conditions and competitive factors, particularly in our key markets; (ii) the risk of the global economic downturn and a downturn in the financial services industries in particular; (iii) performance of financial markets; (iv) levels of interest rates and currency exchange rates; (v) frequency, severity and development of insured claims events; (vi) mortality and morbidity experience; (vii) policy renewal and lapse rates; and (viii) changes in laws and regulations and in the policies of regulators may have a direct bearing on the results of operations of the Company. The Company undertakes no obligation to update or revise any of these forward-looking statements, whether to reflect new information, future events or circumstances or otherwise.

In January 2013, Zurich Insurance Company Ltd ("Zurich") formed the Group Environmental Performance team. This team is dedicated to support the business in reducing the negative impact its operations have on the environment. They are responsible for managing a comprehensive set of activities to accurately measure, track, and improve Zurich's environmental footprint, helping internal stakeholders understand where and how they can operate in a more sustainable and efficient manner. The four focus areas of the Group Environmental Performance Framework are:

- Standards and Governance: continuous improvement of the Group-wide environmental management system (based on ISO 14001)
- Environmental Reporting (measuring impact): achieving further improvements in the quality of data reported, and ensuring alignment to evolving external reporting standards and best practice, including "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)" developed by the World Resources Institute and the World Business Council for Sustainable Development ("the GHG Protocol")
- Strategy and Projects (mitigating impact): develop new opportunities to achieve efficiency gains across operational and business processes
- Communications, Change and Relationship Management: continue to expand environmental networks across the business and broaden the use of business social tools for more effective information sharing and awareness building to achieve impact

In 2008, Zurich set its first global environmental target to reduce carbon emissions per employee by 10 percent by 2013 as compared to a 2007 baseline. Zurich exceeded the original carbon reduction target in 2012. Following, Zurich set new environmental targets including a 50 percent reduction in carbon per employee and 40 percent reduction in energy per employee, by 2020 compared to a 2007 baseline. In 2016, Zurich exceeded these targets achieving a 53 percent reduction in carbon per employee and 43 percent reduction in energy per employee. In 2017 Zurich committed to further long-term environmental targets to be achieved by 2025 against a 2015 baseline. Those targets include Zurich achieving and maintaining a 20% reduction in total carbon emissions per employee, broken down by facilities and business travel emissions, as well as a 20% reduction in energy per employee.

See June 29, 2017 news release: https://www.zurich.com/en/media/news-releases/2017/2017-0629-01

2018 environmental performance results available here: https://www.zurich.com/en/sustainability/climate-change/environmental-key-performance-indicators

Additionally, Zurich has been carbon neutral since 2014, investing in the Rimba Raya Biodiversity Reserve, a REDD+ project validated under the Verified Carbon Standard.

Zurich has achieved these substantial improvements in environmental performance through the following key programs:
- Purchasing renewable electricity – Zurich has set the target to achieve 100% renewable power by end 2022
- Sustainable buildings – Addressing sustainability across the full building life-cycle, starting at building selection, through projects, operations, and finally decommissioning.
- Efficient travel practices – only traveling when necessary and use of video, web and teleconference wherever possible instead. Zurich encourages the transition to a more sustainable car fleet.
- Zurich's workplace strategy program ensures our office space considers evolving workplace trends, enabling the delivery of collaborative, fit-for-purpose work environments, while delivering space efficiency improvements.

Sustainable IT is part of Zurich's sustainable operations focus. Currently, outsourced data centers are not considered part of Zurich's operational control boundary. Energy from data centers that sit onsite in a Zurich premise is included in our environmental footprint.

In 2014, Zurich started sourcing 100 percent renewable electricity at its North America headquarters in Schaumburg, IL. They continued with this commitment at the newly constructed LEED Platinum headquarters which opened in the fall of 2016. As of 2018, Zurich North America sourced 49 percent renewable electricity out of its total electricity demand, while globally, 55 percent of Zurich's electricity comes from renewable sources. Although outside of Zurich's operational control reporting boundary, Zurich has procured 100% renewable power for the strategic data center in Europe.

In addition to purchasing renewable electricity, the new LEED Platinum headquarters boasts a number of best practice examples in sustainable building including: a curtain wall system designed to maximize natural light; a system to provide high-quality indoor air; access to public transportation and accommodations for electric and low-emitting vehicles; incorporation of multiple "green" roofs, totaling more than one acre; landscape including 637 trees and more than 13 acres of native savannah plantings; walking paths and water features; rainwater harvest and re-use; recycling and reduction of waste during construction process and efforts to utilize locally-sourced building materials.

Zurich has also implemented programs to remind employees to power down equipment when it is not in use. Many computer monitors and desktop computers are automatically set to go into a "sleep" or hibernation mode after a short period of inactivity.

Zurich continues to work on reducing the environmental impact from paper and printing. Copier/printer machines in many locations are set for duplex (two-sided) printing and the print/copy default has been set to black and white vs. color. As part of an ongoing plan, Zurich continually looks at optimization of devices based not only on lease expiration, but includes office consolidations, organizational changes, in conjunction with our continued efforts on print reduction. In addition, any new device put in place at lease expiration is the most energy efficient product available. As of 2018, the number of MFDs within our Zurich North America office buildings has been reduced to 215 machines, down from 438 in 2013 (a 51 percent reduction).

Find more information about Zurich's Environmental Performance:

https://www.zurich.com/en/corporate-responsibility/climate-change/minimizing-our-environmental-footprint

Question 2:

Does the company have a climate change policy with respect to risk management and investment management? If yes, please summarize. If no, how do you account for climate change in your risk management?

Yes/No response question 2: Y

Written response question 2:

In 2011, Zurich established a Corporate Responsibility Working (now the Sustainability Leaders Council) Group reporting directly to the Group Executive Committee. In July 2014, this group finalized Zurich's climate change position statement. See https://www.zurich.com/en/sustainability/climate-change In 2017 this was further enhanced. According to the statement, we help our customers and communities become more resilient to natural disasters and extreme weather; we make a difference through our responsible investment approach; and we are swiftly reducing our own carbon footprint. We are working closely with communities and policy-makers to place more emphasis on risk reduction, preparedness and resilience rather than purely focusing on recovery and rebuilding. We are also sharing with our customers the best practices and other risk-related insights developed during our 140-year history.

We have made a broad commitment to help facilitate – if not accelerate – the generational shift to a low-carbon economy. In June 2019 Zurich announced that as the first insurance company, it commits to set targets in the framework of the UN Global Compact Business Ambition Pledge that aims at limiting global temperature rise to 1.5°C above pre-industrial levels. Zurich also has expanded its existing thermal coal policy aimed at reducing the use of carbon intense fossil fuels. See https://www.zurich.com/en/media/news-releases/2019/2019-0625-01. In addition, Zurich is adopting the recommendations of the Financial Stability Board's Task force on Climate Change-related Financial Disclosure (FSB-TCFD) and is reporting on progress made in implementing its commitments. See https://www.zurich.com/en/sustainability/climate-change/tcfd

See response to Question 5 for information on Zurich's climate policy with respect to investment management.

Question 3:

Describe your company's process for identifying climate change-related risks and assessing the degree that they could affect your business, including financial implications.

Yes/No response question 3: Y

Written response question 3: The mission of risk management at Zurich is to promptly identify, measure, report and monitor risks that affect the achievement of strategic, operational and financial objectives. This includes adjusting the risk profile in line with the company's stated risk tolerance to respond to new threats and opportunities. Zurich's risk management framework is a governance process with clear responsibilities for taking, managing, monitoring and reporting risks. This process relates to all types of risk including climate change.

Zurich has a global and interdisciplinary Emerging Risk Group (ERG) that looks at potential risks, including climate-related risks. In May 2016 the Group CRO also established a cross-functional Climate Risk Working Group to assess and coordinate climate risk activities across Zurich.

Understanding the potential effects of natural catastrophes is a critical component of risk management. Zurich uses a combination of third-party and in-house models to manage its underwriting and accumulations in modeling areas to stay within intended exposure limits.

Question 4:

Summarize the current or anticipated risks that climate change poses to your company. Explain the ways that these risks could affect your business. Include identification of the geographical areas affected by these risks.

Yes/No response question 4: Y

Written response question 4: Physical Risks - Zurich has potential exposure to some physical risks of climate change with respect to its own operations and as a result of exposures of its insureds, including those in the U.S., assumed by Zurich though insurance policies. To address the potential physical risks to its own operations, Zurich maintains and tests robust business continuity plans and also maintains property coverage that addresses flooding, windstorm and other perils. Risks assumed through the issuance of insurance policies to customers are addressed as an integrated part of the underwriting process.

Financial Risks - Physical risks impacting Zurich's customers may result in increased frequency and severity of certain claims. These risks are addressed as an integrated part of the underwriting process.

Investment Risks - See response to Question 5.

Insurability Risks - In general, the insurance sector in the U.S. and globally faces the challenge of maintaining the availability and affordability of insurance products while addressing the pressures imposed by potential changes in climate conditions. A deep understanding of the risks posed by climate change, and options for adaptation to and mitigation of these risks, is necessary to adequately underwrite insurance products exposed to those risks.

Regulatory Risks – Zurich has potential exposure to climate-related regulatory risks, both with respect to its own operations as well as those assumed through its products and services. New and enhanced regulation—and the uncertainty leading up to such regulation—in the insurance area and in areas as diverse as emission caps and building codes could impact the insurance sector, directly and indirectly. These risks are addressed as an integrated part of the underwriting process and are monitored by our Government & Industry Affairs function.

Reputational Risks – The reputation of companies perceived as not taking the climate change challenge seriously may be affected over time. Zurich has taken an active approach to dealing with these evolving issues, both as a matter of its commitment to customers and with respect to corporate and fiscal responsibilities.

Question 5:

Has the company considered the impact of climate change on its investment portfolio? Has it altered its investment strategy in response to these considerations? If so, please summarize steps you have taken.

Yes/No response question 5A: Y

Yes/No response question 5B: Y

Written response question 5: For purposes of this Question 5, respondent assumes that the term "altered" includes any consideration or integration of environmental factors and/or climate change in its overall investment process or strategy.

In general, Zurich's Investment Policy pursues simultaneously the goals of security and profitability of the assets in which funds are invested to:
• ensure sufficient liquid funding for all future commitments; and
• generate adequate financial return in the form of investment income and capital appreciation.

In general, Zurich's Investment Policy is designed to take careful consideration of several factors, including but not limited to:
• compliance with applicable rules and regulations;
• the economic risk and reward tradeoff of an investment, including any risks and opportunities related to environmental, social and governance (ESG) factors, and how that investment affects the economic risk and reward tradeoff of the entire investment portfolio taken in the context of Zurich's liabilities;
• compliance with internal risk management policies and constraints;
• the accounting treatment of the investment;
• the impact of the investment, if any, on federal, state and local taxes;
• the impact of the investment on regulatory and accounting solvency measures;
• the liquidity or marketability of the investment taken in the context of liquidity needs stemming from Zurich's liabilities; and
• any potential operational or reputational risks involved in making the investment.

Zurich is committed to responsible investment in achieving its investment objectives, and responsible investment practices form an integral part of Zurich's Investment Policy.

Zurich is making continued progress in integrating ESG factors, including climate change, into security and asset selection processes across its investment portfolio. Zurich is also thoroughly assessing responsible investment practices of its asset managers as part of its manager selection and monitoring processes.

In addition to Zurich's established 'business-as-usual' ESG integration practices we have launched, during 2018 we:

• worked with a variety of partner organizations on methodologies that allow for comprehensive assessment of exposure to physical and transition climate risk for equities, corporate bonds, real estate and infrastructure investments;
• updated our macroeconomic climate risk scenarios;
• actively voted on shareholder resolutions regarding climate change disclosures or actions of investee companies;
• reviewed our asset managers climate position;
• divested all equity holdings and put into run off fixed income investments from companies that generate >50% of their revenues from thermal coal mining or use >50% of coal in their energy generation mix;
• advocated for the transition to a low-carbon economy and for the introduction of an economically viable carbon price;
• as part of its impact investing program, Zurich has also invested over USD 3bn carbon and climate resilient investments on a global basis to help communities adapt to, and mitigate climate change.

Detailed information can be found on Zurich's Responsible Investment web page at the link below:
https://www.zurich.com/en/sustainability/responsible-investment

Question 6:

Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.

Yes/No response question 6: Y

Written response question 6: For purposes of this Question 6, respondent assumes that the phrase "taken steps to encourage" includes general information sharing and education efforts in the area of climate change.

Zurich uses its skills in risk identification and management to assist stakeholders in better adapting to and mitigating risks of climate change. To that end, a variety of activities, including formal information sharing, such as congressional testimony or white papers, and more informal means, such as customer and broker meetings, as well as Risk Engineering assessments have been undertaken to share information and collaborate with policyholders and potential policyholders. Zurich has worked with stakeholders to better understand the potential climate change risks that may require risk management solutions to mitigate those risks.

As part of its initiative, Zurich continuously strives to identify and respond to the risk management needs arising from existing or upcoming climate change legislation. During the first years of its climate initiative, Zurich has climate-related products, some of which are, at least in part, driven by this legislation. Examples of these products include: (1) directors & officers liability insurance extended for climate-related claims; (2) political and trade credit risk coverage for carbon credit projects; (3) green, efficient and resilient rebuild insurance, allowing for the rebuilding of damaged property with improvements to green, efficiency or weather-resilience standards. Zurich also made specialized insurance available for electric cars and is developing specialized agricultural coverages focused on improving resilience in the face of climate change and natural resource strain. Zurich is expanding its work on supply chain risk management for policyholders to address sustainability needs considering climate change as part of the process. Zurich covers many renewable energy construction projects around the world. Policyholders are also given access to the Zurich Risk Room, which is a risk visualization engine, providing a breakdown of global risks by country that includes climate change as a risk factor.

Question 7:

Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.

Yes/No response question 7: Y

Written response question 7: Over the past few years, Zurich has engaged in a dialogue with various governments with the aim of educating lawmakers and regulators, highlighting priorities and influencing legal and regulatory developments in a direction that would enable Zurich to effectively contribute to mitigating climate change risks.

In addition, Zurich has engaged in many collaborative activities designed to improve information sharing and engagement on climate change risk adaptation and management, including to UNFCCC, UNEP FI, PRI, Geneva Association, Association of British Insurers and ClimateWise. Numerous webinars, briefings, media events and university / academic activities addressing climate change risk management were also held, participated in and supported.

Zurich launched a flood resilience program in 2013. It focuses on floods because they affect more people globally than any other type of natural hazard and cause some of the largest economic, social and humanitarian losses. It also represents a new approach to cross-sector collaboration, based on an innovative alliance linking flood research, community-based programs and risk expertise. In July 2018 Zurich announced that the flood resilience alliance led by Zurich will be extended for another five years. The alliance members include the NGOs Concern Worldwide, the International Federation of the Red Cross and Red Crescent Societies (IFRC), Mercy Corps, Plan International and Practical Action as well as research partners International Institute for Applied Systems and Analysis (IIASA), the London School of Economics and the Institute for Social and Environmental Transition-International (ISET).

More information is available at the links below:
https://www.zurich.com/en/sustainability/working-with-customers
https://www.zurich.com/en/sustainability/flood-resilience
https://www.zurich.com/en/sustainability/working-with-customers

Question 8:

Describe actions the company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modeling.

Yes/No response question 8: Y

Written response question 8: Zurich maintains a sophisticated mathematical Natural Catastrophe Model to understand the aggregate risk at the Group level. It includes climate-related perils, such as tropical cyclones, extra-tropical cyclones, floods and severe convective storms. The model is not purely relying on a single model vendor (e.g. Risk Management Solutions Inc.) but has the flexibility to use any vendor model's output and implement proprietary adjustments to both the severity and frequency of events to reflect the 'Zurich View' of risk. Zurich aims to understand the assumptions in the models, gain a multi-model view, compare to claims experience and use internal and external insight.

The time scale of the changes projected is typically over a period of several decades. In the catastrophe accumulation processes Zurich is continuously adjusting to actual developments over time in a manner appropriate for the instruments modeled. Catastrophe models typically are updated every five years. Zurich considers the impact of climate change on a five year time horizon to be smaller than the impact of the natural climate variability (e.g. ENSO, AMO) and the general variability of catastrophe events.

Zurich monitors emerging climate research through internal expertise and gains external insight through the Advisory Committee for Catastrophes, which is made up of world-class scientists, including an author from the Intergovernmental Panel on Climate Change.

The requirement for a Zurich View of risk is contained within Zurich's Risk and Underwriting policies and is governed through the Head of Group Underwriting Excellence , the Head of Group Reinsurance and the Cat Technical Expert Group. The work Zurich has done on its view of risk has in some cases led to vendor model change. The model, which has grown from its initial platform developed in 2004, has been re-approved early 2019 by the Swiss regulator, FINMA following a material review during 2018, for use under the Swiss Solvency Test as well as by the Central Bank of Ireland for use under the Solvency II regulation.

Zurich has a dedicated Cat Research & Development team as part of the Group Accumulation Management function. The team is currently being expanded by 3 additional resources of which 2 will focus on climate risk. This is for both increasing the focus on the model validation for current risk as well as for linking climate and cat models to establish potential risk views for future climates.

< Return to Search Results

Example 2: AIG Property Casualty Company's 2019 CRDS Response

Survey Details

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NAIC Number: 19402

Company Name: AIG Property Casualty Company

Line Of Business: Property & Casualty

Group Filing: Y

Group Number: 0012

Group Name: American International Group

Question 1:

Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations? If yes, please summarize.

Yes/No response question 1: Y

Written response question 1: In 2019, AIG issued its first Task Force on Climate-related Financial Disclosures (TCFD) report to provide greater transparency into our sustainability strategy and to align reporting activities with industry standards. The report summarizes how we incorporate climate-related risks and opportunities into our governance, strategy and risk management approaches, as well as the metrics and targets we use to track performance. More information regarding AIG's sustainability efforts and a copy of the TCFD can be obtained at https://www.aig.com/corporate-responsibility.

AIG uses select metrics to assess and manage our climate-related risks and opportunities in line with our strategy and risk management process. AIG has two regional targets set for reducing operational emissions in the UK and New York City.

• AIG is a supporter of the UK Carbon Reduction Commitment in the UK and has committed to reducing the Scope 1 and Scope 2 carbon emissions associated with its UK business operations by 20 percent below the 2010 baseline level by 2020. As of 1/1/2019 , AIG's UK operations have exceeded the target commitment, reducing overall Scope 1 and Scope 2 emissions by 40 percent, 200 percent of the original target.
• As an original participant in the 2013 NYC Carbon Challenge, AIG committed to reduce the carbon emissions associated with its NYC operations by 30 percent from 2011 levels within 10 years, or by 2023. As of the end of 2018 we are on track to meeting that goal, having achieved 77 percent of the total reductions needed. In 2019, AIG renewed its participation and commitment to the NYC Carbon Challenge, committing to further reduce emissions by 40 percent below 2011 levels by 2030.

For both of these regional targets, AIG has reduced emissions through a combination of energy efficient operational controls and investments in energy efficient infrastructure.

AIG is committed to implementing practices that reduce the environmental impact of our business. Efforts include encouraging the company's suppliers to improve the sustainability of products and services, increasing the efficiencies of internal company operations and physical assets under the company's control, and reducing energy usage.

AIG has invested more than $800 million over the past five years to continuously update our worldwide offices, including the use of high efficiency lighting, sustainably manufactured products, and energy-efficient mechanical infrastructure and computer server technologies. AIG currently occupies over 1MM square feet of office space in Leadership in Energy and Environmental Design (LEED) certified green buildings, and recently committed to relocating our global headquarters office in New York City to a LEED certified building for target occupancy at the end of 2020. Globally, AIG has continued to reduce office footprints through consolidation, densification, and work from home strategies, delivering material impacts which will result in future long-term reductions to our overall GHG emissions.

Question 2:

Does the company have a climate change policy with respect to risk management and investment management? If yes, please summarize. If no, how do you account for climate change in your risk management?

Yes/No response question 2: Y

Written response question 2: AIG's Board of Directors and executive leadership team are responsible for addressing the risks and opportunities posed by climate change while providing the robust governance and risk management oversight needed to ensure the company's ongoing financial strength. AIG strives for transparent and clear communication with our stakeholders, and adheres to high ethical standards in our financial and non-financial disclosures.

AIG has a legacy of leadership in sustainability, which we believe is integral to our long-term success as an insurer, investor, employer and corporate citizen. From supporting low carbon renewable energy projects to providing insurance to the underserved and promoting paperless processes, we are engaged in a variety of sustainability efforts across our global footprint.
AIG supports the scientific consensus that climate change is a reality of increasing global concern. In 2006, AIG was one of the first U.S.-based insurers to formally recognize anthropogenic climate change, indicated by higher concentrations of greenhouse gases, a warming atmosphere and ocean, diminished snow and ice, and rising sea levels.
As the effects of climate change accelerate, they have the potential to impact both the frequency and severity of extreme weather conditions. These and other climate-related risks present opportunities and challenges for the insurance sector with implications for insurers' underwriting, risk capacity, financial reserving, investing, risk modeling and own operations.
In response, AIG consistently employs its expertise in underwriting and risk management to help address the impacts of climate change on our clients, our business and on our stakeholders. For example, we continually assess changes in climate and weather patterns as part of our General Insurance underwriting process. Our General Insurance business continues to identify, adapt, and respond to the developing risk exposures attributed to climate change. AIG is committed to providing insurance products and services to help our clients be proactive against the risks associated with climate change.
As part of our commitment, AIG established a Sustainability Task Force (Task Force) with a mandate to develop recommendations for a corporate sustainability strategy. The Task Force consists of a cross-functional group of AIG employees, including AIG's Executive Vice President and Chief Risk Officer (CRO) and Executive Vice President of Government Affairs, Public Policy and Communications, who both serve as executive sponsors.

While AIG does not have a formal climate change policy with respect to investment management, AIG has been a leading investor in renewable energy projects for over 30 years, with $2.9 billion invested in private placement wind, solar, geothermal and hydroelectric projects worldwide in 2018, resulting in significant reductions in carbon emissions. In addition to renewable power, AIG is a leading investor in green energy projects, such as waste-to-energy, transmission and distributed generation. AIG also invests in infrastructure assets that improve energy efficiency, grid connectivity and reliability. We are also investing in innovative transportation networks that improve mobility and use less energy. Many of these investments are characterized as "Green Bonds."
AIG's diverse investment portfolio includes investments in both fossil fuel generation as well as renewable energy. We recognize that by investing in clean energy technology, we diversify our portfolio and further enable those innovations to drop in cost, improve storage capability and expand uptake globally.

Question 3:

Describe your company's process for identifying climate change-related risks and assessing the degree that they could affect your business, including financial implications.

Yes/No response question 3: Y

Written response question 3: AIG considers the potential impact from climate-related issues on our business, strategy and financial planning over different time horizons ranging from short- to longer-term. In the short- to medium-term, we consider the physical risks resulting from climate change—which can be event-driven or result from shifts in climate patterns. We view these risks as manageable in light of AIG's modeling work, our broadly diversified business, and through regular reviews of our risk appetite and reinsurance strategy. A meaningful proportion of our general insurance policies are renewed on an annual basis providing us the opportunity to re-underwrite and re-price the risk regularly. Medium- and long-term impacts are considered in strategy setting and asset liability management decisions in both the General Insurance and Life and Retirement businesses. Fundamental trends and significant changes over longer horizons are more challenging as precise forecasts are difficult to make.

SHORT- TO MEDIUM-TERM RISKS:
By the nature of our business, our company is exposed to various potential catastrophic events in which multiple losses can occur and affect multiple lines of business in any given calendar year. Natural disasters such as hurricanes, earthquakes and other catastrophes have the potential to adversely affect our operating results.

AIG enjoys a unique profile as a composite insurer (that is, life and non-life businesses) operating in over 80 different countries and jurisdictions. Such a broad diversity in business lines helps us to limit the relative economic impact of any single insured event.

AIG's Risk Appetite Framework establishes and maintains appropriate limits on the material risks identified for our core businesses. Following an extensive review, we have substantially reduced our gross and net limits, particularly in Property and Casualty insurance, which has subsequently lowered our risk of exposure to natural disasters.

Our notable progress on risk management and underwriting in the last year was also critical to a revised reinsurance strategy. In 2018, we reconfigured our reinsurance policies to reduce the net risk in our portfolio, which provided meaningful recoveries in the second half of the year. We will continue to adjust our use of reinsurance to balance our portfolio, manage volatility and protect against extreme events.

The impacts of climate change vary region by region and by type of hazard. While climate change is affecting loss patterns through shifts in hazard frequency and severity, socio-economic factors also contribute to changing loss patterns. Shifting demographics has led to increasing concentrations of catastrophe risk, such as through rapid growth in coastal development and suburban growth next to forests (in what is also known as the "wildland-urban interface").

LONG-TERM RISKS
Transitioning to a low-carbon economy often entails extensive policy, legal, technology, and market changes to address mitigation and adaptation requirements related to climate change. AIG is identifying these longer-term transition risks through our ongoing emerging risk assessment program.
In particular, AIG has established an Emerging Risk Forum which conducts horizon scanning to identify longer-term emerging risks and opportunities—including climate change—to our business to catalyze risk management action and/or new product development The forum is comprised of AIG subject matter experts from across many global geographies and functions and conducts horizon scanning intended to facilitate cross-functional dialogue, improve information flow across the company, catalyze risk management action and spark product innovation. Within its mandate, the Forum considers a range of risks to AIG associated with climate change, including climate-related insurance liabilities, transition risks and investments.

Question 4:

Summarize the current or anticipated risks that climate change poses to your company. Explain the ways that these risks could affect your business. Include identification of the geographical areas affected by these risks.

Yes/No response question 4: Y

Written response question 4: Policy and Regulatory risk
AIG constantly monitors and assesses the potential future impacts that regulatory developments may have on the company.
As a global financial services provider with a relatively small environmental footprint we expect to be able to comply with future potential regulatory changes, such as heightened energy efficiency standards or greenhouse gas emissions limits/taxes, with minimal financial impact. For example, in the United Kingdom, AIG complies with the Carbon Reduction Commitment (CRC). For the year 2017, the CRC related carbon tax for AIG UK office facilities was £42,126 (2,380 tons emitted at a charge of £17.70 per ton) or approximately $53,790. This represents a small fraction of AIG's operating expenses globally.
Beyond the potential impact to our physical operations, insurance regulatory bodies continue to show interest in how the financial services industry including insurance companies are managing climate risk within both their business operations and investment portfolios. For example, UK regulators have introduced climate risk scenarios as part of periodic stress testing of financial services firms. AIG will continue to monitor the potential impact of climate change-related regulatory risks to our businesses or investment management practices.
Litigation and Legal risk
In recent years the industry has seen an overall increase in various climate-related litigation claims brought forward for a multitude of reasons including as a result of a perceived contribution to climate change, or for insufficient disclosure around material financial risks. As the value of loss and damage arising from climate change grows, it is plausible that litigation risk of this kind may increase. For example, Directors and Officers (D&O) may be found personally liable for breaching duty of care and/or due diligence requirements, where they may exist, if they fail to properly consider and disclose foreseeable climate-related risks, which could result in increased D&O claims.
We track ongoing litigation in the United States that seeks to compel companies to remedy their perceived contribution to climate change (i.e., mitigation costs, third party property damage, etc.). Litigation seeking to compel companies to remedy their perceived contribution to climate change may, if successful, also lead to an increase in claims. Based on our monitoring, while the overall volume of litigation activity has increased, past litigation seems to have largely been unsuccessful on numerous grounds including difficulties in determining and attributing fault and liability to a particular company, and the judiciary's deference to the political branches of government on questions relating to climate change. AIG will continue monitoring litigation trends to assess the potential impact of any developments on its businesses and overall risk mitigation strategies.
Technology risk
Technological advancements that support the transition to a lower-carbon, energy-efficient economic system may have a significant impact on a wide range of companies and other organizations. This may affect the nature and financial impact of the risks our customers seek to insure. This economic transition may also materially affect the demand for insurance in specific sectors—most obviously in energy and transport. Although this may not necessarily reduce the overall demand for insurance products and services, it may alter the patterns of demand and the nature of insurance cover required, to which AIG will need to respond to remain competitive.
Reputation risk
Climate change has been identified as a potential source of indirect reputational risk to AIG's corporate brand due to the prospect of changing customer or community perceptions of an organization's contribution to or detraction from the transition to a lower-carbon economy. To date, this has had minimal reputational impact upon AIG or the industry.

Investment/Credit risks
AIG's investment strategies are tailored to specific business needs with the primary objectives of investment income, preservation of capital, liquidity management and growth of surplus. AIG is a diversified company that takes on both short- and long-term liabilities from policyholders. To the fullest extent practicable, AIG seeks to duration-match its assets to its liabilities. As such, for our long-term liabilities that can stretch 30, 40, or even 50 years into the future, we necessarily seek out long-term investments. This involves taking a long-term view including the return profile and sustainability of the investment(s).
Broad asset classes in the portfolio include fixed income securities, real estate, and alternative investments. Some of these investments are either secured by, or heavily dependent on physical assets. Although our credit process considers protections that are in place such as property and business interruption insurance, increased risk from climate change may affect the value of these assets in the future. Given the long-dated nature of our liabilities, our credit research process assesses the long-term sustainability of our borrowers and the assets that secure them.
Over the longer-term, as efforts to move away from a carbon-intensive economy gather pace, we recognize the possibility that, financial market participants may fundamentally reassess the value of carbon-intensive assets and the businesses that rely on them. Shifts in consumer behavior may affect the long-term viability of these businesses and their ability to repay debt. This re-valuation may lead to impairments to the value of these assets. We consider long-term trends as part of our initial credit review process and regularly reassess credit worthiness.

Operational Risk
At a physical asset level, AIG assesses the risks and opportunities associated with the physical impacts of climate change, including individual facilities and office locations. AIG has business continuity plans to respond to incidents that may disrupt business operations, including extreme weather events. AIG
continuously reviews its existing business continuity and disaster recovery practices. Significant events such as Superstorm Sandy and Hurricane Harvey, for example, have provided us with opportunities
to enhance and improve our operational resiliency.

AIG seeks to mitigate financial loss arising from catastrophic events through the purchase of insurance from non-affiliated companies and to require that AIG's service providers and business partners also maintain appropriate insurance coverage. AIG, like many companies with operations in high hazard CAT areas, has experienced property losses but has been able to recoup those losses under its own property insurance policies. To determine the sufficiency of CAT limits, we evaluate AIG's aggregate replacement cost values in high hazard flood, wind and earthquake areas, as well as rely on modeling for probable maximum loss/average annual loss expectancies. AIG continues to evaluate past property losses annually. When we renew our policies, we evaluate, with modeling, the need for higher CAT limits in high hazard areas where AIG has owned/leased high-valued property.

Natural Catastrophe Risk
By the nature of our business, our company is exposed to various potential catastrophic events in which multiple losses can occur and affect multiple lines of business in any given calendar year. Natural disasters such as hurricanes, earthquakes and other catastrophes have the potential to adversely affect our operating results. [See our response to Question Three regarding our process for identifying natural catastrophe risk and how that risk could affect our business, including financial implications.]

Other Risks
AIG will continue to monitor the potential impact of climate change-related regulatory risks to our businesses or investment management practices.

Question 5:

Has the company considered the impact of climate change on its investment portfolio? Has it altered its investment strategy in response to these considerations? If so, please summarize steps you have taken.

Yes/No response question 5A: Y

Yes/No response question 5B: Y

Written response question 5: AIG has been a leading investor in renewable energy projects for over 30 years, with $2.9 billion invested in private placement wind, solar, geothermal and hydroelectric projects worldwide in 2018, resulting in significant reductions in carbon emissions. In addition to renewable power, AIG is a leading investor in green energy projects, such as waste-to-energy, transmission and distributed generation. AIG also invests in infrastructure assets that improve energy efficiency, grid connectivity and reliability. We are also investing in innovative transportation networks that improve mobility and use less energy. Many of these investments are characterized as "Green Bonds." AIG's diverse investment portfolio includes investments in both fossil fuel generation as well as renewable energy. We recognize that by investing in clean energy technology, we diversify our portfolio and further enable those innovations to drop in cost, improve storage capability and expand uptake globally.
AIG recognizes the investment communities growing interest in Environmental, Social and Governance (ESG) products. In 2009, SAAMCo, an AIG asset management company, began offering ESG investment products (VALIC Socially Responsible and VALIC Global Social Awareness). In 2016, AIG launched our first ESG product into the retail mutual fund market (AIG ESG Dividend Fund). AIG continually works to augment its strategic management of climate risk and opportunities. AIG's Executive Leadership Team has committed in 2019 to explore the development of a climate change scenario analysis, which is a formal analysis of the impact that a +2° Celsius scenario would have across the company's underwriting, investments and operations.

Question 6:

Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.

Yes/No response question 6: Y

Written response question 6:

Providing Risk Solutions and Expertise to Clients AIG delivers technical expertise and tailored, solutions-based approaches to assist clients in proactively identifying their exposures, including those stemming from climate change risk, with the aim of managing them to lower their cost of risk and build stronger business resiliency. To this end, we are able to deploy our catastrophe models, consultants and engineers to partner with clients to assess risks and build business resiliency to natural perils (e.g., flooding).
New Products and Services
AIG regularly consults with our clients to understand the unique and emerging risks they face and to consider the development of responsive products and services that meet their needs. As AIG collects relevant data and available metrics on unaddressed risks, we can use that data to guide new product development and underwriting approaches. As the impacts of climate risk are more deeply felt—especially those that currently lack an insurance solution framework—we may explore the development of new products and services to address the needs of current and potential clients.
AIG recognizes that without insurance, the appetite for taking risks in a new or unproven field of opportunity would be dramatically reduced. Our role as an insurer of renewable energy and lower-carbon industries helps support the overall market transition to a lower-carbon economy. AIG is a recognized market leader in the insurance of offshore wind farms, as well as a sizeable number of solar (photovoltaic/concentrated solar power) plants and other renewable energy operations.
For example, Lexington Insurance Company, part of our General Insurance business, offers innovative products and services to assist U.S. clients in becoming more resilient against the effects of climate change. These include: (i) Private market flood insurance that covers flood damage and allows policyholders to rebuild; and (ii) Upgrade to Green, a product offering that provides upgrade benefits that allow for green building upgrades to be included in the recovery from partial and total losses to homes and commercial buildings, and during the construction phases of building. Additionally, professional liability coverages are available for registries that track, confirm, and verify carbon offset credits as well as for claims which may arise from greenhouse gas consulting services or emission reduction verification services. Finally, we offer coverages addressing environmental crisis management and emergency response efforts to our railroad and general construction liability clients to assist with emergency environmental incidents and clean-up efforts associated with a pollution event.

Question 7:

Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.

Yes/No response question 7: Y

Written response question 7:

Due to the scale and complexity of the challenge associated with climate change, AIG is increasingly seeking to partner with private sector peers, academic institutions, NGOs, international organizations and other groups to leverage our expertise in risk management with other key skills sets.
For example, through a partnership with Wood Plc and Enactus, AIG is involved in the Rockefeller Foundation's 100 Resilient Cities (100 RC) program, which assists cities in identifying and managing the risks associated with climate change as well as design and construction solutions to reduce or mitigate these risks. Through a partnership with the Insurance Development Forum (IDF)—a public-private sector partnership bringing together the World Bank, the United Nations and the insurance sector—AIG is contributing to the goal of developing solutions in order to tackle low insurance penetration rates across jurisdictions through commercially viable means. The IDF is also acting as a platform, bringing together a range of stakeholders, such that the insurance industry can address the issue of climate change in a more coordinated and focused manner..
AIG provides a range of products and services across all lines of insurance, helping clients respond to the "greening" of the economy, expanding natural disaster resilience, reducing greenhouse gas emissions and being proactive against the threat of climate change. AIG has taken steps to provide insurance products and solutions that help reduce potential losses that may be caused by climate-change influenced events. Additionally, the company offers Wildfire Protection, Hurricane Protection, and Earthquake Protection products to help clients by maximizing readiness and preparation before a natural disaster occurs.

As an annual respondent to the CDP (formerly the Carbon Disclosure Project), AIG is among a key group that voluntarily measures, discloses, manages, and shares information about its impact on the environment and its mitigation efforts. AIG is also a member of CDP Reporter Services, which provides data, support and insights designed to reduce emissions and improve business performance. As a member, AIG can benchmark its performance against its peers and identify material risks and opportunities using CDP's vast supply of primary climate-change data.

In 2019, AIG issued its first Task Force on Climate-related Financial Disclosures (TCFD) report to provide greater transparency into our sustainability strategy and to align reporting activities with industry standards. The report summarizes how we incorporate climate-related risks and opportunities into our governance, strategy and risk management approaches, as well as the metrics and targets we use to track performance.

More information regarding AIG's TCFD and other sustainability efforts can be obtained at https://www.aig.com/corporate-responsibility .

Question 8:

Describe actions the company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modeling.

Yes/No response question 8: Y

Written response question 8:

AIG has an integrated process for managing risks throughout our organization in accordance with our robust risk management framework. Climate-related risks are included in AIG's risk management framework and integrated into our identification processes, scenario modeling and emerging risk assessment.
Risk Appetite Framework
Our Risk Appetite Framework integrates stakeholder interests, strategic business goals and available financial resources. We balance these by seeking to take measured risks that are expected to generate repeatable, sustainable earnings and create long-term value for our shareholders. The framework reflects our risk appetite statement approved by the Board of Directors or a committee thereof. It also encompasses a set of supporting tools, including risk tolerances, risk limits and policies, which we use to manage our risk profile and allocation of financial resources.
Risk Limits
A key component of our Risk Appetite Framework is having a process in place that establishes and maintains appropriate limits for the material risks related to our core businesses. The potential impact of climate-related risks on these material risks are considered within the framework. Further details on our approach to risk limits can be found on pages 145-146 of the AIG 2018 10-K.
Risk Identification
Risk identification serves as a key tool used to inform the Risk Appetite Framework. We conduct risk identification through a number of processes at the business unit and corporate level focused on capturing our material risks and key areas of focus for follow-up risk management actions. A key initiative is our integrated bottom-up risk identification and assessment process down to the product-line level. These processes are used as a critical input to enhance and develop our analytics for measuring and assessing risks across the organization.
Risk modeling and other risk management tools
AIG employs recognized third-party catastrophe risk models to evaluate and simulate the frequency and severity of catastrophe events and associated losses to our portfolio of exposures. These models are sophisticated, employing physically based modeling with parameters and assumptions derived from historical hazard and claims data. The models are updated as new science and data become available in order to ensure they are continually improved and validated.
We make adjustments to modeled losses to account for loss adjustment expenses, model biases, data quality and non-modeled risks. Our modeling work contributes to prudent underwriting and pricing of traditional climate risks related to natural catastrophes, as well as the use of hedging/protective measures such as issuing catastrophe bonds and purchasing reinsurance.
When catastrophic events happen, AIG uses them as an opportunity to detect and remedy any weaknesses in how we model, select and price risk. Since most of our policies exposed to catastrophic risks are one-year contracts, we can adjust our underwriting guidelines, pricing and exposure accumulation in a relatively short period. Lessons learned from post-catastrophe event studies are incorporated into modeling and underwriting processes of risk pricing and selection.
AIG also utilizes scenario or deterministic analysis to measure and monitor risks that may be exposed to climate change, for example pandemic risk or market and credit risks within our investment portfolios.
Emerging Risk Assessment
AIG has an Emerging Risk Forum to monitor, assess and analyze climate-related risks, among other key emerging risks facing the company. The forum is comprised of AIG subject matter experts from across many global geographies and functions and conducts horizon scanning intended to facilitate cross-functional dialogue, improve information flow across the company, catalyze risk management action and spark product innovation. Within its mandate, the Forum considers a range of risks to AIG associated with climate change, including climate-related insurance liabilities, transition risks and investments.

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Cautionary Statement Regarding Projections and Other Information about Future Events.
This survey response may include, and officers and representatives of American International Group, Inc. (AIG) may from time to time make and discuss, projections, goals, assumptions and statements that may constitute "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995. These projections, goals, assumptions and statements are not
historical facts but instead represent only a belief regarding future events, many of which, by their nature, are inherently uncertain and outside AIG's control. These projections, goals, assumptions and statements include statements preceded by, followed by or including words such as "will," "believe," "anticipate," "expect," "intend," "plan," "focused on achieving," "view," "target," "goal" or "estimate." These projections, goals, assumptions and statements may relate to future actions, prospective services or products, future performance or results of current and anticipated services or products, sales efforts, expenses, the outcome of contingencies such as legal proceedings, anticipated organizational, business or regulatory changes, anticipated sales, monetization and/or acquisitions of businesses or assets, or successful integration of acquired businesses, management succession and retention plans, exposure to risk, trends in
operations and financial results.

It is possible that AIG's actual results and financial condition will differ, possibly materially, from the results and financial condition indicated in these projections, goals, assumptions and statements. Factors that could cause AIG's actual results to differ, possibly materially, from those in the specific projections, goals, assumptions and statements include: changes in market and industry conditions; the occurrence of catastrophic events, both natural and man-made; AIG's ability to successfully reorganize its businesses and execute on its initiatives to improve its underwriting
capabilities and reinsurance programs, as well as improve profitability, without negatively impacting client relationships or its competitive position; AIG's ability to successfully dispose of, monetize and/or acquire businesses or assets or successfully integrate acquired businesses; actions by credit rating agencies; changes in judgments concerning insurance underwriting and insurance liabilities; changes in judgments concerning potential cost saving opportunities; the impact of potential information technology, cybersecurity or data security breaches, including as a result of cyber-attacks or security vulnerabilities; disruptions in the availability of AIG's electronic data systems or those of third parties; the effectiveness of AIG's strategies to recruit and retain key personnel and its ability to implement effective succession plans; negative impacts on customers, business partners and other stakeholders; AIG's ability to successfully manage Legacy portfolios; concentrations in AIG's investment portfolios; the requirements, which may change from time to time, of the global regulatory framework to which AIG is subject; significant legal, regulatory or governmental proceedings; changes in judgments concerning the recognition of deferred tax assets and goodwill impairment; and such other factors discussed in Part I, Item 2. Management's Discussion and Analysis of Financial Condition and Results of Operations (MD&A) in AIG's Quarterly Report on Form 10-Q for the quarterly period ended June 30, 2019, Part I, Item 2. MD&A in AIG's Quarterly Report on Form 10-Q for the quarterly period ended March 31, 2019, and Part II, Item 7. MD&A and Part I, Item 1A. Risk Factors in AIG's Annual Report on Form 10-K for the year ended December 31, 2018. AIG is not under any obligation (and expressly disclaims any obligation) to update or alter any projections, goals, assumptions or other statements, whether written or oral, that may be made from time to time, whether as a result of new information, future events or otherwise.

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Appendix C: The CRDS Adoption Pattern

Disclosing Year	Participating States	Nationwide Direct Written Premium Requirement	No. of Responses from P&C Insurers
2010	California	Group premium > $500M	13
2011	California	Group premium > $300M	22
2012	California, New York, and Washington	Insurer premium > $300M	428
2013	California, Connecticut, Minnesota, New York, and Washington	Insurer premium > $100M	685
2014	California, Connecticut, Illinois, Maryland, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	743
2015	California, Connecticut, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	760
2016	California, Connecticut, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	759
2017	California, Connecticut, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	740
2018	California, Connecticut, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	738
2019	California, Connecticut, Minnesota, New Mexico, New York, and Washington	Insurer premium > $100M	736

TABLE 1 Sample Distribution

This table reports the sample distribution. Panels A and B respectively report the sample distribution by year and by industry (based on the GIC 6-digit industry classification).

Panel A: Sample distribution by year

		Control		Treatment		Full sample	
	Year	Freq.	Pct. (%)	Freq.	Pct. (%)	Freq.	Pct. (%)
Pre-adoption window	2008	207	12.13	217	12.29	424	12.21
	2009	210	12.30	221	12.52	431	12.41
	2010	215	12.60	223	12.63	438	12.62
	2011	221	12.95	224	12.69	445	12.82
Post-adoption window	2016	215	12.60	222	12.58	437	12.59
	2017	215	12.60	222	12.58	437	12.59
	2018	213	12.48	218	12.35	431	12.41
	2019	211	12.36	218	12.35	429	12.36
	Total	1,707	100.00	1,765	100.00	3,472	100.00

Panel B: Sample distribution by industry

GIC 6	Industry Description	Control		Treatment		Full sample	
		Freq.	Pct. (%)	Freq.	Pct. (%)	Freq.	Pct. (%)
101010	Energy Equipment & Services	51	3.01	40	2.28	91	2.64
101020	Oil, Gas & Consumable Fuels	206	11.93	122	6.83	328	9.34
151010	Chemicals	64	3.78	95	5.41	159	4.61
151020	Construction Materials	16	0.95	8	0.46	24	0.70
151030	Containers & Packaging	48	2.84	32	1.82	80	2.32
151040	Metals & Mining	84	4.96	72	4.10	156	4.52
201010	Aerospace & Defense	16	0.89	56	3.19	72	2.06
201020	Building Products	8	0.47	40	2.28	48	1.39
201030	Construction & Engineering	0	0.00	16	0.85	16	0.43
201040	Electrical Equipment	0	0.00	24	1.37	24	0.70
201050	Industrial Conglomerates	8	0.47	16	0.91	24	0.70
201060	Machinery	64	3.78	111	6.26	175	5.04
201070	Trading Companies & Distributors	16	0.95	8	0.46	24	0.70
202010	Commercial Services & Supplies	16	0.95	36	2.05	52	1.51
202020	Professional Services	38	2.24	21	1.08	59	1.65
203010	Air Freight & Logistics	8	0.47	8	0.46	16	0.46
203020	Airlines	13	0.71	8	0.46	21	0.58
203040	Road & Rail	24	1.42	48	2.73	72	2.09
251010	Auto Components	32	1.89	0	0.00	32	0.93
251020	Automobiles	8	0.47	16	0.91	24	0.70
252010	Household Durables	31	1.83	48	2.73	79	2.29
252020	Leisure Products	5	0.30	16	0.91	21	0.61
252030	Textiles, Apparel & Luxury Goods	8	0.41	30	1.71	38	1.07
253010	Hotels, Restaurants & Leisure	109	6.32	40	2.28	149	4.26
253020	Diversified Consumer Services	16	0.95	16	0.91	32	0.93
255020	Internet & Direct Marketing Retail	0	0.00	8	0.46	8	0.23
255030	Multiline Retail	28	1.65	16	0.91	44	1.28
255040	Specialty Retail	48	2.84	32	1.82	80	2.32
301010	Food & Staples Retailing	16	0.95	32	1.82	48	1.39
302010	Beverages	36	2.07	65	3.64	101	2.87
302020	Food Products	32	1.89	64	3.64	96	2.78
302030	Tobacco	8	0.47	0	0.00	8	0.23
303010	Household Products	0	0.00	40	2.28	40	1.16
303020	Personal Products	0	0.00	16	0.91	16	0.46
351010	Health Care Equipment & Supplies	40	2.36	48	2.73	88	2.55
351020	Health Care Providers & Services	106	6.26	32	1.82	138	4.00
352010	Biotechnology	49	2.84	8	0.46	57	1.62
352020	Pharmaceuticals	32	1.89	48	2.73	80	2.32
352030	Life Sciences Tools & Services	8	0.47	32	1.82	40	1.16
451020	IT Services	47	2.72	16	0.91	63	1.80
451030	Software	32	1.89	16	0.91	48	1.39
452010	Communications Equipment	24	1.42	16	0.91	40	1.16
452020	Technology Hardware, Storage & Peripherals	32	1.89	8	0.46	40	1.16
452030	Electronic Equipment, Instruments & Components	15	0.89	40	2.28	55	1.59
453010	Semiconductors & Semiconductor	64	3.78	16	0.91	80	2.32

	Equipment						
501010	Diversified Telecommunication Services	64	3.78	8	0.46	72	2.09
501020	Wireless Telecommunication Services	12	0.65	24	1.37	36	1.01
502010	Media	53	3.07	8	0.46	61	1.74
502020	Entertainment	0	0.00	16	0.91	16	0.46
502030	Interactive Media & Services	8	0.47	0	0.00	8	0.23
551010	Electric Utilities	40	2.36	110	6.21	150	4.32
551020	Gas Utilities	0	0.00	24	1.37	24	0.70
551030	Multi-Utilities	16	0.95	72	4.10	88	2.55
551040	Water Utilities	0	0.00	15	0.80	15	0.41
551050	Independent Power and Renewable Electricity Producers	8	0.47	8	0.46	16	0.46
Total		1,707	100.00	1,765	100.00	3,472	100.00

TABLE 2 Summary Statistics

This table reports the descriptive statistics for all the variables in our baseline regression (see Equation (1)). All variables are defined in Appendix A. The number of observations is 3,472.

Variable	Mean	SD	Skewness	P25	P50	P75
Dependent variable						
Carbon Intensity	3.861	2.104	0.538	2.326	3.272	5.505
Independent variables of interest						
Treat	0.508	0.500	-0.033	0.000	1.000	1.000
Post	0.499	0.500	0.002	0.000	0.000	1.000
Control variables						
Size	9.484	1.254	0.196	8.56	9.391	10.363
MB	2.997	7.306	-1.195	1.462	2.355	3.960
ROA	0.047	0.077	-1.646	0.022	0.05	0.084
Leverage	0.321	0.163	0.728	0.210	0.303	0.411
Capex	0.055	0.050	2.383	0.022	0.040	0.071
PPE	8.049	1.677	-0.111	6.862	8.045	9.317
SalesGr	0.058	0.189	0.936	-0.025	0.045	0.122
EPSGr	-0.003	0.160	-1.211	-0.017	0.005	0.024
HHI	0.447	0.344	0.783	0.172	0.333	0.993
InstOwn	0.647	0.324	-1.154	0.587	0.759	0.869
CashHold	0.098	0.109	2.061	0.025	0.063	0.130
Dividend	0.792	0.406	-1.441	1.000	1.000	1.000
R&D Exp	0.025	0.054	2.980	0.000	0.000	0.020
AdvExp	0.012	0.026	2.874	0.000	0.000	0.012

TABLE 3 Transmission Effect of Insurers' Mandatory Climate Risk Disclosures on Their Corporate Bond Investees' Carbon Emissions Intensity

This table reports the regression results for the effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity. Columns (1) and (2) use the sample period with a four-year pre-CRDS adoption window (2008-2011) and a four-year post-CRDS adoption window (2016-2019). Columns (3) and (4) use the sample period with five-year pre- and post-CRDS adoption windows (2007-2011 and 2016-2020). Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. *t*-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*			
	2008-2011 versus 2016-2019		2007-2011 versus 2016-2020	
	(1)	(2)	(3)	(4)
Treat × Post	-0.163**		-0.170**	
	(-2.03)		(-2.11)	
Treat × T2008				-0.008
				(-0.24)
Treat × T2009		0.004		-0.003
		(0.08)		(-0.06)
Treat × T2010		-0.065		-0.074
		(-1.12)		(-1.23)
Treat × T2011		-0.087		-0.096
		(-1.42)		(-1.49)
Treat × T2016		-0.184**		-0.188**
		(-2.03)		(-2.08)
Treat × T2017		-0.161*		-0.162*
		(-1.72)		(-1.75)
Treat × T2018		-0.226**		-0.230**
		(-2.30)		(-2.36)
Treat × T2019		-0.237**		-0.241**
		(-2.31)		(-2.37)
Treat × T2020				-0.219**
				(-2.07)
Size	-0.140	-0.136	-0.158*	-0.155*
	(-1.63)	(-1.59)	(-1.96)	(-1.91)
MB	0.001	0.001	0.001	0.001
	(0.47)	(0.48)	(0.59)	(0.60)
ROA	-0.583**	-0.598**	-0.677**	-0.686**
	(-2.25)	(-2.31)	(-2.56)	(-2.58)
Leverage	-0.033	-0.034	-0.035	-0.036
	(-0.20)	(-0.20)	(-0.22)	(-0.23)
Capex	-0.315	-0.266	-0.235	-0.188
	(-0.65)	(-0.54)	(-0.49)	(-0.39)
PPE	0.091	0.089	0.129	0.127
	(1.08)	(1.05)	(1.64)	(1.60)
SalesGr	0.040	0.040	-0.019	-0.018
	(0.57)	(0.57)	(-0.27)	(-0.25)
EPSGr	-0.019	-0.024	-0.021	-0.024
	(-0.29)	(-0.36)	(-0.35)	(-0.41)
HHI	-0.159	-0.159	-0.162*	-0.162*
	(-1.59)	(-1.57)	(-1.88)	(-1.85)
InstOwn	0.218	0.216	0.201	0.198

	(1.62)	(1.61)	(1.53)	(1.51)
CashHold	0.389	0.383	0.408*	0.406*
	(1.48)	(1.46)	(1.74)	(1.72)
Dividend	-0.015	-0.014	-0.033	-0.032
	(-0.24)	(-0.23)	(-0.55)	(-0.53)
R&D Exp	-0.444	-0.447	-0.206	-0.202
	(-0.34)	(-0.35)	(-0.17)	(-0.17)
AdvExp	0.112	0.157	0.689	0.701
	(0.07)	(0.10)	(0.43)	(0.44)
Investee FEs	Yes	Yes	Yes	Yes
Industry-year FEs	Yes	Yes	Yes	Yes
Observations	3,472	3,472	4,381	4,381
Adjusted R-square	0.952	0.952	0.947	0.947

TABLE 4 The Extent to which Affected Insurer Investors and/or Investees Experience Strong Public Pressure about Climate Risk Issues

This table reports the results of the regressions that investigate how the extent to which the insurers and/or investees experience climate-risk-related public pressure factors into the impact of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity. We employ three approaches. Columns (1) and (2) report the results of a measure of strong public pressure based on investees' exposure to affected insurer investors that are headquartered in a state where a strong public attitude about climate risk prevails. Columns (3) and (4) report the results of a measure of strong public pressure based on whether investors' headquarters are located in a state with a strong public attitude about climate risk. Columns (5) and (6) report the results of a measure of strong public pressure; the measure is based on investees' exposure to affected insurer investors when the investees are headquartered in a state with a strong public attitude about climate risk and the investors' headquarters are also located in a state with a similar attitude about climate risk. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. *t*-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*					
	Strong pressure based on investees' exposure to affected insurer investors that are headquartered in a state with a strong public attitude about climate risk		Strong pressure based on whether investees' headquarters are in a state with a strong public attitude about climate risk		Strong pressure based on investees' exposure to affected insurer investors that are headquartered in a state with a strong public attitude about climate risk when the investees' headquarters are also in a state with a similar attitude	
	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Treat × *Post*	-0.135	-0.251*	-0.174	-0.245*	-0.120	-0.459*
	(-1.05)	(-1.82)	(-1.16)	(-1.67)	(-1.32)	(-1.98)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Investee FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,453	1,505	1,560	1,207	2,872	346
Adjusted R-square	0.954	0.954	0.951	0.935	0.954	0.958
Diff. (p-value)	0.031		0.084		0.000	

TABLE 5 Extent to which Affected Insurer Investors are Likely to Monitor Investees

This table reports the results of the regressions that investigate how the effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity is affected by the extent to which affected insurer investors are likely to monitor investees. We employ three approaches. Columns (1) and (2) report the results of a measure of monitoring based on the geographic proximity between investees and their affected insurer investors. Columns (3) and (4) report the results of a monitoring measure of investees' exposure to environmentally friendly affected insurer investors. Columns (5) and (6) report the results of a measure based on investees' exposure to affected insurer investors with a publicly listed parent. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. t-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*					
	Geographic distance between investees and their affected insurer investors		Exposure to environmentally friendly affected insurer investors		Exposure to affected insurer investors with a publicly listed parent	
	Far	Close	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
Treat × *Post*	-0.136	-0.324**	-0.108	-0.296**	-0.016	-0.272*
	(-0.85)	(-2.35)	(-0.80)	(-2.17)	(-0.14)	(-1.93)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Investee FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,294	1,286	1,477	1,472	1,494	1,493
Adjusted R-square	0.930	0.967	0.959	0.947	0.966	0.937
Diff. (p-value)	0.025		0.003		0.000	

TABLE 6 Extent of Investees' Financing Dependence on Affected Insurer Investors

This table reports the results of the regressions that investigate how the effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity is affected by the extent to which the investees are dependent on affected insurer investors for financing. We employ three approaches. Columns (1) and (2) report the results using Hoberg and Maksimovic's (2015) measure of debt dependence; this measure is based on investees' likelihood of issuing debt to deal with the risk of investment delay. Columns (3) and (4) report the results based on investees' existing dependence on bond financing. Columns (5) and (6) report the results based on the percentage of affected insurer investors in the investee's headquarters state. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. t-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*					
	Debt dependence		Existing dependence on bond financing		Percentage of affected insurer investors in the investee's headquarters state	
	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)
Treat × *Post*	-0.022	-0.355**	-0.009	-0.288***	-0.060	-0.293**
	(-0.16)	(-2.22)	(-0.07)	(-2.63)	(-0.37)	(-2.43)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Investee FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,130	1,151	1,629	1,615	1,184	1,540
Adjusted R-square	0.955	0.925	0.965	0.921	0.938	0.951
Diff. (p-value)	0.001		0.000		0.006	

TABLE 7 Extent of Investees' Exposure to Affected Insurer Investors with Intense Underwriting Business Competition

This table reports the results of the regressions that investigate how the extent of investees' exposure to affected insurer investors that have intense underwriting business competition factors into the effect of insurers' mandatory climate risk disclosures on their corporate bond investees' carbon emissions intensity. We employ two approaches. Columns (1) and (2) report the results using a weighted measure of competition based on the number of insurers in the affected insurer investors' states. Columns (3) and (4) report the results using a weighted measure of competition based on the Herfindahl-Hirschman index in the affected insurer investors' states. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. t-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*			
	Exposure to affected insurer investors with intense underwriting business competition; competition is measured by the number of insurers		Exposure to affected insurer investors with intense underwriting competition; competition is measured using the Herfindahl-Hirschman index	
	Low	High	Low	High
	(1)	(2)	(3)	(4)
Treat × Post	-0.341***	-0.085	-0.280**	-0.147
	(-3.36)	(-0.55)	(-2.46)	(-0.98)
Controls	Yes	Yes	Yes	Yes
Investee FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
Observations	1,497	1,466	1,483	1,440
Adjusted R-square	0.959	0.952	0.957	0.949
Diff. (p-value)	0.000		0.051	

TABLE 8 Alternative Research Designs

This table reports the results of various robustness checks of our primary finding of a positive insurer-to-investee transmission effect on investees' environmental performance. Column (1) reports the result when the treatment and control investees are classified by the affected insurers' bond holdings in 2015, while column (2) reports the result after classifying the treatment and control investees by affected insurers' bond holdings in 2011 and 2015. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. *t*-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Intensity*	
	Use of affected insurers' bond holdings in 2015	Use of affected insurers' bond holdings in 2011 and 2015
	(1)	(2)
Treat × *Post*	-0.143*	-0.244**
	(-1.92)	(-2.18)
Controls	Yes	Yes
Investee FE	Yes	Yes
Industry-year FE	Yes	Yes
Observations	3,895	2,489
Adjusted R-square	0.954	0.953

TABLE 9 Other Outcomes Related to Investees' Carbon Emissions

This table reports the results of the effect of insurers' mandatory climate risk disclosures on other outcomes related to their corporate bond investees' carbon emissions. Column (1) reports the results of the analysis of the environmental cost of carbon emissions. Columns (2) and (3) respectively report the results of the analyses of the Scope 2 and 3 carbon emissions intensities. Robust standard errors are clustered at the investee level. *, **, and *** denote statistical significance based on two-sided tests at the 10%, 5%, and 1% levels, respectively. *t*-statistics are in parentheses. All variables are defined in Appendix A.

Variable	*Carbon Cost*	*Carbon Intensity S2*	*Carbon Intensity S3*
	(1)	(2)	(3)
Treat × *Post*	-0.169**	-0.073	-0.012
	(-2.13)	(-0.91)	(-0.42)
Controls	Yes	Yes	Yes
Investee FE	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes
Observations	3,472	3,472	3,472
Adjusted R-square	0.956	0.797	0.968