Does Mandatory Climate Risk Disclosure Influence Environmentally Responsible Investing? Evidence from Insurers' Divestment from Fossil Fuel Firms

Jiang Cheng
Faculty of Business, Lingnan University
jiangcheng@ln.edu.hk

Jia Guo
School of Accounting and Finance, The Hong Kong Polytechnic University
gina-jia.guo@polyu.edu.hk

Jeffrey Ng
Faculty of Business and Economics, The University of Hong Kong
jeffngty@hku.hk

Tjomme Rusticus
Independent
tjommerusticushk@gmail.com

Abstract

The Climate Risk Disclosure Survey (CRDS) requires certain U.S. insurers to disclose how their investment strategies consider climate change. Using staggered, state-level CRDS adoption, we show that after CRDS adoption, insurers affected by the survey divest from fossil fuel firms. This divestment is more substantial when insurers' CRDS responses indicate that they actively consider climate change in their investment decisions, when stakeholders pay more attention to climate issues, or when peer insurers are more environmentally responsible in their investments. Finally, we demonstrate that CRDS-affected insurers experience lower investment returns, especially among those that reduce their investments in fossil fuel firms.

Keywords: mandatory climate risk disclosure; environmentally responsible investing; divestment from fossil fuel firms; insurance industry; stakeholder attention; peer effect

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

We appreciate the helpful comments from Jian Kang (discussant), Jiyoon Lee (discussant), Frank Schiemann (discussant), Guoman She, Terry Shevlin, Yen-Jung Tseng (discussant), Lynn Linghuan Wang, Hong Wu, Kun Yu (discussant), and Janus Jian Zhang, as well as from the workshop participants at the Dongbei University of Finance and Economics, Hong Kong Baptist University, Hong Kong Polytechnic University, the University of Hong Kong, and the University of California, Irvine. We are also grateful for the comments and suggestions from the participants at the 2023 EAA Conference, the 2023 JAAF Conference, the 2023 CAAA Conference, the 18th Conference on Asia-Pacific Financial Markets, the 14th International Conference of the Japanese Accounting Review, the 2024 TAA Conference, and 2025 HARC. Jiang Cheng acknowledges financial support from the Hong Kong Research Grants Council and the University Grants Committee under grant number 13500221. Jeffrey Ng acknowledges financial support from the Hong Kong Research Grants Council under grant number 15508022.

> *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)

1. Introduction

In 2010 and in response to the increasing effects and intensity of climate change, the National Association of Insurance Commissioners (NAIC) introduced the annual Climate Risk Disclosure Survey (CRDS). State insurance regulators in CRDS-adopting states require that insurers complete an eight-question survey about how they assess and manage climate-related risks.[1] Question 5 of the survey asks whether insurers consider the impact of climate change on their investment portfolio and if they consequently alter their investment strategy. Since 2012, the California Department of Insurance (CDI) has made the survey responses publicly available on its website.[2] The CDI (n.d.) views the responses as aiding regulators, insurers, and interested members of the public to identify climate change-related trends, vulnerabilities, and best practices within the insurance industry.

In this study, we aim to examine how insurers' mandated public disclosure of their investment strategies in relation to climate change affects their investments in fossil fuel firms. To do so, we use the U.S. insurance industry's staggered, state-level adoption of the CRDS, and we present a comprehensive analysis of how the CRDS affects insurers' divestment from fossil fuel firms. For brevity, unless otherwise specified, "divestment" refers to divestment from such firms;

[1] The U.S. insurance industry is regulated at the state level. The NAIC coordinates regulation across states.
[2] See https://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ClimateSurvey.

such divestment is considered important to global decarbonization efforts (Plantinga and Scholtens, 2021).

It is critical to examine how increased transparency in an insurer's climate change investment strategy affects the insurer's divestment. Because insurers collect and invest insurance premiums from their underwriting operations, they act as crucial financial intermediaries (Ross, 2021). The insurance industry also plays a significant role in U.S. financial markets, holding, as of 2021, approximately $8 trillion in total financial assets (Wong and Carelus, 2021). The industry's investments support U.S. economic growth and ensure capital market stability (U.S. Chamber of Commerce, 2019). Insurers heavily rely on their portfolio returns to fund their business operations, including insurance payouts (Chen, Higgins et al., 2020; Ge and Weisbach, 2021). The returns are also critical in the insurers' overall financial performance (Becker and Ivashina, 2015). However, insurers' investment choices can exacerbate climate change; as of 2019, the U.S. insurance industry had $582 billion invested in a combination of oil, gas, coal, and other fossil fuel–related assets (Ross, 2021). In consequence, insurers are under pressure from various parties to divest from fossil-fuel-firm investments (Liu, 2023; Fonseca, 2025; Naturesave, n.d.).

We hypothesize that relative to insurers that are not required to respond to the CRDS, insurers that are affected by the mandate are more likely to divest from fossil fuel firms. As we detail in Section 2, within the context of an insurer's investment portfolio, the public disclosure of an insurer's CRDS responses increases transparency about its climate change investment strategy. Because various stakeholders—including regulators, insurers, and interested members of the public—pay attention to this strategy, the insurer is incentivized to divest from such firms.

To examine the effect of climate risk disclosure on insurers' investment portfolios, we employ a staggered difference-in-differences (DID) research design that compares changes in the

fossil-fuel-firm investments of insurers subject to the CRDS mandate (the treatment insurers) with those that are not (the control insurers).[3] We find that relative to the control group, the treatment insurers divest more after CRDS adoption. In terms of the economic significance, the treatment insurers' post-disclosure investments in fossil fuel firms decrease by 0.38% relative to those of the control insurers, amounting to 13.10% of the average investment. This finding suggests that insurers that are required to disclose their climate risk significantly adjust their investment strategies toward more environmentally responsible investments.

Our results hold through various robustness checks. First, we implement the Goodman-Bacon (2021) diagnostic decomposition, which shows that our staggered DID estimates are not biased by inefficient comparisons. Second, the stacked DID estimates indicate that our staggered DID estimates are not sensitive to heterogeneous treatment effects. Third, we adopt two alternative regression specifications: we cluster standard errors by state and we use insurer and state-year fixed effects instead of insurer and year fixed effects. Finally, we adopt several alternative samples. Specifically, we employ narrow bandwidth estimations around the CRDS reporting threshold based on nationwide direct premiums, we exclude insurers that are licensed in California to mitigate the concern that our documented result is simply a California effect, we exclude the years after 2016 to avoid confounding effects caused by California's regulation about the mandatory disclosure of fossil fuel investments in 2016, and our final alternative sample includes the years 2008 and 2009. Across all these alternative specifications, the CRDS continues to positively affect divestment. Together, these tests offer robust evidence of the CRDS's causal effect on insurers' divestment.

[3] Using fossil-fuel-firm investment as our measure of environmentally responsible investing means that our analyses' inference focuses on insurers' choice of investees, rather than on the investees' environmentally responsible actions. A firm's identity as a fossil fuel firm is inherent to its business and unlikely to change over time.

Next, we test whether insurers' CRDS responses serve as the mechanism linking the CRDS to divestment. We study the moderating effect of insurers' responses to CRDS Question 5, which concerns whether insurers consider the impact of climate change on their investment portfolio. We specifically examine their yes-versus-no responses and the number of words therein. A positive response can be viewed as a signal of a commitment to a more environmentally friendly investment strategy (Kim and Yoon, 2023). We find that the CRDS's positive effect on divestment is greater for those treatment insurers that indicate that they proactively incorporate climate change considerations into their investment strategies.

We then present evidence that stakeholder attention to climate issues serves as an important moderator of the CRDS's effect on divestment. Stakeholders' attention to climate issues is important if an insurer's disclosure of its climate change investment strategy can influence divestment; such attention has clear heterogeneity. When stakeholders pay more attention, the insurer's managers are more likely to be concerned about the loss of underwriting business, political and regulatory costs, reputational concerns, and environmental activism. To capture the extent to which an insurer's stakeholders pay attention to climate issues, we develop three proxies: whether the insurer's underwriting business is concentrated in a Democratic state; whether its underwriting business is concentrated in a CRDS-adopting state; and if the ultimate parent is a publicly listed firm. Using these proxies, we find that the CRDS's positive effect on divestment is more pronounced when stakeholders are likely to pay more attention to climate issues.

Next, we consider the effect of peer benchmarking. A firm's peers play an important role in influencing its actions. To examine the moderating effect of peer benchmarking on the CRDS's effect on divestment, we develop the following measures: the percentage of the insurer's peers that divest from fossil fuel firms, the percentage of the insurer's peers that indicate that they consider

climate change in their investment strategy in response to CRDS Question 5, and the environmental friendliness of the insurer's portfolio relative to that of its peers. We show that the CRDS's positive impact on insurers' divestment is more pronounced when their peers are more environmentally responsible in their investments. This outcome is consistent with peer benchmarking serving as a factor that drives insurers' divestment.

In a supplementary analysis, we offer more evidence of actions that insurers take to make their investment portfolios more environmentally friendly, particularly in relation to climate risk. We show that the treatment insurers are more likely to reduce their holdings in high-carbon-emissions firms and to increase their holdings in low-carbon-emissions firms. In the second supplementary analysis, we examine a particularly important consequence of the changes in insurers' investment portfolios: how divestment affects their investment returns. We find that compared to the control insurers, the treatment insurers experience a post-adoption reduction in their investment returns. These reductions are concentrated among those treatment insurers that divest after CRDS adoption.

Our study makes several contributions. First, we contribute to the growing literature on sustainability disclosure, which includes climate-related disclosures and subsequent firm actions (e.g., Christensen et al., 2017; Chen et al., 2018; Rauter, 2020; Fiechter et al., 2022; Cohen et al., 2023; Kim et al., 2023; Baik et al., 2024; Krueger et al., 2024; Dai et al., 2025). Given the vast literature on this topic, we discuss only a few papers on climate disclosure. Kim et al. (2023) report that firms affected by the U.S. Securities and Exchange Commission's (SEC) interpretive guidance on climate change risk disclosure engage in more pro- and fewer anti-environmental activities. Cohen et al. (2023) report that firms owned by the Carbon Disclosure Project (CDP) signatories are more likely to disclose information to the CDP and that such disclosures are associated with

lower subsequent carbon emissions. Dai et al. (2025) employ the EU Sustainable Finance Disclosure Regulation, which requires funds that are domiciled or marketed in the EU to classify themselves based on different degrees of commitment to sustainability; the regulation also includes disclosure requirements based on these classifications. Using this setting, they document that in the wake of the regulation, a significant decarbonization (around 10 percent) occurs in the investment portfolios of funds domiciled or marketed in the EU that claim to invest based on sustainability criteria. Ozdagli and Wei (2024) document that after the introduction of the CRDS, affected insurers reduced their exposure to high-climate risk corporate bonds; however, on average, they still have significant exposure to high-climate risk sectors.

Our study complements and contrasts with this research. We assess how mandated disclosure about insurers' climate change investment strategies affects their fossil-fuel-firm investments. Our primary finding, that such disclosures can lead to divestment, supports regulatory efforts to use sustainability disclosure to influence firms to make sustainability-supporting choices. Furthermore, we find that the CRDS lowers investment returns, which is a potentially unintended consequence. These lower returns are concentrated among the divesting insurers.[4] As a result of this outcome, regulators may want to weigh the possibility of reduced firm performance when they mandate climate risk disclosure.[5]

Second, our study contributes to the literature on sustainable investing. Research links investors' sustainability disclosures to sustainable investing (e.g., Kölbel et al., 2020; Gibson Brandon et al., 2022; Heath et al., 2023; Kim and Yoon, 2023; Wang, 2023). However, evidence

[4] This finding challenges the claim made by Dave Jones, the California Insurance Commissioner, that insurers should divest from fossil-fuel-firm investments because such investments yield lower returns (CDI, 2016).

[5] Chen et al. (2018) find that although mandated corporate social responsibility disclosure has positive social externalities, it reduces firm profitability. Their finding is consistent with firms sacrificing some profits for the benefit of society.

that such disclosures affect investors' choice of investees is limited. One challenge that studies face is the use of investees' environmental, social, and governance (ESG) ratings to evaluate investors' sustainable investments. The use of these ratings makes it difficult to determine whether any of the documented changes to more sustainable investment result from investors' choice of investees or from changes in investees' sustainability behavior. Our study complements and contrasts with prior research by focusing on investor divestment. This focus enables us to isolate the effect of disclosure on institutional investors' choice of investees. It also aligns with some organizations' efforts to pressure insurers to engage in more sustainable investment.[6]

Third, our study contributes to the literature on the determinants of insurers' portfolio choices. Prior research documents several factors that affect these choices: financial conditions (Ge and Weisbach, 2021), regulatory capital constraints (Ellul et al., 2011; Becker and Ivashina, 2015; Becker et al., 2022), accounting methods (Ellul et al., 2015; Chen, Higgins et al., 2020), operating risk from insurers' underwriting business (Chen, Sun et al., 2020), and motivations to meet or beat earnings expectations (Fan et al., 2025). We extend this literature by documenting that the public disclosure of insurers' climate change investment strategies can lead insurers to choose more environmentally friendly investments.

2. Institutional Background and Hypothesis Development

2.1 Institutional Background of the CRDS

The CRDS is a reporting mechanism through which insurers offer insight into how they assess and manage climate-change-related risks. The survey comprises eight questions about how insurers incorporate climate risk into their mitigation, risk management, and investment strategies

[6] For example, Naturesave has pushed for the industry's divestment from fossil fuel firms to promote the sustainable development of the insurance industry (Naturesave, n.d.).

(see Appendix A, Panel A).[7] In 2010, approximately two dozen states administered the survey to licensed insurers that wrote more than $500 million in nationwide direct premiums; the resulting data were aggregated. In 2011, the threshold was lowered to $300 million, and California was the only state to administer the survey. In 2012, California, New York, and Washington state administered the CRDS to all licensed insurers that wrote more than $300 million in nationwide direct premiums. In 2013, the premium threshold was further lowered to $100 million, and three more states joined the survey (Connecticut, Minnesota, and New Mexico). Panel B of Appendix A summarizes the CRDS adoption process during our sample period (2010–2019). Appendix A, Panel C, includes an example of a CRDS notice sent by the CDI to all licensed insurers in California. Initially confidential, the CRDS responses have been posted on the CDI website since 2012.

In 2021, nine more states or jurisdictions joined the disclosure survey initiative, resulting in a total of 15 members (California, Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, Minnesota, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington state). According to the CDI (n.d.), insurers that responded to the 2021 survey comprise nearly 80% of the entire U.S. insurance market in terms of premiums written, ensuring a sufficiently large sample of climate change data for use by regulators, insurers, and the public.

The CRDS's regulatory objective is for the survey responses to serve as a tool that enables regulators, insurers, and interested members of the public to identify climate-change-related trends, vulnerabilities, and best practices within the industry (CDI, n.d.). The CRDS has attracted the attention of various stakeholders. For example, Ceres, a non-profit organization that focuses on

[7] In April 2022, in alignment with the international Task Force on Climate-Related Financial Disclosures, the NAIC replaced the eight-question CRDS with a new standard for insurance companies' climate-related risk reporting.

sustainability, uses CRDS data in several of its reports and scorecards of insurers' climate risk management practices, which various stakeholders can use in their interactions with insurers.[8]

2.2 Primary Hypothesis: The CRDS's Effect on Insurers' Fossil-Fuel-Firm Investments

Firms practice sustainability, including climate-friendly investing, to align with the interests of various stakeholders, including regulators and interested members of the public. Transparency regulation is one way in which regulators enable stakeholders to exert pressure on firms to adopt more sustainable practices (Bonetti et al., 2024). In the context of insurers' investment portfolios, if CRDS-driven transparency about insurers' climate change investment strategies increases stakeholders' awareness of that strategy, then political costs, reputational concerns, and activism by investors or other parties could serve as incentives for managers to divest from fossil fuel firms. These incentives are stronger if the insurers' CRDS responses claim that they plan to or already pursue such a strategy. We present an economic framework to discuss how each type of stakeholder mentioned on the CDI website—regulators, interested members of the public, and insurers—uses CRDS disclosures to influence insurers' divestment.

Regulators use CRDS data to understand how insurance companies assess, manage, and mitigate climate change risks (CDI, n.d.). Such data are critical to regulators' goal of ensuring that the insurance industry remains stable and resilient in the face of increasing climate-related risk. For example, the data are used to ensure that insurers properly assess their investments' climate-related risk, including physical risks, such as extreme weather events, and transition risks, such as policy changes and market shifts related to the transition to a low-carbon economy. As regulators analyze the CRDS data, they may impose stricter guidelines on or even discourage investment in

[8] For an example of a Ceres report, see https://www.insurance.wa.gov/sites/default/files/documents/Ceres-climate-risk-disclosure-reoprt-2016.pdf.

high-carbon sectors, which includes fossil fuel firms. These effects may depend on the state's political leaning, as regulators in Democratic states may take stronger actions.[9]

Next, public advocacy groups may use CRDS information to pressure insurers. As noted earlier, Ceres relies on CRDS responses to produce an annual report and scorecard for insurers. For another example, some insurance consumers consider insurers' ESG practices when making purchase decisions (Deloitte Insights, 2022; Naujoks et al., 2023; Shalender et al., 2023; Beck and Baumgart, 2025). Disclosure of such practices, including climate risk disclosures, can influence their decisions. Other consumers may choose an insurer based on information from third parties that process the disclosures (e.g., the media and ESG activists). In addition, investors such as pension funds, asset managers, and other institutional investors can use climate risk disclosures to evaluate insurers' climate risk exposure and practices.[10]

Finally, an insurer's CRDS responses can help its peers benchmark their own climate risk-management practices and identify areas for improvement (Cao et al., 2019; Tomar, 2023). Cao et al. (2019) find that firms react to their product-market peers' commitment to corporate social responsibility and adoption of such practices by following their peers' lead. Tomar (2023) finds that U.S. manufacturing facilities' greenhouse gas emissions disclosure enables these firms to assess their relative emissions, allowing those with relatively higher emissions to reduce them. If a firm's CRDS responses indicate that it intends to consider the impact of climate change on its investment portfolio or even divest, its peers may feel pressured to do the same.

[9] The first three states to mandate the CRDS in 2012 were California, New York, and Washington state; all were Democratic states. In 2016, the California insurance regulator became the first insurance regulator in the nation to call on insurance companies to voluntarily divest from thermal coal (CDI, 2016).

[10] For example, BlackRock, the world's largest asset manager, uses climate risk disclosure data to engage with the insurance companies in its portfolio (BlackRock, 2024). In 2020, BlackRock announced it would vote against management at companies, including insurers, that fail to adequately disclose their climate risk. This decision pressures insurers to retain investor confidence by improving their climate risk disclosure and management practices.

Insurers' CRDS responses indicate that some insurers make a real effort to divest from fossil fuel firms. For example, CRDS Question 5 asks whether the insurer considers the impact of climate change on its investment portfolio and whether it consequently alters its investment strategy. In their 2019 response to that question, the Zurich American Insurance Company stated that during 2018, it "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." See Appendix A, Panel D for the Zurich American Insurance Company's responses to CRDS Question 5 from 2013 to 2019, which we obtained from the CDI (n.d.).

In summary, as mentioned previously, if the publicly disclosed CRDS facilitates greater transparency about insurers' climate change investment strategy and consequently raises stakeholders' awareness of this change in strategy, then factors such as political costs, reputational risks, or pressure from investors or other groups may motivate managers to divest from fossil fuel firms.[11] Our primary hypothesis, stated in alternative form, is as follows:

Hypothesis*: Following the CRDS, insurers that provide climate risk disclosures under the CRDS mandate are more likely to divest from fossil fuel firms compared with those that do not.*

However, this hypothesis is not without tension. Because environmentally responsible actions can be costly, insurers may choose to engage in greenwashing, which involves promoting an environmentally responsible public image with little to no accompanying action (Delmas and Burbano, 2011; Kaustia and Yu, 2021; Liang et al., 2021).In addition, a significant percentage of respondents state that they do not consider the impact of climate change on their investment

[11] Such risk mitigation emphasizes that divestment need not be sub-optimal from the insurer's viewpoint. Information gathered in preparation for the CRDS and from peers' disclosures may inform an insurer's managers about the risk–return tradeoffs of fossil-fuel-firm investments, and they may adjust their investments accordingly (Roychowdhury et al., 2019).

portfolios. The variation in these responses raises an empirical question about whether and to what extent the CRDS influences insurers' fossil-fuel-firm investments.

3. Research Design

3.1 Sample

We construct our sample using the NAIC Annual Statement Database, which includes statutory financial statement data for all U.S. insurers. The sample period spans from 2010 through 2019, which prevents the respective impacts of the 2008–2009 financial crisis and the COVID-19 pandemic from influencing our results.

We begin with all property and casualty insurers and life insurers with positive total admitted assets. In our staggered DID research design, 2012 is the first year when both the CRDS was required (in California, New York, and Washington state) and the survey responses were made public. The CDI has some pre-2012 CRDS responses from a small number of insurers on its website (CDI, n.d.). To avoid confounding effects from these responses, our sample excludes these 27 insurers.

We define the treatment insurers as those that meet the compulsory CRDS disclosure criteria and that have their CRDS disclosures published on the CDI website. To identify these insurers, we first obtain the insurers' direct premium data from Schedule T of their annual statutory filings. We then match these data to the insurers' CRDS response data to ensure that the qualified insurers' disclosures are available on the CDI website. Insurers that do not meet these requirements are assigned to the control group. After excluding observations that lack the data needed to calculate the variables in our baseline regression, our final sample includes 22,859 insurer-year observations from 2,595 insurers from 2010 to 2019. Table 1 presents the distribution of the baseline analysis sample during the sample period. The insurer-year observations are distributed

almost equally across each year of the sample period. The treatment and control groups include 6,597 and 16,262 observations, respectively.

3.2 Measurement of Insurers' Fossil-Fuel-Firm Investments

We measure an insurer's fossil-fuel-firm investments based on the proportion of the fair value of its investment portfolio that is invested in such firms. Insurers in the U.S. are required to report detailed investment portfolio holdings in their NAIC statutory filings. Schedule D, Part 1 (Part 2) of the insurers' annual statements reports their Committee on Uniform Security Identification Procedures (CUSIP)-level bond (stock) holdings data, including the fair value of each security held. We follow the selection criteria in Campbell and Taksler (2003) and Chen, Sun et al. (2020) for identifying corporate bonds and equities. We consider the issuer obligations of unaffiliated public utilities bonds and unaffiliated industrial and miscellaneous bonds as corporate bonds and we identify unaffiliated public utilities stocks and unaffiliated industrial and miscellaneous stocks as corporate equities. First, we use the CUSIP of each security in the insurer's corporate investment portfolio to identify the security's issuer. Second, we classify whether the issuer belongs to the fossil fuel industry based on its Standard Industrial Classification (SIC) code. We consider firms with a 4-digit SIC code from 1200 to 1399 as involved in fossil fuel extraction (Beyene et al., 2022). Next, we measure the insurer's fossil-fuel-firm investments using the following equation:

$$Inv\_FFF_{i,t} = \sum_{s=1}^{n} w_{i,s,t} \times FFF_{s,t}. \quad (1)$$

i, s, and t index the insurer, corporate security, and year, respectively. $Inv\_FFF_{i,t}$ is insurer i's fossil-fuel-firm investments at time t. $w_{i,s,t}$ is the fair value of insurer i's holdings in corporate security s as a fraction of the total fair value of its corporate securities holdings with SIC codes at

time t. $FFF_{s,t}$ is a dummy variable equal to one when a fossil fuel firm has security s outstanding at time t, and zero otherwise.

3.3 Regression Specification

To examine the effect of mandatory CRDS disclosure on insurers' fossil-fuel-firm investments, we employ the following staggered DID model:[12]

$$Inv\_FFF_{i,t} = \alpha + \beta\, CRDS_{i,t} + \gamma\, Controls_{i,t} + Insurer\ FE + Year\ FE + \varepsilon_{i,t}. \quad (2)$$

i and t index the insurer and year, respectively. As previously defined, *Inv_FFF* captures the insurer's corporate investment intensity in fossil fuel firms. *CRDS* is a dummy variable that equals one for the first year of CRDS adoption and all subsequent years, zero otherwise.[13] *Controls* represent a vector of insurer-level variables that affect insurers' investment portfolios. Following prior literature (Lai and Limpaphayom, 2003; Becker and Ivashina, 2015; Chen, Sun et al., 2020; Ge and Weisbach, 2021), we include several variables as controls. *Size* is the natural logarithm of the total admitted assets (i.e., assets allowed to be included) in the insurer's financial statements, based on the NAIC's Statutory Accounting Principles. *Leverage* is the total liabilities divided by the total admitted assets. *Mutual* is a dummy variable that equals one when the insurer's legal form is a mutual, and zero otherwise. *Group* is a dummy variable that equals one when the insurer is affiliated with a group, and zero otherwise, which allows us to control for the group-wide policies that might affect an insurer's investment decision. *InvRisk* is the riskiness of the insurer's investment portfolio, which is the ratio of risk-weighted assets to the total invested assets.

[12] Our staggered DID relies on CRDS adoption in California, New York, and Washington state in 2012 and Connecticut, Minnesota, and New Mexico in 2013. When the CRDS reporting threshold for nationwide direct premiums was reduced from $300 million to $100 million in 2013, some insurers licensed in the first three CRDS-adopting states become treatment insurers in 2013.

[13] The requirement to respond to the CRDS is based on where an insurer is licensed, not headquartered. An insurer requires a separate license for each state where it conducts underwriting. For example, an insurer headquartered in non-adopting Texas is required to respond to the CRDS if it meets the nationwide direct premium threshold for disclosure and operates in at least one adopting state (e.g., California).

Reinsurance is the percentage of gross premiums ceded to reinsurers; it controls for an insurer's risk exposure in its underwriting business. Appendix B presents the detailed variable definitions. To mitigate the effects of outliers, we winsorize all continuous variables at the 1st and 99th percentiles by year. We also include insurer and year fixed effects to control for invariant characteristics across insurers and years, respectively. We adopt heteroscedasticity-robust standard errors clustered at the insurer level. The coefficient β on *CRDS* is the coefficient of interest; it captures the effect of mandatory CRDS disclosure on insurers' fossil-fuel-firm investments.

3.4 Summary Statistics

Table 2 reports the summary statistics for the variables used in the baseline regression. For the insurers in our sample, the mean value of the corporate investment intensity in fossil fuel firms, *Inv_FFF*, is 0.029, indicating that on average, 2.9% of the fair value of insurers' investment portfolios is invested in fossil fuel firms. The mean values of *Size* and *Leverage* are 18.905 and 0.558, respectively, comparable with those in Ge and Weisbach (2021). Mutual insurers constitute 28.5% of the insurers in our sample, with 73.9% of them being affiliated with a group. Insurers have, on average, a ratio of risk-weighted assets to total invested assets of 2.1% and a ratio of premiums ceded to reinsurers to gross premiums written of 42.2%.

4. Empirical Results

4.1 Mandatory CRDS Disclosure and Insurers' Fossil-Fuel-Firm Investments

Table 3 presents the regression results for the effect of mandatory CRDS disclosure on insurers' investments in fossil fuel firms. Column (1) reports the results when we include only insurer and year fixed effects as controls. The coefficient on *CRDS* is negative and statistically significant (coefficient = -0.0042, *t*-stat = -3.32). Column (2) presents the results of estimating Equation (2), which includes a vector of insurer-level control variables. Again, we document a

significantly negative coefficient on *CRDS* (coefficient = -0.0038, *t*-stat = -3.02). These results suggest that compared to the control insurers, the treatment insurers reduce their fossil-fuel-firm investments more after CRDS adoption. In terms of the economic significance, the magnitude of the coefficient in Column (2) indicates that after disclosure, the treatment group's fossil-fuel-firm investments decrease by 0.38% relative to the control group. This change represents 13.10% of our sample insurers' average investment in fossil fuel firms.

For the control variables, the positive and significant coefficient on *Size* suggests that large firms are less likely to engage in environmentally responsible investing, perhaps because they are more likely than small firms to make investments that generate higher returns. Environmentally responsible investments generally yield lower returns than do conventional investments (Renneboog et al., 2008; El Ghoul and Karoui, 2017; Bolton and Kacperczyk, 2021; Pástor et al., 2021). The positive and significant coefficient on *InvRisk* suggests that insurers investing in riskier assets to gain higher returns are less likely to engage in environmentally responsible investing.

The basic identifying assumption that underlies the DID estimation is that in the absence of a treatment event, the dependent variable would exhibit a parallel trend for both the treatment and control firms. Although this assumption is not directly testable, we can offer some assurance about it by investigating whether differences in the treatment and control insurers' fossil-fuel-firm investments exist prior to treatment. We replace *CRDS* with a series of time dummy variables (*CRDS_t-3*, *CRDS_t-2*, *CRDS_t*, *CRDS_t+1*, *CRDS_t+2*, *CRDS_t+3*, *CRDS_t+4*, *CRDS_t+5*, and *CRDS_t+6+*) that indicate the year relative to the adoption year. We use the year immediately preceding the adoption year (*CRDS_t-1*) as the benchmark. The coefficients on these variables track the difference between the treatment and control insurers' fossil-fuel-firm investments from the pre- to post-CRDS adoption periods.

Column (3) of Table 3 reports the results of the parallel trend test. To better visualize the trends, Figure 1 plots a parallel trend graph using the coefficients on the time dummies in Column (3). The x-axis indicates the year relative to the CRDS adoption year, while the y-axis indicates the difference between the treatment and control insurers' respective fossil-fuel-firm investments relative to the difference between these investments in the benchmark year (i.e., the year before CRDS adoption). Each point in the graph represents a coefficient on the relevant time dummy. We observe that the coefficients on *CRDS_t-3* and *CRDS_t-2* are statistically insignificant, suggesting that before adoption, the difference between the treatment and control groups' respective fossil-fuel-firm investments is statistically similar to the benchmark year. More importantly, the pattern of the coefficients does not indicate a divergence between the treatment and control insurers' pre-adoption fossil-fuel-firm investments. In contrast to the pre-CRDS coefficients, the coefficients on *CRDS_t+2*, *CRDS_t+3*, *CRDS_t+4*, *CRDS_t+5*, and *CRDS_t+6+* are significantly negative, reflecting a post-adoption reduction in the treatment insurers' fossil-fuel-firm investments. The pattern of the coefficients suggests that the treated insurers' divestment manifests over time.[14]

4.2 Robustness Tests

4.2.1 Goodman-Bacon Diagnostic Decomposition

Following Goodman-Bacon (2021), we decompose the weights in the various cross-group comparisons in the staggered DID estimation. This test allows us to examine whether the staggered adoption pattern causes inefficient comparisons that bias the staggered DID estimates. Panel A of Table 4 shows that the weight of the comparison between the treatment and never-treated groups is 0.946 and that the average estimated treatment effect for this group comparison is -0.005. These

[14] When we split fossil-fuel-firm investments into Coal (SIC 1200–1299) and Oil & Gas (SIC 1300–1399), we find negative and statistically significant effects in both sub-groups, consistent with the results in the main tests. The parallel trend test also holds for the sub-groups.

results show that most (94.6%) of our estimated treatment effect derives from the comparison between the treatment and never-treated groups, indicating that our staggered DID estimates are not biased by inefficient comparisons.

4.2.2 Stacked DID

To address concerns about heterogeneous treatment effects in the staggered DID estimation, we follow prior literature and employ stacked DID estimates (e.g., Gormley and Matsa, 2011; Cengiz et al., 2019). Specifically, for each treatment event (i.e., CRDS adoption), we construct a cohort set that includes all insurer-year observations from three years before the event to three years after it. We then exclude the treated insurer-year observations from each cohort to ensure that the control group is pure. After stacking all cohort sets together, we estimate the following equation:

$$Inv\_FFF_{i,c,\tau} = \alpha + \beta\ CRDS\_Stacked_{i,c,\tau} + \gamma\ Controls_{i,c,\tau} + Insurer\text{-}cohort\ FE + Year\text{-}cohort\ FE + \varepsilon_{i,c,\tau}. \quad (3)$$

i, c, and τ index the insurer, cohort, and event year (i.e., the calendar year minus the treatment year in a cohort), respectively. *CRDS_Stacked* is a dummy variable that equals one for the first year of a cohort's CRDS adoption and all subsequent years, zero otherwise. We include insurer-cohort and year-cohort fixed effects, and we cluster standard errors at the insurer-cohort level. The other variables are as defined in Equation (2). Coefficient β on *CRDS_Stacked* captures the effect of mandatory CRDS disclosure on insurers' fossil-fuel-firm investments.

Panel B of Table 4 shows the results of the stacked DID estimates. Columns (1) and (2) report the regression results without and with the insurer-level control variables, respectively. The columns show negative and statistically significant coefficients on *CRDS_Stacked* (coefficient = -0.0038, *t*-stat = -3.16 in Column (1); coefficient = -0.0039, *t*-stat = -3.26 in Column (2)). These

results indicate that our main finding remains robust to the stacked DID estimation, confirming that our staggered DID estimates are not sensitive to heterogeneous treatment effects.

4.2.3 Alternative Regression Specifications

To further examine the robustness of our main finding, we adopt alternative regression specifications. First, we cluster the standard errors by state to account for any dependence in a state's climate-related policymaking preferences. Table 4, Panel C, Column (1) shows that the coefficient on *CRDS* (coefficient = -0.0038, *t*-stat = -2.64) remains negative and statistically significant, indicating that our main result remains robust when clustering standard errors by state. Second, our regression model includes state-year fixed effects rather than year fixed effects to control for any unobservable, time-varying state characteristics that would affect insurers' investment portfolios. Table 4, Panel C, Column (2) continues to show a negative and statistically significant coefficient on *CRDS* (coefficient = -0.0038, *t*-stat = -2.77), indicating that our main result remains robust when state-year fixed effects are added as controls.

4.2.4 Alternative Samples

We also employ several alternative samples to examine the robustness of our main finding. First, whether an insurer is subject to the CRDS depends on whether it has business in a CRDS-adopting state and whether its nationwide direct premiums exceed the threshold. We use the latter criterion to sharpen the causal identification. Following Chow et al. (2023), we conduct a narrow bandwidth estimation using only observations with direct premiums that are close to the revised reporting threshold of $100 million. Specifically, we first exclude observations with nationwide direct premiums above $300 million, eliminating insurers covered by the earlier higher reporting threshold. We also exclude observations with nationwide direct premiums above $200 million. The resulting sample is more symmetric around the remaining reporting threshold. Table 4, Panel

D, Columns (1) and (2) report the estimated outcomes; the coefficients on *CRDS* remain negative and statistically significant in both columns (coefficient = -0.0049, *t*-stat = -2.36 in Column (1); coefficient = -0.0071, *t*-stat = -2.54 in Column (2)). These results suggest that our main finding is likely driven by the effect of CRDS adoption on the affected insurers' investment portfolios.

Second, given that insurers affected by California's CRDS adoption constitute a significant component of our sample, we examine whether our main result is sensitive to the exclusion of insurers licensed in California. Doing so mitigates the concern that what we document is simply a California effect. In addition, the CDI launched, in 2016, the Climate Risk Carbon Initiative, which consists of two components. First, with the view that thermal coal investments were at significant risk of or had become "stranded assets", the insurance commissioner asked all insurance companies doing business in California to voluntarily divest their investments in thermal coal. Second, since 2016, the CDI has made a database publicly available that provides information about the extent to which insurers doing business in California are invested in oil, gas, coal, and utilities that rely on these fuels.[15] While we document in our parallel trend test (see Figure 1) that the reduction in fossil-fuel-firm investments had begun before this initiative, a concern arises that the initiative confounds our post-CRDS treatment effects (Miller et al., 2025; Zhang, 2025). Table 4, Panel D, Column (3) presents the results after excluding California-licensed insurers. The coefficient on *CRDS* (coefficient = -0.0062, *t*-stat = -2.71) remains negative and statistically significant, indicating that our main result is not solely driven by a California effect.

To further mitigate this concern about the 2016 Climate Risk Carbon Initiative, we run another robustness test that excludes the years after 2016 from our baseline sample. Table 4, Panel

[15] See https://interactive.web.insurance.ca.gov/apex_extprd/f?p=250:1:3082324437110: for more information about the initiative.

D, Column (4) presents the result. The coefficient on *CRDS* (coefficient = -0.0033, *t*-stat = -2.73) remains negative and statistically significant, indicating that our main result remains robust.

Last, we test whether our results hold when we lengthen the pre-event period by including the years 2008 and 2009. These years coincide with the global financial crisis, which is why we exclude them from our main tests. One downside of doing so is that we have a relatively short pre-event window. Table 4, Panel D, Column (5) confirms that our results are not driven by this design choice, as the coefficient on *CRDS* is negative and statistically significant (coefficient = -0.0038, *t*-stat = -3.09). This outcome suggests that our main result remains robust when including the financial crisis period in the sample.

4.3 Tests of the Transparency Mechanism

In this section, we establish the CRDS's causal effect on divestment using insurers' responses to Question 5, which concerns the impact of climate change on an insurer's investment portfolio. An important argument inherent to our primary hypothesis is that the transparency of an insurer's climate change investment strategy leads to its divestment. To test this transparency mechanism, we use the responses to Question 5 to investigate whether the extent of divestment varies with the content of the insurer's response to this question.

Since 2013, the CDI has compiled insurers' CRDS responses in a uniform format on its website. Insurers' responses to each question are first summarized as "yes" or "no" and then presented in full. We compile the responses using Python's Selenium library.[16] We then use the Natural Language Toolkit library to identify text at the word level and count the number of words in each insurer's response. We employ two measures to capture an insurer's proactiveness when considering climate risk in its investment portfolio. *Q5_Yes* is a dummy variable that equals one

[16] Selenium is a popular webpage automation testing tool that can be used to download information from a website in batch mode.

when the insurer responds "yes" to CRDS Question 5a (i.e., "has the company considered the impact of climate change on its investment portfolio?") or 5b (i.e., "has it altered its investment strategy in response to these considerations?"), and zero otherwise. *Q5_Words* is the number of words in the insurer's response to the question. In Panel A of Table 5, the summary statistics for *Q5_Yes* and *Q5_Words* from 2013 to 2019 show a gradual increase in insurers' proactiveness. The average number of words used in the detailed responses increases significantly during this period, nearly doubling between 2013 and 2019.

Next, we test the transparency mechanism that underlies our primary hypothesis using "yes" or "no" responses and the number of words in the detailed responses to CRDS Question 5. If transparency drives the CRDS's effect on divestment, we expect the effect to be more pronounced for those treatment insurers that respond positively or in more detail to CRDS Question 5. To test this expectation, we extend Equation (2) as follows:[17]

$$Inv\_FFF_{i,t} = \alpha + \beta_1 CRDS \times Q5\_Yes/Log\_Q5\_Words_{i,t} + \beta_2 CRDS_{i,t} + \gamma Controls_{i,t} + Insurer\ FE + Year\ FE + \varepsilon_{i,t}. \quad (4)$$

Log_Q5_Words is the natural logarithm of one plus the number of words in the insurer's response to Question 5. The other variables are as defined above.

Table 5, Panel B reports the results of the mechanism tests. In Column (1), the negative and statistically significant coefficient on *CRDS* × *Q5_Yes* (coefficient = -0.0026, *t*-stat = -2.06) indicates that the CRDS's positive effect on divestment is more pronounced for those treatment insurers that respond positively to whether they have considered the impact of climate change on their investment portfolio and, in consequence, altered their investment strategy. After CRDS

[17] Given that *Q5_Yes* and *Log_Q5_Words* are only available for the treatment insurers after CRDS adoption (i.e., *CRDS* = 1), the main effect of *Q5_Yes* or *Log_Q5_Words* will always be equal to the interaction term between *CRDS* and *Q5_Yes* or *CRDS* and *Log_Q5_Words*. Thus, the main effect of *Q5_Yes* or *Log_Q5_Words* is absorbed in the regression.

adoption, treatment insurers with a "yes" response experience an incremental reduction of 0.26% in their fossil-fuel-firm investments. This reduction amounts to 8.97% of insurers' average fossil fuel firm investment. In Column (2), the negative and statistically significant coefficient on *CRDS* × *Log_Q5_Words* (coefficient = -0.0006, *t*-stat = -2.24) indicates that the CRDS's positive effect on divestment is more pronounced for those treatment insurers that respond in more detail about whether they considered the impact of climate change on their investment portfolio and consequently altered their investment strategy. After CRDS adoption, a one-standard-deviation increase (i.e., 1.88, untabulated) in *Log_Q5_Words* for the treatment insurers leads to an incremental reduction of 0.11% (0.06% × 1.88) in their fossil-fuel-firm investment, amounting to 3.80% of insurers' average such investment. Overall, these results suggest that the CRDS-induced transparency of an insurer's investment strategy serves as the mechanism that links the survey to the divestment actions of the insurers impacted by it.

4.4 Heterogeneity Analyses

To further deepen our understanding of the effect of insurers' increased transparency about their climate change investment strategy on their divestment, we examine how this effect varies cross-sectionally with stakeholders' attention to climate issues and whether peer insurers are more environmentally responsible in their investments. The regression specification used in this examination extends Equation (2) as follows:[18]

$$Inv\_FFF_{i,t} = \alpha + \beta_1 CRDS \times Heterogeneity_{i,t} + \beta_2 CRDS_{i,t} + \gamma Controls_{i,t} + Insurer\ FE + Year\ FE + \varepsilon_{i,t}. \quad (5)$$

[18] A potential concern with cross-sectional tests that pertain to the initiation of an event is that the event may affect firm characteristics, leading to inconsistent estimates of the treatment effect (Gormley and Matsa, 2014). To mitigate this concern, we use ex-ante insurer characteristics measured during the pre-treatment period to construct the moderating variables for the cross-sectional analyses. The proxies remain constant for each insurer during the sample period because they are measured in the year prior to CRDS adoption; thus, the main effect of the proxies is subsumed when we add insurer fixed effects.

Heterogeneity is a dummy variable that equals one for a cross-sectional partition that is expected to lead to the CRDS having a more pronounced positive effect on insurers' divestment, and zero otherwise. The other variables are as defined in Equation (2).

4.4.1 Stakeholder Attention to Climate Issues

First, we examine whether the CRDS's effect on an insurer's divestment is more pronounced when the insurer's managers are more concerned about stakeholders' attention to climate issues. We suggest that although the CRDS does not directly influence an insurer's investment in fossil fuel firms, it can impact such investment if the insurer, or more specifically, its managers, believes that stakeholders pay significant attention to climate issues, and consequently, to the CRDS responses that relate to investment in fossil fuel firms. Managers have incentives to reduce such investments to the extent that the attention paid to them induces managerial concerns about the loss of underwriting business, political and regulatory costs, reputational concerns, and environmental activism.

We develop three measures to assess managers' concerns about stakeholder attention. The first two assume that if the majority (i.e., at least 50%) of an insurer's underwriting business is concentrated in a particular state, its managers will be particularly concerned about the extent to which the state's stakeholders consider climate issues. This assumption follows from the fact that underwriting is a crucial part of an insurer's operations, and the insurance premiums generated from the underwriting business give insurers the capital that they use in their investing. An insurer's underwriting business is also regulated at the state level and the insurance regulator in a CRDS-adopting state imposes the CRDS on insurers with operations in the state. Our first measure of stakeholder attention to climate issues is motivated by the polarized political views on climate risk issues (McCright and Dunlap, 2011; Funk and Kennedy, 2016). Democrats are more likely

than Republicans to be concerned about climate issues. We define *Democratic_State* as a dummy variable that equals one when, in the year before CRDS adoption, the insurer's underwriting business is concentrated in a Democratic state, and zero otherwise. We define a Democratic state as a state where the winner of the most recent gubernatorial election is a Democrat.[19] Similarly, because regulators in a CRDS-adopting state are more likely to be concerned about climate risk, we define *CRDS_State* as a dummy variable that equals one when, in the year before adoption, the insurer's underwriting business is concentrated in a CRDS-adopting state, and zero otherwise.

Our third measure uses the insurer's trading status to measure stakeholder attention to the insurer. Public firms are more visible to regulators, the media, non-governmental organizations, and the public. Such visibility means that these firms' climate-risk-related actions, or lack thereof, are more likely to attract attention and even environmental activism. To capture the increased attention that public firms receive, we use *Public_Insurer*, a dummy variable that equals one when, in the year preceding CRDS adoption, the insurer's ultimate parent is a public firm, and zero otherwise.

We estimate Equation (5) by replacing *Heterogeneity* with each of the above proxies; Table 6 reports the results. Across all columns, the coefficients on *CRDS* × *Heterogeneity* are negative and statistically significant. In Column (1), the coefficient on *CRDS* × *Democratic_State* (coefficient = -0.0059, *t*-stat = -2.18) indicates that treatment insurers that have their primary business in a Democratic state experience an incremental post-CRDS reduction of 0.59% in their fossil-fuel-firm investments compared with those in non-Democratic states. This reduction

[19] Based on this definition, the following states are considered Democratic when the CRDS was adopted in 2012: Arkansas, California, Colorado, Connecticut, Delaware, the District of Columbia, Hawaii, Illinois, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Montana, New Hampshire, New York, North Carolina, Oregon, Vermont, Washington, and West Virginia. For CRDS adoption in 2013, North Carolina is not defined as a Democratic state.

amounts to 20.34% of the insurers' average fossil-fuel-firm investments. The Column (2) coefficient on *CRDS* × *CRDS_State* (coefficient = -0.0058, *t*-stat = -1.94) indicates that compared to treatment insurers in non-adopting states, those that have their primary business in an adopting state experience an incremental post-adoption reduction of 0.58% in their fossil-fuel-firm investments, or 20.00% of the insurers' average such investment. In Column (3), the coefficient on *CRDS* × *Public_Insurer* (coefficient = -0.0050, *t*-stat = -2.39) indicates that compared with private insurers, treatment firms that are public experience an incremental, post-CRDS fossil-fuel-firm-investment reduction of 0.50%, amounting to 17.24% of insurers' average fossil fuel firm investment.

Overall, the results in Table 6 indicate that the effect of CRDS adoption on an insurer's divestment is more pronounced when the insurer's stakeholders pay more attention to climate risk issues.

4.4.2 Peer Benchmarking

Next, we examine how peer benchmarking moderates the CRDS's effect on divestment. Companies often benchmark their performance, practices, and strategies against those of their peers. Recent research examines how peers' sustainability actions influence a firm's own choices (Cao et al., 2019; Tomar, 2023). For example, Tomar (2023) employs the U.S. Greenhouse Gas Reporting Program as a setting. This program requires thousands of industrial facilities to measure and report their greenhouse gas emissions. Tomar (2023) finds that facilities decrease their greenhouse gas emissions by 7.9% after they release their emissions data. He concludes that benchmarking—facilities comparing their emissions to those of their peers—encourages reductions in greenhouse gas emissions.

We define an insurer's peers as insurers that share a headquarters state with the insurer. We use two measures to capture the extent to which peer insurers are relatively more environmentally responsible. First, to capture the effect from peer divestment practices, we define *Peer_Div_FFF* as the percentage of the insurer's peers that divest from fossil fuel firms in the year before CRDS adoption. Second, to capture pressure from peers' proactiveness in considering climate risk in their investment portfolios, we define *Peer_Q5_Yes* as the percentage of the insurer's peers that respond "yes" to CRDS Questions 5a, 5b, or both.

Suppose that an insurer's pre-CRDS investment portfolio is less environmentally friendly than those of its peers, the insurer is likely to divest from less environmentally unfriendly investments, such as fossil-fuel-firm investments (Fiechter et al., 2022). To test this conjecture, we measure the environmental sustainability of an insurer's investment portfolio using the environmental sustainability ratings from two major ESG rating agencies, Refinitiv and MSCI.[20] First, we use the CUSIP of each security in the insurer's corporate investment portfolio to identify the security's issuer. We then obtain the issuer's environmental performance score from either the Refinitiv or MSCI ESG database. For securities issued by firms with an environmental performance score in these databases, we assign the issuers' environmental performance score to their securities. Next, we measure the environmental sustainability of the insurer's corporate investments as the investments' weighted average environmental score:

$$InvEScore\_Ref\,(InvEScore\_MSCI)_{i,t} = \sum_{s=1}^{n} w_{i,s,t} \times EScore\_Ref\,(EScore\_MSCI)_{s,t}. \quad (6)$$

i, *s*, and *t* index the insurer, corporate security, and year, respectively. $InvEScore\_Ref\,(InvEScore\_MSCI)_{i,t}$ is the environmental sustainability of insurer *i*'s corporate investments measured using data from the Refinitiv (MSCI) ESG database at time *t*. $w_{i,s,t}$ is the fair value of

[20] Our review of insurers' text responses to CRDS Question 5 reveals that some insurers care about ESG ratings; see Zurich American Insurance Company's 2019 response in Panel D of Appendix A.

insurer *i*'s holdings in corporate security *s* as a fraction of the total fair value of its holdings in corporate securities that have an environmental performance score at time *t*. *EScore_Ref* $(EScore\_MSCI)_{s,t}$ is the environmental performance score for corporate security *s* from the Refinitiv (MSCI) ESG database at time *t*. *Low_InvEScore_Ref* (*Low_InvEScore_MSCI*) is a dummy variable that equals one when, in the year before CRDS adoption, the environmental sustainability of the insurer's corporate investments, which we construct using data from the Refinitiv (MSCI) ESG database, is below the treatment sample median, and zero otherwise.

We estimate Equation (5) by replacing *Heterogeneity* with each of the above proxies; Table 7 reports the results. Across all columns, the coefficients on *CRDS* × *Heterogeneity* are negative and statistically significant. The Column (1) coefficient on *CRDS* × *Peer_Div_FFF* (coefficient = -0.0208, *t*-stat = -1.75) indicates that a one-standard-deviation increase (i.e., 0.13, untabulated) in the percentage of a treatment insurer's peers that divest in the year before CRDS adoption leads to an incremental post-CRDS reduction of 0.27% (2.08% × 0.13) in the insurer's own fossil-fuel-firm investments. This reduction amounts to 9.31% of the insurers' average fossil-fuel-firm investment. The coefficient on *CRDS* × *Peer_Q5_Yes* (coefficient = -0.0107, *t*-stat = -2.37) in Column (2) indicates that a one-standard-deviation increase (i.e., 0.13, untabulated) in the percentage of a treatment insurer's peers that respond "yes" to Question 5 leads to an incremental, post-CRDS, fossil-fuel-firm-investment reduction of 0.14% (1.07% × 0.13). This reduction amounts to 4.83% of the insurers' average fossil fuel firm investment. In Column (3), we measure insurers' pre-CRDS environmental performance score for their corporate investments using data from the Refinitiv ESG database. The coefficient on *CRDS* × *Low_InvEScore_Ref* (coefficient = -0.0085, *t*-stat = -4.10) indicates that those treatment insurers for which this score is low experience an incremental, post-CRDS reduction of 0.85% in their fossil-fuel-firm investments, amounting to

29.31% of insurers' average fossil-fuel-firm investment. Finally, we use data from the MSCI ESG database to measure the pre-CRDS environmental performance score. In Column (4), the coefficient on *CRDS* × *Low_InvEScore_MSCI* (coefficient = -0.0055, *t*-stat = -2.61) indicates that treatment insurers with a low score for their corporate investments experience an incremental post-CRDS fossil-fuel-firm-investment reduction of 0.55%. This reduction amounts to 18.97% of the insurers' average fossil fuel firm investment.

Overall, the results in Table 7 indicate that insurers pressured by their peers' CRDS-related disclosures and divestment, as well as those perceived as having a more environmentally unsustainable investment portfolio, aggressively divest after CRDS adoption.

4.5 Supplementary Analyses

4.5.1 Mandatory CRDS Disclosure and Insurers' Investments in High- and Low-Carbon-Emissions Firms

Our first supplementary analysis considers firms' carbon emissions from insurers' portfolios. Our primary finding indicates that insurers focus on decarbonization in their investment strategies by divesting from fossil fuel firms. In their CRDS responses, several insurers mention that their investment portfolios account for investees' carbon emissions. Because such emissions are an important contributor to climate change, we examine whether insurers shift from high- to low-carbon-emissions firms.

To measure insurers' holdings in high- and low-carbon-emissions firms, we first use the CUSIP of each security in the insurer's corporate investment portfolio to identify its issuer. We then obtain the issuer's carbon emissions data from the Refinitiv ESG database. We classify the issuer as a high- (low-) carbon-emissions firm if its estimated CO_2 and CO_2-equivalent emissions intensity ranks in the top (bottom) half per year, according to the Refinitiv ESG database. We

measure the insurer's investments in high- and low-carbon-emissions firms using the following equation:

$$Inv\_HighCarbon\ (Inv\_LowCarbon)_{i,t} = \sum_{s=1}^{n} w_{i,s,t} \times HighCarbon\ (LowCarbon)_{s,t}. \quad (7)$$

i, *s*, and *t* index the insurer, corporate security, and year, respectively. *Inv_HighCarbon* (*Inv_LowCarbon*)$_{i,t}$ is insurer *i*'s investments in high- (low-) carbon-emissions firms at time *t*. $w_{i,s,t}$ is the fair value of insurer *i*'s holdings in corporate security *s* as a fraction of the total fair value of the insurer's corporate securities holdings in firms that have carbon emissions data in the Refinitiv ESG database at time *t*. *HighCarbon* (*LowCarbon*)$_{s,t}$ is a dummy variable that equals one when corporate security *s* is issued by a high- (low-) carbon-emissions firm at time *t*, and zero otherwise.

We estimate Equation (2) by replacing the dependent variable with *Inv_HighCarbon* and *Inv_LowCarbon*; Table 8, Columns (1) and (2) report the respective results. Column (1) shows a negative and statistically significant coefficient on *CRDS* (coefficient = -0.0206, *t*-stat = -3.23); Column (2) shows a positive and statistically significant coefficient on *CRDS* (coefficient = 0.0202, *t*-stat = 3.19). These results suggest that after mandatory CRDS adoption, the treatment insurers reduce their holdings in high-carbon-emissions firms and increase their holdings in firms with low carbon emissions. Figure 2 shows the parallel trend graphs for these tests. The graphs show that treatment insurers' holdings in high- (low-) carbon-emissions firms only significantly decrease (increase) after CRDS adoption, lending support to the parallel trend assumption. Taken together, these results show that after adoption, treatment insurers shift their investments away from firms with high carbon emissions to low-emissions firms.

4.5.2 Mandatory CRDS Disclosure and Insurers' Investment Returns

Our final supplementary analysis focuses on an important issue related to the CRDS's effect on divestment: whether the affected insurers' divestment impacts their investment returns.

To the extent that environmentally sustainable (unsustainable) investments generate lower (higher) returns, divestment should reduce investment returns (e.g., Renneboog et al., 2008; El Ghoul and Karoui, 2017; Bolton and Kacperczyk, 2021; Pástor et al., 2021).[21] For example, Bolton and Kacperczyk (2021) find that after controlling for size, book-to-market ratio, and other return predictors, the stocks of firms with higher total carbon dioxide emissions generate higher returns, which is consistent with investors demanding higher returns for these firms because of their exposure to carbon emissions risk.

Following Ge and Weisbach (2021), we define an insurer's investment return, *InvRet1*, as its investment income earned plus realized and unrealized capital gains scaled by cash and invested assets at the end of the previous year. Alternatively, we follow Chen, Sun et al. (2020) in defining an insurer's investment returns, *InvRet2*, as its investment income earned plus realized and unrealized capital gains scaled by invested assets at the end of the previous year.[22] We then estimate Equation (2) by substituting first *InvRet1* and then *InvRet2* as the dependent variables. Table 9, Columns (1) and (3) present these results. In both columns, the coefficients on *CRDS* are negative and statistically significant, indicating that the treatment insurers experience reduced post-adoption investment returns. The Column (1) (Column (3)) coefficient suggests that the treatment insurers' post-adoption investment returns decrease by 0.18% (0.15%) relative to those of the control insurers, amounting to 4.26% (3.35%) of the average investment return of 4.23% (4.48%) (untabulated).

[21] The literature generally documents that socially responsible investments have lower returns than socially irresponsible investments. However, Nofsinger and Varma (2014) find no significant difference, on average, between the investment returns of socially responsible and conventional investment funds. They also find that the former outperforms the latter during market crises. Henke (2016) further finds that socially responsible bond funds outperform conventional ones, especially during recessions and in bear markets.

[22] We obtain the two investment performance elements, investment income earned and capital gains, from the Exhibits of Net Investment Income and Capital Gains (Losses) in insurers' annual statutory fillings in the NAIC database.

Next, we examine whether the treatment insurers' divestment serves as a channel through which CRDS adoption reduces their returns. We consider whether the impact of CRDS adoption on insurers' investment returns is concentrated among those treatment insurers that divest after adoption. Following recent literature that conducts channel tests within a DID research design (e.g., Ahmed et al., 2020; Ye et al., 2023; Chen et al., 2024), we employ the following regression model:

$$InvRet_{i,t} / InvRet2_{i,t} = \alpha + \beta_1 CRDS \times Div\_FFF\_Dum_{i,t} + \beta_2 CRDS \times NoDiv\_FFF\_Dum_{i,t} + \gamma Controls_{i,t} + Insurer\ FE + Year\ FE + \varepsilon_{i,t}. \quad (8)$$

Div_FFF_Dum (*NoDiv_FFF_Dum*) is a dummy variable that equals one when the insurer's average corporate investment intensity in fossil fuel firms in the post-adoption period is below (not below) that in the pre-adoption period, and zero otherwise. The other variables are as defined above. The coefficient β_1 (β_2) on *CRDS* × *Div_FFF_Dum* (*NoDiv_FFF_Dum*) captures, relative to the control insurers, the effect of CRDS adoption on the investment returns of those treatment insurers that divest (do not divest) after adoption.

Table 9, Columns (2) and (4) report the regression results. Both columns show that the coefficients on *CRDS* × *Div_FFF_Dum* are negative and statistically significant, while the coefficients on *CRDS* × *NoDiv_FFF_Dum* are not statistically significant. These results suggest that the negative impact of mandatory climate risk disclosure on insurers' investment returns is driven by insurers' post-adoption divestment. The coefficient on *CRDS* × *Div_FFF_Dum* in Column (2) (Column (4)) indicates that after adoption, the treatment insurers that divest experience a 0.27% (0.27%) decrease in their investment returns, relative to the control insurers. This decrease amounts to 6.38% (6.03%) of the average investment returns.

Overall, the results in Table 9 indicate that insurers experience lower investment returns due to divestment. From a traditional risk–return tradeoff perspective, one inference is that

divestment reduces an insurer's exposure to riskier firms. Thus, lower investment returns are a manifestation of lower expected returns from a less risky investment portfolio. An alternative inference is that some CRDS-affected insurers may adopt a profit-satisficing, rather than profit-maximizing, approach to meet certain stakeholders' expectations. Importantly, neither interpretation indicates that divesting treatment insurers adopt a sub-optimal investment strategy. Employing a less risky investment strategy or meeting stakeholders' expectations can be optimal given the increased public scrutiny in the wake of the CRDS and the transition risks that arise from other regulations on fossil-fuel-firm investment.[23]

5. Conclusion

In this study, we use the staggered state-level adoption of the CRDS to examine how the public disclosure of insurers' climate change investment strategies impacts their investments in fossil fuel firms. We find that insurers required to respond to the CRDS subsequently divest from fossil fuel firms. This finding suggests that increased transparency about insurers' climate change investment strategies incentivizes them to engage in environmentally responsible investing. We find additional evidence that supports this conclusion in the observation that divestment tends to be stronger when insurers' CRDS responses show that they actively incorporate climate change considerations into their investment strategies. Furthermore, we find that CRDS adoption has a greater impact on divestment efforts when insurers are subject to increased stakeholder attention to climate issues and when peer insurers are more environmentally responsible. We also demonstrate that CRDS-affected insurers shift their investments from high- to low-carbon-emissions firms. This finding further supports the notion that the public disclosure of insurers'

[23] For example, on 7 November 2024, the European Insurance and Occupational Pensions Authority released a report recommending additional capital requirements for fossil fuel assets on European insurers' balance sheets to address these assets' high exposure to transition risks (see https://www.eiopa.europa.eu/eiopa-recommends-dedicated-prudential-treatment-insurers-fossil-fuel-assets-cushion-against-2024-11-07_en).

climate change investment strategies encourages decarbonization. Finally, we show that the CRDS mandate reduces insurers' investment returns, particularly for those treatment insurers that divest after adoption.

Overall, our study offers fresh insight into the consequences of mandated climate risk disclosure by showing that investors' disclosure of how climate change impacts their investment plans can affect their fossil-fuel-firm investments. Studying the broad research question of how publicly available and mandated climate risk disclosures can influence the disclosing parties' actions is particularly relevant to the insurance industry. However, as institutional investors, insurers possess distinct characteristics that constrain our findings' generalizability to other institutional investors, such as mutual funds. Another constraint commonly faced by studies such as ours is the unique nature of individual disclosure mandates. The findings in the CRDS setting may not apply to other mandated climate risk disclosure settings. Nevertheless, our analysis will be useful for policymakers considering the potential implications of such mandates. Future research should consider the implications of newly mandated climate risk disclosures as they evolve.

References

Ahmed, A. S., Li, Y., & Xu, N. (2020). Tick size and financial reporting quality in small-cap firms: Evidence from a natural experiment. *Journal of Accounting Research*, *58*(4), 869–914.

Baik, B., Even-Tov, O., Han, R., & Park, D. (2024). The real effects of supply chain transparency regulation: Evidence from Section 1502 of the Dodd–Frank Act. *Journal of Accounting Research*, *62*(2), 551–587.

Beck, T. N., & Baumgart, E. (2025). From policy to practice: Unpacking ESG expectations of insurance customers. Available at https://www.wavestone.com/en/insight/esg-expectations-insurance-customers-journey/.

Becker, B., & Ivashina, V. (2015). Reaching for yield in the bond market. *Journal of Finance*, *70*(5), 1863–1902.

Becker, B., Opp, M. M., & Saidi, F. (2022). Regulatory forbearance in the U.S. insurance industry: The effects of removing capital requirements for an asset class. *Review of Financial Studies*, *35*(12), 5438–5482.

Beyene, W., Delis, M., & Ongena, S. (2022). Financial institutions' exposure to fossil fuel assets. Available at https://www.europarl.europa.eu/RegData/etudes/STUD/2022/699532/IPOL_STU(2022)699532_EN.pdf.

BlackRock. (2024). Climate-related risks and the low-carbon transition. Available at https://www.blackrock.com/corporate/literature/publication/blk-commentary-climate-risk-and-energy-transition.pdf#:~:text=BlackRock%20applies%20a%20long%2Dterm%20lens%20to%20assessing,among%20other%20things%2C%20toward%20a%20low%2Dcarbon%20world.

Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics*, *142*(2), 517–549.

Bonetti, P., Leuz, C., & Michelon. G. (2024). Internalizing externalities through public pressure: Transparency regulation for fracking and water quality. Available at SSRN 4959265.

California Department of Insurance (CDI). (n.d.). NAIC climate risk disclosure survey. Available at http://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ClimateSurvey/.

California Department of Insurance (CDI). (2016). California Insurance Commissioner Dave Jones calls for insurance industry divestment from coal. Available at https://www.insurance.ca.gov/0400-news/0100-press-releases/archives/statement010-16.cfm.

Campbell, J. Y., & Taksler, G. B. (2003). Equity volatility and corporate bond yields. *Journal of Finance*, *58*(6), 2321–2350.

Cao, J., Liang, H., & Zhan, X. (2019). Peer effects of corporate social responsibility. *Management Science*, *65*(12), 5487–5503.

Cengiz, D., Dube, A., Lindner, A., & Zipperer, B. (2019). The effect of minimum wages on low-wage jobs. *Quarterly Journal of Economics*, *134*(3), 1405–1454.

Chen, X., Higgins, E., Xia, H., & Zou, H. (2020). Do financial regulations shape the functioning of financial institutions' risk management in asset-backed securities investment? *Review of Financial Studies*, *33*(6), 2506–2553.

Chen, X., Sun, Z., Yao, T., & Yu, T. (2020). Does operating risk affect portfolio risk? Evidence from insurers' securities holding. *Journal of Corporate Finance*, *62*, 101579.

Chen, Y. C., Hung, M., & Wang, Y. (2018). The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China. *Journal of Accounting and Economics*, *65*(1), 169–190.

Chen, Y., Ng, J., Ofosu, E., & Yang, X. (2024). Tick size and earnings guidance in small-cap firms: Evidence from the SEC's tick size pilot program. *Management Science*, *70*(8), 5386–5407.

Chow, T., Fan, Z., Huang, L., Li, O. Z., & Li, S. (2023). Reciprocity in corporate tax compliance—Evidence from ozone pollution. *Journal of Accounting Research*, *61*(5), 1425–1477.

Christensen, H. B., Floyd, E., Liu, L. Y., & Maffett, M. (2017). The real effects of mandated information on social responsibility in financial reports: Evidence from mine-safety records. *Journal of Accounting and Economics*, *64*(2-3), 284–304.

Cohen, S., Kadach, I., & Ormazabal, G. (2023). Institutional investors, climate disclosure, and carbon emissions. *Journal of Accounting and Economics*, *76*(2-3), 101640.

Dai, J., Ormazabal, G., Penalva F., & Raney R. (2025). Mandatory investor disclosure, sustainability commitments, and portfolio decarbonization. *Journal of Accounting and Economics*. https://doi.org/10.1016/j.jacceco.2025.101817.

Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, *54*(1), 64–87.

Deloitte Insights. (2022). MetLife's Jon Richter on why a sustainability focus is essential in insurance. Available at https://www2.deloitte.com/us/en/insights/multimedia/podcasts/esg-for-insurance-companies.html.

El Ghoul, S., & Karoui, A. (2017). Does corporate social responsibility affect mutual fund performance and flows? *Journal of Banking and Finance*, *77*, 53–63.

Ellul, A., Jotikasthira, C., & Lundblad, C. T. (2011). Regulatory pressure and fire sales in the corporate bond market. *Journal of Financial Economics*, *101*(3), 596–620.

Ellul, A., Jotikasthira, C., Lundblad, C. T., & Wang, Y. (2015). Is historical cost accounting a panacea? Market stress, incentive distortions, and gains trading. *Journal of Finance*, *70*(6), 2489–2538.

Fan, Z., Guo, J., Ng, J., & Zhang, X. (2025). Investment portfolio management to meet or beat earnings expectations. *Review of Accounting Studies*, *30*(2), 2134–2183.

Fiechter, P., Hitz, J. M., & Lehmann, N. (2022). Real effects of a widespread CSR reporting mandate: Evidence from the European Union's CSR Directive. *Journal of Accounting Research*, *60*(4), 1499–1549.

Fonseca, R. (2025). Insurance companies retreated from California while investing billions in fossil fuels. Available at https://www.latimes.com/california/newsletter/2025-01-31/insurance-companies-fossil-fuel-industry-eaton-palisades-fire-essential-california.

Funk, C., & Kennedy, B. (2016). The politics of climate. Available at https://www.pewresearch.org/science/2016/10/04/the-politics-of-climate/.

Ge, S., & Weisbach, M. S. (2021). The role of financial conditions in portfolio choices: The case of insurers. *Journal of Financial Economics*, *142*(2), 803–830.

Gibson Brandon, R., Glossner, S., Krueger, P., Matos, P., & Steffen, T. (2022). Do responsible investors invest responsibly? *Review of Finance*, *26*(6), 1389–1432.

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*(2), 254–277.

Gormley, T. A., & Matsa, D. A. (2011). Growing out of trouble? Corporate responses to liability risk. *Review of Financial Studies*, *24*(8), 2781–2821.

Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *Review of Financial Studies*, *27*(2), 617–661.
Heath, D., Macciocchi, D., Michaely, R., & Ringgenberg, M. C. (2023). Does socially responsible investing change firm behavior? *Review of Finance*, *27*(6), 2057–2083.
Henke, H. M. (2016). The effect of social screening on bond mutual fund performance. *Journal of Banking and Finance*, *67*, 69–84.
Kaustia, M., & Yu, W. (2021). Greenwashing in mutual funds. Available at SSRN 3934004.
Kim, J. B., Wang, C., & Wu, F. (2023). The real effects of risk disclosures: Evidence from climate change reporting in 10-Ks. *Review of Accounting Studies*, *28*(4), 2271–2318.
Kim, S., & Yoon, A. (2023). Analyzing active fund managers' commitment to ESG: Evidence from the United Nations Principles for Responsible Investment. *Management Science*, *69*(2), 741–758.
Kölbel, J. F., Heeb, F., Paetzold, F., & Busch, T. (2020). Can sustainable investing save the world? Reviewing the mechanisms of investor impact. *Organization & Environment*, *33*(4), 554–574.
Kreidler, M. (2021). Re: US insurance regulator experience with insurer financial disclosure on climate change. Available at https://www.sec.gov/comments/climate-disclosure/cll12-8916247-244993.pdf.
Krueger, P., Sautner, Z., Tang, D. Y., & Zhong, R. (2024). The effects of mandatory ESG disclosure around the world. *Journal of Accounting Research*, *62*(5), 1795–1847.
Lai, G. C., & Limpaphayom, P. (2003). Organizational structure and performance: Evidence from the nonlife insurance industry in Japan. *Journal of Risk and Insurance*, *70*(4), 735–757.
Liang, H., Sun, L., & Teo, M. (2021). Greenwashing: Evidence from hedge funds. Available at https://ink.library.smu.edu.sg/lkcsb_research/6737.
Liu, E. (2023). Fossil fuel insurance is turning into a climate change fight. What's at stake. Available at https://www.barrons.com/articles/fossil-fuel-insurance-is-turning-into-a-climate-change-fight-whats-at-stake-a3e09ce5.
McCright, A. M., & Dunlap, R. E. (2011). The politicization of climate change and polarization in the American public's views of global warming, 2001–2010. *Sociological Quarterly*, *52*(2), 155–194.
Miller, G. S., Stockbridge, D. R., & Williams, C. D. (2025). Mandatory disclosure of investors' fossil fuel holdings. *Journal of Accounting and Economics*, 101829.
Naturesave. (n.d.). Campaign for insurance divestment. Available at https://naturesave.co.uk/campaign-for-insurance-divestment/.
Naujoks, H., Schwedel, A., & Brettel, T. (2023). Customer behavior and loyalty in insurance: Global edition 2023. Available at https://www.bain.com/insights/customer-behavior-and-loyalty-in-insurance-global-edition-2023/.
Nofsinger, J., & Varma, A. (2014). Socially responsible funds and market crises. *Journal of Banking and Finance*, *48*, 180–193.
Ozdagli, A., & Wei, V. (2024). The effect of climate regulatory actions on credit allocation: Evidence from the insurance industry. Federal Reserve Bank of Dallas (Working Paper).
Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, *142*(2), 550–571.
Plantinga, A., & Scholtens, B. (2021). The financial impact of fossil fuel divestment. *Climate Policy*, *21*(1), 107–119.
Rauter, T. (2020). The effect of mandatory extraction payment disclosures on corporate payment and investment policies abroad. *Journal of Accounting Research*, *58*(5), 1075–1116.

Renneboog, L., Ter Horst, J., & Zhang, C. (2008). The price of ethics and stakeholder governance: The performance of socially responsible mutual funds. *Journal of Corporate Finance*, *14*(3), 302–322.

Ross, H. (2021). Climate risk for insurers: Why the industry needs to act now to address climate risk on both sides of the balance sheet. Available at https://www.spglobal.com/esg/insights/climate-risks-for-insurers-why-the-industry-needs-to-act-now-to-address-climate-risk-on-both-sides-of-the-balance-sheet.

Roychowdhury, S., Shroff, N., & Verdi, R. S. (2019). The effects of financial reporting and disclosure on corporate investment: A review. *Journal of Accounting and Economics*, *68*(2-3), 101246.

Shalender, K., Singla, B., & Sharma. S. (2023). Adoption of ESG by the insurance industry: Conceptual framework and future recommendations. In K. Sood, S. Grima, P. Young, E. Ozen, & B. Balusamy (Eds.), *The Impact of Climate Change and Sustainability Standards on the Insurance Market*. Wiley.

Tomar, S. (2023). Greenhouse gas disclosure and emissions benchmarking. *Journal of Accounting Research*, *61*(2), 451–492.

U.S. Chamber of Commerce. (2019). The role of insurance investments in the U.S. economy. Available at https://www.uschamber.com/assets/documents/CCMC_InsurancePaper_March2019.pdf.

Wang, L. L. (2023). Transmission effects of ESG disclosure regulations through bank lending networks. *Journal of Accounting Research*, *61*(3), 935–978.

Wong, M., & Carelus, J. B. (2021). U.S. insurance industry's cash and invested assets continue to grow amid the pandemic. Available at https://content.naic.org/sites/default/files/capital-markets-asset-mix-ye-2020-final.pdf.

Ye, M., Zheng, M. Y., & Zhu, W. (2023). The effect of tick size on managerial learning from stock prices. *Journal of Accounting and Economics*, *75*(1), 101515.

Zhang, X. (2025). Transparency and divestment: The impact of a public database about insurers' carbon-intensive investments on their portfolio choices. Available at SSRN 5559081.

Appendix A: Background on the CRDS

Panel A: CRDS Questions

No.	Question
1	Does the company have a plan to assess, reduce or mitigate its emissions in its operations or organizations? If yes, please summarize.
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?
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.
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.
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.
6	Summarize steps the company has taken to encourage policyholders to reduce the losses caused by climate change-influenced events.
7	Discuss steps, if any, the company has taken to engage key constituencies on the topic of climate change.
8	Describe actions your company is taking to manage the risks climate change poses to your business including, in general terms, the use of computer modeling.

Panel B: CRDS Adoption Pattern

Year	Participating States	Nationwide Direct Premiums Requirement	No. of Responses from Insurers
2010	Approximately two dozen states surveyed their insurers, and the data was aggregated	> $500M	
2011	California	> $300M	
2012*	California, New York, and Washington state	> $300M	690
2013	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,070
2014	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,187
2015	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,210
2016	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,193
2017	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,174
2018	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,162
2019	California, Connecticut, Minnesota, New Mexico, New York, and Washington state	> $100M	1,257

* In 2012, California, New York, and Washington state began administering the survey to all insurance companies licensed in these states that write at least $300 million in direct premiums. In that year, the survey also became mandatory and the results were made publicly available on the website of the California Department of Insurance. In the last column, we tabulate the number of responses on this website from 2012 onwards.

Panel C: 2019 CRDS Notice from the CDI

RICARDO LARA
CALIFORNIA INSURANCE COMMISSIONER

July 19, 2019

CLIMATE RISK DISCLOSURE SURVEY
REPORTING YEAR 2018

TO: Licensed Insurers in the State of California

In cooperation with the Connecticut Insurance Department, the Minnesota Department of Commerce, the New Mexico Office of Superintendent of Insurance, the New York Department of Financial Services, and the Washington State Office of the Insurance Commissioner, the California Department of Insurance (the "Department") is conducting the Climate Risk Disclosure Survey for Reporting Year 2018. The questions contained in the survey continue to be the same questions that were adopted by the National Association of Insurance Commissioners in 2009 and 2010. Survey responses for the current and prior years are available to the public and can be found on the Departments' website.

All insurers who are licensed in the State of California and who collected direct written premium amounts of more than 100 million dollars nationwide during 2018 must respond to the survey for California; except for insurers required to respond to the survey by Connecticut, New Mexico, Minnesota, New York, or Washington. Insurers within the same group whose policies and practices are the same and whose answers would not be materially different from each other may submit uniform group responses.

For 2019, we would like to highlight that the responses to the eight NAIC survey questions have substantial overlap with the recent guidelines and recommendations developed by the Task Force on Climate-related Financial Disclosures (TCFD), which were approved by the G-20 Finance Ministers and created by an industry-led task force. The TCFD Guidelines are endorsed by many institutions and supported by the IAIS (International Association of Insurance Supervisors).

Insurers that respond to the NAIC annual survey are already largely in alignment with the TCFD recommendations, since they report on climate-related risks and opportunities, innovative products, such as premium reductions for risk mitigation efforts, green building insurance, renewable energy, natural infrastructure, or others. The TCFD recommendations also call on respondents to undertake a "scenario analysis" on effects on the company under various climate outcomes.

This year, we are including in our letter to you the link to the TCFD recommendations. We encourage you to refer to this information as you develop this year's responses to the eight NAIC survey questions. By doing so, U.S. insurers will assume a leadership position in applying this new international standard.

https://www.fsb-tcfd.org/publications/final-recommendations-report/

The completed survey is due **August 31, 2019**. Please register and submit your survey responses to the Department by going to the survey registration webpage at the following link: https://interactive.web.insurance.ca.gov/apex_extprd/f?p=416:1. Additional information concerning the survey is available on the survey registration webpage. Substantive and technical questions can be directed to: ClimateRiskSurvey@insurance.ca.gov.

Sincerely,

RICARDO LARA,
Insurance Commissioner

Attachment: Survey Questions and Guidelines

Panel D: Zurich American Insurance Company's Responses to CRDS Question 5 from 2013 to 2019[24]

2013 Response:

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 achieving these goals, Zurich is committed to its Responsible Investment practices. A position statement in this regard can be found at the following Internet address:

http://www.zurich.com/internet/main/sitecollectiondocuments/corporate-responsibility/zurich-responsible-investment-position-statment.pdf

In support of these goals, Zurich also became a signatory of the Principles for Responsible Investment (PRI) in 2012. Additional information regarding the PRI Initiative can be found at the following Internet address:

http://www.unpri.org/

In general, Zurich's Investment Policy is designed to take careful consideration of several factors, including but not limited to
• the economic risk and reward tradeoff of an investment, including any risks and opportunities related to environmental, social and governance 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 applicable rules and regulations;
• 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's asset managers are expected to effectively and proactively integrate environmental, social and governance (ESG) factors in the investment process where relevant.

2014 Response:

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
• 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 applicable rules and regulations;
• 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, as part of its impact investing program, Zurich has committed to invest up to USD 2bn in green bonds 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:

http://www.zurich.com/en/corporate-responsibility/responsible-investment

2015 Response:

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
• 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 applicable rules and regulations;
• 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, as part of its impact investing program, Zurich has committed to invest up to USD 2bn in green bonds 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:

http://www.zurich.com/en/corporate-responsibility/responsible-investment

[24] These responses are obtained from the CDI website (https://www.insurance.ca.gov/0250-insurers/0300-insurers/0100-applications/ClimateSurvey). In all years, the company responded "yes" to both Questions 5a and 5b. The written response to Question 5 is shown here.

2016 Response:

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
• 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 applicable rules and regulations;
• 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, as part of its impact investing program, Zurich has committed to invest up to USD 2bn in green bonds 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:

http://www.zurich.com/en/corporate-responsibility/responsible-investment

2017 Response:

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
• 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 applicable rules and regulations;
• 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 2016:

• A comprehensive assessment of exposure to physical climate risk for real estate and infrastructure investments
• In-depth analysis of portfolio carbon footprint
• Formulation of macroeconomic climate risk scenarios
• Development of a bespoke climate risk assessment methodology for equities and corporate bonds encompassing both climate related physical and transition risks

As part of its impact investing program, Zurich has also invested (close to/over) USD 2bn in green bonds 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:

http://www.zurich.com/en/corporate-responsibility/responsible-investment

2018 Response:

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
• 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 applicable rules and regulations;
• 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 2017:

• 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
• Conducted an in-depth analysis of portfolio carbon footprint
• Updated our macroeconomic climate risk scenarios
• Actively voted on shareholder resolutions regarding climate change disclosures or actions of investee companies
• Published Zurich's climate change investment strategy
• Committed to divest equity and 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 by the end of 2018

As part of its impact investing program, Zurich has also invested (/over) USD 2bn in green bonds 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

2019 Response:

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

Appendix B: Variable Definitions and Sources

Variable	Definition	Source
Variables used in Table 3		
Inv_FFF	The insurer's corporate investment intensity in fossil fuel firms based on the portion of the fair value of its investment portfolio that is invested in such firms (SIC codes 1200–1399).	NAIC database CRSP/Compustat Merged database
CRDS	Dummy variable that equals one for the first year of CRDS adoption and all subsequent years, zero otherwise.	NAIC database CDI website
CRDS_X	Dummy variable that equals one for CRDS-affected insurer observations in year *X*, where *X* = *t-3*, *t-2*, *t-1*, *t*, *t+1*, *t+2*, *t+3*, *t+4*, *t+5*, and *t+6+*, and zero for other observations. Year *t+6+* refers to the sixth year after CRDS adoption and all subsequent years.	NAIC database CDI website
Size	The natural logarithm of the total admitted assets. The total admitted assets are those included in the insurer's financial statements based on the NAIC's Statutory Accounting Principles. This is a narrower definition of assets than that in U.S. GAAP. Assets that cannot be readily converted into cash to pay for liabilities, such as most intangibles, office furniture, and fixtures, are excluded.	NAIC database
Leverage	Total liabilities divided by the total admitted assets.	NAIC database
Mutual	Dummy variable that equals one when the insurer's legal form is a mutual, and zero otherwise.	NAIC database
Group	Dummy variable that equals one when the insurer is affiliated with a group, and zero otherwise.	NAIC database
InvRisk	Riskiness of the insurer's investment portfolio, which is the ratio of the risk-weighted assets to the total invested assets. The NAIC provides the risk weights; riskier assets have higher risk weights. To compute the risk-weighted assets, weights are multiplied by the amounts of each type of asset in which the insurer invests.	NAIC database
Reinsurance	Percentage of gross premiums written that is ceded to reinsurers.	NAIC database
Additional variable used in Table 4		
CRDS_Stacked	Dummy variable that equals one for the first year of a cohort's CRDS adoption and all subsequent years, zero otherwise. A cohort includes all insurer-years from the three years before the adoption year to the three years after it.	NAIC database CDI website
Additional variables used in Table 5		
Q5_Yes	Dummy variable that equals one when the insurer responds "yes" to CRDS Question 5a (i.e., "has the company considered the impact of climate change on its investment portfolio?") or Question 5b (i.e., "has it altered its investment strategy in response to these considerations?"), and zero otherwise.	CDI website
Q5_Words	The number of words in the insurer's response to CRDS Question 5.	CDI website

Log_Q5_Words	The natural logarithm of one plus the number of words in the insurer's response to CRDS Question 5.	CDI website
Additional variables used in Table 6		
Democratic_State	Dummy variable that equals one when, in the year before CRDS adoption, the insurer's underwriting business is concentrated in a Democratic state, and zero otherwise. A Democratic state is defined as a state where the Democratic party won the most recent gubernatorial election.	NAIC database Wikipedia
CRDS_State	Dummy variable that equals one when, in the year before CRDS adoption, the insurer's underwriting business is concentrated in a CRDS-adopting state, and zero otherwise.	NAIC database CDI website
Public_Insurer	Dummy variable that equals one when, in the year before CRDS adoption, the insurer's ultimate parent is a public firm, and zero otherwise.	NAIC database CRSP/Compustat Merged database
Additional variables used in Table 7		
Peer_Div_FFF	The percentage of the insurer's peers that divested from fossil fuel firms in the year before CRDS adoption. An insurer's peers are other insurers with the same headquarters state as the insurer.	NAIC database CRSP/Compustat Merged database
Peer_Q5_Yes	The percentage of the insurer's peers that respond "yes" to CRDS Question 5a (i.e., "has the company considered the impact of climate change on its investment portfolio?") or 5b (i.e., "has it altered its investment strategy in response to these considerations?"). An insurer's peers are other insurers with the same headquarters state as the insurer.	NAIC database CDI website
Low_InvEScore_Ref	Dummy variable that equals one when, in the year before CRDS adoption, the environmental sustainability of the insurer's corporate investments (constructed using data from the Refinitiv ESG database) is below the treatment sample median, and zero otherwise.	NAIC database Refinitiv ESG database
Low_InvEScore_MSCI	Dummy variable that equals one when, in the year before CRDS adoption, the environmental sustainability of the insurer's corporate investments (constructed using data from the MSCI ESG database) is below the treatment sample median, and zero otherwise.	NAIC database MSCI ESG database
Additional variables used in Table 8		
Inv_HighCarbon	The insurer's corporate investment intensity in high-carbon-emissions firms based on the portion of the fair value of its investment portfolio that is invested in such firms. We define a firm as having high carbon emissions if its estimated CO_2 and CO_2-equivalent emissions intensity ranks in the top half for the year, according to the Refinitiv ESG database.	NAIC database Refinitiv ESG database
Inv_LowCarbon	The insurer's corporate investment intensity in low-carbon-emissions firms based on the portion of the fair value of its investment portfolio that is invested in such firms. A low-carbon-emissions firm is defined as a firm with an estimated CO_2 and CO_2-equivalent emissions intensity that ranks in the bottom half per year, according to the Refinitiv ESG database.	NAIC database Refinitiv ESG database

Additional variables used in Table 9		
InvRet1	The insurer's investment income earned plus its realized and unrealized capital gains in year *t*, scaled by the insurer's cash and invested assets at the end of year *t*-1.	NAIC database
InvRet2	The insurer's investment income earned plus its realized and unrealized capital gains in year *t*, scaled by its invested assets at the end of year *t*-1.	NAIC database
Div_FFF_Dum	Dummy variable that equals one when the insurer's average corporate investment intensity in fossil fuel firms in the post-adoption period is below that in the pre-adoption period, and zero otherwise.	NAIC database CRSP/Compustat Merged database
NoDiv_FFF_Dum	Dummy variable that equals one when the insurer's average corporate investment intensity in fossil fuel firms in the post-adoption period equals or exceeds that in the pre-adoption period, and zero otherwise.	NAIC database CRSP/Compustat Merged database

Figure 1: Parallel Trend Graph for Insurers' Fossil-Fuel-Firm Investments

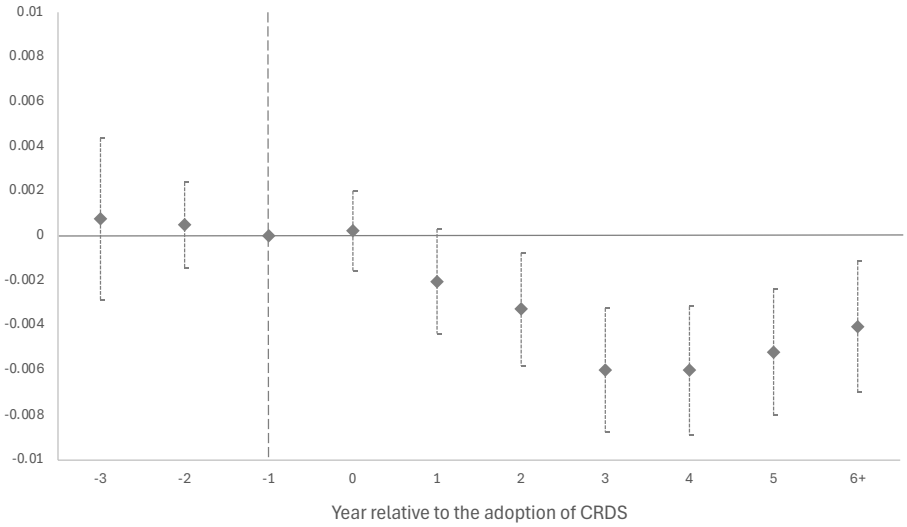
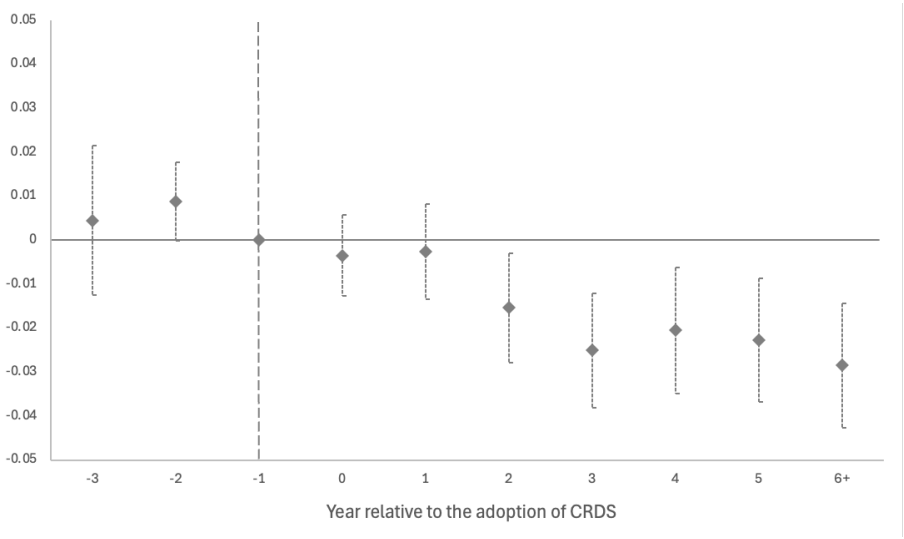


Figure 1 shows the coefficients that indicate the difference between the treatment and control insurers' fossil-fuel-firm investments (*Inv_FFF*) over time. We plot the coefficients on the time dummy variables relative to the CRDS adoption year. The year immediately preceding the CRDS adoption year serves as the benchmark, and the coefficient for this benchmark is set to zero. The coefficients are plotted using 90% confidence intervals based on robust standard errors clustered by insurer.

Figure 2: Parallel Trend Graphs for Insurers' Investments in High- and Low-Carbon-Emissions Firms

Dependent variable: *Inv_HighCarbon*



Dependent variable: *Inv_LowCarbon*

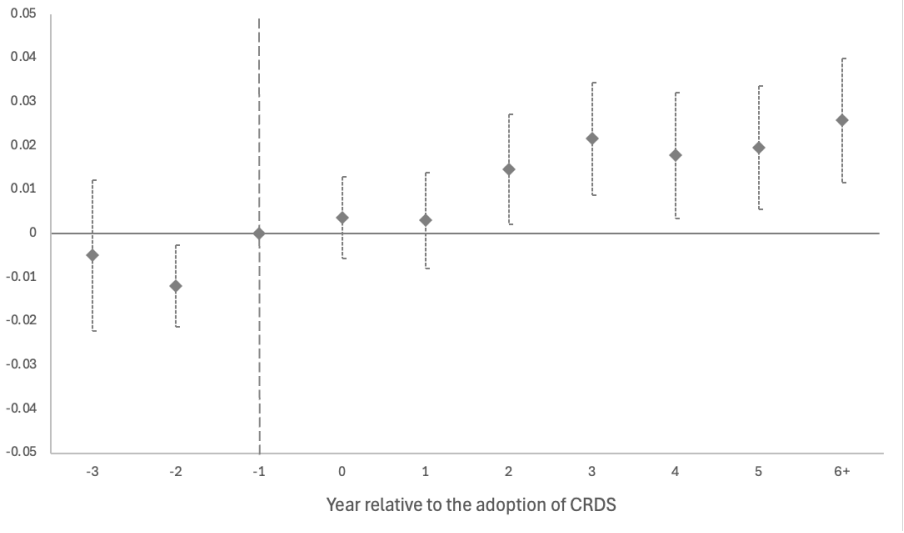


Figure 2 shows the coefficients that indicate the difference between the treatment and control insurers' high-carbon-emissions-firm investments (*Inv_HighCarbon*) and low-carbon-emissions-firm investments (*Inv_ LowCarbon*) over time. We plot the coefficients on the time dummy variables relative to the CRDS adoption year. The year immediately preceding the CRDS adoption year serves as the benchmark, and the coefficient for this benchmark is set to zero. The coefficients are plotted using 90% confidence intervals based on robust standard errors clustered by insurer.

Table 1: Sample Distribution

This table presents the sample distribution by year for the sample period.

Year	Treatment		Control		Full Sample	
	Freq.	Pct. (%)	Freq.	Pct. (%)	Freq.	Pct. (%)
2010	647	9.81	1,485	9.13	2,132	9.33
2011	657	9.96	1,538	9.46	2,195	9.60
2012	662	10.03	1,567	9.64	2,229	9.75
2013	662	10.03	1,600	9.84	2,262	9.90
2014	659	9.99	1,643	10.10	2,302	10.07
2015	664	10.07	1,676	10.31	2,340	10.24
2016	661	10.02	1,694	10.42	2,355	10.30
2017	665	10.08	1,704	10.48	2,369	10.36
2018	668	10.13	1,702	10.47	2,370	10.37
2019	652	9.88	1,653	10.16	2,305	10.08
Total	6,597	100.00	16,262	100.00	22,859	100.00

Table 2: Summary Statistics

This table presents the summary statistics for the variables used in the baseline regression. The total number of observations is 22,859. See Appendix B for the variable definitions.

Variable	Mean	SD	P25	Median	P75
Inv_FFF	0.029	0.035	0.000	0.020	0.046
Size	18.905	2.183	17.315	18.656	20.154
Leverage	0.558	0.247	0.409	0.585	0.727
Mutual	0.285	0.451	0.000	0.000	1.000
Group	0.739	0.439	0.000	1.000	1.000
InvRisk	0.021	0.025	0.003	0.013	0.031
Reinsurance	0.422	0.361	0.091	0.327	0.747

Table 3: Effect of CRDS Adoption on Insurers' Fossil-Fuel-Firm Investments

This table presents the regression results of the effect of CRDS adoption on insurers' fossil-fuel-firm investments. The dependent variable is the insurer's fossil-fuel-firm investments (*Inv_FFF*), defined as the insurer's corporate investment intensity in fossil fuel firms based on the portion of the fair value of the insurer's investment portfolio that is invested in such firms (SIC codes 1200–1399). The independent variable of interest, *CRDS*, is a dummy variable that equals one for the first year of CRDS adoption and all subsequent years, zero otherwise. Column (1) reports the results of the regression that controls for insurer and year fixed effects only. Column (2) reports the baseline regression results. Column (3) reports the results of the parallel trend test. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Dep. Var. =	*Inv_FFF*		
	(1)	(2)	(3)
	Controlling FEs only	Baseline regression	Parallel trend
CRDS	-0.0042***	-0.0038***	
	(-3.32)	(-3.02)	
CRDS_t-3			0.0008
			(0.35)
CRDS_t-2			0.0005
			(0.43)
CRDS_t			0.0002
			(0.22)
CRDS_t+1			-0.0020
			(-1.43)
CRDS_t+2			-0.0033**
			(-2.12)
CRDS_t+3			-0.0060***
			(-3.55)
CRDS_t+4			-0.0060***
			(-3.43)
CRDS_t+5			-0.0052***
			(-3.02)
CRDS_t+6+			-0.0040**
			(-2.27)
Size		0.0038***	0.0037***
		(3.66)	(3.57)
Leverage		-0.0013	-0.0012
		(-0.33)	(-0.32)
Mutual		-0.0029	-0.0028
		(-0.65)	(-0.63)
Group		-0.0013	-0.0014
		(-0.63)	(-0.70)
InvRisk		0.1224***	0.1201***
		(3.53)	(3.44)
Reinsurance		-0.0026	-0.0027
		(-1.36)	(-1.41)
Insurer FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	22,859	22,859	22,859
Adjusted R^2	0.471	0.474	0.474

Table 4: Robustness Tests

This table presents the results of the robustness tests. Panel A shows the results of the Goodman-Bacon diagnostic decomposition. Panel B shows the estimates of the stacked DID. Panel C shows the results of the tests using alternative regression specifications in which we cluster standard errors by state and include insurer and state-year fixed effects. Panel D shows the results of the tests using alternative samples, which include narrow bandwidth samples, a sample that excludes insurers licensed in California, a sample that excludes the years after 2016, and a sample that includes the years 2008 and 2009. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Panel A: Goodman-Bacon Diagnostic Decomposition

DID Comparison	Weight	Average DID Estimates
Earlier treatment vs. Later control	0.011	0.002
Later treatment vs. Earlier control	0.036	0.004
Treatment vs. Never treated	0.946	-0.005
Treatment vs. Already treated	0.008	0.001

Panel B: Stacked DID

Dep. Var. =	*Inv_FFF*	
	(1)	(2)
CRDS_Stacked	-0.0038***	-0.0039***
	(-3.16)	(-3.26)
Controls	No	Yes
Insurer-cohort FE	Yes	Yes
Year-cohort FE	Yes	Yes
N	26,736	26,736
Adjusted R^2	0.531	0.534

Panel C: Alternative Regression Specifications

Dep. Var. =	*Inv_FFF*	
	(1) Clustering by state	(2) Including insurer and state-year fixed effects
CRDS	-0.0038**	-0.0038***
	(-2.64)	(-2.77)
Controls	Yes	Yes
Insurer FE	Yes	Yes
Year FE	Yes	No
State-year FE	No	Yes
N	22,859	22,855
Adjusted R^2	0.474	0.481

Panel D: Alternative Samples

Dep. Var. =	*Inv_FFF*				
	(1) Narrow bandwidth estimation [0, 300M]	(2) Narrow bandwidth estimation [0, 200M]	(3) Excluding California-licensed insurers	(4) Excluding the years after 2016	(5) Including the years 2008 and 2009
CRDS	-0.0049**	-0.0071**	-0.0062**	-0.0033***	-0.0038***
	(-2.36)	(-2.54)	(-2.71)	(-2.73)	(-3.09)
Controls	Yes	Yes	Yes	Yes	Yes
Insurer FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
N	17,840	16,295	12,397	13,395	26,555
Adjusted R^2	0.447	0.443	0.424	0.575	0.443

Table 5: Tests of the Transparency Mechanism

This table presents the results of the tests of the transparency mechanism that links the CRDS to divestment. The tests examine the moderating effects of insurers' responses to CRDS Question 5. Panel A shows the yearly mean of the variables related to insurers' responses. *Q5_Yes* is a dummy variable that equals one when the insurer responds "yes" to Question 5a (i.e., "has the company considered the impact of climate change on its investment portfolio?") or 5b (i.e., "has it altered its investment strategy in response to these considerations?"), and zero otherwise. *Q5_Words* is the number of words in the insurer's response to Question 5. Panel B presents the regression results. *Log_Q5_Words* is the natural logarithm of one plus the number of words in the insurer's response to Question 5. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Panel A: Yearly Mean for the Variables Related to Insurers' Responses to CRDS Question 5

Variable	2013	2014	2015	2016	2017	2018	2019
Q5_Yes	0.688	0.763	0.754	0.774	0.784	0.800	0.814
Q5_Words	166	144	153	158.	169	260	285

Panel B: Moderating Effects of Insurers' Responses to CRDS Question 5

Dep. Var. =	*Inv_FFF*	
	(1) "Yes" or "No" response	(2) Number of words in the response
CRDS × *Q5_Yes*	-0.0026**	
	(-2.06)	
CRDS × *Log_Q5_Words*		-0.0006**
		(-2.24)
CRDS	-0.0022*	-0.0017
	(-1.72)	(-1.22)
Size	0.0038***	0.0038***
	(3.64)	(3.66)
Leverage	-0.0012	-0.0012
	(-0.32)	(-0.32)
Mutual	-0.0029	-0.0029
	(-0.64)	(-0.63)
Group	-0.0013	-0.0014
	(-0.66)	(-0.68)
InvRisk	0.1221***	0.1220***
	(3.51)	(3.51)
Reinsurance	-0.0026	-0.0026
	(-1.34)	(-1.34)
Insurer FE	Yes	Yes
Year FE	Yes	Yes
N	22,859	22,859
Adjusted R^2	0.474	0.474

Table 6: Heterogeneity Analysis Based on Stakeholder Attention to Climate Issues

This table presents the results of the heterogeneity analysis based on stakeholders' attention to climate issues. *Democratic_State* is a dummy variable that equals one when, in the year before CRDS adoption, the insurer's underwriting business is concentrated in a Democratic state and zero otherwise. We define a Democratic state as a state where the Democratic party won the most recent gubernatorial election. *CRDS_State* is a dummy variable that equals one when, in the year before CRDS adoption, the insurer's underwriting business is concentrated in a CRDS-adopting state, and zero otherwise. *Public_Insurer* is a dummy variable that equals one when, in the year before CRDS adoption, the insurer's ultimate parent is a public firm and zero otherwise. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Dep. Var. =	*Inv_FFF*		
	(1)	(2)	(3)
Heterogeneity =	*Democratic_State*	*CRDS_State*	*Public_Insurer*
CRDS × *Heterogeneity*	-0.0059**	-0.0058*	-0.0050**
	(-2.18)	(-1.94)	(-2.39)
CRDS	-0.0030**	-0.0031**	-0.0013
	(-2.18)	(-2.34)	(-0.78)
Size	0.0038***	0.0038***	0.0038***
	(3.70)	(3.68)	(3.62)
Leverage	-0.0013	-0.0012	-0.0009
	(-0.33)	(-0.33)	(-0.24)
Mutual	-0.0028	-0.0030	-0.0030
	(-0.63)	(-0.66)	(-0.66)
Group	-0.0013	-0.0012	-0.0014
	(-0.63)	(-0.63)	(-0.69)
InvRisk	0.1222***	0.1225***	0.1225***
	(3.52)	(3.53)	(3.53)
Reinsurance	-0.0025	-0.0025	-0.0025
	(-1.33)	(-1.33)	(-1.31)
Insurer FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	22,859	22,859	22,859
Adjusted R^2	0.474	0.474	0.474

Table 7: Heterogeneity Analysis Based on Peer Benchmarking

This table presents the results of the heterogeneity analysis based on peer benchmarking. An insurer's peers are other insurers with the same headquarters state as the insurer. *Peer_Div_FFF* is the percentage of the insurer's peers that divested from fossil fuel firms in the year before CRDS adoption. *Peer_Q5_Yes* is the percentage of the insurer's peers that respond "yes" to CRDS Question 5a (i.e., "has the company considered the impact of climate change on its investment portfolio?") or 5b (i.e., "has it altered its investment strategy in response to these considerations?"). *Low_InvEScore_Ref* is a dummy variable that equals one when, in the year before CRDS adoption, the environmental sustainability of the insurer's corporate investments, which we construct using data from the Refinitiv ESG database, is below the treatment sample median, and zero otherwise. *Low_InvEScore_MSCI* is a dummy variable that equals one when, in the year before CRDS adoption, the environmental sustainability of the insurer's corporate investments, which we construct using data from the MSCI ESG database, is below the treatment sample median and zero otherwise. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Dep. Var. =	*Inv_FFF*			
	(1)	(2)	(3)	(4)
Heterogeneity =	*Peer_Div_FFF*	*Peer_Q5_Yes*	*Low_InvEScore_Ref*	*Low_InvEScore_MSCI*
CRDS × Heterogeneity	-0.0208*	-0.0107**	-0.0085***	-0.0055***
	(-1.75)	(-2.37)	(-4.10)	(-2.61)
CRDS	0.0018	-0.0012	0.0004	-0.0011
	(0.50)	(-0.74)	(0.29)	(-0.67)
Size	0.0038***	0.0037***	0.0039***	0.0039***
	(3.65)	(3.57)	(3.77)	(3.79)
Leverage	-0.0011	-0.0013	-0.0012	-0.0012
	(-0.30)	(-0.34)	(-0.32)	(-0.33)
Mutual	-0.0030	-0.0029	-0.0031	-0.0032
	(-0.66)	(-0.64)	(-0.70)	(-0.72)
Group	-0.0013	-0.0013	-0.0014	-0.0013
	(-0.63)	(-0.66)	(-0.69)	(-0.67)
InvRisk	0.1211***	0.1208***	0.1211***	0.1232***
	(3.49)	(3.48)	(3.49)	(3.55)
Reinsurance	-0.0026	-0.0026	-0.0026	-0.0026
	(-1.35)	(-1.37)	(-1.34)	(-1.35)
Insurer FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	22,859	22,859	22,859	22,859
Adjusted R^2	0.474	0.474	0.475	0.474

Table 8: Effect of CRDS Adoption on Insurers' Investments in High- and Low-Carbon-Emissions Firms

This table presents the results of the effect of CRDS adoption on insurers' investments in high- and low-carbon-emissions firms. In Column (1), the dependent variable is *Inv_HighCarbon*, defined as the insurer's corporate investment intensity in high-carbon-emissions firms based on the portion of the fair value of its investment portfolio that is invested in such firms. We define a firm as having high carbon emissions if its estimated CO_2 and CO_2-equivalent emissions intensity ranks in the top half for the year using the Refinitiv ESG database. In Column (2), we define the dependent variable, *Inv_LowCarbon*, as the insurer's corporate investment intensity in low-carbon-emissions firms based on the portion of the fair value of its investment portfolio that is invested in such firms. A low-carbon-emissions firm is defined as a firm with an estimated CO_2 and CO_2-equivalent emissions intensity that ranks in the bottom half per year, according to the Refinitiv ESG database. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Dep. Var. =	*Inv_HighCarbon*	*Inv_LowCarbon*
	(1)	(2)
CRDS	-0.0206***	0.0202***
	(-3.23)	(3.19)
Size	0.0136**	-0.0141**
	(2.24)	(-2.37)
Leverage	-0.0167	0.0186
	(-0.76)	(0.84)
Mutual	0.0511*	-0.0514*
	(1.71)	(-1.72)
Group	0.0199*	-0.0228**
	(1.95)	(-2.25)
InvRisk	0.1961	-0.2091
	(0.94)	(-1.01)
Reinsurance	-0.0205*	0.0206*
	(-1.91)	(1.90)
Insurer FE	Yes	Yes
Year FE	Yes	Yes
N	22,751	22,751
Adjusted R^2	0.558	0.550

Table 9: Effect of CRDS Adoption on Insurers' Investment Returns

This table presents the results of the effect of CRDS adoption on insurers' investment returns. In Columns (1) and (2), the dependent variable is *InvRet1*, defined as the insurer's investment income earned plus its realized and unrealized capital gains in year *t*, scaled by its cash and invested assets at the end of year *t*-1. In Columns (3) and (4), the dependent variable is *InvRet2*, defined as the insurer's investment income earned plus its realized and unrealized capital gains in year *t*, scaled by its invested assets at the end of year *t*-1. Columns (1) and (3) report the results about the effect of CRDS adoption on insurers' investment returns. Columns (2) and (4) report the results about how insurers' divestment or non-divestment impacts CRDS adoption's effect on insurers' investment returns. *Div_FFF_Dum* (*NoDiv_FFF_Dum*) is a dummy variable that equals one when the insurer's average corporate investment intensity in fossil fuel firms in the post-adoption period is below (not below) that in the pre-adoption period, and zero otherwise. *t*-statistics are reported based on robust standard errors clustered by insurer. *, **, and *** denote statistical significance at the 1%, 5%, and 10% levels, respectively. See Appendix B for the variable definitions.

Dep. Var. =	*InvRet1*		*InvRet2*	
	(1)	(2)	(3)	(4)
CRDS × *Div_FFF_Dum*		-0.0027***		-0.0027***
		(-3.03)		(-2.89)
CRDS × *NoDiv_FFF_Dum*		-0.0008		-0.0002
		(-0.79)		(-0.19)
CRDS	-0.0018**		-0.0015**	
	(-2.48)		(-1.97)	
Size	0.0090***	0.0090***	0.0092***	0.0092***
	(10.13)	(10.08)	(9.57)	(9.52)
Leverage	-0.0161***	-0.0161***	-0.0156***	-0.0156***
	(-6.08)	(-6.08)	(-5.46)	(-5.47)
Mutual	-0.0013	-0.0013	-0.0018	-0.0018
	(-1.30)	(-1.27)	(-1.59)	(-1.55)
Group	0.0020	0.0020	0.0019	0.0019
	(1.36)	(1.36)	(1.18)	(1.19)
InvRisk	0.3657***	0.3655***	0.3890***	0.3888***
	(11.10)	(11.11)	(11.00)	(11.01)
Reinsurance	-0.0019	-0.0019	-0.0020	-0.0019
	(-1.24)	(-1.24)	(-1.19)	(-1.18)
Insurer FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	21,699	21,699	21,700	21,700
Adjusted R^2	0.424	0.424	0.404	0.404