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

Jiang Cheng*
Jia Guo#
Xiaohui (Fiona) Li#
Jeffrey Ng^
Nan Yang#

*Lingnan University, #Hong Kong Polytechnic University, ^Hong Kong University
2024 ASSA San Antonio
importance of climate risk in corporate decision-making

demand for information about climate risk

• Equity institutional investors (*Krueger, Sautner, and Starks 2020*);
• Banks and bondholders (*Seltzer, Starks, and Zhu 2022*);

Current practice: voluntary disclosure

• Lack of comparability and verifiability
Initiatives for mandatory climate-related disclosure

- **June 5, 2021**: G7’s appeal for mandatory climate-related disclosures (*John 2021*).
- **March 2022**: SEC’s proposal for mandated disclosure for U.S. public firms (*SEC 2022*).

- **June 14, 2021**: Mike Kreidler--the Insurance Commissioner of Washington--state in his letter to SEC:
  
  “...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*).
Research Question

U.S. National Association of Insurance Commissioners (NAIC)’ Adoption of Climate Risk Disclosure Survey (CRDS)

Mandatory climate risk disclosure by INSURERS

Whether & How

Environmental Friendliness by CORP. BOND INVESTEES
Institutional Background – the CRDS

- Starting in 2010, NAIC requires the largest insurers operating in the U.S. to respond to CRDS, about their approach to climate risk.
  - to help regulators, investors, and other stakeholders better understand how insurers are managing climate risks and opportunities

- 8 Qs about how insurers manage climate risk in their investment
  - Q2: Any climate change policy with respect to risk management and investment management?
  - Q5: Any consideration of the impact of climate change on its investment portfolios and any change of its investment strategy thus triggered?
  - Q7: How to engage its key constituencies on the topic of climate change?
Zurich American Insurance Company (Response to Q5):

“In 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;
• …;
• actively voted on shareholder resolutions regarding climate change disclosures or actions of investee companies;
• …;
• 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.”
Main Findings

- **carbon emission intensity of investees with significant bond ownership by CRDS affected insurers:**
  - robust using alternative measures for (i) event window (ii) treatment and control investees and (iii) environmental friendliness.

- **More pronounced positive transmission effect:**
  - investees or their affected insurer investors are headquartered in states with strong public climate risk attitudes;
  - investees that are close to their affected insurer investors, have more affected insurers with good ENV score or public parent companies;
  - investees with higher debt constraints/bond ratio, fewer non-affected insurer in their headquarter state;
  - investees with fewer insurers face intense competition in underwriting.
Contribution

➢ The effect of mandatory climate risk disclosure on investment relationships.

• French mandatory climate disclosure law
  ▪ *Mesonnier and Nguyen (2020)*: institutions reduce financing for fossil fuel firms;
  ▪ *Ilhan et al. (2023)*: climate-conscious institutional ownership value and demand firm-level climate risk disclosure;

• **Our study**: the transmission effect of insurers’ mandatory climate risk disclosure on the actions by their corporate bond investees’ to reduce carbon emissions.
  ▪ Difference: The above two papers look at the effect of the law on investors' actions, not investees' environmental actions.
The transmission effect of mandatory ESG-related disclosures

- **Wang (2023):** improved borrowers’ environmental and social performance following the disclosure mandate on banks through the **lending** channel.

- **Our study:**
  - a setting specifically on climate risk disclosures;
  - an outcome directly linked to climate risk, carbon emissions;
  - some novel heterogeneity documented;
  - the investor-investee network;
**The Policy Implication**

- demonstrates the potential benefits of mandatory climate risk reporting and offers useful lessons for those seeking to extend these requirements.

- has the potential to inform policymakers both in the U.S. and elsewhere as they consider mandating climate risk disclosure across industries.

- highlights that the transmission effects of such disclosures should be carefully considered.
Hypothesis Development

- **Insurers Monitoring Incentive:**
  - Insurers have strong monitoring incentives due to heavy investment in their bond investees
    * Using insurers’ transaction data in the secondary bond market, prior studies document informed trading prior to material events, including:
      - the class action lawsuits (Billings, Klein, and Zur 2011)
      - M&As (Kedia and Zhou 2014)
      - earnings announcements (Wei and Zhou 2016).
  
  * Campbell et al. (2021): insurers’ bondholding → investees’ conservative financial reporting.
Mechanism 1: Climate-risk-related engagement

- Insurers’ mandatory climate risk disclosures

Mechanism 2: Climate-risk-related investment strategy

- Corporate bond investees’ environmental friendliness (Carbon emission intensity)
Regarding climate-related problems at investees: “Invest and Engage” > “Divestment”

“Divestment is not the solution – it does not change the physical world as far as emissions are concerned.” – former chief investment officer at Zurich

Azar, Duro, Kadach, and Ormazabal (2021): the big three investors are more likely to engage investee firms that exhibit higher carbon emissions in the past.

CRDS requires disclosure on climate change engagement of key constituencies (Q7), increasing the pressure that insurers face to engage their corporate bond investees

Treated investees improve their environmental performance after CRDS
Investment strategy mechanism

- **Ex-ante walk threat from existing insurer investors:**
  - Bharath et al. (2013): the threat of exit by institutional investors exerts a strong governance effect on the managers.
  - Identifying environmental unfriendly investees → Divestment →
    - ↓ bond price → ↑ cost of investees

- **Reduced future demand on bonds because insurers rely on ESG profile to invest, especially following CRDS adoption**
  - Insurers: the largest corporate bond investors
  - Many large insurers required to respond to the CRDS
  - More states adopt the survey → Increasing number of insurers affected
  - Mésonnier and Nguyen (2020) & Seltzer et al. (2022): affected institutional investors/insurers reduce their investment in firms with poor environmental profile
Hypothesis Development (Cont.)

- **UNCLEAR, given:**
  
  * divesting weaken the incentives of engagement
  * CRDS is qualitative and unaudited disclosures
  * both insurers and investees may greenwash
Data and Sample

➢ Data resource

• Corporate bond data: Mergent Fixed Income Securities Database (FISD)
• CRDS insurers identification: NAIC Annual Statement Database
• CRDS insurers bond holding: eMAXX
• Annual carbon emissions data: S&P Global Trucost
• Other info: COMPUSTAT
Sample period


<table>
<thead>
<tr>
<th>Disclosing Year</th>
<th>Participating States</th>
<th>Nationwide Direct Written Premium Requirement</th>
<th>No. of Responses from P&amp;C Insurers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>California</td>
<td>Insurer premium &gt; $500M</td>
<td>13</td>
</tr>
<tr>
<td>2011</td>
<td>California</td>
<td>Insurer premium &gt; $300M</td>
<td>22</td>
</tr>
<tr>
<td>2012</td>
<td>California, New York, and Washington</td>
<td>Insurer premium &gt; $300M</td>
<td>428</td>
</tr>
<tr>
<td>2013</td>
<td>California, Connecticut, Minnesota, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>685</td>
</tr>
<tr>
<td>2014</td>
<td>California, Connecticut, Illinois, Maryland, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>743</td>
</tr>
<tr>
<td><strong>2015</strong></td>
<td>California, Connecticut, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>760</td>
</tr>
<tr>
<td>2016</td>
<td>California, Connecticut, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>759</td>
</tr>
<tr>
<td>2017</td>
<td>California, Connecticut, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>740</td>
</tr>
<tr>
<td>2018</td>
<td>California, Connecticut, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>738</td>
</tr>
<tr>
<td>2019</td>
<td>California, Connecticut, Minnesota, New Mexico, New York, and Washington</td>
<td>Insurer premium &gt; $100M</td>
<td>736</td>
</tr>
</tbody>
</table>
Data and Sample (Cont.)

- **CRDS Affected insurers**
  - Meeting compulsory disclosure criteria:
    - Nationwide direct written premium > $100m
    - Having business in any of the 6 CRDS-participating states
    - Disclosing the CRDS in 2015

- **Treatment and Control Investees**
  - Final sample: **3,472** investee-year obs. (control: 1,707; treatment: 1,765)
  - Treatment (control) group:
    - % of bond held by affected insurers in 2011 (the last year in the pre-adoption window)
    - above or at (below) the median (*Agarwal et al. 2018; Sani et al. 2021*)
Research Design

- **Standard DID Model**

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

- \(Treat_i\) = 1 for investees whose bonds held by affected P&C insurers in 2011 is at or above the median, and 0 o.w.
- \(Post_t\) = 1 for period 2016-2019, and 0 for period 2008-2011.
- **Carbon Intensity**\(_{i,t}\): scope 1 carbon emissions / its revenue, log-transformed.
- \(\theta_i\) and \(\delta_{j,t}\) are investee firm FEs and industry-year FEs.
- \(X_{i,t/i,t-1}\): Size, MB, ROA, Leverage, Capex, PPE, SalesGr, EPSGr, HHI, IO, Cash, DivPos, RD, AD, following Bolton and Kacperczyk (2021).
- OLS and cluster SE at investee firm level.
## Sample Distribution

### Panel A: Sample distribution by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Control</th>
<th>Treatment</th>
<th>Full sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>207</td>
<td>12.13</td>
<td>217</td>
</tr>
<tr>
<td>2009</td>
<td>210</td>
<td>12.30</td>
<td>221</td>
</tr>
<tr>
<td>2010</td>
<td>215</td>
<td>12.60</td>
<td>223</td>
</tr>
<tr>
<td>2011</td>
<td>221</td>
<td>12.95</td>
<td>224</td>
</tr>
<tr>
<td>2016</td>
<td>215</td>
<td>12.60</td>
<td>222</td>
</tr>
<tr>
<td>2017</td>
<td>215</td>
<td>12.60</td>
<td>222</td>
</tr>
<tr>
<td>2018</td>
<td>213</td>
<td>12.48</td>
<td>218</td>
</tr>
<tr>
<td>2019</td>
<td>211</td>
<td>12.36</td>
<td>218</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,707</strong></td>
<td><strong>100.00</strong></td>
<td><strong>1,765</strong></td>
</tr>
</tbody>
</table>
## Descriptive Statistics

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

Economic significance:

Kim et al. (2022): 25% reduction following the SEC’s 2010 rule on climate change risk reporting in 10-Ks.

Wang (2023): 13.53% improvement in response to bank lenders’ ESG disclosure regulations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Carbon Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Treat × Post</td>
<td>-0.163***</td>
</tr>
<tr>
<td></td>
<td>(-2.03)</td>
</tr>
<tr>
<td>Treat × T2008</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
</tr>
<tr>
<td>Treat × T2009</td>
<td>-0.065</td>
</tr>
<tr>
<td></td>
<td>(-1.12)</td>
</tr>
<tr>
<td>Treat × T2010</td>
<td>-0.087</td>
</tr>
<tr>
<td></td>
<td>(-1.42)</td>
</tr>
<tr>
<td>Treat × T2011</td>
<td>-0.184**</td>
</tr>
<tr>
<td></td>
<td>(-2.03)</td>
</tr>
<tr>
<td>Treat × T2016</td>
<td>-0.161*</td>
</tr>
<tr>
<td></td>
<td>(-1.72)</td>
</tr>
<tr>
<td>Treat × T2017</td>
<td>-0.226**</td>
</tr>
<tr>
<td></td>
<td>(-2.30)</td>
</tr>
<tr>
<td>Treat × T2018</td>
<td>-0.237**</td>
</tr>
<tr>
<td></td>
<td>(-2.31)</td>
</tr>
<tr>
<td>Treat × T2019</td>
<td>-0.219**</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Treat × T2020</td>
<td></td>
</tr>
</tbody>
</table>

Controls: Yes
Investee FE: Yes
Industry-year FE: Yes
Observations: 3,472
Adjusted R-square: 0.952

22
## Cross-sectional Analyses: Public Pressure on Climate Risk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Carbon Intensity</th>
<th>Carbon Intensity</th>
<th>Carbon Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong pressure based on investees being exposed to affected insurer investors headquartered in states with strong public climate risk attitudes</td>
<td>Strong pressure based on investees being headquartered in a state with strong public climate risk attitudes</td>
<td>Strong pressure based on investees being exposed to affected insurer investors headquartered in states with strong public climate risk attitudes and investees being headquartered in a state with strong public climate risk attitudes</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Treat × Post</td>
<td>-0.135 (-1.05)</td>
<td>-0.251* (-1.82)</td>
<td>-0.174 (-1.16)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1.453</td>
<td>1.505</td>
<td>1.560</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.954</td>
<td>0.954</td>
<td>0.951</td>
</tr>
<tr>
<td>Diff. (p-value)</td>
<td>0.031</td>
<td>0.084</td>
<td>0.000</td>
</tr>
</tbody>
</table>
## Cross-sectional Analyses: Monitoring

<table>
<thead>
<tr>
<th>Variable</th>
<th>Geographic distance between investees and their affected insurer investors</th>
<th>Exposure to environmentally friendly affected insurer investors</th>
<th>Exposure to affected insurer investors with publicly listed parents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Far (1)</td>
<td>Low (3)</td>
<td>Low (5)</td>
</tr>
<tr>
<td></td>
<td>Close (2)</td>
<td>High (4)</td>
<td>High (6)</td>
</tr>
<tr>
<td><strong>Treat × Post</strong></td>
<td>-0.136 (-0.85)</td>
<td>-0.108 (-0.80)</td>
<td>-0.016 (-0.14)</td>
</tr>
<tr>
<td></td>
<td><strong>-0.324</strong>** (**)</td>
<td><strong>-0.296</strong>** (**)</td>
<td><strong>-0.272</strong>* (**)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,294</td>
<td>1,477</td>
<td>1,494</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.930</td>
<td>0.959</td>
<td>0.966</td>
</tr>
<tr>
<td>Diff. (p-value)</td>
<td>0.025</td>
<td>0.003</td>
<td>0.000</td>
</tr>
</tbody>
</table>
**Cross-sectional Analyses: Investees’ Financing Dependence**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Likelihood of issuing debt to deal with risk of investment delay</th>
<th>Existing reliance on bond financing</th>
<th>Percentage of affected insurer investors in the investee’s headquarter state</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low (1) High (2)</td>
<td>Low (3) High (4)</td>
<td>Low (5) High (6)</td>
</tr>
<tr>
<td><strong>Treat × Post</strong></td>
<td>-0.022 (-0.16) <strong>-0.355</strong> (-2.22)</td>
<td>-0.009 (-0.07) <strong>-0.288</strong> (-2.63)</td>
<td>-0.060 (-0.37) <strong>-0.293</strong> (-2.43)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,130</td>
<td>1,151</td>
<td>1,629</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.955</td>
<td>0.925</td>
<td>0.965</td>
</tr>
<tr>
<td>Diff (p-value)</td>
<td>0.001</td>
<td>0.000</td>
<td>0.006</td>
</tr>
</tbody>
</table>
## Cross-sectional Analyses: Investees’ Exposure to Insurers’ Underwriting Competition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Carbon Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exposure to affected insurer investors with intense underwriting competition; competition is measured by the number of insurers</td>
</tr>
<tr>
<td></td>
<td>Low (1)</td>
</tr>
<tr>
<td></td>
<td>High (2)</td>
</tr>
<tr>
<td><strong>Treat × Post</strong></td>
<td>-0.341***</td>
</tr>
<tr>
<td></td>
<td>(-3.36)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,497</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.959</td>
</tr>
<tr>
<td>Diff. (p-value)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Notes:**

- **Treat × Post** coefficients are estimated using a fixed effects model.
- The Herfindahl-Hirschman index is calculated as the sum of the squares of the market shares of all insurers in the market.
- The table reports the coefficient estimates and standard errors in parentheses.
- Statistical significance levels:**
  - ***p < 0.01
  - **p < 0.05
  - *p < 0.1
### Robustness Tests: Alternative Research Designs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Carbon Intensity</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of affected insurers’ bond holdings in 2015</td>
<td>Use of affected insurers’ bond holdings in 2011 and 2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>$Treat \times Post$</td>
<td>-0.143*</td>
<td>-0.244**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-1.92)</td>
<td>(-2.18)</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>3,895</td>
<td>2,489</td>
<td></td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.954</td>
<td>0.953</td>
<td></td>
</tr>
</tbody>
</table>
### Further Analyses: Other Outcomes of Investees’ Carbon Emissions

<table>
<thead>
<tr>
<th>Variable</th>
<th>Carbon Cost</th>
<th>Carbon Intensity S2</th>
<th>Carbon Intensity S3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Treat x Post</td>
<td>-0.169**</td>
<td>-0.073</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(-2.13)</td>
<td>(-0.91)</td>
<td>(-0.42)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Investee FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3,472</td>
<td>3,472</td>
<td>3,472</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>0.956</td>
<td>0.797</td>
<td>0.968</td>
</tr>
</tbody>
</table>
Conclusion

- CRDS adoption leads to reduced carbon emission intensity of investees with significant bond ownership held by affected insurers.

- Our causal evidence is consistent with the view that investors’ mandated climate risk disclosure generates a positive transmission effect on improving investees’ environmental performance.

  - M’essonier and Nguyen (2020) and Ilhan et al. (2023): French mandatory climate disclosure law

- We also extend the literature on the ESG effect of institutional investors: Instead of equity institutional investors, we focus on insurance companies.