Banking on Carbon: Corporate Lending and Cap-and-Trade Policy

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Views expressed in this presentation are those of the speaker and not necessarily of the Federal Reserve Board of Governors.
Motivation

- Debate on climate change and financial stability.

- Discussion centers around physical and transition risks.
  - “… transition risks: the financial risks which could result from the process of adjustment towards a lower-carbon economy” (Carney, 2015).
  - Tradeoff between physical and transition risks.

- Banks are among the largest stakeholders in the transition to a low-carbon economy:
  - Mandatory emissions reductions could adversely affect borrowers.
  - Concerns about transition risks could prevent climate change regulation.
  - Does climate change regulation affect bank health and financial stability?
Our paper

- Focus on a prominent policy tool in climate change regulation: cap-and-trade programs.

- Study cap-and-trade bills as they move through the legislative process.
  - Isolate period of high transition risk.
  - Heterogeneous treatment of firms.

- Analyze how banks manage exposure to affected private and public firms.
  - Assess bank expectations of program impact on firms.
  - Important evidence for architects of cap-and-trade programs.

- Examine the California and Waxman-Markey cap-and-trade bills.
  - Different time periods and treatment dimensions help assess external validity.
The California cap-and-trade bill

Passed in 2011 and implemented in 2013.
The Waxman-Markey cap-and-trade bill

Passed the House in June 2009 and, after high probability of passing the Senate, ultimately failed in July 2010.
Main results

▶ Banks gain flexibility to revoke credit in response to cap-and-trade regulation. Covered firms have:
  – Shorter loan maturity
  – Decrease in share of term loans
  – Interest rates increase
  – Total loan commitments and utilization unchanged

▶ Results concentrated within private firms.
  – Banks expect private firms to face greater challenges.

▶ Banks also appear to reduce transition risks exposure by:
  – Selling loans to shadow banks.
  – Monitoring firms more closely.
Outline

Overview

Data

Empirical strategy and baseline results

Other channels and robustness

Conclusion
Data

▶ California analysis
  – Federal Reserve’s Y-14 Collection:
    • Covers both syndicated and bilateral loans >$1 million since 2011.
    • Has interest rate data and includes smaller private firms.
  
  – Emissions data from the EPA
    • Mandatory reporting by facilities emitting ≥25,000MT/yr CO₂ equiv.
    • Covers both direct and indirect emissions → facilities that produce material that emit ≥25,000MT when combusted.
    • Aggregate firms to the parent level and map to credit data.

▶ Waxman-Markey analysis
  – Shared National Credit (SNC) Program
    • Covers virtually entire syndicated loan market, including private firms.
    • Provides a complete view of lending syndicate, including non-bank participants.
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Identification strategy: California cap-and-trade bill

- **First difference**: Compare lending in Q3-4 2011 (pre) to Q3-4 2012 (post).

- **Second difference**: Use EPA data to determine firms with large share of high emission facilities in California (Bartram, Hou, and Kim, 2021).
  - Threshold 1: Firm’s CA emission > 25%
  - Threshold 2: Firm’s CA emission > 50%
California regression specification

Baseline regression specification:

\[ y_{i,q} = \lambda I_{CA_{Emissions i} > 50\%} \times I_{Post \ CA \ bill} + Controls_{i,q} + \psi_i + \phi_{q,ind} + \epsilon_{i,q}. \]

- \( I_{CA_{Emissions i} > 50\%} \) is 1 if firm \( i \) has a CA emission share of > 50%, 0 otherwise.
- Dependent variables are equilibrium outcomes of the loan contracting process between banks and firms:
  - Credit commitment
  - Maturity
  - Fraction of term loans (vs. credit lines)
- \( \lambda \) is negative if banks cut credit commitment or seek higher contract flexibility.
California analysis

<table>
<thead>
<tr>
<th></th>
<th>Log committed credit</th>
<th>Maturity (in months)</th>
<th>Term loans share (0 to 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>$I_{CA_Emissions_{i} &gt; 25%} \times I_{Post \ CA \ bill}$</td>
<td>0.015</td>
<td>-3.905**</td>
<td>-0.245***</td>
</tr>
<tr>
<td></td>
<td>(0.061)</td>
<td>(1.670)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>$I_{CA_Emissions_{i} &gt; 50%} \times I_{Post \ CA \ bill}$</td>
<td>0.030</td>
<td>-4.946***</td>
<td>-0.262***</td>
</tr>
<tr>
<td></td>
<td>(0.072)</td>
<td>(1.633)</td>
<td>(0.043)</td>
</tr>
</tbody>
</table>

|                          | Observations | 2,717 | 2,717 | 2,717 | 2,717 | 2,717 | 2,717 |
| R2                      | 0.965        | 0.965 | 0.807 | 0.808 | 0.717 | 0.719 |
| Controls                | Yes          | Yes   | Yes   | Yes   | Yes   | Yes   | Yes   |
| Firm FE                 | Yes          | Yes   | Yes   | Yes   | Yes   | Yes   | Yes   |
| Industry-Quarter FE     | Yes          | Yes   | Yes   | Yes   | Yes   | Yes   | Yes   |

Firms with large CA emissions have:

- 4–5 months shorter maturity
- 0.25 lower term loan share
Private vs. public firms

- Results so far consistent with banks paying attention to transition risks.

- Explore heterogeneity in the effect of cap-and-trade programs on firms:
  - Important knowledge for the design of cap-and-trade policies.

- Different effects for public versus private firms?
  - Private (smaller) firms tend to be more financially constrained.
  - Economies of scale in regulation compliance.
  - Private firms tend to use older equipment and are likely less efficient.
Emissions inefficiency higher for private firms

Corporate Lending and Cap-and-Trade Policy
Effects for private firms are substantially larger.
California analysis - public firms only

<table>
<thead>
<tr>
<th>Log committed credit</th>
<th>Maturity (in months)</th>
<th>Term loans share (0 to 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>( l_{CA_{Emissions_i} &gt; 25%} \times l_{Post CA bill} )</td>
<td>0.223** (0.086)</td>
<td>1.617 (3.160)</td>
</tr>
<tr>
<td>( l_{CA_{Emissions_i} &gt; 50%} \times l_{Post CA bill} )</td>
<td>0.058 (0.113)</td>
<td>-1.788 (4.234)</td>
</tr>
</tbody>
</table>

Observations 822 822 822 822 822 822
R2 0.977 0.978 0.810 0.811 0.829 0.829
Controls Yes Yes Yes Yes Yes Yes
Firm FE Yes Yes Yes Yes Yes Yes
Industry-Quarter FE Yes Yes Yes Yes Yes Yes

No effects for public firms.
# California analysis - impact on interest rates

<table>
<thead>
<tr>
<th></th>
<th>Full sample</th>
<th>Private firms</th>
<th>Public firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>[I_{CA_{Emissions_i} &gt; 25%} \times I_{Post \text{ CA bill}} ]</td>
<td>0.667*</td>
<td>0.538*</td>
<td>1.748**</td>
</tr>
<tr>
<td></td>
<td>(0.395)</td>
<td>(0.270)</td>
<td>(0.719)</td>
</tr>
<tr>
<td>[I_{CA_{Emissions_i} &gt; 50%} \times I_{Post \text{ CA bill}} ]</td>
<td>0.294</td>
<td>0.137</td>
<td>2.299**</td>
</tr>
<tr>
<td></td>
<td>(0.662)</td>
<td>(0.523)</td>
<td>(1.031)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,191</td>
<td>1,191</td>
<td>1,191</td>
</tr>
<tr>
<td>R2</td>
<td>0.911</td>
<td>0.910</td>
<td>0.919</td>
</tr>
<tr>
<td>Controls</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry-quarter FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Banks require compensation from private firms for bearing transition risks.
Identification strategy: Waxman-Markey bill

- **First difference**: Compare lending in 2008 (pre) to 2009 (post).

- **Second difference**: Exploit difference in how high-emission manufacturing firms would be impacted by the law (Meng, 2017).
  - Manufacturing firms from sectors (6-digit NAICS) with an energy intensity of above 5% get allocated “free permits” for emissions.
  - Firms below the threshold are treated. Firms above the threshold are controls.

- Examine manufacturing firms close to the 5% threshold.
### Waxman-Markey analysis: private firms

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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>$I_{i \in Treated} \times I_{t=2009}$</td>
<td>-0.049</td>
<td>-10.317*</td>
<td>-0.240***</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(5.181)</td>
<td>(0.068)</td>
</tr>
<tr>
<td>$I_{i \in TreatedWide} \times I_{t=2009}$</td>
<td>0.053</td>
<td>-8.354*</td>
<td>-0.214***</td>
</tr>
<tr>
<td></td>
<td>(0.071)</td>
<td>(4.573)</td>
<td>(0.052)</td>
</tr>
</tbody>
</table>

- Observations: 170, 276, 170, 276, 170, 276
- R2: 0.965, 0.954, 0.820, 0.852, 0.868, 0.842
- Controls: Yes, Yes, Yes, Yes, Yes, Yes
- Firm FE: Yes, Yes, Yes, Yes, Yes, Yes
- Year FE: Yes, Yes, Yes, Yes, Yes, Yes
- Lead bank FE: Yes, Yes, Yes, Yes, Yes, Yes

Again, substantially stronger effect for private firms:
- 9 months shorter maturity
- 0.20 lower term loan share
Waxman-Markey analysis: public firms

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<thead>
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<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>$I_{i \in Treated} \times I_{t=2009}$</td>
<td>0.108 (0.088)</td>
<td>-0.532 (2.304)</td>
<td>0.060 (0.056)</td>
</tr>
<tr>
<td>$I_{i \in TreatedWide} \times I_{t=2009}$</td>
<td>0.066 (0.062)</td>
<td>1.969 (2.368)</td>
<td>0.041 (0.051)</td>
</tr>
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</table>

|                      | Observations 172    | 348                  | 172 348                  | 172 348                  | 172 348              |
| R2                   | 0.945 0.963         | 0.926 0.858          | 0.876 0.858              |
| Controls             | Yes Yes Yes Yes Yes | Yes Yes Yes Yes Yes  |
| Firm FE              | Yes Yes Yes Yes Yes | Yes Yes Yes Yes Yes  |
| Year FE              | Yes Yes Yes Yes Yes | Yes Yes Yes Yes Yes  |
| Lead bank FE         | Yes Yes Yes Yes Yes | Yes Yes Yes Yes Yes  |

No effect for public firms.
Outline

Overview

Data

Empirical strategy and baseline results

Other channels and robustness

Conclusion
Banks manage transition risks in alternative ways

- So far, results consistent with banks managing transition risk by increasing contract flexibility.

- Banks have alternative ways to mitigate exposure to firms covered by a cap-and-trade program.

- Sell syndicated loans on the secondary loan market.
  - SNC comprehensively covers the participants in lending syndicates over the life of the loan.
  - Observe dynamics for both banks and shadow banks.

- Unlike equilibrium outcomes of the loan contracting process, banks can unilaterally decide to sell loans.
  - Isolate banks expectations for firm outcomes.
Loan sales and the Waxman-Markey bill

1. Lenders with higher ex ante exposure to GHG-emitting firms participate less in covered firms’ syndicates and more likely to sell loans.

2. Shadow bank share increases by about 0.07 (avg. 0.15).

<table>
<thead>
<tr>
<th></th>
<th>All firms</th>
<th>Private firms</th>
<th>Public firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I_i \in Treated \times I_t = 2009)</td>
<td>0.054** (0.026)</td>
<td>0.071* (0.037)</td>
<td>0.026 (0.029)</td>
</tr>
<tr>
<td>(I_i \in TreatedWide \times I_t = 2009)</td>
<td>0.067*** (0.022)</td>
<td>0.107*** (0.026)</td>
<td>0.019 (0.027)</td>
</tr>
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<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observations</td>
<td>342</td>
<td>624</td>
<td>170</td>
<td>276</td>
<td>172</td>
<td>348</td>
</tr>
<tr>
<td>R2</td>
<td>0.877</td>
<td>0.883</td>
<td>0.841</td>
<td>0.844</td>
<td>0.928</td>
<td>0.927</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lead bank FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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</table>
Placebo tests

- Do treated and control groups exhibit similar trends before treatment occurred?

- Using two different natural experiments with similar findings alleviates this concern.

- Placebo regressions for Waxman-Markey analysis.
  - “Falsify” treatment in the years before the bill’s passage.
  - We should see reversal of effects in 2010 when the bill fails the Senate.
Placebo test: remaining maturity
Placebo test: term loans share

![Graph showing coefficient estimates over years 2005 to 2010.]

Corporate Lending and Cap-and-Trade Policy
Placebo test: shadow bank share
Other results

- Lenders monitor high-emission firms more closely and impose cash flow covenants.

- Firm balance sheet effects under CA bill:
  - Following passage: covered firms increase cash, capex
  - Following implementation: cash, capex revert to pre-passage levels
Outline

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Conclusion

▶ We isolate high transition risk periods around cap-and-trade bills moving through the legislative process.

▶ We show that banks act swiftly to reduce transition risks
  – Gain flexibility to cut credit exposure.
  – Require additional compensation for bearing transition risk.
  – Reduce syndicate participation in favor of shadow banks.
  – Transition risks unlikely to pose systemic stability risks for banking sector.

▶ Effects concentrated within the subsample of private firms.

▶ Adverse effects of cap-and-trade programs on affected private firms:
  – Evidence potentially useful for design of cap-and-trade policies.