

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

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November 19, 2021

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

Outline

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Data

Empirical strategy and baseline results

Other channels and robustness

Conclusion

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.

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▶ 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 $\geq 25,000$ MT/yr CO₂ equiv.
 - Covers both direct and indirect emissions \rightarrow facilities that produce material that emit $\geq 25,000$ MT 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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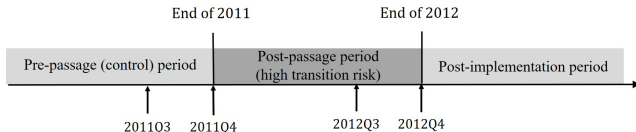
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Identification strategy: California cap-and-trade bill



- ▶ **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:

$$y_{i,q} = \lambda I_{CA_Emissions_i > 50\%} \times I_{\text{Post CA bill}} + \text{Controls}_{i,q} + \psi_i + \phi_{q,ind} + \epsilon_{i,q}.$$

- $I_{CA_Emissions_i > 50\%}$ 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)
- λ is negative if banks cut credit commitment or seek higher contract flexibility.

California analysis

	Log committed credit		Maturity (in months)		Term loans share (0 to 1)	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{CA_Emissions_j > 25\%} \times I_{Post\ CA\ bill}$	0.015 (0.061)		-3.905** (1.670)		-0.245*** (0.034)	
$I_{CA_Emissions_j > 50\%} \times I_{Post\ CA\ bill}$		0.030 (0.072)		-4.946*** (1.633)		-0.262*** (0.043)
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
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

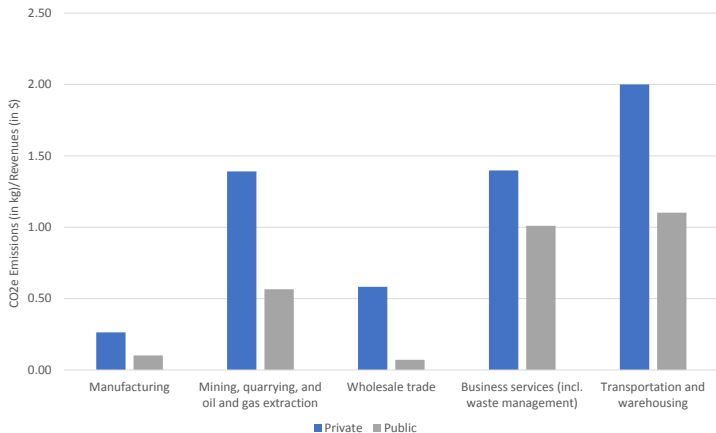
Firms with large CA emissions have:

- ▶ 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



California analysis - private firms only

	Log committed credit		Maturity (in months)		Term loans share (0 to 1)	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{CA_Emissions_j > 25\%} \times I_{Post\ CA\ bill}$	0.028 (0.146)		-6.318** (2.431)		-0.535*** (0.078)	
$I_{CA_Emissions_j > 50\%} \times I_{Post\ CA\ bill}$		0.031 (0.160)		-5.539* (2.875)		-0.498*** (0.103)
Observations	1,546	1,546	1,546	1,546	1,546	1,546
R2	0.956	0.956	0.861	0.861	0.776	0.776
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Effects for private firms are substantially larger.

California analysis - public firms only

	Log committed credit		Maturity (in months)		Term loans share (0 to 1)	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{CA_Emissions_i > 25\%} \times I_{Post\ CA\ bill}$	0.223** (0.086)		1.617 (3.160)		0.011 (0.040)	
$I_{CA_Emissions_i > 50\%} \times I_{Post\ CA\ bill}$		0.058 (0.113)		-1.788 (4.234)		0.001 (0.043)
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

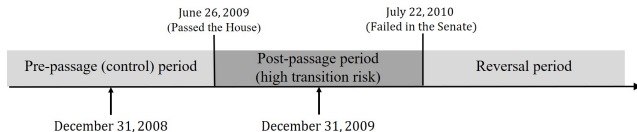
No effects for public firms.

California analysis - impact on interest rates

	Full sample				Private firms				Public firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$I_{CA,Emissions_i > 25\%} \times I_{Post\ CA\ bill}$	0.667*		0.538*		1.748**		1.013*		0.175		0.082	
	(0.395)		(0.270)		(0.719)		(0.552)		(0.458)		(0.474)	
$I_{CA,Emissions_i > 50\%} \times I_{Post\ CA\ bill}$		0.294		0.137		2.299**		1.356		-0.967*		-0.958*
		(0.662)		(0.523)		(1.031)		(0.889)		(0.480)		(0.508)
Observations	1,191	1,191	1,191	1,191	610	610	609	609	390	390	384	384
R2	0.911	0.910	0.919	0.918	0.953	0.954	0.959	0.959	0.916	0.917	0.925	0.927
Controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

	Log committed credit		Maturity (in months)		Term loans share (0 to 1)	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{i \in Treated} \times I_{t=2009}$	-0.049 (0.059)		-10.317* (5.181)		-0.240*** (0.068)	
$I_{i \in TreatedWide} \times I_{t=2009}$		0.053 (0.071)		-8.354* (4.573)		-0.214*** (0.052)
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

	Log committed credit		Maturity (in months)		Term loans share (0 to 1)	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{i \in Treated} \times I_{t=2009}$	0.108 (0.088)		-0.532 (2.304)		0.060 (0.056)	
$I_{i \in TreatedWide} \times I_{t=2009}$		0.066 (0.062)		1.969 (2.368)		0.041 (0.051)
Observations	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
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

No effect for public firms.

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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.

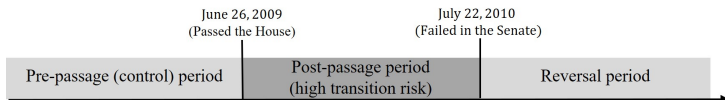
Loan sales and the Waxman-Markey bill

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).

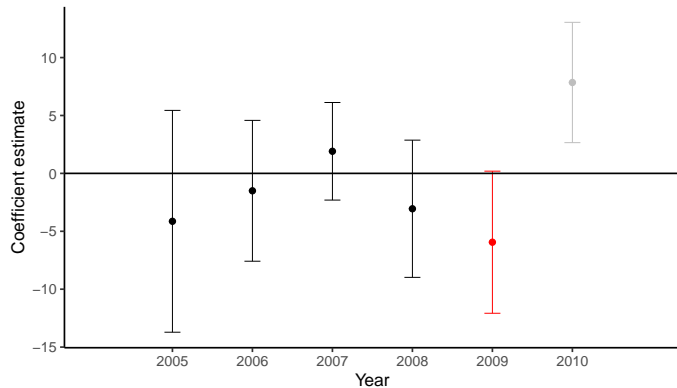
	All firms		Private firms		Public firms	
	(1)	(2)	(3)	(4)	(5)	(6)
$I_{i \in Treated} \times I_{t=2009}$	0.054** (0.026)		0.071* (0.037)		0.026 (0.029)	
$I_{i \in TreatedWide} \times I_{t=2009}$		0.067*** (0.022)		0.107*** (0.026)		0.019 (0.027)
Observations	342	624	170	276	172	348
R2	0.877	0.883	0.841	0.844	0.928	0.927
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

Placebo tests

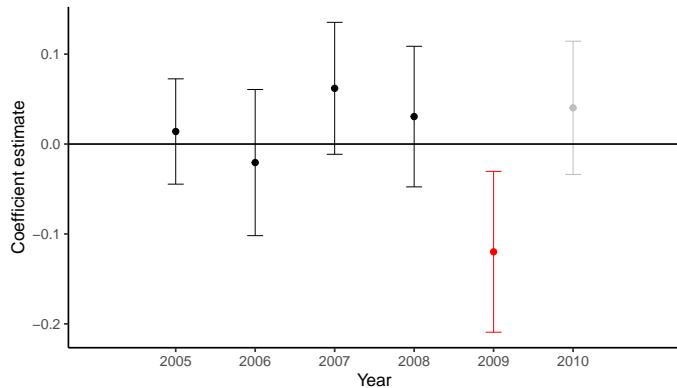
- ▶ Do treated and control groups exhibit similar trends before treatment occurred?
- ▶ Using two different natural experiments with similar findings alleviates this concern.
- ▶ Placebo regressions for Waxman-Markey analysis.
 - “Falsify” treatment in the years before the bill’s passage.
 - We should see reversal of effects in 2010 when the bill fails the Senate.



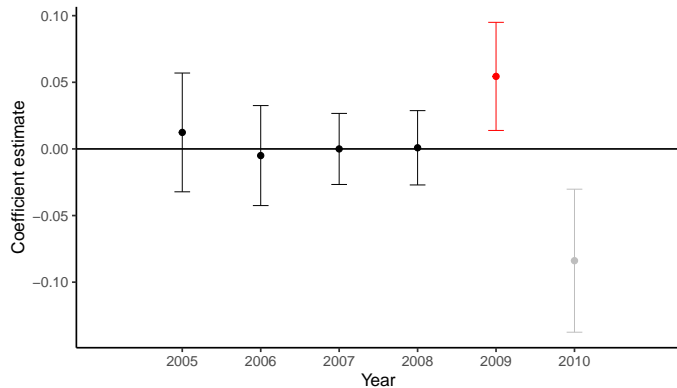
Placebo test: remaining maturity



Placebo test: term loans share



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

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- ▶ 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.