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

Ivanov et al. (2023)

Env Climate discussion group S24

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Research questions

Estimate the effect of carbon pricing policy on bank credit to GHG emitting firms, exploiting

- geographic restrictions in California's cap-and-trade bill
  - passed in December 2011; implemented in January 2013
  - only affect emitting firms in California
- discontinuity in the embedded threshold of the federal Waxman-Markey cap-and-trade bill
  - a federal legislation that came closest to passage in the US
  - peak probability of passage in 2009 (under consideration until July 2010)
    $\rightarrow$ compare end of 2009 to 2008
  - exempt manufacturing firms with energy intensity at or above the 5% cutoff (free permit to emit GHGs)

Preview of findings

California's cap-and-trade bill:

- High-emission firms face:
  - loan maturity $\downarrow$ by about 5 months =
    a decline in maturity within loan type & a reduction in permanent forms of bank financing
    (credit line financing instead of term loan financing)
  - higher interest rates
  - (total committed credit does not change significantly)

The Federal Waxman-Markey cap-and-trade bill:

- Firms just below the threshold experience qualitatively similar debt structure changes.

Implications for the banking sector:

- the fluid nature of bank lending relationships allows banks to adjust their exposure quickly through loan renegotiation, and bank lenders actively manage exposure to transition risk
- but the reallocation of credit may exacerbate the financial constraint of high-emission firms, adversely impacting on the firm survival

Preview of findings (2)

Heterogeneity in the effects:

- within the sample of private firms
  - higher operating costs expected (due to lower GHG emission efficiency)
  - greater financial constraint (size and ownership)
- additional dimension: lenders with large ex ante exposure to high GHG-emitting firms reduce syndicated loan exposure to firms below the threshold by a greater extent
- additional dimension: some shadow banks (CLOs) take a significantly larger loan share

Real effects following California's cap-and-trade program:

- private firms:
  - lower profitability
  - increase cash holdings
  - decrease capital expenditure

Background Info

California's cap-and-trade bill:

- only mandatory cap-and-trade program in the US, covering the majority of firms with high GHG emissions across industries
- all facilities emitting more than 25,000 metric tons of CO2 equivalent per year are required to obtain allowances for their emissions
- some quantity of free allowances + secondary market purchase for the remaining allowances

Waxman-Markey cap-and-trade bill:

- no federal cap-and-trade program has been implemented in the US yet
- this bill passed the US House of Representatives in 2009 April; high probability of passage but ultimately failed in 2010
- centerpiece: cap relative to GHG emissions in 2005 = 3% reduction in 2012, 17% in 2020, 83% in 2050
- about 15% of all emissions permits to emit GHG would be given for free to selected manufacturing firms

Credit risk of polluting borrowers

The passage of cap-and-trade legislation may affect the credit risk of polluting borrowers:

- expected loan loss: $ExpectedLoss = PD \times LGD \times EAD$
- cap-and-trade = higher PD & LGD
  - higher operating cost $\rightarrow$ reduce cash flow, increase the variance $\Longrightarrow$ higher PD
  - decrease of resale value $\rightarrow$ collateral value decline $\Longrightarrow$ increase LGD
- uncertainty $\Longrightarrow$ banks: insure against the state of world
  - cut credit or regnegoiate loan terms
  - gain flexibility to reduce exposure in the future (**reduce EAD**)

Analysis focus: how banks manage EAD in response to realization of transition risk

Data

Credit data:

- Y14 (since 2011) for California's cap-and-trade bill:
  interest rates + bilateral lending & syndicated lending
  - cover 30 US banks with $at > 50$ *billionUSD*
  - large loans: > 1 *million* in commitment amount
  - exclude government entities, financial firms, real estate firms, and offices of bank holding companies
  - exclude capitalized lease obligations, fronting exposures, commitments to commit, other real estate owned and other assets
  - exclude loans guaranteed by the US government, associated with SPV, in default, not fully synidcated, or with missing data, or evergreening
- SNC data from the Federal Reserve for Waxman-Markey analysis:
  syndicated lending
  - cover all syndicated loans that > 20 *milllion* and are held by three or more supervised institutions as of year-end

Emission: EPA, each production facility emitting more than 25k mton CO2E + California Air Resources Board (California electricity importers out of state)

Empirical strategy

Three key tests:

- reduced exposure?
- more flexibility?
- increased loan interest rates?

dependent variables:

- firm's total loan commitment, commitment-weighted average remaining loan maturity, share of term loan committments and commitment-weighted average interest rates
- firm-level: the renegotiation affects all loans to a firm

DID for California's Cap-and-trade program

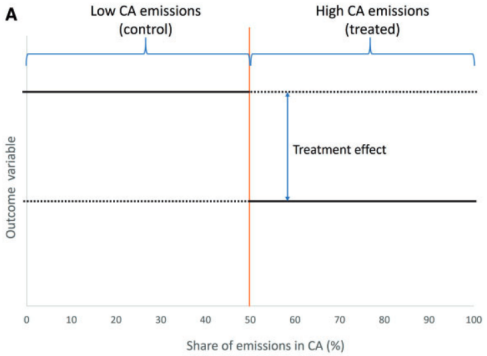
Treatment group = firms covered by the cap-and-trade program; treatment intensity measure:

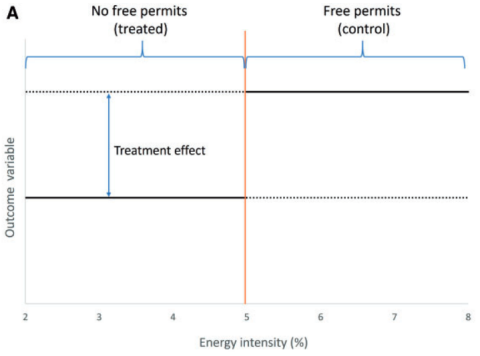
$$CA\_Emissions\_Share_i = \frac{\sum_{k_i=1}^{K_i} FacilityEmissions_{k_i} \times I_{k_i \in CA}}{\sum_{k_i=1}^{K_i} FacilityEmissions_{k_i}}, \quad (2)$$

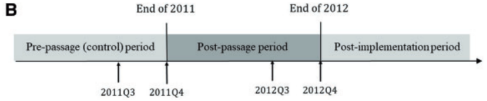
also discretize: treatment=1 if CA emission share $> 50\%$
(each firm's GHG emissions in California as a share of its total emissions)

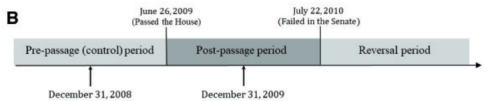
$$y_{i,q} = \lambda CA\_Emissions\_Share_{i,q} \times I_{\text{Post CA bill}} + \beta_1 CA\_Emissions\_Share_{i,q} + \beta_2 Controls_{i,q} + \psi_i + \phi_{q,ind} + \epsilon_{i,q}, \quad (3)$$

Sample: a pre-period and a post-period: 3rd and 4th quarters of 2011 and 2012 (avoid 1,2 of 2012 for possible seasonality); exclude fuel suppliers because they were only covered starting in 2015 instead of 2013


A
Low CA emissions
(control)
High CA emissions
(treated)
Treatment effect
Outcome variable
0
10
20
30
40
50
60
70
80
90
100
Share of emissions in CA (%)


A
No free permits
(treated)
Free permits
(control)
Treatment effect
Outcome variable
2
3
4
5
6
7
8
Energy intensity (%)


B
End of 2011
End of 2012
Pre-passage (control) period
Post-passage period
Post-implementation period
2011Q3
2011Q4
2012Q3
2012Q4


B
June 26, 2009
(Passed the House)
July 22, 2010
(Failed in the Senate)
Pre-passage (control) period
Post-passage period
Reversal period
December 31, 2008
December 31, 2009

DID for Waxman-Markey bill

Free permits to manufacturing firms with energy intensity at or above the 5% cutoff and trade intensity of $> 15\%$ between 2004 and 2006,

Control = just above the cutoff; treatment = just below the cutoff; while both above the trade intensity cutoff

$$y_{i,t} = \lambda I_{i \in Treated} \times I_{t=2009} + Controls_{i,t} + \psi_i + \phi_t + \gamma_b + \epsilon_{i,t}, \quad (4)$$

where the sample is limited to 2008 and 2009 (the "pre" and "post" periods) and the coefficient of interest, λ, measures the relative change in the outcomes of interest between the treatment and control groups. Treatment, $I_{i \in Treated}$, takes the value of one if firm i does not receive free permits under Waxman-Markey and is zero otherwise. The dependent variables of interest are again a firm's remaining maturity, share of term loans, and the natural log of a firm's total loan commitments. We consider two bandwidths around the free permit threshold of 5% energy intensity. The baseline bandwidth includes firms in six-digit NAICS manufacturing industries that have an energy intensity between 2% and 8%. The wide bandwidth includes firms in six-digit NAICS manufacturing industries with an energy intensity between 1% to 9%. Internet

Robustness checks

The end!