Regulating Conglomerates: Evidence from an Energy Conservation Program in China

Chen, Chen, Liu, Suárez Serrato, and Xu

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What does this paper do?

Quantifies reallocation within a conglomerate

- Measures the effect of an energy reduction mandate on energy consumption, output, profits, and welfare
- Looks across affiliates in a conglomerate where the largest affiliate is subject to regulation, but smaller affiliates are not
  - Considers reallocation within-conglomerate, across affiliates

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Implications for

- Energy consumption (policy target)
- Profits
- Consumer welfare

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- Outcomes:
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  - Revenue (output) (-**)
  - Energy efficiency (~0)

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- Outcomes:
  - Affiliate-level energy consumption (+**)
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Reduced Form Diff-in-Diff: same industry, unregulated

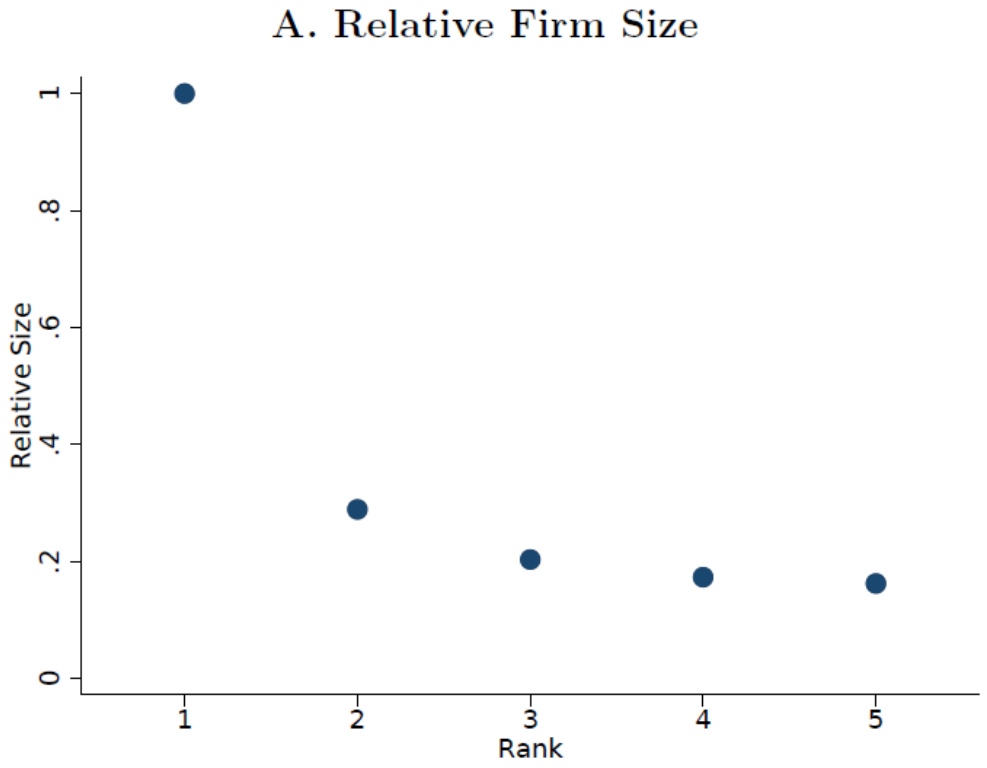
- Outcomes:
  - Revenue (output) (+**)

$\rightarrow$ Untreated are not unaffected by treatment, a classic SUTVA violation

- Put structure on the spillover(s)
- Decompose DiD estimates

What does this paper do?

Disentangling reallocation of production within a conglomerate due to regulation



- Size of affiliates must be efficient
  - Conglomerate *can* reallocate capital
- Lets authors infer costs of production at each affiliate
- We don't usually see within-conglomerate, across-affiliate costs of production, but these will determine energy consumption, pollution, profit impacts of reallocation

What does this paper do?

$$\frac{q_i}{q_1} = \frac{k_i}{k_1} = \frac{l_i}{l_1} = \frac{e_i}{e_1} = \delta^{\frac{i-1}{1-\alpha}}.$$

- δ is the decline in production knowledge
  - "span of control"
- α is the decreasing returns to scale
  - Control the relationship between ranks
  - Taken from literature $\alpha = .9$
- ϕ controls the conglomerate (j) efficiency
  - If top firm in conglomerate j is in Top 1,000, $\phi_j > \tilde{\phi}$
  - Threshold ϕ_1 for entry ($\pi(\phi_1) = 0$)
  - Shadow cost of regulation (cost of within- i reallocation) is decreasing in ϕ

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Shadow cost $\lambda(\phi)$

- Since number of affiliates in a conglomerate is lumpy, shadow costs $\lambda(\phi)$ are a step function of n
- So equilibrium is determined by a single shadow cost for each n
- Key to welfare calculations

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  - Literature has focused on trade (Fowlie (2009), Shapiro and Walker (2018))
  - But what happens within a conglomerate?
- Related: Theory of Second-Best Regulation
  - Significant contribution in policy analysis section comparing to a energy tax
  - Rules out fuel-switching as large channel, so energy tax is close to Pigouvian under some assumptions

Why I will assign this paper to my students

- Reduced form estimates + theoretical model are very well linked
  - Model helps decompose the reduced form estimates $\rightarrow$ bias from spillovers
- Assumptions are clear
  - Strong assumptions are well-justified
- Model is only what is necessary

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Looking forward: can this be done in the US?

Framing/positioning in the literature

- Two forms of spillovers: trade (external) and domestic reallocation
  - A unifying framework?
  - Market-level spillovers could be connected to trade "leakage" in a (possibly) straightforward manner
  - Compare magnitudes?

- Can you get all the way to Pigouvian (second-best)?
  - Difference between "universal energy tax" (in paper) and pigouvian tax:
  - Can switch to cleaner source
  - Spatial variation in pollution

A few suggestions going forward

- Colmer (2020) finds the opposite results in France.
  - Typology of market structures?
  - Policy differences (EU-ETS vs. Top 1,000 conservation mandate)
  - Glean from variation across industry in China

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- Colmer (2020) finds the opposite results in France.
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  - Glean from variation across industry in China
- Alternative explanation: conglomerates "spread" production (and jobs) spatially to gain favor with regional ministers.
  - Larger firms have more to spread around (and are more likely to have a Top 1,000 firm)
  - $\rightarrow$ any change in industry that increases value of political capital will encourage the downward shift of production allocation, appearing equivalent to the Top 1,000 results.
  - Parallel trends should look different (and within-conglomerate DiD results are the opposite, Fig 6A)
  - Are there conglomerates with >1 affiliate in the Top 1,000?
  - What is the sign on a dummy for "2nd in Top 1,000"?

US Clean Air Act (1970, 1990 am.)

- "Attainment" and "nonattainment" areas
  - "nonattainment" required state plan and regulation to improve criteria pollution levels
  - Chay and Greenstone show large effect of CAA of 1970 on infant mortality (2003) and housing price (2005)
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Holistic measure of effect of CAA

- Decompose effects of CAA on pollution; include reallocation across conglomerates
  - Emissions replace energy consumption
  - Still consider output reallocation
- But CAA "treatment" isn't as direct as in China
  - Nonattainment designation led to varied plans for reducing emissions
  - Most technology-based
  - De facto tradable permits in that new sources could be allowed if offsets were made

Location, location, location

- Spillovers from CAA move towards unregulated areas
- CAA 1970 **Prevention of Significant Deterioration** (PSD) sought to affect the exact sort of spatial spillover hypothesized here
  - Clean areas could not get significantly worse
  - Affects entry in unregulated ("attainment" areas) and expansions (reallocation of capital)
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Dose-response

- Non-linear damage function from pollution
  - Carbon probably linear
- So there may be some welfare *increase* in pushing pollution out of nonattainment areas, even if the **total overall pollution levels** were the same
- ** Assuming some functional form of "curvature" of a dose-response curve, back out degree of curvature that would rationalize aspects of PSD