

# Do Environmental Regulations Affect the Decision to Export?

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## Research Question

- ▶ Do environmental regulations affect the export decisions of manufacturing plants?

# Motivation

- ▶ Environmental policy's "competitiveness" effects often central in policy debates.
  - ▶ Question of policy incidence, not costs.
- ▶ Incidence tells us who is affected by policy.
  - ▶ Important dimension of policy.
  - ▶ Informative on political feasibility of policy.
- ▶ But "competitiveness" can have many definitions/features.
  - ▶ E.g. plant closures, lost output, increased costs.
- ▶ This vagueness matters.
  - ▶ How "competitiveness" is measured reflects who is bearing that incidence.

# Motivation

- ▶ We focus on exports.
- ▶ Capture an important dimension of competitiveness: **relative cost shocks**.
  - ▶ ER raises domestic costs.
  - ▶ Exporters disadvantaged in foreign markets.

# This Paper:

- ▶ Examines the effects of air quality standards on the export volumes and export participation decisions of manufacturing plants.
- ▶ Two steps:
  1. Develop a simple theoretical model.
  2. Estimate the effects of Canadian air quality regulation on manufacturing plant exports.

# Background: Air Quality Standards

- ▶ Air quality standards are a common form of environmental regulation: Canada, US, EU, Chile, India...
- ▶ Designed to achieve a minimum level of air quality.
- ▶ Implementation: two-part design.
  - ▶ Regulated plants must either use clean production processes or face penalty/reduce polluting activities.

# Theory: Overview

- ▶ Theoretical model:
  - ▶ General equilibrium model of a small open economy with heterogeneous firms.
  - ▶ Domestic pollution regulated using an air quality standard.
  - ▶ Firms can upgrade technology in response to regulation, or face a pollution tax.
  
- ▶ Key implications from theory:
  - ▶ Two margins: **extensive** margin (who exports) and **intensive** margin (how much they export).
  - ▶ Not all producers will be equally affected: the **marginal exporter** most affected.

# Empirics: Overview

- ▶ Examine the effects of the Canada Wide Standards for Particulate Matter and Ozone (CWS) on the export decisions of Canadian manufacturing plants.
- ▶ The CWS was a Canadian air quality standard in place from 2000 onward.
  - ▶ Set ambient air quality standards for  $PM_{2.5}$  and  $O_3$ .
    - ▶ Regions exceeding standard's threshold subject to more stringent regulation.
    - ▶ "Target industries" subject to more stringent regulation.
- ▶ We focus on  $PM_{2.5}$  emitting plants.



# Identifying the Effects of the CWS

- ▶ To identify the CWS' effect on plants, we use a triple-difference research design.
  - ▶ Compare outcomes for plants in targeted industries and regulated regions to other plants.
- ▶ Consider two dependent variables:
  - ▶  $\ln[\text{Exports}]_{pijt}$  and  $\mathbb{1}[\text{Exit Exporting}]_{pijt}$
- ▶ Model predicts regulatory effects will vary by plant size.
  - ▶ Also allow effects to vary by plant-size quartile.

# Empirical Results

- ▶ Average effects:
  - ▶ 20% reduction in export volumes from continuing exporters.
  - ▶ No significant effect on export exit rates.
- ▶ Effects on marginal exporters:
  - ▶ 35% reduction in export volumes from smallest continuing exporters.
  - ▶ 5 percentage point increase in export exit rates from smallest plants.
- ▶ Air quality standards affect trade via intensive and extensive margins.
  - ▶ In total, the CWS caused over \$8 billion in lost export revenues.

# Implications for Environmental Policy

- ▶ Exports capture relative cost shocks of environmental policy.
  - ▶ These shocks may be large...
  - ▶ ...but may be limited to a narrow set of firms.
- ▶ Translating to climate policy depends on stringency.
  - ▶ Equally stringent policy likely has similar extensive margin.
    - ▶ Plants affected by air quality standards face monetary penalty/production limits that are similar to carbon taxes/emissions caps.
  - ▶ However, would likely produce a larger intensive margin effect.
    - ▶ Air quality standards differentially affect larger plants; a carbon tax would also raise costs for these plants, making exporting more difficult.

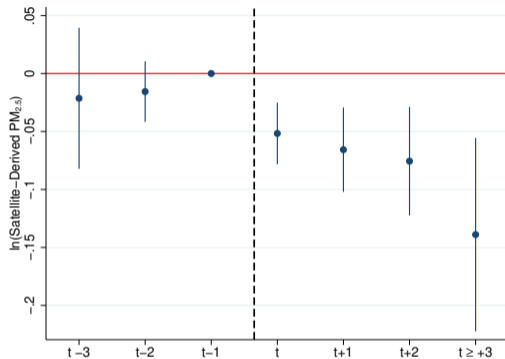
# Future Research

- ▶ Conceptual/theoretical:
  - ▶ Should we adjust policy to reflect this form of incidence?
  - ▶ If so, how? Particularly if policy has differential effects on firms.
- ▶ Empirical:
  - ▶ New micro-data on firms: costs, production choices, investment decisions, innovation, etc.
  - ▶ Micro-data needed for causal estimates, and to understand heterogeneity.

# Thank you!

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# Evidence of Regulatory Effectiveness



**Figure:** CWS Effect on Local Air Quality - Event Study

*Notes:* Figure shows results from an event study comparing PM<sub>2.5</sub> violating regions to non-violating regions. Treatment is relative to the first year in violation (time t). Dependent variable is the natural log of the mean PM<sub>2.5</sub> concentration within a CSD-year, where PM<sub>2.5</sub> is derived from satellite data (Van Donkelaar et. al., 2015). Regression includes CSD and year fixed-effects. Years pre t-3 are dropped, and years post t+3 are pooled. Standard errors clustered by CMA. *Source:* Najjar and Cherniwchan (2017).