The Displacement Effects of Environmental Regulation: Evidence from Canada

Felix Fosu (Queen's University)
Wenshuang Yu (University of Calgary)

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Research Questions

- Do stricter Canadian air quality standards increase firm import intensity?
- Do firms substitute toward foreign, potentially dirtier, suppliers?

Motivation

- Air quality regulations raise the cost of emissions, incentivizing firms to adopt cleaner technologies. However, firms may also respond by offshoring pollution-intensive activities or exiting the market.
- Firms' adjustment margins ultimately determine the policy's effect on aggregate emissions.
- In Canada, these standards have meaningfully improved environmental quality, accounting for nearly 40% of the decline in manufacturing emission intensity (Najjar and Cherniwchan, 2021).
- Unfortunately this decline is accounted for mainly by decline in value added or output.

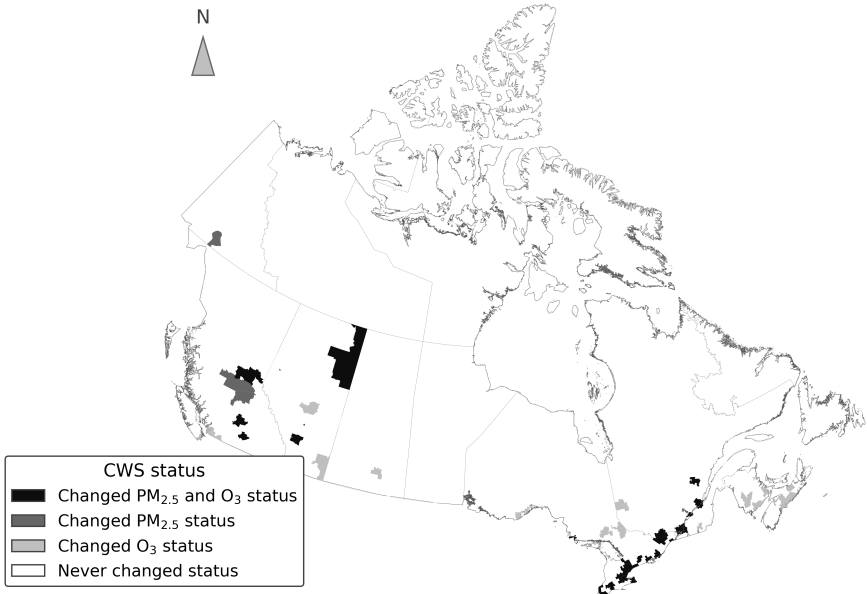
Air Quality Regulation: Canada-Wide Standards

Canada-Wide Standards for PM_{25} and Ozone (CWS)

Feature	**Details**
Adopted	2000, by federal/provincial/territorial ministers
PM_{25} target	≤ 30 µg/m^3 (24-hour average) by 2010
Ozone target	≤ 65 ppb (8-hour average) by 2010
Mechanism	CMAs exceeding thresholds face stricter pollution rules
Superseded by	CAAQS in 2012 (tighter targets)

- $PM_{2.5}$ refers to airborne particles that are 2.5 microns or less in diameter.
- Ozone refers to an oxygen compound (O3) occurring in the form of a gas in the atmosphere at ground-level.
- Policy variation across CMAs and over time.

Treated Regions



Data

- **Business Register Microdata (BRM) — Statistics Canada**
  - Coverage: All registered Canadian enterprises, 2000–2021
  - Primary analysis window: 2005–2010
  - Firm identifiers: CMA, industry classification
- **National Air Pollution Surveillance Program**

Results

Baseline Results: Effect of Air Quality Regulation

	(1) *log(Import/Input)*	(2) *log(Import/Output)*	(3) *log(Import/Export)*	(4) *log(Real Imports)*
Treatment × Post	0.4087[a]	0.3784[a]	0.4485[a]	0.4994[a]
	[0.1677]	[0.1587]	[0.1468]	[0.2332]
Observations	150,600	150,600	150,600	150,600

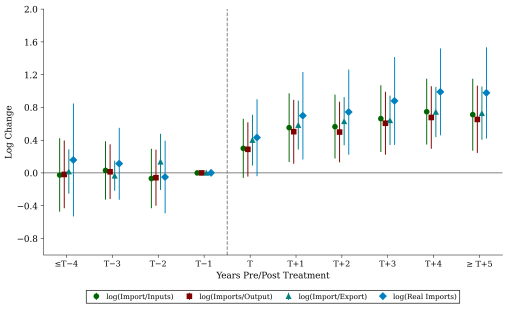
Robust Standard errors in brackets.

[a] Coefficient statistically significant at 5% level.

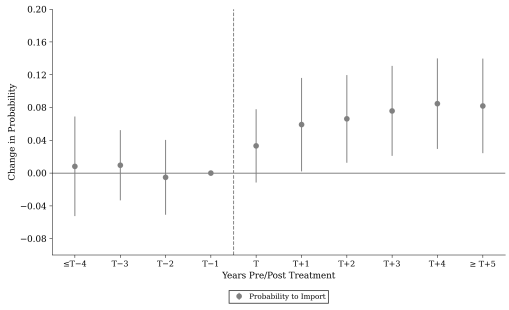
Firms in treated regions significantly increased foreign sourcing.

Flexible Estimates

Figure: The Effect Air Quality Regulation by Years: Pre/Post Regulation



(a) Total Effect



Extensive Margin Effect

Heterogeneous Effects

- Exporters increase import intensity more than non-exporters.
- Multi-establishment firms likely reallocate internally, dampening per-site responses.
- Small and less productive firms drive the extensive margin effect.
- New imports predominantly originate from high-income countries.
- Spillovers: Non-manufacturing sectors (wholesale, retail) also increase imports as domestic supply chains are disrupted.

Policy Implications

- Unilateral air quality standards may reduce **domestic** emissions but increase **global** carbon leakage
- Findings inform Canada's, the EU's, and the US's ongoing Border Carbon Adjustments (BCA) design debates
- Coordinated international climate policy is essential to avoid pollution haven effects