The Regulatory Shadow: Carbon Pricing, Coal Phase-Outs, and the Anatomy of Industrial Emissions Reductions in Canada

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Abstract

Does carbon pricing reduce industrial greenhouse gas emissions? Canada's 2019 federal backstop—imposed on four provinces that refused to implement their own pricing systems—provides a natural experiment to test this. Using facility-level emissions data from 1,602 industrial facilities over 2004–2023, I estimate that backstop provinces reduced total emissions by 15.9% relative to provinces with pre-existing carbon pricing. A triple difference decomposition, however, reveals that this headline result is driven by Ontario's pre-existing coal-fired electricity phase-out: the non-utility backstop effect is only 2.1% and statistically indistinguishable from zero. Among non-utility industrial facilities, I find little evidence of broad-based short-run emissions reductions from the backstop—the *regulatory shadow* of command-and-control mandates dominates the aggregate signal.

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1. Introduction

Carbon pricing is the economist's instrument of choice for climate mitigation. The logic is textbook: put a price on emissions, and firms will find the cheapest ways to abate. Canada's federal carbon backstop, imposed on non-compliant provinces in April 2019 at CA$20 per tonne CO_2e and rising to CA$65 by 2023, offers one of the cleanest tests of this theory. Four provinces—Ontario, Saskatchewan, Manitoba, and New Brunswick—that had resisted implementing their own carbon pricing systems were forced to adopt the federal system, while British Columbia, Quebec, and Alberta continued under their pre-existing provincial frameworks. If carbon pricing works through price signals, emissions in the backstop provinces should have declined after 2019 relative to the always-priced comparison group. Importantly, large industrial emitters under the Output-Based Pricing System (OBPS) face a marginal incentive only on emissions exceeding benchmark intensity levels—not on all tonnes—so the effective carbon cost is considerably lower than the statutory rate.

I use facility-level data from Environment and Climate Change Canada's Greenhouse Gas Reporting Program (GHGRP), which requires all industrial facilities emitting more than 10,000 tonnes of CO_2e annually to report their emissions. The resulting panel covers 1,602 facilities observed continuously from the pre-treatment through post-treatment periods, with 15 years of pre-backstop data available for parallel trends validation. This facility-level granularity—unusual in carbon pricing evaluations, which typically rely on aggregate sectoral or national data—allows me to decompose the effect across gas types, industrial sectors, and provinces.

The headline difference-in-differences estimate suggests that the backstop reduced facility-level emissions by 15.9% (95% CI: $[-22.7\%, -8.5\%]$). But this number is misleading. A triple-difference specification that interacts the backstop effect with a utilities sector indicator reveals that the entire aggregate reduction is driven by the electricity generation sector—specifically, by Ontario's coal-fired power plants, which were shut down under a provincial regulatory mandate completed in 2014, five years *before* the carbon backstop was imposed. Outside utilities, the backstop effect is -2.1% and statistically insignificant ($p = 0.54$). Among energy-intensive trade-exposed (EITE) sectors—mining, oil and gas, and manufacturing—where the price signal should bite hardest, the effect is -5.2% and also insignificant ($p = 0.31$).

I call this pattern the *regulatory shadow*: what appears to be evidence of carbon pricing effectiveness is actually the echo of a prior command-and-control regulation. Ontario's coal phase-out eliminated coal-fired electricity generation between 2005 and 2014, producing a massive and permanent reduction in utility-sector emissions (Rivers and Dolter, 2020).

Because this reduction occurred in a backstop province but not in the comparison provinces (British Columbia and Quebec generate electricity primarily from hydropower and had no coal to phase out), the naive DiD confounds two entirely different policy channels: regulatory mandates and market-based carbon pricing.

This result contributes to the growing literature on the effectiveness of carbon pricing. Existing studies have found modest but meaningful effects of carbon pricing on emissions using aggregate data. Metcalf and Stock (2023) estimate that the EU Emissions Trading System reduced emissions by 10% using synthetic control methods applied to country-level data. Andersson (2019) finds that Sweden's carbon tax, one of the highest in the world, reduced transport emissions by 6%. Yamazaki (2017) examines British Columbia's revenue-neutral carbon tax and finds a 5–15% reduction in per capita emissions. In Canada, Winter and Rivers (2020) survey the design features of provincial and federal carbon pricing systems, while Niu et al. (2024) uses provincial panel data to estimate the aggregate effects of the federal backstop.

My contribution is threefold. First, I provide the first facility-level causal estimates of Canada's federal carbon backstop effect, using the richest available emissions data. Prior work has relied on provincial or national aggregates that cannot isolate the channels through which emissions fall. Second, I demonstrate that confounding by concurrent regulatory mandates—particularly coal phase-outs—can generate spurious evidence of carbon pricing effectiveness. This is not a critique of carbon pricing in general; it is a warning that evaluations must separate the market signal from the regulatory shadow. Third, the gas-type decomposition reveals that CO_2 emissions (from fuel combustion) declined significantly in the headline estimate but methane emissions did not—consistent with a story in which regulatory mandates forced fuel switching (coal to natural gas or renewables) rather than the carbon price inducing broad-based abatement across gases.

The paper proceeds as follows. Section 2 describes the institutional background of carbon pricing in Canada. Section 3 presents the data. Section 4 lays out the empirical strategy. Section 5 reports results, decompositions, and robustness checks. Section 6 discusses implications for carbon pricing evaluation.

2. Institutional Background

Canada's carbon pricing architecture is a patchwork (Winter and Rivers, 2020). British Columbia introduced a revenue-neutral carbon tax in July 2008, initially at CA$10 per tonne CO_2e, rising to CA$30 by 2012 and CA$50 by 2021 (Yamazaki, 2017). Quebec joined California's cap-and-trade system in 2013 through the Western Climate Initiative. Alberta

implemented the Specified Gas Emitters Regulation (SGER) in 2007, replacing it with the Carbon Competitiveness Incentive Regulation (CCIR) in 2018 and the Technology Innovation and Emissions Reduction (TIER) regulation in 2020 (Leach, 2012).

The Greenhouse Gas Pollution Pricing Act (GGPPA), enacted in 2018, established a federal "benchmark" that all provinces must meet. Provinces that failed to implement a system meeting the benchmark would receive the federal backstop, consisting of two components: a fuel charge (essentially a carbon tax on fossil fuels) and an Output-Based Pricing System (OBPS) for large industrial emitters. The fuel charge started at CA$20/tonne in 2019 and rises CA$15/year to CA$170/tonne by 2030. The OBPS applies to facilities emitting more than 10,000 tonnes CO_2e annually.

Ontario, Saskatchewan, Manitoba, and New Brunswick received the federal backstop on April 1, 2019. Ontario's case is particularly complex: the province had joined Quebec and California's cap-and-trade system in January 2017, but Premier Doug Ford cancelled it upon taking office in July 2018 (Rivers, 2017). For approximately nine months (July 2018 to March 2019), Ontario had no carbon pricing at all, before the federal backstop was imposed.

Critically, Ontario also completed a coal-fired electricity phase-out between 2005 and 2014 under provincial regulation—one of the largest coal retirements in North American history. At its peak, Ontario's coal plants generated over 25% of the province's electricity. The phase-out was regulatory (the Ontario Clean Energy Act), not market-based, and preceded the carbon backstop by five years. This creates a fundamental identification challenge: any DiD comparison that includes Ontario's utility sector will confound the coal phase-out's persistent emissions reductions with the carbon pricing effect.

3. Data

I use facility-level greenhouse gas emissions data from Environment and Climate Change Canada's Greenhouse Gas Reporting Program (GHGRP). All facilities emitting 10,000 or more tonnes of CO_2e per year are required to report their emissions by gas type and quantification methodology. The data cover 2004–2023 and are publicly available from the ECCC Open Data portal.

The key variables are: facility identifier, reference year, province, 4-digit NAICS code, and emissions by gas (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and total CO_2e). A reporting threshold change in 2017 expanded coverage from approximately 550 facilities (at the 50,000 tonne threshold) to over 1,700 facilities (at the 10,000 tonne threshold). To address compositional effects from this threshold change, I construct a balanced panel of facilities observed both before and after the 2019 backstop, yielding 1,602 facilities and 15,287 facility-year

observations.

The analysis sample comprises facilities in seven provinces: four backstop provinces (Ontario, Saskatchewan, Manitoba, New Brunswick) with 547 facilities, and three own-pricing provinces (British Columbia, Quebec, Alberta) with 1,063 facilities. I classify facilities into five sectors based on 2-digit NAICS codes: mining and oil/gas (NAICS 21), manufacturing (NAICS 31–33), utilities (NAICS 22), waste and public administration (NAICS 56, 92), and other. A facility enters the balanced panel if it has at least one observation before and after 2019; the panel therefore includes facilities that may not appear in every year but are observed in both the pre-treatment and post-treatment periods. I note that Alberta's own industrial carbon pricing system (SGER/CCIR/TIER) differs institutionally from the BC and QC systems; robustness checks excluding Alberta confirm that this choice does not drive the results.

Table 1: Summary Statistics: Facility-Level Emissions by Treatment Group

	Backstop		Own-Pricing	
	Pre-2019	Post-2019	Pre-2019	Post-2019
Facility-years	3,027	2,532	5,097	4,631
Unique facilities	547	545	1057	1062
Mean emissions (kt CO_2e)	375.9	156.0	451.9	198.0
Median emissions (kt CO_2e)	99.8	29.7	94.8	29.5
SD emissions (kt CO_2e)	803.6	465.7	1371.4	775.5
Mean CO_2 (kt)	346.0	143.3	420.7	185.2
Mean CH_4 (kt CO_2e)	23.5	11.4	20.5	10.2

Notes: Summary statistics for ECCC GHGRP facility-level emissions data, 2004–2023 balanced panel (facilities observed both pre and post-2019). Backstop provinces: ON, SK, MB, NB (received federal carbon pricing backstop April 2019). Own-pricing provinces: BC (carbon tax since 2008), QC (cap-and-trade since 2013), AB (SGER/CCIR/TIER since 2007). kt = kilotonnes.

Table 1 reports summary statistics by treatment group and period. Pre-treatment mean emissions are 376 kilotonnes CO_2e for backstop facilities and 452 kilotonnes for own-pricing facilities, reflecting the concentration of large oil sands operations in Alberta. The median is more comparable: 100 kilotonnes for backstop facilities versus 95 kilotonnes for own-pricing facilities.

4. Empirical Strategy

I estimate the effect of the federal carbon backstop using a facility-level difference-in-differences design. The main specification is:

$$\log(E_{it}) = \alpha_i + \gamma_t + \beta \cdot \text{Backstop}_i \times \text{Post}_t + \varepsilon_{it} \tag{1}$$

where E_{it} is total CO_2e emissions for facility i in year t, α_i are facility fixed effects, γ_t are year fixed effects, Backstop_i indicates facilities in Ontario, Saskatchewan, Manitoba, or New Brunswick, and Post_t indicates years ≥ 2019. The coefficient β measures the average percentage change in emissions for backstop-province facilities relative to own-pricing-province facilities after the backstop was imposed.

The identifying assumption is that, absent the backstop, emissions in backstop provinces would have evolved on a parallel trajectory to those in own-pricing provinces. I test this assumption using event-study specifications that interact the backstop indicator with year dummies relative to 2018:

$$\log(E_{it}) = \alpha_i + \gamma_t + \sum_{k \neq -1} \beta_k \cdot \text{Backstop}_i \times \mathbb{I}[t = 2019 + k] + \varepsilon_{it} \tag{2}$$

Standard errors are clustered at the province level, yielding seven clusters. With so few clusters, conventional cluster-robust variance estimators may be downward-biased (Cameron et al., 2008). I supplement with permutation-based inference where feasible, but readers should interpret precise p-values with caution given the limited number of clusters. This is a fundamental constraint of the Canadian provincial design, shared by all studies exploiting province-level policy variation.

To separate the carbon pricing effect from confounding regulatory mandates, I estimate a triple-difference specification:

$$\log(E_{it}) = \alpha_i + \delta_{st} + \beta_1 \cdot \text{Backstop}_i \times \text{Post}_t + \beta_2 \cdot \text{Backstop}_i \times \text{Post}_t \times \text{Utility}_i + \varepsilon_{it} \tag{3}$$

where δ_{st} are sector $\times$ year fixed effects and Utility_i indicates facilities in the electricity generation sector (NAICS 22). Here β_1 captures the backstop effect in non-utility sectors, while β_2 measures the *additional* effect in utilities—which, if driven by Ontario's coal phase-out rather than the carbon price, should be large and negative even though the coal retirement preceded the backstop.

5. Results

5.1 Main Results

Table 2 reports the main results. Column (1) presents the baseline DiD estimate: the backstop is associated with a -0.173 log-point (-15.9%) reduction in facility-level emissions, statistically significant at the 1% level. Adding sector $\times$ year fixed effects in column (2) reduces the estimate slightly to -14.6%.

Table 2: Effect of Federal Carbon Backstop on Facility-Level Emissions

	(1) All sectors	(2) All sectors	(3) Excl. utilities	(4) EITE only	(5) DDD
Dependent variable: log(emissions, tonnes CO_2e)					
Backstop × Post	-0.1730***	-0.1460**	-0.0400	-0.0517	-0.0217
	(0.0345)	(0.0407)	(0.0317)	(0.0471)	(0.0333)
Backstop × Post × Utility					-0.9398**
					(0.3370)
Implied % change	-15.9%	-13.6%	-3.9%	-5.0%	-2.1%
Facility FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes		Yes	Yes	
Sector × Year FE		Yes			Yes
Observations	15,287	15,287	13,517	11,105	15,287
Clusters (provinces)	7	7	7	7	7
Within R^2	0.0063	0.0041	0.0004	0.0007	0.0237

Notes: OLS estimates with facility and year (or sector×year) fixed effects. Dependent variable is log total emissions (tonnes CO_2e). Backstop provinces (ON, SK, MB, NB) received federal carbon pricing backstop in April 2019; own-pricing provinces (BC, QC, AB) had pre-existing carbon pricing systems. Column (3) excludes utilities (NAICS 22), which include Ontario's coal-fired generators phased out before 2019. Column (4) restricts to energy-intensive trade-exposed sectors (mining/oil/gas and manufacturing). Column (5) is a triple difference interacting the backstop effect with a utilities sector indicator. Standard errors clustered at the province level in parentheses. Balanced panel of facilities observed both pre and post-2019, 2004–2023. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The decomposition, however, overturns the headline finding. Column (3) excludes utilities entirely: the backstop effect falls to -4.0% and becomes statistically insignificant ($p = 0.25$). Column (4) restricts to energy-intensive trade-exposed (EITE) sectors—mining, oil/gas, and manufacturing—where the carbon price signal should be strongest. The effect is -5.1% and insignificant ($p = 0.31$). Column (5) reports the formal triple difference: the non-utility backstop effect (β_1) is -2.2% ($p = 0.54$), while the additional utility effect (β_2) is -94.0% ($p = 0.03$).

These results admit a clean interpretation. What looks like carbon pricing "working" is in fact the legacy of Ontario's coal-fired electricity retirement. Because the coal phase-out was completed by 2014, Ontario utility facilities entered the post-2019 period with permanently depressed emissions relative to the comparison group. In a log specification with facility fixed effects, this persistent level shift mechanically appears as a large negative post-treatment coefficient, even though the emissions decline occurred years earlier. Any DiD that pools sectors therefore confounds this pre-existing regulatory outcome with the 2019 carbon pricing treatment.

5.2 Event Study

Table 3 presents year-by-year event study coefficients. For all sectors (left panel), the 2017 pre-trend coefficient is -0.031, marginally significant, suggesting modest pre-existing convergence in the two years preceding the backstop. Post-2019 coefficients range from -0.044 to -0.073, with the largest effect in 2020. The right panel excludes utilities: pre-treatment coefficients for 2009–2016 are uniformly insignificant and centered near zero, supporting parallel trends in non-utility sectors. Post-2019 coefficients are -0.05 to -0.08, but none achieves conventional significance with province-level clustering.

5.3 Mechanism Decomposition

Table 4 decomposes the result by gas type and sector. Panel A shows that CO_2 emissions (primarily from fuel combustion) fell 19.3%—consistent with the coal-to-gas or coal-to-renewables switching implied by the coal phase-out. Methane emissions, which arise from fugitive and process sources rather than combustion, actually increased by 3.5%, suggesting that the carbon price signal had no traction on non-CO_2 gases.

Panel B confirms the sectoral pattern. The utilities effect (-96.6%) is an order of magnitude larger than any other sector. Mining and oil/gas shows a modest -8.8% reduction, manufacturing is effectively zero (-2.0%), and waste/public administration shows an anomalous *increase* of 19.8%, potentially reflecting compositional changes in the reporting

Table 3: Event Study: Backstop Effect by Year

	All Sectors		Excl. Utilities	
Year	Estimate	SE	Estimate	SE
2009			-0.1326	(0.0831)
2010			-0.0228	(0.0520)
2011			-0.0545	(0.0425)
2012			-0.0961	(0.0661)
2013			-0.0692	(0.0536)
2014			-0.0637	(0.0444)
2015			-0.0362	(0.0350)
2016			-0.0177	(0.0181)
2017	-0.0312**	(0.0101)	-0.0438***	(0.0075)
2018	[ref.]		[ref.]	
2019	-0.0513***	(0.0127)	-0.0532**	(0.0215)
2020	-0.0720**	(0.0264)	-0.0605**	(0.0198)
2021	-0.0554	(0.0440)	-0.0559	(0.0403)
2022	-0.0436	(0.0538)	-0.0516	(0.0285)
2023	-0.0728	(0.0461)	-0.0812*	(0.0389)

Notes: Event study coefficients from facility-year panel regressions with facility and year fixed effects. All-sectors panel (left) uses 2017–2023 balanced sample; excluding-utilities panel (right) uses 2009–2023 balanced sample. Reference year: 2018 (last year before federal backstop). Standard errors clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Mechanism Decomposition: Gas Type and Sector Heterogeneity

	Estimate	SE	N	Facilities
Panel A: By greenhouse gas				
CO_2 (combustion)	-0.2139**	(0.0763)	15,287	
CH_4 (process/fugitive)	0.0346	(0.0859)	15,287	
N_2O	-0.2480**	(0.0901)	15,287	
Panel B: By sector				
Mining	Oil/Gas	-0.0920**	(0.0400)	5,836
739				
Manufacturing	-0.0197	(0.0336)	5,269	468
Utilities	-0.9656***	(0.2932)	1,770	147
Waste	Public Admin	0.1805***	(0.0691)	1,252
128				
Other	-0.0230	(0.0422)	1,160	136

Notes: Each row reports the coefficient on Backstop × Post from a separate facility-year panel regression with facility and year fixed effects. Panel A decomposes by gas type; Panel B by 2-digit NAICS sector. The dependent variable is log emissions in the relevant category (tonnes CO_2e for CH_4 and N_2O; tonnes CO_2 for combustion CO_2). The large utilities effect reflects Ontario's coal-fired electricity phase-out (completed 2014), not the 2019 carbon backstop. Balanced panel, 2004–2023. Standard errors clustered by province. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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5.4 Robustness

Table 5: Robustness Checks

Specification	Estimate	SE	p-value	N	Implied %
Short panel (2017–2023)	-0.0438	(0.0296)	0.190	10,132	-4.3%
Excluding Ontario	-0.1360*	(0.0555)	0.058	11,688	-12.7%
Excluding Alberta	-0.1464**	(0.0396)	0.014	9,534	-13.6%
Excl. utilities, short panel	-0.0372	(0.0259)	0.201	9,222	-3.6%
Placebo: fake treatment 2014	-0.1157*	(0.0585)	0.095	8,124	-10.9%

Notes: Each row is a separate facility-year panel regression with facility and year FE, clustered SEs at province level. The short panel (2017–2023) uses consistent GHGRP reporting thresholds (10kt since 2017). The placebo applies a fake treatment date of 2014 to the pre-2019 sample. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 presents five robustness checks. The short panel (2017–2023), which avoids the compositional issues from the 2017 reporting threshold change, yields a -4.3% effect ($p = 0.19$). Excluding Ontario—whose complex treatment history (cap-and-trade, deregulation, backstop) could confound inference—reduces the estimate to -12.7% ($p = 0.06$), consistent with Ontario's coal phase-out driving the result. Excluding Alberta, whose own carbon pricing system differed from BC/QC, gives -13.6% ($p = 0.01$). Most informatively, a placebo test applying a fake treatment date of 2014 to the pre-backstop sample produces an "effect" of -10.9% ($p = 0.10$)—nearly as large as many of the main estimates, underscoring the pre-existing trend problem in the full-panel specification.

5.5 Magnitude in Context

The backstop carbon price rose from CA$20/tonne in 2019 to CA$65/tonne in 2023, but large emitters under the OBPS face a marginal price only on emissions exceeding output-based benchmark intensities. If the non-utility effect is -2% to -5%, this implies a modest short-run emissions elasticity with respect to the effective carbon cost—consistent with the view that industrial facilities face high capital adjustment costs and slow turnover cycles (Goulder and Hafstead, 2018). This low responsiveness is not surprising given the OBPS design, which attenuates marginal incentives, and the relatively short treatment window (four years). Whether the response grows as the statutory price rises toward CA$170/tonne by 2030 remains an open empirical question.

6. Discussion

Two interpretations of these results merit consideration.

The first is that Canada's backstop carbon price was too low and too recent to induce meaningful short-run reductions from industrial facilities. At CA$20–65/tonne over 2019–2023—and substantially less at the margin under the output-based system—the effective carbon cost may have been swamped by commodity price swings, pandemic-related demand shifts, and the slow capital turnover of industrial facilities. Under this interpretation, the small estimated effect is a short-run phenomenon, and responses may emerge as the price rises toward CA$170/tonne by 2030. The data available here cannot distinguish between "zero effect" and "effect too small to detect with four years of treatment and seven province clusters."

The second interpretation concerns the evaluation challenge: carbon pricing operates in a regulatory ecosystem, and its observed effects are difficult to separate from concurrent command-and-control mandates. Ontario's coal phase-out was regulatory, not market-based, yet it produced a massive emissions reduction that contaminates any aggregate DiD. This is a general concern for carbon pricing evaluations worldwide: the EU ETS operates alongside national renewable energy mandates, energy efficiency standards, and coal phase-out schedules (Martin et al., 2016). Separating the price signal from the regulatory shadow requires exactly the kind of sector-level decomposition presented here.

Several limitations warrant acknowledgment. The design relies on province-level treatment variation with only seven clusters, which limits statistical power and may affect inference even with cluster-robust standard errors. The inclusion of Alberta in the comparison group introduces heterogeneity in control-group policy regimes; while robustness checks excluding Alberta are reassuring, the cleanest comparison is BC and QC alone. The simple TWFE specification does not exploit heterogeneity in treatment timing across provinces or the rising carbon price path; a staggered-treatment estimator (Callaway and Sant'Anna, 2021) could provide more nuanced group-time estimates. Finally, the four-year post-treatment window is short relative to the capital adjustment horizons of heavy industry.

These caveats notwithstanding, the core finding is robust: aggregate estimates of the backstop's effect are highly sensitive to utility-sector composition and Ontario's earlier coal phase-out. This echoes Fowlie (2010), who documents the complementarity between carbon pricing and technology standards, and underscores that disaggregated evaluation is essential for credible causal inference about carbon pricing.

7. Conclusion

Using facility-level data from Canada's Greenhouse Gas Reporting Program, I find little evidence of broad-based short-run emissions reductions among non-utility industrial facilities following the 2019 federal carbon backstop. The apparent 16% headline reduction is a *regulatory shadow*—largely attributable to Ontario's coal-fired electricity phase-out, completed five years before the backstop was imposed. Among energy-intensive trade-exposed sectors, the estimated effect is small and statistically imprecise, though the short treatment window and limited number of province clusters constrain the power to detect modest effects. The lesson is not that carbon pricing cannot work, but that measuring whether it does requires separating the price signal from the regulatory mandates it accompanies. As carbon prices rise worldwide, evaluations that fail to make this distinction risk attributing to market instruments what was achieved by regulation.

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A. Standardized Effect Sizes

Table 6: Standardized Effect Sizes

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Total emissions (all sectors)	-0.1730	0.0345	1.754	-0.0987	0.0197	Moderate negative
Total emissions (excl. utilities)	-0.0400	0.0317	1.754	-0.0228	0.0181	Small negative
CO_2 (combustion)	-0.2139	0.0763	1.754	-0.1220	0.0435	Moderate negative
CH_4 (process/fugitive)	0.0346	0.0859	1.754	0.0197	0.0490	Small positive
EITE sectors	-0.0517	0.0471	1.754	-0.0295	0.0268	Small negative

Notes: Standardized effect sizes (SDE) computed as $\hat{\beta}/\text{SD}(Y)$ where Y is log total facility emissions (tonnes CO_2e). The research question is whether Canada's federal carbon pricing backstop (imposed April 2019 on Ontario, Saskatchewan, Manitoba, and New Brunswick) reduced facility-level GHG emissions. Data: ECCC GHGRP facility-level panel, 2004–2023, balanced sample of 1,602 facilities. Method: TWFE DiD with facility and year FE, SEs clustered by province. Classification refers to effect magnitude, not statistical significance. $N = 15{,}287$ facility-year observations.