

The Enforcement Lottery: Does It Matter Who Inspects?

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Abstract

Under cooperative federalism, EPA delegates 85% of Clean Air Act enforcement to state agencies but retains concurrent inspection authority. Using 1.16 million EPA compliance monitoring records linked to Toxics Release Inventory data for 9,907 facilities (2005–2023), I test whether federal inspectors produce different pollution outcomes than state inspectors. Instrumenting facility-level federal inspection with state-year aggregate federal enforcement intensity, I find a strong first stage ($F = 397$) but no effect on toxic releases: the IV estimate is 0.259 log points ($SE = 0.268$). An event study around facilities' first federal inspection confirms clean pre-trends and null post-treatment effects. The results suggest that the identity of the inspector matters far less for environmental outcomes than the act of inspection itself—a finding with direct implications for the ongoing debate over federal-state enforcement delegation.

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1. Introduction

Every year, EPA and state agencies conduct over 60,000 Clean Air Act compliance inspections at facilities across the United States. In principle, a federal inspector walking through a chemical plant’s gate should enforce the same law as a state inspector. In practice, critics of cooperative federalism have long argued that state enforcers face weaker incentives—revolving doors with local industry, political pressure from job-conscious governors, smaller budgets—and that this “enforcement gap” allows pollution that federal oversight would prevent (Mintz, 2012; Rechtschaffen and Markell, 2003). If true, the delegation of enforcement authority to states imposes a hidden cost: a pollution premium paid by communities near facilities that happen to be inspected by the less stringent tier of government. This paper asks whether that premium exists.

The question matters because the architecture of American environmental regulation depends on it. The Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act all follow the same cooperative federalism template: EPA sets standards, states implement and enforce, and EPA retains concurrent authority to step in when states fall short (Engel, 2006; Sigman, 2014). Periodically, EPA’s State Review Framework (SRF) evaluates state enforcement programs on a rotating four-to-five-year cycle, triggering increased federal oversight in states found deficient. If federal and state inspectors produce equivalent outcomes, this elaborate dual-sovereignty apparatus is redundant for pollution reduction—a costly institutional arrangement solving a problem that does not exist. If federal inspectors produce measurably less pollution, the case for recentralizing enforcement becomes compelling.

I test this by exploiting within-facility variation in exposure to federal versus state inspectors among 9,907 TRI-reporting facilities inspected under the Clean Air Act from 2005 to 2023. The empirical challenge is that federal inspections are not randomly assigned: EPA may target facilities with worse compliance histories, particular industry sectors, or states with weaker enforcement records. To address this selection, I instrument facility-level federal inspection receipt with the state-year aggregate share of federal inspections—a measure that captures statewide shifts in EPA inspection intensity driven by administrative priorities, SRF review cycles, and regional office staffing decisions that are plausibly exogenous to individual facility pollution trajectories.

The first-stage relationship is strong: a one-percentage-point increase in a state’s federal inspection share raises a facility’s probability of receiving a federal inspection by 0.56 percentage points ($F = 397$). Despite this powerful instrument, the second-stage effect on log TRI releases is small and statistically insignificant: the IV estimate is 0.259 ($SE = 0.268$). The OLS estimate—0.031 ($SE = 0.031$)—is essentially zero. Neither result is consistent with

the hypothesis that federal enforcement reduces toxic releases relative to state enforcement.

An event study around each facility’s first federal inspection provides complementary evidence. Pre-treatment coefficients are uniformly small and insignificant, confirming that federal inspections are not preceded by differential emission trends. Post-treatment coefficients are likewise small (0.03–0.08 log points) and insignificant across all horizons from zero to five years after the first federal inspection.

These results connect to a broader literature on the determinants of environmental compliance. [Gray and Shadbegian \(2005\)](#) find that inspections themselves—regardless of source—reduce future violations, a result I replicate at the extensive margin. [Shimshack and Ward \(2008\)](#) show that inspections paired with penalties produce deterrence, but my design cannot separately identify the penalty channel since federal inspectors impose penalties at similar rates to state inspectors in this sample. [Duffo et al. \(2013\)](#) demonstrate that even the structure of auditing matters for environmental outcomes in India, but in the U.S. context where both federal and state inspectors operate under the same statutory authority and penalty guidelines, the identity of the inspector may be less consequential. My contribution is to provide the first quasi-experimental estimate of this federal-state enforcement gap using the universe of Clean Air Act inspections linked to facility-level emission outcomes. The null finding is informative: it suggests that the debate over federal versus state enforcement ([Adler, 2005](#); [Glicksman and Earnhart, 2010](#)) may overstate the environmental stakes while underweighting the institutional costs of maintaining dual enforcement capacity.

The paper proceeds as follows. Section 2 describes the institutional setting of cooperative federalism and EPA’s State Review Framework. Section 3 presents the data. Section 4 details the empirical strategy. Section 5 reports results. Section 6 discusses implications.

2. Institutional Background

Cooperative federalism under the Clean Air Act. The 1970 Clean Air Act established a federal-state partnership for air quality regulation. EPA sets National Ambient Air Quality Standards (NAAQS) and emission limits; states develop State Implementation Plans (SIPs) and conduct the majority of compliance monitoring and enforcement activities. As of 2023, state agencies perform approximately 85% of CAA inspections, with EPA regional offices conducting the remainder ([U.S. Environmental Protection Agency, 2023](#)). States receive federal grants under Sections 103 and 105 of the CAA to support their enforcement programs, creating a financial dependence that theoretically aligns incentives ([Engel, 2006](#)).

The State Review Framework. EPA’s State Review Framework, established in 2004, provides the institutional mechanism through which EPA evaluates state enforcement performance. Under the SRF, EPA reviews each state’s Clean Air Act, Clean Water Act, and RCRA enforcement programs on a rotating four-to-five-year cycle. Each review produces publicly available reports with metrics on inspection coverage, violation identification rates, penalty assessment, and timely enforcement actions. When EPA finds a state program “deficient” on core metrics, it may increase direct federal inspection activity in that state—known as “overfiling”—to supplement state capacity (Gaynor et al., 2016). This SRF review schedule creates temporal variation in the federal-state inspection mix that is driven by administrative rotation rather than by individual facility behavior.

Federal versus state inspectors. Federal (EPA) and state inspectors operate under the same statutory authority and can assess the same penalties. However, institutional differences may affect stringency. Federal inspectors: (1) report to EPA regional administrators rather than state governors, reducing political pressure from local industry; (2) face less revolving-door exposure since career trajectories differ from state environmental agencies; (3) may apply national enforcement norms rather than locally calibrated standards (Mintz, 2012). These differences motivate the hypothesis that federal enforcement is systematically stricter.

3. Data

I construct a facility-year panel from three EPA data systems. First, the ICIS-Air database provides the universe of Clean Air Act compliance monitoring activities, including 1.16 million inspection records from 2005 to 2023. Each record identifies the inspecting agency through the STATE_EPA_FLAG field, coded as “E” (EPA/federal), “S” (state), or “L” (local). The COMP_MONITOR_TYPE field distinguishes Full Compliance Evaluations (FCEs)—comprehensive on-site inspections—from Partial Compliance Evaluations (PCEs). Second, the Toxics Release Inventory (TRI) provides facility-year chemical releases in pounds, covering approximately 21,000 facilities annually. Third, the ECHO Exporter provides facility characteristics including NAICS codes, geographic coordinates, and EPA region.

I link ICIS-Air inspections to TRI releases through EPA’s Facility Registry Service (FRS), which maps program-specific identifiers to a common REGISTRY_ID. The matched panel contains 43,129 facility-year observations from 9,907 unique facilities across 51 states (including DC). These TRI-linked facilities tend to be larger, more heavily regulated, and more frequently inspected than the broader universe of CAA-regulated facilities.

Table 1 presents summary statistics. In the full inspection panel, 3% of inspections are

Table 1: Summary Statistics

	Mean	SD	N
<i>Panel A: All CAA-inspected facilities (2005–2023)</i>			
Inspections per facility-year	2.027	3.249	573,162
Federal inspections	0.057	0.494	573,162
Any federal inspection	0.034	0.180	573,162
Federal share	0.024	0.142	573,162
FCE rate	0.501	0.439	573,162
<i>Panel B: TRI-linked facilities</i>			
Log(TRI releases + 1)	7.794	3.729	43,129
TRI releases (1000 lbs)	86.740	395.815	43,129
Inspections per facility-year	2.677	4.346	43,129
Any federal inspection	0.059	0.235	43,129
Federal share	0.041	0.180	43,129
Number of pollutants	6.093	8.391	43,129
<i>Panel C: State-year level</i>			
State federal share	0.064	0.116	969
State inspections	1198.932	1600.538	969
State federal inspections	33.874	60.652	969

Notes: Data from EPA ECHO (ICIS-Air compliance monitoring records) linked to TRI facility-level releases and ECHO Exporter facility characteristics. Sample covers Clean Air Act inspections from 2005 to 2023 across 51 states (including DC). Panel A includes all facilities receiving at least one CAA inspection. Panel B restricts to facilities also reporting to the Toxics Release Inventory. Panel C aggregates to state-year level. Federal inspections identified via the STATE_EPA_FLAG field (“E” = EPA/federal inspector). TRI releases measured in pounds per facility-year across all reported chemicals.

conducted by federal (EPA) inspectors. TRI-linked facilities receive 2.7 inspections per year on average, with 5.9% of facility-years involving at least one federal inspection. Mean log TRI releases are 7.79 (SD = 3.73), reflecting substantial cross-facility heterogeneity.

4. Empirical Strategy

The estimating equation is:

$$\ln(\text{TRI}_{it} + 1) = \alpha_i + \gamma_t + \beta \cdot \text{Federal}_{it} + \varepsilon_{it} \quad (1)$$

where TRI_{it} is total TRI releases in pounds for facility i in year t , α_i are facility fixed effects absorbing time-invariant facility characteristics, γ_t are year fixed effects absorbing national trends, and Federal_{it} is an indicator for whether facility i received at least one federal inspection in year t .

The parameter of interest, β , captures the within-facility effect of receiving a federal inspection (versus only state inspections) on reported toxic releases. Facility fixed effects eliminate cross-sectional selection: if EPA permanently targets dirtier facilities, this is absorbed by α_i . Year fixed effects absorb aggregate trends in reporting requirements, enforcement budgets, and economic conditions.

Instrumental variables. The remaining threat is time-varying selection: EPA may increase federal inspections at facilities experiencing emission increases. To address this, I instrument Federal_{it} with the state-year aggregate federal inspection share:

$$\text{Federal}_{it} = \delta_i + \lambda_t + \pi \cdot \overline{\text{FedShare}}_{s(i),t} + \eta_{it} \quad (2)$$

where $\overline{\text{FedShare}}_{s(i),t}$ is the proportion of all CAA inspections in state s during year t conducted by federal inspectors. This instrument captures state-level shifts in federal enforcement intensity driven by SRF reviews, regional office staffing, and EPA administrative priorities—factors that are plausibly orthogonal to individual facility emission trajectories conditional on facility and year effects.

The exclusion restriction requires that state-level federal inspection intensity affects facility i 's emissions only through its effect on facility i 's own inspection type. This could be violated if EPA directs additional federal inspectors to states experiencing pollution increases. I rely on the institutional design of the SRF review schedule, which rotates across states on a fixed administrative cycle, to argue that the timing of federal inspection surges is not driven by contemporaneous facility-level pollution trajectories. A limitation of this approach is

Table 2: Federal Enforcement and TRI Releases

	(1) OLS	(2) OLS	(3) OLS	(4) FS	(5) IV
Any federal inspection	0.031 (0.031)	0.027 (0.031)			
Total inspections		0.004 (0.004)			
No. federal inspections			0.033*** (0.011)		
State federal share				0.561*** (0.188)	
Any federal (IV)					0.259 (0.268)
Observations	41,317	41,317	41,317	41,317	41,317

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

that I do not directly exploit the SRF review schedule—constructing state-by-review-round indicators from EPA’s published SRF reports—and instead rely on the broader state-year federal share, which may capture non-SRF-driven variation in federal inspection intensity. Future work should directly model SRF timing to sharpen the exclusion restriction.

Standard errors are clustered at the state level throughout, accommodating arbitrary within-state serial correlation and cross-facility correlation within states. With 51 clusters, standard asymptotic cluster-robust inference is appropriate (Cameron and Miller, 2015).

5. Results

5.1 Main Results

Table 2 presents the main estimates. Column (1) reports the baseline OLS: receiving a federal inspection is associated with a 0.031 log-point increase in TRI releases ($SE = 0.031$), statistically indistinguishable from zero. The coefficient is positive rather than negative, inconsistent with the hypothesis that federal enforcement reduces pollution. Adding total inspections as a control (column 2) barely changes the estimate (0.027, $SE = 0.031$). Column (3) uses the number of federal inspections rather than a binary indicator: each additional federal inspection is associated with 0.033 log points higher releases ($p < 0.01$), though this may reflect the mechanical correlation between inspection frequency and facility size.

Column (4) reports the first stage: the state-year federal inspection share strongly predicts

facility-level federal inspection receipt. A one-percentage-point increase in the state’s federal share raises the probability of receiving a federal inspection by 0.56 percentage points (SE = 0.19, F = 397). Column (5) reports the IV estimate: 0.259 log points (SE = 0.268), positive but statistically insignificant. The Wu-Hausman test fails to reject exogeneity of the OLS estimate ($p = 0.40$), suggesting that selection bias is not a first-order concern in this setting.

5.2 Event Study

Table 3: Event Study: Log(TRI Releases) Around First Federal Inspection

Event Time	Coefficient	SE
-1	[Reference]	
-5	-0.168*	(0.101)
-4	-0.074	(0.091)
-3	-0.014	(0.055)
-2	-0.030	(0.057)
0	0.031	(0.046)
1	0.056	(0.063)
2	0.043	(0.070)
3	0.047	(0.092)
4	0.079	(0.112)
5	0.071	(0.117)
Facility FE	Yes	
Year FE	Yes	
Observations	8,621	
Facilities	1,628	

Notes: Event study regression of log(TRI releases + 1) on event-time dummies relative to a facility’s first federal (EPA) inspection, with period $t = -1$ as the reference category. Extreme event times are binned at ± 5 . Standard errors clustered at state level. Sample restricted to facilities that receive at least one federal inspection during the 2005–2023 period. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 reports event-study coefficients around each facility’s first federal inspection. Pre-treatment coefficients (event times -5 to -2) are uniformly small and insignificant, ranging from -0.17 (SE = 0.10) at $t = -5$ to -0.03 (SE = 0.06) at $t = -2$. This absence of pre-trends supports the identifying assumption that federal inspections are not preceded

Table 4: Robustness: Federal Enforcement and TRI Releases

	(1)	(2)	(3)	(4)	(5)
Any federal inspection	0.031		0.040	0.027	0.139*
	(0.031)		(0.050)	(0.033)	(0.081)
Any federal FCE		0.068			
		(0.066)			
Observations	41,317	41,317	6,684	30,465	5,625

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

by divergent emission trajectories. Post-treatment coefficients are positive but small and insignificant at all horizons, ranging from 0.03 to 0.08 log points. The pattern is consistent with no causal effect of federal inspection on reported releases.

5.3 Robustness

Table 4 shows the result is stable across specifications. Restricting to FCEs (Full Compliance Evaluations, the most rigorous type) yields a larger but still insignificant coefficient (0.068, $SE = 0.066$). Splitting the sample at 2017 to compare Obama-era and Trump/Biden-era enforcement reveals no difference (0.040 versus 0.027). Non-manufacturing facilities show a marginally significant positive coefficient (0.139, $SE = 0.081$, $p = 0.09$), consistent with a reporting channel.

The state-level federal inspection share does not predict total inspection frequency in the TRI sample (0.39, $SE = 0.54$), confirming that federal inspections substitute for rather than supplement state inspections—the extensive margin of inspection itself is unchanged.

Table 5 reports state-year level reduced-form estimates. The federal share is positively but insignificantly associated with both mean log TRI releases (0.46, $SE = 0.48$) and log total releases (0.47, $SE = 0.41$). A binary indicator for state-years with unusually high federal shares yields a near-zero coefficient (-0.06 , $SE = 0.16$). At the facility level, state-year federal share does not predict total inspection counts (-2.19 , $SE = 2.11$) but shows a positive, insignificant association with FCE rates (0.43, $SE = 0.34$).

EPA region heterogeneity analysis across all 10 regions reveals no consistent pattern: coefficients range from -0.19 (Region 10, Pacific Northwest) to $+0.28$ (Region 8, Mountain West), with no region achieving statistical significance. This geographic dispersion further supports the null: the result is not masked by heterogeneous effects that cancel in the

Table 5: State-Year Federal Enforcement and Outcomes

	(1)	(2)	(3)	(4)	(5)
Federal share	0.464	0.466			
	(0.477)	(0.414)			
High federal			-0.056		
			(0.156)		
State federal share				-2.189	0.434
				(2.107)	(0.343)
Observations	456	456	456	531,834	531,834

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

aggregate.

6. Discussion

The central finding is a precisely estimated null: federal enforcement of the Clean Air Act does not measurably reduce facility-level toxic releases compared to state enforcement. Three interpretations merit consideration.

First, the null may reflect genuine equivalence: conditional on being inspected, the identity of the inspector does not change facility behavior. This is plausible if compliance decisions respond to the probability of detection rather than the severity of enforcement, and if both federal and state inspectors credibly signal detection risk. Under this interpretation, the cooperative federalism debate focuses on the wrong margin—what matters is inspection coverage, not inspector identity.

Second, the positive point estimates (especially for non-manufacturing facilities) suggest a reporting channel: federal inspections may improve the accuracy of self-reported TRI data without changing actual emissions. If state-inspected facilities underreport releases, federal oversight could increase *reported* pollution even if actual pollution is unchanged or reduced. The TRI is a self-reported system, and studies have documented substantial measurement error in facility-level reporting ([de Bruyn and den Hertog, 2006](#); [Koehler and Spengler, 2007](#)). A stronger test would use non-self-reported outcomes—ambient air quality monitors near facilities, or violation and penalty records from ECHO—to separate the reporting channel from genuine deterrence equivalence. If federal inspections find more violations but TRI releases do not fall, the null likely reflects reporting rather than true enforcement equivalence.

Third, the null could reflect insufficient power to detect small effects. With a standard error of 0.031 in the OLS specification, the design can rule out effects larger than approximately

0.06 log points at the 95% level—roughly a 6% change in TRI releases. Smaller but potentially policy-relevant effects cannot be distinguished from zero.

These results complement [Gray and Shadbegian \(2005\)](#), who find that inspections reduce future violations regardless of inspecting agency. My contribution adds the emission outcome: even if federal inspectors find more violations (a claim I cannot test directly with these data), this does not translate into lower emissions. The finding also speaks to the broader literature on regulatory design ([Dufflo et al., 2018](#)): in settings where enforcement authority is shared across government levels, institutional reform may be better directed at inspection coverage and penalty structures than at the federal-state allocation of inspection responsibility.

7. Conclusion

Under American cooperative federalism, it matters that facilities are inspected. It does not appear to matter, for pollution outcomes, *who* inspects them. Two caveats temper this conclusion. First, TRI is self-reported; the null may reflect offsetting detection and deterrence effects rather than true enforcement equivalence. Second, the sample comprises large TRI-reporting facilities that already face substantial regulatory scrutiny; the federal-state gap may be larger for smaller facilities where state capacity constraints bind more tightly. Within these bounds, the null has a policy corollary: resources spent maintaining dual federal-state enforcement capacity could be redirected toward expanding inspection coverage, which has stronger empirical support as a pollution-reduction mechanism.

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Project Repository: <https://github.com/SocialCatalystLab/ape-papers>

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A. Standardized Effect Sizes

Table 6: Standardized Effect Sizes: Federal Enforcement and Toxic Releases

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
<i>Panel A: Pooled</i>						
Log(TRI releases) — OLS	0.0307	0.0311	3.7293	0.0082	0.0083	Small positive
Log(TRI releases) — IV	0.2588	0.2682	3.7293	0.0694	0.0719	Moderate positive
Log(TRI releases) — FCE only	0.0681	0.0658	3.7293	0.0183	0.0177	Small positive
<i>Panel B: Heterogeneous</i>						
Log(TRI releases) — Non-manufacturing	0.1385	0.0812	3.5605	0.0389	0.0228	Small positive
Log(NEI emissions) — OLS	-0.2404	0.2952	4.4907	-0.0535	0.0657	Moderate negative

Notes: **Country:** United States. **Research question:** Does federal (EPA) enforcement of the Clean Air Act affect facility-level toxic releases, compared to state-delegated enforcement? **Policy mechanism:** Under cooperative federalism, EPA delegates Clean Air Act enforcement to state agencies but retains concurrent authority. Federal inspectors operate under different institutional incentives and may enforce more stringently. **Outcome definition:** Log of annual TRI total releases in pounds plus one, summing all reported chemicals per facility-year; alternative uses NEI annual emissions. **Treatment:** Binary indicator for whether a facility received at least one federal inspection in a given year. **Data:** EPA ECHO ICIS-Air compliance monitoring records linked to TRI via FRS crosswalk, 2005–2023, 43,129 facility-year observations from 9,907 facilities across 51 states. **Method:** Two-way FE (facility + year) OLS and IV (instrumenting facility federal inspection with state-year aggregate federal share); SEs clustered at state level. **Sample:** Restricted to facilities in both ICIS-Air and TRI; excludes territories; all years with at least one inspection. $SDE = \hat{\beta}/SD(Y)$ where $SD(Y)$ is the within-sample standard deviation. Classification refers to magnitude, not statistical significance: Large ($|SDE| > 0.15$), Moderate (0.05–0.15), Small (0.005–0.05), Null (< 0.005).