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Research Article

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Environmental Disadvantage and the Distribution of Regulatory Inspections in the United States

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Abstract

Environmental justice research documents unequal exposure to environmental harm, but less is known about how regulatory monitoring is distributed across disadvantaged communities. This study distinguishes baseline regulatory attention from burden responsiveness and examines both dimensions using a county-year panel of environmental inspections in the United States from 2013 through 2022. The analysis combines Environmental Protection Agency inspection records, Risk-Screening Environmental Indicators pollution-burden scores, and Climate and Economic Justice Screening Tool classifications for 23,155 observations from 2,500 counties and county-equivalent units. Negative binomial models estimate total, air, and water inspections while accounting for regulated facilities, state differences, annual variation, and repeated observations within counties. Counties containing at least one CEJST-designated tract receive approximately 10.7 percent more total inspections at the average level of logged pollution burden. This association is concentrated in air inspections, while the water-inspection difference is statistically insignificant. The interaction between disadvantage and pollution burden is close to one across outcomes, indicating no stronger inspection response as burden increases. A facility-offset specification and alternative measures of disadvantage qualify the baseline result. The findings show that greater average regulatory attention does not necessarily imply greater responsiveness to environmental need or more inspections per facility in regulatory practice.

Keywords: environmental justice; regulatory inspections; environmental enforcement; administrative attention; pollution burden; environmental governance

1 Introduction

Environmental justice scholarship documents persistent racial and socioeconomic inequalities in exposure to hazardous facilities, toxic releases, air pollution, and other environmental risks in the United States (Ringquist, 2005; Mohai, Pellow, et al., 2009; Agyeman et al., 2016; Tessum et al., 2019). Exposure, however, captures only one part of environmental inequality. Protection also depends on how public agencies monitor regulated facilities and respond after communities become exposed. Regulatory attention may be directed toward highly burdened communities as part of risk-based or equity-oriented enforcement, or it may be weaker where limited political resources reduce institutional visibility.

This study examines the distribution of environmental inspections across disadvantaged and non-disadvantaged counties. Inspections allow regulators to observe facility behavior, identify possible violations, assess compliance, and determine when further enforcement is appropriate (Konisky and Reenock, 2013; Konisky, Reenock, and Conley, 2021). Inspection counts do not measure monitoring depth, sanctions, compliance outcomes, or reductions in environmental harm. They nevertheless provide an observable indicator of where agencies direct regulatory attention and where the enforcement process begins.

Two competing accounts generate different expectations. Risk- and equity-based targeting suggests that agencies prioritize locations associated with elevated environmental risks or formally identified environmental justice communities (Collins, 2011; Liang, 2016). Political marginalization instead suggests that communities with fewer economic, organizational, and political resources face greater difficulty attracting government attention (Konisky, 2009; Konisky and Reenock, 2018). Prior research finds evidence of enforcement disparities, but the direction and magnitude vary across regulatory programs, enforcement stages, and empirical specifications (Konisky and Schario, 2010; Konisky and Reenock, 2013; Konisky, Reenock, and Conley, 2021). This variation makes it difficult to infer a single relationship between disadvantage and regulatory monitoring.

The analysis separates two dimensions of regulatory allocation that are often combined. *Baseline regulatory attention* is the expected difference in inspection activity between disadvantaged and non-disadvantaged counties at a comparable pollution-burden level. *Burden responsiveness* is the degree to which inspection activity changes as pollution burden rises within each county category. A county may receive more inspections on average without receiving a stronger regulatory response as its environmental burden increases. Conversely, two county categories may receive similar attention near the center of the burden distribution while following different trajectories at higher burden levels. Distinguishing the level of attention from its responsiveness prevents higher inspection totals from being interpreted automatically as evidence that monitoring tracks environmental need.

The study also separates air and water inspections. These programs regulate different facilities and pollutants through distinct statutes, permitting systems, delegation arrangements, and administrative routines. An aggregate difference may therefore reflect a broad pattern across environmental regulation or originate mainly within one program. Program-specific estimates make it possible to identify where an overall association is concentrated without assuming that environmental inspection operates as a unified administrative process.

The empirical analysis combines annual inspection records from the Environmental Protection Agency's Enforcement and Compliance History Online database, modeled pollution-burden scores from the Risk-Screening Environmental Indicators program, and community classifications from the Climate and Economic Justice Screening Tool (U.S. Environmental Protection Agency, 2025a; U.S. Environmental Protection Agency, 2025b; White House Council on Environmental Quality, 2024). The panel contains 23,155 county-year observations from 2,500 counties and county-equivalent units in the 50 states and the District of Columbia from 2013 through 2022. Negative binomial models estimate total, air, and water inspection activity while accounting for pollution burden, regulated facilities, state differences, annual variation, and repeated observations within counties.

The results reveal greater but programmatically uneven regulatory attention in counties containing CEJST-designated communities. At the average level of logged pollution burden, these counties receive approximately 10.7 percent more total inspections. The association is concentrated in air inspections, where the estimated difference is 24.7 percent, while the water-inspection estimate is small and statistically insignificant. The disadvantage-by-pollution-burden interaction remains close to one across outcomes, so the inspection difference does not expand as modeled burden rises. A strict facility-offset model also removes the disadvantage difference, and alternative measures of disadvantage produce a different responsiveness pattern.

The paper contributes in three ways. First, it distinguishes average regulatory attention from responsiveness to increasing environmental burden. Second, it identifies programmatic variation hidden by aggregate inspection counts. Third, it clarifies the boundary between total county-level monitoring and inspections per facility. The findings indicate that conclusions about regulatory equity depend on the program examined, the measure of disadvantage, and the benchmark used to evaluate inspection allocation.

2 Regulatory Attention and Environmental Disadvantage

Environmental laws acquire practical meaning through administrative decisions about where monitoring occurs, which facilities receive scrutiny, and how agencies allocate limited enforcement capacity. Frontline officials translate broad mandates into operational choices under resource constraints, incomplete informa-

tion, and competing organizational demands (Lipsky, 1980). Environmental inspection decisions also reflect administrative priorities, enforcement styles, perceived risks, and relationships between regulators and regulated entities (May and Winter, 1999). Inspection allocation can therefore be understood as administrative triage across facilities, industries, and places.

This triage occurs within a decentralized regulatory system. States differ in enforcement capacity, political leadership, industrial composition, institutional priorities, delegation arrangements, and relationships with regulated industries (Atlas, 2007; Konisky, 2007; Konisky and Teodoro, 2016). Counties also contain different numbers and types of regulated facilities and therefore present agencies with different numbers of possible inspection targets. Comparisons of regulatory attention must account for facility concentration, state institutions, and annual conditions before differences are attributed to community disadvantage.

Community disadvantage introduces two competing pressures into this administrative setting. Political marginalization predicts weaker regulatory attention because disadvantaged communities often possess fewer resources for demanding action. Risk-based and equity-based targeting predicts greater attention because these communities may face elevated hazards and have become explicit subjects of environmental justice policies. The observed distribution of inspections reflects the balance between these pressures.

2.1 Political Marginalization and Regulatory Attention

The political-marginalization account emphasizes unequal access to government. Communities with stronger organizations, financial resources, media visibility, and relationships with public officials are better positioned to report environmental problems, participate in regulatory proceedings, request intervention, and impose political costs on agencies that fail to respond. Communities with fewer resources face greater barriers to sustaining these forms of pressure and may receive less attention even when environmental conditions are serious.

Environmental inequalities often reflect historical land-use decisions, residential segregation, uneven economic development, housing constraints, and differences in political influence (Ringquist, 2005; Mohai and Saha, 2006; Mohai and Saha, 2015; Bullard, 2018). The same processes that concentrate environmental hazards can also limit the capacity to demand regulatory protection. Agencies operate under legislative oversight, executive priorities, public complaints, organized pressure, and reputational concerns, creating a risk that disadvantaged communities experience both elevated exposure and weaker monitoring.

Prior enforcement research supports concern about unequal administrative responses. State environmental enforcement varies with community racial and economic characteristics, and facility-level findings differ across enforcement stages and programs (Konisky, 2009; Konisky and Schario, 2010; Konisky and Reenock,

2013). Clean Water Act research also identifies racial and income disparities in inspection timing (Konisky, Reenock, and Conley, 2021). Formal environmental justice commitments depend on implementation within administrative agencies and therefore do not guarantee equal treatment (Provost and Gerber, 2019).

The political-marginalization account predicts fewer inspections in disadvantaged counties after environmental burden, facility concentration, state differences, and annual conditions are considered. A negative association would indicate that limited institutional visibility restricts access to routine monitoring even after differences in environmental need and industrial activity are included.

2.2 Risk-Based and Equity-Based Targeting

A competing account begins from the need to direct limited inspection resources toward locations associated with greater environmental harm, compliance risks, or statutory priorities. Agencies collect information about regulated facilities, releases, permits, prior violations, and community conditions. These indicators can direct attention toward communities facing serious environmental risks even when those communities possess limited political influence.

Disadvantaged communities frequently contain industrial facilities and cumulative environmental burdens that increase their visibility within risk-based systems. Environmental justice initiatives and screening tools also make social vulnerability and cumulative burden relevant to administrative priority setting. Such tools have distributive consequences because decisions about environmental priorities determine which communities receive public resources and attention (Schultz et al., 2022). A designation may therefore function not only as a description of community conditions but also as information that can shape agency planning.

Higher inspection activity in disadvantaged counties would be consistent with elevated regulatory need, equity priorities, or both. This account does not imply that more monitoring resolves environmental injustice. Higher totals may reflect more serious environmental conditions, repeated noncompliance, or a larger concentration of regulated facilities. Inspections may also differ in depth and consequences. The targeting account makes a narrower prediction: after relevant environmental and administrative differences are considered, disadvantaged counties receive greater monitoring attention.

2.3 Baseline Attention and Burden Responsiveness

The competing accounts concern the average level of attention received by disadvantaged counties, but evaluating inspection proportionality also requires examining how monitoring changes with environmental burden. Risk-based enforcement approaches generally expect regulators to direct greater attention toward locations presenting greater environmental or compliance risks (Collins, 2011; Liang, 2016; Konisky and

Reenock, 2018). Baseline attention refers to the expected inspection difference between disadvantaged and non-disadvantaged counties at a comparable burden level. In the empirical model, logged pollution burden is centered at its sample mean, so the disadvantage coefficient represents this difference at the average burden level.

Burden responsiveness refers to the rate at which inspections change as pollution burden rises. A regulatory system may assign disadvantaged counties a higher general level of monitoring while responding similarly to changes in burden across county categories. Under that pattern, the groups retain a roughly constant inspection gap. A different system may increase monitoring more rapidly in disadvantaged counties as conditions worsen.

An equity-oriented extension of proportional targeting predicts a stronger response in disadvantaged counties because residents may have fewer political, organizational, and private resources for avoiding exposure, relocating, recovering from environmental harm, or securing government intervention (Konisky, 2009; Ard and Fairbrother, 2017; Konisky, Reenock, and Conley, 2021). The interaction between disadvantage and logged pollution burden tests this expectation. A positive interaction indicates that inspections rise more rapidly with burden in disadvantaged counties. A negative interaction indicates weaker responsiveness, while an interaction near zero indicates similar burden slopes.

Higher baseline attention and stronger burden responsiveness therefore represent distinct allocation patterns. This distinction matters for environmental justice claims. More inspections at an average burden level may indicate greater administrative attention, but it does not establish that agencies direct progressively greater resources toward the most heavily burdened disadvantaged counties.

2.4 Programmatic Differences and Expectations

Air and water enforcement operate through different statutes, permits, regulated entities, delegation arrangements, and monitoring routines. Air programs often regulate identifiable stationary sources through emissions permits and reporting requirements, while water programs cover a different mix of dischargers, treatment systems, and shared governmental responsibilities. These institutional differences influence inspection frequency, available information, and the set of facilities eligible for monitoring.

Separate outcome models identify the programmatic source of any aggregate difference. The models are exploratory with respect to mechanism because the county-level data do not include program-specific staffing, facility eligibility, inspection-selection rules, or detailed compliance histories. They nevertheless prevent a relationship concentrated in one program from being presented as a uniform feature of environmental enforcement.

The theoretical argument produces competing expectations about baseline regulatory attention:

H1a: Political Marginalization. Disadvantaged counties will receive fewer environmental inspections than non-disadvantaged counties after accounting for pollution burden, regulated facilities, state differences, and year differences.

H1b: Risk and Equity Targeting. Disadvantaged counties will receive more environmental inspections than non-disadvantaged counties after accounting for pollution burden, regulated facilities, state differences, and year differences.

A separate expectation concerns responsiveness:

H2: Burden Responsiveness. The positive relationship between pollution burden and environmental inspection activity will be stronger in disadvantaged counties than in non-disadvantaged counties.

The analysis evaluates observed allocation patterns rather than inspector motivations and does not identify a causal effect of disadvantage. The estimates describe conditional differences in regulatory attention after observed environmental and administrative factors are included.

3 Data and Measurement

3.1 Data Sources

Environmental inspection records come from EPA's ECHO database, which integrates compliance-monitoring and enforcement information reported by federal, state, local, and tribal agencies (U.S. Environmental Protection Agency, 2025a). The analysis uses annual counts of Clean Air Act and Clean Water Act inspections assigned to counties through facility geographic identifiers and FIPS codes. Aggregating facility records to the county-year level produces a common measure of annual regulatory monitoring.

Pollution burden is measured with annual county-level RSEI scores (U.S. Environmental Protection Agency, 2025b; U.S. Environmental Protection Agency, 2023). RSEI begins with TRI chemical-release information and combines release quantities with chemical toxicity, modeled environmental transport and exposure, and potentially exposed population. The score is unitless and designed for relative comparisons across chemicals, facilities, locations, and years. It is a screening-level indicator rather than an observed concentration, individual health outcome, or formal risk assessment.

Community disadvantage classifications come from CEJST (White House Council on Environmental Quality, 2024; White House Council on Environmental Quality, 2024). CEJST identifies census tracts

meeting thresholds across environmental, climate, health, infrastructure, and socioeconomic categories. The analysis aggregates these tract designations to counties, the geographic unit used for inspections and pollution burden.

3.2 Analytic Sample

The unit of analysis is the county-year. The annual design retains changes in inspection activity, pollution burden, and facility concentration and permits the models to account for nationwide annual changes and persistent differences across state regulatory systems.

The primary sample covers 2013 through 2022 and contains 23,155 observations from 2,500 counties and county-equivalent units in the 50 states and the District of Columbia. Territories are excluded from the primary analysis because their geographic and administrative systems differ from the state-based systems examined here. A full-geography specification is reported in the Online Appendix.

The panel is unbalanced, although annual coverage remains stable. A total of 2,150 counties appear in all ten years, producing a 21,500-observation balanced-panel robustness sample. County FIPS codes provide the common identifier across data sources. Detailed geographic harmonization, duplicate resolution, annual coverage, and sample construction are documented in the Online Appendix.

3.3 Inspection Outcomes

The primary dependent variable is the annual number of environmental inspections recorded within each county. Total inspections equal the sum of air and water inspections:

$$\text{Total Inspections}_{it} = \text{Air Inspections}_{it} + \text{Water Inspections}_{it}. \tag{1}$$

Separate models use annual air and water inspections to identify program variation. The available outcomes cover the Clean Air Act and Clean Water Act programs and do not represent every federal environmental statute.

Inspection counts measure the frequency of recorded monitoring, not inspection depth, detected violations, sanctions, compliance, or environmental improvement. The outcomes are strongly right-skewed and overdispersed. In the primary sample, total inspections have a mean of approximately 47.0 and a variance of approximately 7,019.2.

3.4 Pollution Burden

The raw RSEI score is highly right-skewed, so the analysis uses:

$$\text{Logged Burden}_{it} = \log(1 + \text{RSEI Score}_{it}). \tag{2}$$

Adding one retains observations with zero recorded burden, while the logarithm reduces the influence of extremely large values. Logged burden is mean-centered in models containing the interaction. Mean-centering does not change the interaction estimate, but it allows the disadvantage coefficient to represent the expected inspection difference at the average level of logged burden.

RSEI captures TRI-reported releases and modeled exposure pathways and therefore does not represent every pollutant or environmental hazard within a county. The measure is treated as a consistent national indicator of relative modeled burden rather than a complete inventory of environmental conditions.

3.5 Disadvantage and Facility Concentration

The primary explanatory variable equals one when a county contains at least one CEJST-designated census tract and zero otherwise. This measure captures the presence of a designated community rather than the intensity or geographic extent of disadvantage. A county containing one designated tract receives the same classification as a county containing several designated tracts. CEJST status is treated as time-invariant across the panel because annual classifications corresponding to each inspection year are unavailable. Supplementary analyses use the share of county tracts designated as disadvantaged, divide the study period, restrict the sample to states with within-state variation, and add county poverty.

The annual number of regulated facilities measures industrial concentration and the number of potential inspection targets. The primary specification includes the natural logarithm of facility count. All county-year observations contain at least one facility. The facility coefficient is estimated freely because inspection activity need not increase in exact proportion to the number of sites. A robustness model instead treats logged facilities as an exposure offset, imposing a one-to-one relationship between facility counts and expected inspections. The available measure does not distinguish air-regulated from water-regulated facilities, which limits program-specific rate interpretations.

Table 1 reports descriptive statistics for the primary sample.

Table 1: Descriptive Statistics for the Main County-Year Sample

Variable	N	Mean	SD	Median	Min	Max
Total inspections	23155	47.005	83.781	23.000	0	1571.00
Air inspections	23155	19.541	46.116	6.000	0	1571.00
Water inspections	23155	27.464	54.053	13.000	0	1178.00
Pollution burden	23155	161099.684	1493226.423	1155.870	0	83594637.66
Logged pollution burden	23155	6.663	4.132	7.053	0	18.24
Regulated facilities	23155	8.181	16.672	4.000	1	384.00
Chemicals	23155	16.241	18.518	11.000	1	368.00
Disadvantaged county	23155	0.886	0.318	1.000	0	1.00

Notes: The unit of analysis is the county-year. The primary sample contains 23,155 observations from 2,500 counties and county-equivalent units in the 50 states and the District of Columbia from 2013 through 2022. Total inspections equal the sum of annual air and water inspections. Logged pollution burden equals $\log(1 + \text{RSEI score})$.

4 Empirical Strategy

Inspection outcomes are nonnegative counts with substantial overdispersion. The analysis therefore uses negative binomial regression, which permits the conditional variance to exceed the conditional mean (Cameron and Trivedi, 2013). Let μ_{it} denote the expected inspection count for county i in year t. The primary model is:

$$\begin{aligned}\log(\mu_{it}) = \beta_0 &+ \beta_1 \text{Disadvantaged}_i + \beta_2 \text{CenteredBurden}_{it} \\ &+ \beta_3 \left(\text{Disadvantaged}_i \times \text{CenteredBurden}_{it}\right) + \beta_4 \text{LoggedFacilities}_{it} \\ &+ \gamma_{s(i)} + \lambda_t, \end{aligned} \tag{3}$$

where $\gamma_{s(i)}$ and λ_t denote state-jurisdiction and year fixed effects. State effects account for stable differences in regulatory institutions, capacity, industrial composition, political environments, and enforcement practice. Year effects account for national changes in priorities, resources, reporting, economic conditions, and other common influences on inspection activity.

Coefficients are reported as incidence-rate ratios. Since burden is centered, $\exp(\beta_1)$ compares expected inspections in disadvantaged and non-disadvantaged counties at the average level of logged burden. The term $\exp(\beta_2)$ represents the burden association among non-disadvantaged counties, and $\exp(\beta_3)$ indicates the degree to which the burden slope differs across county categories. An interaction above one indicates stronger responsiveness in disadvantaged counties, while an interaction near one indicates similar slopes.

Average adjusted predictions supplement the interaction estimates because nonlinear interaction coefficients can be difficult to interpret in isolation. For each burden value and disadvantage category, expected

inspections are calculated for all observations while retaining their observed facility counts, states, and years, and those predictions are averaged across the sample. Confidence intervals use the county-clustered covariance matrix.

The freely estimated facility coefficient avoids imposing exact proportionality between facilities and inspections. An offset would require a doubling of facilities to produce a doubling of expected inspections, although agencies may inspect only a subset of sites, return repeatedly to selected facilities, or allocate attention using risk and compliance information. The offset specification is therefore treated as an alternative benchmark rather than the primary model.

All models use heteroskedasticity-robust standard errors clustered by county to account for dependence among repeated annual observations (Cameron and Miller, 2015). County fixed effects are not included because the primary CEJST indicator is time-invariant and would be absorbed by county indicators. The resulting estimates compare counties within the same state jurisdiction and year, conditional on observed covariates. They are interpreted as associations rather than causal effects of disadvantage.

The same specification is estimated for total, air, and water inspections. Robustness analyses retain all geographic units, restrict the sample to the balanced panel, exclude observations above the ninety-ninth percentile of burden and total inspections, impose the facility offset, examine early and late subperiods, restrict the sample to states with within-state disadvantage variation, and use alternative measures of disadvantage. Sequential models and count-model diagnostics are reported in the Online Appendix.

5 Results

5.1 Descriptive Patterns

Table 1 shows strong right skew in inspection activity and pollution burden. County-years average 47.0 total inspections, compared with a median of 23 and a maximum of 1,571. Air inspections average 19.5 and water inspections average 27.5. The raw RSEI score has a mean of approximately 161,100 and a median of approximately 1,156, while the logged measure has a mean of 6.663.

County-years contain an average of 8.2 regulated facilities, although the median is four and the maximum is 384. The disadvantage indicator has a mean of 0.886, so 88.6 percent of observations belong to counties containing at least one CEJST-designated tract. This high share follows from the aggregation rule and does not imply that the same proportion of county residents, tracts, or land area is disadvantaged.

5.2 Disadvantage and Total Inspection Activity

Table 2 reports estimates for total, air, and water inspections. Each model includes logged facilities, state and year fixed effects, and county-clustered standard errors.

Table 2: Environmental Inspections, Disadvantage, and Pollution Burden

Term	Total inspections	Air inspections	Water inspections
Disadvantaged county	1.107* [1.007, 1.217]	1.247** [1.058, 1.469]	1.022 [0.929, 1.124]
Logged pollution burden	1.007 [0.986, 1.028]	1.015 [0.965, 1.067]	1.005 [0.985, 1.026]
Disadvantaged × pollution burden	1.004 [0.983, 1.025]	1.009 [0.959, 1.062]	1.000 [0.979, 1.021]
Logged facilities	1.657*** [1.585, 1.733]	1.945*** [1.836, 2.060]	1.503*** [1.430, 1.579]
Observations	23,155	23,155	23,155
Counties	2,500	2,500	2,500
Year fixed effects	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
County-clustered SEs	Yes	Yes	Yes
Negative binomial theta	2.020	1.172	1.538

Notes: Entries are incidence-rate ratios, with county-clustered 95 percent confidence intervals reported in brackets beneath the estimates. Logged pollution burden is centered at its sample mean. All models include logged facility count, state fixed effects, and year fixed effects. $+p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, and $^{***}p < 0.001$.

In the total-inspection model, the incidence-rate ratio for disadvantaged counties is 1.107, with a 95 percent confidence interval from 1.007 to 1.217. At the average level of logged burden, counties containing a CEJST-designated tract receive approximately 10.7 percent more inspections after facility concentration, state differences, and annual variation are included. The estimate supports H1b in the primary specification and does not support H1a.

The adjusted difference is substantially smaller than the unadjusted gap between county categories. This reduction indicates that facility concentration and state-level regulatory differences explain much of the initial variation in inspection totals. The remaining estimate represents a conditional difference among counties in the same state jurisdiction and year. It does not establish that CEJST status causes higher inspection activity or identify the motivations underlying agency decisions.

Logged facilities have an incidence-rate ratio of 1.657. The corresponding coefficient implies that a 1 percent increase in facility count is associated with approximately a 0.51 percent increase in expected inspections, conditional on the remaining covariates. Inspection activity therefore increases with facility concentration but less than proportionally.

5.3 Responsiveness to Pollution Burden

The incidence-rate ratio for centered logged burden among non-disadvantaged counties is 1.007, with a 95 percent confidence interval from 0.986 to 1.028. Once facilities, state effects, year effects, and disadvantage status are included, the analysis does not identify a precise independent burden association.

The disadvantage-by-burden interaction is 1.004, with a confidence interval from 0.983 to 1.025. The estimate is close to one and statistically insignificant, providing no support for H2. The result indicates that the relationship between pollution burden and total inspections is similar across the two county categories.

Figure 1 presents adjusted predictions across the observed burden distribution.

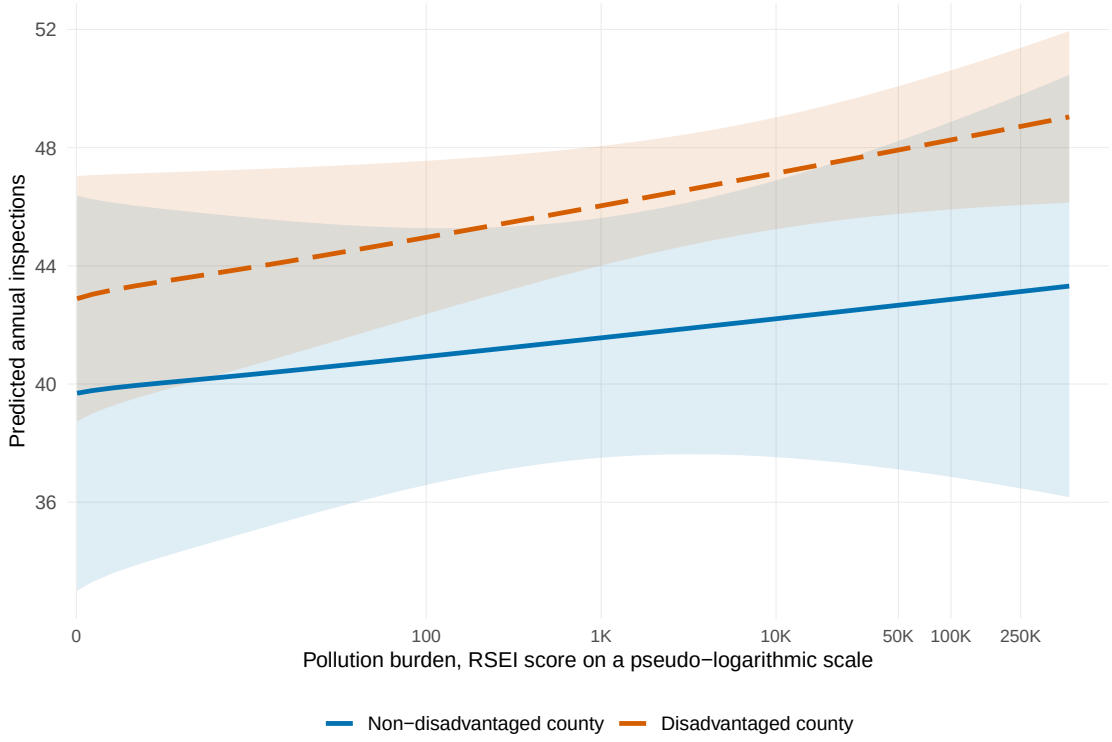


Figure 1: **Predicted Environmental Inspections Across Pollution Burden.** The figure presents average adjusted predictions from the primary negative binomial model. Separate lines report predicted annual inspections for disadvantaged and non-disadvantaged counties across the observed distribution of RSEI pollution burden. Shaded bands report county-clustered 95 percent confidence intervals.

The predicted lines remain separated by a modest vertical distance and follow nearly parallel trajectories. The separation reflects higher baseline attention in disadvantaged counties, while the similar slopes reflect the near-null interaction. Disadvantaged counties receive somewhat greater expected monitoring across burden levels, but the difference does not expand as modeled pollution burden rises.

5.4 Air and Water Inspections

The aggregate association is concentrated in air regulation. The incidence-rate ratio for disadvantaged counties is 1.247 in the air model, with a 95 percent confidence interval from 1.058 to 1.469. Counties containing a designated tract therefore receive approximately 24.7 percent more air inspections at the average burden level after the same covariates are included.

The water-inspection estimate is 1.022, with a confidence interval from 0.929 to 1.124, and is statistically insignificant. The combined outcome therefore conceals a substantial difference across programs. Figure 2 compares the disadvantage estimates across outcomes.

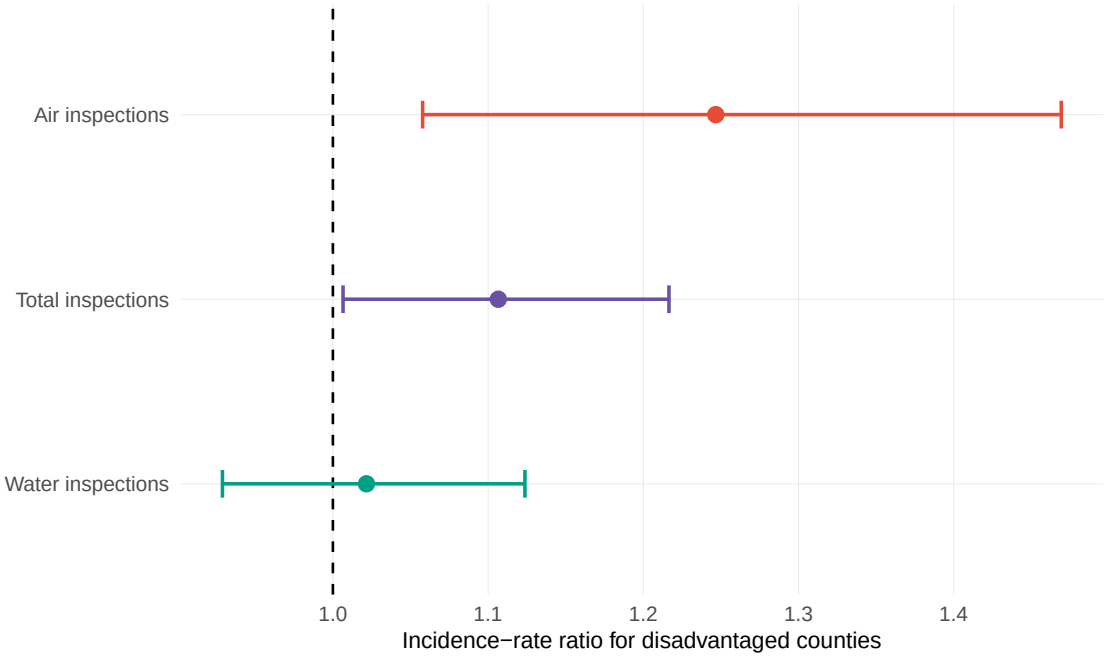


Figure 2: **Estimated Disadvantage Difference Across Inspection Outcomes.** Points report incidence-rate ratios for the disadvantaged-county indicator from separate negative binomial models of total, air, and water inspections. Intervals report county-clustered 95 percent confidence intervals, and the dashed line marks an incidence-rate ratio of one.

The air confidence interval lies above one, while the water interval crosses one and centers near the null. The interaction estimates are 1.009 for air inspections and approximately 1.000 for water inspections, and neither is statistically significant. The program-specific models therefore provide no evidence that either air or water inspection activity becomes more responsive to burden in disadvantaged counties.

Facility concentration is positively associated with both outcomes, although its estimated elasticity is larger for air inspections. This comparison should be interpreted cautiously because the facility measure does not identify separate air and water regulatory universes. The estimates locate the aggregate disadvantage

association within air regulation but do not reveal the administrative mechanism producing the difference.

5.5 Robustness and Alternative Measures

The disadvantage estimate is stable across alternative sample definitions. The incidence-rate ratio is 1.105 in the full geographic sample and 1.113 in the balanced panel, compared with 1.107 in the primary sample. The associated confidence intervals overlap closely, and the burden interactions remain near one. The result is therefore not produced by territorial exclusions or incomplete annual county coverage. Excluding observations above the ninety-ninth percentile and dividing the study period also produce similar baseline estimates.

The facility-offset model provides an important qualification. Under the strict proportionality assumption, the disadvantage estimate is 0.944 with a 95 percent confidence interval from 0.847 to 1.053. The primary result therefore describes higher total county-level monitoring after facility concentration is adjusted flexibly, not higher inspections per facility. The freely estimated facility elasticity of approximately 0.51 is far below the value of one imposed by the offset. The primary model is retained because it reflects the observed relationship rather than imposing exact proportionality, while the offset places a clear boundary around the substantive claim.

Alternative measures of disadvantage also change the pattern. Replacing the binary indicator with the share of a county's tracts designated as disadvantaged yields no statistically significant baseline association. Its interaction with burden is negative and statistically significant, indicating weaker responsiveness where disadvantage is more concentrated. Adding county poverty strengthens the binary CEJST estimate, while poverty itself is associated with fewer inspections. These findings indicate that the presence of a designated tract, the concentration of designated tracts, and economic hardship capture different dimensions of disadvantage.

The remaining checks are reported in the Online Appendix. The binary association persists in early and late subperiods and in states containing both county categories. Sequential specifications show that facility concentration and state effects explain much of the unadjusted difference but do not eliminate the final baseline association. Count-model diagnostics strongly favor the negative binomial specification over Poisson regression.

6 Discussion

The findings indicate that disadvantaged counties receive a modestly higher level of environmental inspection activity after accounting for pollution burden, regulated facilities, state-jurisdiction differences, annual

changes in enforcement, and repeated observations within counties. At the average level of logged pollution burden, disadvantaged counties receive approximately 10.7 percent more total inspections than non-disadvantaged counties. This result is more consistent with the risk and equity targeting account than with the political marginalization account developed in the theory section. Agencies appear to direct somewhat greater monitoring attention toward counties containing CEJST-designated communities, even after differences in industrial concentration and modeled pollution burden are considered. The result does not demonstrate that disadvantaged status itself causes higher inspection activity because the research design does not isolate an exogenous change in community classification or agency priorities. The estimate instead identifies a conditional difference in regulatory attention across counties located within the same state and observed during the same year. The magnitude of the estimate also counsels against describing the difference as evidence of extensive preferential oversight because most of the unadjusted inspection gap is accounted for by facility concentration and state-level differences.

The program-specific results suggest a clearer account of where the total-inspection difference originates because disadvantaged counties receive approximately 24.7 percent more air inspections, whereas the estimated difference in water inspections is small and statistically indistinguishable from zero. Environmental inspection activity therefore does not operate as a uniform administrative process across regulatory programs. Air and water enforcement rely on different statutory authorities, permitting systems, regulated entities, delegation arrangements, and monitoring routines, which creates distinct administrative settings for inspection allocation. Air programs often regulate identifiable stationary sources through emissions permits and reporting requirements, giving agencies a defined set of facilities for routine monitoring. Water programs cover a different mix of dischargers, treatment systems, permits, and shared federal-state responsibilities. The available data do not identify which administrative features account for the difference, so the analysis does not attribute the air result to a specific mechanism. Program-specific staffing, facility risk classifications, compliance histories, inspection-selection rules, and delegation arrangements would be required to determine why disadvantage is associated with air inspection activity but not water inspection activity. The difference nevertheless shows that conclusions based only on combined inspection counts risk concealing meaningful variation across environmental programs.

These results depart from prior work finding that disadvantaged communities receive systematically weaker environmental enforcement (Konisky, 2009; Konisky, Reenock, and Conley, 2021). The supplementary analyses reported in Appendix D help clarify this divergence rather than resolve it. When disadvantage is measured using CEJST's binary county classification, the present analysis finds modestly higher inspection activity in disadvantaged counties, consistent with risk- and equity-based targeting. When disadvantage is instead measured using the continuous share of disadvantaged census tracts or county poverty rate, both

measures point in the opposite direction, toward less inspection activity or weaker responsiveness to pollution burden in more disadvantaged and higher-poverty counties, consistent with political marginalization. Prior studies finding weaker enforcement in disadvantaged communities typically rely on continuous or graded measures of race and income rather than a binary presence indicator, which may account for part of the divergence. The CEJST binary measure also reflects a broader, more recently developed multi-indicator definition of disadvantage that combines environmental, health, infrastructure, and socioeconomic criteria, rather than race or income alone, and a county needs only one qualifying tract to receive the designation. These measurement differences suggest that conclusions about whether disadvantaged communities receive more or less regulatory attention depend substantially on how disadvantage is operationalized, and that the apparent conflict with prior findings may reflect differences in measurement and time period as much as differences in underlying enforcement behavior.

The results suggest no support for the expectation that inspection activity responds more strongly to pollution burden in disadvantaged counties. The disadvantage-by-burden interaction is close to one in the total, air, and water models, and the predicted inspection lines remain nearly parallel across the observed burden distribution. Disadvantaged counties receive a somewhat higher expected level of inspection activity at the average burden level, but the difference does not increase as modeled pollution burden rises. The distinction between baseline attention and burden responsiveness therefore carries substantive consequences for claims about proportionality. A county might receive more inspections than another county with a similar burden level without receiving a stronger regulatory response when its burden increases. The findings identify a modest difference in baseline regulatory attention rather than an inspection system that adjusts more aggressively to rising pollution burden in disadvantaged communities. This result narrows the environmental justice interpretation because greater average attention does not establish that agencies direct additional resources toward the most heavily burdened disadvantaged counties.

Facility concentration has a role in the allocation of inspection activity, with the number of facilities producing the largest and most precise association in the primary model where the estimated facility elasticity is approximately 0.51, indicating that inspection counts increase as the number of facilities grows but at a substantially slower rate than a one-to-one relationship. This result helps explain the contrast between the primary model and the facility-offset specification. The primary model estimates the association between facilities and inspections from the data and finds modestly higher total inspection activity in disadvantaged counties. The offset model fixes the facility coefficient at one and asks if disadvantaged counties receive a different number of inspections per facility under a strict proportionality assumption. Under that specification, the disadvantage estimate becomes negative, smaller in magnitude, and statistically insignificant. The evidence therefore supports the conclusion that disadvantaged counties receive more total monitoring

activity after accounting for facility concentration, but it does not support a general claim that facilities in disadvantaged counties receive more inspections than facilities elsewhere. Since the observed relationship between facilities and inspections falls well below the coefficient imposed by the offset, the freely estimated facility model provides the less restrictive primary specification. The offset result still places a clear boundary around the interpretation of the main estimate.

Higher inspection totals should not be treated as proof of fair, effective, or sufficient environmental enforcement. Inspection counts record the frequency of administrative monitoring, but they do not reveal inspection duration, technical depth, violation severity, penalty amounts, compliance outcomes, or reductions in environmental harm. Greater inspection activity might reflect stronger environmental justice targeting, elevated compliance risks, repeated inspections at facilities with persistent violations, or greater administrative attention to particular industries. A county receiving more inspections might still experience weaker penalties, longer enforcement delays, or environmental conditions that exceed the protection generated by regulatory activity. Prior research on environmental enforcement shows that disparities might appear at several stages of the regulatory process, including inspection timing, sanctioning, and compliance responses (Konisky, 2009; Konisky, Reenock, and Conley, 2021). The present analysis addresses the monitoring stage and should therefore be read as evidence about the distribution of regulatory attention rather than the complete performance of environmental enforcement.

Several measurement and design limitations also qualify the findings. The county disadvantage indicator equals one when at least one census tract receives a CEJST designation, so counties with one disadvantaged tract receive the same classification as counties containing many such tracts. This aggregation rule creates a broad measure of the presence of disadvantage and does not capture the proportion of county residents, tracts, or land area classified as disadvantaged. A supplementary analysis using the continuous share of disadvantaged tracts per county, net of tract count, finds no significant difference in baseline inspection levels but a significant reduction in burden-responsiveness among counties with more concentrated disadvantage (Online Appendix, Section D.4), suggesting the binary measure is more informative about baseline attention than about how responsive enforcement is to rising environmental burden. A related check adding county poverty rate as a covariate finds that the binary disadvantage estimate strengthens rather than weakens, while poverty rate itself is independently associated with fewer inspections (Online Appendix, Section D.7). Jointly, these two supplementary analyses suggest that the CEJST binary classification and direct measures of disadvantage concentration or economic hardship are not capturing the same underlying construct, and that conclusions about regulatory equity in this setting depend on which dimension of disadvantage is measured. The county-year unit also links countywide inspection counts and pollution burden to a tract-derived social classification, leaving uncertainty about the proximity of regulated facilities to the disadvantaged pop-

ulations represented in the measure. RSEI provides a consistent national screening score based on toxicity, modeled exposure, and potentially exposed population, but it does not capture every pollutant, source, or environmental hazard within a county. The facility variable identifies the number of facilities represented in the merged data but does not distinguish air-regulated facilities from water-regulated facilities or account for facility size, production, risk, or compliance history. State and year fixed effects address broad institutional and temporal differences, but unobserved county characteristics remain possible.

Additionally, the county-based design also assumes that environmental burden and regulatory activity are contained within the same geographic unit, although pollution does not stop at county boundaries. Air emissions and water contaminants released near a county border might travel into neighboring counties, leaving residents exposed to pollution generated by facilities located outside their county. Inspections are assigned to the county containing the regulated facility, whereas part of the modeled exposure associated with that facility might occur elsewhere. This cross-boundary movement creates a possible spatial mismatch between the location of regulatory monitoring and the location of environmental harm (U.S. Environmental Protection Agency, 2023). The direction of the resulting measurement error is uncertain because a county might receive pollution from neighboring jurisdictions, export pollution to them, or experience both processes.

Future research should connect facility-level inspection records to the CEJST status of surrounding census tracts and examine how community disadvantage relates to inspection timing, inspection depth, violations, penalties, corrective actions, and subsequent compliance. Facility-level analysis would permit separate denominators for air and water programs and would support comparisons among facilities with similar regulatory obligations, emissions, and compliance histories. Research linking inspection activity to health or environmental outcomes would also establish if greater monitoring produces measurable improvements for nearby residents. The present study provides a national county-year account of regulatory attention and shows that disadvantage is associated with modestly higher total inspections, primarily through air programs, without a stronger inspection response to rising pollution burden. The findings identify a national pattern in the allocation of regulatory attention and clarify how environmental disadvantage relates to inspection activity across regulatory programs.

7 Conclusion

Environmental inspections represent one of the main ways regulatory agencies monitor facilities, identify possible violations, and direct administrative attention across communities. This study examines the distribution of that attention across disadvantaged and non-disadvantaged counties by combining annual inspection records from EPA's Enforcement and Compliance History Online database, pollution-burden scores

from the Risk-Screening Environmental Indicators model, and disadvantage classifications from the Climate and Economic Justice Screening Tool (U.S. Environmental Protection Agency, 2025a; U.S. Environmental Protection Agency, 2025b; White House Council on Environmental Quality, 2024). The county-year analysis covers 2,500 counties and county-equivalent units in the 50 states and the District of Columbia from 2013 through 2022, producing 23,155 observations and preserving annual differences in inspection activity, pollution burden, and facility concentration.

The analysis separates two dimensions of regulatory allocation that are often treated as a single question. The first concerns baseline regulatory attention, measured as the expected difference in inspection activity between disadvantaged and non-disadvantaged counties at the average level of logged pollution burden. The second concerns burden responsiveness, measured by the degree to which inspection activity changes as pollution burden rises across the two county categories. This distinction prevents higher inspection totals from being interpreted automatically as stronger responsiveness to environmental need.

The preferred negative binomial model shows that disadvantaged counties receive approximately 10.7 percent more total inspections than non-disadvantaged counties after accounting for regulated facilities, state-jurisdiction differences, annual changes in inspection activity, and repeated observations within counties. The estimate remains close to 11 percent in the balanced-panel and full-sample specifications, indicating that incomplete annual coverage and the exclusion of the territories do not account for the result. Facility concentration remains the strongest predictor of inspection activity, confirming that the distribution of regulated facilities explains a substantial portion of the difference in inspection totals across counties.

The program-specific models reveal that the overall disadvantage estimate is concentrated in air inspections. Disadvantaged counties receive approximately 24.7 percent more air inspections at the average pollution burden, whereas the estimated difference in water inspections is small and statistically indistinguishable from zero. Environmental inspection activity therefore varies across regulatory programs rather than following a single national allocation process. Differences in statutory authority, regulated entities, permitting systems, administrative routines, and delegation arrangements offer plausible explanations for the divergence, although the available county-level data do not identify the administrative mechanism responsible for the air-inspection result.

The findings do not support the expectation that inspection activity becomes more responsive to pollution burden in disadvantaged counties. The interaction between disadvantage and logged pollution burden remains close to one in the total, air, and water models, and the adjusted prediction lines remain nearly parallel across the burden distribution. Disadvantaged counties receive modestly higher inspection activity at the average burden level, but the difference does not expand as modeled pollution burden rises. The results therefore identify a baseline difference in regulatory attention rather than enhanced agency responsiveness

to increasing environmental burden.

The facility-offset model adds an additional qualification because the disadvantage estimate becomes statistically insignificant when the number of facilities is treated as a strict exposure term. The primary model estimates the facility relationship freely and finds that inspection activity increases less than proportionally with facility count, whereas the offset model requires a one-to-one relationship between facilities and expected inspections. The contrast indicates that disadvantaged counties receive more total monitoring activity after facility concentration is adjusted flexibly, but the evidence does not establish that each facility in a disadvantaged county receives more inspections than facilities elsewhere.

Inspection counts should also remain distinct from broader measures of environmental protection. More inspections do not establish that monitoring is more thorough, violations receive stronger sanctions, facilities return to compliance more quickly, or environmental harms decline. Prior research shows that inequalities might emerge at several stages of the enforcement process, including inspection timing, sanctioning, and compliance responses (Konisky, 2009; Konisky, Reenock, and Conley, 2021). County-level aggregation introduces further uncertainty because disadvantage varies within county boundaries, and pollution released near county borders might travel through air or water into neighboring jurisdictions. The county containing an inspected facility might therefore differ from the county experiencing part of the resulting exposure.

The findings establish a national pattern in the allocation of regulatory attention and clarify how environmental disadvantage relates to inspection activity across environmental programs. Disadvantaged counties receive modestly higher total inspection activity, primarily through air programs, but agencies do not respond more strongly to rising pollution burden in those counties. Future research linking facility-level inspections to surrounding census tracts, compliance histories, penalties, corrective actions, and environmental outcomes would extend this analysis from the distribution of monitoring toward the consequences of regulatory enforcement.

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There are no competing interest.

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