Newspapers, Information and Enforcement of Environmental Laws*

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Abstract

Can media outlets contribute to stricter monitoring and enforcement of environmental laws? This study investigates how newspaper closures affect environmental monitoring and enforcement activities by the U.S. Environmental Protection Agency. I propose a model of regulatory behaviour where newspapers may influence the probability of detection of environmental violations by working as vehicles of information dissemination about the firms' environmental performance. I find that a daily newspaper closure leads to a drop in the number of inspections, detected violations, and enforcement actions that is within a range of 8%-22% of their yearly averages. Consistent with the information mechanism I propose in the model, I find evidence that newspapers serve as an informant to the regulator and to other firms, improving the effectiveness of regulation enforcement.

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1 Introduction

Local newspapers are recognized to be important sources of information for communities to hold firms, governments and regulators accountable, and are associated with increased political participation (Gentzkow et al., 2011), decreased municipal borrowing costs (Gao et al., 2018), and improved environmental quality (Campa, 2018). However, in the last few decades there has been a significant drop in newspaper coverage and readership in the U.S., leading to an unprecedented number of newspaper closures, especially dailies, which are particularly relevant vehicles of information (Gentzkow et al., 2011; Abernathy, 2018)[1]. What is the impact of these closures on the effectiveness of government regulation?

This paper investigates the effects of newspaper closures on monitoring and enforcement activities by the U.S. Environmental Protection Agency (EPA). Information provision about facilities' environmental records encourages reductions in emissions and discharges (Evans, 2016). I examine how information dissemination can translate into improvements in environmental performance through regulation enforcement. Understanding how information shapes the enforcement of environmental laws is relevant since inspections and sanctions have shown to be a dominant factor behind improvements in environmental quality (Gray and Shimshack, 2011; Shimshack, 2014; Grant and Grooms, 2017).

To understand how newspapers can influence environmental policy decisions, I introduce a conceptual framework in which newspapers influence the ability of the regulator to identify potential violators. I build on a model described in Polinsky and Shavell (2000) in which a violation is privately beneficial to the firm but harmful to the society, and the regulator chooses monitoring and enforcement levels that minimize environmental damages. To this model, I add an information parameter that lowers the marginal cost of detection of

[1] In fact, a survey conducted in 2011 by the Pew Research Center shows that newspapers are the main source that most people rely upon for a number of subjects, the Internet being a distant second Suh (2011).

violations. Furthermore, I recognize that firms might not perfectly observe the regulator's enforcement efforts (based on the framework in Bebchuk and Kaplow (1992) and Garoupa (1999)), and that newspapers contribute to informing facilities about the probability of violation detection. I show and argue that both these channels may work towards increasing regulatory strictness.

My empirical strategy builds upon existing evidence by Campa (2018) that the probability of environmental coverage of a facility by a daily newspaper increases with its proximity to the plant. I collect data from online US newspaper archives and combine it with firm level data from the EPA for facilities regulated under the Clear Air Act. I then create a panel of more than 19,000 facilities observed from 1990 to 2009, with yearly information on all monitoring and enforcement activities by year, as well as violations identified and sanctions applied. Having the location of both the plants and the newspapers, and the year of closure of newspapers (if relevant), I assign a newspaper as covering a facility based on its distance to the facility.

My main analysis uses a Difference-in-Differences (DiD) framework that compares facilities exposed to the closure of a daily newspaper that covered them, with facilities not exposed, before and after the closure. It accounts for time varying demographics that are shown to determine the probability of a newspaper closure (Gentzkow et al., 2011). I implement a DiD estimator described in Callaway and Sant'Anna (2021), which allows for multiple time periods and variation in treatment timing, it flexibly accounts for determinants of newspaper closures using a conditional parallel trends assumption, and allows units to anticipate treatment[2].

I find that there is a drop in monitoring activities (concentrated in Full Compliance Eval-

[2]I will show evidence that anticipation is relevant for my context based on the fact that newspapers' circulation start dropping a few years before the closure, which might already represent a reduction in the information dissemination channel before treatment itself occurs.

uations (FCEs), which are more thorough inspections) associated with a newspaper closure that represents about 19% of the FCEs' yearly average. I also find that closures lead to a drop in enforcement activities; in particular, closures lead to a drop in detected violations and enforcement actions that is about 22% and 9% of their yearly averages, respectively. My event study analysis confirms that dynamically there is an immediate and persistent drop in inspections following a daily newspaper closure, and on the level of detected violations and enforcement actions starting a few years afterwards. I argue that this delayed response can be partially attributed to enforcement policies responding to the drop in monitoring activities.

Motivated by the framework described above, I then investigate possible channels through which newspapers affect the levels of monitoring and enforcement. I first run a triple differences event study model, in order to tease out heterogeneity effects of newspaper closures across facilities that are required to report to the Toxic Release Inventory (TRI) versus facilities that are not. I show that the drop in monitoring and enforcement is stronger for non-TRI facilities, suggesting that newspapers are more relevant determinants of regulatory activities for plants in which compliance is harder to be observed by the regulator.

Lastly, I investigate spillover effects of monitoring and enforcement by interacting a measure of newspaper presence around a facility with past indicators of inspections and sanctions applied, and looking at its impact on current inspections and enforcement. I show that the presence of newspapers around a facility strengthens spillover effects of inspections and enforcement, meaning that it helps firms learn about enforcement applied to other firms, thus improving the effectiveness of regulatory activities.

This paper contributes to the literature that explores the role of information on environmental quality and on the effectiveness of environmental policies. Information disclosure about the sources and extent of environmental harm may impact the firm's expected net benefits of compliance through community pressure and increased monitoring, potentially leading to reduced emissions (Shimshack et al., 2007; Muehlenbachs et al., 2011; Evans, 2016; Grant and Grooms, 2017; Shimshack, 2020)[3]. I show compelling evidence that information provision through media influences the regulator's capacity to enforce compliance, which is an important mechanism that affects environmental quality.

This study is also related to a strand of papers that investigate the role of media in keeping local governments and firms accountable. Gentzkow et al. (2011) show that newspaper closures increase voter turnout, and Gao et al. (2018) find that newspaper closures are associated with increases in municipal borrowing costs. Most relevant to this paper is Campa (2018), who shows that media coverage of toxic releases influences corporate emissions decisions and improves environmental quality. This paper is the first to look at how newspaper exits influence regulatory stringency by the EPA, which can be seen as a channel through which it impacts environmental compliance. In the context of environmental policies in particular, this paper contributes to a literature that looks at the role of information dissemination and disclosure as an enforcement strategy (Lyon and Shimshack, 2015; Evans, 2016; Grant and Grooms, 2017; Maniloff and Kaffine, 2021). This study goes further and investigates the mechanisms through which a particular vehicle of information (newspapers) can affect how regulation is enforced.

Lastly, this study is also related to work that measures the effect of monitoring and enforcement on environmental quality (Shimshack and Ward, 2008; Gray and Shimshack, 2011; Shimshack, 2014; Alm and Shimshak, 2014), in particular to papers that use DiD and event study designs to evaluate the dynamic effects of specific interventions that affect the environment (Hanna and Oliva, 2010; Grooms, 2015). Notably, I apply the DID estimator recently

[3]Information disclosure has also shown to be effective in other regulation settings as well, like workplace safety (Johnson, 2020).

developed by Callaway and Sant'Anna (2021), since it is more suitable for setting with more than two periods and where treatment occurs for different units at different times[4].

The rest of this paper is organized as follows: Section 2 provides a background description of the regulatory activities by the EPA, and describes my conceptual framework. Section 3 describes the data used. Section 4 describes my main empirical strategy results. Section 5 shows spillover results. Section 6 concludes the paper and discusses policy implications.

2 Context and Framework

2.1 Background on EPA inspections and enforcement under the Clean Air Act

Air pollution regulation in the United States is regulated under the Clean Air Act (CAA), and the stringency of enforcement activities varies at the county level (Walker, 2011). To ensure that plants comply with the regulations of criteria air pollutants[5], the EPA has a set of enforcement tools that include inspections, and financial and non-financial penalties.

For large facilities regulated under the CAA, self-reported pollution data is the main source of information on compliance (Gray and Shimshack, 2011). The EPA's Toxic Release Inventory (TRI) program, for instance, mandates the disclosure of the plants' emissions. The program started in 1989, and made it mandatory for plants with more than 10 employees in certain

[4]Several other papers in the last few years have identified issues with using two-way fixed effects (TWFE) for staggered treatment and proposed solutions that are applicable to different settings (De Chaisemartin and D'Haultfoeuille, 2020; Sun and Abraham, 2021; Lin and Zhang, 2022). Marcus and Sant'Anna (2021) provide a review and critique of these methods in several settings within the environmental economics literature.

[5]The Clean Air Act Amendments (CAAA) gave the EPA the authority to regulate criteria air pollutants, which are ozone (O3), particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOX), sulphur dioxide (SO2), and lead (Pb).

sectors (manufacturing, metal mining, electric power generation, chemical manufacturing, and hazardous waste treatment) to annually report the quantity of each toxic substance that is released into the air, water or land.

For facilities without extensive self-monitoring requirements, inspections are the primary source of compliance monitoring information. Under inspections, CAA Evaluations can be either a Full Compliance Evaluation (FCE) or a Partial Compliance Evaluation (PCE). FCEs are comprehensive inspections that "look for all regulated pollutants at all regulated emission units, and it addresses the compliance status of each unit, as well as the facility's continuing ability to maintain compliance at each emission unit."[6]. PCEs are less comprehensive and focus on a subset of regulated pollutants or emission units in a facility. Each of these type of evaluations can occur on site or off site.

Once a violation is identified, the EPA has a set of enforcement tools that can be applied. A facility can receive an enforcement action, which can be informal or formal. The former is generally in the form of warning letters or Notices of Violation (NOVs), while the latter is usually an order issued directing an entity to take action to come into compliance or to clean up a site. A formal enforcement action can be followed by a financial penalty. The frequency and magnitude of sanctions depend, among other things, on the severity of the violation, and on the facility's compliance and enforcement history.

Within the universe of CAA violations, some are designated Federally Reportable Violations (FRV), and High Priority Violations (HPV). An FRV is reported for federally enforceable violations under certain conditions[7], and state and local agencies are required to make its reporting a priority. FRV reporting is needed in order to consistently and effectively manage

[6]See *https://www.epa.gov/compliance/how-we-monitor-compliance*, accessed August 31st, 2022.

[7]See the National Association of Clean Air Agencies (NACAA) Strping Membership Meeting presentation (https://www.4cleanair.org/wp-content/uploads/2021/01/NACAA_presentation_Final.pdf, pages 15 to 22, accessed August 31st, 2022) for details.

CAA enforcement programs nationally. Within FRVs, the EPA designates HPVs to repeat offenders and targets them with elevated scrutiny and penalties, which increases the costs to the plant of being a violator. A single plant can have several HPVs at the same time, and these costs are further increased because the plant will only return to compliance once those violations have been resolved.

Most of the monitoring and enforcement activities are carried out by state-level regulatory agencies. State and regional level interventions have been shown to be closely related to community characteristics, such as political activism and participation, income, and education (Earnhart, 2004; Grant and Grooms, 2017). Communities sensitive to environmental concerns may pressure regulators to monitor and enforce frequently (Gray and Shimshack, 2011), and inspections can also happen as a result of tips and complaints received by the agency from the public (Maniloff and Kaffine, 2021). This variation in regulation enforcement at the local level is particularly important in my analysis, in which I explore how state and local environmental agencies respond to the presence of local media.

2.2 Conceptual framework

I start with a simple conceptual framework that relates the presence of newspapers to violation detection, monitoring, and enforcement outcomes. This framework is based on the model described in Polinsky and Shavell (2000), where risk-neutral individuals (firms) choose whether to commit a harmful act, i.e., an environmental violation. The violation is privately beneficial to the firm but costly to the society. The firm compares the expected benefit b of an environmental violation with the expected costs of that action, where expected costs are a function of the detection probability p and of the magnitude of the sanction f if detected. The parameter b is assumed to be uniformly distributed in the interval [0,1]. The firm will commit a violation if, and only if:

$b > pf$

The regulator (enforcement authority) minimizes the expected environmental damages, which is the harm h to society of an environmental violation minus the aggregate gain of violating, plus the monitoring costs. Let $x(p,\gamma) = wL(p,\gamma)$ (with $x_p > 0$ and $x_{p,p} > 0$) be the monitoring costs, which is a function of the probability of detection and an information parameter γ. The parameter w is the wage of the inspection agent (which is per inspection and fixed) and $L(p,\gamma)$ is the number of inspections.

The parameter γ captures the dissemination of information which improves the regulator's ability to detect a violation. In other words, I assume that $x_{p,\gamma} < 0$, which means that every unit of effort dedicated towards inspections is more effectively used if the regulator has more information about potential violators, thus lowering the costs of detection.

The enforcement authority chooses the detection probability p, and the sanction f, subject to a maximum fine F[8]. The regulator then solves:

$$Min_{p,f} \quad x(p,\gamma) - \int_{pf}^{1} (b-h)db \tag{1}$$

s.t. $f \leq F$.

As shown in Bebchuk and Kaplow (1992), when there is perfect information (i.e., firms observe p accurately), the optimal fine is the maximum. If $f < F$, the regulator can increase f and reduce p such that pf is constant. In that case, the magnitude of the first term in equation 1 falls and the second term is unaffected, which means it is optimal to increase f

[8]Garoupa (1999) interprets F as being the maximum feasible fine. In the context of environmental regulations, one can think of F as the maximum fine allowed by legal statutes.

up to the maximum amount. Setting $f = F$, the first order condition with respect to p is:

$x_p + pf^2 - Fh = 0 \Rightarrow p = \frac{hF - x_p}{F^2}$

I am interested on understanding the effect of increasing information dissemination on the probability of detection. Taking the total derivative of the equation with respect to γ, we get:

$$\frac{dp}{d\gamma} = -\frac{x_{p,\gamma}}{F^2 + x_{pp}} = -\frac{wL_{p,\gamma}}{F^2 + wL_{p,p}} > 0 \tag{2}$$

Which means that when dissemination of information increases (decreases), it is optimal for the regulator to choose a higher (lower) probability of detection. What happens to the monitoring levels? Taking the total derivative of $L_{p,\gamma}$ with respect to γ, we get:

$$\frac{dL}{d\gamma} = \frac{\delta L}{\delta p}\frac{dp}{d\gamma} + \frac{\delta L}{\delta \gamma} = \frac{\delta L}{\delta p}\Big[-\frac{wL_{p,\gamma}}{F^2 + wL_{p,p}}\Big] + \frac{\delta L}{\delta \gamma} \tag{3}$$

Because $\frac{\delta L}{\delta p} = L_p > 0$ and $\frac{dp}{d\gamma} > 0$, the first term on the right hand side of equation 3 is positive. This term (which I will call "intensity effect") captures the positive effect γ has on the probability of detection, and the fact that in order to achieve a higher p the regulator needs to increase the number of inspections. The second term represents the cost-saving effect, and it is negative, because with more information less inspections are needed to achieve a given level of p. In other words, $\frac{\delta L}{\delta \gamma} < 0$. In principle, we do not know which effect dominates, so that the impact of information dissemination on the level of inspections is an empirical question.

In this setting, newspapers influence the information dissemination parameter γ. The main prediction of the model is that more information dissemination (i.e., more newspapers) would lead to an increase in the detection of violations. That could be translated into an increase in inspections if the intensity effect dominates the cost-saving effect. Newspapers can act as informants, alerting regulators of negligence and potential violations, thus increasing the optimal level of the probability of detection, which can be achieved through increasing inspections frequency, and potentially translate into increased enforcement.

In the context of a shrinking newspaper market, these theoretical predictions serve as a motivation for my main empirical analysis. If newspapers are relevant for information dissemination, newspaper closures lead to a decrease in violations detection, and thus enforcement, and potentially affect monitoring levels negatively.

3 Data

3.1 Monitoring, Enforcement, and Compliance

I collect data on monitoring, enforcement and violation history from the EPA. The EPA maintains a comprehensive database on permitted facilities, the Integrated Compliance Information System for Air (ICIS-Air) for stationary sources of air pollution regulated under the CAA. The data includes activities from the federal EPA, as well as state and regional agencies. It contains information on facility characteristics, geolocation, industry, inspections (both full and partial compliance evaluations), detected violations that are reported as FRVs or HPVs[9], enforcement actions (both formal and informal), and the penalties assessed. The information in ICIS-Air is used to track the monitoring and enforcement activities, as well as the compliance status, of point sources with various regulatory programs under the

[9] FRVs and HPVs are a subset of CAA violations. The ICIS-Air data contains all detected violation violations reported as FRVs or HPVs for each facility regulated under the CAA.

CAA. Table 1 reports summary statistics for my main variables.

Table 1: Monitoring and Compliance

Monitoring and enforcement measures by facility	Mean/total	Std. Dev.
Inspections (total)	0.950	2.986
Full Compliance Evaluations (FCE)	0.310	0.738
FCE Onsite	0.306	0.732
FCE Offsite	0.005	0.095
Partial Compliance Evaluations (PCE)	0.639	2.822
PCE Onsite	0.297	1.187
PCE Offsite	0.341	2.386
Reported violations (FRVs and HPVs)	0.112	0.700
Enforcement actions	0.159	0.843
Number of TRI facilities	10,605	
Number of FRVs/HPVs[1]	4,701	
Number of facilities in panel	19,123	

Note: This table provides means for the main variables used in the regression analysis, as well as standard deviations. This data is from EPA's ICIS-Air. [1] Number of facilities that had at least one FRV or HPV reported within sample years.

My final sample is a balanced panel of 19,123 facilities, from 1990 to 2009. The facilities have a unique id across the years of ICIS-Air data, however each facility only appears in a specific year if it is inspected, received any type of enforcement action, had an identified violation in that year, or is otherwise a TRI facility. Therefore, I create a balanced panel based on the facilities that appear in the beginning and at the end of my sample.

I report the average and the standard deviation of the total number of inspections, enforcement actions, and detected violations (FRVs and HPVs) by firm and year. The average number of inspections is 0.95, of which around 33% are FCEs, with an average of 0.31, and the average number of reported violations and enforcement actions are 0.11 and 0.16, respectively. Only about 18% of the EAs are followed by a financial penalty. An additional data source is the EPA's TRI data. There are 10,605 facilities in my sample that have to report to the TRI, which is about 55% of the total. Additionally, the number of facilities that had an HPV status at least once throughout the sample represent around 28% of the total.

Other descriptive data are provided in Appendix A, including statistics on monitoring and enforcement by industry, and on other details on compliance and enforcement mechanisms such as the FRV/HPV and the TRI.

3.2 Newspapers and Demographics

I compile the newspapers headquarter location by city, year founded and year of closure (if relevant) from the website *Chronicling America*, from 1990 to 2009, which contains these information for almost all US newspapers. I have information on a total of 1,820 daily newspapers. I complement this data with newspaper closure dates compiled from *Newslibrary*, and with data provided by the University of North Carolina's Center for Innovation and Sustainability in Local Media (Abernathy, 2018).

I assign newspapers to facilities based on their geographic distance. More specifically, in my main analysis I assign a newspaper as covering a facility if the newspaper is within a radius of 80km from the facility[10]. Table 2 reports summary statistics at the facility level for newspapers within that radius.[11]. There is an an average of 8.48 daily newspapers within 80km of each facility, and 12,282 facilities that had at least one daily newspaper closure in the 80km ring. That means more than half of the facilities in my sample experienced at least

[10] I do not have the exact geolocation for each newspaper. What I use instead is the centroid of the city in which the newspaper is issued.

[11] I present statistics for both daily and weekly newspapers for comparison purposes, but my analysis focuses on daily newspapers.

one daily newspaper closure in that period.

Table 2 also reports the demographic variables that I use as controls in some of my specifications, namely: total population; total employed population; percent of the population that is urban, female, Hispanic/Latino, and college educated; income per capita. Those are collected from the US Population Census at the level of the census tract, which are small and relatively permanent statistical subdivisions of the counties. The measures are calculated based on the census tract areas that are within or that intersect the radius of 80 km from each facility.

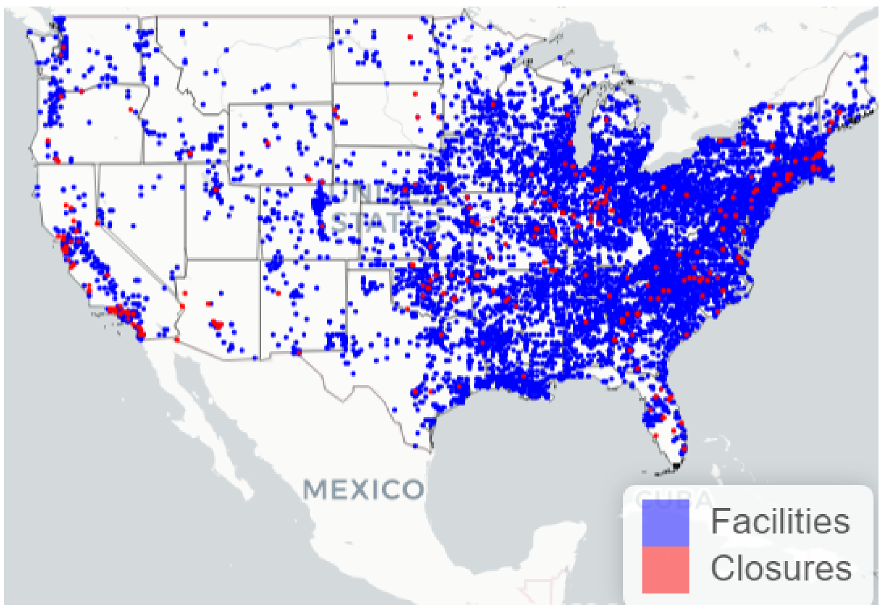
Table 2: Newspapers and demographics

	Average	Closures (Average)	Closures (# facilities)
Newspapers (80 km radius)			
Newspapers (weekly)	38.16	0.1360	15,080
Newspapers (daily)	8.48	0.0746	12,282
Demographics (80 km radius)			
Population (in 100K)	8.21		
Employed population (in 100K)	3.67		
% Urban	69.82		
% Female	51.17		
% Hispanic/Latinx	6.71		
% College educated	21.14		
Income per capita (in $K 2010)	25.05		

Note: This table provides basic statistics for the number of newspapers and newspaper closures, both weekly and daily, that are within 80 kilometers of the facilities. It also provides the average of some demographic variables from the US census tracts that are within 80 kilometers of the facilities.

The map in Figure 1 plots the location of each facility in my panel in blue, and the location of daily newspaper closures in red. The red dots are the centroid of the city in which the newspaper that closed has its headquarters. The facilities and newspaper closures have a higher concentration on the eastern part of the country. That is because that region has a higher number of newspapers to begin with. There is a total of 316 daily newspaper closures in my sample. Figure 5 in the Appendix show the number of daily newspaper closures by year.

Figure 1: Facility locations and newspaper closures



Note: Each red dot in this map is the centroid of a city that had at least one daily newspaper closures at any point in my sample, from 1990 to 2009. The blue dots are the locations of every facility in my sample.

3.3 Additional data sources

I use data from the US Newspaper Panel compiled by Gentzkow et al. (2011) from the *Editor and Publisher Yearbook*. In each federal election year they extract several information for every English-language daily newspaper, including the name, county, circulation, year of founding and year of closure (if relevant). This data is used in my analysis to investigate what happens to newspaper circulation as it approaches its closure year[12].

I use newspaper exits and circulation data for 1,970 daily newspapers, every four years from 1984 to 2004. There are 307 newspaper closures within this period, and an average yearly circulation of 35,524 newspapers per publisher.

Additionally, I use data from the National Telecommunications and Information Administration (NTIA). NTIA provides data on internet usage at the state level starting in 1998, namely, the percentage of the population in each state and year who uses the internet at any location. I use this data to explore cross-state differences in the effects of newspaper closures depending on state-level measures of internet usage. The average percentage of state level population with access to the Internet within my sample years is around 65%. The yearly average is of 34.2% in 1998 (the first year available), and almost doubles by 2009, reaching 69.5%.

4 Newspaper closures and enforcement

4.1 Newspapers circulation

In this Section, I show and discuss evidence of the relationship between newspaper closures and the drop in circulation. More specifically, I look at what happens with newspaper circulation as the newspaper closure date approaches, by estimating the following event study regression:

[12] I use this data source exclusively for this additional analysis, as it was compiled for every four years and thus not ideal for studying yearly changes in environmental monitoring and enforcement due to newspaper closures.

$$Circulation_{jt} = Closure_j * \sum_{\substack{m=-20 \\ m \neq -4}}^{0} \beta_m I(t - t_0 = m) + \lambda_j + \lambda_t + \epsilon_{jt} \tag{4}$$

Where $Circulation_{jt}$ is the total newspaper circulation of newspaper j in year t. $Closure_j = 1$ if daily newspaper j closed, and $I(t - t_0 = m)$ are indicators of the time relative to the closure year, t_0, of each newspaper. The coefficients β_m's capture the lagged effects of the newspaper closure on total circulation. λ_j and λ_t are newspaper and year fixed effects.

Here I use data from the US Newspaper Panel (as described in Section 3.3), which is only available every 4 years, on election years. Hence, the lagged indicators in Equation 4 are for every election year. I omit the first lag as indicated, which is $t = -4$, so that the coefficients are the effects by year relative to the last available year before closure.

I plot β_m's in Figure 2, and the 95% confidence intervals. The coefficient drops as the newspaper closure date approaches. In particular, it is negative starting on the fourth year before closure, and continuing until the closure year, although the confidence intervals include zero. As shown in Gentzkow et al. (2011), newspapers remain large until the year before they exit, but the closures are preceded by unusually slow growth in circulation, which is in accordance with Figure 2.

This analysis serves as evidence that, although newspaper closures do represent large discrete drops in coverage, the drop in circulation that precedes a newspaper exit may impact news coverage significantly, and hence may generate some response in terms of monitoring and enforcement before a newspaper exits the market. Hence, a differences-in-differences estimation in which treatment starts when a newspaper closes might miss the effects of the loss in information dissemination that already started in the years preceding the closure. I take that into account in some of my estimates in Section 4.2, where I present DiD estimation results that allow for units anticipating treatment.

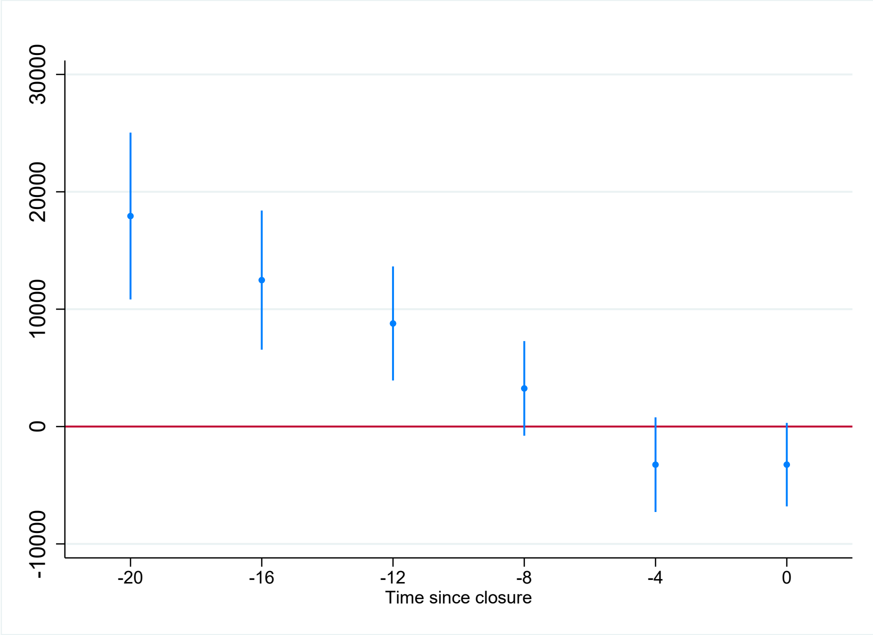


Figure 2: Change in circulation and year of closure

Note: The figure plots the event study coefficients of newspaper circulation with lags of the newspaper closure indicator, and the 95% confidence intervals. It includes newspaper and year FEs.

4.2 Empirical strategy and main results

My empirical strategy exploits changes in annual inspections, detected violations, and enforcement actions (hereon, EAs) in facilities that faced a daily newspaper closure relative to other facilities, before and after the closure. I use daily newspaper closures as events that represent negative local media shocks, as they cause large discrete changes in local media coverage (Gentzkow et al., 2011).

To examine the impact of newspaper closures on monitoring and enforcement activities, I start by estimating a TWFE model:

$$Y_{it} = \beta_0 Closure_{80;i} * Post_t + X_{80;it} + \lambda_i + \lambda_t + \epsilon_{it} \tag{5}$$

where Y_{it} is either the number of inspections, violations detected and reported as FRVs or HPVs, or EAs in facility i and year t. As described earlier, I assign a facility to a newspaper if that newspaper is within 80 km of the facility[13]. The choice of the 80km ring is based on evidence that the probability of environmental coverage of a facility drops to zero after around 80km (Campa, 2018). Hence, $Closure_{80;i}$ is an indicator that equals one if a daily newspaper within that radius around facility i closed during the sample period, and $Post_t$ equals one for the closure year. This interaction then turns on starting in the year of a daily newspaper closure.

I include time varying demographic characteristics $X_{80;it}$ using data from census tracts that are within 80km of the facility as described in Table 2, namely, total population, total employed population, percent of the population that is urban, female, Hispanic/Latinx, and college educated, and income per capita. Gentzkow et al. (2011) show that some of these variables are closely related to the probability of newspaper closures, and Shimshack (2014) show that they might also affect local regulatory strictness. λ_i and λ_t are firm and year fixed effects. In some specifications I include EPA region by year FEs, and industry by year FEs. In all my results, errors are clustered by city to allow for correlation over time within a city.

The results of equation 5 are reported in Table 3. Panel A reports the results for FCE inspections[14]. I add controls and several fixed effects as indicated. I start by reporting the basic TWFE specification; I then add time-varying controls; EPA region by year FEs[15]; and

[13]I show additional results for a 50km radius in the Appendix.

[14]CAA inspections are composed of FCEs and PCEs, as described in Section 2.1. I present the results for PCE in the Appendix.

[15]The country is divided in 10 EPA regions, as described in Table 8, Appendix A.

industry by year FEs[16].

Table 3: TWFEs: Monitoring and Enforcement

	(1)	(2)	(3)	(4)
Panel A: Inspections (FCE)				
Closure x Post	-0.0831***	-0.0840***	-0.0637***	-0.0828***
	(0.0217)	(0.0189)	(0.0139)	(0.0187)
Panel B: Reported violations (HPV or FRV)				
Closure x Post	-0.0192	-0.0224***	-0.0251***	-0.0211***
	(0.0118)	(0.00741)	(0.00745)	(0.00737)
Panel C: Enforcement Actions				
Closure x Post	-0.0125	-0.0145*	-0.0127*	-0.0139*
	(0.00889)	(0.00766)	(0.00728)	(0.00763)
Controls		✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Region x Year FE			✓	
Industry x Year FE				✓
Observations (Panel A)	312,208	312,203	312,203	312,203
R-squared (Panel A)	0.353	0.313	0.359	0.318
R-squared (Panel B)	0.413	0.424	0.429	0.425
R-squared (Panel C)	0.317	0.322	0.326	0.322

Note: The table displays the results of OLS regressions of firm-level monitoring and enforcement outcomes, on newspaper closure indicator variables. In Panels A, B, and C the dependent variable is number of FCEs, detected violations that are either FRVs or HPVs, and EAs, respectively. I add controls and fixed effects as indicated. Controls are population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. I drop facilities that had a newspaper closure in the first year of the sample. Standard errors are clustered by city and in parenthesis, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

In Panel A the coefficients are consistently negative and significant for all specifications. If

[16] I use the one-digit Standard Industrial Classification (SIC) codes. SIC descriptions and its summary statistics are shown in Table 7 in Appendix A.

we take the coefficient in column (3) of Panel A[17], it suggests that a daily newspaper closure leads to a 0.0637 drop in monitoring activities (as measured by Full Compliance Evaluation inspections), which is around 19% of the yearly average.

Are newspaper closures also affecting enforcement? Panel B of Table 3 reports the results for the level of detected violations for which there was an enforcement response in the form of an HPV or an FRV. The coefficients are consistently negative and mostly statistically significant for all specifications. The coefficient in column (3) of Panel B suggests that a newspaper closure leads to a 0.0251 drop in reported violations designated as FRV or HPV, which is around 22% of the yearly average.

Similarly, Panel C of Table 3 report the results for EAs. The coefficients are consistently negative and of similar magnitudes, although with a higher p-value. The coefficient in column (3) of Panel C suggests that a newspaper closure leads to a drop in EAs of 0.0127, which is around 8% of the yearly average. The magnitudes of the coefficients in Table 3 are of sizable magnitude, which shows that newspaper closures are relevant determinants of changes in monitoring and enforcement activities by the EPA.

Newspaper closures are not randomly assigned, and it is not reasonable to assume that facilities around newspapers that closed (i.e., "treated" facilities) and non-treated facilities are otherwise the same. In other words, the differences in observed time-varying characteristics create non-parallel dynamics in the monitoring and enforcement outcomes between treatment and control groups. As mentioned earlier, Gentzkow et al. (2011) show that newspaper closures are being driven by underlying economic conditions in the region, which are mostly captured by population and income, but also educational level and other demographic characteristics. These conditions are also likely to affect monitoring and enforcement activities

[17] Since most of the monitoring activities are conducted by the state and regional authorities (Shimshack, 2014), and hence potentially subject to events happening at that level, this is my most preferred specification.

(Shimshack, 2014)[18]. Despite addressing observed confounding factors in Equation 5 by adding several controls, including time-varying controls in TWFE regression might generate covariate effect biases, as noted by Sun and Abraham (2021), Lin and Zhang (2022) and others.

Besides not being able to rely on an unconditional parallel trends assumption for my TWFE estimation, there are other known issues that might arise with using TWFE in my context, which makes the estimation unreliable. Namely, I have multiple time periods and variation in treatment timing, meaning that units are entering treatment at different dates. Several papers in the last few years have identified these estimation issues and proposed new ways of dealing with them[19].

I use an inference procedure developed by Callaway and Sant'Anna (2021) (hereon, CS) that allows for multiple time periods and variation in treatment timing, and pre-treatment covariate-specific trends across groups, which is appropriate for my context where the parallel trends assumption arguably holds only after conditioning on observed covariates. More specifically, the CS estimation procedure allows me to flexibly account for pre-treatment time varying controls. The average treatment effects are reported in Table 4, still assigning newspapers as covering a facility if they are within a 80km radius it[20].

Panels A, B, and C report the results for FCEs[21], reported violations that received an enforcement response in the form of FRV or HPV, and EAs, respectively. In columns (1)-(3) I report the simple average treatment on the treated (ATT), which is a weighted average of

[18]Monitoring and enforcement are closely related to community characteristics that are associated to political activism, such as education and income.

[19]De Chaisemartin and D'Haultfoeuille (2020), Sun and Abraham (2021), Callaway and Sant'Anna (2021), to name a few.

[20]I report results for a 50km radius as a robustness check in Tables 13 and 14 in Appendix B.

[21]The results for PCEs are reported in Table 12 in the Appendix. Some coefficients are positive, although non-significant. It seems that newspaper closures not only are affecting the most comprehensive inspections (i.e., FCEs) more strongly, but also to some degree leading to a substitution of the latter with PCEs, which are less thorough inspections.

all group-time average treatment effects with weights proportional to group size. In columns (4)-(6) I report the dynamic ATT, which is the average effect across positive lengths of exposure to the treatment, similar to an event study. The pre-treatment and time-varying controls included in the model are population and income per capita[22].

Table 4: CS estimator: FCEs, reported violations, and EA

	Simple			Dynamic		
	(1)	(2)	(3)	(4)	(5)	(6)
Mean dep. vars.: 0.31; 0.16						
Panel A: FCE						
ATT	-0.0658***	-0.0922***	-0.1031***	-0.0661***	-0.0923***	-0.103***
	(0.0178)	(0.0218)	(0.0259)	(0.0174)	(0.0216)	(0.0265)
Panel B: Reported Violations (HPV or FRV)						
ATT	-0.0403***	-0.0443***	-0.0359***	-0.0411***	-0.0451***	-0.0366***
	(0.0095)	(0.0098)	(0.0105)	(0.0094)	(0.0104)	(0.0103)
Panel C: EA						
ATT	-0.0465***	-0.0560***	-0.0646***	-0.0476***	-0.0570***	-0.0658***
	(0.0134)	(0.0150)	(0.0171)	(0.013)	(0.0163)	(0.0166)
Anticipation	0	1	2	0	1	2
Observations	326,553	326,553	326,548	326,548	326,548	326,548

Note: The table displays the results for the average treatment on the treated (ATT) based on the first step regression estimator as in Callaway and Sant'Anna (2021), for the group and dynamic aggregations. In Panels A, B, and C the dependent variable is number of FCEs, detected violations that are either FRVs or HPVs, and EAs, respectively. Treatment is defined as the closure of a daily newspaper which is within a ring of 80km around a facility. Standard errors are clustered by city and in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. Pre-treatment time-varying covariates are population and income per capita within 80km from facility.

The results in columns (1) and (4) of Panel A have the same sign and similar magnitudes as

[22]Due to some groups being very small (in 2007 for instance, there were only 3 daily newspaper closures), the inclusion of more controls makes the system computationally singular, so that estimation is not possible. In Tables 13 and 14, in Appendix B, I report the results including all controls, but changing the pre-treatment covariates to cover a ring of 2km around the facility. I present this alternative choice of controls based on empirical evidence by Currie et al. (2015) which suggests that emissions originating from TRI plants are detectable within about one mile from the plant.

our TWFE estimates in column (3) of Table 3, and the magnitude of the confidence intervals are also similar. These results confirm that the negative impact of newspaper closures on monitoring activities is very robust to different specifications. For Panels B and C, the results in columns (1) and (4) are of even higher magnitude than the TWFE estimates in Table 3, and also significant at the 1% level, suggesting that newspaper closures lead to a drop in severe violations detected and enforced, and on enforcement actions of nearly 25% to 40% of their yearly averages[23].

Additionally, the CS procedure allows for some anticipation, meaning that units start responding to the treatment before it occurs. As shown in Figure 2 of Section 4.1, anticipation seems to be a relevant aspect in my context, where newspapers circulation start dropping in the years preceding their closure. It is possible that monitoring and enforcement activities start responding to potential drops in coverage that is associated to the shrinking of newspapers which starts before the year of closure. Therefore, in columns (2)-(3) and (5)-(6) of Table 4 I allow for anticipation effects of one and two periods, respectively. The ATTs are still negative and even larger in magnitude, and still significant at the 1% level.

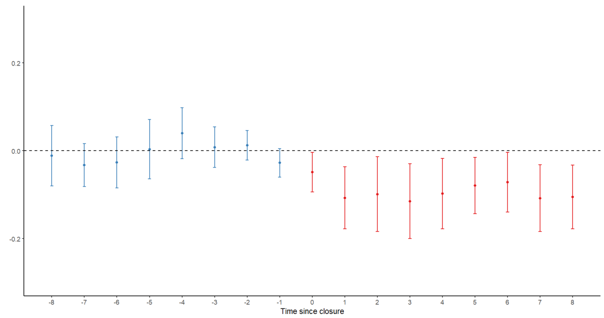
Next, I show the event study graphs based on the CS estimation. The event study also serves as a visual inspection that the conditional parallel trends assumption hold at least in pre-treatment periods, and it also helps us understand the average effects by length of exposure to treatment. Panels A, B, and C of Figure 3 plot the event study coefficients for FCEs, reported violations, and EAs, respectively, and confidence intervals at 5% significance level. For these plots I allow for one period anticipation in treatment[24].

[23]It is important to note here that as we move away from treatment, the groups become smaller, hence the estimation less reliable. I limit the ATT calculation to 8 periods before and after treatment here, but the effects are still of high magnitude near the tails. I try different lengths for calculating the ATTs, and the effects are still negative and significant, both statistically and economically. Results are available upon request.

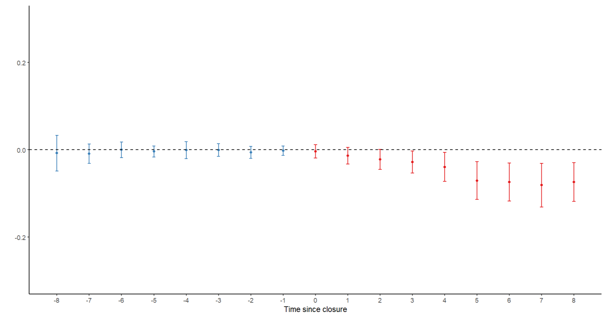
[24]Figure 6 in Appendix B show the event study plots with no anticipation. The conclusions remain similar.

Figure 3: CS Event Study Plots

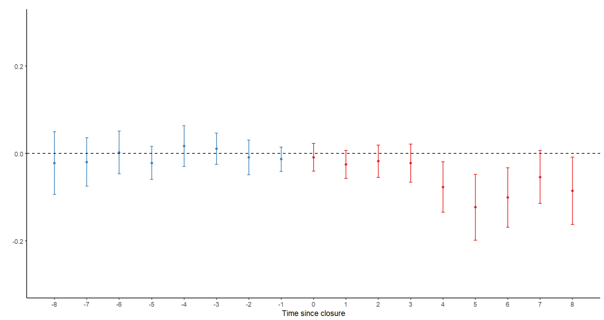
(a) Full Compliance Evaluations



(b) Reported Violations (HPV or FRV)



(c) Enf. Actions



Note: The figure plots the estimated dynamic coefficients by length of exposure to treatment from the event study model type estimation as in Callaway and Sant'Anna (2021), based on the first step regression estimator, and allowing for a one period anticipation of treatment. Treatment is defined as the closure of a daily newspaper which is within a ring of 80km around a facility. Panels A, B, and C plot the coefficients for FCEs, detected violations, and EAs, respectively. 95% confidence intervals are plotted above and below the coefficient estimates. The model includes firm and year FE, and account for pre-treatment population and income per capita as covariates. Standard errors are clustered by city.

Panel A shows there is a significant, negative and persistent drop in FCEs starting on the second year post newspaper closures. For reported violations and EAs the effect is slightly delayed. It starts in $t = 3$ for reported violations, but the effects are quite persistent over time. For EAs it starts at $t = 4$, which is the fifth year post closure, and persists strongly up to $t = 7$. As discussed, monitoring activities are an important way through which the

EPA learns of potential violations, and hence is able to apply sanctions. Therefore, we can interpret the delayed drop in detected violations and EAs as enforcement partly responding to a drop in monitoring that happens because of daily newspapers closing.

Given the persistent negative effects of newspaper closures on monitoring and enforcement actions, it would seem that alternative sources of media were imperfect substitutes for newspapers during my sample period. I test this conclusion directly by comparing the impact of newspaper closures on EPA activities in states with low versus high Internet usage. More specifically, I estimate a triple differences estimation where I interact the Closure x Post indicator with an indicator that equals one if the fraction of the state population that has access to the internet is above the median.

The results are reported in Table 11 in Appendix B. The coefficient of the triple interaction is either negative (for EAs) or non-significant (for FCEs and reported violations), which suggests that the Internet presence is not mitigating the negative impact of newspaper closures on regulatory activities.

In summary, I have shown strong evidence that monitoring and enforcement activities respond negatively to daily newspaper closures, which suggests that large drops in news coverage lead to a reduction in regulatory strictness.

4.2.1 Is the regulator being informed?

So far, I have found strong evidence that newspaper closures trigger a downward trend in monitoring and enforcement activities by the EPA. However, this does not tell us much about the channels through which a drop in news coverage affects the degree of monitoring and enforcement. Having built upon a conceptual framework in which information reduces the marginal cost of detection for the regulator, I will try to test if the information dissemination through newspapers helps the regulator to identify potential violators. Unfortunately we can't observe directly if the regulator is being informed through newspapers, so I instead take advantage of my firm-level panel to explore a specific feature of the regulation that makes it easier for the regulator to identify a violation.

The feature I will explore is TRI reporting. The TRI tracks the emissions of toxic chemicals that impose a threat to human health and the environment. As an important information disclosure mechanism, data submitted by facilities that are require to report to the TRI is compiled and made publicly available by the EPA. Here I use a firm-level indicator of TRI reporting as a proxy for improved capacity of the regulator (and the public) to observe compliance. More specifically, if newspapers inform the regulators and the public about facilities not complying to environmental regulations, we would expect that a daily newspaper closure would lead to a stronger drop in monitoring and enforcement on facilities that are not required to report to the TRI.

I test this channel by estimating the following triple-differences equation in an event study setting:

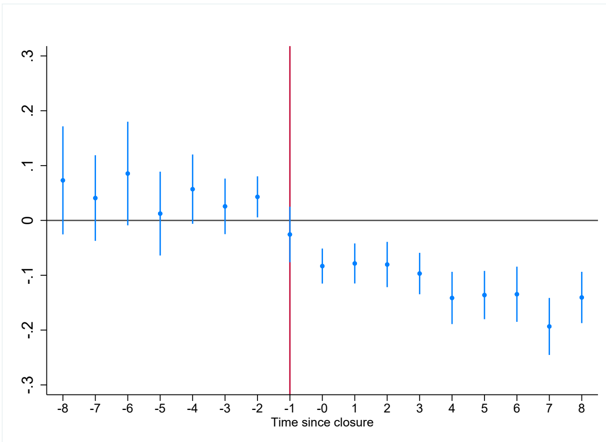
$$Y_{it} = nonTRI_i * Closure_i * \sum_{\substack{m=-M \\ m\neq -1}}^{M} \beta^1_m I(t-t_0 = m) + Closure_i * \sum_{\substack{m=-M \\ m\neq -1}}^{M} \beta^2_m I(t-t_0 = m) + \lambda_i + \lambda_t + \epsilon_{it} \tag{6}$$

where $Closure_i = 1$ if a daily newspaper closed within 80km of facility i, and $nonTRI_i = 1$ if facility i does not report to TRI. Indicator variables $I(t - t_0 = m)$ measure the time relative to the closure year, t_0, of a daily newspaper covering each facility, and are zero in all periods for facilities that did not have a daily newspaper closure within an 80km ring. λ_i and λ_t are firm and year FEs. If we remove the first part of equation 6, β_m^2 are simply the coefficients of a classic difference-in-difference event study specification. Here I add a triple interaction with the indicator $nonTRI_i$, and my coefficients of interest are the β_m^1's. These coefficients will tell us whether and to what extent there is a difference in responsiveness of regulatory strictness on TRI versus non-TRI facilities post newspaper closures relative to before, on firms that are affected by a closure versus firms that are not. The coefficients β_m^1 are plotted in Panels A, B, and C of Figure 4, along with 95% confidence intervals, for FCEs, detected violations that were reported as FRVs or HPVs, and EAs, respecively.

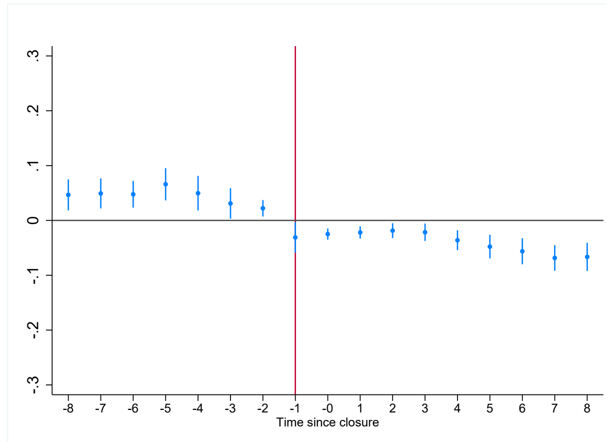
The pre and post-treatment coefficients plotted in Figure 4 show that the drop in monitoring and enforcement activities is more pronounced for non-TRI facilities. This differential effects seem to be much stronger for FCEs - and to a lesser degree for reported violations- than EAs. Because these facilities don't have to report their emissions to the TRI, compliance is harder to observe to the regulator. In the case of inspections, the stronger effect on non-TRI facilities is in accordance with my previous results; the regulator inspects less when they have less information. This is evidence that the closure of a newspaper affects the ability of the regulator to identify violations, inspect and, to a lesser degree, apply sanctions, in particular for facilities in which information on emissions and compliance is not directly observed. These results suggest that the information channel through the regulator plays a role, and that newspapers might be working through reducing the marginal cost of detection as described in the framework on section 2.2.

Figure 4: Newspaper closures and TRI

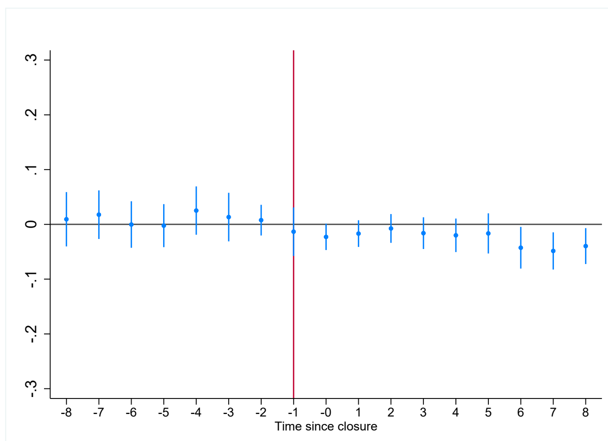
(a) Full Compliance Evaluations



(b) Reported Violations (HPV or FRV)



(c) Enf. Actions



Note: This figure plots the triple difference event study coefficients by length of exposure to treatment as in Equation 6. Panels A, B, and C plot the coefficients for FCEs, reported violations, and EAs, respectively. 95% confidence intervals are plotted above and below the coefficient estimates. The model includes firm and year FE, and controls at the facility level. Standard errors are clustered by city.

5 Information, spillovers, and effectiveness of enforcement

The previous section showed evidence that newspapers assist regulatory behaviour by arguably providing information to the regulator about firms that may be violating environmental laws, thus lowering the marginal cost of detection and leading to an increase in monitoring and enforcement activities.

In this section I explore the role of newspapers in providing information for facilities. More specifically, I examine whether newspapers might separately strengthen the spillover effects of deterrence, by informing facilities of inspections and identified violations applied to other facilities.

5.1 Imperfect information and spillover effects

Environmental monitoring and enforcement improve environmental quality by generating specific and general deterrence. The former is the direct effect on compliance of the facility being inspected or for whom sanctions are applied. The latter is a result of those actions having a spillover effect on the future environmental performance of other facilities (Shimshack and Ward, 2005; Gray and Shadbegian, 2007; Shimshack, 2014). Plants learn about the probability of monitoring or sanctions by observing the regulator's recent history at other plants within the same industry and regulated under the same authority, i.e., the state.

The general findings in studies that investigate spillover effects of environmental enforcement is that it improves compliance indirectly, i.e., environmental performance at individual firms is improved without them being directly inspected or sanctioned (Gray and Shimshack, 2011).

In terms of the framework described in section 2.2, we can think of firms as imperfectly informed about the detection probability that the regulator is choosing [25]. In fact, empirical evidence suggests that plants may not be fully informed of monitoring and enforcement at other facilities.

Having shown that newspapers provide information to regulators, I now examine whether newspapers also contribute to informing the facilities about detected violations and EPA activities in other firms. Specifically, to what extent the presence of newspapers strengthens the general deterrence effect? In model terms, media coverage could reduce the error with which the facilities observe p and enhancing spillover effects of inspections and enforcement.

In order to empirically test if and how newspapers affect monitoring and enforcement outcomes through disseminating information to facilities about EPA actions, I estimate a statistical model that allows for the effects of inspections to spill over to nearby firms:

$$Y_{i,g,s,t} = \alpha_1 News_{80;i,t} + \beta News_{80;i,t}\tilde{Y}_{-i,g,s,t-1} + \alpha_2 \tilde{Y}_{-i,g,s,t-1} + X_{80;i,t} + \lambda_i + \lambda_t + \epsilon_{i,g,s,t} \quad (7)$$

where $Y_{i,g,s,t}$ is the either the number of full compliance inspections, or newly detected FRV or HPV in facility i, in sector g, State s, and year t; $News_{80;i,t}$ is either the number of daily newspapers within 80km of the facility, or an indicator that equals one if there is a daily newspaper within the 80km ring; $\tilde{Y}_{-i,g,s,t-1}$ is an indicator that equals one if there was a positive number of inspections, or detected FRV or HPV in state g, and sector s, in year $t-1$, in any facility except i; $X_{80;i,t}$ are demographic characteristics calculated within the 80km ring from the facility (as described in Table 2); and λ_i and λ_t are facility and year

[25] Bebchuk and Kaplow (1992) and Garoupa (1999), for instance, introduce imperfect information to the enforcement authority model, with agents (firms) observing p with an error.

FEs.

In Equation 7, α_1 is the direct impact of newspapers presence on inspections and enforcement at the firm when $\tilde{Y}_{-i,g,s,t-1} = 0$; $\alpha_1 + \beta$ is the direct impact of newspapers' presence on inspections and enforcement at the firm when $\tilde{Y}_{-i,g,s,t-1} = 1$, i.e., when there were enforcement activities in that state and industry the year before. The main coefficient of interest is β, which tells us how past EPA activities in a state and industry affect current levels of inspections and enforcement in a facility depending on the strength of the presence of newspapers around that facility.

Table 5 displays the results of regressions of FCE on both measures of presence of newspapers within 80km of the facility, interacted with an indicator that equals one if another facility in the same industry and state was inspected or received at least one FRV or HPV the year before. I include firm and year FEs, and region by election year FEs[26].

In columns (1)-(2) and (3)-(4) I report the results using an indicator that equals one if there was at least one newspaper within 80km from the facility, and the total number of newspapers within that ring, respectively. The direct impact of newspaper presence is positive, which is in accordance with my previous results. If we take column (1) of Table 5 for instance, being covered by at least one newspaper has a positive impact of, on average, around 40 percentage points on average on the number of FCEs; when there were EPA activities within the same state and industry the year before, that impact is still positive and of about 20 percentage points on average. The lagged indicators have a positive impact on current levels of FCE, which is in accordance with previous findings and conclusions about the persistence of monitoring and enforcement policies within a state and industry (Shimshack and Ward, 2005; Gray and Shadbegian, 2007).

[26] The reason for this choice of fixed effects is that, for some specifications, when including region by year FEs there was high co-linearity, which made estimation unfeasible. The region by election year FEs still partially capture unobserved changes in regional EPA policies.

Table 5: Spillover Effects on Monitoring

Dep Var.: FCE	(1)	(2)	(3)	(4)
News > 0	0.1230**	0.1138*		
	(0.0622)	(0.0600)		
Inspection state sec t-1	0.1205***		0.1005***	
	(0.0333)		(0.0120)	
Inspection state sec t-1 x News > 0	-0.0590*			
	(0.0336)			
FRV/HPV state sec t-1		0.0322**		-0.0090
		(0.0155)		(0.0064)
FRV/HPV state sec t-1 x News > 0		-0.0440***		
		(0.0159)		
Number news			0.0084***	0.0050**
			(0.0023)	(0.0022)
Inspection state sec t-1 x Number news			-0.0048***	
			(0.0011)	
FRV/HPV state sec t-1 x Number news				-0.0002
				(0.0006)
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Region x Elec Year FE	✓	✓	✓	✓
Observations	363,332	362,965	363,332	362,965
R-squared	0.409	0.408	0.409	0.408

Note: The dependent variable is the number of FCEs at the firm. The first two columns display results of the interaction between an indicator that equals one if there is a positive number of daily newspapers within 80km of the facility, and an indicator that equals one if another facility in the same industry and state was inspected, or received an FRV/HPV, the year before. Columns (3) and (4) display results for the number of newspapers within 80km of the facility. Controls are defined in the same 80km ring and are population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. I include firm and region by election year FEs, and year FEs. Standard errors are clustered by city and in parenthesis, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The interactions are all negative and mostly significant, suggesting that in states and industries that had at least one inspection or detected violation the year before, the amount of current FCEs in the facility is lower on average the stronger the presence of daily newspapers around the facility. More specifically, the interaction coefficient in column (1) (column (2)) suggests that in a state and industry that had an inspection (detected FRV/HPV) the year before, having at least one daily newspaper around a facility leads to a reduction in FCEs of, on average, 37 (28) percentage points of their yearly averages. The conclusions are similar for the results in columns (3), namely, that in a state and industry that had an inspection the year before, having more daily newspaper leads to a decrease in current FCEs (the interaction coefficient in column (4) is still negative, but non-significant).

Now I will test the interacted effects of lagged sanctions and inspections with newspaper presence on current enforcement levels. My outcome here is the number of violations that were reported as FRV or HPV in that year. The idea here is very similar: I will test if and to what extent the presence of newspapers leads to a decrease in enforcement when sanctions or evaluations were applied to facilities in the same industry and jurisdiction the year before.

Table 6 reports the results. Similarly to Table 5, in columns (1)-(2) and (3)-(4) I report the results for an indicator that equals one if there was at least one newspaper within that ring, and the total number of newspapers within 80km of the facility, respectively. That is interacted with indicators of whether a facility within the same industry and state had a detected FRV or HPV the year before (columns (1) and (3)), or received an inspection the year before (columns (2) and (4)). I include the same controls and FEs as in Table 5. Like before, the lagged coefficients are all positive and statistically significant, suggesting a temporal correlation in the degree of enforcement policies within the state and industry. The direct impact of newspaper presence is again positive, although non-significant.

Table 6: Spillover Effects on Enforcement

Dep Var.: Detected FRV/HPV	(1)	(2)	(3)	(4)
News > 0	0.0358	0.0180		
	(0.0247)	(0.0275)		
FRV/HPV state sec t-1	0.0653***		0.0451***	
	(0.0093)		(0.0024)	
FRV/HPV state sec t-1 x News > 0	-0.0290***			
	(0.0093)			
Inspection state sec t-1		-0.0087		0.0032
		(0.0160)		(0.0077)
Inspection state sec t-1 x News > 0		0.0047		
		(0.0160)		
Number news			0.0015	0.0014
			(0.0010)	(0.0014)
FRV/HPV state sec t-1 x Number news			-0.0010***	
			(0.00024)	
Inspection state sec t-1 x Number news				-0.0008
				(0.0009)
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Region x Elec Year FE	✓	✓	✓	✓
Observations	362,965	363,332	362,965	363,332
R-squared	0.198	0.198	0.198	0.198

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the number of FRVs or HPVs that the facility received in the current year. The first two columns display results of the interaction between an indicator that equals one if there is a positive number of daily newspapers within 80km of the facility, and an indicator that equals one if another facility in the same industry and state received an FRV/HPV, or was inspected, the year before. Columns (3) and (4) display results for the number of newspapers within 80km of the facility. Controls are defined in the same 80km ring and are population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. I include firm and region by election year FEs, and year FEs. Standard errors are clustered by city and in parenthesis, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The interaction between the measures of presence of newspapers around a facility and the lagged FRV/HPV indicators are negative and statistically significant. What the interaction coefficients indicate is that detected violations on firms in the same industry and jurisdiction the year before decreases the detected FRVs or HPVs of the facility in the current year the stronger the presence of daily newspapers is.

More specifically, in a state and industry that had at least one reported FRV or HPV the year before, being covered by at least one daily newspaper reduces the firm's detected violations by 77 percentage points of the yearly mean, on average[27]. Similarly, for column (3), the coefficient of the interaction terms indicates that in a state and industry that had an FRV or HPV the year before, one more daily newspaper reduces the firm's yearly detected violations by, on average, 2.7 percentage points. There is no evidence of a lagged effect of industry-state level inspections on detected violations at the facility.

One might argue that an alternative explanation for the results presented in Table 5 is that when there were EPA activities and media outlets are covering them, the agency gets publicity benefits for regulation strictness, receiving less pressure to exert inspection activities. This might serve as an inventive for the regulator to decrease monitoring levels since inspections are costly, in particular FCEs. However, because the interaction between lagged sanctions and inspections is negative also for enforcement activities in the form of FRV and HPV assignments, the explanation in favour of spillover effects of monitoring and enforcement on compliance is more compelling[28].

The results suggest that daily newspapers contribute to enhancing spillover effects of monitoring and enforcement policies[29]. Newspaper presence has an overall positive effect on the

[27] The average of newly detected FRV/HPV is 0.037.

[28] Measuring compliance in my sample is not possible, since emissions of individual firms is only available for TRI facilities.

[29] I estimate similar equations using EAs as an outcome, as well as the indicator of lagged EAs in the same state and industry on the right hand side of the regression. The interaction coefficients are non-significant, which indicates that the spillover effect on enforcement is concentrated on violation detection, and not as

level of inspections and violation detection, but over time they play a role in making these policies more effective, reducing the need for specific deterrence to improve future performance at the evaluated or sanctioned facility. Here I have found evidence that newspapers arguably serve as a channel through which other facilities learn about the probability of detection and of being inspected, hence reducing the need for monitoring and enforcement given a fixed target level of environmental quality.

6 Conclusion

This paper studies the effects of newspaper closures on regulatory monitoring and enforcement activities by the EPA. I find that a daily newspaper closure that is located within 80km from a facility is associated with a drop in the level of FCE inspections, violations detected and reported as FRV or HPV, and EAs of about 19%, 22%, and 8% of their yearly averages, respectively. These results are robust to different specifications, namely, to the implementation of the DiD estimator as in Callaway and Sant'Anna (2021), that is more suitable for this context than TWFE estimation. It is also robust to different controls, different radii, and different anticipation periods, and to restricting the sample to facilities that are only treated once. The CS event studies provide evidence that the conditional parallel trends assumption holds, and it shows that there is a significant, negative and persistent drop in FCEs starting on the first year post newspaper closures, and a significant but delayed negative effect for detected violations and EAs.

These results are consistent with a theoretical framework in which newspapers influence the detection probability of an environmental violation by making the costs of detection cheaper, which can encourage stricter enforcement. Within this framework, my empirical analyses

much on enforcement actions. Results are reported in Table 15 in the Appendix.

suggest two potential channels that would explain these results, namely, that newspapers act as informants of potential violations by a facility to the regulators and to other firms. It shows that the drop in inspections, detected violations and EAs caused by a newspaper closure is more pronounced for firms that are not obliged to report to the TRI, whose actions are harder to observe. I also find that the presence of newspapers around a facility enhances spillover effects of monitoring and enforcement, given that other facilities in the same industry and jurisdiction were fined in the previous period. Both these channels have the potential to positively influence environmental quality without fully translating into an increase in the costs of enforcement.

Environmental regulations are an essential aspect of policies that target emissions reductions. This paper measures the importance of information dissemination on the design of environmental policies. The findings of this paper are extremely relevant in informing the regulatory agency on what enforcement tools are most effective in achieving environmental quality, whether it is information-based tools such as information disclosure or dissemination, or traditional enforcement tools such as inspections and fines.

Local newspaper markets have been shrinking for about 30 years in the United States. The widespread of mass media and internet access, as I have shown, don't seem to be replacing local newspapers strongly enough to hinder the drop in monitoring and enforcement activities, at least in the period analyzed. This is consistent with what was noted by Snyder Jr and Strömberg (2010), which is that the incentives of online mass media sources to cover local news is small. Overall, my findings suggest that when agents (namely, citizens, firms and regulators) are less informed about environmental performance, regulatory stringency and compliance may be compromised.

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A Data

Here I present additional summary statistics using my firm-level panel. Table 7 reports statistics by Standard Industrial Classification (SIC) divisions. The table shows the industry composition of my sample, and the fraction of TRI facilities in each industry; it also reports the averages of my main outcomes by industry, namely: inspections and inspections by type (FCEs and PCEs), FRV or HPVs that were designated, and EAs applied. Lastly, it reports the average financial penalty by industry, in 2010 US$.

The majority of the facilities in my sample are in the manufacturing industry. This sector also contains most of the firms that are obliged to report to the TRI. The sectors with the highest average number of inspections and enforcement actions, as well as detected FRVs and HPVs, are Transportation, Communication, and Utilities, Public Administration, and Manufacturing.

Table 7: Enforcement and compliance

Industry	Fraction (%)	TRI (%)	Inspections	FCE	PCE	FRV and HPV	EA	Penalty (in $)
Manufacturing	67.76	88.35	0.93	0.30	0.63	0.12	0.17	81377.73
Wholesale Trade	4.18	2.65	0.74	0.28	0.46	0.06	0.09	65639.37
Services	6.69	0.76	0.75	0.25	0.50	0.04	0.09	16678.50
Transp, Communic, Utilities	9.60	5.46	1.36	0.40	0.95	0.14	0.20	201563.23
Retail Trade	0.87	0.04	0.10	0.05	0.05	0.00	0.01	740.62
Mining	8.09	1.01	0.80	0.34	0.46	0.06	0.11	68763.06
Construction	0.32	0.20	0.37	0.16	0.20	0.02	0.06	6026.47
Public Administration	1.26	0.98	1.27	0.42	0.85	0.12	0.17	9846.08
Agriculture, Forestry, Fishing	0.42	0.15	0.60	0.16	0.44	0.01	0.06	8196.25
Finance, Insurance, Real Estate	0.52	0.11	0.67	0.15	0.52	0.08	0.12	61492.25

Note: This table provides the statistics on the average of inspections and EAs by industry, by TRI reporting status, and overall. It also provides the percentage of these activities that are conducted by the federal, state and local (regional) EPA. This data is from EPA's ICIS-Air.

The EPA has ten regional offices, and they are responsible for overseeing regulatory activities within the EPA programs in several States and territories. Table 8 describes each region and the States it covers.

Table 8: EPA regions

Regions	States served
Region 1 - Boston	CT, ME, MA, NH, RI, VT
Region 2 - New York City	NJ, NY
Region3 - Philadelphia	DE, DC, MD, PA, VA, WV
Region 4 - Atlanta	AL, FL, GA, KY, MS, NC, SC, TN
Region5 - Chicago	IL, IN, MI, MN, OH, WI
Region 6 - Dallas	AR, LA, NM, OK, TX
Region 7 - Kansas City	IA, KS, MO, NE
Region 8 - Denver	CO, MT, ND, SD, UT, WY
Region 9 - San Francisco	AZ, CA, HI, NV
Region 10 - Seattle	AK, ID, OR, WA

Note: This table describes the 10 EPA regions, and the States it covers. I do not include any territories, as they are not part of my sample.

Table 9 reports average rates of monitoring and enforcement activities by FRV and HPV status, i.e., facilities that had at least one reported violation that was an FRV or an HPV. It reports the average rate of inspections and inspections by type (full and partial compliance evaluations), and EAs. Not surprisingly, the average of all monitoring and enforcement activities is higher for facilities that had a reported violation. This is expected given that the EPA targets these facilities with elevated scrutiny and penalties, especially the ones designated with a HPV.

Table 10 reports the summary statistics for newspapers and the US census demographic controls within a radius of 50 km from each facility. There is an an average of 4.57 daily newspapers within 80km of each facility, and a total number of daily newspaper closures of 9,170. Table 10 also reports the demographic variables that I use as controls in my robustness checks of the main results. The measures are calculated based on the census tract areas that are within or that intersect the radius of 50 km from each facility.

Figure 5 plots the total yearly number of daily newspaper closures from 1991 to 2009. Most of the closures are concentrated in the 1990s, in particular the first few years of the sample.

Table 9: Federally Reportable Violations and High Priority Violations

	Non FRV/HPV	**FRV/HPV**
Fraction (%)	24.58	75.42
TRI (%)	50.73	69.94
Averages		
Inspections	0.714	1.674
FCE	0.270	0.436
PCE	0.444	1.235
Enf Actions	0.061	0.461

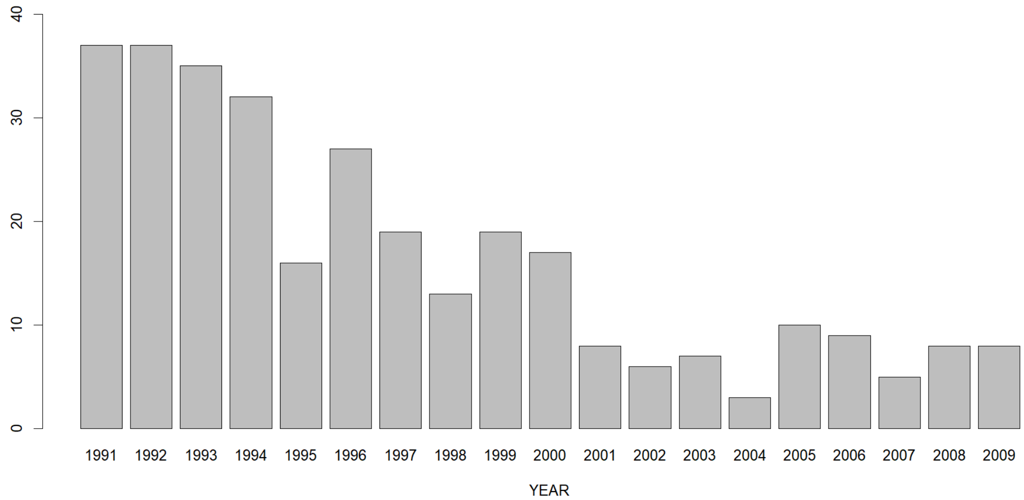
Note: This table provides statistics on the average rate of inspections and EAs, by agency, and by type of inspections, separately for HPV and non-HPV facilities. This data is from EPA's ICIS-Air.

Table 10: Newspapers and demographics

	Average	Closures (Average)	Closures (# facilities)
Newspapers (50 km radius)			
Newspapers (weekly)	22.25	0.0928	12,469
Newspapers (daily)	4.57	0.0489	9,170
Demographics (50 km radius)			
Population	4,761,425		
Employed population	2,124,156		
% Urban	68.34		
% Female	51.14		
% Hispanic/Latinx	6.61		
% College educated	20.83		
Income per capita (in $2010)	24,896.68		

Note: This table provides basic statistics for the number of newspapers and newspaper closures, both weekly and daily, that are within 50 kilometers of the facilities. It also provides the average of some demographic variables from the US census tracts that are within 50 kilometers of the facilities.

Figure 5: Newspaper closures by year



Note: The figure plots the number of daily newspaper exits by year for my sample years. It uses data compiled from *Chronicling America*, complemented with data from *Newslibrary* and from (Abernathy, 2018).

B Additional Results and Robustness Checks

Newspapers are not the only potential source of information provision about environmental regulations. Do other media outlets fill the void left by newspaper closures? I try to answer this question by using state-level Internet usage data from the NTIA. Unfortunately, this data is only available at the state level and starting in 1998. Additionally, given the lack of data on online news readership, I assume that the latter is correlated with Internet usage. Despite its limitations, I use this data to shed some light on the issue of substitutability by online news sources.

I divide the states between high and low Internet usage based on its median yearly value, so that High Internet Usage equals one if this value is above the median. I interact this with my Closure x Post indicator and estimate OLS regressions with my main outcomes, namely, FCEs and EAs. The triple interaction coefficient tells us whether and to what extent there is a difference in responsiveness of monitoring and enforcement on states with high versus low internet usage, post newspaper closure relative to before, on firms that are affected by a closure versus firms that are not. Table 11 reports the results for FCE and EA, in columns (1) and (2), respectively. I include population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population as controls. I add region by year FEs and facility FEs.

Table 11: Newspaper Closures and Internet Usage

VARIABLES	(1) FCE	(2) FRVs, HPVs	(3) EA
Post x Closure x High Internet Usage	0.00136	-0.0111	-0.0341***
	(0.0250)	(0.0136)	(0.0118)
Post x Closure	-0.0702***	-0.00657	0.0120
	(0.0194)	(0.0110)	(0.0110)
High Internet Usage	0.0658***	0.0117	0.00866
	(0.0215)	(0.0121)	(0.0108)
Controls, Firm, Region x Year FE	✓	✓	✓
Observations	286,844	286,844	286,844
R-squared	0.426	0.521	0.417

Note: The table displays results of OLS regressions with an interaction between the newspaper closure indicator (using the 80km ring around the facilities) variable and a high internet usage indicator variable at the State level. Outcomes are the number of Full Compliance Evaluations and Enforcement Actions at the firm level. Controls are defined in the same 80km ring and are population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. I add region by year FEs and facility FEs. Standard errors are clustered by city and in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

The coefficient of the indicator of high Internet usage is positive, and although we can't make any strong claims about its causality, it indicates that facilities in states with higher Internet access have a higher degree of monitoring intensity. If there was a strong substitution effect between newspapers and online media outlets, we would expect that a newspaper closure would have a significantly higher impact on the intensity of monitoring and enforcement in states with lower Internet usage. In other words, we should expect the coefficient of the triple interaction in Table 11 to be positive and significant. However, the interaction coefficient is not significant column (1) and negative in column (2). This provides some evidence that online news sources are not replacing local newspapers to a degree that is strong enough to hinder the drop in monitoring and enforcement activities.

Next, I present additional results and robustness checks for my main specification. I start by presenting the ATT estimates for the CS model, using the Partial Compliance Evaluations and an outcome. The results are reported in Table 12. There is no evidence of an effect of newspaper closures on PCEs, and the coefficient is positive when allowing for two periods of anticipation. The negative effect on monitoring activities is then concentrated on FCEs, which are more thorough inspections, as described in Section 2.1.

Table 12: CS estimator: PCE

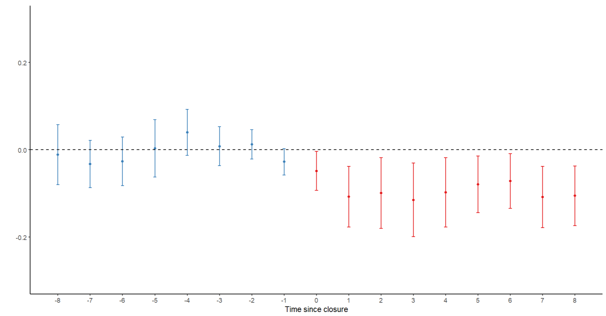
	Simple			Dynamic		
	(1)	(2)	(3)	(4)	(5)	(6)
ATT	-0.0046	-0.0114	0.0488	-0.0035	-0.0107	0.467
	(0.0237)	(0.0240)	(0.0346)	(0.0237)	(0.0256)	(0.0324)
Anticipation	0	1	2	0	1	2
Observations	326,553	326,553	326,548	326,548	326,548	326,548

Note: The table displays the results for the ATT based on the first step regression estimator as in Callaway and Sant'Anna (2021), for the group and dynamic aggregations, respectively. Treatment is defined as the closure of a daily newspaper which is within a ring of 80km around a facility. Standard errors are clustered by city and in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. Pre-treatment time-varying covariates are population and income per capita within 80km from facility.

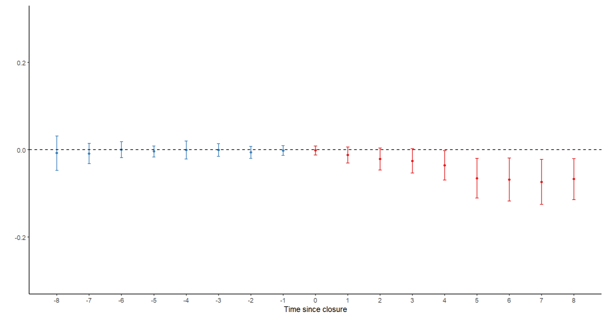
Next, I plot the CS event study coefficients with no anticipation periods. Panels A, B, and C of Figure 6 report the coefficients, along with its 95% confidence intervals, for FCEs, reported violations (HPV or FRV), and EAs, respectively. The coefficient plots are very similar to the ones reported in Figure 3, which allow for one period of anticipation, hence the conclusions are the same.

Figure 6: CS Event Study Plots

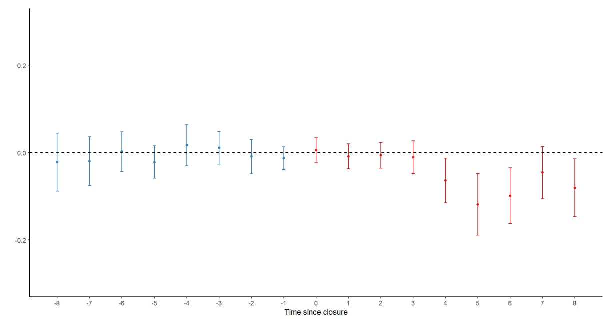
(a) Full Compliance Evaluations



(b) Reported Violations (HPV or FRV)



(c) Enf. Actions



Note: The figure plots the estimated dynamic coefficients by length of exposure to treatment from the event study model type estimation as in Callaway and Sant'Anna (2021), based on the first step regression estimator, and allowing for a one period anticipation of treatment. Treatment is defined as the closure of a daily newspaper which is within a ring of 80km around a facility. Panels A, B, and C plot the coefficients for FCEs, detected violations, and EAs, respectively. 95% confidence intervals are plotted above and below the coefficient estimates. The model includes firm and year FE, and account for pre-treatment population and income per capita as covariates. Standard errors are clustered by city.

Next, I report robustness checks for the ATT using the CS estimation procedure, for monitoring and enforcement outcomes in Tables 13 and 14, respectively. More specifically, I report: the CS estimator changing the assignment of a facility as being covered by a daily newspaper to a 50km radius (Panel A); the CS estimator using all controls described in Table 2, but calculated within a 2km radius from each facility (Panel B); and the CS estimator restricting the sample to facilities that are treated only once[30], i.e., to facilities that experienced only one daily newspaper closure throughout the sample period (Panel C).

Table 13: Robustness check for CS estimator: Monitoring (FCE)

	(1)	(2)	(3)
Panel A: 50km ring newspapers			
ATT	-0.0282*	-0.0593***	-0.0639***
	(0.0173)	(0.0200)	(0.0256)
Panel B: Controls within 2km ring			
ATT	-0.0473***	-0.0665***	-0.0882***
	(0.0126)	(0.0163)	(0.0199)
Panel C: Facilities treated only once			
ATT	-0.0249*	-0.0441***	-0.0587***
	(0.0142)	(0.0133)	(0.0164)
Anticipation	0	1	2
Observations	326,553	326,553	326,548

Note: The table displays the results for the simple aggregation ATT based on the first step regression estimator as in Callaway and Sant'Anna (2021). Panel A displays results for newspapers within a 50km ring from each facility, and the controls are population and income per capita in the same area. Panel B display results using covariates within 2km from the facility, namely, population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. Panel C display results restricting the sample for facilities that are treated only once Standard errors are clustered by city and in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Although the magnitudes are lower as compared to the main results in Table 4, the ATTs are still negative, and significant for most of the specifications shown, especially when I allow for anticipation periods. Note that for enforcement actions the magnitudes reduce quite significantly, and the standard errors are higher. However, the conclusions remain the same,

[30] About 26% of the facilities in my sample are treated more than one time.

which is that newspaper closures lead to a drop in monitoring and enforcement activities by the EPA.

Table 14: Robustness check for CS estimator: Enforcement

	FRVs, HPVs			EA		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: 50km ring newspapers						
ATT	-0.0250**	-0.0340***	-0.0340***	-0.0211	-0.0372**	-0.0492***
	(0.0085)	(0.009)	(0.0102)	(0.0131)	(0.0155)	(0.0184)
Panel B: Controls within 2km ring						
ATT	-0.0171***	-0.0183***	-0.0200***	-0.0105	-0.0175	-0.0293**
	(0.0062)	(0.0063)	(0.0080)	(0.0089)	(0.0107)	(0.0119)
Panel C: Facilities treated only once						
ATT	-0.0254***	-0.0270**	-0.0205**	-0.0365***	-0.0394**	-0.0488***
	(0.0080)	(0.0080)	(0.0098)	(0.0108)	(0.0133)	(0.0131)
Anticipation	0	1	2	0	1	2
Observations	326,553	326,553	326,548	326,548	326,548	326,548

Note: The table displays the results for the simple aggregation ATT based on the first step regression estimator as in Callaway and Sant'Anna (2021). Panel A displays results for newspapers within a 50km ring from each facility, and the controls are population and income per capita in the same area. Panel B display results using covariates within 2km from the facility, namely, population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. Panel C display results restricting the sample for facilities that are treated only once Standard errors are clustered by city and in parenthesis. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

Table 15 displays the results of regressions of EA on both measures of presence of newspapers within 80km of the facility, interacted with an indicator that equals one if another facility in the same industry and state was inspected, or received at least one FRV or HPV, or an EA, the year before. I include firm and year FEs, and region by election year FEs. There is no evidence of an interaction effect of the lagged indicators and the measures of newspaper presence. That suggests that the spillover effects on enforcement described in section 5 are concentrated on more severe enforcement responses, namely, in the form of FRV and HPV assignments.

Table 15: Spillover Effects on Enforcement

Dep Var.: EAs	(1)	(2)	(3)	(4)	(5)	(6)
News > 0	0.139**	0.0696	0.108*			
	(0.0609)	(0.0655)	(0.0621)			
Inspection state sec t-1		-0.0816*			-0.0137	
		(0.0475)			(0.0324)	
Inspection state sec t-1 x News > 0		0.0896*				
		(0.0489)				
FRV/HPV state sec t-1	0.0802***			0.0606***		
	(0.0213)			(0.00697)		
FRV/HPV state sec t-1 x News > 0	-0.0297					
	(0.0215)					
EA state sec t-1			0.0168			0.0312***
			(0.0269)			(0.0121)
EA state sec t-1 x News > 0			0.0206			
			(0.0270)			
Number news				0.00285	-0.000319	0.00170
				(0.00444)	(0.00568)	(0.00434)
Inspection state sec t-1 x Number news					0.00246	
					(0.00431)	
FRV/HPV state sec t-1 x Number news				-0.00119		
				(0.000750)		
EA state sec t-1 x Number news						0.000844
						(0.00102)
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Region x Elec Year FE	✓	✓	✓	✓	✓	✓
Observations	362,965	363,332	363,332	362,965	363,332	363,332
R-squared	0.358	0.358	0.358	0.358	0.358	0.358

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The dependent variable is the number of EAs at the firm. The first three columns display results of the interaction between an indicator that equals one if there is a positive number of daily newspapers within 80km of the facility, and an indicator that equals one if another facility in the same industry and state was inspected, or received an FRV/HPV, or received an EA, the year before. Columns (4)-(6) display results for the number of newspapers within 80km of the facility. Controls are defined in the same 80km ring and are population, employment, income per capita, share of college educated, share of female, share of Latinx or Hispanic origin, and share of urban population. I include firm and region by election year FEs, and year FEs. Standard errors are clustered by city and in parenthesis, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.