Coming Clean…and Cleaning Up? Examining the Effects of Self-Policing

Michael W. Toffel*
Harvard Business School
mtoffel@hbs.edu

Jodi L. Short
Department of Sociology
University of California, Berkeley
jodishort@earthlink.net

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As regulators increasingly embrace cooperative approaches to governance, voluntary public-private partnerships and self-regulation programs have proliferated. However, because few have been subjected to robust evaluation, little is known about whether these innovative approaches are achieving their objectives. In the context of a nationwide self-policing program that encourages companies to voluntarily self-disclose regulatory violations, we examine the behaviors of facilities and regulators to gain empirical insights on the theoretical promise of self-policing. We find evidence that regulators reduce their scrutiny over self-policing facilities, and that self-policing is associated with improved compliance. We also find evidence that these effects vary by firms' compliance history.

1. Introduction

As part of a trend toward collaboration between the public and private sectors, regulatory agencies have developed a variety of "self-policing" programs that shift the burden of monitoring regulatory compliance from the government to firms themselves. For example, firms with comprehensive safety management programs and low injury rates can join the US Occupational Safety and Health Administration's (OSHA) *Voluntary Protection Program*, which exempts participants from routine OSHA inspections (Chelius and Stark 1984). The US Department of Veterans Affairs sponsors an initiative that encourages medical professionals to self-disclose medical errors (Andrus *et al.* 2003). And the US Department of Justice, the US Department of Defense, and the Securities and Exchange Commission offer incentives including amnesty, limited liability, prosecutorial leniency, and confidentiality to encourage companies to disclose fraudulent or other illegal behavior (Duggin 2003;

* Corresponding author. Harvard Business School, Soldiers Field, Boston MA 02163. (617) 384-8043. Insightful comments by Neil Fligstein, Robert Kagan, David I. Levine, Howard Shelanski, Bill Simpson, and Jason Snyder are gratefully acknowledged. Ara Abrahamian provided excellent research assistance.

Fleder 1999; Medinger 2003).

While these kinds of programs have proved exceedingly popular in an era of shrinking regulatory budgets, little is known about the effects of the programs themselves or the motivations of those who participate in them. The act of self-policing presents a behavioral paradox. Tasked with policing themselves, it is not clear why firms would turn themselves in to regulators. Nor is it obvious why regulators would voluntarily forfeit enforcement powers to regulated entities. The goal of this paper is to explore what sort of benefits might justify each party's participation in a self-policing arrangement.

There has been surprisingly little research evaluating the outcomes of self-policing programs. The literature on self-policing is largely theoretical and primarily focuses on program design (e.g., Innes 1999a, b; Innes 2001; Kaplow and Shavell 1994; Malik 1993; Pfaff and Sanchirico 2000). And existing evaluations of voluntary programs typically address themselves to the achievements of "beyond compliance" programs rather than self-policing initiatives (Khanna and Damon 1999; Vidovic and Khanna 2005). As self-policing programs proliferate, it is important to understand what kind of results these programs produce. We address this need by conducting one of the first empirical evaluations to assess the effects of self-policing on regulatory outcomes. Specifically, we examine the US Environmental Protection Agency's (EPA) *Audit Policy*, a self-policing program that encourages firms to self-disclose environmental compliance violations by offering to waive their associated penalties. We ask whether participation in this program helps regulators by improving compliance or economizing their enforcement resources, and whether it helps participants by getting regulators off their backs.

We examine facilities' compliance behavior and regulators' inspection behavior in the context of enforcing two of the most widely applicable federal environmental statutes, the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA). With respect to the CAA, we find a "win-win" scenario: self-policing is associated with improved compliance, and that CAA inspectors reduce their scrutiny over firms that self-police. With respect to RCRA however, we find no evidence that self-policing was associated with improved RCRA compliance rates, and no evidence that RCRA inspectors reduced their scrutiny over self-policing facilities.

2. Literature Review

Much of the prior literature on self-policing uses economic models to better understand the self-reporting of legal violations (Kaplow and Shavell 1994; Stafford 2006; Innes 2001; Pfaff and Sanchirico 2000). This literature suggests a number of reasons why self-policing might benefit both regulator and regulated. Firms that voluntarily turn themselves in, for instance, are said to economize on avoidance costs (Innes 2001) and optimize their levels of self-auditing (Pfaff and Sanchirico 2000). Regulators benefit because self-policing has been shown to save enforcement resources that otherwise would have to be spent identifying self-disclosing wrongdoers (Kaplow and Shavell 1994) and to ensure lower-cost remediation of voluntarily disclosed violations (Innes 1999a).

The limited empirical research on self-policing programs has, however, called into question some of these assumptions. Short and Toffel (Forthcoming), for instance, demonstrate that regulators must devote substantial enforcement resources to get firms to participate in self-policing. And Pfaff and Sanchirico (2004) suggest that firms do not report significant violations under the EPA Audit Policy because it is a "bad deal" for companies. In short, we know very little about this behavior that has come to underlie so many new agency programs.

The few empirical studies of self-policing have identified some factors that encourage firms to "turn themselves in" by self-reporting undetected compliance violations. In essence, what these studies find is that firms are most likely to come clean when they fear they will get caught. So, for instance, Short and Toffel (Forthcoming) find that firms are more likely to self-report if they were subjected to recent on-site regulatory inspections, prosecuted in an enforcement action, or targeted for heightened scrutiny by a compliance incentive program. Related studies find that recently inspected firms are more likely to comply with regulations requiring them to self-report pollution levels and violations (Helland 1998; Laplante and Rilstone 1996). This paper represents an important contribution to the literature on the determinants of self-policing. These studies explain self-policing behavior solely in terms of the risks of non-disclosure; the present paper addresses the potential benefits of voluntary disclosure, and thus provides additional explanations for self-policing.

In addition, while there is some literature examining the determinants of self-policing, few studies have examined the consequences of self-policing programs. For example, the US General Accounting Office recently noted that "OSHA currently lacks the data needed to fully assess the effectiveness of its voluntary compliance programs" (US GAO 2004b: 29) including its *Voluntary Protection Program,* which has been offered since 1982. Similarly, despite the FAA's having launched its *Aviation Safety Reporting Program*'s in 1975, "FAA and NASA have no formal national evaluation program to measure the overall effectiveness of the program" (US GAO 2004a: 43). The US EPA's *Audit Policy*, the subject of the current study, has only been "evaluated" once, by the agency three years after the program's inception in 1995. That evaluation was based on a survey of participants and state regulators who were involved in the program and reported high levels of participant satisfaction, including several anecdotes from participants who claimed the program helped them reduce risks to the environment and human health (Federal Register 1999). Thus, to our knowledge, the current study is the first robust empirical examination of the consequences of self-policing.

In this way, our work will contribute to two related literatures evaluating outcomes under different kinds of voluntary programs. A few studies have examined third-party monitoring of regulatory compliance. For example, Esbenshade (2001) and Weil (2005) examined an innovative initiative by the US Department of Labor that encouraged major apparel companies to monitor their Los Angeles-based garment suppliers. In her qualitative study, Esbenshade (2001) found that while such independent monitoring was erratic and often failed to follow the agency's guidelines, it was nonetheless prolific: apparel companies and the independent monitors they hired conducted more than 10,000 audits of garment manufacturers in 1998 alone, ten times the number of inspections conducted by state and federal regulators.[1] A second study, based on a robust quantitative evaluation, concluded that garment contractors

[1] Nonetheless, Esbenshade Esbenshade, J. 2001. The Social Accountability Contract: Private Monitoring from Los Angeles to the Global Apparel Industry. *Labor Studies Journal* **26** 98-120. concludes, based on aggregate data, that such third-party monitoring contributed to a significant increase in compliance.

monitored by their buyers exhibited fewer, and less egregious, violations of minimum wage regulations (Weil 2005).

A second related body of work evaluates the outcomes of government-initiated voluntary initiatives that encourage firms to (1) perform beyond minimal compliance thresholds (Khanna and Damon 1999; Vidovic and Khanna 2005) or (2) promote regulatory objectives in domains where the regulator has no formal sanctioning authority, such as encouraging energy efficiency to reduce carbon dioxide emissions (Welch et al. 2000). Similarly, some evaluations have examined self-regulation programs purporting to achieve regulatory objectives such as reducing pollution and enhancing worker safety that are initiated by industry associations (King and Lenox 2000; Rivera et al. 2005) and international consortia (Toffel 2006). The empirical studies that examined mandatory self-disclosure of regulatory violations (Helland 1998; Laplante and Rilstone 1996), government initiatives to outsource compliance monitoring (Esbenshade 2001; Weil 2005), and most evaluations of industry self-regulation programs (King and Lenox 2000; Rees 1994; Rivera et al. 2005) have focused on a single industry. Our study spans a wide variety of industries, which should enable our insights about the dynamics of industry self-regulation to be more generalizable. In addition, our approach enables us to examine whether the effects of self-policing differ across industries.

3. Empirical Context: US EPA Audit Policy

The US EPA's "Incentives for Self-Policing: Discovery, Correction and Prevention of Violations" (Audit Policy), launched in 1995, provides the empirical setting for our research. The main objective of the Audit Policy is to encourage facilities to implement "systematic, objective, and periodic" environmental auditing and to develop a "documented, systematic procedure or practice which reflects the regulated entity's due diligence in preventing, detecting, and correcting violations" (Federal Register 1995: 66708). Under this program, when a facility promptly discloses a violation to US EPA, corrects the violation, and takes steps to prevent future violations, US EPA reduces or waives the penalties that would have accrued and provides a loose assurance that it will not refer the voluntarily reported case to the US Department of Justice for criminal prosecution. The Audit Policy cannot be applied to violations that are

similar to others the facility experienced within the past several years, or to violations that "resulted in serious actual harm or which may have presented an imminent and substantial endangerment to public health or the environment" (Federal Register 1995: 66709). Overall, nearly 3500 facilities have self-disclosed violations under the Audit Policy during 1997-2003.

The US EPA's Audit Policy is an attempt to alter significantly the enforcement dynamic between regulator and regulated. In fact, US EPA has expressed hope that private sector self-policing will "[render] formal EPA investigation and enforcement action unnecessary" (US EPA 2005). The Audit Policy attempts to achieve this by requiring participating firms to maintain a systematic, internal auditing system to monitor compliance with environmental regulations. While the particular violations disclosed under the program are certainly helpful to the regulator, the real leverage of the program is its insistence on company-wide compliance monitoring. If self-disclosing is a reliable indicator that the company is conducting effective internal compliance audits that lead to adequate regulatory compliance, then US EPA could improve its inspection efficiency by reallocating its enforcement resources to focus on non-participants, who would thus be more likely to have violations.

We are aware of only two empirical analyses of self-reporting under the US EPA Audit Policy. Short and Toffel (Forthcoming) found that facilities are more likely to self-disclose violations under this program if they were subject to more inspections or enforcement actions, were targeted by a US EPA compliance incentive program, or were provided with immunity from prosecution for self-disclosed violations. Pfaff and Sanchirico (Pfaff and Sanchirico 2004) find that violations self-disclosed under the Audit Policy are significantly less severe than those routinely prosecuted by the regulator.

4. Hypotheses

We evaluate the effects of the EPA *Audit Policy* on regulatory enforcement effort and outcomes. To assess the benefits of the program from the participants' perspective, we examine whether participants enjoy a regulatory holiday after their voluntary disclosures. We also evaluate the program's benefits from the regulator's perspective, by examining whether firms that engage in the compliance monitoring required by the Audit Policy "clean up their act" more broadly and improve their overall regulatory

compliance by exhibiting fewer violations, and by examining whether this allows regulators to target their enforcement resources elsewhere.

4.1 Inspections

"Inspection holidays," or decreased regulatory scrutiny of compliant firms, are one tool that regulators have to encourage self-reporting. Reducing the scrutiny a facility faces from regulatory inspectors offers several benefits to firms. It reduces the direct costs associated with inspections, including the staff time and resources that would be distracted from business activities (Shover *et al.* 1984) and the cost of tests conducted during inspections that the firm would have to bear (US EPA 1986). In addition, inspection holidays reduce the likelihood that the firm's violations will be discovered and punished (Dimento 1989).

US EPA provides no assurances of reduced inspections for facilities that self-report violations under the Audit Policy. Instead, the agency takes the formal stance that participating in the Audit Policy does not prevent inspections, noting that "Auditing does not…replace regulatory agency inspections," and that "EPA will not promise to forgo inspections, reduce enforcement responses, or offer other incentives in exchange for implementation of environmental auditing." This approach coincides with EPA's position that "environmental audits are in no way a substitute for regulatory oversight" (Frey and Johnson 2000: 4). While not making any explicit promises, US EPA does, however, leave open the possibility that facilities that self-disclose violations to the Audit Policy might be subjected to fewer inspections (Frey and Johnson 2000; US EPA 1997).[2] And the agency acknowledges that the Audit Policy can only attract self-disclosures if the US EPA avoids the impression that self-disclosing will attract increased regulatory

[2] For example, US EPA noted in 1997 that "EPA's longstanding policy is not to agree to limit its non-penalty enforcement authorities as a provision of settlement or otherwise. While EPA may consider such a facility to be a lower inspection priority than a facility that is not known to be auditing, whether and when to conduct an inspection does, and should, remain a matter of Agency discretion" US EPA. 1997. Audit Policy Interpretive Guidance. Office of Regulatory Enforcement, US Environmental Protection Agency, Washington, D.C.. Also, US EPA's Regional Council notes that "While EPA inspections of self-audited facilities will continue, to the extent that compliance performance is considered in setting inspection priorities, facilities with a good compliance history may be subject to fewer inspections" Frey, B.C., K.A. Johnson. 2000. Environmental Auditing Since EPA's 1986 Audit Policy. Office of Regional Counsel, Region 5, US Environmental Protection Agency, Chicago, IL..

scrutiny.[3]

Despite the regulator's formal stance, Pfaff and Sanchirico (2004: 426) speculate that organizations may self-report violations under the Audit Policy "to satisfy the enforcement appetite of local and national regulators and thereby lower the probability or intensity of future external audits." In addition, Short and Toffel (Forthcoming) suggest that firms subjected to regulatory enforcement measures may self-report under the Audit Policy to generate regulatory goodwill that might result in a lessening of regulatory pressure.

Shifting enforcement resources away from self-reporting firms may be more than simply a reward. It may also be part of a regulatory targeting strategy to identify compliant firms and shift enforcement resources to the "bad apples" of the regulatory community. Some regulatory agencies are explicitly using their industry partnerships to hone their inspection targeting. For example, the US Occupational Safety and Health Administration (OSHA) publicizes reduced inspection priority as a benefit to participants of its *OSHA Star Program* (Hunt and Wilkins 1992), while the US EPA does the same for participants of its *National Performance Track* program (US EPA 2006). US EPA also uses a "carrot and stick" approach in many of its Compliance Incentive Programs, notifying targets of these programs that those facilities that participate by reviewing their compliance and self-disclosing violations will be rewarded with fewer inspections, while those that fail to do so should expect to be inspected.[4] Thus, reducing scrutiny of voluntary reporters may be not only an incentive to encourage voluntary self-disclosure of compliance violations, but part of a broader strategy for efficiently targeting enforcement resources. We empirically evaluate whether self-reporters enjoy an inspection holiday by examining whether they subsequently face fewer inspections.

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[3] In a conversation with one of the authors, a US EPA program administrator noted, "The Agency has to avoid the perception that it is picking on companies who participate in the Audit Policy." (Personal communication, March 16, 2004).

[4] For example, in its letter encouraging iron and steel mini-mills to report violations under the Audit Policy, EPA wrote: "This is a unique opportunity to ensure compliance with environmental requirements before EPA and authorized states begin increased inspections of minimills."

Regulators may treat self-disclosures differently depending on the facility's compliance record. On the one hand, since regulators may be especially eager to encourage facilities with poor compliance history to improve, they may be particularly likely to reward such facilities for taking steps to improve their compliance management system. On the other hand, regulators may be more suspicious of self-disclosures from such facilities, and thus more hesitant to reward them for actions that may be viewed as minor or merely symbolic. Furthermore, regulators may hesitate in risking public or political reproach from granting regulatory relief to such plants.

4.2 Compliance

In the end, targeting provides effective leverage for the regulator only if the firms receiving reduced scrutiny improve and maintain their compliance levels even as regulatory resources are shifted elsewhere. Toward this end, US EPA only allows an organization to self-disclose violations to the Audit Policy if the organization discovered the violation through its own internal auditing program. This emphasis on internal auditing is meant to encourage managers to identify and correct compliance problems before regulators arrive to conduct inspections. By actively auditing their own compliance, the agency is hoping that self-reporters "clean up their act" and improve their regulatory compliance more broadly. To the extent this occurs, regulatory inspections should yield fewer violations at organizations with effective internal auditing systems in place. If such mechanisms do in fact improve firm-wide compliance, and if self-disclosing is a reliable indicator of their efficacy, regulators could achieve overall gains in compliance by inspecting self-disclosers less frequently or intensely and shifting their limited resources to inspect other organizations where they might discover more violations. We examine whether this is occurring.

5. METHODS

5.1 Sample

We gathered data on facilities located across the United States that are subject to the US Clean Air Act (CAA) or the US Resource Conservation and Recovery Act (RCRA). 50,436 facilities in our

sample emit air pollutants beyond CAA regulatory thresholds, which subjects them to CAA regulations. 25,351 facilities in our sample generate, manage, store, or treat hazardous waste, which subjects them to RCRA regulations. We focus on these two federal regulations because they apply to a wide range of facilities and activities.

5.2 Data and Measures

We measured *voluntary disclosure* as a dummy variable, coded 1 for a facility in a year when it disclosed a compliance violation in conjunction with the US EPA Audit Policy. We compiled data on self-disclosures from the US EPA Integrated Compliance Information System (ICIS) database, the US EPA Audit Policy Docket, and lists of facilities that participated in Compliance Incentive Programs (discussed below). Our sample includes 1142 instances (facility-years) of self-disclosed violations.

We obtained data on regulatory *inspections* to which each facility was subjected during 1991 through 2003 from the US EPA's Resource Conservation and Recovery Act Information (RCRIS) database and Aerometric Information Retrieval System (AIRS)/AIRS Facility Subsystem database.[5] From on these databases, we also calculated the number of annual inspections as well as the number of *years since the facility was last inspected* for compliance with RCRA or CAA. We also calculated the annual number of RCRA and CAA *violations* and *penalties*, as well as the annual *penalty dollar values*, which we log after adding one. We created a dummy variable to indicate whether the facility had any *enforcement actions*, based on data from the US EPA's ICIS database.[6]

We gathered data on two forms of general deterrence. First, we considered the *National Priority Sectors* that US EPA announced every two years that would be targeted as nationwide enforcement priorities. We coded this as a dummy variable based on data from the US EPA's website. National Priority sectors relevant to our sample include chemical preparation (1998-9), coal-fired power plants

[5] To avoid spurious results, we recoded annual inspection tallies beyond 12 to 12. This affected only 0.08% of observations with RCRA inspections, and 0.55% of observations with CAA inspections

[6] Over 80% of facilities with enforcement actions had only a single one in a particular year. To be conservative and avoid spurious results, we created a dummy variable to measure enforcement actions.

(1996-9), industrial organic chemicals (1996-9), iron and basic steel products (1996-9), metal electroplating and coating (2000-3), mining (1996-7), petroleum refining (1996-2003), plastic materials and synthetics (1996-7), primary nonferrous metals (1996-9), printers (1996-7), and pulp mills (1996-9).[7]

Second, we gathered data on the facilities targeted by US EPA Compliance Incentive Programs**.** These programs encourage facilities in particular EPA Regions or industries or that conduct specific regulated activities to reexamine their compliance status regarding a particular regulatory issue and self-disclose and correct any violations they discover. We coded *Compliance Incentive Program targets* as a dummy variable based on data we obtained via a Freedom of Information Act Request of the US EPA. Compliance Incentive Programs relevant to our sample include several nationwide programs (Above-Ground Storage Tank Emission Reduction, Airlines, Asphalt Emulsifiers, Bakery Partnership, Food & Kindred Products, Industrial Organic Chemicals, Iron & Steel Mini-mills, Natural Gas Processors, Nitrate Compounds, Pork Producers Cap, Telecommunications, VADEN) and many programs implemented by EPA Regional offices (Region 1: Chemical Industry, Municipal Department of Public Works Audit Initiative, Colleges & Universities; Region 2: Healthcare, Colleges & Universities; Region 3: WV-N. Branch Potomac R. Coal Facility Self Audit & Self Disclosure Projects; Region 5: Iron & Steel Mini-mills; Region 7: Wood Treaters, Continuous Release, Grain Processing; Region 9: Colleges & Universities; Region 10: Oil & Gas).[8]

To distinguish whether regulators treat self-disclosures differently depending on facilities' recent compliance records, we created *any recent CAA violations,* a dummy variable coded 1 if the facility had any CAA violations during the two years preceding the year it self-disclosed, and 0 otherwise. Likewise, we created *any recent RCRA violations* as a dummy variable.

Descriptive statistics and correlations are provided in Tables 1 and 2.

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[7] http://www.epa.gov/compliance/data/planning/shortterm.html (last updated March 17, 2005)

[8] US EPA Region 1 includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. US EPA Region 2 includes New Jersey and New York. US EPA Region 3 includes Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. Region 5 includes Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. US EPA Region 9 includes Arizona, California, Hawaii, and Nevada. US EPA Region 10 includes Alaska, Idaho, Oregon, and Washington state.

5.3 Models

Inspection holiday model. To assess the effect of self-disclosures on regulatory inspections, we estimate the following equation:

$$y_{it} = \beta_{1j} D_{i,t} + \beta_{2j} D_{i,t} * Z_{i,t} + \beta_3 X_{i,t-1} + \beta_{4t} \lambda_t + \alpha_i + \varepsilon_{i,t} \quad (1)$$

The dependent variable y_{it} refers to the number of CAA or RCRA inspections to which the facility has been subjected. Our key explanatory variable is *D*, a dummy variable that indicates whether the facility has self-disclosed in any prior year.[9] We also examine whether inspection holiday effects differ by the enforcement mindedness of regulatory agencies, the hazardousness of industries, or facilities based on their compliance history by including those dummy variables as *Z*, and interacting them with the post self-disclosure variable *D*.

We control for many potential determinants of inspections. According to several economic models, regulators can bolster the effectiveness of their limited enforcement budgets by targeting their inspections based on facilities' prior compliance records (Friesen 2003; Harrington 1988). In addition, US EPA notes that achieving compliance given its limited resources "is dependent on effective targeting of the most significant public health and environmental risks" (US EPA 1999: 20). This means not only targeting enforcement resources in the most pressing problem areas, but also at the firms most likely to be creating those problems, "taking into account… compliance/enforcement history" (US EPA 1999: 20). Indeed, facilities found in violation are often targeted for more frequent inspections in the near future (Harrington 1988; Helland 1998; US EPA 1990). Thus, we include the number of CAA or RCRA violations for which the facility was cited and a dummy variable indicating whether the facility was subjected to an Enforcement Action, each lagged one and two years.

Because regulators may attempt to ensure that they return to inspect facilities before a certain time lag occurs, we create a counter variable to capture the number of years since the facility was last

[9] If β_1 is statistically significant and negative, this will indicate that on average, facilities faced fewer inspections after they self-disclosed a violation and committed to conduct internal compliance auditing.

subjected to a CAA or RCRA inspection. Because this duration may have a non-linear effect on the probability of inspections, we include dummy variables to denote 2, 3, or 4-or-more years since the last inspection. We also include dummy variables to control for whether the facility was targeted for heightened inspector scrutiny via an EPA Compliance Incentive Program or an EPA National Priority sector (described below).

We include year dummies to control for year-specific factors. Finally, we include conditional fixed-effects to control for all time-invariant facility-level variables that might influence inspection rates, such as heterogeneity across state regulatory authorities, the facility's year of construction, industry, proximity to the inspection agency, and the affluence of the facility's community (Helland 1998).

Compliance model. To assess the effect of self-disclosures on regulatory compliance, we change our unit of analysis from the facility-year to the individual inspection. Here, we are examining whether the likelihood of a regulatory inspection resulting in no violations increases (improves) among facilities once they begin self-policing. We estimate the following equation:

$$y_{it} = \beta_{1j} D_{i,d-j} + \beta_{2j} D_{i,t} * Z_{i,t} + \beta_3 I_{i,d-j} + \beta 4\, X_{i,d-1} + \beta_{5t} \lambda_t + \alpha_i + \varepsilon_{i,d} \quad (2)$$

The dependent variable y_{id} is a "clean inspection" dummy variable that refers to a facility's regulatory inspection on date *d*, and is coded 1 if the inspection resulted in no compliance violations (i.e., it was "clean"), or else coded 1 if the inspector cited the facility for a violation (i.e., it was "dirty"). This distinction between "clean" and "dirty" inspections has been used by other empirical analyses of regulatory compliance (e.g.,Gray and Scholz 1993). We employ a single "post-voluntary disclosure" dummy variable to denote inspections of a facility that had already self-disclosed a violation to the Audit Policy.

We control for a wide array of potential facility-specific deterrence measures that can affect a facility's compliance behavior. Because a facility's recent regulatory experience can affect its current compliance, we include the number of inspections, log dollar value of penalties associated with violations, and a dummy indicating whether the facility had any enforcement actions (Gray and Deily

1996; Gray and Jones 1991; Gunningham et al. 2005; Helland 1998; Magat and Viscusi 1990; Olson 1999; Shimshack and Ward 2005; Weil 1996), each lagged one and two years.

Because a facility's compliance behavior can also be influenced by penalties recently imposed on *other* facilities monitored by the same regulatory agency (Shimshack and Ward 2005), we calculate the total penalties assessed in the facility' state each year and include the log (after adding one), also lagged one year.

Because the perceived likelihood of being inspected can affect compliance behavior (Laplante and Rilstone 1996; Shimshack and Ward 2005), we include the predicted probability of being inspected as a control variable (Earnhart 2004; Gray and Deily 1996; Laplante and Rilstone 1996). We measure this using the predicted value from the baseline inspection models specified above, run as a pooled logit model that estimates the probability of being inspected at least once in the current year.

We include year dummies to control for year-specific factors. Finally, as in the inspection models, we include facility-level conditional fixed effects to control for all time-invariant factors that might affect violation rates, such as the facility's and parent company's size, year of construction, state and EPA Region, industry, and headquarters country location (Delmas and Toffel 2005; Gawande and Bohara 2005; Gray and Deily 1996; Helland 1998; Shimshack and Ward 2005).

6. Results

Inspections. For the inspection holiday analysis, we model the annual number of inspections with a conditional fixed-effects negative binomial specification. Table 3 presents our results, which indicate that regulators do indeed grant an inspection holiday to self-disclosers. Overall, self-disclosing is associated with a 6% reduction in the annual number of CAA inspections (p=0.02) (Column 1). While our results also indicate a slight reduction in the number of RCRA inspections (a 1% decline), this estimate is not statistically significant (Column 3).

Decomposing these average effects, we found evidence that regulatory responses differed according to the self-disclosing facilities' recent compliance records. With respect to CAA violations and inspections, facilities that had at least one violation during the two years preceding their self-disclosure

experienced a 17% reduction in inspections ($p<0.01$)[10], whereas we found no evidence of an inspection holiday being granted to self-disclosers with better compliance records (Column 2). We found a similar pattern for RCRA inspections: self-disclosures that followed recent RCRA violations resulted in a 22% decline in inspections ($p<0.01$)[11], while we found some evidence that self-disclosures by facilities with no recent RCRA violations attracted greater regulatory scrutiny, as such facilities subsequently experienced 7% more inspections ($p=0.10$) (Column 4).

Compliance. For the compliance analysis, we begin by conducting simple t-tests for self-reporters to identify whether their proportion of inspections where no violations were cited—were "clean"—changed, one-year before versus one-year after they self-reported. The t-test results indicate that among the self-disclosing facilities, 92.1% of CAA inspections were clean one year prior to self-disclosing, a figure that improved to 94.7% one year after self-disclosing (statistically significant at $p=0.03$). However, this comparison for RCRA inspections indicated no change.[12] Of course, these simple t-tests examine crude differences only among self-disclosers, and do not account for other determinants of compliance rates or any secular trends among facilities that did not voluntarily disclose. To account for those factors, we turn to our difference-in-differences regression results.

The conditional fixed-effects logit models provide strong evidence that self-policing is associated with improved compliance (Table 4). On average, CAA inspections conducted after facilities self-disclosed were 13% more likely to be "clean" (i.e., no CAA violations cited) ($p=0.01$) (Column 1). Given the likelihood of an inspection being clean at the mean of all variables is 43%, this represents a 30% improvement above the baseline probability. Improved compliance was particularly pronounced among self-disclosing facilities that had recently been cited with violations: for such facilities, CAA inspections

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[10] This significance level is determined through a Wald test that the sum of *Post voluntary-disclosure* and *(Post voluntary-disclosure* × *Poor recent compliance history*) equal zero ($\chi^2=10.22$; $p<0.01$).

[11] This significance level is determined through a Wald test that the sum of *Post voluntary-disclosure* and *(Post voluntary-disclosure* × *Poor recent compliance history*) equal zero ($\chi^2=12.30$; $p<0.01$).

[12] We found similar results using a two-year time window. One year before self-disclosing, 74.7% of RCRA inspections were clean; one year after, 72.2% were ($p=0.31$). Two years before self-disclosing, 75.0% of RCRA inspections were clean; two years after, 73.5% were ($p=0.52$). For CAA inspections, two years before self-disclosing, 91.3% of inspections were clean; two years year after, 94.8% were ($p<0.01$).

after self-disclosure were 27% more likely to be clean ($p<0.01$)[13] (Column 3). This represents a 62% improvement above the baseline probability. Among self-disclosing facilities that had no violations in the two years prior to self-disclosing, subsequent inspections were 5% more likely to be clean, although this estimate is not statistically significant. The RCRA results provide no evidence that compliance improved, either on average (Column 2) or among self-disclosing facilities that had recently been in or out of compliance (Column 4).

7. Discussion and Future Research

Our CAA results support the conjecture many have made that self-reporting violations to the regulator "might help to favorably dispose the regulator toward the firm" (Pfaff and Sanchirico 2004 :426) We demonstrate that "coming clean" can yield benefits for self-policing participants in the form of reduced scrutiny from regulatory inspections. Fewer inspections lowers both the direct costs associated with inspections (Shover *et al.* 1984; US EPA 1986) as well as the risk of getting caught for additional violations (Dimento 1989). This result begins to identify concrete benefits that firms can accrue if they are willing to turn themselves in.

Inspecting voluntary disclosers less often may also benefit regulators. The agency can use this practice as a tool to informally reward self-disclosers and to encourage additional disclosures from these or other facilities. In addition, decreased scrutiny of voluntary disclosers might be part of a broader targeting strategy that focuses resources on non-participating firms, where violations are more likely to be found. In any case, our finding suggests that some regulators take seriously Audit Policy participants' pledge to bolster their internal audit processes, and that they expect these processes will keep participating firms compliant.

Was there merit for the CAA inspection holiday self-disclosers earned, and is there evidence that RCRA inspectors ought to provide an inspection holiday? Our empirical evaluation of inspection

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[13] 27% is the sum of the marginal effects of *Post voluntary-disclosure* and *(Post voluntary-disclosure × Poor recent compliance history*). Its statistical significance is determined through a Wald test that the sum of these coefficients equals zero ($\chi^2=18.26$; $p<0.01$).

outcomes found that self-disclosing facilities' subsequent CAA inspections were less likely to result in violations, but there was no change for RCRA inspections. Empirical research on regulatory compliance typically assumes that violations cited by regulatory inspectors is an unbiased estimate of actual compliance (e.g., Gray and Deily 1996; Gray and Shadbegian 2005; Helland 1998). Under this assumption, our results suggest that self-disclosing facilities have indeed "cleaned up their act," at least in terms of the CAA. As such, the Audit Policy appears to be a "win-win": the private sector takes on some of the inspectors' role by self-policing, compliance improves, and regulators are freed up to focus on other companies presumed to be worse compliers.

However, a significant body of research suggests that compliance, at least as measured by violations cited by regulatory inspectors, is highly situational and subjective. McAllister (2006) describes how the meaning of compliance with traditional environmental statutes gets negotiated in the context of an ongoing relationship between regulator and regulated. The amount of goodwill accrued by a regulated firm cannot help but influence the nature of this relationship. Hawkins (1984), for instance, documents how a firm's compliance status emerges from the on-the-ground relationships between inspectors and regulated firms. Inspectors perceive a firm "as 'co-operative' or having a 'good attitude,' or, in contrast, as 'unhelpful,'" (Hawkins 1984:113) and this dichotomy significantly shapes the enforcement approach these officials take with different firms – in some cases, whether they cite violations at all. Similarly, Aoki and Coiffi (2000) argue that regulators tend to "throw the book at" facilities they perceive as recalcitrant by interpreting regulations legalistically to maximize the number of violations. In other words, regulatory goodwill may not be limited to decisions about how frequently to inspect facilities, but may also affect the way in which inspectors both cite and even perceive violations.

In addition, some firms play an active role in manipulating the regulator's perceptions. For instance, Gray (2006) describes how facilities create elaborate "Potemkin Villages" to mask health and safety violations when they know inspectors are going to visit the plant. In sum, the socially situated and contingent nature of compliance inspections makes it very difficult to interpret with confidence a decline in cited violations strictly as an improvement in compliance. One must consider that some portion of the

decline in cited violations among self-disclosing facilities may reflect these facilities' improved status in the eyes of inspectors, which enabled them to gain leniency from inspectors.

Teasing apart the extent to which self-disclosing facilities subsequently *committed* fewer violations or were merely *cited* less often due to inspector goodwill is a question that is important not only to those interested in the public welfare question of whether self-policing enhances actual compliance. In addition, facility managers should be interested because inspector goodwill may erode if compliance does not actually improve over time. Parsing apart these interpretations presents an important opportunity of future research. Developing techniques that can tease apart actual facility compliance from compliance reported by inspectors is crucial for assessing the public welfare implications of voluntary compliance initiatives.

Finally, future evaluations of self-policing could employ different types of outcomes. For example, researchers could focus on outcome metrics more closely aligned to the ultimate objectives of the regulations. For example, in the Audit Policy context, improving compliance with hazardous waste regulations' labeling and storage requirements might reduce the frequency and severity of spills and injuries, and might reduce the amount of hazardous waste being erroneously shipped to unsuitable treatment facilities. Prior research has found that voluntarily disclosing environmental liabilities can bolster the credibility of other information such firms release, which reduces their cost of capital and attenuates negative shocks to stock prices when they release bad news (Blacconiere and Patte 1994; Cormier and Magnan Forthcoming). Researchers could investigate whether such benefits also accrue to firms that voluntarily disclose regulatory compliance violations.

8. Conclusions

We have described how both regulators and regulated entities each stand to gain from self-policing relationships. Regulated firms earned limited relief from regulatory oversight with respect to the CAA, and this seems appropriate given that self-policing was found to be associated with improved CAA compliance rates. Such apposite regulatory relief enables regulators to reallocate their resources toward more recalcitrant firms. Both sides also appear to benefit from the lower violation rates at participating

firms. What remains to be seen is whether these arrangements benefit the public and the environment. While lower violation rates are a promising indicator, they must be accompanied by lower actual pollution rates before success can be claimed for self-regulation. In addition, we found no evidence that RCRA inspectors provided an inspection holiday to facilities that chose to self-police, and no evidence that self-policing was associated with improved RCRA compliance rates. It may well be that self-policing has much greater promise in some regulatory domains than others; further empirical research can illuminate such distinctions.

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Table 1. Variable Definitions & Summary Statistics

Panel A: Annual inspection models

Variable	Obs	Mean	SD	Min	Max
Annual CAA inspections	425990	0.97	1.74	0	12
Annual RCRA inspections	405199	0.30	0.89	0	12
Voluntarily disclosed this year (dummy)	425990	0.00	0.05	0	1
Years since prior CAA inspection	366276	1.93	1.19	1	4
Years since prior RCRA inspection	229400	2.62	1.28	1	4
Annual CAA violations†	425990	0.03	0.17	0	3
Annual RCRA violations†	405199	0.09	0.32	0	2
Any enforcement actions (dummy)	405199	0.01	0.11	0	1
Compliance Incentive Program target (dummy)	425990	0.03	0.16	0	1
National Priority sector (dummy)	425990	0.12	0.32	0	1
Log total CAA penalties in the state-year	413671	4.97	1.32	1.37	7.68
Log total RCRA penalties in the state-year	385481	4.40	1.22	-0.37	7.26
Log number of CAA regulated facilities in the state-year	425990	7.27	0.68	2.83	8.29
Log number of RCRA regulated facilities in the state-year	425990	7.16	0.70	2.20	8.67

Panel B: Compliance models

	Obs	Mean	SD	Min	Max
Clean CAA inspection (dummy)	69633	0.85	0.36	0	1
Clean RCRA inspection (dummy)	83569	0.70	0.46	0	1
Post-voluntarily disclosed (dummy)	153202	0.01	0.09	0	1
Annual CAA inspections†	120346	2.75	2.25	0	6
Annual RCRA inspections†	100985	2.75	1.79	1	6
Annual CAA violations	120346	0.18	0.39	0	3
Annual RCRA violations†	92256	0.92	0.83	0	3
Any enforcement actions (dummy)	153202	0.04	0.20	0	1
Predicted probability of a CAA inspection	116670	0.58	0.13	0.20	0.89
Predicted probability of a RCRA inspection	120194	0.40	0.18	0.14	0.89

Notes: RCRA = Resource Conservation and Recovery Act; CAA = Clean Air Act. The unit of analysis is a facility-year in Panel A, and an inspection in Panel B. Variables denoted † are top coded at 99th percentile

Table 2. Pair-wise correlations

Panel A: Annual inspection models

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Annual CAA inspections	1.00													
2	Annual RCRA inspections	0.03	1.00												
3	Voluntarily disclosed this year (dummy)	0.01	0.02	1.00											
4	Years since prior CAA inspection	-0.24	-0.03	0.00	1.00										
5	Years since prior RCRA inspection	-0.05	-0.26	-0.01	0.11	1.00									
6	Annual CAA violations	0.15	0.03	0.01	-0.07	-0.03	1.00								
7	Annual RCRA violations	0.01	0.61	0.02	-0.01	-0.13	0.03	1.00							
8	Any enforcement actions (dummy)	0.03	0.06	0.31	-0.01	-0.05	0.08	0.05	1.00						
9	Compliance Incentive Program target (dummy)	0.03	0.03	0.05	-0.01	-0.01	0.01	0.02	0.05	1.00					
10	National Priority sector (dummy)	0.04	0.06	0.01	0.02	-0.02	0.03	0.04	0.05	0.22	1.00				
11	Log total CAA penalties in the state-year	0.06	0.01	0.02	-0.03	0.04	0.07	0.01	0.03	0.05	0.03	1.00			
12	Log total RCRA penalties in the state-year	-0.06	0.06	0.00	-0.03	-0.10	0.03	0.04	0.01	0.00	-0.04	0.15	1.00		
13	Log number of CAA regulated facilities in the state-year	0.03	-0.03	0.00	-0.04	0.01	-0.03	-0.05	-0.02	0.00	0.00	0.32	0.03	1.00	
14	Log number of RCRA regulated facilities in the state-year	-0.06	0.06	0.00	0.06	-0.03	0.00	0.03	0.00	0.01	0.04	0.39	0.21	0.67	1.00

Panel B: Compliance models

		1	2	3	4	5	6	7	8	9	10
1	Clean CAA inspection (dummy)	1.00									
2	Clean RCRA inspection (dummy)	.	1.00								
3	Post-voluntarily disclosed (dummy)	0.01	0.00	1.00							
4	Annual CAA inspections†	0.18	0.03	0.03	1.00						
5	Annual RCRA inspections†	0.03	0.21	0.02	-0.03	1.00					
6	Annual CAA violations	-0.35	0.04	0.00	0.20	0.03	1.00				
7	Annual RCRA violations†	0.04	-0.34	0.05	0.13	0.40	0.06	1.00			
8	Any enforcement actions (dummy)	-0.01	0.02	0.29	0.06	0.06	0.08	0.07	1.00		
9	Predicted probability of a CAA inspection	0.15	0.04	0.02	0.44	0.03	0.16	0.07	0.06	1.00	
10	Predicted probability of a RCRA inspection	0.07	0.16	0.05	0.05	0.46	0.03	0.25	0.13	0.12	1.00

Notes: CAA = Clean Air Act; RCRA = Resource Conservation and Recovery Act. In Panel A, the unit of analysis is a facility-year in Panel A, and an inspection-date in Panel B. † indicates variables top coded at 99th percentile

Table 3. Self-policing is associated with inspection holidays, especially for self-disclosers with poor recent compliance history

Conditional Fixed Effects Negative Binomial Models

Dependent variable	(1) Annual number of CAA inspections	(2) Annual number of CAA inspections	(3) Annual number of RCRA inspections	(4) Annual number of RCRA inspections
Post voluntary-disclosure	-0.060	-0.031	-0.009	0.063
	[0.025]**	[0.028]	[0.034]	[0.038]
Post voluntary-disclosure × Poor recent compliance history†		-0.152		-0.308
		[0.063]**		[0.079]***
2 years since last inspection†	0.097	0.097	-0.002	-0.002
	[0.006]***	[0.006]***	[0.012]	[0.012]
3 years since last inspection†	0.078	0.078	0.225	0.225
	[0.009]***	[0.009]***	[0.015]***	[0.015]***
4 or more years since last inspection†	0.229	0.229	0.774	0.773
	[0.009]***	[0.009]***	[0.013]***	[0.013]***
Number of violations 1 year ago†	0.036	0.036	0.077	0.077
	[0.009]***	[0.009]***	[0.007]***	[0.007]***
Number of violations 2 years ago†	0.016	0.017	0.051	0.051
	[0.010]*	[0.010]*	[0.007]***	[0.007]***
Any enforcement actions 1 year ago	-0.032	-0.032	-0.026	-0.025
	[0.018]*	[0.018]*	[0.022]	[0.022]
Any enforcement actions 2 years ago	-0.057	-0.056	-0.035	-0.035
	[0.019]***	[0.019]***	[0.024]	[0.024]
Compliance Incentive Program target	0.007	0.007	0.075	0.076
	[0.012]	[0.012]	[0.020]***	[0.020]***
National Priority sector	0.015	0.015	0.069	0.068
	[0.008]*	[0.008]*	[0.012]***	[0.012]***
Log total penalties last year in the facility's state†	0.022	0.022	0.047	0.047
	[0.003]***	[0.003]***	[0.004]***	[0.004]***
Log total facilities last year in the facility's state†	0.621	0.621	0.284	0.285
	[0.011]***	[0.011]***	[0.025]***	[0.025]***
Year dummies (1994-2003)	Included	Included	Included	Included
Constant	-2.895	-2.895	0.345	0.340
	[0.069]***	[0.069]***	[0.178]*	[0.178]*
Facility-year observations (N)	353,021	353,021	177,803	177,803
Facilities	50,436	50,436	24,810	24,810
Wald chi-squared	10327.5***	10334.3***	5227.5***	5242.4***

Unit of analysis is a facility-year. CAA = Clean Air Act. RCRA = Resource Conservation and Recovery Act. Conditional fixed effects are at the facility-level. Standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%. The sample for these inspection models includes data from 1993, several years before the Audit Policy was launched, through 2003, the most recent data we could obtain. The conditional fixed effects negative binomial model drops facilities that are never inspected during the sample period.

† For CAA models, this variable refers to CAA inspections, CAA violations, and CAA-regulated facilities. For RCRA models, this variable refers to RCRA inspections, RCRA violations, and RCRA-regulated facilities;

Table 4. Self-policing is associated with improved CAA compliance

Conditional Fixed Effects Logit Models

Dependent variable	(1) CAA inspection is "clean" (no associated violations)	(2) CAA inspection is "clean" (no associated violations)	(3) RCRA inspection is "clean" (no associated violations)	(4) RCRA inspection is "clean" (no associated violations)
Post voluntary disclosure	0.513	0.199	0.017	-0.008
	[0.206]**	[0.240]	[0.122]	[0.134]
Post self-disclosure × Poor recent compliance history†		0.889		0.150
		[0.304]***		[0.176]
Probability of a inspection†	-0.560	-0.563	2.755	2.754
	[0.171]***	[0.171]***	[0.163]***	[0.164]***
Number of inspections 1 year ago†	-0.010	-0.011	-0.015	-0.015
	[0.012]	[0.012]	[0.013]	[0.013]
Number of inspections 2 years ago†	-0.001	-0.001	-0.005	-0.005
	[0.011]	[0.011]	[0.011]	[0.011]
Number of violations 1 year ago†	0.793	0.793	0.103	0.103
	[0.043]***	[0.043]***	[0.028]***	[0.028]***
Number of violations 2 years ago†	0.812	0.809	-0.111	-0.110
	[0.044]***	[0.044]***	[0.028]***	[0.028]***
Any enforcement actions last year	0.138	0.140	-0.141	-0.142
	[0.091]	[0.090]	[0.061]**	[0.061]**
Any enforcement actions 2 years ago	0.097	0.095	-0.127	-0.127
	[0.091]	[0.091]	[0.058]**	[0.058]**
Year dummies (1996-2003)	Included	Included	Included	Included
Inspections (N)	69633	69633	83569	83569
Facilities	7177	7177	13220	13220
Wald chi-squared	956.60***	977.82***	1139.91***	1139.83***

Unit of analysis is a facility's inspection. CAA = Clean Air Act. RCRA = Resource Conservation and Recovery Act. Dependent variable is coded 1 if the inspection results in no cited violations, and coded 0 if at least one violation is cited. Conditional fixed effects are at the facility-level. Standard errors in brackets clustered by facility; * significant at 10%; ** significant at 5%; *** significant at 1%. These compliance models are based on a sample that extends from 1995, when the Audit Policy was launched, through 2003, the most recent data we could obtain. The conditional fixed effects logit model drops facilities that have only clean inspections or only dirty inspections throughout the sample period.

† For CAA models, this variable refers to CAA-associated inspections, violations, penalties, and facilities. For RCRA models, this variable refers to RCRA-associated inspections, violations, penalties, and facilities.