

Designing Cooperation: Agency Design, Credible Commitment and Regulatory Compliance

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Abstract

To cultivate optimal compliance levels, regulatory officers can engage in “cooperative enforcement” to signal their willingness to tradeoff minor violations for firms’ willingness to address major ones. The promise of cooperative enforcement, however, is risky for firms in the absence of a credible commitment device that lowers the likelihood of an agency renegeing on its pledge. I argue that agency design choices on two dimensions, regional scale and decentralization of authority, can ease firms’ concerns by signaling an agency’s intention to credibly commit itself to cooperative enforcement. To test this expectation, I use data on individual-firm compliance in air pollution control in each of the fifty U.S. states along with data on two agency design features to characterize the regulatory environment in each state agency’s regional office. Results suggest that these design features operate jointly as commitment devices, securing higher cooperation among firms compared to any other institutional combination.

1. Introduction

While the necessity of social regulation is generally accepted by democratic governments, the method of implementing such regulation fuels intense debate. One controversial issue, in particular, is how might governments *efficiently* regulate social behavior (Ayres and Braithwaite 1992; Bardach and Kagan 1982; Braithwaite and Makkai 1991; Scholz 1984; Scholz 1991; Tsebelis 1989; Winter and May 2001)? In other words, how might a government deliver the optimal benefits of regulation to society at the lowest cost? This is an important question not only for academic theories of regulation but also for governments seeking to meet the pressing needs of their constituents with the least amount of disruption to their citizens' economic productivity. The literature has offered so-called "cooperative enforcement" as a potential solution to this problem (Scholz 1984; 1991). Under this type of regulatory regime, agencies promise to engage in "flexible enforcement," concentrating on inspecting repeat offenders and punishing major violations, but overlooking minor ones. In return, the regulated promise to "voluntarily comply," directing their resources toward self-policing their own worst offenses (Scholz 1991). Such a cooperative outcome is more efficient than maximal deterrence because enhanced compliance on major violations is supplied at lower cost for agencies and firms alike (Scholz 1984; 1991). But how can parties to this agreement trust that each will live up to their commitments? After all, this cooperative outcome entails a classic commitment dilemma, where at least one party has the ability to renege on its commitments *ex post* (North and Weingast 1989).

The challenge for any agency pursuing cooperative enforcement is that while regulators may pledge to concentrate on major compliance breaches, they nevertheless retain the ability to pursue minor violations with equal vigor. In the absence of some credible assurances, firms are

likely to view any promises from an agency with suspicion, taking greater efforts to conceal their activities, thus undermining the goal of cooperative enforcement (Lubell 2004a, 2004b; Lubell et al. 2002; Ostrom 1990; Scholz and Lubell 1998; Scholz and Gray 1997; Winter and May 2001). If, agencies could only credibly signal their intention to commit to cooperative enforcement, then firms might be induced to voluntarily comply with their worst violations. But how is a firm to recognize and trust an agency's intention to honor a commitment to cooperative enforcement? What signals might an agency send to mitigate this credible commitment problem?

One potential solution to this commitment problem between regulatory agencies and firms is the institutional design of a regulatory agency. While institutional designs have been found to be attractive solutions to commitment dilemmas in other areas of political science (Acemoglu and Robinson 2006; Fearon 1995; North and Weingast 1989; Stasavage 2002), there has been less attention to such commitment devices in the context of regulatory politics. I argue that institutions that serve as commitment devices are particularly appealing in the present regulatory context for at least two reasons. First, design choices are visible, explicit signals that minimize the likelihood of firms misinterpreting or missing such signals in their calculations of which strategy an agency is likely to pursue (Bendor and Mookherjee 1987). Second, design choices are durable (Defiguieredo 2002; Moe 1989), reducing firms' concerns that commitments could be easily overturned in the presence of new political coalitions. Both of these features suggest that design choices may have unique abilities to serve as credible commitment devices for agencies to signal their intention to engage in cooperative enforcement.

Accordingly, in this paper, I propose a theory of regulatory compliance in which firms use design choices as signals of agency intentions to pursue cooperative enforcement. I argue that two design choices, regional scale and decentralization of authority, enhance an agency's

ability to credibly commit to cooperative enforcement. Specifically, I argue that regulatory agencies whose design choices combine both greater regional scale *and* decentralized enforcement authority are better equipped to induce firms to resist the short-run temptation to pursue minimal compliance. While the theory proposed can be applied to any regulatory context, I test my hypotheses within the context of air pollution control in the U.S. states with an original dataset. This dataset combines information on both individual-level regulatory compliance in air pollution control for all major stationary sources in the U.S. and institutional designs for all 276 state air pollution control regional offices across the U.S. I find that, compared to any other institutional form, regional offices that combine large regional scale and decentralized authority are most successful at securing optimal cooperation from regulated firms.

In the next section, I summarize the cooperation dilemma inherent in regulatory enforcement, review the credible commitment component of this dilemma and discuss how design choices may mitigate the commitment problem from the perspective of regulated firms. I then describe the empirical research design, discuss my measures and present tests of the argument. I conclude by considering the implications of these results for the study of regulatory compliance and evaluate the political tradeoffs inherent in my findings.

2. Cooperative Enforcement and Optimal Compliance

The standard cooperative enforcement setup portrays agencies and firms as being locked in a prisoner's dilemma (Scholz 1984; 1991). Under this setting, firms pursue attempt to minimize their expected costs of compliance and agencies attempt to maximize the net utility of compliance benefits minus their enforcement costs. Firms choose between minimal and flexible (or "voluntary") compliance and agencies choose between maximal or flexible enforcement (Scholz 1991). In repeated interactions, a firm's eventual choice to pursue voluntary compliance

is tied to their expectations about an agency's pursuit of flexible enforcement (Braithwaite and Makkai 1991; Scholz 1984; Scholz 1991; Tsebelis 1989; Winter and May 2001).

In the absence of cooperative enforcement, agencies pursue maximal deterrence and firms pursue minimal compliance. This outcome is characterized by legalistic interactions between firms and regulatory officers. Regulatory officers frequently inspect all firms with equal probability, refusing to distinguish between firms based upon their past records. Moreover, these officers adopt a strict posture toward enforcement, punishing all violations and providing firms little flexibility in how they might come into compliance. Firms, on the other hand, respond to their short-term incentives, engaging in minimal compliance, ignoring their worst violations and aggressively challenging any agency action with costly litigation. Typical of a prisoners' dilemma, mutual defection is suboptimal since both firms and the agency would be better off in a different outcome. With mutual defection, firms expend higher resources on total compliance costs including required technology investments for both major and minor violations, administrative penalties and sanctions, and extensive legal fees, while agencies spend resources on protracted legal battles and inefficient enforcement efforts (Scholz 1984; 1991). Their short-term incentives to defect prevent each party from capturing the greater social good.

The mutual cooperation equilibrium on the other hand is of course more efficient in the sense that both actors would be better off in this outcome. For firms, cooperation means adopting voluntary compliance or directing their resources toward mitigating their worst offenses while ignoring smaller ones. For agencies, cooperation means both treating firms differentially and engaging in flexible enforcement (Scholz 1991, 119). Differential treatment of firms requires the agency to discriminate between firms expected to be repeat violators and those likely to remain compliant, while flexible enforcement requires the agency to inspect cooperating firms less and

overlook minor violations.¹ In this respect, mutual cooperation is attractive for both parties. Firms pay lower compliance costs as a result of the agency's reduction in inspections and issuance of sanctions for minor violations and agencies secure high compliance rates on major violations at significantly lower costs.² Last, compared to maximal deterrence, under this setting, benefits are also accrued to society by from the parties avoiding costly litigation, which can drain resources and delay eventual compliance.

Two general expectations follow from this logic. First, between these enforcement settings, *firms should be less likely to engage in minimal compliance when an agency pursues cooperative enforcement* compared to when it pursues maximal deterrence. Second, when a firm does defect and an agency punishes them, *the firm should be more likely to recognize the greater payoffs to returning to compliance under a cooperative enforcement setting* compared to a maximal deterrence setting, given that the agency is also likely to return to cooperating.

The difficulty with the cooperative outcome is that mutual cooperation in a one-shot prisoners' dilemma is not in the interest of the parties. Only when repeated play is allowed and the parties do not discount the future is mutual cooperation possible. Under such conditions, however, previous research has demonstrated that trust between the parties is essential for maintaining mutually cooperative outcomes (Lubell 2004a, 2004b; Ostrom 1990; Scholz and Lubell 1998; Scholz and Gray 1997; Winter and May 2001). But given that agencies, for practical purposes, are likely to move first in such enforcement contexts, how is a firm to know

¹ Hunter and Waterman refer to this as “pragmatic enforcement” (1996, 59-62).

² Scholz (1984) refers to the off-diagonal conditions in which the agency cooperates and the firm evades as “opportunism” and the condition in which the agency maximally deters and the firm cooperates as “harassment.”

and to trust an agency's intention to honor a commitment to cooperative enforcement? At low levels of trust, agency signals will not be sufficient to induce firms to engage in flexible compliance, resulting in the inefficient maximal deterrence outcome. What then is the solution to this dilemma? In the next section, I argue that institutional design choices can serve as commitment devices for an agency wishing to credibly signal its intentions to firms.

3. Enhancing Agency Commitment via Institutional Design

To mitigate the dilemma outlined above, a regulatory agency that wishes to pursue the benefits of cooperative enforcement must reduce firms' uncertainty that an agency's commitment to that strategy is credible. I argue below that certain institutional features of a regulatory agency can enhance the credibility of this offer. But to understand how institutional designs might accomplish this, consider first how firms form beliefs about an agency's enforcement strategy.

I assume that firms are interested in minimizing their expected costs of compliance and agencies are interested in maximizing the net utility of compliance benefits minus the enforcement costs of obtaining such benefits. In choosing a compliance strategy, firms look for signals of an agency's strategic intention in pursuing a cooperative enforcement strategy. I also assume that firms gather information from various sources in their immediate regulatory environment to construct beliefs about expected agency enforcement strategies (Braithwaite and Makkai 1991; Scholz 1984; Scholz 1991; Tsebelis 1989; Winter and May 2001). Firms then use their beliefs about an agency's enforcement intention to inform their compliance choices. Last, I assume that that information sources in the regulatory environment do not equally reduce the uncertainty in assessing an agency's strategic intention. Rather, I assume that the quality of these

information sources varies in at least two important respects: signal noise and expected duration of the signal.

There are a variety of informational sources that firms could use to divine the enforcement strategies of a regulatory agency including demographics (Atlas 2001; Lavelle and Coyle 1992; Lynch, Stretesky and Burns 2004; Ringquist 1993; Ringquist 1998; Scholz and Wei 1986), political representation within elected institutions (Davis and Davis 1999; Hunter and Waterman 1996; Scholz and Wei 1986; Scholz, Twombly and Headrick 1991; Wood 1992) and policy task factors, such as problem severity or complexity (Potoski 1999; Ringquist 1993). However, from a firm's perspective these information sources are fraught with ambiguity. With respect to signal noise, the above sources are more prone to subjective interpretation or misinterpretation, with different firms extracting different meaning from the same signal or missing the meaning of such signals altogether (Bendor and Mookherjee 1987). Moreover the basis of these particular sources, political and policy task factors, are hardly durable. Political fortunes and policy task factors can change frequently and rapidly, undermining the possibility that firms could use either as signals of an agency's strategic commitment in the long run.

A regulatory agency's institutional features, on the other hand, offer unique benefits in their signal clarity and durability. First, institutional designs are visible, explicit signals that minimize the likelihood of firms misinterpreting or missing such signals in their calculations over which strategy to pursue. In this respect, institutional design avoids the informational uncertainties that may plague solutions to the cooperative dilemma (Bendor and Mookherjee 1987) since design elements are public information sources, prominently displayed, and are less prone to subjective interpretations. Second, institutions are durable and have high costs associated with altering them once in place (Moe 1989). In this respect, they represent credible

devices to lock in a policy solution even in the face of changing political coalitions (Defiguieredo 2002). It is precisely their clarity and durability that elevates institutional devices above other sources of information in a regulatory environment in their ability to alleviate firms' concerns over an agency's renegeing on its commitment to flexible enforcement. But which institutional features are likely to reduce firms' uncertainty over an agency's intention to engage in flexible enforcement?

Clearly there are a host of institutional features that together constitute a regulatory agency. Indeed, the literature has identified a number of design choices that shape agency decision making and discretion (Epstein and O'Halloran 1999; Huber and Shipan 2000; McCubbins 1985; McCubbins, Noll, and Weingast 1987, 1989). To narrow the field of possibilities, I revisit Scholz's suggestion that, at a minimum, regulatory discretion is a necessary, although not sufficient, condition for regulatory officers to pursue "cooperative enforcement" (1991). For the agency, the "two key features of the cooperative strategy – flexible enforcement and the differential treatment of firms – both require more administrative discretion than the baseline..." (Scholz 1991). What institutional features might supply differential treatment of firms and administrative discretion?

I argue below that two institutional design choices, in particular, are capable of increasing the likelihood of these conditions and as a result are attractive options for an agency seeking to credibly signal a more cooperative enforcement setting. The first design dimension, *regional scale*, shapes the agency's ability to pursue differential treatment of firms by altering the size of the regulated community within the regional jurisdictions of an agency. The second design dimension, *decentralized authority*, reflects the degree to which decision making authority over enforcement actions has been devolved to regulatory field officers. In the following sections, I

introduce each of these design dimensions and deduce hypotheses about how these design choices might induce firms to engage in flexible compliance.

3.1. Differential Treatment of Firms: Regional Scale

I refer to the first design dimension as an agency's *regional scale*. By regional scale, I mean the design-induced workload that regulatory officers of an agency, unit, or subunit face with respect to the size of the regulated community that the unit or subunit defines. In the construction of a regulatory agency, regulatory responsibilities are often divided into regional offices that shape the size and homogeneity of the regulated clientele over which regulatory officers operate (Hunter and Waterman 1996; Ringquist 1993; Whitford 2002a; 2002b). I argue that these design features shape an agency's ability to engage in differential treatment of firms.

Consider that some states decentralize their enforcement offices into regional offices, while others do not. Upon decentralizing, however, state officials make important decisions relevant to these regional offices including their total number, their location, and the nature of their administrative boundaries. With respect its ability to convince firms of an agency's commitment to flexible enforcement, the most important consequence of this first design dimension is the degree to which the agency is likely or able to engage in the differential treatment of firms. As discussed above, if firms believe that agencies are employing maximal enforcement in which a regional office targets all firms equally, as opposed to differential enforcement in which a regional office selectively targets firms with histories of significant violations, they will be more likely to engage in minimal compliance (Scholz 1984; 1991). Therefore, an agency's regional scale must be able to credibly signal a greater propensity for differential treatment of firms. Why might regional scale succeed in doing this?

Assuming fixed resources, if an agency has on average more firms per region, enforcement officers within those regions will be less likely to pursue maximal deterrence. This is because officers in regions with more regulated firms will have fewer resources with which to enforce all firms equally. For example, Florida's Department of Environmental Protection's (DEP) has six air pollution control districts. With respect to the number of regulated major stationary sources in the regions, the Southwest District includes 270 major stationary sources (firms) while the Southern District includes only 44. Assuming fixed resources, an agency's regional scale supplies firms with signals with which they can form beliefs about an agency's enforcement strategy within their region. Indeed, recent work suggests that larger scaled regions do indeed produce fewer enforcement cases in a given year (Whitford 2007). This suggests that, as regional scale increases, regulatory officers are induced to treat firms differentially. They simply cannot afford to inspect all firms equally as the scale of the region rises. Rather under larger scale, they will be more likely to use their limited resources to target more troublesome firms. Firms therefore can use this institutional design as a signal of agency intention to engage in differential treatment, one component of cooperative enforcement. If a firm observes a regional office with a relatively large scale, it can infer that cooperating firms will be less likely to be targeted compared to those suspected by the agency of defecting.

In isolation, however, this design choice is not sufficient to secure a cooperative outcome. With greater regional scale, in the absence of firms also trusting that an agency's officers are willing or, at a minimum, *able* to engage in flexible enforcement once violations are detected, firms have incentive to defect against the agency and pursue minimal compliance. Only when combined with sufficiently high levels of trust that the agency is likely to commit to flexible enforcement, should increased scale lead to greater voluntary compliance. The next section

introduces how agencies might signal their willingness to commit to the other component of cooperative enforcement, flexible enforcement.

3.2. Flexible Enforcement: Decentralization of Authority

The second design dimension, *decentralization of authority*, reflects the extent to which decision-making authority resides with field officers. Institutional choices over this design dimension shape field officers' legal authority to issue certain abatement actions (Hammond 1986). Whether located in the state capital or in regional field offices, decisions over where in the chain of command to locate the legal authority to issue enforcement actions must be made. Simply because a state has subdivided its regulatory responsibilities into regional offices does not necessarily suggest that those regional offices will have the ability to capitalize on their relative closeness to their regional interests (Whitford 2002). Given that regulatory officers' ability to negotiate over compliance outcomes is conditioned by their discretionary authority to do so (Brudney and Hebert 1987; Hedge, Menzel and Williams 1988; Kaufman 1960, 1973; Lipsky 1980; Wamsley and Zald 1973; Wilson 1989) it is reasonable to expect that decentralized authority will affect field officers' propensity to engage in flexible enforcement.

Key to this second design choice is where decision-making authority is located relative to field officers. At the extremes, decentralization locates decisionmaking authority with the actual field officers of the agency, while centralization locates decisionmaking with high-level political appointees. Under more decentralized authority, regulated firms in the region have greater access to and the ability to develop more dense networks with agency officials. Given that proximity to regulatory officers has been linked to enhanced trust between firms and officers (Lubell 2004a, 2004b; Lubell et al. 2002; Ostrom 1990; Winter and May 2001), I argue that decentralized decision-making authority is critical to firms' beliefs about officers pursuing flexible

enforcement. Namely, under decentralized authority, firms will recognize that local agency officials possess the ability to engage in flexible enforcement and, given their enhanced trust, will be more likely to hold an agency's promise to negotiate over compliance outcomes more credible. Alternatively, as the locus of decision making is moved further away from local field offices, firms will be increasingly likely to distrust agency promises of flexible enforcement. This is because central rule makers have less knowledge and fewer incentives than local field officers to negotiate over abatement outcomes (Scholz 1984). Therefore, under more centralized authority, firms will be more suspicious of agency claims of pursuing flexible enforcement, increasing a firm's incentives to engage in minimal compliance.

3.3. Expectations on Institutional Design and Minimal Compliance

To summarize, I expect that under enhanced regional scale firms will have a greater expectation of differential treatment by regulatory officers and that under decentralized decision making authority firms will have a greater expectation of flexible enforcement by regulatory officers. As discussed earlier, individually these institutional features are necessary but perhaps not sufficient to encourage voluntary compliance. Only when taken together do these two institutional designs offer firms a relatively more credible signal of a regulatory agency's propensity to engage in cooperative enforcement. For these design features to optimally enhance the cooperative outcome of voluntary compliance, they must appear jointly. In other words, it must be the case that regulatory officers in larger scaled regions also have the discretion to pursue flexible enforcement and vice versa. Therefore, I expect that when an agency possesses both a relatively large regional scale and a high degree of decentralized authority, regulatory officers will be most likely to engage in both differential treatment of firms and flexible enforcement. As a result, under these conditions firms will have the greatest incentive to engage

in voluntary compliance, or stated differently, will have the greatest incentive to reject minimal compliance. Alternatively, I expect that when either regional scale is relatively small or authority is centralized away from field officers, firms will interpret such design choices as signals of the agency's likelihood of adopting a maximal deterrence strategy and will therefore have greater incentives to engage in minimal compliance.

This logic suggests that the effect of either regional scale or decentralized authority on compliance is conditioned by the presence of the other. And only for sufficiently high levels of one should the other have an effect on encouraging a cooperative outcome. While the theory doesn't provide information on precisely when each variable will be sufficiently high, it does suggest that if the marginal effect of either regional scale or decentralized authority on minimal compliance is not lower for higher levels of the other design variable, then my theory will have been falsified. This suggests the following testable hypotheses:

H1: In the presence of institutional designs that reflect both larger regional scale and greater decentralized authority, a firm is less likely to engage in minimal compliance.

In addition, the ability of an agency's issuance of an enforcement action to encourage flexible compliance on behalf of a regulated entity should be greater under cooperative enforcement compared to maximal deterrence settings. Given the logic above, firms will have greater incentives to return to cooperation under cooperative enforcement compared to maximal deterrence. If firms recognize an agency's signal of cooperative enforcement via the design components discussed above, they will be more likely to recognize that their continued defection will be more costly in the long run. Accordingly, in cooperative settings, punished firms are incentivized to return to cooperate in the resolution of compliance issues. In maximal deterrence settings, firms who have received sanctions will have less incentive to return to cooperation and will therefore be more likely to engage in minimal compliance. Therefore, the impact of a past

enforcement action on a firm's willingness to engage in minimal compliance is conditioned by the institutional setting of the agency. In the presence of institutional designs that more credibly commit an agency to flexible enforcement (e.g. increased regional scale accompanied with decentralized authority), a firm that has received a past enforcement action should be less willing to engage in minimal compliance compared to firms that have received similar actions under any other institutional setting. If the marginal effect of a previous enforcement action on minimal compliance is not lower for higher levels of both design variables, then my theory will have been falsified. This suggests that following testable hypotheses:

H2: In the presence of both larger regional scale and greater decentralized authority, a previously punished firm is less likely to engage in minimal compliance.

4. Research Design

To test my hypotheses about the impact of a regulatory agency's institutional design features on regulated firms' willingness to engage in minimal compliance, I consider the regulatory compliance of individual firms within the context of air pollution control across the U.S. states. Air pollution control represents varying levels of political saliency and technical complexity across the states (Gormley 1986; Lowry 1992; Ringquist 1993), making this policy area context a prime candidate for considering design's utility in encouraging flexible compliance. I assembled an original dataset that combines individual compliance data with agency design variables along with contextual variables across county, state administrative region, and U.S. states. Alaska was excluded from the analysis due to difficulties matching demographic data and state regional enforcement offices and Nebraska was excluded due to its non-partisan state legislature. The resulting unit of analysis for this study is therefore the individual major stationary emissions source in 48 states, for a total 43,025 cases for 2004.

To isolate the effect of the institutional design variables on a firm's willingness to engage in minimal compliance, I also control for a variety of variables that are also likely to inform a firm's estimate of an agency's likelihood of pursuing cooperative enforcement versus maximal deterrence. Given that the dependent variable, minimal compliance status, is a dichotomous variable, I estimated all models using the logit estimator in STATA 9.0.³ All models were estimated with robust standard errors, corrected for clustering on county.

4.1. Dependent Variable

To assess whether a regulated firm is engaging in minimal compliance, my dependent variable reflects whether a regulated facility is currently designated as a High Priority Violator (HPV) under the Clean Air Act (CAA).⁴ *HPV Status* is a dichotomous variable that takes the

³ Data sets with a small percentage of events may underestimate the effects of independent variables (King and Zeng 2001). Even though my data do not qualify as a small-sample, rare-events dataset by King and Zeng's criteria, logit models using Tomz, King and Zeng's rare events logit software (1999) produce findings identical to those reported here.

⁴ "High Priority Violator" is a relatively recent term that replaced the previous violation flag of "Significant Violator" in April of 1999. A High Priority Violation is one that fits at least one of several criteria laid out by the EPA in its memorandum, "The Timely and Appropriate Enforcement Response to High Priority Violations" (1999). Generally, both significant and high priority violations include those entities that violated their Title V permits, committed gross violations, or had repeated violations without coming into compliance. Under the Clean Air, a facility or permit is considered as a *High Priority Violator (HPV)* if one or more of the following situations occurred in the most recent quarter: 1) Failure to obtain a Prevention of Significant Deterioration (PSD) permit; 2) Violation of the air toxic requirements; 3) Violation of an

value of “one” if the facility or permit is currently designated as a *High Priority Violator* (HPV) and “zero” otherwise. Entities currently designated as HPVs represent, in the eyes of the administering agency, those entities that are not willingly making efforts to tackle their worst violations. In this respect HPV status is a unique indicator of firm compliance. Rather than simply reflecting whether a firm is guilty of a violation, HPV status reflects a higher threshold of compliance. It offers the most valid operationalization of “minimal compliance,” or firms that are taking great lengths to resist compliance with society’s most important compliance targets. Accordingly, I use HPV status to reflect an individual entity’s resistance to engage in “flexible compliance,” or mitigation of their worst violations. For this research, a firm that is designated as an HPV is a firm that is engaging in minimal compliance.

I obtained data on this dependent variable from the EPA’s Enforcement and Compliance History Online program. I extracted individual-level data for each of the fifty states from EPA’s database for the year 2004. The result is a cross-sectional dataset for the year 2004 which included a total of 43025 cases. Of these firms, 2074, or approximately 4.8% of all regulated firms, were designated as HPVs.

4.2. Measuring Agency Design Features

To assess the implications of agency design on regulatory compliance, I first identified each of the 276 state environmental regional offices across the U.S. states. To do this, I gathered

administrative or judicial order; 4) Violation of an allowable emission limit detected during a source test, and 5) If the testing, monitoring and record keeping or reporting substantially interferes with enforcement or determination of a facility’s compliance report; 6) Violation of a sources Title V obligation; 7) Failure to submit a Title V application within 60 days of the deadline, and 8) Violation of the 112 (r) requirements can also trigger HPV status.

geographic border data on regional office boundaries within each of the fifty states from jurisdictional maps and documents provided by state environmental agency personnel. In almost every case, these state air pollution control regions overwhelmingly represent aggregates of counties within a given state. Therefore, I identified the counties included in the jurisdiction of each regional office and assigned a unique I.D. number for each regional office and used these unique identifiers to merge these data at the individual, county and state level. The number of regional offices ranges from one regional office in: Arkansas, Colorado, Connecticut, Montana, North Dakota, South Dakota, Rhode Island, Utah and Vermont to 35 regional offices in California (36 including the central office). The average number of state regional offices in the 50 U.S. states is 6.4 with a standard deviation of 5.5.

4.2.1. The Differential Treatment of Firms: Regional Scale

With respect to the likelihood that firms will be treated differentially, I consider the practical consequence of a state's decision to decentralize its regulatory agency's services into regional offices. The number of regulated entities that exist within a given region will affect a firm's estimation of the likelihood that they will be treated differentially. *Regional Scale* indicates the total number of major source entities that a region is charged with overseeing and is measured as the total number of Title V permitted facilities within each region's administrative boundary. These data were collected from EPA's ECHO program. The number of entities in a given state administrative region range from a low of 1 to a high of 1095 with a mean of 176 and a standard deviation of 185.⁵

⁵ The small number of firms on the low end of the scale (which occurs in only 2 of the 276 regional offices) is not surprising given that many states set up their environmental regional

4.2.2. Flexible Enforcement: Decentralized Authority

I assess the propensity of a regulatory officer to engage in flexible enforcement with an original measure that reflects the extent to which field officers in each state agency's region have the authority to issue enforcement citations. This measure reflects whether the authority to issue enforcement related actions rests with field officers, is centralized in the hands of high-level agency officials, or lies somewhere in between. To derive this measure, I divided potential enforcement actions into three levels. Level I actions include all of the informal and formal notices that typically are reserved for the first step in a case of noncompliance, including notices of violation, notices of noncompliance, letters of deficiency and warning letters. Level II actions consist of formal administrative actions, which may include penalties, and are most often referred to as Notices of Violation. The last group, Level III actions, contains the most serious abatement actions: civil and criminal cases filed against a noncompliant entity.

Given my interest in the extent to which authority over such abatement actions has been decentralized, I determined, for each agency and each enforcement action, where in an agency's vertical chain of command, authority final signature authority rested. The greatest amount of decentralized authority corresponds to field officers possessing final signature authority over enforcement actions, while the least amount of decentralized authority involves either removing a specific enforcement action as a possibility or placing that final signature authority in the hands of the agency head, whether director, manager, or secretary. The middle range of signature approvals varies between regional supervisors, media division chiefs, centralized enforcement office heads, and deputy secretaries.

office jurisdictions to serve a variety of media (i.e. water, hazardous waste etc.). As a result some jurisdictions designed primarily to serve water media clientele may possess few air sources.

The location of the entity in the agency with final signature authority for a level of action, relative to the number of entities in the chain of command, indicates the extent of decentralized authority for that action. This measure is assessed from the perspective of the regulatory field officer. For a given agency, *Vertical Depth* represents the number of entities in the direct chain of command from the field officer, who is responsible for carrying out inspections and the initial enforcement review, up to and including the individual or committee at the top of the chain of command.⁶ For example, the state of North Dakota's Department of Environmental Quality has five levels: the Environmental Quality Commission, the director of the department, the air quality control officer, the regional director, and finally the field officers. *Vertical Depth* across state agencies ranges from a low of five in states like North Dakota, Vermont, Connecticut and Delaware, to a maximum of ten in California; the average score is approximately six.

Final Authority represents the location of final signature authority for a given action within the chain of command. If the top entity in the chain has final signature authority, *Final Authority*, is assigned a score equal to *Vertical Depth*. If final signature authority is given to a lower entity in the chain, *Final Authority* is assigned a lower integer value, ultimately reaching 1 for the lowest entity in the chain. The final measure of an agency's decentralization of authority, *Decentralized Authority*, is then calculated by dividing $(Final\ Authority - 1)$ by $(Vertical\ Depth - 1)$. This measure is standardized by the agency's vertical depth to assure that a deeper vertical structure does not necessarily determine the overall measure of discretion. The resulting variable ranges between (0) and (1), where zero represents perfectly centralized decision-making authority and one represents authority decentralized to the field officer level. Increasingly higher

⁶ This measure refers only to the functions carried out under a state's air pollution control program. In some states, these measures vary across air, water and hazardous waste media.

scores indicate that an agency has moved decision-making authority closer to the field officer and further away from the central authorities.

This equation yields a measure of decentralization of authority for each of the three enforcement action levels across each state. The states have lower signature requirements for Level I actions, with an average *Decentralized Authority* score of .628. Decision-making authority is centralized away from field officers as enforcement levels increase however. *Decentralized Authority* for Level II and III actions averages .30 and .18, respectively, across the states. I standardized each of these measures and created an additive scale for an overall measure of *Decentralized Authority* for each state agency's region.

4.3. Control Variables

Firms may use a host of other information sources within their environment to inform their decisions over minimal compliance. When these sources suggest that an agency is likely to adopt a maximal deterrence strategy or when deviations from cooperation are likely to be punished, firms should be more likely to pursue minimal compliance. Given that these alternative information sources may be correlated not only with a firm's decision to engage in minimal compliance but also my main independent variables, I include several controls to minimize the possibility of drawing incorrect inferences.

Previous Enforcement Actions. Firms may use an agency's previous actions as indicators of the agency's enforcement strategy. Firms with previous inspections and enforcement actions may be more likely to expect an agency to pursue maximal deterrence. To control for this possibility, I include *Inspection*, a dichotomous variable that reflects whether a firm has been inspected by the agency within the last two-year period (1) or not (0). I also include *Enforcement Action*, a dichotomous variable that indicates whether the firm has been punished previously with at least

one enforcement action taken against a facility within the most recent 2-year period (1) or not (0). I obtained data for these variables from the EPA's Enforcement and Compliance History Online program. To test H2, I also include a three-way multiplicative interaction variable between the two agency design parameters, *Regional Scale* and *Decentralized Authority*, and *Enforcement Action*, including all two-way constituent interactions.

Demographic Indicators. Firms may use demographic information from their immediate environment to gauge the likelihood that a regulatory agency is likely to pursue cooperative enforcement or punish firms for noncooperation. As the likelihood of punishment for noncooperation declines, firms would be expected to take advantage, preferring minimal compliance. To control for the possibility that firms located in poorer areas and in areas populated with minorities may expect less rigorous enforcement from regulatory agencies (Lavelle and Coyle 1992; Lynch, Stretesky and Burns 2004)⁷, I include *Percentage of Minority Population*. This variable is the combination of both African American and Hispanic population at the county level and *Median Household Income* (Inflation-adjusted Thousands of Dollars) at the county level for the year 2002 and was extracted from the U.S. Census Bureau CD-ROM (2002). To control possibility that firms experiencing economic difficulties may face lower likelihood of punishment from the regulatory agency (Scholz and Wei 1986) and be less likely to divert their resources to flexible compliance, I include *Unemployment Rate* in 2004 and the *Unemployment Rate Change* from 2003 to 2004 as measures of economic health. I obtained these county-level data from the Bureau of Labor Statistics (BLS). In addition, to control for the

⁷ Evidence for this effect is mixed with some studies reporting support for this claim and others suggesting that minority neighborhoods have similar penalty assessments as other neighborhoods (Atlas 2001; Lavelle and Coyle 1992; Lynch, Stretesky and Burns 2004; Ringquist 1998).

possibility that firms that comprise a prominent share of their county's economy are likely to expect less stringent enforcement (Ringquist 1993; Scholz and Wei 1986), I include a measure of industry salience as the percentage of a given county's total non-farm income that derives from *Air Polluting Industries* (Ringquist 1993).⁸ I gathered these data from the Department of Commerce, Bureau of Economic Analysis' Regional Economic Information System (REIS) CD-ROM. Last, to control for the possibility that firms who are more likely to view government regulations either as unfair or poorly enacted are less willing to comply with those regulations (Bardach and Kagan 1982; Levi 1997; Tyler 1990; Winter and May 2001), I include the percentage of *Votes Received by Bush* in the 2000 Presidential election at the county level. I obtained these county level data from the U.S. Geological Survey's 2000 Presidential General Election county-level database (2001).

Political Indicators. Firms may also use the political control of key elected institutions as information on whether regulatory agencies are expected to enforce defecting behavior by firms. A stronger Democratic presence in state government has been associated with greater regulatory activity – i.e., a larger number of regulatory outputs such as inspections, actions and penalties (Davis and Davis 1999; Hunter and Waterman 1996; Scholz and Wei 1986; Scholz, Twombly and Headrick 1991; Wood 1992). Therefore, I would expect that the likelihood of a firm engaging in opportunistic behavior will be higher when conservative or Republican representatives are present in elected institutions, given firms' expectations of lax enforcement.

⁸ Air polluting industries, with their Standard Industrial Classification (SIC) in parentheses include: Paper and Allied products (26), Chemicals and Allied Products (28); Petroleum and Coal Products (29); Rubber and Miscellaneous Plastics Products (30); Stone, Clay and Glass Products (32); Primary Metal industries (33); Transportation Equipment (37) (Ringquist 1993).

To control for the political environment, I include *Democratic Governor*, a dummy variable which assesses partisan control of the governor's office. I also include, *State Legislature Democratic*, which is the total percentage of Democrats in both houses at the state level and, *Regional Democratic*, which is the total percentage of Democratic state legislators out of the total number of state legislators from the relevant administrative region.⁹ Last, I also include the Berry et al. (1998) updated 2002 measure of *Government Ideology* to control for the ideology of the state's government, where higher scores reflect more liberal government officials.

Agency Task Environment Indicators. Firms may use features of their policy domain to determine an agency's likely enforcement strategy. Previous research suggests that the problem severity of the regulated activity and the complexity of the tasks that regulatory officers face influence an agency's enforcement effort (Hunter and Waterman 1996; Ringquist 1993; Scholz and Wei 1986). In such areas, firms are likely to believe that regulators are under greater pressure to reduce pollution levels and as a result will expect the agency to pursue maximal deterrence. Accordingly, when problem severity is high, firms will be more likely to be classified as being HPVs. To control for problem severity, I include the variable, *Non-attainment*, which is a simple additive scale across each of the dichotomous indicators of whether a given county is in

⁹ A regional state legislator is defined as any legislator that has any portion of their district in the administrative region. To code this variable, I use state legislative district data provide by each state's Department of State to note whether the state upper and lower house district boundaries overlap with state administrative regional boundaries and the total number of representatives, along with their party affiliation, in the upper and lower house whose districts lie within a state administrative boundary.

non-attainment for any of the six primary pollutants listed in the NAAQS. These data are listed in the Federal Register and have been published in the EPA's *Greenbook*.

To control for the policy complexity faced by regulatory officers, I include *Policy Entropy*, which is essentially a diversity index of the state air emissions sources for each county within each state, where higher values represent a more complex implementation environment.¹⁰ As the diversity of the regulated community increases regulatory officers face unique sets of technical and administrative challenges, providing them incentives to engage cooperative enforcement. As a result, firms may recognize this potential for cooperation, responding to greater complexity with a lower likelihood of being classified as an HPV. To calculate this measure, I retrieved data from EPA's *Toxic Release Inventory* database.

Last, to control for each regional office's capacity, I include *Regional Budget*, a measure of each region's enforcement budget. I use the FY2000 annual state air program budgets in hundred of thousands of dollars from the Council of State Governments (CSG 2000) divided by the total number of regulated entities in the state, which yields a budget per entity conversion parameter. I then multiply this parameter by the total number of entities in a region to yield the expected *Regional Budget*.¹¹ Firms will interpret higher budgetary resources as a sign that the

¹⁰ This measure is calculated with the following formula $E = -\sum_{i=1}^n p_i \ln(p_i)$, where p represents the probability of the *i*th Standard Industrial Classification source category for a given county within each state (Potoski 1999).

¹¹ An alternate measure of regional resources that assumes equal allocations across regions produces similar findings.

agency will be more likely to pursue maximal enforcement and as a result will increase the propensity of an agency to have identified an entity as being a HPV.

5. Results

Table 1 below presents the findings from the multivariate analysis. Model 1 displays the results for the test of H1 and Model 2 displays the results for the test of H2. Overall, likelihood ratio tests suggest that the models perform better than both constant-only models and models that restricted the main institutional variables to zero, suggesting that the addition of these institutional variables improves the overall fit of the models.

(Table 1)

The results in Table 1 support H1's expectation that firms under cooperative settings, characterized by both greater regional scale and more decentralized authority, are less likely to engage in minimal compliance. With respect to how this cooperative setting influences a firm's likelihood of engaging in minimal compliance, Model 1 demonstrates that the coefficient on the interaction term between regional scale and decentralized authority is in the expected negative direction and is statistically significant. This suggests that firms located in more cooperative settings are less likely to be high priority violators. Specifically, the coefficients suggest that increasing decentralized authority by one standard deviation for regional offices with small scale (<10 firms) would change the likelihood of observing an HPV by a factor of 1.203, a more than a 20% increase. However, the same increase in decentralized authority for large regional offices, (>1000 firms), decreases the likelihood of observing an HPV by a factor of .79, nearly a 20% decrease. These findings provide support for H1. In the presence of both a larger regional scale and greater decentralized authority, firms are less likely to be high priority violators, while firms in settings in which institutional design choices signal maximal deterrence are more likely to be

HPVs. Given that 43.6% of the firms in the data are located in larger-scale regions with more centralized authority (with both variables split on the median), the results suggest that compliance for the worst offenses among these firms could be improved by further decentralizing enforcement authority to regulatory field officers in those regions. In fact, when I estimated a model with dummy variables representing each of the four ‘ideal-type’ enforcement settings with each design variable split on its median (results not reported here), all settings increase the propensity of a firm’s being a HPV compared to large scale, decentralized regions.¹²

Several control variables also have statistically significant effects in the expected direction. Demographic indicators reflecting county unemployment and the percentage of a county’s income that derives from air polluting industry both have positive effects on a firm’s likelihood of being a HPV. Firms’ expect less rigorous enforcement during challenging economic conditions or when they have greater influence in the local economy and are more likely to be minimally compliant. With respect to the political control variables, only the overall liberal ideology of state officials has an impact on HPV status. In the presence of more liberal government officials, firms expect a higher likelihood of punishment for deviations from cooperation and are therefore less likely to be a HPV. Last, with respect to the controls for the agency’s task environment, firms are more likely to expect a maximal deterrence enforcement strategy from agencies when enforcement settings include less diverse industrial pollution sources and higher pollution levels. In each of these settings, firms are more likely to be HPVs.

¹² These regions also do not appear to be “giving away the store” to obtain these compliance rates. In results, not reported here, while large scale, decentralized regions, have lower inspection rates compared to the maximal deterrence regions, they do not have significantly different violations or enforcement actions compared to other settings.

Model 2 in Table 1 presents the results of the test of H2 that previous enforcement actions should be more effective at inducing firms to reject minimal compliance under cooperative compared to maximal deterrence settings. In Model 2, the interaction effect between a previous enforcement action, regional scale, and the decentralization of authority is significant and in the expected negative direction. This suggests that in the presence of both a larger regional scale and greater decentralized authority, firms that received an enforcement action in the past two years are less likely to be HPVs compared to firms that received similar actions under maximal enforcement. Regardless of institutional setting, a firm with a prior enforcement action taken against them is more likely to be a current high priority violator than an entity with no prior enforcement action. However, this likelihood is lower in cooperative enforcement settings. In fact, for highly decentralized authority, the effect of a previous enforcement action within a small scaled region increases the likelihood of observing an HPV by a factor of 27.87, whereas the same enforcement action within a large scaled region only increases the likelihood of observing an HPV by a factor of 1.028. The results of the analysis provide support for H2. In increasingly cooperative settings, those with large regional scale *and* decentralized authority, a previous enforcement action is more likely to induce firms to avoid minimal compliance compared to firms in more deterrent oriented settings. In other words, a firm that has defected in the past is more likely to recognize the greater payoffs for returning to cooperation in the presence of credible commitment devices that signal cooperative enforcement.

6. Conclusion

Previously, we knew little about how cooperative enforcement might be supplied and by what specific mechanisms regulatory agencies might credibly commit to such strategies. The findings reported here offer insight into how policymakers might obtain the gains of cooperative

outcomes. To reap these rewards, regulatory agencies cannot rely upon their good words alone. Even in the presence of agency preferences to signal a more cooperative enforcement setting, failure to adopt design choices that reinforce such claims may render agencies unable to reap the benefits of their preferred strategy. Indeed, the results here suggest that the very manner in which abatement actions influence firms' behavior varies over different institutionally structured enforcement settings. This is because skeptical firms will discount agency promises of cooperative enforcement if such promises are made in the absence of some credible commitment device. The message of these findings is clear: the institutional design of regulatory agencies is an important solution to this commitment problem. Visible and durable institutional devices offer clear signals of an agency's intention to engage in cooperative enforcement and induce firms to forgo the temptations to make short term gains in compliance.

While the results here suggest that 'properly' constituted institutional environments can provide a fertile setting within which cooperation can thrive, they also suggest a cautionary note. Poorly designed institutional environments, or suboptimal combinations of regional scale and authority, can yield settings that exacerbate the distrust between agencies and regulated firms. Under such conditions, the potential gains to be made in efficient enforcement are undermined by such institutional combinations. These findings have important implications for scholars and policymakers interested in the development of trust and cooperation in regulatory settings (Lubell 2004a; Lubell 2004b; May and Wood 2003; Schneider et al. 2003). For example, efforts to encourage the development of informal partnerships or networks between practitioners, regulated clientele and policymakers to enhance trust and cooperation may work at cross purposes with an agency's institutional configurations. To enhance the possible benefits of

network development for cooperative outcomes, attention must be paid to whether a regulatory agency's institutional configuration reinforces or hampers such efforts.

In this respect, agency design choices can secure favorable policy outcomes in ways similar to other more overt political and policy features. Yet, curiously, agency design elements rarely appear in theories of regulatory compliance. The results reported here suggest that scholars must begin to recognize that agency design choices induce particular enforcement styles and that firms use these design choices to develop expectations about a regulatory agency's enforcement strategy. As a result, the institutional choices that constitute a regulatory agency must be included in our attempts to better understand firms' choices over compliance.

A final implication of these results is tied to the characteristic of credible commitment devices that enable their success -- durability. The durability of design choices is important to increase firms' confidence in agency commitments. However, this very quality may present obstacles for political coalitions seeking to 'fix' compliance issues by reforming an agency's institutional configuration (Sparrow 2000). Moreover, adopting durable design choices may in some cases result in a more politically insulated agency, exacerbating the principal agent relationship between central political authorities and agency field officers (Hedge and Scicchitano 1994; Kaufman 1960; Potoski 2002; Scholz 1991; Whitford 2002). In this respect, durable design choices that insulate an agency from political interference may present legislators with political and policy tradeoffs that they may not be willing to pay (DeFigueredo 2002), including decreased accountability to elected officials (May 2003, 2007). This suggests that while certain institutional features may increase the likelihood of socially optimal regulatory outcomes, those very institutional features may be the most difficult to implement politically.

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Table 1. High Priority Violator Status for Individual Regulated Entities

	Model 1			Model 2		
	High Priority Violator Status			High Priority Violator Status		
	b	s.e. b	Standard Factor Change	b	s.e. b	Standard Factor Change
Institutional Setting						
Decentralized Authority (D.A.)	0.0879	**	0.0422	0.0326	0.0460	
Regional Scale	0.0001		0.0002	0.0003	0.0002	
D.A.*Regional Scale	-0.0002	**	0.0001	-0.0001	0.0001	
Enforcement Action (E.A.)	2.3080	***	0.0697	1.8805	2.5728	***
D.A.*E.A.	-----	-----	-----	0.1510	***	0.0555
Regional Scale*E.A.	-----	-----	-----	-0.0008	***	0.0002
D.A.*Regional Scale*E.A.	-----	-----	-----	-0.0005	***	0.0001
Controls						
Demographic Indicators						
Percent Minority	0.0010		0.0018	0.0011	0.0017	
Median Family Income	-0.0031		0.0025	-0.0031	0.0024	
% Change in Unemployment	0.0477		0.0449	0.0407	0.0453	
Unemployment	0.0539	**	0.0224	1.1375	0.0513	**
% Income Air Pol. Industry	0.0280	***	0.0058	1.1814	0.0276	***
% Vote for Bush	0.0050		0.0043		0.0041	0.0041
Political Indicators						
Democratic Governor	-0.0854		0.0819	-0.0669	0.0814	
% Democrats in State House	-0.5953		0.4880	-0.5796	0.4851	
% Democrats in Region	-0.4275		0.2899	-0.4288	0.2944	
Government Ideology (liberal)	-0.0091	***	0.0025	0.8017	-0.0086	***
Policy Task Factor Indicators						
Non-attainment	0.1671	***	0.0567	1.1824	0.1828	***
Policy Entropy	-0.2109	**	0.0832	0.8706	-0.2085	**
Agency Regional Budget	0.0006		0.0006		0.0009	0.0006
Previous Inspection	0.7543	***	0.1059	1.4441	0.7713	***
Constant	-3.8168	***	0.3772		-3.8900	***
Log-Likelihood			-7052.73			-7029.48
χ^2			(18) 1565.23***			(21) 1742.87***
Number of cases			43021			43021

Note: * $p < .10$, ** $p < .05$, *** $p < .01$, two-tailed tests. Standard errors clustered on county.