Compliance Bias and Environmental (In)Justice

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Scholarship on race- and class-based disparities in regulatory outcomes has failed to provide a theoretically grounded account of this bias' origin. We address this shortcoming by providing a microlevel explanation of how demographics influence compliance bias or the failure to detect noncompliant firms. We argue that regulatory compliance is best understood as a dual-agent—firm and regulatory officer—production function, and that community mobilization and agency decision-making authority shape bureaucrats' incentives to report non-compliance. We test our argument with an original dataset on community mobilization and agency structure that delineates the political costs and benefits of state regulatory officers implementing the U.S. Clean Air Act. Using detection-controlled estimation, we find that while certain communities are vulnerable to compliance bias, such bias is mitigated in the presence of either politically mobilized communities or decentralized enforcement authority within the implementing agency.

E qual protection under the law is a fundamental principle of democratic public policy. When governments fail to treat citizens equally, the very legitimacy of democracy is threatened.[1] Accordingly, the roots of equal protection extend deeply and broadly in the discipline. Scholars recognize its importance as a key component of the rule of law and the civil liberties protected in society (Maravall and Przeworski 2003). Bureaucracy scholars refer to doctrines of administrative fairness and representation (Meier 1993) and judicial scholars to impartiality and neutrality (Raz 1977). The core questions on equal protection turn on whether government is treating citizens differently, and, if so, what remedies might reduce such inequities?

In approaching this question, scholars have investigated policy domains that are ripe for violations of equal protection such as housing, pay, environment, education, and employment. Of these areas, environmental protection is particularly salient because of the potential for adverse public health effects. Advocates for "environmental justice" often allege that minority and low-income communities experience disproportionate environmental hazards, in part, as a result of unequal enforcement of laws (e.g., Bryant 1995; Bullard, 1993; Bullard & Johnson 2000). Some recent

research investigating these claims has found that governments conduct fewer inspections and impose fewer punitive sanctions when firms are located in poor and minority areas, but other work has identified few such disparities (Dion, Lanoie & Laplante 1998; Gray and Shadbegian 2004; Helland 1998b; Konisky 2009; Konisky and Schario 2010; Scholz and Wang 2006).

Notwithstanding the mixed results, these studies share a common approach of establishing correlations between community demographics and regulatory enforcement outputs. However, while demonstrating these correlations helps to diagnose the presence of enforcement bias, prior research has not developed a strong theoretical account of the sources of this bias. Enforcement actions rely upon initial determinations of firm compliance, which are generally ascertained through government detection efforts. As a result, observed correlations between community demographics and enforcement actions may be *either* evidence of bias originating in an agency's decision to take that action *or* evidence of bias originating in the initial compliance determination. Moreover, bias in regulatory outputs is generated from a process that involves the strategic interaction of *both* firms and regulatory officers.

Observed correlations between community demographics and regulatory outputs may reflect a firm's decision to be compliant, an officer's decision to accurately identify noncompliant firms, or both. When studying regulatory outputs alone, these sources of bias are observationally equivalent.

We believe a more productive path for revealing the sources of bias is to focus on compliance. Compliance is the foundation upon which other regulatory outputs are based, and for this reason, studying firm compliance is not vulnerable to the first problem noted above. In this sense, exploring environmental justice issues within a compliance framework highlights the core process within which we believe bias is likely to originally arise.[2] Second, while compliance does entail dual-agent (firm and officer) production, we can explicitly model each data-generating process, allowing us to determine if the bias originates with firms and/or regulators.

In this article, we develop a novel theoretical account of compliance bias, or the systematic nondetection of violations, in the context of environmental justice. Building on past work (e.g., Feinstein 1990; Helland 1998a, 1998b; Scholz and Wang 2006), we argue that compliance bias is best characterized as a dual-agent production function of firms and regulatory officers. While pursuing different goals, both firms and bureaucrats attempt to minimize their costs. We argue that the costs associated with noncompliance (firms) and failure to detect noncompliance (bureaucrats) are lower in poor and minority communities because these communities have fewer resources with which to document and protest noncompliance. For this reason, firms in these areas are more likely to be noncompliant and less likely to be detected by regulatory officers.

This dual-agent approach reveals two potential remedies for such bias. First, politically mobilized communities are better equipped to generate compliance costs for firms and political costs for bureaucrats, and, as a result, bias will diminish in poor and minority communities that have overcome the collective action problems necessary to exert political pressure. Second, we argue that high-level agency managers have a strong incentive to overreport compliance rates in order to craft positive impressions of agency performance. For this reason, they are more likely to engage in what we refer to as *motivated, nondetection of compliance* when a firm is located in a poor or minority area, since these communities have fewer political resources and are therefore less likely to discover the bureaucrat's behavior.

The empirical setting for our analysis is firm-level compliance with the federal Clean Air Act (CAA). Using an original dataset on both local mobilization and the decision-making authority of the state regulatory officers largely responsible for implementing the CAA, we employ detection-controlled estimation (DCE) to model the effects of demographic characteristics on both individual firm and regulatory officer compliance decisions. We find that compliance bias is more likely in Hispanic (but, not in African American) communities, but that such bias is mitigated in the presence of either politically mobilized communities or decentralized enforcement authority. Our results suggest that compliance bias in policy implementation can be curbed not just by investing in the political capacity of communities but also by modifying agency decision-making structures.

The article proceeds as follows. We begin by developing our theoretical expectations about the linkage between compliance bias and community demographics. We then discuss our research design and explain the usefulness of using a DCE approach to test these expectations. Next we discuss our empirical analysis of compliance bias in the case of enforcement of the CAA and then conclude with a discussion of the implications.

Theory and Hypotheses

Models of regulatory compliance recognize two distinct processes: Firms make decisions over compliance, and regulatory officers make decisions over compliance determination. Strategic-deterrence models provide basic expectations that are useful for our purposes. In such models, firms and bureaucrats base their behavior on an expected utility calculation in which each attempts to maximize their expected payoffs given their beliefs about the other's action (Braithwaite and Makkai 1991; Scholz 1991; Winter and May 2001). Of the many outcomes of this strategic interaction, we are interested in features of the policy environment that may increase the potential for "opportunistic" behavior—that is, when firms pursue noncompliance based on their lower expectations of being caught and/or punished by regulatory officers. The end result of this outcome is undetected noncompliance—the object of our study.

We assume that firms choose whether to remain in compliance or to violate the law. In making this choice, firms are interested in maximizing their individual profit at the lowest cost of compliance.

[2]A few studies look at disparities in firm compliance with mixed findings (Earnhart 2004a, 2004b; Mennis 2005; Scholz and Wang 2006).

The expected costs of compliance are related to various features of the market and to policy and political factors that shape the consequences of noncompliant behavior. Expectations about the costs of compliance are also related to the detection efforts pursued by regulatory officers, and specifically, the likelihood that noncompliant behavior will not only be discovered but treated as violations. It is for this reason that one needs to conceptualize compliance outcomes as a dual-agent production function. When firms expect agency officials to pursue less rigorous enforcement strategies, they have greater incentive to avoid full compliance. Alternatively, when firms believe that agency officials are more likely to pursue a maximal deterrence strategy, they will have greater incentive to stay in compliance.

We assume that bureaucrats choose whether to determine a given firm's compliance status. This decision is perhaps the most fundamental enforcement activity for a regulatory officer, since it is not only the first action in a long line of potential actions directed at an individual firm but also represents an important performance indicator for an agency at the aggregate level. In making this choice, officers are interested in maximizing the political benefits of successful detection (i.e., getting credit for making correct compliance determinations) while minimizing the political costs of errors (i.e., getting blamed for making incorrect compliance determinations). Political benefits stem from being responsive to policy demands such as managing the aggregate consequences of noncompliance (e.g., pollution levels, accident rates) and political demands including the preferences of political principals and other stakeholders. As we argue below, an important element in being responsive is whether the agency is viewed as being "effective." In addition to the various types of transaction costs involved for any given case (i.e., search and information costs, bargaining and decision costs, policing and enforcement costs), regulatory officers must also consider the political costs of their decisions. Specifically they must weigh the consequences of making wrong decisions, and we argue that they will allocate their effort to minimize the net costs of different incorrect compliance determinations.

Incorrect compliance decisions come in two forms. First, the officer could wrongly attempt detection of a compliant firm (so called "harassment"; Scholz 1991). Second, the officer could fail to detect a noncompliant firm. Each of these errors generates different political costs from unique clientele. For the first error, business interests are more likely to generate costs for officers, while environmental advocacy groups are more likely to generate costs for the second error. In the aggregate, at the level of a region or a community, officers attempting to minimize one set of errors necessarily increase the probability of the other (this is of course not the case at the individual firm level). On the whole, clientele generate cross-cutting incentives for officers, who attempt to minimize costs associated with making errors, offering officers a trade-off. A rational regulatory officer, seeking to be responsive to stakeholders, will attempt to minimize costs generated from relevant clientele. We are interested in how community demographics affect the second type of errors, or failures to detect noncompliance. As we will argue below, factors such as demographics alter the relative political costs of these errors, making one error more attractive than the other, ceteris paribus.

In the context of firm compliance, officers are unable to fully and regularly assess the behavior of all regulated entities. Even if bureaucrats are motivated primarily by functional or intrinsic preferences (Brehm and Gates 1997), they are still constrained by practical limits. For this reason, bureaucrats may engage in some satisficing behavior as a decision-making shortcut (Simon 1976) or, alternatively, choose to strategically allocate more effort to accurately determine the compliance status of some firms more than others. This could take the form of directing agency efforts to easier cases (Wilson 1989) or directing resources to cases depending on the estimation of the political costs of a wrong decision. We assume that firms are aware that officers face such limitations but are uncertain of precisely which officer type they are dealing with—one preferring less or more rigorous detection effort.

Given that firms and regulatory officers are uncertain about each other's preferences, they develop beliefs using signals in the policy environment. These signals inform a firm's (agency's) expectations about an agency's (firm's) strategy, and they originate from political and policy task factors alike (Potoski 1999; Ringquist 1993; Scholz and Wei 1986; Scholz, Twombly and Headrick 1991; Wood 1992). When signals from the policy environment are sufficiently suggestive that regulatory officers may pursue less rigorous detection, firms will be more likely to risk noncompliance.

Community Demographics, Mobilization, and Enforcement Authority

We posit that community characteristics shape firms' and regulatory officers' behavior by providing signals about each others' preferences over compliance and enforcement, respectively. For firms, demographics provide informative signals about the expected costs of compliance. For reasons we specify below, bureaucrats are less likely to devote their limited resources to

correctly detecting noncompliance when the firms are located in less politically active areas. Because large minority and poor communities tend to have fewer political resources with which to engage in advocacy, these communities as well as the regulatory officers who serve them will be less likely to employ aggressive detection efforts. Strategic firms respond accordingly and should be more inclined to risk noncompliance, leading to our first hypothesis:

> *H1*: Firms in minority (or poor) neighborhoods are more likely to be in noncompliance.

Community demographics may generate costs for regulatory officers in several ways. First, failure to detect noncompliance, if uncovered, can lead to objections from interested stakeholders. Rational bureaucrats seeking to minimize costs generated from a specific clientele over incorrect decisions will devote fewer resources to carefully determining compliance for cases where the costs associated with wrongful detections are lower. Conversely, they will dedicate more attention to those cases where the costs of making incorrect decisions are higher. To be clear, officers cannot simply ignore these resource-intense cases to avoid the costs associated with them. Doing so will generate either undetected noncompliance or detection against compliant firms, both of which generate costs, albeit from different clientele. In this sense, the costs that a regulator faces for failing to detect a noncompliant firm vary, depending on the probability that an incorrect determination will be revealed. Community characteristics enter this decision-making equation because some communities have better capacity to identify and dispute an incorrect compliance decision. In particular, poor and minority communities tend to have fewer political resources to demand and secure accurate compliance decisions from bureaucrats. This raises the relative attractiveness of compliance bias in these communities.

A second reason regards the identification of potential violations. In policy contexts where third-party monitoring assists bureaucrats in detecting problems, communities with reserve time, resources, and social capital are better equipped to serve in this role. Poor and minority communities are less likely to possess this capacity. As a result, regulatory officers are more likely to mischaracterize noncompliant firms as compliant in these areas. Whichever reason holds, the end result is the same—poor and minority neighborhoods are less likely to be able to generate political costs for regulatory officers. Therefore, bureaucrats have less incentive to actively pursue noncompliant firms in these communities, leading to the following hypothesis:

> *H2*: Bureaucrats are less likely to code violating firms as noncompliant when they are located in minority (or poor) communities.

The effect of community demographics on firm and regulatory officer behavior, however, should not be constant across all contexts. Rather, we argue that the effect should be mediated by two contextual features— the ability of a community to generate political costs through effective mobilization and the vulnerability of a regulatory officer to these costs. We discuss each in turn.

Community Mobilization. Past work demonstrates that communities with higher political capacity are better able to influence firm decision making (Hamilton 1993, 1995; Hamilton and Viscusi 1999), and we argue that a similar dynamic exists with firm compliance. While community demographics provide signals to bureaucrats (and firms) about *potential* political mobilization, they do not account for the effects of *actual* mobilization. Politically mobilized communities should alter the incentives of firms and bureaucrats in decisions regarding compliance. Regarding firms, communities that overcome collective action problems and exercise their political voice can modify the costs of compliance through direct pressure, "shaming" poor performers, or litigation. Well-organized communities should also increase the political costs to a bureaucrat of making an incorrect decision, since they can protest and publicize what they believe are any erroneous decisions. In turn, these higher costs should reduce the likelihood of officers wrongly classifying a firm violating the law as compliant and of firms being noncompliant. Two specific political-mobilization hypotheses follow from this logic:

> *H3a*: Firms in minority (or poor) communities are less likely to be noncompliant when they are located in politically mobilized communities.

> *H3b*: Bureaucrats are more likely to code violating firms in minority (or poor) communities as noncompliant when these communities are politically mobilized.

Enforcement Authority. To this point, we have implicitly assumed that all bureaucrats share similar incentive structures when it comes to determining firm compliance. Yet, within an agency, different bureaucrats have varied tasks. Front-line agents focus on the day-to-day activities of policy delivery, while high-level managers focus on achieving overall organizational goals and managing relationships with external stakeholders (Hammond 1986). As a consequence, the incentives that influence bureaucrats' compliance decisions may vary with their position in the agency. Critically important for our purposes, not all states assign the

same personnel final decisionmaking authority over compliance decisions. Some states allow field officers wide discretion over compliance decisions, while others require final authorization from higher-level agency managers. We argue that there is strong reason to believe that, depending upon their position and task responsibilities, bureaucrats are not equally vulnerable to the political costs that a community may generate.

Specifically, we posit that compared to lower-level field officers (e.g., career civil servant front-line compliance officers), higher-level bureaucrats serving in agency management roles (e.g., Department Secretaries, Deputy Secretaries, Division Managers, or Regional Directors) have additional incentives to inaccurately characterize noncompliant firms as compliant. Compliance rates are a key indicator by which stakeholders evaluate the performance of regulatory agencies, and they are often included in annual reports to state legislatures and to federal overseers. In many areas of policy, where it is difficult to precisely measure bureaucratic performance, for reasons of both asymmetric information and causal ambiguity between agency action and policy outcomes, stakeholders rely on these types of metrics instead. The use of such performance indicators often results in goal displacement where agencies focus on producing metrics to satisfy external stakeholders, rather than achieving more relevant policy outcomes (Blau and Meyer 1971; Bohte and Meier 2000; Downs 1967). Knowing this, bureaucrats serving in high-level management positions responsible for crafting impressions of agency performance have a stronger incentive to deliver high compliance rates.

High-level managers, faced with these incentives, may be tempted to overlook noncompliant firms in some circumstances. We refer to this behavior as *motivated, nondetection of compliance*, and it is analogous to Bohte and Meier's (2000) idea of organizational cheating in public agencies. Although bureaucrats enjoy informational advantages over many stakeholders, there are potentially adverse consequences to engaging in this behavior, and strategic bureaucrats are more likely to pursue motivated, nondetection of compliance when the risks of being caught are smaller.[3] It is here again that we return to the important role of community characteristics. Since there is a higher probability of the deception not being detected, bureaucrats will be more likely to deliberately mischaracterize a firm violating the law as compliant when the community in which the firm is located has fewer political resources (i.e., poor and minority communities). To be clear, this incentive is above and beyond the reasons stated previously regarding the political mobilization capacity of these communities, leading us to our final hypothesis:

> *H4:* Bureaucrats who are more likely to be held accountable for agency performance are more likely to mischaracterize violating firms as compliant when these firms are located in minority (or poor) communities.

Research Design

To test our expectations we employ DCE, a statistical technique that enables us to jointly model the dual production of compliance. Originally developed by Feinstein (1990), DCE statistically controls for the possibility that some portion of noncompliant firms may remain undiscovered by regulatory officers. As a result, facilities may be entered into a database as compliant when they are actually violating the law. DCE estimates the likelihood of a firm being noncompliant, as well as the likelihood that a given entity was correctly coded as noncompliant by a regulatory officer. Failure to account for the two reasons for observing compliance (actual compliance and the failure to detect noncompliance), which is implicitly done when compliance is modeled with a single-equation probit or logistic regression specification, can bias inferences.

DCE techniques have been utilized to correct for compliance bias in a variety of settings, including taxpayer compliance (Feinstein 1999) and firm compliance with environmental (Brehm and Hamilton 1996; Helland 1998a, 1998b; Scholz and Wang 2006), occupational health and safety, (Feinstein 1990), and food and drug (Olson 1995) regulation. The DCE approach has two specific benefits for our purposes. First, it corrects for bias in estimating demographic effects in firm-compliance models. Second, it enables us to explicitly account for the dual-agent production problem. With DCE we can consider the sources of bias by separately testing whether demographics affect firm decisions on compliance and regulators' determinations of facility compliance.

Specifically, we utilize Feinstein's (1990) DCE estimator, which consists of two binary choice models: one that models the likelihood of a "true" violation and a second that models the likelihood of detection of "true" compliance. Because the likelihood of a violation and the likelihood of detection are separately unobservable, these likelihood functions are estimated

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[3]To be clear, the mechanisms by which motivated nondetection occur are not necessarily nefarious. We do not necessarily envision managers explicitly manipulating compliance documents or turning the other way to blatant violations—although we do not rule this out. Rather, such motivations may translate into directing subordinates' detection efforts either to or away from specific geographical areas of concern, based upon political demands.

jointly via maximum-likelihood estimation. The DCE estimator is equivalent to a bivariate probit model with partial observability (Abowd and Farber 1982; Poirier 1980). More formally, we model the observed dichotomous compliance variable, z_i, as the product of two unobserved latent dichotomous variables, y_{i1} and y_{i2}, such that z_i is only observed, where $z_i = y_{i1} \times y_{i2}$. In our application, we assign the interpretations of firm noncompliance and agency detection to y_{i1} and y_{i2}, respectively, such that:

$$Z_i = \begin{cases} 1, y_{i1} \text{ and } y_{i2} = 1 \\ 0, \text{ otherwise} \end{cases}$$

Thus, we expect to observe a firm being listed as noncompliant ($z_i = 1$) when both the firm is non-compliant and the agency has detected this noncompliance. In all other combinations of firm and agency behavior, we observe a case of compliance ($z_i = 0$), which highlights the fact that we cannot distinguish between true compliance and undetected violators.[4] In this model the probabilities are jointly and simultaneously determined with a correlated error term, ρ,

$$Pr(z = 1) = \Phi_2(x_1\beta_1, x_2\beta_2, \rho)$$
$$Pr(z = 0) = 1 - \Phi_2(x_1\beta_1, x_2\beta_2, \rho)$$

yielding the following likelihood to be estimated:

$$lnL = \sum_{i=1}^{N} \{z_i ln\Phi_2(x_1\beta_1, x_2\beta_2, \rho) + (1 - z_i) ln[1 - \Phi_2(x_1\beta_1, x_2\beta_2, \rho)]\}$$

Identification of this model requires an exclusion of at least one exogenous variable to ensure that the parameters being estimated in each model are not identical. Moreover, identification is enhanced when the exogenous variable exhibits sufficient variation over the sample. This condition is likely to be met when the exogenous variable is continuous (Poirier 1980). In our model, *Signature Authority* (which as we describe below is our measure of agency structure) is a continuous exogenous variable which we restrict to the detection equation based on our theoretical argument that the location of decision making in a state administrative agency creates different incentives for bureaucrats. We do not include *Signature Authority* in the firm model given what we think is a reasonable assumption that firms are largely unaware of this feature of administrative agencies, and, even if they

were aware, it is unlikely to affect their compliance costs. The other variables not included in both equations are the firm-level indicators of past enforcement. Because firms' compliance costs are affected by the temptation to cheat, which is in turn a function of the likelihood of getting caught, we include measures of past government inspections in the firm equation. For their part, we argue that regulators will devote their time and effort to "bad actors," so we include measures of whether recent violations resulted in a punitive action in the detection equation.

The empirical setting for our analysis is the regulatory compliance of individual firms within the context of air pollution control across the U.S. states. We use an original dataset that combines firm-level compliance with the federal CAA with data on community characteristics and contextual variables across county, state administrative region, and U.S. states. The federal government sets most standards under the CAA, but the states have responsibility for enforcing many of its provisions. To best capture the policy and political demands on state regulatory officers, we use novel data on how each state agency divides enforcement responsibilities among bureaucrats internal to the agency. We discuss these data in greater detail below. Our attention to the details of administrative program structure does, however, generate a trade-off. Given the demands of gathering these data, we can only examine a limited time frame (2001–2004) for which we have compiled administrative data. However, we do not believe that this trade-off compromises our ability to draw valid inferences because our hypotheses only require cross-sectional variance. Moreover, by limiting our analysis to a single Presidential term, we can hold constant variations in national factors that might influence state enforcement patterns. Of course, we must be cautious extending our inferences beyond this temporal domain.

Measuring Compliance

The dependent variable, *HPV Status*, reflects whether a regulated facility was designated as a High Priority Violator (HPV) of the CAA. An HPV facility is one that is failing to meet core CAA obligations, usually pollution performance standards. Dissimilar to minor paper-work violations, noncompliance of this sort can trigger significant punitive sanctions including substantial monetary penalties. For this reason, designating a firm as HPV is of high political relevance for regulatory officers. *HPV Status* is a dichotomous variable that takes a value of one for a facility designated as a HPV at any time during the year, and zero otherwise. The variable is

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[4]It is possible that there could be "false" noncompliance, but this would be exceedingly rare in our context. HPV determinations represent cases of severe noncompliance and typically include major infractions of emissions standards, minimizing errors, even by overly zealous regulators.

measured on annual basis from 2001 to 2004, and we examine all federally reportable facilities under the CAA. The result is a panel dataset that includes a total of 160,896 cases (40,224 firms per year),[5] although the number of cases analyzed is slightly fewer due to missing data.[6] Table A.1 in the online appendix includes sources and descriptive statistics for all data.

Measuring Community Characteristics

Environmental justice concerns typically emerge with respect to race and class. We use two standard measures in the literature to assess the racial composition of a community: *Percentage of African-American Population and Percentage of Hispanic Population.* The literature is less consistent when accounting for class, with most using some combination of income, poverty, and education measures. Rather than emphasize any one measure, we constructed a scale based on four standardized variables, median household income, percent below poverty line, percent college educated, and percent high school educated, each measured at the zip-code level. The resulting scale, *Class,* obtained a Cronbach's alpha of .86, and an investigation of the dimensionality of the scale revealed a single factor with an eigenvalue of 2.73, accounting for 79% of the total variance.

Measuring Community Political Mobilization

To assess the degree of community political mobilization, we require a measure that captures whether citizens have overcome collective action costs and organized around environmental justice concerns. Standard measures of political mobilization, such as voter turnout and campaign donations, are too broad to capture our concept of interest. Moreover, it is likely that it is precisely in communities where traditional political mobilization is low that the pressures for organization around equity issues are highest. As a result, we use a more direct measure: the presence of locally oriented environmental justice advocacy organizations.

We assembled data from the People of Color Environmental Groups Directory (Environmental

Justice Resource Center 2000), which publishes a list of organizations whose activities include advocating for environmental justice. Specifically, we coded the presence of groups listed as "environmental justice resource groups" at the zip-code level, as well as information about the constituency served by each group and its geographic focus. Using these data, we first aggregated this group information up to the three-digit zip-code level to take into account the positive spillovers from the presence of a group, under what we believe is a reasonable assumption that the reach of these groups extends beyond the specific mailing zip code of their main office.[7] We then constructed a scale based on five standardized variables, the total number of groups, the total number of groups focused on African Americans, the total number of groups focused on Hispanic groups, the total number of groups with a neighborhood focus, and the total number of groups with a local focus. The resulting scale, *Mobilization,* obtained a Cronbach's alpha of .80, and an investigation of the dimensionality of the scale revealed a single factor with an eigenvalue of 2.54, which accounts for 92% of the total variance. Section 3 of the online appendix discusses the measurement of this variable in more detail.

Measuring Regulatory Officer Incentives

To test our hypothesis regarding motivated, nondetection of compliance, we must know 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. We believe that a reasonable proxy is the location within the agency where (or more precisely within whose hands) final signature authority to issue enforcement actions lies. We measure the locational authority over three sets of enforcement actions (Reenock and Gerber 2008). For each state air-pollution control agency, this measure divides (*Final Authority*—1) by (*Vertical Depth*—1), where *Final Authority* represents the location of final signature authority for a given action within the chain of command, and *Vertical Depth* represents the number of entities in the direct chain of command from the field officer up to and including the individual or committee at the top of the chain of command. Tennessee, for example, has a very centralized authority structure. Typically, enforcement actions are pushed up the agency's chain of command all the way to the top,

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[5]We correct for the panel structure of the data by including time dummy variables as well as estimating robust standard errors that are clustered in the firm. Additional analysis is reported in the online appendix, Table A.6.

[6]About 4.5% of our cases are missing demographic data at the zip-code level from the U.S. Census (likely due to shifting zip codes). The missing zip codes have slightly lower HPV rates and likely possess higher than average incomes. Given this pattern, we likely underestimate demographic effects on compliance bias.

[7]A detailed description of this measure and a robustness check, using five-digit zip codes (the results were substantively similar) is presented in the online appendix (Section 3, Table A.3).

eventually being signed off by the agency head. Compare this to a state such as South Carolina, where these actions are signed off by civil servants located five levels below the agency head. 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. This equation yields a measure of locational authority and is available for three levels of enforcement action across each state—Level I actions (informal and formal notices that typically are reserved for the first step in a case of noncompliance), Level II actions (formal administrative actions, which may include penalties), and Level III actions (civil and criminal cases filed against a noncompliant entity). We standardized each of these measures and added them to construct an equally weighted scale of sign-off authority. The final measure, *Signature Authority*, has a mean of approximately zero and a standard deviation of 2.5.

Control Variables

Firms and regulatory officers rely on a host of signals to inform their decisions. Given that these signals may be correlated with their compliance decisions as well as with the demographic composition of the relevant community, we include several controls to avoid drawing incorrect inferences. To account for relevant policy task factors, we include measures of problem severity and complexity in the local policy arena. We measure problem severity with *Nonattainment*, a count of the number of CAA ambient air-quality standards a county fails to meet on an annual basis. We also include *Policy Entropy*, a diversity index of state air-emissions sources in a county, where higher values represent a more complex implementation environment (Potoski 1999). Last, many states have decentralized their CAA compliance-monitoring activities to regional offices. To control for each office's workload, we include *Regional Scale*, which is the total number of regulated firms in the region.

Firms' and bureaucrats' compliance decisions may also be influenced by economic and political conditions. To account for economic conditions, we use *Unemployment Rate,* measured at the county-level. In addition, we include a measure of industry salience as the percentage of a given county's total nonfarm income that derives from *Air Polluting Industries* (Ringquist 1993). Political factors at both the state and local level may also affect compliance decisions. A stronger Democratic presence in state government has been associated with greater regulatory activity in general (Scholz, Twombly, and Headrick 1991; Scholz

and Wei 1986), and in enforcement of the CAA in particular (Konisky 2007; Wood 1992). To account for state-level political influence, we include *Democratic Governor,* a dummy variable reflecting gubernatorial partisan control, and *Percentage Democrats in State Legislature*, which is the total percentage of Democrats in both state houses. Past research has also shown that regulators are responsive to local political conditions (Scholz, Twombly, and Headrick 1991; Scholz and Wei 1986; but see Huber 2007). Given that minorities tend to live in more Democratic areas, and state governments led by Democrats tend to pursue more enforcement, it is important to control for any local political effects, which we do with *Percent Democratic Vote*, which is the county-level percentage of the 2000 presidential vote for the Democratic candidate.

Last, we include a set of firm-level controls to account for heterogeneity in compliance costs across firm types and for variation in the political costs that officers face in handling cases for different types of firms. First, firms with a recent agency-inspection history are more likely to assign a higher cost to future noncompliance. Therefore, we include two dichotomous inspection variables in the firm model that indicate whether it has been inspected in the prior year, *State Inspection* and *Federal Inspection*. Moreover, regulatory officers will be more likely to incur greater political costs for failing to detect a prior noncompliant firm. Therefore, in the regulatory detection model, we include two dichotomous enforcement actions variables that indicate whether the firm has been punished with at least one enforcement action in the prior year, *State Enforcement Action* and *Federal Enforcement Action.*

We also include three firm-level dummy variables reflecting a facility's industrial classification code: *Manufacturing, Utilities*, and *Transportation*. Last, we also included a firm-level variable reflecting the level of pollution generated by the regulated entity. This variable, *Major Source*, is a dummy variable that is coded one if the firm is classified as a major source of air pollution (generally greater than 100 tons per year) and zero if it is not.

Empirical Results

Before describing the results from estimating the DCE model, it is important to recall that the model consists of two sets of estimated parameters. For the first set, the firm model, positive coefficients reflect an increase in the probability of a firm being an HPV. For the second set, the detection model, positive coefficients reflect an increase in the probability of a firm

being detected as an HPV. In addition, it is important to note that the mean of the group-mobilization and signature authority variables are essentially zero. Accordingly, the parameters on the constituent terms, *Percentage of African American Population and Percentage of Hispanic Population*, represent the effect of either community demographic when both mobilization and signature authority are at their respective means.

The results are displayed in Table 1. Given space constraints, we focus our discussion on the variables of central theoretical interest. Across both the firm and detection models, the results are generally consistent with our expectations. The estimates from the firm model suggest that community demographics have statistically significant associations with a firm's HPV classification. Specifically, firms located in Hispanic communities and lower socioeconomic status communities are more likely to be noncompliant with the CAA. Firms located in African American communities, however, are not more likely to be major violators—a finding that cuts against our expectations and claims made by many environmental justice advocates. It is also worth noting that the coefficients on the Hispanic and class variables are of greater magnitude than those derived from a single-equation probit model, which highlights the problem of modeling compliance without taking into account the compliance bias inherent in the data.[8] (We present estimates from a probit model in Section 2 of the online appendix.)

The estimates in the detection model suggest that community demographics are also systematically associated with the likelihood of regulatory officers accurately detecting noncompliant firms. The percentage of Hispanics (but not African Americans) in a community and a community's socioeconomic class each have a statistically significant effect on regulatory officers' reliably detecting noncompliance. The results suggest that, on average, regulators are less likely to detect HPVs in these communities. Taking the results of both models together, we now have a clearer picture of the process behind disparities in environmental regulatory outputs. Relative to those located in more upper-class, non-Hispanic communities, firms are both more likely to be significant violators of the CAA and less likely to be characterized as such as by bureaucrats. This supports our expectations in both Hypothesis 1 and Hypothesis 2.

What of the ability to mitigate this pattern of bias via political mobilization? Recall that our expectation is that, in more mobilized communities, firms will face

greater costs associated with noncompliance, and bureaucrats will face greater costs associated with failing to detect noncompliance. To the extent that discriminatory patterns exist across community demographics, these patterns ought to be attenuated in the presence of actual political mobilization. The analysis is consistent with our expectations in Hypothesis 3. The interaction terms in both the firm and detection models suggest a diminishment of bias—that is, in the presence of mobilized, Hispanic communities, firms are less likely to be noncompliant, and bureaucrats are more likely to detect noncompliance.[9] (We would have expected an analogous effect in African American communities, but as noted above, the coefficient on the initial percentage African American variable does not suggest any baseline bias to attenuate.) This finding lends additional support to a widely held belief among scholars that political mobilization can effectively counter environmental inequities. The novelty of our findings, however, lies in demonstrating that political mobilization can alter not only *firms'* compliance decisions, but also *regulatory officers'* detection decisions.[10]

It also appears that the ability of political mobilization to mitigate this bias does not extend to other standard indicators of mobilization. We gathered data on both voter turnout from the 2000 Presidential election at the county level and the number of campaign donations made to candidates annually (2001–2004) at the zip-code level. When we estimate the effect of these indicators of political mobilization, neither successfully attenuates the compliance bias present in Hispanic neighborhoods—the coefficient on the interaction term is null in both cases. We suspect that voting and campaign donations represent diffuse mobilization across policy issues—too diffuse to alter the incentives of firms or regulatory officers in Hispanic communities. (These results are provided in Section 4, Table A.5 in the online appendix.)

Finally, the parameter estimate on the *Signature Authority* interaction term is consistent with our last hypothesis that institutional structures alter regulatory officers' incentives to detect noncompliance.

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[8]Moreover, with a single equation, the analyst must decide whether to interpret an effect as influencing compliance or detection.

[9]Our mobilization measure primarily reflects groups representing persons of color and may be a less valid measure of mobilization around class issues. Including a multiplicative interaction term between mobilization and class yields a null coefficient.

[10]Our results are also robust to alternative specifications of group mobilization. Specifically, we used a simple count of environmental justice groups, and differentiated between groups focused on African American and Hispanic issues when creating our interaction terms. These results are reported in the online appendix (Section 3, Table A.4).

TABLE 1 **High Priority Violator Status for Individual Regulated Firms**

	HPV Status			
	Bivariate Probit, with Partial Observability			
	Firm Model Pr(Observing HPV)		Detection Model Pr(Detection)	
	b	s.e. b	b	s.e. b
Environmental Justice Indicators				
% African American	0.0002	0.0010	0.0003	0.0013
% Hispanic	0.0069***	0.0011	-0.0069***	0.0014
Class	-0.0632**	0.0254	0.0635**	0.0320
Mobilization	0.1011**	0.0402	-0.0962*	0.0494
Mobilization X African American	-0.0011	0.0008	0.0008	0.0009
Mobilization X Hispanic	-0.0024***	0.0007	0.0022**	0.0009
Signature Authority	—	—	-0.0216***	0.0054
Sig. Authority X African American	—	—	0.0000	0.0002
Sig. Authority X Hispanic	—	—	0.0008***	0.0002
Policy Task Factor Indicators				
Regional Scale	0.0003***	0.0001	-0.0001	0.0001
Policy Entropy	-0.0474	0.0282	0.0860**	0.0351
Nonattainment	0.0994***	0.0431	-0.0634	0.0535
Economic Context Indicators				
Unemployment	0.0850	0.0117	-0.0761***	0.0143
% Income Air Pollution Industry	0.0076	0.0041	-0.0060	0.0049
Political Context Indicators				
Democratic Governor	-0.1617***	0.0302	0.1584***	0.0396
% Democratic in State Legislature	-0.0012	0.0013	0.0006	0.0017
% Democratic Vote	-0.0095***	0.0015	0.0080***	0.0018
Firm-Level Factors				
State Inspection (1 Year Lag)	0.1759***	0.0258	—	—
Feb Inspection (1 Year Lag)	-0.0341	0.0219	—	—
State Enforcement Action (1 Year Lag)	—	—	5.4527***	0.5632
Feb Enforcement Action (1 Year Lag)	—	—	1.2510***	0.2173
Manufacturing Firm	0.0148	0.0402	0.0913*	0.0551
Utility Firm	0.0073	0.0476	-0.0621	0.0570
Transportation Firm	0.0234	0.1167	-0.0583	0.1368
Major Source	0.6429***	0.0344	-0.2262**	0.0984
Year Dummy (2002)	-0.1832***	0.0373	0.2145***	0.0503
Year Dummy (2003)	-0.1932***	0.0392	0.1815***	0.0503
Year Dummy (2004)	-0.2502***	0.0388	0.2185***	0.0499
Intercept	-1.1353***	0.1032	0.5389*	0.2785
rho			-0.867**	
Log-Likelihood			-27858.16	
χ^2			(49) 1241.56***	
Number of Cases			153580	

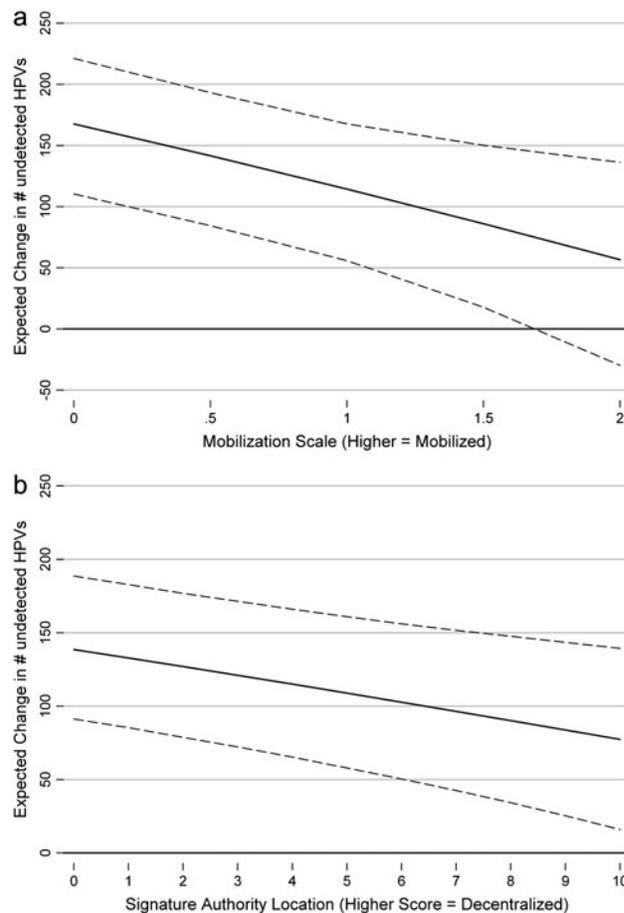*Note:* *$p < .10$, **$p < .05$, ***$p < .01$, two-tailed test. Standard errors clustered on firm.

The results suggest a statistically significant interaction between percentage of Hispanic residents in a community and the location of enforcement authority. When this authority rests with field officers, while a certain degree of failed detection still exists, field officers are less sensitive to whether a community is Hispanic. In other words, the detection of noncompliance is relatively flat across levels of Hispanic communities. However, when enforcement authority is centralized near the top of the agency's chain of command, a different type of pressure arises. For these high-level managers, the detection of noncompliance wanes in the presence of an increasingly more Hispanic community. This relationship is consistent with our argument that bureaucrats near the top of the agency's structure feel greater pressure for their agency to perform well (i.e., produce high compliance) and as such are more sensitive to registering noncompliance in heavily Hispanic communities. It is worth noting that this relationship is not conditional on party control of the governor's office. In models not reported, we included a three-way interaction term—*Democratic Governor X Signature Authority X % Hispanic* (and similarly for *% African-American*)—but the coefficient was not statistically significant, suggesting that high-level bureaucrats' compliance determinations are not conditioned by executive political control. This is consistent with the idea that high-level managers, across political contexts, worry about maintaining a positive image of their agency.

Figure 1 better demonstrates the substantive effects of these findings. Each of the panels display the marginal effect of a 10% increase in the percentage of the population that is Hispanic in a zip code on the joint probability of observing a noncompliant, undetected firm.[11] The top panel displays the marginal effect of Hispanic across the mobilization scale, while the lower panel displays the effect across the signature authority scale.[12]

FIGURE 1   **Effect of Percent Hispanic on Undetected HPVs across Mobilization and Signature Authority**

Note: Dashed lines represent 95% confidence intervals for marginal effect.

The top panel of Figure 1 shows that regulatory officers respond to Hispanic communities differently, conditioned on whether those communities are more mobilized around environmental justice concerns. In fact, the number of undetected noncompliant firms (nationwide) can decrease from a high of approximately 150 in the absence of mobilized communities to nearly 50 in the presence of highly mobilized ones. A decrease of 100 HPVs nationally may appear to some to be a diminutive effect, but the presence of a single HPV can be quite impactful for the surrounding community. Direct mobilization of at-risk communities is not the only incentive mechanism that affects regulator decision making. The lower panel suggests that the location of signature authority within an agency is a powerful incentive device as well. While all agency bureaucrats engage in some amount of failed detection (i.e., the expected number

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[11]The substantive effect that we report is the change in the unconditional joint probability of observing a noncompliant firm, that is likely to have gone undetected, or $\Pr(y_1 = 1, y_2 = 0) = \Phi(x_1\beta_1) - \Phi_2(x_1\beta_1, x_2\beta_2, \rho)$ multiplies by the total number of firms for whom the condition is reasonable (see next note for explanation).

[12]The figures were created by estimating the mean expected probability and associated standard errors from 10,000 draws off of the variance-covariance matrix. To display a substantively interesting outcome, we multiplied the marginal probability for a given condition by the nationwide subset of the firm population for whom an additional 10% Hispanic gain is reasonable (approximately 18%, or 6,913 firms for our data). This calculation produced the expected change in the number of undetected noncompliant firms across the United States.

of undetected noncompliant firms is positive over the entire range of signature authority), those officers nearer the top of an agency's chain of command succumb to an additional disincentive to code noncompliance. At the extreme, in the presence of a more Hispanic community, when decision making over enforcement rests with high-level bureaucrats, nearly 140 noncompliant HPVs will go undetected compared to 80 when such authority rests with field officers. We believe that this is due to high-level bureaucrats being more likely to engage in organizational cheating in the presence of a community that is less politically mobilized and therefore less likely or able to engage in fire-alarm oversight.[13]

The relative impact of the mobilization and signature authority variables on the joint probability of observing an undetected violating firm compares reasonably well with other variables in the model. For example, having a Democratic governor decreases the number of undetected violators by an estimated 290 firms, nationally. This suggests that the greatest impact of mobilization or signature authority ($\sim$150) is nearly half the magnitude of changing the party of the governor's office. Another factor, local-level partisan representation, also motivates firms and regulators. An increase of a standard deviation (about 14 points) above the average percent of the Democratic county vote in the 2000 presidential election (around 46%), decreases the number of undetected violators by an estimated 200 firms, nationally. These results are consistent with long-held findings in the literature that central and local partisan actors shape policy delivery (Scholz and Wei 1986). But, our analysis reveals two alternate and meaningful pathways to influence community compliance bias—one emphasizing community empowerment and political mobilization and the other emphasizing regulatory officers' incentives structures via creative-agency design features.

Discussion and Conclusion

Democratic governments continue to wrestle with shortfalls in equitable policy delivery. Examining the occurrence of such shortfalls has been a central focus of scholars and practitioners alike. In this article, we

focused on one area, environmental policy, for which research has failed to arrive at a consensus on the causal process that generates bias in regulatory outcomes. We have attempted to move this discussion in a different direction—one that considers the incentives of both firms and regulatory officers making decisions about compliance.

Our argument suggests that disparities in U.S. environmental policy outcomes are rooted in the incentives facing both firms and the bureaucrats tasked with implementation. Although past research has recognized the dual production of compliance bias, we offered a novel theoretical account focusing on the incentives of bureaucrats to code firm compliance status. This approach enabled us to then show how decisions change in the presence of variation in these incentives. We demonstrated that when communities overcome collective action problems, bureaucrats will dedicate more resources to the firms in their areas. We also showed that agency design can accentuate bias in compliance decisions. High-ranking bureaucrats have an incentive to overreport compliance rates, since these rates are used as indicators of agency performance by external stakeholders. Because these bureaucrats are less likely to get caught engaging in this behavior when communities have fewer political resources to detect it, the outcome is likely to further disadvantage poor and minority communities since they tend to lack these resources.

An unanticipated finding is that the bias revealed from our analysis pertains to poor and Hispanic communities, but not African American ones. It is worth noting that this result would have been masked had we just considered minorities collectively, which is often done in the literature. What might explain this pattern, and particularly the lack of bias in firm and regulatory compliance decisions toward firms located in African American communities? The simplest interpretation, of course, is that there is no systematic bias. Although this runs counter to claims made in the literature (e.g., Bryant 1995; Bullard 1993), it would be welcome news for these communities which past work has found to be subject to disproportionate environmental burdens (Ringquist 2005). It may also reflect the time period analyzed. Our analysis was limited to 2001–2004, and by this time, the environmental justice movement was quite mature in many African American communities, and firms and regulators alike may have factored in the costs of committing major violations and failing to detect noncompliance, respectively. In other words, advocacy in these communities may have paid considerable dividends by the time of our study. For Hispanics, however, the results

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[13]We also considered the possibility that mobilized groups might change the decision calculus for upper-level bureaucrats. We examined whether a three-way interaction was present between Hispanic community, mobilization, and signature authority, but the coefficient was not statistically significant.

suggest a more traditional story of environmental disparities. Firms in these communities are not only more likely to be significant violators of their CAA obligations, but they are less likely to be designated as such by regulatory officers.

There are several additional implications of our study. While our findings suggest that substantial disparities in compliance outcomes exist, they also suggest the possibility that patterns of bias stem from the decision-making structures of regulatory officers, not necessarily from intentional discrimination. This by no means discounts the importance of the disparate outcomes, but it does suggest that the source of bias need not rest with deliberate prejudice, but with bureaucrats' rational responses to their resource constraints. In other words, biased outcomes are possible, indeed probable, even in the absence of explicit discrimination.

Our results also offer a cautionary note on goal displacement. Political principals can use various performance measures to determine agency "success." However, in certain contexts, indicators such as compliance rates may present perverse incentives to regulatory officers. Our analysis suggests that when bureaucrats face such perverse incentives, they may substitute the appearance of successful policy delivery for equitable policy delivery. Assessing the way in which such indicators incentivize regulatory officers is essential for any effort to reducing compliance bias. Given the increasing prevalence of performance measurement at all levels of government, the potential implications of this type of goal displacement on equitable policy implementation likely extends into many different areas of public policy.

Last, our study reveals evidence of multiple ways that class- and race-based disparities could be redressed. Communities could be empowered through capacity-building efforts. Such efforts designed to help poor and minority areas organize around issues of environmental protection will produce a demand for more equitable treatment from government and put direct pressure on firms to improve their performance. Second, our results suggest that changes to the institutional decision-making structure of the agencies responsible for implementing policy would also be effective. Specifically, our analysis suggests that decentralizing authority to regulatory officers in agencies could result in fewer cases of deliberate nondetection of compliance. That is, moving the location of compliance determinations away from high-ranking officials with incentives to overreport compliance may result in fairer—although not necessarily fair—treatment of communities hosting regulated firms.

Acknowledgments

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