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Occupational Safety and Health Enforcement and Labor Union Strength

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Abstract: A sample selection model is used to examine how labor union strength, both in state politics and at inspected business establishments, affects the enforcement of U.S. occupational safety and health (OSH) codes. Unionized workplaces but not statewide labor strength are associated with higher fines. However, the positive effect of unionized workplaces on fines for occupational safety and health violations is substantially smaller than that of state political conditions, and in fact is only significant when interacting with state political conditions. Organized labor has less effect on OSH enforcement than do sympathetic politicians. Interest groups that are more vigorous than labor may have a stronger impact on regulatory enforcement both in the field and in state capitals.

Keywords: occupational safety and health; regulatory enforcement; labor unions; state politics; political sociology

INTRODUCTION

Many quantitative studies have examined the influence of state or national politicians and interest groups on regulation (Badaracco, 1985; Brickman, Jasanoff, & Ilgen, 1985; Hedge, 1993; Hedge & Scicchitano, 1994; Kagan, 2001; Kim, 2008; Moe, 1985, 1989; Scholz & Wei, 1986; Vike, 2007; Vogel, 1986; Weingast & Moran, 1983; Wood & Waterman, 1994). Fewer have attended to interest-group influence at inspection sites (Gormley, 1998; Weil, 1991), although a tradition of qualitative research has focused on inspectors in the field as key decision makers in enforcement outcomes (Cranston, 1979; Hawkins, 1984; Hutter, 1989, 1999; Lloyd-Bostock, 1988; Richardson, Oigus, & Burrows, 1982). This paper looks at both the micro and macro level: it investigates how both labor union presence at inspected business establishments and statewide labor union strength correspond to the enforcement of occupational safety and health codes by the U.S. Occupational Safety and Health Administration (OSHA).

The goal of this paper is to investigate whether interest groups exercise more influence on regulatory enforcement through their presence at inspected establishments or in state government and politics, and also whether such groups' statewide political influence affects the strength of their influence at inspected establishments. OSHA is highly suitable for an examination of the channels through which interest groups affect regulatory enforcement since its traditional interest group ally, organized labor, can have contact with the agency in a variety of settings: in inspected workplaces, in area offices around the country, and at OSHA national headquarters. By examining the effects of establishment-specific and statewide labor presence on OSHA enforcement, it is possible to gain insight into whether interest groups might exercise

greater influence through contact with inspectors and other "street-level bureaucrats" (Lipsky, 1980) or through influence with state political leadership; and whether statewide influence can enhance establishment-specific influence.

Literature Review

OSHA has been described as a quintessentially inflexible agency that limits field agents' discretion and mandates that they enforce occupational safety and health codes "by the book" (Bardach & Kagan, 1982; Brickman et al., 1985; Lloyd-Bostock, 1988; Vogel, 1986). However, most quantitative studies of influences on OSHA enforcement have found that labor union or Democratic Party strength is associated with more aggressive OSHA enforcement (Kim, 2008; Scholz & Wei, 1986; Thompson & Scicchitano, 1985; but see Marvel, 1982). Scholz, Twombly, and Headrick (1991) examined how OSHA enforcement varied with the political allegiances of county-level as well as state and federal politicians, but similarly found a positive effect for Democratic Party strength.

Scholz et al. (1991) suggested that local politicians may work with labor leaders and OSHA to address health and safety problems or crack down on troublesome employers. If this is the case, then OSHA area offices are likely to seek good relations with union leaders in order to gain or maintain such informal implementation and leadership resources. Inasmuch as such informal, locally relevant resources are less reliably available than formal, officially provided resources, OSHA leaders may even expend more effort to obtain the former (Scholz et al., 1991; Scholz & Wei, 1986). Hodge and Scicchitano (1994) describe Scholz and Wei's (1986) findings that Democrat-dominated states experience more aggressive OSHA enforcement as an example of "legislative freelancing," in

which Congresspersons rely on interested constituents to monitor agency behavior and intervene in response to specific complaints.

Unlike these researchers, Huber (2007) concluded that neither state nor national political pressures have consistently affected OSHA enforcement, including staffing decisions, the targeting of inspections, inspector productivity, and inspector punitiveness. He theorized that because of the highly contentious political environment in which OSHA operates, agency personnel must avoid accusations of favoritism. Accordingly, OSHA has adopted a regulatory approach that discriminates among businesses on the basis of task-specific variables such as firm size, danger in an industry, and firm compliance history, but not local political conditions. Huber accounted for the discrepancies between his findings and those of previous researchers by arguing that during the years covered by Scholz and Wei's (1986) data, states that elected more liberal politicians also tended to have more dangerous manufacturing industries, which provoked OSHA to impose more citations and higher fines. Similarly, covariation between political and economic changes led Scholz et al. (1991) to overemphasize the effects of local politics on regulation.

Huber's overall conclusion that OSHA does not tailor its enforcement to local political conditions needs to be qualified in one way. Union employees were at least as likely to participate in inspections in conservative or Republican areas as in liberal or Democratic areas; by contrast, nonunion employees were less likely to participate in conservative or Republican areas. This is noteworthy because Huber found employee participation to be positively related to inspector punitiveness. Therefore, unionization might promote aggressive regulatory enforcement by

increasing employee participation in inspections.

Huber's findings indicated that this was the only mechanism whereby unionized workplaces might promote inspector punitiveness, since unionized workplaces had no effect when controlling for employee participation in inspections. By contrast, Weil (1991) concluded that not only were unionized workplaces inspected more thoroughly because of employees' exercising their "walkaround" rights, but also unionized workplaces were more likely to be inspected, and inspections of unionized workplaces generated more violations and higher penalties. An interesting characteristic of both Huber's and Weil's studies is that their empirical investigations mainly treat individual inspections as the unit of analysis, which puts the theoretical emphasis on decisions that are ultimately made by inspectors and the people with whom they interact. Most quantitative analyses of OSHA enforcement by political scientists focus on relationships between national or area office leadership and politicians or interest-group leaders. Yet attending to the decisions taken by inspectors in the field may be warranted. A number of qualitative studies from the field of law and society scholarship suggest that decisions made by inspectors in the field critically shape the implementation of regulatory law (Cranston, 1979; Hawkins, 1984; Hutter, 1989, 1999; Lloyd-Bostock, 1988; Richardson, Ogun, & Burrows, 1982).

Theory and Hypotheses

Labor unions have been one of the principal interest groups seeking to affect OSHA policy and enforcement since the agency's founding; they have certainly been the most consistent voice calling for more aggressive enforcement of safety and health codes. Moreover, one can plausibly hypothesize that they interact both with

OSHA area office leadership and with OSHA compliance safety and health officers (CSHOs) in the workplace. Therefore, this paper focuses on labor unions as the primary institutions seeking to influence OSHA.

As noted above, most research has concluded that state-level and other subnational political influences affect the work of national regulatory agencies. However, Huber's (2007) study cannot be ignored. It stands out for its thoroughness; in particular, Huber paid attention not only to the political and economic conditions that have been the primary focus of other researchers (Kim, 2008; Scholz, Twombly, & Headrick, 1991; Scholz & Wei, 1986; Thompson & Scicchitano, 1985), but also to characteristics of inspections and business establishments as variables affecting inspection outcomes. Because of these considerations, it is not unreasonable to expect that statewide union strength will have little impact on OSHA enforcement. All in all, however, it is probably best to begin with the more conventional assumption that greater labor union strength in state politics will be positively related to regulatory punitiveness. Specifically, in states where a larger proportion of the workforce belongs to labor unions and where unions have more power, unions should be able to more successfully press leadership in OSHA area offices for aggressive enforcement.

Hypothesis 1: States where labor unions are more influential will have more aggressive regulatory enforcement of occupational safety and health codes.

Although researchers may disagree about how unionization in the workplace affects OSHA enforcement, they basically agree that unionized business establishments experience more aggressive enforcement (Huber, 2007; Weil, 1991). Accordingly, the

second hypothesis reflects the conventional wisdom.

Hypothesis 2: Unionized business establishments will have more aggressive regulatory enforcement.

Huber (2007) did not directly estimate whether the effect of employee participation on inspection outcomes differs significantly among different political units. However, his finding that nonunion employees in more conservative or Republican areas were less likely to participate in inspections suggests that the effects of unions in promoting aggressive regulation should actually be greater where unions are weaker overall, inasmuch as employee participation facilitates the discovery of violations and the imposition of higher fines. By contrast, Weil's (1991) view that unions promote regulatory severity in ways that include but are not limited to encouraging employee participation would be more consistent with the theory that CSHOs receive more encouragement at unionized workplaces, and that such encouragement may be more forthcoming where unions are more influential. In this case, the effect of unionized workplaces on regulatory severity would be greater in pronunion areas. Therefore, it is hard to predict how the overall strength of labor unions in a state might change the impact of unionized workplaces on OSHA enforcement. To start, however, one can reasonably suppose that the effects of union establishments will be greater in states with a stronger union presence.

Hypothesis 3: The effect of unionized business establishments on enforcement will be greater in states where unions wield more influence.

Together, these three hypotheses reflect a view of regulation as being highly affected by political influences. Falsification of one or more hypotheses will indicate that such an understanding must be modified

somehow. For example, a finding that a positive effect of unionized workplaces on regulatory severity has no interaction with a similarly positive effect of state union strength would indicate that the effects of unionized workplaces and state politics are independent of one another. This could support a modified view of Huber's work that unionized workplaces affect CSHOs by providing not influence but information: facilitating the discovery of violations, not encouraging CSHOs to enforce regulations more severely. Different results may indicate that enforcement needs to be understood in ways that have not received extensive consideration as yet.

DATA AND METHODS

Data Sources and Variables

The basic research strategy of this paper is to observe first the influence of a variable indicating establishment-specific union presence on OSHA enforcement, and then the influence of a variable measuring state union strength; and then, to observe whether and how the effects of these variables change when both are included in the same model. If both establishment-specific and statewide union strength effects are apparent, an interaction term for statewide union strength and unionized establishment will be introduced.

The overall level of union membership in a state may not accurately measure the influence of those unions in industries on which OSHA focuses, since OSHA pays particular attention to more dangerous industries. Therefore, this study focuses on inspections of manufacturing workplaces (SIC Division D). Such workplaces receive extensive attention from OSHA, and unionization data specific to the manufacturing sector is readily available. Observations were taken from a comprehensive list of inspection records in OSHA's Integrated Management

Information System (IMIS) database. All available observations in SIC Division D from 1989 through 1994 were used, subject to limitations that resulted from lack of data for other variables. Except where noted, data for inspection-specific variables came from the IMIS database.

The age of these data may be seen as a problem, especially since in the mid-1990s OSHA adopted a regulatory strategy that was more focused on cooperative inclination than aggressive adversarialism (Vike, 2007). In another regard, however, these data may be better than more recent data for examining the ability of interest groups to affect OSHA enforcement, because they come from a time when labor unions were somewhat stronger and when OSHA was more receptive to calls for aggressive regulation. With more recent data, there is a greater risk of understating the potential of labor unions or other pro-regulation groups to affect the enforcement of occupational safety and health. Moreover, although OSHA's overall approach to regulation has changed over the years, labor groups have been consistent in their calls for more aggressive regulation, and any influence that they had in the early 1990s should not differ in kind from influence that they wield today.

Previous studies of OSHA enforcement have employed multiple dependent variables, including number of inspections, number of citations, and dollar amount of fines (Huber, 2007; Marvel, 1982; Scholz et al., 1991; Scholz & Wei, 1986; Thompson & Scicchitano, 1985; Weil, 1991). Here, however, the only dependent variable is *fine per inspection*, adjusted for inflation. This is because the main concern of this paper is to compare the effect of union leadership within a state to that of union presence in inspected workplaces, and the imposition of citations and fines are the only enforcement decisions that can be made at inspected workplaces as well as at area offices.

Fine per inspection indicates the regulatory approach of the CSHOs and their superiors (i.e., toward greater or less severity). However, it also reflects the physical conditions of the inspected workplace. So that *fine per inspection* has more validity as an indicator of regulatory approach, the models of principal interest here will include the number of *other*, *serious*, and *willful / repeat citations imposed per inspection*.¹ Including citations in these models presents a disadvantage inasmuch as the number of *citations per inspection* reflects not only the physical characteristics of inspected workplaces but also CSHO discretion (Lloyd-Bostock, 1988). Controlling for *citations per inspection* results in overly conservative models because it shuts off a mechanism through which enforcement strategy is effected. Against these disadvantages, however, is the advantage of more thoroughly controlling for workplace conditions, and this consideration seems more important.

Another independent variable is the statewide *injury and illness rate* for the industry of the inspected establishment. CSHOs should enforce regulations more vigorously when the *injury and illness rate* indicates more safety problems (Scholz & Wei, 1986). Data for this variable came from the Survey of Occupational Injuries and Illnesses (SOII). State data from the SOII had to be obtained from state labor departments, but many states did not have these data for 1989–94. To obtain a larger sample size, state SOII data from the years 1997 through 2002 were substituted for those state-year combinations that were missing 1989–94 data. Statistical analysis suggested that this substitution would not unduly bias the results.²

Size of the inspected establishment, as indicated by the number of employees, is also included. Cranston (1979) found that

regulators believed that larger businesses needed severer penalties. On the other hand, Lynxwiler, Shover, and Clelland (1984) suggested that once the number of violations is taken into account, fines may be lower for larger establishments. Because of privacy concerns, OSHA did not provide the exact number of employees for each inspected establishment. Dummy variables are used instead, with the reference category being establishments with 1 to 10 employees.

Dummy variables indicating the *industry of the inspected establishment*, as indicated by the establishment's two-digit SIC code, are included as a proxy for the physical characteristics of the inspected workplace (McCaffrey, 1983), which may influence CSHO decisions in ways not fully captured by *citations per inspection*. A dummy for *post-accident inspections* is included because inspections prompted by an accident should generate higher fines (Hutter & Lloyd-Bostock, 1990; Lloyd-Bostock, 1992). Another dummy, *complaint / referral inspection*, indicates whether an inspection was prompted by a complaint or referral, because attention from external third parties, even in the absence of an accident, may generate pressure to regulate more stringently. Finally, *union establishment* is a dummy that indicates whether an inspected establishment was unionized. As explained above, it is expected that fines will be higher at unionized establishments.

Presidential administrations have a large impact on federal agencies (Moe, 1985; Scholz et al., 1991; Scholz & Wei, 1986; Vike, 2007; Wood & Waterman, 1994). Also relevant is a 1990 amendment to the Occupational Safety and Health Act (OSH Act), which established OSHA, that increased the ceiling on fines sevenfold. The impact of these variables, and any temporal changes not otherwise included in the models, is controlled through the inclusion

of dummy variables for *year* (reference year is 1989).

Statewide political conditions are captured with five variables. All are expected to be positively associated with *fine per inspection* (Hedge, 1993; Scholz et al., 1991; Scholz & Wei, 1986; Thompson & Scicchitano, 1985). *Statewide rate of unionization* in the manufacturing sector is the state political variable of principal interest here; it is used as a measure of union strength, following Thompson and Scicchitano (1985) and Kim (2008). Data came from the Web site www.unionstats.com (September 23, 2011). This variable was calculated for each state by dividing the number of union members in private manufacturing by the total number of employees in the private workforce, not by the total number of employees in private manufacturing. The resulting quotient reflects both the extent to which private manufacturing was unionized and the size of the manufacturing sector; consequently, it should indicate not only the power of labor unions in each state's manufacturing sector but also the importance of the manufacturing sector in each state's overall economy. This quotient was multiplied by 1,000 to scale it.

The remaining four political variables indicate the proportions of politicians in different institutions of government who can be expected to support regulatory severity. *Pro-labor Senators* is an ideological index of U.S. Senators, calculated from the ratings given by the U.S. Chamber of Commerce and the AFL-CIO for U.S. Congresspersons. For any given state, the rating for the Senator with the more pro-labor record is given, on the expectation that unions will attempt to work with and through their more sympathetic Senator. Because Congress is often thought to influence regulatory agencies through Congressional committees (Hedge, 1993; Hedge & Scicchitano, 1994; Weingast & Moran, 1983), a dummy is

included that indicates whether a state had for specific years at least one Congressperson on an *oversight* committee concerned with labor issues. *Percent Democrats in state legislature* refers to the proportion of state legislative seats occupied by Democrats. *Democratic governor* is the number of years for which the governorship in a state is controlled by Democrats. Data for these four variables came from Congressional Quarterly's publication *Politics in America*.

A dummy variable indicates whether an inspection was conducted under the auspices of federal OSHA or one of the twenty-three *state plans* active in 1989–94.³ This controls for any overall difference in regulatory approach between state governments and the federal U.S. government. Finally, the models include dummy variables representing *states*, in order to control for otherwise unmeasured state characteristics, such as state per capita income and state unemployment rate (Thompson & Scicchitano, 1985). The inclusion of the *state* dummies was feasible because of the very large size of the data set, over 100,000 observations.

It would have been preferable to include the universe of 1989–94 inspections for SIC Division D. However, because of missing data for *injury and illness rate* and *Democrats in state legislature*, the states of Colorado, Idaho, Mississippi, Nebraska, New Hampshire, North Dakota, Ohio, Pennsylvania, and South Dakota are excluded from these analyses. The lack of the major manufacturing states of Ohio and Pennsylvania is regrettable but should not be critical, given that the data do include such manufacturing states as Indiana, Illinois, Michigan, North Carolina, New York, and Wisconsin. Otherwise, the major absence in the data is of the Great Plains states. These are generally smaller states with largely

agricultural economies, and their loss should be less consequential.

Statistical Issues and Methods

Fine per inspection is highly non-normally distributed, with a large number of zero values and an extreme rightward skew. Because of the large number of zero values, the data can be treated as censored; that is, information about the dependent variable is limited (Long, 1997). The basic model for dealing with censored data is a tobit model. However, tobit models are based on the assumption that the censoring mechanism is the same as the data generating process. Two-part models relax this assumption by employing one model to estimate the probability that values of the latent dependent variable, y , will be observed and another model to predict values of y in excess of the censoring threshold (Cameron & Trivedi, 2005; Cragg, 1971; Heckman, 1979). In the present analysis, a logit or probit model could estimate the probability of a nonzero fine (zero dollars being the censoring threshold with which this analysis is concerned), and a linear model could estimate those nonzero fines. However, two-part models do not account for the fact that even after modeling the participation process, observations with values above the censoring threshold are likely to constitute a nonrandom sample of the universe of y , leading to selection bias. Sample selection models, such as a Heckman selection model, correct for this bias. Like the two-part model, the Heckman model employs one model (called a participation equation) to estimate the probability of observing values of y and a second model (called an outcome equation) to estimate y ; however, it additionally models the dependence of the outcome equation on the participation equation. The Heckman selection model incorporates the correlation in error terms of the participation and outcome equations; the

two-part model ignores such correlation, effectively treating it as being equivalent to 0 (Cameron & Trivedi, 2005; Heckman, 1979). Accordingly, this paper employs a Heckman selection model, since it depends on the fewest assumptions about the distribution of the data and the data generating processes at work.

While it is true that fines were never imposed in the absence of any citations for OSHA violations, it is also true that CSHOs could cite employers without fining them. Inspections with at least one *citation* but with *fine* equal to 0 constitute 17 percent of this data set. Therefore, it would not necessarily be adequate to include only the three *citation* variables as independent variables in the participation model. Theoretically, any of the possible independent variables described in the previous section could affect the probability of observing a nonzero value for *fine per inspection* as well as affecting the size of *fine*. In a preliminary logit model, including all independent variables reduced the log-likelihood to -14,101.351 from -17,545.163 for a model with only the three *citation* variables. This suggested that including the full set of independent variables in both the participation and outcome equations was justified.

Preliminary analysis indicated that the linear outcome model was heteroscedastic, mainly because the variance of *fine per inspection* increased along with values of *other*, *serious*, and *willful / repeat citations per inspection*. In order to reduce this heteroscedasticity, the *fine* and *citations* variables were root transformed (Fox, 1991); specifically, the tenth root for each these variables was obtained, and each root was then multiplied by ten to facilitate convergence of the models. Visual inspection of residual-versus-fitted plots for the outcome model indicated that the heteroscedasticity had

been satisfactorily reduced. However, in order to make the dependent variable more interpretable, the natural log was substituted for the multiplied tenth root of *fine*. Comparing models revealed that this substitution did not change the theoretically key relationships between fines and measures of union strength; neither did the residual-versus-fitted plot evidence heteroscedasticity with the natural log of *fine* as the dependent variable.

As a check that using a Heckman selection model was appropriate, the AIC for the Heckman model was compared to the AIC for a tobit and a two-part model. The AIC for the Heckman selection model was 253,811.4, which was slightly smaller than the AIC for the two-part model (254,436). The tobit model yielded an AIC of 226,069.6, indicating a better fit than the Heckman model. However, as described above the Heckman model requires fewer assumptions. In addition, the coefficients derived from the tobit model were identical to those derived from the outcome equation of the Heckman model in terms of significance at conventional levels and direction of relationship (positive or negative). Therefore, it is the results from

the Heckman selection model that are presented in this paper.

The basic model yields reasonably accurate predictions of the dependent variable. When the predicted values of logged *fines* were transformed back into their original metrics (Cameron & Trivedi, 2005), they exhibited a 0.38 correlation with actually observed nonzero values of *fine per inspection*. The participation equation is still more successful, with the predicted probabilities of nonzero values for *fine per inspection* exhibiting a 0.94 correlation with observed nonzero values. The rho coefficient, indicating the extent of interdependence between the participation and outcome equations, is 0.634, which supports the idea that the selection process substantially affects the outcomes.

All non-dummy variables are centered on their means to facilitate interpretation of the intercepts when continuous variables are at their means and dummy variables have their reference-category values. Coefficients for the dummies then represent adjustments to the intercepts. Coefficients for all independent variables indicate how much deviations from each independent variable's mean alter the predicted values of the dependent variable.

Analysis and Results

Table 1 presents the distribution of the variables used in the analyses, prior to any variable transformations. The statistics for *fine per inspection* and *citations* are noteworthy in that they indicate these variables' highly skewed nature. Most OSHA inspections result in no or a small number of citations and low fines; however, a few, such as the investigation following the Texas City refinery explosion (Greenhouse, 2009), may uncover many violations and generate fines of over a million dollars.

Table 2 presents the effects of *union establishment* and *statewide unionization rate* on *fine per inspection* both individually and together. Column (1) presents the logit odds of a fine from the participation equation, and column (2) presents the linear effect of the variables on *fine per inspection*. *Union establishment* and *statewide unionization rate* both negatively affect the probability of a nonzero *fine*. *Union establishment* has a positive linear effect on *fine*, but the linear coefficient for *statewide unionization rate* is nonsignificant. The interaction effect between *union*

establishment and *unionization rate* is positive in both the participation and

Table 1. Distribution of Variables (N=139,418)

	Mean	S. D.	Min	Max	Percentage of Is
<u>CONTINUOUS VARIABLES</u>					
Fine per Inspection	2,624.953	39,591.14	0	7,424,524	
Other Citations	2.685	3.956	0	155	
Serious Citations	2.903	5.202	0	263	
Willful / Repeat Citations	0.193	2.974	0	566	
Injury and Illness Rate	13.601	5.819	0.8	61.8	
Statewide Unionization Rate	51.607	32.440	2.286	134.464	
Pro-Labor Senators	38.386	45.375	-100	92	
Democrats in State Legislature	60.171	10.599	29	91	
<u>DUMMY VARIABLES</u>					
Union Establishment					24.34
State Plan Inspection					62.80
Post-Accident Inspection					6.22
Complaint / Referral Inspection					37.38
Congressional Oversight Committee					75.73
Democratic Governor					55.66
Size of Inspected Establishment					
			11 – 20 Employees		15.93
			21 – 50 Employees		22.57
			51 – 100 Employees		14.56
			101 – 250 Employees		14.74
			251 – 500 Employees		6.91
			501 – 1,000 Employees		3.65
			Over 1,000 Employees		4.11
Year					
				1990	18.07
				1991	18.14
				1992	17.24
				1993	15.61
				1994	15.60

outcome equations; however, it is only significant at $\alpha = .05$, which is unimpressive given the large N . Furthermore, adding the interaction to the model only increases the log-likelihood to -126,729.7 from -126,733.7, which is not a statistically significant increase at conventional levels. The reasons to further examine the interaction are not compelling.

Table 3 presents a model with no interaction but with both *union*

establishment and *statewide unionization rate*, both for the full data set and for inspections conducted under state plan auspices. Most of the following discussion focuses on the model for the full data set, which is presented in columns (1) and (2).

For convenience' sake Table 3 presents neither the *industry of inspected establishment* dummies nor the *state* dummies, which are interesting only as control variables. The three *citations*

Table 2. Effects of Statewide Unionization Rate and Union Establishment on OSHA Fines per Inspection (Control Variables Not Shown)

Variable	Model 1		Model 2		Model 3		Model 4	
	Participation Equation (Logit) (D.V.: Pr(<i>Fine</i> =1)) (1)	Outcome Equation (Linear) (D.V.: ln(<i>Fine</i>)) (2)						
	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
Union Establishment	-0.079** (0.021)	0.067** (0.009)			-0.077** (0.021)	0.067** (0.009)	-0.113** (0.027)	0.049** (0.012)
Statewide Unionization Rate			-0.032** (0.002)	-0.0002 (0.0008)	-0.032** (0.002)	-0.0002 (0.0008)	-0.032** (0.002)	-0.0004 (0.0008)
Establishment*Unionization Rate							0.0012* (0.0006)	0.0005* (0.0002)
	N = 139,418	83,630	139,418	83,630	139,418	83,630	139,418	83,630

* = p < .05; ** = p < .01

Table 3. Effects of Statewide Unionization Rate and Union Establishment on OSHA Fines per Inspection (Control Variables Shown)

Variable	Model 1				Model 2			
	Participation		Outcome		Participation		Outcome	
	Equation		Equation		Equation		Equation	
	(All Inspections)		(All Inspections)		(State Plan Inspections)		(State Plan Inspections)	
	(D.V.: Pr(<i>Fine</i> = 1))		(D.V.: ln(<i>Fine</i>))		(D.V.: Pr(<i>Fine</i> = 1))		(D.V.: ln(<i>Fine</i>))	
	(1)		(2)		(3)		(4)	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Intercept	0.135	0.111	4.898**	0.045	0.353**	0.125	4.792**	0.059
Other Citations	0.110**	0.002	0.026**	0.001	0.128**	0.002	0.028**	0.001
Serious Citations	0.407**	0.002	0.239**	0.001	0.413**	0.003	0.219**	0.002
Willful / Repeat Citations	0.291**	0.004	0.157**	0.001	0.303**	0.004	0.148**	0.001
Injury and Illness Rate	0.011**	0.002	0.009**	0.001	0.028**	0.003	0.014**	0.002
<i>Size of Inspected Establishment</i>								
11 – 20 Employees	0.103**	0.027	0.110**	0.012	0.029	0.030	0.123**	0.016
21 – 50 Employees	0.129**	0.025	0.396**	0.011	0.068*	0.028	0.408**	0.015
51 – 100 Employees	0.092**	0.028	0.570**	0.012	0.025	0.033	0.574**	0.016
101 – 250 Employees	0.123**	0.029	0.779**	0.013	0.084*	0.033	0.808**	0.017
251 – 500 Employees	0.124**	0.036	0.892**	0.016	0.083	0.043	0.940**	0.022
501 – 1,000 Employees	0.196**	0.045	0.983**	0.021	0.188**	0.055	1.023**	0.029
Over 1,000 Employees	-0.217**	0.045	0.953**	0.022	0.057	0.056	1.082**	0.031
Post-Accident Inspection	0.395**	0.032	0.578**	0.014	0.417**	0.036	0.540**	0.017

Complaint / Referral Inspection	0.195**	0.018	0.161**	0.007	0.222**	0.022	0.194**	0.011
State Plan Inspection	0.519**	0.058	-0.313**	0.029				
Union Establishment	-0.077**	0.021	0.067**	0.009	-0.046	0.025	0.051**	0.013
Statewide Unionization Rate	-0.032**	0.002	-0.0002	0.0008	-0.046**	0.025	-0.008**	0.001
Oversight Committee	-0.102	0.074	0.098**	0.0026	-0.192	0.102	0.328**	0.039
Pro-Labor Senators	0.0064**	0.0004	0.0006**	0.0001	0.013**	0.001	0.0046**	0.0003
Democrats in State Legislature	0.009**	0.003	0.008**	0.001	-0.002	0.004	0.007**	0.002
Democratic Governor	0.213**	0.030	0.227**	0.011	0.651**	0.044	0.319**	0.021

Years

1990	-0.004	0.030	0.173**	0.012	-0.106**	0.037	0.091**	0.019
1991	0.140**	0.031	0.719**	0.013	0.068	0.041	0.327**	0.020
1992	0.244**	0.034	1.065**	0.014	0.252**	0.043	0.797**	0.021
1993	0.490**	0.037	1.173**	0.015	0.552**	0.047	0.939**	0.022
1994	0.591**	0.040	1.269**	0.016	0.729**	0.050	1.066**	0.023

$\rho =$ 0.634 0.593

Log-likelihood = -126,733.7 -73,709.15

N = 139,418 87,550

* = $p < .05$; ** = $p < .01$

variables have predictably positive effects on *fine per inspection*. As an estimate of an average change in the number of citations between two observations, one may use the difference from one standard deviation below the mean to one standard deviation above. Based on such an estimate, it can be seen that an average increase in *other citations* between two observations is associated with an 81.8 percent increase in the probability of a fine (holding all other variables constant); an average increase in *serious citations* is associated with a 920.4 percent increase in the probability of a fine; and an average increase in *willful / repeat citations* is associated with a 115.8 percent increase.⁴ The enormous impact of *serious citations* on the probability of a fine is unsurprising, given that the OSH Act mandates that a fine “shall” be imposed for each serious citation. Turning to the outcome equation, one sees that all three categories of *citations* have significant and predictably positive effects on *fine*.

Consistent with expectations, *injury and illness rate*, *post-accident inspection*, and *complaint / referral inspection* are positively related to the likelihood of a nonzero *fine* and the size of *fine*. *Size of inspected establishment* increases the likelihood of a fine, although surprisingly the dummy for business establishments with over one thousand employees is associated with a lower probability of a fine, as compared to the reference category of establishments with under ten employees. In the outcome equation the linear coefficients for *establishment size* dummies increase as the dummies correspond to larger and larger establishments. The *year* dummies increase both the likelihood of a fine and the dollar value for *fine per inspection*. The conditional likelihood of a fine first increases significantly in 1991, and the conditional average size of a fine increases substantially in 1991 and again in 1992.

These findings probably reflect the impact of the 1990 legislation increasing OSHA fines and the advent of the Democratic Clinton Administration. One noteworthy finding is that where a fine is imposed and controlling for other factors, the fine is lower for an average state OSHA inspection than for a comparable federal OSHA inspection. Based on the 0.519 coefficient in Table 3, *state plan inspection* is associated with a 25.4 percent increase in the probability of a fine;⁵ however, the coefficient given in the outcome equation indicates that where a fine is imposed, for an average state OSHA inspection it is 31.3 percent less than for a federal OSHA inspection. These findings suggest that leaving regulation to state governments does not unequivocally lead to less severe enforcement: although fines are lower, they are more likely to be imposed.

The variables measuring political conditions and interest group influence are generally significant in the expected direction in both the participation and outcome equations. Surprisingly, however, *statewide unionization rate* has a large negative effect on the likelihood of a fine. An average change in *statewide unionization rate* between two observations, if defined in the same manner as was done for *citations*, is associated with a 64.6 percent decrease in the probability of a fine. The coefficient for *union establishment* in the participation equation is also negative, but the change is only a 3.8 percent decrease in the probability of a fine. Furthermore, *union establishment* exhibits a positive linear effect in the outcome equation, increasing the value of a fine by 6.7 percent.

It may be wondered whether the effects of state political variables are stronger in state-plan OSHA states. Columns (3) and (4) in Table 3 reveal that this is not the case: the results shown do not differ greatly from what is seen in columns (1) and

(2). *Citations* still are the main determinants of whether *fine per inspection* will have a nonzero value. Holding all other variables constant, an average increase in *other citations* yields a 78.7 percent increase in the probability of a nonzero *fine*, an average increase in *serious citations* yields a 643.7 percent increase, and an average increase in *willful/ repeat citations* yields a 95.5 percent increase.⁶ The coefficients in the outcome equation are broadly similar to those given for the full data set.

Although *statewide unionization rate* does not indicate that OSHA enforcement is more aggressive in more liberal or Democratic states, the four political variables *oversight committee*, *pro-labor Senators*, *Democrats in state legislature*, and *Democratic governor* do. Examining interactions between *union establishment* and these variables might illuminate whether a more sympathetic political environment increases the effect of *union establishment* in promoting aggressive enforcement. The results given in Table 4 suggest that this is in fact the case. Furthermore, with these interaction terms included, the coefficient for *union establishment* becomes nonsignificant, which indicates that the effect of unionized establishments on OSHA entirely depends on a locally sympathetic political environment.

DISCUSSION

These findings bear out hypothesis 2 but not hypotheses 1 or 3. *Fines per inspection* are higher at unionized manufacturing workplaces. Since this analysis controls for number of citations, it suggests that the impact of such workplaces does not result simply from unionized employees helping CSHOs uncover violations (Huber, 2007), and may also result from such activities as unionized employees speaking against their employers (Weil, 1991), or expressing

support for CSHOs in their enforcement activities (Scholz et al., 1991). Regardless, the mechanisms that linearly increase *fine per inspection* in *union establishments* are unaffected by the relative strength of manufacturing-sector labor unions in a state, as indicated by *statewide unionization rate*.

It is unclear why *statewide unionization rate* is associated with lower probabilities of a fine being imposed during an OSHA inspection. This variable may be capturing a tendency for workplaces in more unionized states to be safer, even after controlling for *industry of inspected establishment*, *citations*, and *injury and illness rates*. It is unlikely that unions discourage aggressive enforcement. Importantly, although the specific measure of statewide manufacturing-sector labor union strength is not associated with higher OSHA fines, measures of more generalized statewide liberal or Democratic political strength do exhibit such an association, consistent with previous research (Kim, 2008; Scholz et al., 1991; Scholz & Wei, 1986; Thompson & Scicchitano, 1985). This suggests that the politicians and interest groups sympathetic to occupational safety and health issues promote aggressive enforcement, even if labor unions themselves are not especially strong in a state. This influence appears to operate not only through state politics but in the workplace as well, inasmuch as the coefficients of Table 4 suggest that *union establishment* promotes higher *fines per inspection* only in states with more supportive political conditions. Specifically, *union establishment* has an effect only through its interaction with *pro-labor Senators* and *Democratic governor*.

Although state political forces are seen here to influence OSHA enforcement, the federal government seems to have far stronger effects. This is true even in state-plan states, which are operated

Table 4. Effects of Union Establishment and Political Variables on OSHA Fines per Inspection (Control Variables Not Shown)

Variable	Participation		Outcome	
	Equation		Equation	
	(D.V.: Pr(<i>Fine</i> = 1))		(D.V.: ln(<i>Fine</i>))	
	(1)		(2)	
	Coeff.	SE	Coeff.	SE
Union Establishment	-0.081	0.056	-0.007	0.023
Oversight Committee	-0.095	0.075	0.093**	0.026
Pro-Labor Senators	0.0064**	0.0004	0.0005**	0.0001
Democrats in State Legislature	0.010**	0.003	0.009**	0.001
Democratic Governor	0.196**	0.031	0.208**	0.012
Establishment*Committee	-0.035	0.051	0.033	0.022
Establishment*Pro-Labor Senators	-0.0002	0.0005	0.0005*	0.0002
Establishment*State Legislature	-0.003	0.002	-0.0009	0.0008
Establishment*Governor	0.070	0.040	0.084**	0.017
	$\rho =$	0.634		
	Log-likelihood =	-126,716.4		
	N =	139,418		

* = $p < .05$; ** = $p < .01$

independently but nonetheless subject to the approval of federal OSHA. In the full-sample model presented in Table 3, an average difference in *pro-labor Senators* between two observations is associated with a 33.7 percent increase in the probability of a nonzero *fine per inspection*, and also a 5.4 percent increase in the dollar amount of *fine*. Other state political variables have similar or smaller effects. By contrast, the *year* dummies, except for 1990, increase *fine per inspection* by 71.9 percent or more and also increase the probability of a fine. The effects of the *year* dummies are so large that it is hard to see what temporal events other than those relating to the central leadership of OSHA— i.e., changes in presidential administration and the 1990 increase in upper limits of fines —could be responsible for such changes both on the likelihood of a nonzero *fine per inspection* and on linear increases in the size of *fin*es. Vike's (2007) account of OSHA's history confirms that both the executive and legislative branches of the federal government were more sympathetic to aggressive enforcement

under the George H. W. Bush and Clinton Administrations than had been the case under Reagan.

CONCLUSION

The fact that variables measuring state political context have substantially smaller effects on OSHA enforcement than the *year* dummies suggests that overall, OSHA remains an agency that is dominated by its top leadership and exercises considerable control over its field personnel. This finding is not surprising. Regulatory agencies established in the 1970s, including OSHA, curtailed the discretion of field agents in order to minimize regulatory capture by business interests (Bardach & Kagan, 1982; Moe, 1989; Vogel, 1986). At OSHA this was done by prescribing in detail procedures for targeting inspections, issuing citations, and calculating fines (Huber, 2007; Lloyd-Bostock, 1988). However, discretion was not so much eliminated as centralized, since the president and Congress could still affect agency operations, through presidential

appointments and other means (Moe, 1989; Vike, 2007).

However, not only federal but also state political conditions were seen to affect OSHA enforcement. Of the variables measuring state political conditions, *pro-labor Senators*, *Democratic governor*, and *Democratic state legislature* had positive effects on the probability of a fine being assessed and the size of the fine. *Oversight committee* did not affect the probability of a fine, but it was associated with higher fines. These findings are consistent with other research which indicates that it is very difficult to entirely eliminate local influences on regulatory enforcement (Hedge, 1993; Hedge & Scicchitano, 1994; Scholz & Wei, 1986).

The significant and positive effect of *union establishment* suggests that interaction with field inspectors constitutes a third channel through which politically interested actors can influence regulatory enforcement. However, the small size of the effect of *union establishment*—increasing fines by only 6.7 percent—gives one pause, particularly in light of the fact that the only state political variable not to affect positively *fine per inspection* was *statewide unionization rate*. It was suggested earlier, in the section on data and methods, that the data used in this paper reflect a time when organized labor had more power; however, these findings suggest that even by the early 1990s, labor unions had already declined to a point where they could exercise little influence over OSHA enforcement. Democratic or liberal politicians who were sympathetic to labor issues such as occupational safety and health had a greater impact on OSHA enforcement than did organized labor itself. This interpretation is supported still more by the findings, reported in table 4, that unionized establishments only affected OSHA enforcement in sympathetic political

environments (as indicated by the significant interactions with *pro-labor Senators* and *Democratic governor*). In all, these findings suggest several conclusions. First, interest groups may influence regulatory enforcement through contact with field inspectors. Second, the strength of this influence is increased in more sympathetic political environments. Third, the interest group investigated here, organized labor in the manufacturing sector, was apparently incapable of having a large impact. It may be the case that other interest groups would be able to have a stronger impact on regulatory enforcement, even in less hospitable political conditions. Future research may profitably investigate this question, perhaps by examining for example the impact of environmental groups on the Environmental Protection Agency, or of consumer interest groups on the Consumer Product Safety Commission.

The lack of a substantial labor union effect is particularly troubling, given that unions have been identified as a key factor empowering workers to stand up for safe and wholesome workplaces (Aulette & Michalowski, 2006; Scholz & Wei, 1986; Weil, 1991). Worker empowerment is not an incidental concern for OSHA. Under the OSH Act employees received rights to register complaints about workplace conditions with OSHA personnel and to accompany CSOs on inspections, and protection from employer reprisals for exercising such rights. The intent was to make the agency responsive to the grassroots concerns of the workforces it was intended to serve. Without strong labor unions, however, workers may lack an adequate sense of security and confidence needed to make good on this promise.

The findings presented here then suggest that the strongest allies in promoting occupational safety and health are to be found in Washington, D.C., and in state

governments, among politicians and interest-group leaders who are sympathetic to labor interests even if they do not specifically work on behalf of labor unions. Union activism and organizing are not to be disparaged, and indeed in recent years there have been some signs of revived militancy outside mainstream labor unions (Eidelson,

2013; Porter, 2012). However, in terms of the long-standing debate over whether supporters of occupational safety and health and other labor issues should devote time and energy primarily to electing sympathetic officials or to promoting activism outside of normal political channels, this paper lends weight to the former strategy.

ENDNOTES

¹ OSHA classifies violations as serious, other than serious (referred to as “other” for short), willful, or repeat. A serious violation creates a substantial probability of death or serious physical harm. An other-than-serious violation does not create such a probability but does have a direct and immediate relationship to employees’ safety and health. A willful violation results from deliberate, voluntary, or intentional action, as opposed to mere accident or negligence; a repeat violation is one for which the employer has previously been cited. Willful and repeat violations both expose employers to the possibility of criminal charges.

² The correlation between the earlier and later SOII data is 0.79. The 1997–2002 data were regressed on the 1989–94 data and the residuals were analyzed; the resulting histogram indicated that the residuals are reasonably balanced, which means that replacing the earlier data with the later should not introduce any systemic bias.

³ The OSH Act permits states to operate their own occupational safety and health agency, subject to the approval of federal OSHA. Currently twenty-five states operate their own OSHA plan; of these twenty-five, four state plans (Connecticut, Illinois, New Jersey, and New York) cover state and local public sector employees only.

⁴ The standard deviations for the root-transformed and multiplied *other*, *serious*, and *willful / repeat citations* are 5.432, 5.707, and 2.644, respectively. Multiplying these figures by the coefficients in column (1) of Table 3 and taking the antilog yields the odds of a nonzero *fine* when *citations* are one standard deviation above the mean. Multiplying the standard deviation by the additive inverse of the coefficient yields the odds of a nonzero *fine* one standard

deviation below the mean. Probabilities can be calculated from these odds in a straightforward manner, and the change in probability of a nonzero *fine* can be obtained through dividing the probability for an increase by the probability for a decrease. Thus, for example, the odds of a nonzero *fine* if *serious citations* are a standard deviation below the mean is $\exp(0.407 * -5.707) = 0.098$, and the associated probability of a fine is 0.089. If *serious citations* are a standard deviation above the mean, the odds of a fine is $\exp(0.407 * 5.707) = 10.204$ and the probability of a fine is 0.911. The change in probability is $0.911 / 0.089 = 10.204$, indicating that the probability of a fine is now 1,020.4 percent of what it was before. This is equivalent to a change of 920.4 percent. Similar calculations can be performed for other continuous variables in the model.

⁵ In the participation equation described in column (1) of Table 3, the coefficient is not statistically different from 0. Therefore, with all other variables held constant, the odds of a fine being imposed when *state plan inspection* = 0 (i.e., for a federal OSHA inspection) are $\exp(0) = 1$. This is equivalent to a probability of a fine of 0.50. If *state plan inspection* = 1, the odds of a fine are $\exp(0 + 0.519) = \exp(0.519) = 1.680$. This is equivalent to a probability of 0.627. The change in probability of a nonzero *fine* for a state plan inspection is then $0.627 / 0.5 = 25.4$ percent. Similar calculations can be performed for other dummy variables in the model.

⁶ The changes in probabilities differ from those for the full model not only because the coefficients in column (3) in Table 3 are different, but because the standard deviations are different for the data with only state plan inspections included: they are 5.451, 5.554, and 2.653 for *other*, *serious*, and *willful / repeat citations*, respectively.

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