XI. BUILDING HEALTH AND SAFETY INTO EMPLOYMENT RELATIONSHIPS IN THE CONSTRUCTION INDUSTRY

Construction Site Regulation and OSHA Decentralization

Alison Morantz
National Bureau of Economic Research

Abstract

Promoting regulatory compliance in the construction industry has long been a high institutional priority of the Occupational Safety and Health Administration (OSHA). Yet OSHA officials carry out enforcement activities in only 29 U.S. states. Elsewhere, it is state officials who conduct inspections. This paper links the partly decentralized structure of OSHA enforcement to interstate disparities in regulatory enforcement. First, construction regulations seem to be less strictly enforced by state inspectors. Second, only in the federal enforcement regime do repeat inspections of the same construction site or firm significantly reduce the number of future violations found.

Introduction

Because construction workers are at especially high risk of occupational injuries and fatalities, promoting regulatory compliance in the construction sector has long been an institutional priority for the Occupational Safety and Health Administration (OSHA). Yet, because of a special "opt-out" provision of the Occupational Safety and Health Act, federal OSHA officials conduct inspections in only 29 U.S. states, two territories, and the District of Columbia. It is state officials who enforce OSHA regulations in the remaining 21

Author's address: 2 Gardner Road, Apt. 2, Brookline, MA 02445

states and two territories (collectively known as the "state plan states"). This paper explores whether the partly decentralized structure of OSHA enforcement is linked to any interstate variations in the nature or effectiveness of regulatory activity.

The paper is divided into two sections. The first section compares several key characteristics of enforcement behavior across state plan states and federal OSHA. The second section examines, across regimes, the impact of an inspection on a construction site's future level of regulatory compliance. The data set on which I rely, drawn from OSHA records between the years 1987 and 1994, includes inspection data for national construction firms at or above the eightieth percentile in annual revenues. It contains information on the timing and frequency of inspections, number and severity of regulatory violations, and magnitude of fines.

Comparing Patterns in Regulatory Behavior

Regardless of whether it is state or federal officials who actually conduct inspections, OSHA requires enforcement officials to record many key statistics associated with an inspection of a construction site. Among the most important of these are the date and location of the inspection, the name of the inspected firm, the reason the inspection took place, the number of violations (including the subset deemed to be "serious"), the number of workers in the establishment, whether the workforce is unionized, and the average size of penalties assessed. By focusing on these characteristics, one can compare the basic features of regulatory behavior across the two enforcement regimes.

As is shown in Table 1, the general impression that emerges from such a comparison is that the regulations are applied less stringently in state plan states. Although the probability of an inspection is slightly higher in state plan states, the probability of an inspection *carrying a penalty* is much higher in federal OSHA. Federal inspectors record roughly twice as many serious violations per inspection as do their state counterparts. Average penalties per establishment worker are more than three times as large in federal OSHA as in state plan states. Even when one limits the comparison to inspections in which a penalty is imposed, the size of the fine is still twice as large in federal OSHA. The "net" expected penalty for each firm (i.e., the probability of an inspection $\times$ the average penalty) in state plan states is more than double that of the federal OSHA system. Finally, the average monetary penalty assessed per serious violation is about 70 percent higher in the federal OSHA system than in state plan states.

It is possible that the decentralization of OSHA enforcement is not the root cause of these differences. For example, the very states that are most likely to engage in lax enforcement (because of unobservable historical or political fac-

TABLE 1

Patterns in Regulatory Behavior in Construction, 1987–1993

Enforcement Characteristic	Federal Enforcement	State Enforcement
Annual probability of being inspected	W: 36.48% U: 35.96%	W: 40.55% U: 37.22%
Annual probability of having an inspection with a penalty	W: 19.92% U: 19.67%	W: 17.21% U: 14.20%
Average penalty per worker per inspection	W: $141.25 U: $210.04	W: $42.51 U: $57.90
Average penalty per worker per inspection if there is a penalty	W: $323.15 U: $375.11	W: $158.64 U: $163.32
Probability of an inspection × expected value of penalty	W: $47.42 U: $62.47	W: $15.36 U: $18.63
Probability of inspection with penalty × expected value of penalty if inspection carries a penalty	W: $78.03 U: $91.23	W: $37.33 U: $35.04
Probability of no serious violations being found during an inspection	W: 58.05% U: 53.13%	W: 74.56% U: 70.29%
Average number of "serious" violations cited per inspection	W: 1.019 U: 1.164	W: .4584 U: .5544
Average monetary penalty assessed per serious violation recorded	W: $1726.72 U: $1783.32	W: $1015.16 U: $1020.89

Note. For each regime, weighted estimates (W) treat the inspection as the unit of observation, implicitly weighting more heavily those states in which inspections are relatively frequent. Unweighted estimates (U), by using state averages as the unit of observation, give each state equal weight within a given regime.

tors) may be the very states most likely to have chosen state plan status. In an effort to test for the existence of selection bias, I divided the 50 states into three propensity score "strata" ($p > 0.5$; $p < 0.5$; and $0.25 < p < 0.75$) and compared enforcement indicators within each stratum. Although the magnitude of the differentials varies, the same cross-regime disparities emerge in all of the strata. (Complete results are available on request.)

Comparing the Effects of Regulatory Behavior

OSHA's existence is premised on the notion that regulatory intervention can alter firm behavior. Therefore, a key "litmus test" of regulatory effectiveness is whether the inspection of a given construction site (or the inspection of a different site operated by the same firm) reduces the number of future

violations found at the site. Using this criterion as a basis for comparison, one can use the OSHA inspection data to determine whether construction site inspections are equally likely to improve future compliance inside and outside of the federal regime.

For this phase of the analysis, I use the full sample of inspections, which often includes many repeated inspections of the same site. I share with earlier studies the critical assumption that, although firms take into account the expected net costs of hypothetical OSHA inspections in their initial optimization decision, the occurrence of an *actual* OSHA inspection has an independent effect on firm behavior. The goal of the modeling technique, therefore, is to quantify this "specific deterrence" effect of inspection behavior by examining the *change* in measured compliance between successive inspections. There are four key independent variables in each of the models used: the "sequence number" of an inspection at a particular site; the sequence number of the inspection for a particular firm (across all of its sites); and both variables interacted with state plan status. A significantly negative coefficient on any of these variables indicates a downward effect on the future number of violations.

Past literature has modeled the outcome variable of interest—regulatory compliance—in two different ways. Focusing on the "extensive" margin of compliance, Weil (2000) has defined compliance as the absence of any serious recorded violations. Meanwhile, Gray (1990) has incorporated the "intensive" margin by using a continuous dependent variable in a count model specification. I used both techniques throughout the analysis, estimating both a probit model and a negative binomial count model. (A negative binomial specification was chosen because of the frequency of zero values and strong evidence of overdispersion.)

Finally, I examine the effects of inspections in two different ways. First, I explore the impact of the very first OSHA inspection in two regimes, because undergoing a formal inspection for the first time may help alert firms and workers to simple dangers of which they were not previously aware and encourage them to implement simple safety practices that require only negligible capital investments. After the initial inspection, however, changing firm behavior may involve more systemic workplace restructuring and/or costly expenditures. Therefore, I separately model the impact of *repeated* OSHA inspections in the two regimes to isolate the effect of later inspections on firm behavior. This two-phased approach differs somewhat from that used in previous studies, which use a single specification to encompass the effects of all inspections (Gray 1990; Weil 2000).

Table 2 summarizes the control variables included in the models. I include two factors that could affect firm-specific costs of compliance: union status and the log of the number of workers in the establishment. I also control for sev-

TABLE 2

Summary Statistics on State and Federal OSHA Inspections in Construction, 1987–1993

Dependent Variables	Federal Enforcement	State Enforcement
Probability that no serious violations found during an inspection	59.92%	76.24%
Average number of serious violations found per inspection	0.916	0.428
Independent Variables:		
Inspection triggered by a complaint	0.076	0.066
Inspection triggered by an accident	0.021	0.031
Unionized workforce	0.510	0.521
Unionized * complaint	0.042	0.036
Log of prior accumulated penalties	7.09	7.18
Log of prior accumulated inspection hrs	5.23	5.70
Log of number workers in establishment	2.31	2.27
Total inspections of contractor	41.92	59.33
First inspection of site	80.08%	65.29%
Inspection sequence number of site	1.31	2.06
Inspection sequence number of firm	21.86	30.85

Note. All data, extracted from OSHA's Integrated Management Information System, were obtained from Professor David Weil of Boston University.

eral specialized "triggers" of OSHA inspections that could affect the thoroughness of the inspection and/or likelihood of violations: employee complaints, on-site accidents, and employee complaints issuing from unionized workplaces. (The latter interaction term was included on the theory that, in some unionized settings, employees may file OSHA complaints as part of a concerted strategy to enhance their bargaining position with management.)

Two additional independent variables included in the model require elaboration. First, Gray (1990) has found that firms respond more readily to inspections with penalties than to those carrying no monetary sanction. Moreover, in an intuitive sense, one might expect that a construction site or firm that has been frequently inspected in the past, but never penalized, might respond differently than one that has faced a series of escalating penalties. (OSHA's penalty structure, for example, contains escalating penalties for repeated noncompliance.) To capture this aspect of a site's inspection history, I include the log of prior accumulated penalties as an independent variable. Second, there may be significant "type" heterogeneity among construction firms in terms of their inherent technological capacity, or institutional willingness, to comply with regulations. Without using a fixed effects specification, it is impossible to fully control for such site-specific variation. When firms are

subjected to a high number of inspections over a sustained period, however, it could be because inspectors have identified something about their compliance behavior, production technology, management, and/or inherent dangerousness that merits special scrutiny. I follow the lead of several earlier studies in using the *total* number of inspections experienced by each construction contractor during the entire study period as a rough proxy for firm "type" (Gray 1990; Weil 2000).

In one key respect, my results show that the two regimes are statistically indistinguishable. The *first* inspection has a large, significant impact on a construction site's future level of compliance in both regimes. (Complete results are available on request.) As is shown in Table 3, however, a different pattern emerges when one focuses on "repeat" inspections (i.e., the second and sub-

TABLE 3

Effect of Inspection of Construction Site on Violations Found at Next Inspection, 1987–1993

Independent Variable	Probit Model Pseudo-R^2 = .0666 (dy/dx reported in parentheses)	Negative Binomial Model Pseudo-R^2 = .0461 w = .5838
State plan dummy	–.2443*** (.0216)	–1.109*** (.0925) [–.7111]
Sequence number of inspection of site	–.0299*** (.0053)	–.1125*** (.0205) [–.0657]
Sequence number of site * state plan dummy	.0250*** (.0055)	.0893*** (.0214) [.0521]
Sequence number of inspection of firm	–.0008** (.0003)	–.0027* (.0012) [–.0016]
Sequence number of firm * state plan dummy	.0011*** (.0004)	.0041*** (.0014) [.0024]
Employee complaint triggered the inspection	.0024 (.0226)	.0392 (.0845)
Employee complaint trigger * state plan dummy	–.0571 (.0307)	–.1134 (.1315)
On-site accident triggered the inspection	.1835*** (.0312)	.4507*** (.0960)
On-site accident trigger * state plan dummy	.0175 (.0360)	.0811 (.1277)
Union shop	.0054 (.0086)	.0544 (.0333)

Independent Variable	Probit Model Pseudo-R^2 = .0666 (dy/dx reported in parentheses)	Negative Binomial Model Pseudo-R^2 = .0461 w = .5838
Union shop * state plan dummy	–.0234*	–.0781
	(.0121)	(.0499)
Union shop* complaint inspection	–.0256	–.0010
	(.0295)	(.1140)
Union shop* complaint inspection* state plan dummy	.0643	.1206
	(.0478)	(.1756)
Log (number workers in establishment)	.0271***	.1821***
	(.0032)	(.0123)
Log (number workers in establishment)*state plan dummy	.0106*	.0295
	(.0045)	(.0187)
Log (1 + penalties from first inspection)	.0159***	.0620***
	(.0021)	(.0081)
Log (l + penalties from first inspection) * state plan dummy	–.0024	.0158
	(.0028)	(.0116)
Total inspections of firm	.0005**	–.0017**
	(.0002)	(.0007)
Total inspections * state plan dummy	.0001	–.0006
	(.0002)	(.0008)
Year and four-digit SIC dummies	Yes	Yes

Note. In probit model, dependent variable is presence of at least one violation and there are 27,146 observations. In negative binomial model, dependent variable is number of serious violations and there are 27,149 observations. Standard errors are given in parenthesis. Dy/dx, presented in brackets for selected coefficients, represent a 1 standard deviation change in the predicted number of events (w) or, for dummy variables, a discrete change from 0 to 1.

*Statistically significant at the 5% level.

**Statistically significant at the 1% level.

***Statistically significant at the .5% level.

sequent inspections of the same construction site). In both of the specifications tested (probit model and negative binomial model), the coefficients on the dummies for repeat inspections are negative and highly significant. Yet their interactions with state plan status are positive, significant, and large enough to offset the negative coefficient on repeat inspections. In other words, although repeated OSHA inspections of the same construction firm or site

significantly increase compliance in the federal regime, the same does not hold true for state plan states.

Conclusions

Since the passage of the Occupational Safety and Health Act, the provision permitting individual states to "opt out" of the federal enforcement system has remained controversial. Although this provision is explicitly premised on the requirement that state enforcement be "at least as effective" as federal OSHA, many observers in the 1970s questioned the wisdom of this partial decentralization of regulatory authority. After posing the question of whether the opt-out provision has fostered any interstate disparities in enforcement behavior or effectiveness, this study offers a preliminary answer through an analysis of OSHA inspection records.

The results suggest that the partly decentralized structure of OSHA enforcement may, indeed, be linked to two salient interstate disparities in regulatory activity. First, OSHA regulations seem to be enforced more stringently when federal officials are conducting the inspections. Second, repeated inspections of the same construction site or firm significantly reduce future violations only within the federal system.

These results provide some empirical basis for questioning whether state officials are "at least as effective" as their federal OSHA counterparts in promoting regulatory compliance in the construction industry. Elsewhere, I link these disparities in enforcement behavior to differentials in injury rates and show that similar disparities between state and federal enforcement emerge from an empirical analysis of the steel sector (Morantz 2003). Future work might profitably explore whether the disparities I identify for construction are the norm across the OSHA-regulated economy, whether they have changed significantly over time, and whether they apply in other regulatory settings.

References

Gray, Wayne and Carol Adaire Jones. 1990. "Are OSHA Inspections Effective? A Longitudinal Study in the Manufacturing Sector." NBER Working Paper No. 3233. Cambridge, MA: National Bureau of Economic Research, Inc.

Morantz, Alison. 2003. "Has Regulatory Devolution Injured American Workers? An Empirical Comparison of State and Federal OSHA Enforcement." Paper to be presented at the American Law & Economics Association Annual Conference. September 19–21, 2003.

Weil, David. 2000. "Assessing OSHA Performance: Evidence from the Construction Industry." IRRA Proceedings 2000 (52nd Annual Meeting). In "OSHA Enforcement and Regulatory Compliance in the U.S. Construction Industry," pp. 83–93.