

Evaluating OSHA inspections for intended and unintended outcomes

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Randomized Government Safety Inspections Reduce Worker Injuries with No Detectable Job Loss

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Controversy surrounds occupational health and safety regulators, with some observers claiming that workplace regulations damage firms' competitiveness and destroy jobs and others arguing that they make workplaces safer at little cost to employers and employees. We analyzed a natural field experiment to examine how workplace safety inspections affected injury rates and other outcomes. We compared 409 randomly inspected establishments in California with 409 matched-control establishments that were eligible, but not chosen, for inspection. Compared with controls, randomly inspected employers experienced a 9.4% decline in injury rates (95% confidence interval = -0.177 to -0.021) and a 26% reduction in injury cost (95% confidence interval = -0.513 to -0.083). We find no evidence that these improvements came at the expense of employment, sales, credit ratings, or firm survival.

OSHA, a much-criticized agency

Too lenient! (?)

- Inspections too seldom
- Penalties too small
- Lengthy process to adopt new regulations compromises worker safety

Too costly! (?)

- Stifling job creation / job killer
- Increasing labor costs
- Eroding America's competitiveness



OSHA's Michaels Responds to Criticism his Agency is a Job Killer

Dr. David Michaels, assistant secretary of labor for OSHA, is responding to critics in Congress who claim that OSHA regulations place an unfair burden on employers, saying sensible regulations not only keep American workers safe and healthy, but improve American competitiveness.

Sandy Smith

Feb. 17, 2011

Challenges evaluating impact of OSHA inspections:

Causality

Most OSHA inspections are not random:

- After accidents and deaths
- When employees complain

If accidents/deaths are rare events, outcomes will feature mean reversion:

- Problems likely decline after inspections...
but even without inspections

Our approach

- ✓ Examine random inspections and compare to a control group.

Challenges evaluating impact of OSHA inspections:

Measuring outcomes

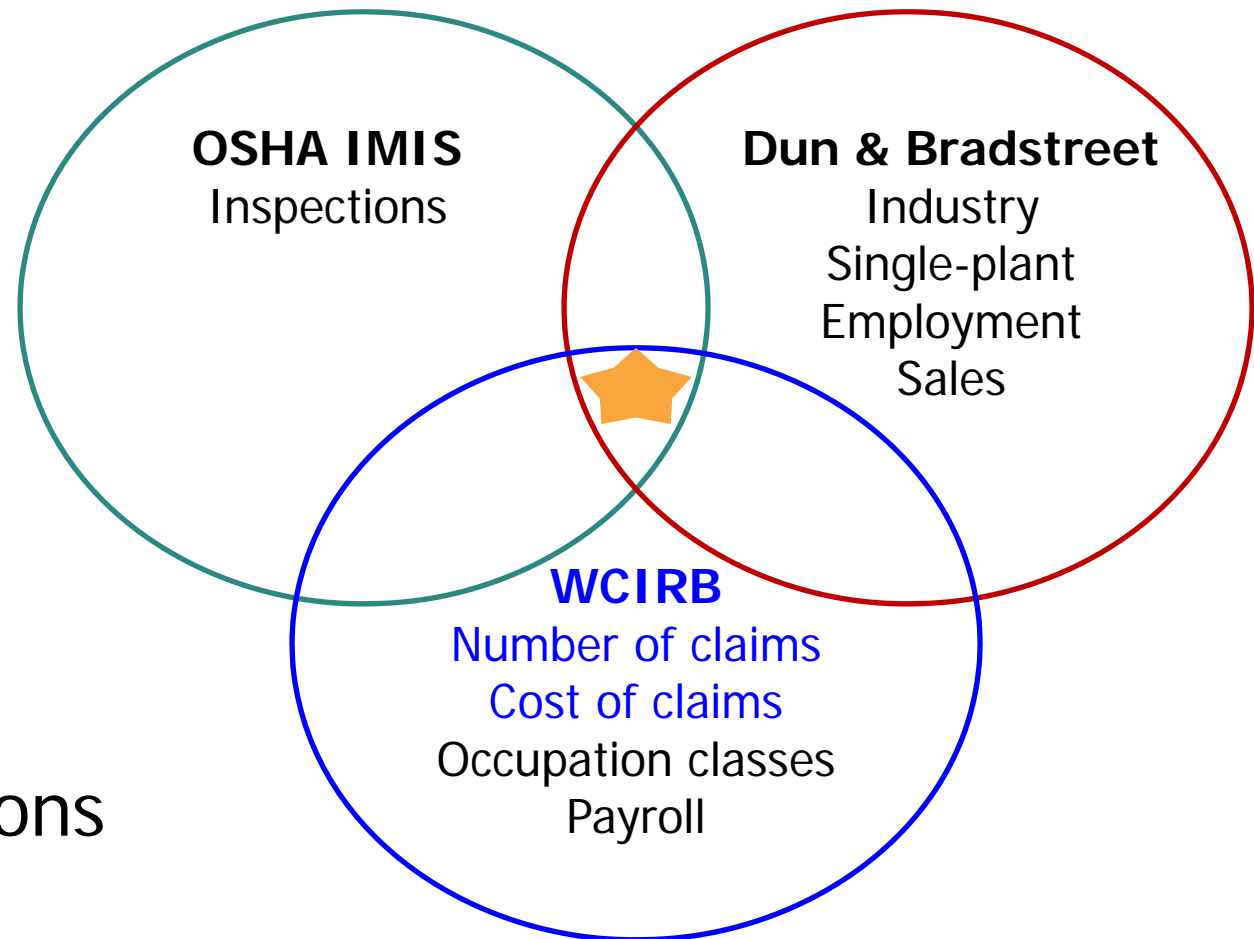
Several studies have relied on company logs

- But inspections can lead companies to improve logs' comprehensiveness, increasing reported injuries
- This cloaks changes in actual injury rates

Our approach

- Rely on **workers' compensation** claims
 - ✓ Annual number of workers' comp. claims
 - ✓ Annual cost of all workers' comp. claims

3 data sources



Data restrictions

- California
- Cal/OSHA
- Some high hazard industries (randomization targets)
- Single-plant firms

Developing a matched sample

Treatments

- Single-plant establishments randomly selected for a programmed inspection
 - ✓ The high-hazard industries that Cal/OSHA targeted for random inspection each year

Matched controls

- Find population of single-plant establishments at risk of random inspection, but not selected
 - ✓ Exclude if < 10 employees or recently inspected
- For each treatment, select one control:
 - ✓ Same industry and region
 - ✓ Closest size

Result: 409 matched pairs

Matching led to a balanced sample of very similar treatments and controls

In the two years before the match year, the 409 matched pairs had indistinguishable:

- Sales
- Employment
- Payroll
- Credit scores (D&B PAYDEX, Comprehensive Credit Appraisal)
- Annual number of WC claim
- Annual total cost of WC claims

Figure S1: Indistinguishable levels

Distributions of pre-match-year variables, treatments vs. controls

Levels

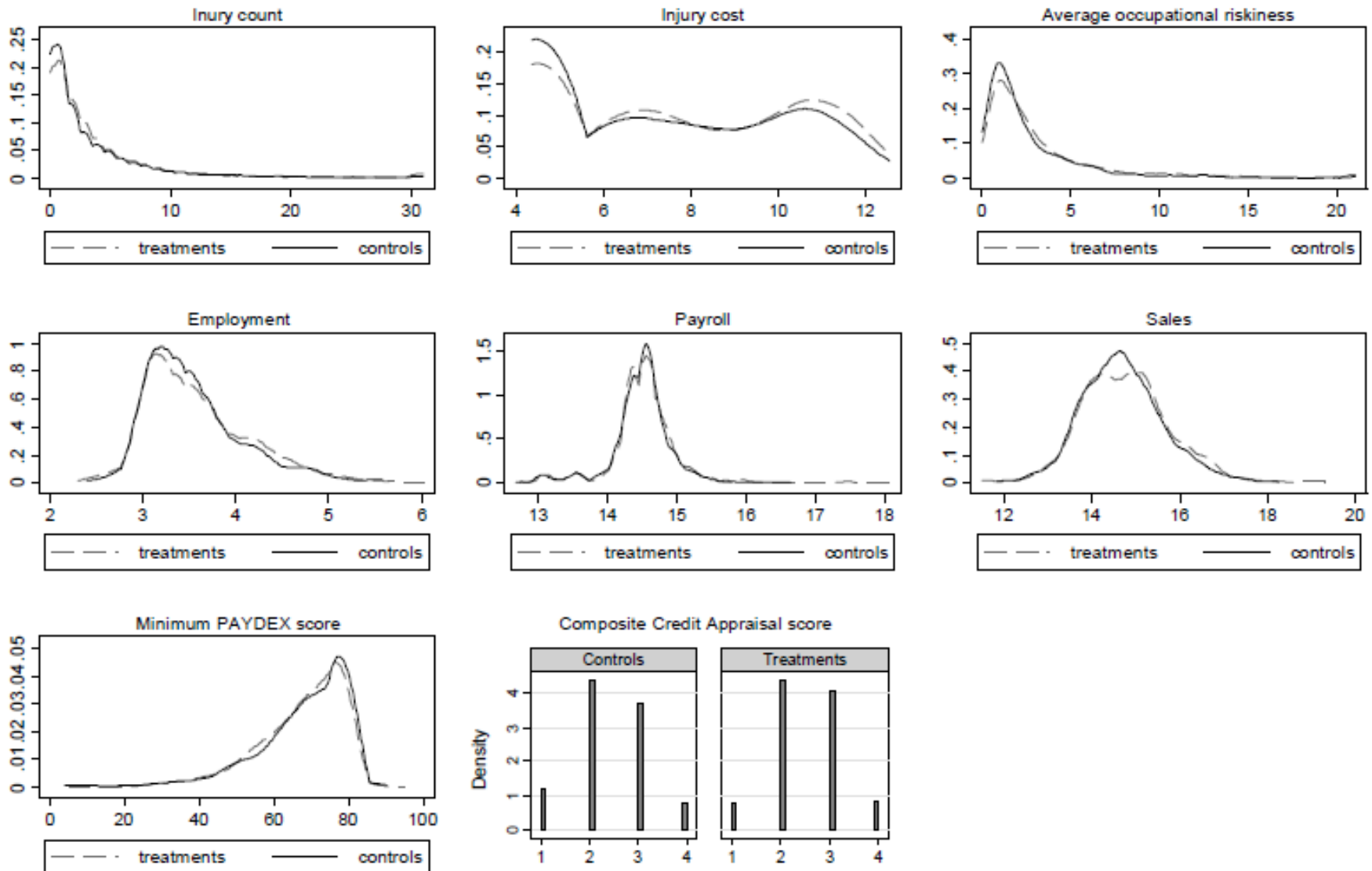
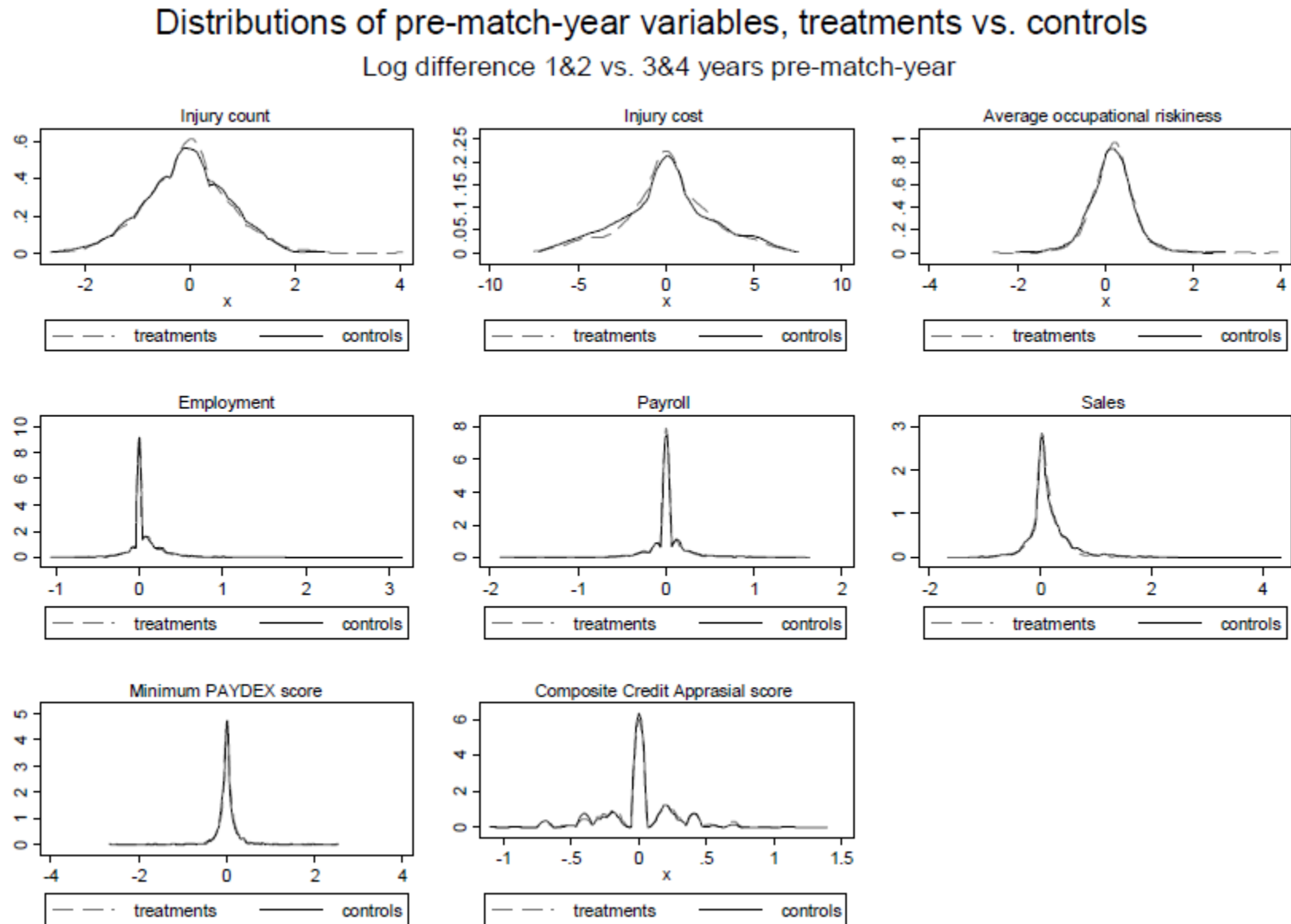


Figure S2: Indistinguishable trends



Industry distribution of matched sample (Table S2)

Two-digit SIC code and description		Number of matched pairs of treatment and control establishments
07	Agricultural Services	6
15	General Building Contractors	4
17	Special Trade Contractors	32
20	Food and Kindred Products	49
23	Apparel and Other Textile Products	4
24	Lumber and Wood Products	63
25	Furniture and Fixtures	36
30	Rubber and Miscellaneous Plastics Products	9
32	Stone, Clay, and Glass Products	6
33	Primary Metal Industries	14
34	Fabricated Metal Products	49
35	Industrial Machinery and Equipment	17
36	Electronic and Other Electric Equipment	6
37	Transportation Equipment	15
39	Miscellaneous Manufacturing Industries	8
42	Trucking and Warehousing	5
50	Wholesale Trade—Durable Goods	14
51	Wholesale Trade—Nondurable Goods	18
52	Building Materials and Garden Supplies	5
57	Home Furniture and Furnishings Stores	4
73	Business Services	8
75	Auto Repair, Services, and Parking	3
76	Miscellaneous Repair Services	3
80	Health Services	4
Various	Other industries (with 1–2 matched pairs)	27
Total :		409

Evaluation model

Did treatments experience a greater decline in annual injuries (or injury-related costs) after inspections than the controls, examined over the same time period?

- Fixed effects regression
- Control for establishment characteristics
- Difference-in-differences approach
 - ✓ Compares two groups over time

Randomized inspections reduce annual injuries by 9.4%

Dependent variable
Specification

(1)	(2)
<hr/>	
Injury count	
Conditional fixed-effects negative binomial regression	

Randomized inspections reduce annual injuries by 9.4%

Dependent variable Specification	(1)	(2)
	Injury count Conditional fixed-effects negative binomial regression	
Has been randomly inspected (this year or before)	-0.099 ± 0.040*	
Year of random inspection		
One year after random inspection		
Two years after random inspection		
Three years after random inspection		
Four years after random inspection		
Year dummies	Included	
Observations (establishment-years)	5593	
Number of establishments	765	
Number of treatment establishments	389	
Number of control establishments	376	
	** $P < 0.01$, * $P < 0.05$, + $P < 0.10$.	

Randomized inspections reduce annual injuries by 9.4%

Dependent variable Specification	(1)	(2)	
	Injury count Conditional fixed-effects negative binomial regression		
Has been randomly inspected (this year or before)	-0.099 ± 0.040*		} Persistent effect
Year of random inspection		-0.152 ± 0.053**	
One year after random inspection		-0.023 ± 0.055	
Two years after random inspection		-0.033 ± 0.063	
Three years after random inspection		-0.135 ± 0.077+	
Four years after random inspection		-0.266 ± 0.091**	
Year dummies	Included	Included	
Observations (establishment-years)	5593	5593	
Number of establishments	765	765	
Number of treatment establishments	389	389	
Number of control establishments	376	376	
	** $P < 0.01$, * $P < 0.05$, + $P < 0.10$.		

Randomized inspections reduce annual injury costs by 26%

	(3)	(4)
Dependent variable		
Specification		
	Log Injury cost	
	Fixed-effects OLS	

Randomized inspections reduce annual injury costs by 26%

Dependent variable Specification	(3)	(4)
	Log Injury cost Fixed-effects OLS	
Has been randomly inspected (this year)	$-0.298 \pm 0.110^{**}$	
Year of random inspection		
One year after random inspection		
Two years after random inspection		
Three years after random inspection		
Four years after random inspection		
Year dummies	Included	
Observations (establishment-years)	5872	
Number of establishments	818	
Number of treatment establishments	409	
Number of control establishments	409	
	$**P < 0.01, \quad *P < 0.05, \quad +P < 0.10.$	

Randomized inspections reduce annual injury costs by 26%

Dependent variable Specification	(3)	(4)	
	Log Injury cost Fixed-effects OLS		
Has been randomly inspected (this year)	-0.298 ± 0.110**		
Year of random inspection		-0.379 ± 0.123**	} Persistent effect
One year after random inspection		-0.217 ± 0.145	
Two years after random inspection		-0.085 ± 0.172	
Three years after random inspection		-0.558 ± 0.194**	
Four years after random inspection		-0.455 ± 0.223*	
Year dummies	Included	Included	
Observations (establishment-years)	5872	5872	
Number of establishments	818	818	
Number of treatment establishments	409	409	
Number of control establishments	409	409	
	**P < 0.01,	*P < 0.05,	+P < 0.10.

Unanticipated consequences of inspections?

Inspections (and consequences) cause interruptions, but are they substantial?

- Sales impact?
- Credit worthiness?
- Employment, payroll?
- Firm survival?

Unanticipated consequences of inspections?

Table 2. Regressions yielded no evidence that random OSHA inspections influenced employment, payroll, or sales. OLS coefficients \pm standard errors clustered by establishment; effects are not statistically significant ($P > 0.10$). To reduce the effect of very small outliers, we added roughly the first percentile of nonzero values (10 to Employment and \$100,000 to Payroll and Sales) before taking logs.

Dependent variable Specification	(1)	(2)	(3)
	Log Employment OLS	Log Payroll OLS	Log Sales OLS
Has been randomly inspected (this year or before)	0.027 \pm 0.016	0.005 \pm 0.013	0.002 \pm 0.044
Year dummies	Included	Included	Included
Establishment-level fixed effects	Included	Included	Included
Observations (establishment-years)	5278	5872	3190
Number of establishments	787	818	640
Number of treatment establishments	390	409	329
Number of control establishments	397	409	311
Dependent variable sample mean	3.61	14.50	14.86

Unanticipated consequences of inspections?

No difference in employment, payroll, sales (Table 2)

- Tight confidence intervals enable us to rule out that inspections caused big declines of employment or payroll

No difference in credit ratings (Table S8)

- Late bills, etc. more sensitive to financial burden than firm death
- Two D&B metrics of financial distress: PAYDEX & CCA

No difference in firm survival (Table S7)

- Approx. 5% of treatments and of controls died
 - ✓ Difference not statistically significant
 - ✓ Result robust to survival regressions

Summary of results

Evidence of intended results

- Annual injuries reduced by 9.4%
- Annual injury costs reduced by 26%

No evidence of unintended consequences

- Sales impact
- Credit worthiness
- Employment, payroll
- Firm survival

Levine, David I., Michael W. Toffel, and Matthew S. Johnson. "Randomized Government Safety Inspections Reduce Worker Injuries with No Detectable Job Loss." *Science* 336, no. 6083 (May 18, 2012)

Our future research in this domain

Do random inspections have spillover effects?

1. Spillover within facilities:
bolster compliance with EPA regulations?
2. Spillover within a multi-plant firm:
increase safety at corporate siblings?
3. Spillover within neighborhoods:
increase safety at neighboring facilities?

Your ideas?

Thank you!

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