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2 August 2018

Online at <https://mpra.ub.uni-muenchen.de/88318/>  
MPRA Paper No. 88318, posted 10 Aug 2018 07:23 UTC

# INSPECTION REGIMES AND REGULATORY COMPLIANCE: HOW IMPORTANT IS THE ELEMENT OF SURPRISE?

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August 2, 2018

## Abstract

Regulatory compliance is often promoted *via* unannounced inspections where firms found to be in violation of environmental, health, or safety regulations face punishments. When compliance is costly to firms, a key aspect of this approach is that the timing of inspections is unannounced and difficult to anticipate, lest firms comply only when they believe an inspection is likely. With data from Los Angeles (LA) County food-service health inspections, I estimate how the (in)ability to anticipate inspection timing affects compliance using a novel approach. Many facilities such as hotels, grocery stores, or food courts, consist of multiple food-service establishments sharing a single physical location. Multiple establishments within a single facility are commonly, though not always, inspected on the same day, meaning all but one of the establishments involved likely anticipate the timing of their next inspection to a considerable extent. Within such facilities, I show that establishments perform significantly worse on days in which they receive the sole inspection conducted at their facility. These “surprise” inspections detect 7.75% more violations, 9.1% more inspection score point deductions, and 16.3% more major critical violations (the most severe violations of the county health code).

**JEL:** K32, L51, Q18

**Keywords:** regulatory inspection, health and safety regulation, monitoring, restaurant hygiene

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# 1 Introduction

Enforcement of environmental, health, and safety regulations often involves periodic unannounced inspections of firms, during which, detected violations incur punishments. Inspection regimes promote compliance by establishing, at all times, an expected cost for committing violations: the cost incurred if the violation is detected multiplied by the probability of inspection and subsequent detection. However, if firms can anticipate the timing of inspections to some extent (*i.e.*, correctly predict when their inspection probability is low), much of this expected cost may be mitigated.

Regulatory agencies face a tradeoff: limiting firms' abilities to anticipate inspection timing (*e.g.*, by increasing inspection frequency) should improve compliance, but is costly. This makes it important to understand how, and to what extent, the ability to anticipate inspection timing affects compliance.

Accounting for firms' abilities to anticipate inspection timing severely complicates empirical assessment of this relationship. The most closely related existing studies employ a two-step approach. First, inspection probabilities for different time periods are estimated using firm observables. Then, compliance measures are estimated as a function of the probability predictions, which proxy for firms' expected inspection probabilities.<sup>1</sup> Alternatively, I exploit a feature of Los Angeles (LA) County food-service health inspections that provides sharp within-firm variation in the ability to anticipate inspection timing.

The LA County Department of Public Health (DPH) conducts regular unannounced food-service health inspections. Many LA County facilities (*e.g.*, hotels, grocery stores, food courts) house multiple separate food-service establishments. Within such facilities, multiple establishments are sometimes inspected on the same day. When this occurs, the first establishment inspected may be the only one to truly receive a "surprise inspection". The other establishments, if aware of the inspector's presence, have considerable ability to anticipate

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<sup>1</sup>Using this approach, Gray and Deily (1996), Eckert (2004), and Telle (2009) find positive relationships between inspection probability estimates and environmental regulatory compliance among Canadian petroleum storage sites, US steel producers, and Norwegian plants, respectively.

the timing of their next inspection.

Using data from 9,545 inspections spanning October 2015 through March 2018, I find that within multiple-establishment facilities, individual establishments perform significantly worse on days when they receive their facility's only inspection. Specifically, 7.75% more violations and 16.27% more major critical violations (the most severe LA County health code violations) are detected compared to days when they receive one of multiple inspections at their facility. This suggests that these establishments exhibit lower compliance levels than is often detected due to their ability to anticipate inspection timing; and that if the practice of multiple same-day inspections were abandoned, their compliance levels would improve.<sup>2</sup>

These results add to a relatively small body of evidence regarding regulatory compliance and the surprise nature of inspections. To my knowledge they are the first such results that, rather than proxying for firm beliefs with inspection probability estimates, utilize two different inspection states across which ability to anticipate inspection timing varies considerably within firms. Finally, they highlight a dilemma likely faced by many authorities regulating food-service hygiene. Facilities housing multiple food-service establishments are very common, and it's less costly to inspect these establishments by sending an inspector to the location once. Are the additional costs of inspecting separate establishments during separate visits outweighed by the potential public health benefits?<sup>3</sup> My results enable evaluation of this tradeoff, and follow a methodology by which regulatory bodies across the industry can make similar assessments.

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<sup>2</sup>These establishments presently receive a mix of *surprise* and *non-surprise* inspections. Going forward, if establishments wish to at least maintain their average performance from the mixed period, a policy of surprise inspections only would require compliance improvements.

<sup>3</sup>The Centers for Disease Control and Prevention estimated in 2011 that about 1 in 6 Americans contract foodborne illness annually (see <http://www.cdc.gov/foodsafety/foodborne-germs.html>). They also estimated that, in 2013, restaurants accounted for 60 percent of US foodborne illness outbreaks with a single known food-preparation source (see Centers for Disease Control and Prevention (2013)).

## 2 Los Angeles County Food-Service Health Inspections

The LA County DPH inspects all restaurants and retail food markets in unincorporated areas, and 85 of the 88 municipalities in the county.<sup>4</sup> Establishments are categorized as low, moderate, or high risk, based on the nature of the food served.<sup>5</sup> Establishments are inspected 1 to 3 times annually, and inspection frequency is higher for establishments in higher risk categories.

Establishments receive inspection scores beginning at 100, and points are deducted for health code violations. Violations are classified as critical or non-critical. Non-critical violations carry 1-point deductions. Critical violations are further classified as minor or major, carrying 2-point and 4-point penalties respectively.<sup>6</sup> The scoring criteria were revised beginning January 1, 2017. Three major critical violations now carry 11 rather than 4-point deductions. Also, committing two or more of the other major critical violations incurs an additional 3-point deduction.<sup>7</sup> In estimation, I account for the possible effects of these changes on compliance.

Detected violations are costly to establishments, in part, due to a disclosure program. Excluding seven municipalities, establishments are required to display letter-grade placards for their most recent inspection score in their window.<sup>8</sup> Inspection data are shared with Yelp.com, and since 2014, Yelp posts letter grades on the profile pages of all establishments, even those in municipalities not requiring grade-card posting.

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<sup>4</sup>Pasadena, Long Beach, and Vernon have their own health departments.

<sup>5</sup>For example, drug stores that sell pre-packaged food and drinks are categorized as low risk, whereas sushi restaurants are categorized as high risk.

<sup>6</sup>There are eleven critical violations that may be classified as minor or major based on the observed infraction's severity.

<sup>7</sup>The 3-point penalty is not added in inspections where an 11-point deduction is incurred.

<sup>8</sup>Above 89 receives an *A*; 80 to 89, a *B*; 70 to 79, a *C*; and numeric scores are posted when below 70.

### 3 Data and Estimation Sample

The data come from County of Los Angeles Open Data (2018), and span October 1, 2015 through March 31, 2018. Observations correspond to violations and indicate the health code violated and resulting point deduction.<sup>9</sup> The inspection date, final inspection score, and identifiers for the establishment, establishment owner, establishment facility, and inspector that conducted the inspection, are also included.

The data contain 190,163 inspections of 47,487 establishments located at 44,104 facilities. There are 4,852 establishments located at one of 1,469 multiple-establishment facilities. Among multiple-establishment facilities, there are 1,913 establishments that: (1) at least once received their facility’s sole inspection that day, and (2) at least once received one of multiple inspections at their facility that day. These establishments’ 9,545 inspections form my estimation sample.

### 4 Methodology

To estimate how the ability to anticipate inspection timing affects compliance, I compare establishment performance across two inspection states: days where they received their facility’s sole inspection, and days where they received one of multiple inspections at their facility. Using all 190,163 inspections, Figure 1 compares scores across both inspection states, revealing that establishments perform much better in the latter.<sup>10</sup> However, these simple comparisons pose a problem: at single-establishment facilities, establishments always receive their facility’s sole inspection, and the choice to locate at multiple-establishment facilities may correlate with unobservable features that affect compliance.

To remove this potential source of bias, I focus on multiple-establishment facilities only.

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<sup>9</sup>These entries are empty for 100-point scores.

<sup>10</sup>All scores are measured under the pre-2017 scoring criteria. Scores from 2017 and 2018 were adjusted when appropriate.

Estimating equations take the form

$$Y_{i,j,t} = \alpha_1 \text{Sole}_{i,j,t} + \mathbf{X}_{i,j,t}' \boldsymbol{\alpha} + a_i + \epsilon_{i,j,t}, \quad (1)$$

where  $Y_{i,j,t}$  is an inspection outcome (*e.g.*, total violations).  $\text{Sole}_{i,j,t}$  equals 1 if, on date  $t$ , establishment  $i$  receives the sole inspection at facility  $j$ , and equals 0 otherwise.

I restrict my estimation sample to the 1,913 establishments with at least one inspection where  $\text{Sole}_{i,j,t} = 1$ , and at least one inspection where  $\text{Sole}_{i,j,t} = 0$ , and include establishment fixed effects. This compares the performance of establishments when  $\text{Sole}_{i,j,t} = 1$  against their own performance when  $\text{Sole}_{i,j,t} = 0$ . Estimates of  $\alpha_1$  provide a lower bound on, *e.g.*, average violations per inspection that go undetected when ability to anticipate inspection is elevated. It is a lower bound because, even on days when multiple establishments at a facility are inspected, the first establishment inspected lacks an elevated ability to anticipate inspection timing.<sup>11</sup>

## 5 Results

Table 1 presents estimates of equation (1) where the only controls are establishment fixed effects and an indicator variable equal to 1 if an inspection occurred after 2016 (when the scoring criteria changed). Standard errors are clustered two-way, following Cameron et al. (2011), at the facility and inspector levels.

This simple specification is applied to four inspection outcomes: total violations, total critical violations, total major critical violations, and deducted points.<sup>12</sup> Table 2 presents estimates with additional controls for the inspection’s day of the week, month, and year.<sup>13</sup> Under both specifications, receiving a facility’s sole inspection leads to significant and substantial increases in all outcomes. Within this sample, when receiving one of multiple inspections

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<sup>11</sup>On a single day, the ordering of inspections within a facility is unknown.

<sup>12</sup>For consistency, scores are measured under the county’s original criteria across the entire sample period.

<sup>13</sup>Inspector fixed effects are nearly perfectly colinear with establishment fixed effects, and thus, excluded.

at their facility, establishments average: 3.5941 violations, 0.7614 critical violations, 0.1715 major violations, and 4.6985 deducted points. Relative to those averages, full-specification estimates suggest that reduced ability to anticipate inspection timing leads to detection of: 7.75% more violations, 12.24% more critical violations, 16.27% more major critical violations, and 9.10% more point deductions.

Recall that establishments are assigned to three risk categories based on the type of food served (not inspection histories), and establishments in higher risk categories are inspected at higher frequencies.<sup>14</sup> Of the 1,402 facilities in the estimation sample, 962 house establishments in at least two different risk categories. Thus, most of the variation in  $Sole$  is likely driven by the need to inspect different risk-level establishments at different frequencies. However, it could be problematic if  $Sole_{i,j,t}$  is influenced by an establishment’s recent inspection history. For instance, if sole inspections tend to follow worse-than-usual inspections,  $\hat{\alpha}_1$  might partly reflect establishments’ persistent declines in hygiene quality. Table 3 alleviates these concerns, showing that my results are robust to including establishments’ lagged deducted points as a regressor.

## 6 Conclusion

This paper shows that regulatory compliance is quite sensitive to the ability to anticipate inspection timing. Establishments that are often able to anticipate inspection timing are found to be significantly less compliant when that ability is occasionally removed. If establishments desire the inspection outcomes they receive when able to anticipate inspection timing, then permanent removal of this ability would cause compliance improvements. This demonstrates a dilemma likely faced by many regulatory bodies: conducting same-day inspections of establishments at a shared facility is less costly, but reduces compliance among these establishments. In LA County, this reduced compliance includes the commission of significantly more major critical violations, suggesting potential public health benefits that

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<sup>14</sup>Risk category is time-invariant and absorbed in the establishment fixed effects.



may exceed the cost of inspecting separate establishments at such facilities on separate days.

## References

- Cameron, A., J. B. Gelbach, and D. Miller (2011). Robust inference with multiway clustering. *Journal of Business and Economic Statistics* 29(2), 238–249.
- Centers for Disease Control and Prevention (2013). Surveillance for foodborne disease outbreaks United States, 2013: Annual report. Retrieved from <http://www.cdc.gov/foodsafety/pdfs/foodborne-disease-outbreaks-annual-report-2013-508c.pdf>.
- County of Los Angeles Open Data (2018). Los Angeles County Restaurants and Markets Violations. Retrieved from <https://data.lacounty.gov/>.
- Eckert, H. (2004). Inspections, warnings, and compliance: The case of petroleum storage regulation. *Journal of Environmental Economics and Management* 47(2), 232–259.
- Gray, W. and M. E. Deily (1996). Compliance and enforcement: Air pollution regulation in the U.S. steel industry. *Journal of Environmental Economics and Management* 31(1), 96–111.
- Telle, K. (2009). The threat of regulatory environmental inspection: Impact on plant performance. *Journal of Regulatory Economics* 35(2), 154–178.

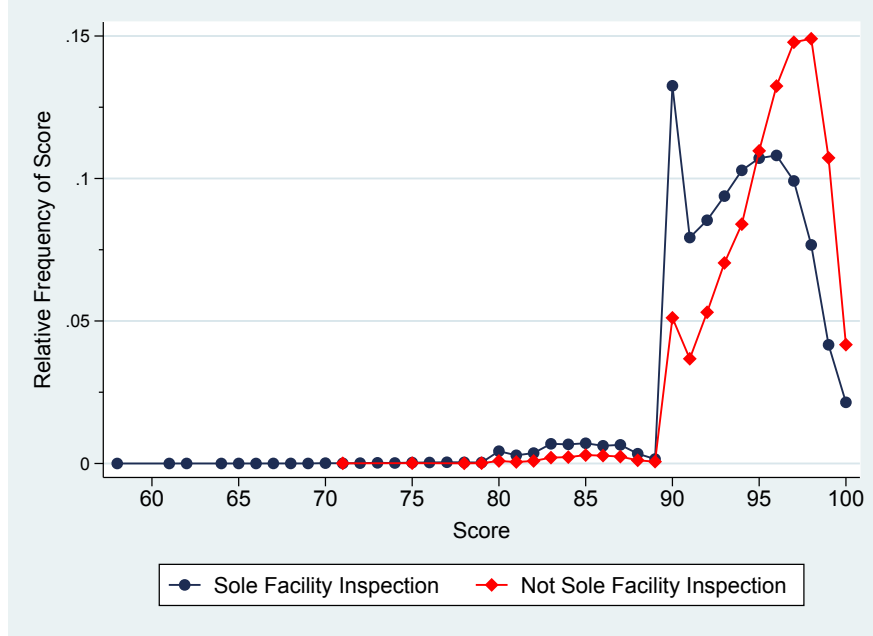


Figure 1: Distribution of Inspection Scores at All Facilities

Navy dots mark the relative frequency of scores among 173,181 inspections on days where establishments received their facility’s only inspection. Red diamonds mark the relative frequency of scores among 16,982 inspections on days where establishments received one of multiple inspections at their facility. All scores are measured under the pre-2017 scoring criteria.

Table 1: The Effect of Surprise Inspections on Performance: Simple Specification

	(1)	(2)	(3)	(4)
Variable	Violations	Critical Violations	Major Critical Violations	Deducted Points†
<i>Sole</i>	0.2380*** (0.0722)	0.0714** (0.0294)	0.0271** (0.0117)	0.3636*** (0.1060)
Post-2016 FE	Y	Y	Y	Y
Establishment FE	Y	Y	Y	Y
R-squared	0.5643	0.4344	0.3571	0.5563
N	9,545	9,545	9,545	9,545

OLS estimates. Standard errors, reported in parentheses, are clustered two-way at the facility and inspector levels. †Points deducted from scores measured by pre-2017 scoring criteria.

Table 2: The Effect of Surprise Inspections on Performance: Full Specification

	(1)	(2)	(3)	(4)
Variable	Violations	Critical Violations	Major Critical Violations	Deducted Points†
<i>Sole</i>	0.2786*** (0.0726)	0.0932*** (0.0298)	0.0279** (0.0124)	0.4276*** (0.1064)
Post-2016 FE	Y	Y	Y	Y
Establishment FE	Y	Y	Y	Y
Day of Week FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
R-squared	0.5684	0.4440	0.3597	0.5618
N	9,545	9,545	9,545	9,545

OLS estimates. Standard errors, reported in parentheses, are clustered two-way at the facility and inspector levels. †Points deducted from scores measured by pre-2017 scoring criteria.

Table 3: The Effect of Surprise Inspections on Performance: Robustness Check

	(1)	(2)	(3)	(4)
Variable	Violations	Critical Violations	Major Critical Violations	Deducted Points†
<i>Sole</i>	0.2650*** (0.0938)	0.1118*** (0.0429)	0.0405** (0.0169)	0.4579*** (0.1455)
Lagged Deducted Points	-0.0372 (0.0866)	-0.0298 (0.0349)	-0.0061 (0.0124)	-0.0792 (0.1416)
Post-2016 FE	Y	Y	Y	Y
Establishment FE	Y	Y	Y	Y
Day of Week FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
R-squared	0.5927	0.4778	0.3968	0.5888
N	7,632	7,632	7,632	7,632

OLS estimates. Standard errors, reported in parentheses, are clustered two-way at the facility and inspector levels. †Points deducted from scores measured by pre-2017 scoring criteria.