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R E P O R T



# Small Businesses and Workplace Fatality Risk

## An Exploratory Analysis

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## Summary

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It has long been argued that the burden of health, safety, and environmental regulations falls more heavily on small businesses than on large ones. This is important because over 55 percent of Americans are employed in businesses with fewer than 100 workers. Small businesses cannot take advantage of economies of scale and have less ability to stay aware of the voluminous and growing body of regulatory requirements. Therefore, it is not surprising that policymakers have shown concern about the regulatory burden on small business. The Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) and its predecessor, the Regulatory Flexibility Act of 1980, seek to increase the weight given to small-business concerns in the regulatory rulemaking and enforcement processes. Similarly, the Occupational Safety and Health Administration (OSHA) exempts workplaces with fewer than 11 workers from regular “programmed” inspections and considers firm size when assessing penalties for violations of its safety and health standards. OSHA has also developed a consultation program for firms with fewer than 500 workers.

Yet while concern over the regulatory burden on small business is important, policymaking should also be guided by an understanding of the benefits of health, safety, and environmental regulations in preventing injury and other harms. Both the burden and benefits of regulations are likely to be affected by the magnitude of the risks at small businesses. Our current understanding of such risks is incomplete, however. There is a good deal of evidence that small *establishments* (single physical locations at which business is conducted) have much higher rates of deaths or serious injuries than larger establishments have (see, e.g., Mendeloff and Kagey, 1990; Nichols, Dennis, and Guy, 1995; Fenn and Ashby, 2001), but there has been little study regarding injury or fatality rates at small *firms* (e.g., businesses with a small number of employees). Do the findings for establishment size actually represent the effects of firm size? Or do both independently affect risks? Different preventive strategies may be appropriate if firm size rather than establishment size is a key factor in affecting levels of risk.

To shed light on these issues, we examined the relationship between the fatality rate, i.e., the number of deaths per 100,000 workers, and business size, both in terms of establishment size and firm size, for the period from 1992 to 2001. We focus on fatality rates chiefly because we believe that underreporting of injuries is greater for less-serious injuries and that smaller firms and establishments are especially likely to underreport. Because our study looks at both firm size and establishment size, we are able to disentangle the effects of each.

The analysis uses fatality data drawn from OSHA accident investigation reports, employment data from *County Business Patterns* (CBP) (U.S. Department of Commerce, 2006), and a table from the U.S. Census on employment in establishment-size and firm-size combinations (U.S. Census Bureau, undated). It is important to note that OSHA generally does not investigate deaths due to highway crashes or assaults. Therefore, these events are excluded here, despite the fact that they account for almost half the deaths counted in the Census of Fatal Occupational Injuries conducted by the Bureau of Labor Statistics (U.S. Department of Labor, 2004).

## Why Size Might Make a Difference

We might expect the risks of injury to be *higher* at *small firms* for several reasons.

- Smaller firms might be expected to receive lower savings from preventing injuries. The limited actuarial experience at small firms means that they are subject to little or no experience rating by workers' compensation insurers. Thus, small firms will not see reductions in their workers' compensation premiums even if their injury losses decline. Small firms are also less likely to be unionized, and some evidence indicates that unions increase the probability that workers will receive higher wages to compensate for higher risks (Viscusi, 1983). OSHA also levies reduced fines against small firms, which reduces the incentive to correct hazards.
- Smaller firms are also more likely than larger firms to employ "higher-risk" workers (i.e., workers who are younger, unmarried, and have lower levels of education and experience) (Belman and Levine, 2004). They may not pressure management on safety issues as much as older and married workers would. These characteristics also may make it more costly for firms to achieve a given level of safety.
- Both smaller firms and establishments will be less able to realize economies of scale in the production of safety. Lacking in-house expertise, they may face higher marginal costs to obtain information about risks and how to reduce them.
- Smaller establishments are less likely to be inspected, reducing the marginal benefit of compliance.

In sum, there appear to be good reasons to expect that both smaller firms and establishments will exhibit higher levels of risk than will larger ones. The reasons are more numerous and perhaps more powerful at the firm level.

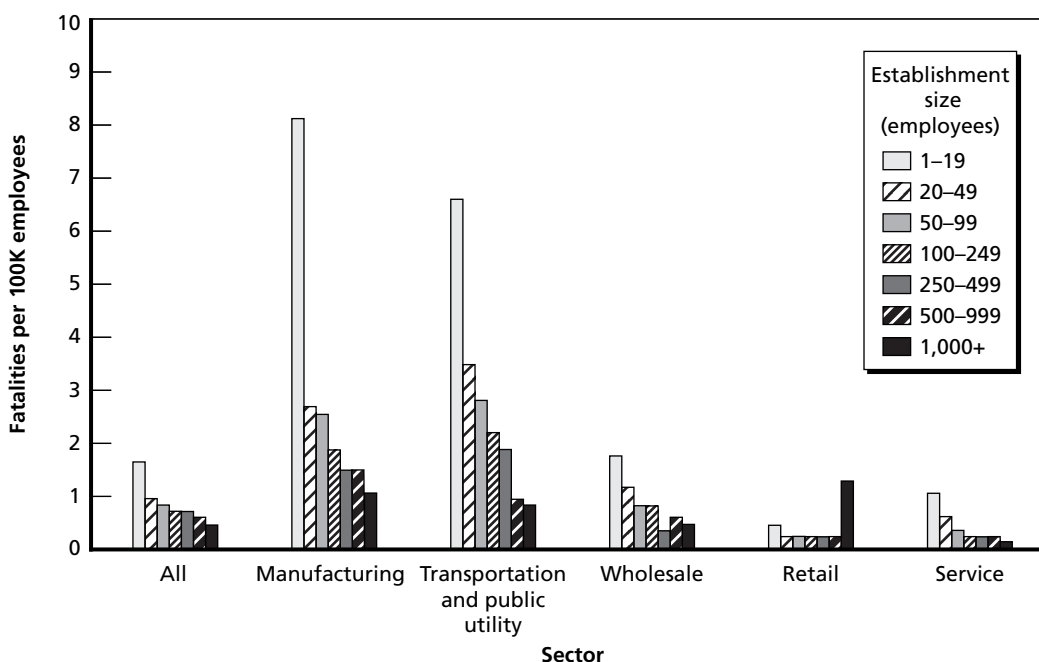
## Key Findings

The findings below relate primarily to the 10 years from 1992 to 2001 and are based on the 17,481 workplace fatalities investigated by OSHA.

### The Simple Relationships Between Establishment Size and Fatality Rates and Between Firm Size and Fatality Rates Are Both Strongly Negative

Our analysis of fatality rates among establishments of different sizes indicated that the smallest establishments had the highest fatality rates. Figure S.1 shows the fatality rates for each establishment size category and for each of the industry sectors with the most employees and most deaths (other than construction<sup>1</sup>): manufacturing, transportation and public utilities, wholesale trade, retail trade, and services. The figure indicates that, except in retail trade, establishments with 1–19 workers had fatality rates that were 4 to 10 times higher than those in the category with the lowest rate and 1.5 to 3 times higher than those in establishments with 20–49 employees. Further analysis indicated that, within the 1–19 category, the rates dropped sharply as well, with rates for establishments with 1–4 workers much higher than those in establishments with 5–9 workers, and higher still compared to those with 10–19. Our results, therefore, confirm findings from earlier research on fatalities and establishment size.<sup>2</sup>

**Figure S.1**  
Fatality Rate by Establishment Size, by Sector



RAND TR371-S.1

<sup>1</sup> We exclude the construction sector from some analyses because of ambiguity about the meaning of an “establishment” in that sector.

<sup>2</sup> We also considered the possibility that the negative relationship between fatality rates and establishment size could be due to composition; that is, industries with higher fatality rates might happen to be those with smaller establishments. When we examined very detailed industry categories, we still generally found that the smallest establishments had the highest rates. However, the decreases with size were not as great as they were at the sectoral level.

The simple relationship between fatality rates and *firm size* was similar to that shown in Figure S.1. Fatality rates also decreased with firm size, although the decreases were not as strong or consistent as they were for establishments.

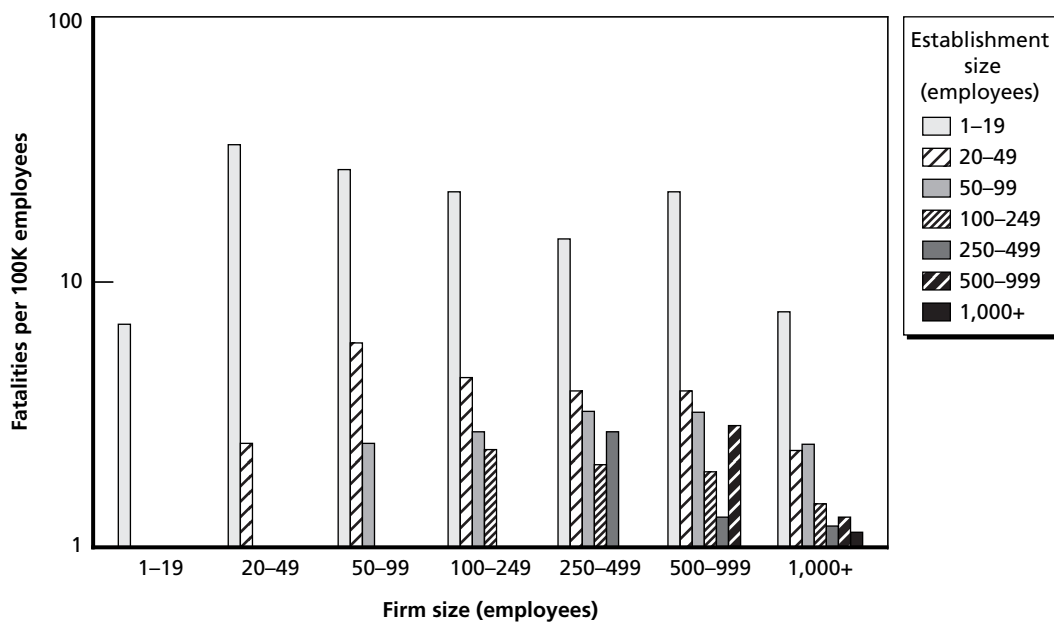
**Within Firms of a Given Size, Fatality Risk Still Declines Steadily with Larger Establishment Size, but Once We Control for Establishment Size, Firm Size Has Little Impact on Risk**

The two figures below show the effects of establishment and firm size on fatality risk, holding the other one constant. (We show the results here only for the manufacturing sector, although results for other sectors were similar, except for retail trade.) Figure S.2 shows, for example, that in firms with more than 1,000 employees, the fatality rate is highest for establishments with 1–19 workers and drops substantially (although not continuously) for larger establishments. The other firm-size categories in Figure S.2 show the same pattern.

Contrast the patterns in Figure S.2 with the patterns in Figure S.3, which shows how the fatality rates of firms of different sizes vary within establishments of a given size.

For example, if we look at establishments with 1–19 workers in Figure S.3, we see that the smallest *firms* (those with 1–19 workers) actually have the lowest fatality rate, not the highest. Then the rate increases with firm size until it declines for the largest firm size.

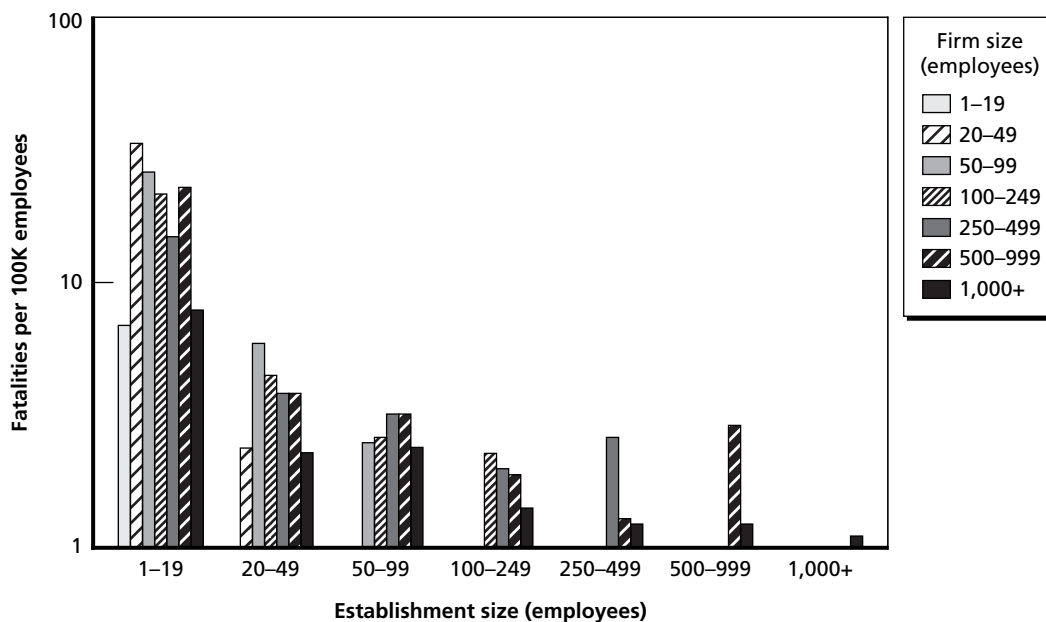
**Figure S.2**  
**Fatality Rate by Establishment Size, Holding Firm Size Constant (Manufacturing)**



RAND TR371-S.2



**Figure S.3**  
**Fatality Rate by Firm Size, Holding Establishment Size Constant (Manufacturing)**



RAND TR371-S.3

### Effect of Firm Size Depends on Establishment Size

The pattern described here applies to the three smallest establishment-size categories in Figure S.3. For establishments with more than 100 workers, in contrast, the smallest firm has the highest fatality rate. So in small establishments, there appears to be something protective about being a small firm.

### Higher Rates in Small Businesses Are Related to Violations

We also considered whether the causes of fatal accidents at small establishments differed from those at larger ones. We looked at two issues here. First, we examined whether the higher fatality rates seen at smaller establishments were related to a higher rate of fatality-causing, serious violations of OSHA standards. Second, we considered whether accident events that are more likely to cause death (e.g., electrocutions, explosions) were more common at small establishments than at larger ones.

We found that some part of the higher fatality rates at small establishments appears to be related to noncompliance with OSHA standards. Our findings varied somewhat for federal OSHA states and those operating their own enforcement programs. In the former, the percentage of deaths with violations was higher in small establishments; in the latter, the percentages were constant across sizes. However, because the total fatality rates are so much higher in small establishments, even when the percentages related to violations are the same, it means that the fatality rate due to violations is also much higher in small establishments.

### **Electrocutions Are Slightly More Common in Small Establishments**

We also found variation in the types of injury events that caused deaths among establishment sizes, but these differences were not very large. Electrocutions were relatively more frequent in establishments with 1–19 employees. Thus, for example, establishments with 1–19 workers had 40 percent of all deaths in a sector, but 45–50 percent of the electrocution deaths.

### **Fatality Rates at Small Establishments Declined Slightly Over Time Compared to Those at Larger Establishments**

We also examined establishment fatality rates by sector for three periods (1984–1989, 1990–1995, and 1996–2002) to see whether there had been any changes in the patterns among size categories.<sup>3</sup> We found that, in some sectors, death rates tended to decline somewhat for establishment sizes below 50 workers but were unchanged or increased somewhat for larger sizes. There was no evidence that death rates at smaller establishments were increasing relative to larger ones.

### **Nonmetropolitan Location and Unionization Were Both Associated with Higher Establishment Fatality Rates**

We carried out a regression analysis (using the Poisson model) to see whether adding variables for nonmetropolitan location and unionization affected our estimates of establishment- and firm-size effects. To do this analysis, we had to use a different subset of the OSHA data. We found that, while both of these variables were associated with increases in the fatality rates (40 percent for the location variable; 12 percent for the union variable), including them did not cause changes in the estimated effects of the firm- and establishment-size variables.

## **Interpreting the Findings**

Our study reinforces the growing body of literature indicating that small establishments tend to have the greatest risks. We were surprised to find, however, that once we controlled for establishment size, risks did not decline steadily or strongly with increasing firm size. Establishment size appears to have a much larger effect on fatality risks than firm size does. To the extent that researchers have found that the simple relationship between firm size and fatality risk is negative, the result would appear to be due to the tendency for larger firms to have larger establishments.

In light of the reasons given for expecting risks to be highest for small firms, our findings are puzzling. Are the increases in the financial incentives to prevent injuries that are associated with larger firm size (e.g., experience rating under workers' compensation) not as strong as we

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<sup>3</sup> This particular review included data only from federal OSHA states because not all the other states were submitting data to the OSHA Integrated Management Information System (IMIS) database (the principal data source for this study) during this period.

assumed? Is the assumption of economies of scale incorrect? Or are there other factors associated with firm size that offset the impact of the factors above? One possibility might be that there are higher costs to understand and coordinate activities at multi-establishment firms.

This speculation may be related to the other unexpected finding in the study. Specifically, we found that in *small establishments*, small firms had the lowest fatality rates, while in *larger establishments* (over 250), the smallest firm generally had the highest rate. This pattern appeared in most sectors.<sup>4</sup> What could explain it?

The only explanation that occurred to us was that this protective effect might reflect the presence of an owner on site. Admittedly, we have no prior evidence that having an owner on site improves safety. However, it seems plausible that an owner might, on average, feel more responsibility to run his or her plant in a way that did not injure workers than a hired manager would. While this explanation is speculative at this point, the pattern appears large enough to warrant further investigation.

Finally, there is some question about how to interpret the strong relationship between risk and establishment size. We assume that smaller establishments generate higher risks. However, if work processes with greater inherent risks tend to get located at smaller establishments (or firms), then the causal effect of small workplaces on risk will be overestimated.

### Limitations

Our findings are subject to some important limitations. First, our largest size category, for both establishments and firms, was 1,000 or more employees. For firms, this level is below what would usually be required to meet self-insurance requirements under most workers' compensation laws. Thus, it is likely that this categorization does not give a very precise measure of risk for the firms that may have the strongest financial incentives to prevent injuries. Second, the OSHA data on fatalities do not include all of the relevant deaths, although we believe that fuller reporting would show even higher relative rates at small establishments. Third, our annual employment estimates are based on March figures, which might lead us to underestimate employment at smaller establishments with high seasonal variation in employment.

### Policy Options

Given the limitations of the study, more research is required to clarify its policy implications. Nonetheless, the findings are clear enough to prompt discussion of several possible policy interventions that might be considered to address health and safety problems at small establishments or firms. Each option is marked by uncertainty. Our goal, therefore, is to provide the foundation for a sound debate on policy options.

Our research suggests that *it may be worthwhile for OSHA to develop programs targeting firms that employ 20–999 workers and have small establishments*. As Figure S.3 showed, if a firm

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<sup>4</sup> However, the Poisson regression analysis, which used a different data set and a slightly different measure of fatality risk, found that firm-size effects were similar for all establishment sizes. For each establishment size, the fatality rates increased steadily with firm size until they reached the 1,000+ category, when they fell.

has between 20 and 999 workers and has small establishments (certainly below 50 and perhaps below 99), the fatality rates in those establishments tend to be quite elevated compared to rates in establishments with either 1–19 or over 999 workers. Rather than trying to work only at the establishment level, OSHA might be more effective (and use fewer administrative resources) if it began discussions at the firm level as it tries to develop an appropriate mix of tools.

### **A Greater Inspection Effort in Small Establishments**

Although small establishments are riskier for workers, and although the fatality rates for deaths linked to violations are also higher, it may still be difficult to justify a greater inspection effort there. For example, even if the risks per worker were five times higher at establishments with eight employees (the mean number in workplaces with fewer than 20), the expected benefits in risk reduction would still be greater at a workplace with more than 40 employees (assuming that the reduction in risk was proportional to the initial risk).

Another source of caution in making the decision to redeploy inspectors to small establishments lies in the fact that there are fixed costs associated with conducting inspections, so that, for example, the time required to inspect an establishment with 20 workers is likely to be more than one-fifth the time required to inspect an establishment with 100. Moreover, the fact that death rates for establishments that have been exempted from programmed inspections declined no less over time than rates in larger establishments casts some doubt on whether removing the exemptions would lead to increased safety performance.

On the other hand, some studies, most recently for the 1992–1998 period (Gray and Mendeloff, 2005) indicate that the effect of OSHA inspections on preventing injuries is greater (in percentage terms) at smaller establishments (fewer than 100 employees) and that there was no evidence of a preventive effect at establishments with more than 250 workers. If the latter finding is valid, then a shift toward emphasizing inspections at smaller workplaces, including those with fewer than 20 employees, might be justified. Unfortunately, the preventive effects of inspections were noted only when OSHA found serious violations and assessed penalties. In their absence, inspections, on average, had no effect or a perverse one, perhaps by signaling to management that there were no problems that needed its attention.

### **Expansion of Existing Small Business Consultation Programs**

OSHA already conducts a consultation program that targets smaller businesses. Another policy option, therefore, would involve expansion of this program. Typically, there are about 25,000 consultations conducted each year, some of which include safety training. Employers who request consultations are not cited for any violations that are found, but they do have an obligation to abate them, and consultants are supposed to make referrals to OSHA when they do not.

However, evidence on the effectiveness of consultations is sparse. Mendeloff and Gray (2001) found declines after consultations for both violations (a large effect) and injuries (a small effect), compared to establishments without consultations. However, this research could not rule out the possibility that employers who request consultations would have made the changes without the consultation. Moreover, the fact that consultation-program waiting lists are short raises questions about whether there is enough unmet demand to justify expan-

sion of the program. In the past, big increase in demand for consultations has occurred only when employers thought they faced a much higher threat of inspection. However, it does seem that state programs have some control over the demand and that it might be possible to expand the demand moderately for consultations from smaller workplaces.

### Information Programs

Based on the accident investigation data we reviewed, we believe that it may be worthwhile to consider a trial of a new educational program that would be targeted at small establishments. OSHA currently publishes an array of educational materials designed to assist employers to reduce hazards. The agency also carries out education programs through cooperative activities with trade associations.

Additional information campaigns might heighten attention to safety by reminding employers about the workers in their industry in establishments like theirs who have died on the job and the factors associated with these deaths. Although workplace deaths are relatively rare, deaths may have a special salience for workers and employers alike. The infrequency of these events seems likely to make it difficult to keep much management focus on safety, especially given the multiple and conflicting demands upon the time of a small business owner. Information campaigns might be a means of raising and maintaining awareness.

Operationally, an employer in a specific industry category might get a list and description of recent deaths occurring in that industry in workplaces with under 20, 50, or 100 employees. The causal factors would be described along with any OSHA violations cited as related to the deaths. These deaths would be limited to those investigated by OSHA and would exclude most highway deaths and assaults. The logic behind this approach is that employers will be more motivated to pay attention to similar issues at their own workplaces and to take actions, including abating hazards that might reduce the probability of such events occurring.

The effects of such an intervention might be small, but the public costs would be small as well, probably no more than several million dollars. A crucial unknown is the level of costs that would be incurred by small establishments in response to this initiative. If, for example, each of 1 million small establishments spent \$1,000, the total cost would be \$1 billion. It would probably make sense to begin with a pilot program in one or two states to identify the scope and nature of the employer response.

### Next Steps

As suggested in its title, this report is intended as exploratory and suggestive, not definitive. However, we believe that the findings of this study raise some interesting questions for social scientists. The finding that the smallest *firms* were relatively safe raises questions about the importance of experience rating under workers' compensation as an incentive for safety. Other studies have found strong effects of firm size on workers' compensation costs, but it is possible that many of these studies confounded firm size and establishment size.

Our finding about the different effects of firm size in small and large establishments may raise important questions for students of entrepreneurship and of organizational behavior.

Some further insights may be obtained by merging IMIS data with establishment-level data from the Census of Manufactures (U.S. Census Bureau, 1999) and the analogous databases for other industries. That match would allow clear identification of single-establishment firms versus others.

One finding of this research was that the size patterns among establishments did sometimes vary by industry. We did not attempt to explain the reasons for these variations, but doing so might shed valuable light on the causal factors at work.

It would also be useful to try to find out whether the poorer fatality performance of mid-sized firms in small establishments also applied to nonfatal injuries. We are not aware of any efforts to untangle establishment-size and firm-size effects for nonfatal injuries. Any effort would need to take care to consider how underreporting would affect the results, but we believe the effort would be worthwhile.