CPWR TECHNICAL REPORT

Occupational Licensing and Injuries and Death in Construction: An Analysis of Electricians and Plumbers

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Abstract

Despite the growth of occupational licensing as an important labor market institution there has been little empirical work on the influence of occupational regulation on workplace injuries and deaths. Our analysis focuses on two major construction occupations, electricians and plumbers, in the U.S. The industry and occupations we study have a relatively large number of deaths and injuries in comparison to other industries, and have also recently experienced an upsurge in occupational regulation. Specifically, we examine how the implementation or changes in occupational requirements, apprenticeships and higher-quality training programs by state government through occupational licensing's influence both on the occurrence and severity of injuries and deaths using proprietary data from the Survey of

largest number of occupational deaths of any blue collar occupational category (Bureau of Labor Statistics, 2006a). In addition, construction occupations also are among the ones that suffer the highest injury rates (Bureau of Labor Statistics, 2007). The main focus of our research has been the development of new data that has the potential to be implemented further in a modeling framework beyond our preliminary multivariate estimates. Nevertheless, we provide basic estimates that can serve as the starting point for future research. Where possible, we provide multivariate estimates linking various levels of state or local occupational regulation to the level and changes of occupational injuries and deaths of electricians and plumbers.

Occupational regulation in the United States generally takes three forms. The least restrictive form is registration, in which individuals file their names, addresses, and qualifications with a government agency before practicing their occupation. The registration process may include posting a bond or filing a fee. In contrast, certification permits any person to perform the relevant tasks, but the government—or sometimes a private, nonprofit agency—administers an examination and certifies those who have achieved the level of skill and knowledge for certification. For example, travel agents and car mechanics are generally certified but not licensed. The toughest form of regulation is licensure; this form of regulation is often referred to as "the right to practice." Under licensure laws, working in an occupation for compensation without first meeting government standards is illegal. According to the Council of State Governments in 1992, more than 800 occupations were licensed in at least one state, and more than 1,100 occupations were licensed, certified, or registered (Brinegar and Schmitt, 1992).

During the early 1950s, less than 5 percent of the U.S. workforce was in occupations covered by licensing laws at the state level (Council of State Governments, 1952). That number grew to almost 18 percent by the 1980s—with an even larger number if federal, city, and county occupational licensing were included. By 2000, according to data gathered from the Department of Labor and the 2000 Census, the percentage of the workforce in occupations licensed by states was at least 20 percent. In contrast to the state level occupational licensing, during this period no systematic attempts were made to gather information on licensing or its wage or employment effects at the federal or local level.

As employment in the United States shifted from manufacturing to service industries, which typically have lower union representation, the members of the occupations established a formal set of standards that governed members of the occupation. For a professional association, obtaining licensing legislation meant raising funds from members to lobby the state legislature, particularly the chairs of appropriate committees. In addition, the occupation association often solicits volunteers from its membership to work on legislative campaigns. With both financial contributions and volunteers, the occupational association has a significant ability to influence

The two data sets have gone through important changes in the listing of categories that constitute the occupations of electricians and plumbers in the construction industry. Table 1B summarizes the main changes of the data sets pertinent to our sample selection. Since year 2003, the SOII and CFOI adopted the 2000 Standard Occupational Classification system and 2002 NAICS to classify occupations and industries. Specifically, from 1992 to 2002, they categorized the construction industry using the 1987 Standard Industrial Classification (SIC) categories numbered 1500 to 1799. After 2003, however, they coded the construction industry as 23600 to 23899 using the North American Industry Classification System (NAICS). As for the occupation classification, they categorized electricians and plumbers using the 1990 Census Occupational Classification System between 1992 and 2002, but then switched to using the 2000 Standard

Specifically, injury rates, expressed as the number of work injuries per 100 workers, were calculated as follows:

1) $(N_{st} / W_{st}) \times 100$,

where N is the nationally weighted number of nonfatal injuries for Electricians (E) or Plumbers (P) in state s in year t from the SOII; and W is the employment of Electricians (E) or Plumbers (P) in state s in year t, which is estimated from electricians and plumbers who work for private industry with the exclusion of the self-employed, farms with fewer than 11 employees, private households, federal, state and local government agencies from the CPS MORG data.[4]

The death rates, expressed as the number of fatal work injuries per 10,000 workers, were calculated as follows:

2) $(N / W) \times 10{,}000$

where N is the number of deaths for Electricians (E) or Plumbers (P) who worked in the private sectors in state s in year t with an exclusion of the self-employed, farms with fewer than 11 employees, private households, federal, state and local government agencies from the CFOI; and W is the employment of Electricians (E) or Plumbers (P) in state s in year t, which is estimated from electricians and plumbers who work for private industry with the exclusion of the self-employed, farms with fewer than 11 employees, private households, federal, state and local government agencies from the CPS MORG data.

There are a number of limitations to these fatality rates to be acknowledged (Bureau of Labor Statistics, 2006b). First, the CPS MORG data used to estimate employment are based upon a sample rather than a complete count of employment. Therefore, the CPS MORG estimates and the injury and death rates have sampling errors. The figures obtained for the rates may differ from figures that would have been obtained if it had been possible to take a census of employed persons. Second, the CPS categorizes workers according to their primary job, which may differ from the job the deceased was working in when fatally injured as reported in the Census of Fatal Occupational Injuries. Finally, the rates are based on employment. The employment-based measure does not take into account differences in the number of hours worked. Although hours-based rates, which are adopted by recent publications by the BLS adopted, are generally considered more accurate, the employment-based rates are used in the analysis because of limitations in the availability of data for hours worked.

This case study can illuminate the potential economic and “life and limb” policy issues of the increased regulation of occupations in the U.S. labor market. This report fills a gap since there has been little analysis of the issue (Shimberg, Esser, and Kruger, 1973; Perloff, 1980). We also plan to examine the impact of occupational regulation on wages to provide a preliminary examination if there are any compensating differentials of wages for more rigorous occupational licensing statutes. The key data we use for the analysis is the CPS Merged Outgoing Rotation Group (MORG) data for 1992-2007 and state statutes and controls. This is mainly because the SOII and CFOI do not survey information on wages and union membership of the injured and deceased construction workers.

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[4] In this report we present empirical analyses using the nationally weighted estimates of nonfatal injuries from the CFOI. The analyses are almost identical when we used the state weighted estimates of nonfatal injuries.

In order to examine occupations in our analysis we show the categories or stages to work in the occupation. The general categories of construction worker hierarchy that are required to have some form of licensing are the following categories:

- Journeyman
- Master
- Maintenance Plumber or Electrician
- Contractor

The licensing of workers in construction generally takes place at the state or local level. The licensing of workers in construction generally takes place at the state or local level. To illustrate, New York City did not have a licensing board well into the 1970s, to regulate journeyman plumbers and electricians. In contrast, Chicago had a 3 person board to license plumbers but no board for licensing electrical contractors in order to substitute for the lack of licensing at the state level. The pass rates for electricians in Chicago were lower than passing the state of Illinois bar exam or dental licensing exam (Shimberg et. al. 1973).

Trends in Injuries and Deathsfor Electricians and Plumbers

From the early 1990s there has been a downward trend in the injury rate for plumbers and electricians. Figure 2 shows the trend in injuries using data from the SOII. However, from about 2000 the decline has been much smaller. In contrast, the death rate as a result of work-related injuries has shown a decline for electricians in Figure 3, but the death rate for plumbers due to work related injuries has remained largely flat from the early 1990s to the present. The estimates from these figures show some decline during the early period of the estimates, but a slow, if any, decline in death and injuries for these two kinds of construction workers from 2005 to 2007. Whether this is due to public policy changes or that given the type of work these two occupations perform, and their inherent danger, that further reductions are hard to obtain, without major technological changes, is difficult to ascertain through these data. Finally, in appendix 1 and 2 we give five main events causing nonfatal injuries for electricians and plumbers and deaths for electricians, respectively.

The basic theory of the licensing and health and safety suggests the following set of issues:

- Licensing introduces standardization in occupation specific training (apprenticeships), education, and procedures which would reduce death and injuries
- Eliminates lowest part of the quality distribution within the occupation through education and testing and reduces death & injuries.
- Maintains quality and time and money attachment to the occupation through continuing education that reduces death & injuries.
- Reduces innovation in safety and health procedures that may raise death & injuries.

In order to examine which of these occupational issues dominates in the determination of health and safety for plumbers and electricians, we developed a regulatory index which captures the major elements of the statutes across states. Table 2 gives the key elements (and their operational

Table 5 gives the growth in the statutes over the period from 1992 through 2007. The results show that both occupations experienced growth in regulations governing the entry and training requirements. The growth in the level of regulation was higher for electricians than for plumbers. However, the overall level of regulation was higher for plumbers than electricians both in 1992 and in 2007.

Empirical Strategy for Estimating the Role of Regulations on Labor Market Outcomes and Health and Safety

The empirical analysis is divided into two sections, each of which examines a different set of outcomes. First, we will use our measures of occupational regulations to examine the influence of the measures of restrictiveness on the labor market outcomes for electricians and plumbers, using wages as a measure of labor market outcomes. Next we will analyze the role of the regulations on measures of injury and death on the job. As background we give the rankings of the top five and bottom five states by their ranking on measures of regulatory restrictiveness in 2007. Table 6 presents the results for electricians, while Table 7 shows the results for plumbers. Although no clear pattern emerges for both occupations, states in the Southeast appear to have few measurable regulations on entry for both plumbers and electricians.

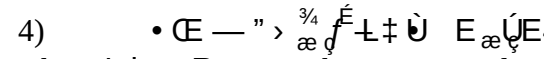
In the following section, we present multivariate analyses focusing on the type of occupational regulations, and three specifications (

percent on hourly earnings. In contrast, the results from the table show the influence of unions on hourly earnings to be between a statistically significant 27 and 32 percent.

The wage effects shown in Table 10 for plumbers are not nearly as clear or robust for as the wage effects on licensing. Similar to electricians the influence of the overall index for licensing is not statistically significant. Moreover, there is no clear pattern of the influence of having regulation at the state or local level having an influence on wage determination. Unlike the influence of apprenticeships, exam requirements, and continuing education requirements for electricians, there was if anything, a small negative influence of these required policies on wage determination for plumbers. There may be some substitution for low quality plumbers who do have these requirements that are getting more work in the construction industry. Moreover, given the lack of variation in the data for plumbers there may be more noise in the wage data for this occupation.[6]

Testing the Health and Safety Models with Licensing Regulations[7]

The main part of our analysis focuses on the incidence of injuries at the state level. This uses two main measures of the severity of injuries: days away from work due to injury/illness and the death incidence rates at the state level. The basic model for the injury incidence rate can be stated as follows:

4) 

where $Injury\ Rates_{st}$ is the injury incidents rates of Electricians (E) or Plumbers (P) at state s in time period t; R_{st} is the licensing occupational regulations and components of the regulation in state s in time period t; X_{st} is the vector includes covariates measuring characteristics of each state s; $/$ and are state and year fixed effects, respectively; and 0_{st} is the error term.[8]

Table 11 shows the influence of occupational regulation on the injury incidence rates for electricians. The results show mixed results for the overall influence of licensing on the injury incidence rates for electricians, with the most rigorous test using state fixed effects showing somewhat of a reduction in injury rates. None of the specific requirements such as apprenticeships, exam requirements, and continuing education is consistent in their impact. Similarly, the results for plumbers of the influence of occupational regulation on the incidence of injury rates for plumbers are inconclusive. In Table 12 none of the regulation variables are statistically significant for the incidence of occupational injuries.

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[6] We also conducted the same analysis using information from the American Community Survey (ACS) as a further test of the role of occupational licensing provisions on wages. The results from the ACS were generally consistent with those for electricians in this report, but not for plumbers. We do not present the results from the ACS in this report, because the ACS partially covers our sample period (i.e., year 2000 and since then) and does not have information on union membership. However, the results are available upon request to the authors.

[7] Our empirical analyses from the health and safety models with licensing regulations do not include states that regulate the occupations at the local level.

[8] The state-level control variables were aggregated using the individual variables shown in Table 9 and 10 from the

In the next section of the analysis of injuries and occupational regulation we examine severity of injuries at the individual level using the same data and a similar model. The severity of injury model can be stated as follows:

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where $Severity\ of\ Injury_{ist}$ is the days away from work due to injury/illness of individual Electricians (E) or Plumbers (P) i at state s in time period t; R_{st} is the licensing occupational regulations and components of the regulation in person i's state s in time period t; X_{ist} is the vector includes covariates measuring characteristics of each injured/ill person; / and are state and year fixed effects, respectively; and 0_{ist} is the error term.[9]

The estimates for severity of injuries for electricians from negative binomial regressions are presented in Table 13. The estimate of the incidence rate ratio of continuing education indicates a 0.361 times reduction in days lost of .70 as a result of having this provision in an occupational licensing law, relative to no requirement of continuing education. None of the other provisions are statistically significant. Similarly, Table 14 gives the estimates of the influence of occupational regulation for plumbers' severity of injuries. Except for the role of the exam requirement which has a counterintuitive sign, all the other results are not statistically significant. Overall the role of occupational regulation does not seem to impact the severity of injuries for either electricians or plumbers.

Our final model tests for the role occupational regulation on the incidence of death rates for both plumbers and electricians. The basic specification follows our earlier models and is presented as follows:

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where $Death\ Rates_{st}$ is the death incidence rates of Electricians (E) or Plumbers (P) at state s in time period t; R_{st} is the licensing occupational regulations and components of the regulation in state s in time period t; X_{st} is the vector includes covariates measuring characteristics of each state s; / and are state and year fixed effects, respectively; and 0_{st} is the error term.

Tables 15 and 16 present the estimates of the statistical model for each occupation separately. The results are consistent with those shown in the earlier estimates presented in this report. We find that measure of occupational regulation have little influence on the death rates in construction of electricians and plumbers. Perhaps the influence of licensing is small because of incentives for adhering to the regulations are small, or because the requirements are not significant barriers to entry into the occupation to keep out individuals who behave in unsafe ways? Further our analysis does not take into account the employer who may require unsafe methods of doing work, and that their requirements may also differ by state. Nevertheless, our analysis across incidence of injury, severity of injury, rates of death of these two highly visible occupations in construction show little influence of occupations regulation on health and safety of these workers.

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Bureau of Labor Statistics. 2007.

Appendix 1: Five Main Events Causing Workplace Non-Fatal injuries, 1992-2007

Electricians				Plumbers			
Events (Code)	Actual Occurrence	Estimated Occurrences	% of Estimated Occurrences	Events (Code)	Actual Occurrence	Estimated Occurrences	% of Estimated Occurrences
Overexertion in lifting (221)	2,031	12,411	9.05	Overexertion in lifting (221)	2,212	17,100	14.05
Fall from ladder (113)	1,519	11,625	8.48	Bending, climbing, crawling, reaching, twisting (211)	914	7,742	6.36
Bending, climbing, crawling, reaching, twisting (211)	1,233	8,608	6.28	Struck by falling object (021)	915	6,406	5.26

Appendix 2: Five Main Events Causing Workplace Deaths for Electricians, 1992-2007

Events (Code)	Electricians	
	Actual Occurrence	%
Contact with wiring, transformers, or other electrical components (3120)	351	30.08
Contact with overhead power lines (3130)	144	12.34
Fall from ladder (1130)	88	7.54
Contact with electric current of machine, tool, appliance, or light fixture (3110)	80	6.86
Contact with electric current, unspecified (3100)	30	2.57
Others	474	40.62
Total	1,167	100

Source: The SOII and CFOI from 1992 to 2002.

Appendix 3: Continued

		Electricians						Plumbers					
state	Year	Type of License	General Rqmt	Apprentice ship	Written Exam	Perf. Exam	Cont. Edu	Type of License	General Rqmt	Apprentice-ship	Written Exam	Perf. Exam	Cont. Edu
New Mexico	1992	S	1	1	1	0	0	S	1	1	1	0	0
New York	1992	L						L					
North Carolina	1992	S	1	1*	0	0	0	S	0	1	1	0	1
	2001							S	1	1	1	0	1
North Dakota	1992	S	0	1*	1	0	0	N					
	1993							S	1	1	1	0	1
Ohio	1992	S	1	1	1	0	0	S	1	1	1	0	1
Oklahoma	1992	S	1	0	1	0	0	S	1	0	1	0	0
	2002	S	1	1*	1	0	0	S	1	1	1	0	0
Oregon	1992	S	0	1	0	0	0	S	0	1	1	12	

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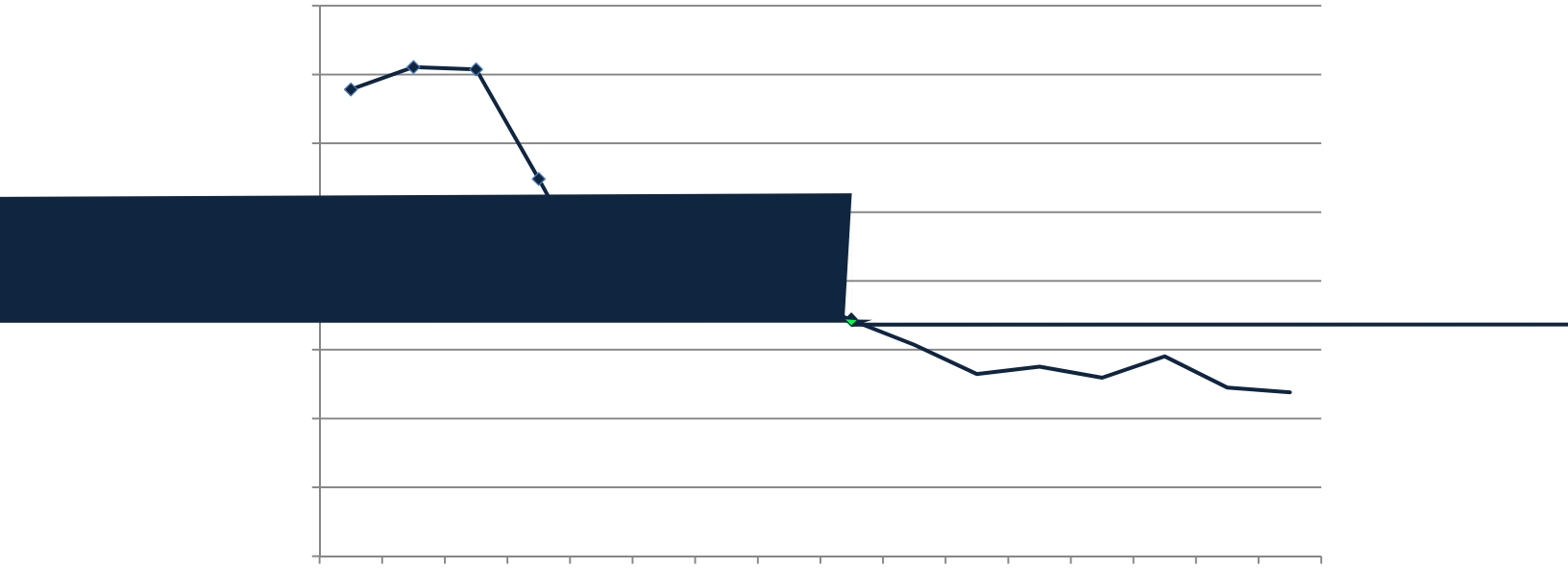
Figure 1: Comparisons in the Time-Trends of Two Labor Market Institutions: Licensing and Unionization

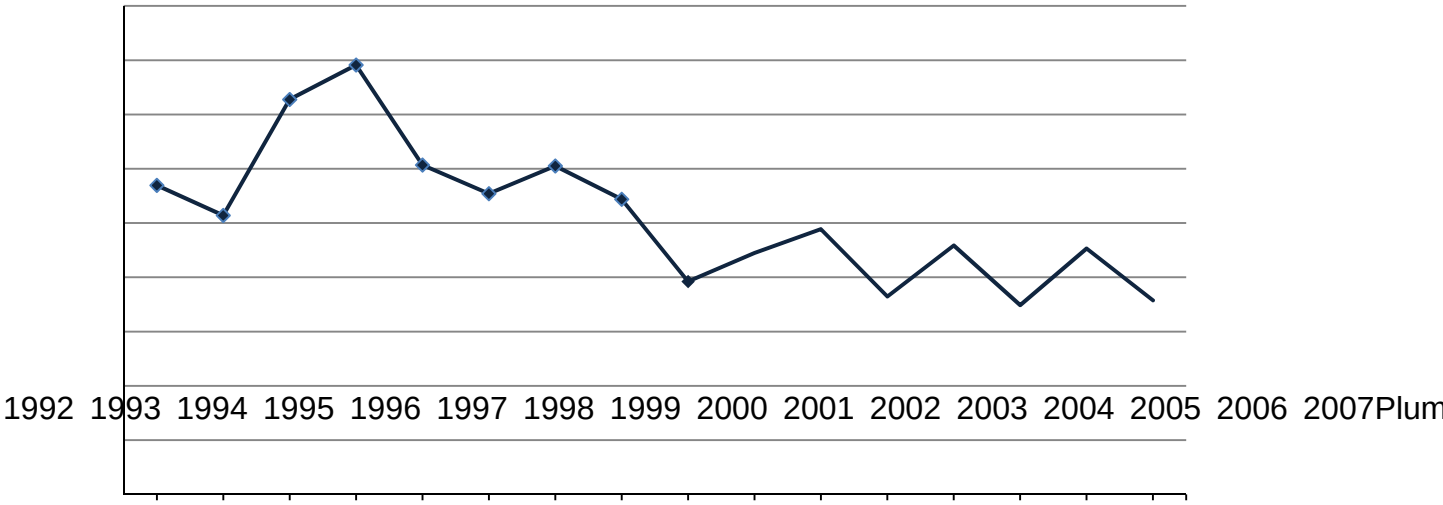
Note: Dashed line shows the value from state estimates of licensing to the Gallup Survey and Westat Survey results, and the union membership estimates are from the CPS.

Figure 2: Injuries Rates for Electricians and Plumbers, 1992-2007



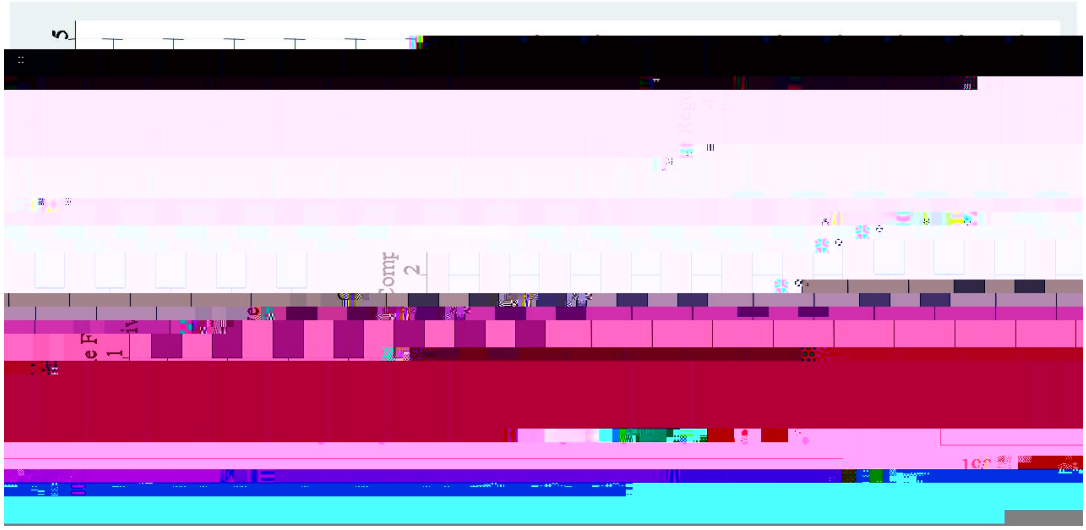
Note: Injury rate = (Estimated Injuries from the SOII using the weight for the national estimate/Estimated number of employment in each occupation from the MORG) ×100.

Figure 3: Death Rates for Electricians and Plumbers, 1992-2007



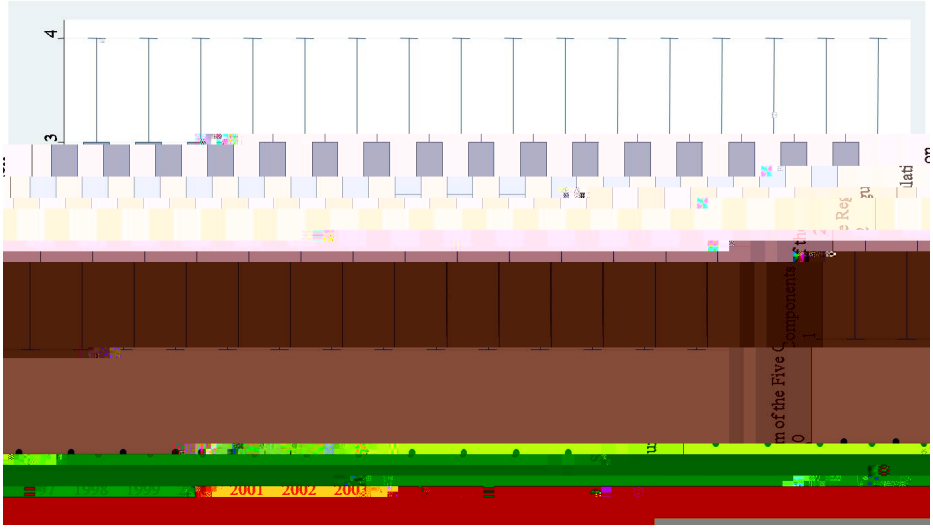
Note: Death rate = (Actual Number of Deaths/Estimated Number of Employment in each occupation from the MORG) ×10,000.

Figure 4: Box and Whisker Graph of the Sum of the Five Key Components of the Licensing Regulations for Electricians, 1992-2007



Source: The authors' survey of licensing statutes for electricians and plumbers by state from 1992 to 2007 in Appendix 3.

Figure 5: Box and Whisker Graph of the Sum of the Five Key Components of the Licensing Regulations for Plumbers, 1992-2007



Source: The authors' survey of licensing statutes for electricians and plumbers by state from 1992 to 2007 in Appendix 3.

Table 1A: Key Descriptions of the SOII and CFOI

Table 2: Key Elements and Definitions of Regulatory Variables

Variable	Definition
License	We coded 1 if either license is required by state statute or local statute; otherwise 0.
State license	We coded 1 if license is required by state statute
Local license	We coded 1 if license is required by statute of local municipality
Five major components	
General requirements	We coded 1 if either

Table 3: Stayers and Switchers in Occupational Regulation of Electricians, 1992-2007

Table 4: Stayers and Switchers in Occupational Regulation of Plumbers, 1992-2007

	State Licensing	Local Licensing	Certification	No Licensing
Stayers	All other States	Iowa; Kansas; Massachusetts; Mississippi; New York; Pennsylvania; Wyoming		Nebraska; West Virginia
Switchers		South Dakota (to state licensing in 1999); Virginia (to state licensing in 1995)	Idaho (to state licensing from 1996)	Alaska (to state licensing from 2005); North Dakota (to state licensing from 1993); Tennessee (to state licensing from 2006)

Source: The authors' survey of licensing statutes for electricians and plumbers by state from 1992 to 2007 in Appendix 3.

Table 5: Changes in the Index of Regulation for Electricians and Plumbers, 1992-2007

	Electricians			Plumbers		
Year	# of States	Mean	S.D.	# of States	Mean	S.D.
1992	42	1.90	1.12	42	2.24	1.21
1993	42	1.90	1.12	42	2.33	1.18
1994	42	1.98	1.18	42	2.33	1.18
1995	42	2.02	1.18	43	2.35	1.17
1996	42	2.02	1.18	43	2.42	1.18
1997	42	2.02	1.18	43	2.42	1.18
1998	42	2.07	1.18	43	2.42	1.18
1999	42	2.12	1.13	44	2.36	1.22
2000	43	2.16	1.09	44	2.39	1.20
2001	44	2.14	1.09	44	2.41	1.23
2002	44	2.16	1.10	44	2.43	1.23
2003	45	2.22	1.04	44	2.50	1.17
2004	45	2.22	1.04	44	2.50	1.17
2005	45	2.24	1.00	44	2.55	1.11
2006	45	2.24	1.00	44	2.61	1.06
2007	46	2.33	0.97	44	2.61	1.06
Total	693	2.11	1.10	694	2.43	1.16

Source: The authors' survey of licensing statutes for electricians and plumbers by state from 1992 to 2007 in Appendix 3.

Table 6: Regulation Rankings of the T**ρ** and Bottom Grouping of States in 2007 for Electricians

Top States		Bottom States	
State	Sum of the five Requirements	State	Sum of the five Requirements
Arizona	5	Alaska	1

Table 7: Regulation Rankings of the Top and Bottom Grouping of States in 2007 for Plumbers

Top States		Bottom States	
State	Sum of the five Requirements	State	Sum of the five Requirements
Connecticut	4	District of Columbia	0
Hawaii	4	California	1
Idaho	4	South Carolina	1
Indiana	4		
Kentucky	4		
Michigan	4		
North Carolina	4		
North Dakota	4		
Ohio	4		
Oregon	4		

Source: The authors' survey of licensing statutes for electricians and plumbers by state from 1992 to 2007 in Appendix 3.

Table 8: Basic Statistics from the CPS MORG, 1992-2007

	Electricians			Plumbers		
Variable	Obs	Mean	S.D.	Obs	Mean	S.D.
Hourly earnings	9,439	21.30	9.89	6,978	20.69	9.57
Gender (1: Male; 0: Female)	10,781	0.98	0.13	8,357	0.99	0.10
Age (Years)	10,781	37.29	10.91	8,357	38.43	10.99
Experience	10,781	18.64	10.95	8,357	20.23	11.10
Experience squared	10,781	4.67	4.71	8,357	5.32	5.03
High school graduate	10,781	0.46	0.50	8,357	0.51	0.50
Some college experience	10,781	0.24	0.43	8,357	0.19	0.40
College diploma or more	10,781	0.23	0.42	8,357	0.15	0.36
Marriage	10,781	0.64	0.48	8,357	0.66	0.47
White	10,781	0.92	0.27	8,357	0.92	0.27
Hispanic origin	10,781	0.08	0.27	8,357	0.11	0.31
Part-time	10,781	0.02	0.14	8,357	0.03	0.17
Government	10,781	0.02	0.14	8,357	0.01	0.11
Union member	9,440	0.38	0.49	6,978	0.33	0.47

Source: The CPS MORG files from 1992 to 2007.

Table 9: The Effects of Occupational Licensing on Hourly Earnings for Electricians

	1	2	3	4	5	6	7	8	9
License	-0.017	0.006	0.026						
	(0.056)	(0.051)	(0.037)						
State license				-0.044	-0.006	0.021			
				(0.057)	(0.053)	(0.038)			
Local license				0.050	0.034	0.085†			
				(0.065)	(0.053)	(0.046)			
Apprenticeship							0.063*		
							(0.030)		
Exam Requirements								0.073**	
								(0.025)	
Continuing Education									0.057†
									(0.034)
Local license							0.061*	0.123***	0.068*
							(0.029)	(0.028)	(0.030)
Union member		0.319***	0.269***		0.314***	0.269***	0.269***	0.269***	0.269***
		(0.012)	(0.013)		(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Gender	0.039	0.080*	0.085*	0.045	0.081*	0.086*	0.085*	0.085*	0.085*
(1: Male; 0: Female)	(0.047)	(0.036)	(0.034)	(0.047)	(0.036)	(0.034)	(0.034)	(0.034)	(0.034)
Age (Years)	0.009	0.014*	0.013*	0.009	0.014*	0.013*	0.012*	0.013*	0.013*
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Experience	0.027***	0.019**	0.019**	0.028***	0.019**	0.020**	0.020**	0.019**	0.019**
	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Experience squared	-0.060***	-0.057***	-0.055***	-0.060***	-0.057***	-0.055***	-0.055***	-0.055***	-0.055***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
High school graduate	0.188***	0.113**	0.100**	0.182***	0.112***	0.099**	0.099**	0.099**	0.099**
	(0.038)	(0.032)	(0.033)	(0.034)	(0.032)	(0.033)	(0.033)	(0.033)	(0.033)
Some college experience	0.228***	0.124**	0.099**	0.223***	0.123**	0.098*	0.098*	0.098**	0.098*
	(0.041)	(0.037)	(0.036)	(0.039)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
College diploma or more	0.315***	0.178***	0.159***	0.307***	0.178***	0.160***	0.160***	0.160***	0.160***
	(0.051)	(0.040)	(0.041)	(0.044)	(0.039)	(0.041)	(0.041)	(0.041)	(0.041)
Marriage	0.085***	0.069***	0.074***	0.082***	0.068***	0.074***	0.074***	0.074***	0.074***
	(0.013)	(0.011)	(0.010)	(0.012)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
White	0.126***	0.126***	0.127***	0.120***	0.124***	0.127***	0.128***	0.127***	0.127***
	(0.024)	(0.023)	(0.022)	(0.026)	(0.024)	(0.022)	(0.022)	(0.022)	(0.022)
Hispanic origin	-0.133**	-0.096**	-0.112***	-0.134**	-0.097**	-0.111***	-0.112***	-0.112***	-0.111***
	(0.042)	(0.032)	(0.021)	(0.048)	(0.035)	(0.021)	(0.021)	(0.021)	(0.021)
Part-time	-0.111*	-0.084*	-0.107**	-0.109*	-0.084*	-0.107**	-0.107**	-0.109**	-0.107**
	(0.044)	(0.040)	(0.039)	(0.044)	(0.041)	(0.039)	(0.040)	(0.040)	(0.039)
Government	-0.034	-0.037	-0.046	-0.038	-0.038	-0.047	-0.045	-0.046	-0.047
	(0.033)	(0.035)	(0.038)	(0.033)	(0.035)	(0.038)	(0.038)	(0.038)	(0.038)
Employment Growth			0.136			0.142	0.130	0.126	0.133
			(0.234)			(0.234)	(0.232)	(0.230)	(0.236)
Unemployment Rate			0.012†			0.012†	0.013†	0.013†	0.012†
			(0.007)			(0.007)	(0.007)	(0.007)	(0.007)
Contract Coverage in the 7l2vSruction InduvSry			0.002 (0.002)			0.003 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003 (0.002)
7l2vSant	2.029***	1.882***	1.713***	2.030***	1.884***	1.720***	1.676***	1.660***	1.738***
	(0.128)	(0.109)	(0.120)	(0.132)	(0.111)	(0.122)	(0.120)	(0.115)	(0.110)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other State Control	No	No	Yes	No	No	Yes	Yes	Yes	Yes
State Fixed	No	No	Yes	No	No	Yes	Yes	Yes	Yes
R-squared	0.210	0.317	0.352	0.218	0.319	0.352	0.352	0.353	0.352
N	9,435	9,435	9,317	9,435	9,435	9,317	9,317	9,317	9,317

Note: † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; and vSandard error shown in parenthesis is clustered by state.

Table 10: The Effects of Occupational Licensing on Hourly Earnings for Plumbers

	1	2	3	4	5	6	7	8	9
License	0.093†	0.083†	-0.050*						
	(0.055)	(0.044)	(0.024)						
State license				0.087	0.080†	-0.049*			
				(0.057)	(0.045)	(0.024)			
Local license				0.122*	0.096*	-0.116***			
				(0.059)	(0.046)	(0.023)			
Apprenticeship							-0.067**		
							(0.024)		
Exam Requirements								-0.087***	
								(0.019)	
Continuing Education									-0.071***
									(0.018)
Local license							-0.065**	-0.152***	-0.064**
							(0.020)	(0.028)	(0.020)
Union member		0.332***	0.290***		0.331***	0.290***	0.289***	0.289***	0.290***
		(0.018)	(0.019)		(0.018)	(0.019)	(0.019)	(0.019)	(0.019)
Gender	0.066	0.075	0.068	0.064	0.074	0.069	0.069	0.069	0.070
(1: Male; 0: Female)	(0.069)	(0.073)	(0.074)	(0.070)	(0.074)	(0.073)	(0.074)	(0.074)	(0.072)
Age (Years)	0.021***	0.019***	0.018***	0.021***	0.019***	0.018***	0.018***	0.018***	0.018***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Experience	0.012*	0.012*	0.012*	0.012*	0.012*	0.012*	0.012*	0.012*	0.013*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Experience squared	-0.050***	-0.053***	-0.051***	-0.050***	-0.053***	-0.051***	-0.051***	-0.051***	-0.051***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
High school graduate	0.186***	0.130***	0.115***	0.184***	0.129***	0.115***	0.115***	0.115***	0.115***
	(0.019)	(0.020)	(0.022)	(0.020)	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)
Some college experience	0.240***	0.161***	0.137***	0.239***	0.160***	0.137***	0.137***	0.138***	0.138***
	(0.028)	(0.026)	(0.026)	(0.029)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
College diploma or more	0.277***	0.176***	0.152***	0.275***	0.175***	0.152***	0.152***	0.152***	0.154***
	(0.039)	(0.040)	(0.041)	(0.041)	(0.040)	(0.041)	(0.041)	(0.041)	(0.041)
Marriage	0.097***	0.083***	0.084***	0.097***	0.083***	0.084***	0.084***	0.084***	0.085***
	(0.015)	(0.013)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
White	0.140***	0.111***	0.109***	0.140***	0.111***	0.109***	0.109***	0.109***	0.108***
	(0.031)	(0.027)	(0.025)	(0.031)	(0.027)	(0.025)	(0.025)	(0.025)	(0.026)
Hispanic origin	-0.133*	-0.091*	-0.107***	-0.130*	-0.090*	-0.107***	-0.107***	-0.107***	-0.107***
	(0.050)	(0.043)	(0.030)	(0.049)	(0.043)	(0.030)	(0.030)	(0.030)	(0.030)
Part-time	-0.153†	-0.098	-0.121†	-0.152†	-0.098	-0.121†	-0.122†	-0.121†	-0.120†
	(0.082)	(0.073)	(0.068)	(0.082)	(0.074)	(0.068)	(0.068)	(0.068)	(0.068)
Government	-0.111*	-0.138***	-0.139***	-0.110*	-0.137***	-0.139***	-0.141***	-0.141***	-0.139***
	(0.043)	(0.037)	(0.039)	(0.043)	(0.038)	(0.039)	(0.039)	(0.039)	(0.039)
Employment Growth			-0.349			-0.352	-0.345	-0.336	-0.352
			(0.235)			(0.234)	(0.234)	(0.235)	(0.231)
Unemployment Rate			0.020†			0.020†	0.020†	0.019†	0.019†
			(0.010)			(0.010)	(0.010)	(0.010)	(0.010)
Contract Coverage in the Construction Industry			0.002			0.002	0.002	0.002	0.003
			(0.002)			(0.002)	(0.002)	(0.002)	(0.002)
Constant	1.689***	1.705***	1.550***	1.693***	1.707***	1.551***	1.571***	1.594***	1.508***
	(0.118)	(0.107)	(0.116)	(0.117)	(0.106)	(0.117)	(0.122)	(0.124)	(0.124)

Table 11: The Effects of Occupational Licensing on the State Injury Rates for Electricians

Variable	1	2	3	4	5	6	7
License	0.181	-0.727					
	(0.738)	(0.916)					
State license			0.218	-0.754			
			(0.753)	(0.906)			
Local license			0.019	-0.457			
			(0.802)	(1.421)			
Apprenticeship					2.613*		
					(1.097)		
Exam requirement						-0.415	
						(0.850)	
Continuing Education							2.032***
							(0.431)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other state controls	No	Yes	No	Yes	Yes	Yes	Yes
State Fixed	No	Yes	No	Yes	Yes	Yes	Yes
Observations	589	589	589	589	502	502	502
R-squared	0.26	0.38	0.26	0.38	0.39	0.38	0.38

Note: † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; standard error shown in parenthesis is clustered by state; and other state controls include the percentages of the following variables: the six age groups between 20 and 24, between 25 and 34, between 35 and 44, between 45 and 54, between 55 and 64, and 65 and greater (age group between 16 and 19 as a reference), marriage status, white and nonwhite (the portion of black as a reference), Hispanic origin, and high school diploma, some other college, college diploma and more (high school dropouts as a reference), part-time, unemployment rate, employment growth, and union coverage in the construction industry.

Table 13: The Effects of Occupational Licensing on the Severity of Injury for Individual Electricians

Variable	1	2	3	4	5	6	7
License	-0.143	0.290					
	(0.095)	(0.286)					
State license			-0.201*	0.303			
			(0.093)	(0.287)			
Local license			0.030	0.176			
			(0.102)	(0.295)			
Apprenticeship					-0.175		
					(0.161)		
Exam requirement						0.120	
						(0.241)	
Continuing Education							-0.361***
							(0.095)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	No	Yes	No	Yes	Yes	Yes	Yes
State Fixed	No	Yes	No	Yes	Yes	Yes	Yes
Observations	19,576	19,556	19,576	19,556	15,999	15,999	15,999
-Log Likelihood	-542,130	-540,250	-541,843	-540,238	-428,577	-428,587	-428,550

Note: † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; coefficients are estimated incidence-rate ratios; standard error shown in parenthesis is clustered by state; and other controls include individual characteristics including age, age squared, gender, and four dummy variables of length of service, and dummy variables indicating white, Hispanic, black, and Asians (other races as a reference), and state level of unemployment rate, employment growth, and union coverage in the construction industry.

Table 14: The Effects of Occupational Licensing on the Severity of Injury for Individual Plumbers

	1	2	3	4	5	6	7
License	-0.118†	0.545					
	(0.064)	(0.371)					
State license			-0.109	0.545			
			(0.067)	(0.371)			
Local license			-0.171	0.559			
			(0.112)	(0.375)			
Apprenticeship					0.216†		
					(0.113)		
Exam requirement						0.325***	
						(0.093)	
Continuing Education							-0.121
							(0.121)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other state controls	No	Yes	No	Yes	Yes	Yes	Yes
State Fixed	No	Yes	No	Yes	Yes	Yes	Yes
Observations	14,681	14,485	14,485	14,454	12,495	12,495	12,495
-Log Likelihood	-491,781	-483,369	-484,705	-482,926	-423,150	-423,138	-423,159

Note: † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; coefficients are estimated incidence-rate ratios; standard error shown in parenthesis is clustered by state; and other controls include individual characteristics including age, age squared, gender, and four dummy variables of length of service, and four dummy variables of race, and state level of unemployment rate, employment growth, and union coverage in the construction industry.

Table 15: The Effects of Occupational Licensing on the State Death Rates for Electricians

Variable	1	2	3	4	5	6	7
License	-0.001	-0.007					
	(0.004)	(0.004)					
State license			-0.001	-0.007			
			(0.004)	(0.004)			
Local license			-0.003	0.003			
			(0.005)	(0.009)			
Apprenticeship					0.000		
					(0.006)		
Exam requirement						0.002	
						(0.006)	
Continuing Education							-0.005
							(0.011)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other state controls	No	Yes	No	Yes	Yes	Yes	Yes
State Fixed	No	Yes	No	Yes	Yes	Yes	Yes
Observations	787	787	787	787	666	666	666
R-squared	0.11	0.21	0.11	0.21	0.24	0.24	0.24

Note: † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; standard error shown in parenthesis is clustered by state; and other state controls include the percentages of the following variables: the six age groups between 20 and 24, between 25 and 34, between 35 and 44, between 45 and 54, between 55 and 64, and 65 and greater (age group between 16 and 19 as a reference), marriage status, white and nonwhite (the portion of black as a reference), Hispanic origin, and high school diploma, some other college, college diploma and more (high school dropouts as a reference), part-time, unemployment rate, employment growth, and union coverage in the construction industry.

Table 16: The Effects of Occupational Licensing on the State Death Rates for Plumbers

	1	2	3	4	5	6	7
License	-0.002	0.003					
	(0.003)	(0.009)					
State license			-0.003	0.004			
			(0.002)	(0.006)			
Local license			-0.007**	-0.016**			
			(0.002)	(0.007)			
Apprenticeship					0.005†		
					(0.003)		
Exam requirement						-0.001	
						(0.005)	
Continuing Education							-0.003
							(0.004)
Year Fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other state controls	No	Yes	No	Yes	Yes	Yes	Yes
State Fixed	No	Yes	No	Yes	Yes	Yes	Yes
Observations	787	787	787	787	666	666	666
R-squared	0.11	0.21	0.11	0.21	0.24	0.24	0.24

Note † significant at the 0.10 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level; standard error shown in parenthesis is clustered by state; and