Analyzing the Extent and Influence of Occupational Licensing on the Labor Market

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This study examines occupational licensing in the United States using a specially designed national labor force survey. Estimates from the survey indicated that 35% of employees were either licensed or certified by the government and that 29% were licensed. Another 3% stated that all who worked in their job would eventually be required to be certified or licensed, bringing the total that are or eventually must be licensed or certified by government to 38%. We find that licensing is associated with about 18% higher wages but that the effect of governmental certification on pay is much smaller.

I. Introduction

Occupational licensing as a topic in economics dates back at least to the comment by Adam Smith that trades conspire to reduce the availability of

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skilled craftsmen in order to raise wages (Smith 1776/1937). The public policy and legal communities, however, have noted that regulating occupations in order to protect the public against incompetent, untrustworthy, or irresponsible practitioners is in the public interest (*Thomas v. Collins* 1945).

Since Friedman and Kuznets's (1945) classic work, there has been little analysis of the labor market influence of occupational regulation in economics (exceptions are Rottenberg 1980; Kleiner 2006; and Kleiner and Krueger 2010).[1] Even though the topic is a major national and state policy issue, the lack of a comprehensive database that allows researchers to address these issues has been a significant drawback. A major reason for the lack of empirical work has been the absence of national data that clearly defines whether a worker is regulated and the extent of regulation. The purpose of this study is to probe in greater detail the prospects for measuring occupational licensing in a new detailed labor force survey and to estimate the labor market effects of occupational licensing. Specifically, we delve into what types of regulatory requirements—and the particular level of government oversight—may contribute to wage gains and wage variability.

We use the results of a new telephone survey of the workforce conducted by Westat that asked detailed questions on occupational regulation as well as questions on the labor market status of individuals. The survey questions were developed as part of the Princeton Data Improvement Initiative (PDII). These questions probe the kind of government regulation required to perform a job, the process of becoming licensed, and the level of education and tests necessary to become licensed. Results of the Westat survey, as well as separate validation results from a related Gallup survey, indicate that occupational licensing can be reasonably well measured in labor force surveys. Our study is the first to provide a general analysis of occupational licensing in the US economy as well as a way to link these data to questions that are regularly asked in the Current Population Survey.

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[1] Major articles in the *Economist* and the *Wall Street Journal* have noted the importance of the issue for public policy (*Economist* 2011; Simon 2011). However, in the academic literature, since 2000, no articles on occupational licensing have appeared in some of the major economic journals, including *American Economic Review*, *Journal of Political Economy*, *Quarterly Journal of Economics*, and *Econometrica*. During the same period, only one article on licensing has appeared in *Journal of Labor Economics*, *Journal of Human Resources*, and *Industrial and Labor Relations Review*—often regarded as the top three labor economics journals. In contrast, 21 articles on unionization have been published since 2000 in these three journals. Moreover, associations such as the Labor and Employment Relations Association and the International Industrial Relations Research Association have been devoted to research on labor management issues, but no such academic organizations exist that focus on occupational licensing. A major reason has been that the data on the topic are poor or nonexistent.

Turning to the substantive results, we find that licensing is associated with about 18% higher wages but that government certification has a much smaller association with pay. Licensing by larger and multiple political jurisdictions, such as regulation by the states and the federal government, is associated with higher wage gains than local regulations. Specific requirements by the government to enter an occupation, such as education level and long internships, are positively associated with wages. This pattern of results is consistent with a monopoly model of occupational licensing in which supply is more restricted if the licensing authority operates on a wider geographic level.

II. Background on Characteristics of Licensing

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. In 2003 the Council of State Governments estimated that more than 800 occupations were licensed in at least one state and that more than 1,100 occupations were licensed, certified, or registered (CLEAR 2004).

Prior to our survey, the data available on occupational licensing in the United States were restricted to classifications as to whether various occupations were licensed at the state level, often based on the CLEAR data. These classifications could be linked to US Census occupational employment data to derive estimates of the proportion of workers in licensed jobs. While informative, there are clear limitations of such data. First, compliance with state licensing requirements could be less than complete; some of those classified as working in licensed occupations may not in fact be licensed. Second, in some occupations there is a trial period when workers can work in a job before becoming licensed. Third, and probably most important, the state data miss licensing that takes place at the local and the federal levels.

Despite these serious limitations, the state-level data show some striking trends. During the early 1950s, less than 5% of the US workforce was in occupations covered by licensing laws at the state level (Council of State Governments 1952). That number grew to almost 18% by the 1980s—with an even larger number if federal, city, and county occupational licensing is included. By 2000, the percentage of the workforce in occupations licensed

by states was at least 20%, according to data gathered from the Department of Labor and the 2000 Census. In contrast, during this period no systematic attempts were made to gather information on licensing or its wage or employment effects at the federal or the local levels.

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 legislation and its administration, especially when opposition to regulatory legislation is absent or minimal (Wheelan 1998). The large potential gain from regulation through increased demand for the service, enhanced earnings, and the ability to restrict supply outweighs the potential losses to consumers of potentially higher prices for the regulated services.

Figure 1 shows trends in the growth of occupational licensing and unionization from 1950 to 2008.[2] Licensing data for earlier periods are available only at the state/occupational level; the data gathered through the Gallup and Westat surveys for 2006 and 2008 are denoted with a dashed line in the figure. Despite possible problems in both data series, occupational licensing clearly is rising and unionization is declining. By 2008, approximately 29% of workers polled in the Westat survey said they were required to have a government-issued license to do their job, compared with about 12.4% who said they were union members in the Current Population Survey (CPS) for the same year.

III. Wage Determination and Licensing: Background

A simple theory of occupational licensing suggests that administrative procedures regulate the supply of labor in the market. The regulators screen entrants to the profession and bar those whose skills or character traits suggest a tendency toward low-quality output. The regulators further mon-

[2] The method used to calculate the percentage licensed prior to 2006 first involved gathering the listing of licensed occupations in each state by Labor Market Information units under a grant from the US Department of Labor (see America's Career InfoNet, http://www.acinet.org/licensedoccupations). This was matched with occupations in the 2000 Census. If no match was obtained, the occupation was dropped. From the census the number working in the licensed occupation in each state was estimated and used to calculate a weighted average of the percentage of the workforce in the United States that works in a licensed occupation. For 2008 we deleted individuals who were certified from our tally of licensed individuals who were either licensed or certified in our survey conducted by Westat.

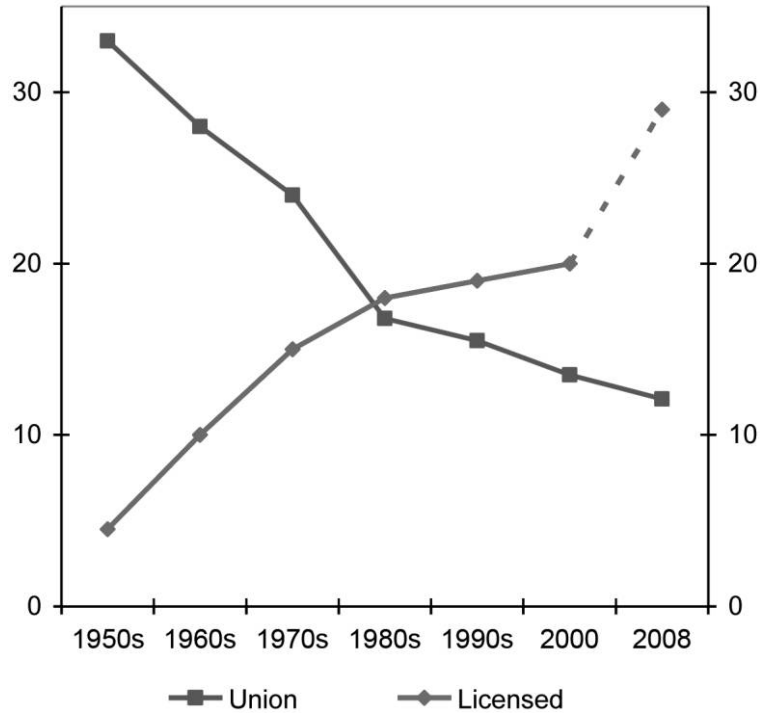

FIG. 1.—Comparisons in the time-trends of two labor market institutions: licensing and unionization. Dashed line shows the value from state estimates of licensing to the Gallup Survey and Westat Survey results, and the union membership estimates are from the CPS. Color version available as an online enhancement.

itor incumbents and discipline those whose performance is below standards, with punishments that may include revocation of the license needed to practice. Assuming that entry and ongoing performance are controlled in these ways, the quality of service in the profession would be expected to be raised by occupational licensing but the supply to be diminished.

Additional costs could include imposition of fines, screening to prevent expelled practitioners from reentering the occupation, or the requirement that incumbents put up capital that would be forfeited upon loss of the license. Entry requirements limit supply and create monopoly rents within the licensed occupation. The threat of losing these monopoly rents could, in principle, give incentives to incumbents to meet high standards. The rents also could motivate potential entrants to invest in high levels of training in order to gain admittance. Demand for the services of licensed workers could increase due to higher perceived quality and lower risk, but demand might also decrease for some segments of the occupation if some consumers demand lower-quality services that are precluded by the licensing procedures (Shapiro 1986). An outward shift in demand could accentuate the

increase in the price of services resulting from diminished supply and further boost provider incomes. Models of licensing assume that consumers can choose among three markets: a market for mature producers known to sell high-quality services, a market for mature producers known to produce low-quality services, and a market for young producers whose quality of service (low or high) is not known by the consumer at time of purchase (Shapiro 1986). The result is that seekers of high-quality services gain by regulation and those who seek low-quality services are worse off because prices are higher and choices more limited.

By using the state to monitor and prevent the potential work effort of unlicensed workers, competition by unlicensed individuals is virtually eliminated through the use of the state's enforcement powers. For example, the work of "hair braiders," which is an unlicensed profession, could be brought under the control of the cosmetology board and limited to only licensed cosmetologists or barbers (*Anderson v. Minnesota Board of Barber and Cosmetology Examiners* 2005). Further, when demand fluctuates for traditional tasks, the board has the ability to expand the regulated work through establishing administrative rules and limiting the work of unregulated workers. Third, the regulatory board, through its administrative procedures of establishing large entry barriers and moral suasion, can reduce the number of openings in schools that train individuals for licensed positions. In addition, by adjusting the pass rate on the licensing exam, they can change the number of new entrants from in state or migrants from other states or nations (Tenn 2001; Pagliero 2010). However, recent federal decisions have noted that there is no required compensation for workers who lose some of the economic value of a license because of a change in government policy that results in more licenses being awarded (*Minneapolis Taxi Owners Coalition, Inc. v. City of Minneapolis* 2009).

Some evidence suggests that licensing does restrict the supply of workers in regulated occupations. One application focuses on the comparison of occupations that are licensed in some states and not in others. The occupations examined were librarians (licensed in 19 states), respiratory therapists (licensed in 35 states), and dietitians and nutritionists (licensed in 36 states) from 1990 to 2000 using US Census data (Kleiner 2006). Using controls for state characteristics, the multivariate estimates showed that in the states where the occupations were unlicensed, there was a 20% faster growth rate than in states that did license these occupations. Another study found that the imposition of greater licensing requirements for funeral directors is associated with fewer women holding jobs as funeral directors relative to men by 18%–24% (Cathles, Harrington, and Krynski 2010).

Studies of the effects of licensing on wages have, in many ways, paralleled the research methods used to study the effect of unions on wages (Lewis 1986). These approaches include cross-section estimates, switchers from regulated to unregulated and vice versa over time, and cross-sectional

results from within occupation comparisons. The general estimates of cross-sectional studies using census data of state licensing's influence on wages with standard labor market controls show a range from 10% to 15% for higher wages associated with occupational licensing. In other studies, basic estimates were developed from the National Longitudinal Survey of Youth (NLSY) from 1984 to 2000 and show the difference in wages between changers from unlicensed to licensed occupations and between those who move from a licensed occupation to an unregulated one. Those estimates show an impact of about 17% of moving to a licensed occupation relative to moving from a licensed occupation to an unlicensed one.[3] However, within-occupation wage variations both for service occupations and for individuals in jobs that repair things suggest a wide range of wages changes from zero to 40% within an occupation. Although these results suggest that licensing—the toughest form of regulation—matters for wage determination, these estimates have small sample sizes even though they use national data bases. Further, they do not examine the levels of government that may matter, and they do not consider the influence of the requirements to become licensed, such as education, testing, or internships, which may further enhance wages.

IV. The Survey Instrument and Design

Our survey is part of the Princeton Data Improvement Initiative (PDII), a multi-researcher project to develop new questions and methods for economic surveys. The questionnaire was patterned after the CPS and included additional questions on career experience, job tasks, and offshorability of jobs. In the summer of 2008, Westat (www.westat.com) conducted a national random digit dial (RDD) survey on behalf of Princeton University. Princeton provided Westat with a draft of a questionnaire at the start of the project. Princeton and Westat collaborated in finalizing the question order and wording. A number of the questions had been developed and tested in earlier work by Princeton and under prior task order contracts with Westat. Several questions regarding the respondent's employer, job activities, and demographics were taken from the CPS. Westat programmed the questionnaire and skip patterns for administration by computer-assisted telephone interviewing (CATI), in both English and Spanish. Westat staff pretested the instrument with several volunteer respondents. This pretest suggested several additional revisions for the questionnaire, including shortening it to achieve the targeted average interview length of 15 minutes.

[3] The estimates from the NLSY included only full-time workers who were not in school and are adjusted by the wage deflator by year from 1984 to 2000. Individuals who switched to an unlicensed occupation from a licensed one had a 26% increase in earnings ($N = 99$), but those who switched from an unlicensed occupation to a licensed one saw a 43% increase in their hourly earnings ($N = 119$). The general switching of occupations estimate is 17%.

Westat conducted the survey from June 5 to July 20, 2008.[4] Individuals ages 18 or older who were in the labor force were eligible for the survey. A total of 2,513 individuals were interviewed. We limit our analysis to those who were employed at the time of the survey. Westat used a random digit dialing sampling design constructed from a national sampling frame of residential exchanges. The selected numbers were called and screened to identify households with eligible respondents. One respondent was randomly selected from each eligible household to complete the survey using the nearest birthday procedure. Up to 15 callbacks were made to try to elicit responses. Some 28% of sampled eligible households agreed to participate in the screening of questions, and 64% of the selected individuals in screened households completed the questionnaire. Thus, the response rate was 17.9%, when using the American Association for Public Opinion Research's response rate definition 3 (see aapor.org/uploads/Standard_Definitions_04_08_Final.pdf, 35).[5]

Although the survey response rate is low compared to many government labor force surveys, it is comparable to that of commercial surveys. While the low response rate is potentially worrisome, Groves and Peytcheva (2008) show that survey nonresponse rates by themselves are not necessarily associated with significant bias. Low response rates are a concern when the causes of participation in the survey are correlated with the survey variables of interest. We suspect that occupational licensing is not strongly associated with the tendency to complete the survey. The response rate was low in large part because many households declined to participate in the screener questions, which did not mention occupational licensing. Another reason for placing some confidence in the representativeness of our sample is that a standard Mincerian wage regression using data from the survey closely matched the corresponding regression from the CPS for education, experience, and experience-squared, but there was a 9% point difference for gender. The variable for gender was significant in both data sets (see app. A). Although we would have preferred a higher response rate, we have no reason to believe that nonresponse skews our results in favor of finding more or less occupational licensing and certification or particular associations between licensing and certification and earnings.

[4] The questionnaire and codebook are available at http://www.krueger.princeton.edu/PDIIMAIN2.htm.

[5] Among the households, 18,520 telephone numbers were screened to be residential. Of these, 4,079 households had eligible persons and 2,086 did not, meaning that the latter households had no adults in the labor force at the time of the interview. For the remaining residential telephone numbers (12,355), it was not possible to ascertain eligibility status. Therefore, an eligibility status adjustment was performed using new adjustment cells defined by Census Region, Metropolitan Statistical Area status, and median income of the telephone exchange. Five median income categories were defined, and there were altogether 50 adjustment cells.

Westat developed survey weights to compensate for variation in selection probabilities, differential response rates, and possible undercoverage of the sampling frame. The derivation of the sample weights focused primarily on matching the marginal distributions of the CPS by sex, age, educational attainment, census region, urbanization, race, Hispanic ethnicity, employment status, and class of employer (private, government, etc.).

Westat collected information on the location where the license or certificate was registered for a random sample of 221 respondents who answered yes to a question that they were licensed. Westat subsequently used this information to try to verify whether the respondent had a valid occupational license or certificate. Our results show that of the 71 individuals for whom Westat could find information, 20 were believed to have answered the question incorrectly and five were found to have an inactive license or other status. For the individuals that Westat could verify, 47 could be found through a government database that was publicly available. Consequently, two-thirds of the sample could be easily verified as having a government license.[6] As a further example of the face validity of our measure, all the physicians said they were licensed.

V. Questionnaire and Data

We designed a module to assess the accuracy of self-reported occupational licensing and certification. The key questions were as follows:

Q11. Do you have a license or certification that is required by a federal, state or local government agency to do your job?

YES 1
NO . . . . . 2 (Go to Q25)
IN PROCESS/WORKING ON IT 3

Q11a. Would someone who does not have a license or certificate be legally allowed to do your job?

YES 1
NO 2

Q12. Is everyone who does your job eventually required to have a license or certification by a federal, state or local government agency?

YES 1
NO 2

[6] Of the 20 respondents who were believed to have answered incorrectly, 11 indicated they were licensed at the federal level, 15 at the state level, and 11 at the local level. About half of the respondents indicated that they were required to have a license by more than one level of government, and the inability to find the license could be an issue of the surveyor looking at the incorrect level of government or that the data were not listed on a readily accessible computer within the department.

Those who answered affirmatively to Q11 were asked additional questions about the agency (federal, state, or local) that required their license or certificate and the requirements they needed to satisfy, such as achieving a high school or college degree, passing a test, demonstrating certain skills, or completing an internship or apprenticeship.

The responses to our analysis showed that 35% of the respondents answered that they were either licensed or certified in question 11. Approximately 6% stated that individuals who did not have a license could do the work in question 11a, which is the definition of government certification. Another 3% stated that all who worked would eventually be required to be certified or licensed, bringing the total that are or eventually must be licensed or certified by government to 38%.[7]

To further examine the test-retest validity of our results for the licensing question, we examined the consistency of responses over several days of the week using data gathered from a time use survey by the Gallup Organization. The Gallup survey asked individuals on Thursday and Saturday whether they were licensed. To summarize the consistency of the responses to the licensing question in comparison to a question on years of education, they examined responses to the survey (166 of 169 after 98.2% stated consistent answers on occupational licensing and 154 of 169 after 91.1% provided consistent answers when stating their level of education) on 2 different days that were 3 days apart. Overall, individuals are internally consistent and apparently reliable in reporting whether they hold a license from government in order to do their work.

Based on estimates from the Bureau of the Census, the cost of adding a question on occupational licensing to the March supplement to the Current Population Survey, such as question 11 above, would be about $50,000 in the first year and less in subsequent years.[8] The cost of collecting such information must be judged against the potential benefit of measuring occupational licensing, an important and growing labor market phenomenon.

[7] Our key results indicate that 29% of the surveyed respondents were fully licensed. This percentage is similar to the 29% found in a 2006 Gallup Poll survey, which asked if the individuals were licensed (Kleiner and Krueger 2010). Using another approach through the use of census data in 2000, about 20% of workers were licensed only at the state level, which is consistent with our estimates in the PDII (Kleiner 2006). These independent tallies provide further confirmation of the reliability of the survey estimates in the PDII.

[8] Charles Nelson, Bureau of the Census, correspondence with authors, August 22, 2011. First-year costs are higher because of fixed costs associated with testing, developing edit procedures, etc. This estimate assumes that appropriate cognitive testing of the question was performed to validate the question. In addition, the Census Bureau, the Bureau of Labor Statistics, and the Office of Management and Budget must approve any new content and question added to the survey.

VI. Who Is Licensed?

To explore the basic demographic and economic characteristics of regulated workers, we examine the distribution of licensed and certified occupations and their standard deviations by education, race, union status, public or private sector, and gender in table 1. The results indicate that licensing rises with education: more than 44% of those with postcollege education are required to have a license, compared to only 15% for those with less than a high school education. The results in the table show that union members are more likely to be licensed, reflecting in part the large number of teachers and nurses who tend to be union members and are licensed more often than other workers. Government workers are more

Table 1
Characteristics of Licensed and Certified Workers

Variable	Licensed	SD	Certified	SD	Not Licensed or Certified	SD	*N*
Gender:							
Male	.2837	.451	.0674	.2509	.646	..478	1,142
Female	.2872	.4526	.0503	.2187	.660	..474	1,351
Education level:							
Less than high school	.1447	.353	.0395	.1954	.816	.389	152
High school	.1993	.3998	.0577	.2334	.740	.439	537
Some college	.2814	.45	.0594	.2366	.656	.475	757
College (BA)	.2915	.4548	.0586	.2351	.646	.479	614
College +	.4411	.4971	.0624	.2421	.495	.501	433
Race:							
White	.2953	.4563	.0581	.234	.645	.479	1,944
Hispanic	.2921	.4573	.0562	.2316	.652	.479	89
Black	.2634	.4417	.0699	.2557	.663	.474	186
Other	.2299	.4216	.0511	.2206	.709	.455	274
Age:							
25 or under	.1216	.328	.027	.1627	.840	.368	148
26–54	.2995	.4582	.0616	.2406	.636	.481	1,509
55 or older	.2883	.4533	.0579	.2337	.651	.477	836
Union status:							
Union	.4465	.4978	.0496	.2174	.499	.501	383
Nonunion	.2567	.4369	.06	.2375	.681	.466	2,100
Private or public:							
Private company	.2481	.432	.059	.2357	.690	.463	1,983
Public	.4415	.4971	.0534	.225	.503	.501	487
Type of work:							
Provide services	.312	.4634	.0586	.2349	.627	.484	2,048
Make things	.1144	.319	.0508	.2202	.831	.375	236
Repair things	.2237	.4181	.0724	.26	.690	.464	152
Tenure (years)	10.54	9.51	8.84	8.91	8.836	9.374	581/96/1,385

NOTE.—The sample consists of the 2,449 individuals who responded to all these questions in the Princeton Data Improvement Initiative survey.

likely to have a license than nongovernment workers, but there is no difference in the rate of licensing by gender.

We find similar licensing rates for men and women and for whites, blacks, and Hispanics. The table also shows that licensing rises with age and then declines slightly over age 54. Table 1 also presents the distribution by type of work. Licensing is much more prevalent among those who provide services or repair items than among those who make things on their jobs. Finally, those individuals who are in licensed occupations have about 10.5 years of job tenure compared to 8.8 for both certificated and unlicensed individuals, which is a difference of about 19%. The values at the end of the row show the number of licensed, certified, and nonlicensed individuals in the PDII who answered the question on job tenure.

The questionnaire also asked questions about the governmental level of licensing for the individuals in our sample. In our survey, about two-thirds of the licensed individuals in our sample are licensed at the state level, followed by the federal and local levels. In general, occupations that are commonly required to have state licenses range from attorneys and dentists to dental hygienists and mortgage brokers. Individuals who usually are federally licensed workers range from workers such as quality assurance inspectors for the Federal Aviation Administration to stockbrokers. At the local level, taxi drivers and massage therapists are often licensed at the local level by cities or counties. The federal courts have largely left licensing as a state issue, since this is the level of government that has largely regulated workers in the United States (*Dent v. West Virginia* 1888). Nevertheless, the courts have determined that licensing by the states can contradict the Sherman Act (*Goldfarb v. Virginia* 1975). The Supreme Court ruled that the state attorney bar association's policy of a minimum fee schedule violated the Sherman Act's prohibition of combinations in restraint of trade. The Court ruled that the legal profession was not a public service, but rather a market-driven service. These Court decisions have made the focus of most licensing largely a state legal and economic policy issue rather than a federal or local issue. The exceptions to the state control of licensing issues occurs when interstate commerce clauses apply under the Sherman Act or there is a federal preemption of state laws due to other national regulations covering health care or construction requirements.

The requirements necessary to enter an occupation potentially influence the quality of services rendered and serve as a barrier to entry. Table 2 gives the percentages of licensed workers from our survey data and their standard deviations that require a college education, a high school education or GED, an internship or apprenticeship, passage of a test, demonstration of qualifications, fees, continuing education, and continued testing to maintain a license. For example, 85% of those persons licensed were required to take an exam, almost 70% were required to take con-

Table 2
Requirements for Becoming Licensed

Variable	% of Licensed Workers Facing Requirement	SD
College	42.8	.4952
High school	31.2	.4636
Exam	85.0	.3576
Continuing education	69.8	.4594
Internship	33.6	.4726
Level of government:		
State only	37.4	.4841
Federal only	5.1	.2193
Local only	2.5	.1571
Licensed, not used	2.3	.1493
State and federal	18.1	.385
State and local	11.7	.3212
Federal and local	.6	.0772
State, federal, and local	21.7	.4123

NOTE.—Observations = 712. The sample consists of the 2,449 individuals who responded to these questions in the Princeton Data Improvement Initiative survey. Percent does not total to 35% due to missing values and because some individuals do not answer these questions in the survey.

tinuing education classes, more than half required an internship, and almost 43% required at least a college education. Each of the requirements can enhance the quality of the practitioners in the occupation or restrict entry and thereby reduce competition for performing the work. In the second part of the table, we show the percentages of political jurisdictions of licensed individuals in our sample. The sample was restricted to workers who had no missing information for each of the jurisdictional variables. This gives a sample of 2,449 individuals, in which 33.2% were licensed or certified. In contrast, the entire sample of 2,504 workers, 34.6% were licensed or certified.

To examine whether licensing is associated with higher pay, we present estimates of log wage regressions in the estimated model in table 3. We augment a standard earnings equation to include a dummy variable indicating whether a license is required for the worker's job. We regard these estimates as mainly descriptive, since licensed workers may differ from unlicensed workers in unobserved ways, even after we condition on education and two-digit occupation.[9] If a dummy variable indicating license status is added to a standard wage equation, having a license is associated with approximately 18% higher hourly wages (p-value $< .001$).[10] The cross-sectional

[9] The estimates in our analysis refer to log points as percentages, with percentages reflecting an intermediate base between the licensed and unlicensed groups (Halvorsen and Palmquist 1980).

[10] Our estimates show no differences in the influence of licensing by gender. Further, by not including a licensing variable, the impact of unionization is biased up-

Table 3
Estimates of the Impact of Licensing on Wages

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)
Licensed	.297***	.136***	.176***	.109***
	(.041)	(.034)	(.035)	(.039)
Female		−.235***	−.189***	−.196***
		(.035)	(.035)	(.037)
Hispanic		−.170***	−.147***	−.138**
		(.056)	(.052)	(.059)
Black		−.154***	−.162***	−.155***
		(.053)	(.044)	(.046)
Asian		.274**	.172	.239*
		(.122)	(.115)	(.128)
Education		.072***	.049***	.052***
		(.009)	(.009)	(.009)
Age/10		−.065*	−.042	−.065**
		(.034)	(.032)	(.032)
Work experience		.045***	.034***	.041***
		(.006)	(.006)	(.006)
(Work experience)^2/1,000		−.622***	−.491***	−.567***
		(.091)	(.088)	(.094)
Union member		.101**	.195***	.145***
		(.046)	(.045)	(.044)
Government		−.010	−.012	−.041
		(.048)	(.047)	(.047)
Service		.032	−.006	.012
		(.045)	(.050)	(.054)
Self-employed		.181**	.183**	.237***
		(.074)	(.076)	(.088)
Northeast		−.110**	−.070	−.105**
		(.049)	(.045)	(.048)
Midwest		−.119**	−.086**	−.112**
		(.048)	(.043)	(.045)
South		−.110**	−.078*	−.107**
		(.046)	(.042)	(.045)
Math skills		.079**	.037	.073*
		(.037)	(.035)	(.038)
Reading skills		.174***	.120***	.169***
		(.039)	(.037)	(.038)
R^2	.041	.353	.444	.502
Occupation controls	None	None	Two-digit	Four-digit

NOTE.—Observations = 1,725. Robust standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

effect of licensing is similar in magnitude to the estimated effect of belonging to a union (see Lewis 1986) and greater than an additional year of schooling.[11] The regression estimates also include educational attainment, age, self employment, career experience and its square, union status, region of the country, and industry and occupation dummy variables.[12]

One could question whether adding a licensing dummy to a standard ordinary least squares (OLS) wage regression with limited human capital controls leads to an unbiased estimate of the wage gain workers receive from working in a licensed job. Licensed workers may have a higher level of unobserved human capital, for example, which would bias OLS estimates. To explore the sensitivity of our estimates, we attempted to instrument for licensing by using the state licensing requirement for occupations (such as electricians, plumbers, and teachers), but we were not able to find a robust relationship in our first-stage estimates. We also explored using other instrumental variables, including political affiliation in the state, state of residence dummies, and union coverage in the state, but again we found weak first-stage estimates given our sample size. As a consequence, we emphasize the OLS estimates below and attempt to assess the size of the omitted variable bias necessary to eliminate the observed relationship between pay and licensing, but we believe that finding suitable instruments for occupational licensing should be a priority for researchers in the future.

In order to further probe potential issues of selectivity bias for the licensing variable, we implemented the implied ratio of selection on unobservables to selection on observables (see Altonji, Elder, and Taber 2005). We find that if there is no causal relationship between licensing and wages, then the positive OLS estimate ($\hat{a}$) requires a correlation between the licensing dummy and the error term that is 40% as large as the correlation between all the observables and the licensing dummy. The relative relationship between the licensing dummy and unobservables such as

ward in a standard wage equation. We find no statistically significant effect of the interaction of unions and licensing.

[11] In app. B, we show that licensing only slightly drives down the returns to education in general and that it does so for specific types of educational attainment. Further, as we would expect given the positive correlation between licensing and educational attainment (documented in table 2), adding a licensing dummy attenuates the estimated returns to schooling, especially at higher levels of attainment (although the differences in coefficients across specifications 1 and 2 and across specifications 3 and 4 in app. B do not appear to be significant).

[12] We also estimated all the wage equations for only occupations that were regulated in some states and not in others (e.g., interior designers and mortgage brokers). Our estimates show that such licensing was always statistically significant, with point estimates ranging from 9% to 17%. There was no qualitative change in the estimates by dropping universally licensed occupations from the analysis of the survey. These estimates are available from the authors.

ability and effort would have to be at least as large as this value to render the licensing effect to be zero.[13]

The Westat survey was designed for estimating OLS wage regressions with a wider set of controls than normally available. Specifically, the question for experience was: "Since age 18, in how many years altogether have you worked for pay or profit? Please count all years in which you worked either all or part of the year."[14] The variable tracked well the traditional variable for experience used in human capital analysis.

A major policy issue for the governmental regulation of occupations is the role for certification, which permits noncertified workers to perform the work but enables individuals to earn a title that signifies that they achieved certain requirements. Unlike licensing, for certification there are no restrictions other than titling for doing the relevant task for pay.[15] In table 4 we estimate wage equations similar to those in table 3 using largely the same covariates but add an indicator for certification status. We find that the certification variable, although positive, is not statistically significant and that the coefficients are much smaller in magnitude than was found for licensing, averaging about 8%. We find that once we controlled for observable worker and job characteristics, the certification variable, although positive, is not statistically significant even though it is significant when no controls were included in the specification.

Specifications with no controls for occupation and estimates with four-digit occupational controls produced precisely estimated coefficients for the licensing coefficients and were of similar magnitude. The results of these wage equations are consistent with the interpretation that licensing policy enables the individuals in a licensed job to obtain a degree of monopoly control, or the ability to "fence out" competitors for a service, which results in increased wages for licensed workers. Licensing policies, with regulations that require additional effort to get into the occupation,

[13] The implied ratio for the equations in table 3 and 4 were estimated as

$$\text{Implied ratio} = \frac{\{E[z \mid \text{Lic} = 1] - E[z \mid \text{Lic} = 0]\}/\text{Var}(z)}{\{E[x'y \mid \text{Lic} = 1] - E[x'y \mid \text{Lic} = 0]\}/\text{Var}(x'y)}.$$

The implied rated was .395 for the $\hat{a}$ in table 3 and .397 in table 4. These implied ratios do not rule out the possibility of omitted variable bias modifying the results of our estimates.

[14] A distinguishing characteristic of the Westat survey, for example, is that the variable for career experience is the reported actual experience of the respondents rather than an estimate based on age and education (Blau and Kahn 2013, in this issue).

[15] The nomenclature surrounding licensing and certification can be confusing. For example, a certified public accountant (CPA) is licensed rather than certified as we use the terms as someone who is not qualified as a CPA cannot perform the work of a CPA.

Table 4
Analysis of Licensing and Certification on Wages

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)
Licensed	.311***	.140***	.187***	.116***
	(.042)	(.034)	(.036)	(.040)
Certified	.204**	.041	.085	.060
	(.090)	(.081)	(.078)	(.089)
Female		−.234***	−.186***	−.195***
		(.035)	(.036)	(.037)
Hispanic		−.172***	−.152***	−.140**
		(.057)	(.053)	(.060)
Black		−.155***	−.163***	−.156***
		(.053)	(.044)	(.045)
Asian		.275**	.175	.238*
		(.122)	(.115)	(.128)
Education		.072***	.049***	.051***
		(.009)	(.009)	(.009)
Age/10		−.066*	−.044	−.066**
		(.034)	(.032)	(.032)
Work experience		.045***	.034***	.041***
		(.006)	(.006)	(.006)
(Work experience)^2/1,000		−.620***	−.486***	−.566***
		(.092)	(.088)	(.095)
Union member		.100**	.194***	.143***
		(.046)	(.045)	(.043)
Government		−.010	−.010	−.040
		(.049)	(.047)	(.047)
Service		.032	−.006	.012
		(.045)	(.050)	(.054)
Self-employed		.178**	.178**	.234***
		(.074)	(.076)	(.088)
Northeast		−.111**	−.071	−.107**
		(.049)	(.045)	(.048)
Midwest		−.120**	−.088**	−.113**
		(.048)	(.044)	(.046)
South		−.111**	−.080*	−.108**
		(.046)	(.042)	(.045)
Math skills		.079**	.037	.073*
		(.037)	(.035)	(.038)
Reading skills		.172***	.116***	.167***
		(.040)	(.037)	(.038)
R^2	.045	.353	.445	.502
Occupation controls	None	None	Two-digit	Four-digit

NOTE.—Observations = 1,725. Robust standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

Table 5
Governmental Level of the License and Wage Determination

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)
State only	.388***	.160***	.174***	.091*
	(.050)	(.043)	(.046)	(.048)
Federal only	.363***	.243**	.194**	.092
	(.080)	(.104)	(.086)	(.097)
Local only	.015	.075	.122	.191
	(.150)	(.117)	(.118)	(.144)
Licensed, not used	.295*	.106	.145	.043
	(.170)	(.153)	(.138)	(.161)
State and federal	.427***	.198***	.242***	.214***
	(.081)	(.067)	(.062)	(.071)
State and local	.305***	.175**	.242***	.201**
	(.082)	(.081)	(.071)	(.088)
Federal and local	.040	−.134	−.130	−.088
	(.169)	(.198)	(.109)	(.214)
State, federal, and local	.094	−.039	.050	−.040
	(.077)	(.058)	(.064)	(.070)
Female		−.237***	−.185***	−.191***
		(.036)	(.036)	(.038)
Hispanic		−.165***	−.142***	−.120**
		(.057)	(.053)	(.058)
Black		−.148***	−.159***	−.145***
		(.051)	(.044)	(.045)
Asian		.223*	.106	.184
		(.132)	(.116)	(.137)
Education		.072***	.048***	.052***
		(.009)	(.009)	(.009)
Age/10		−.053	−.039	−.061*
		(.035)	(.033)	(.033)
Work experience		.043***	.033***	.040***
		(.006)	(.006)	(.006)
(Work experience)^2/1,000		−.598***	−.473***	−.551***
		(.091)	(.087)	(.093)
Union member		.097**	.185***	.134***
		(.044)	(.044)	(.041)
Government		.005	.006	−.023
		(.046)	(.047)	(.047)
Service		.031	−.009	.026
		(.045)	(.050)	(.052)
Self-employed		.168**	.168**	.229***
		(.075)	(.076)	(.087)
Northeast		−.105**	−.059	−.094*
		(.050)	(.045)	(.049)
Midwest		−.119**	−.080*	−.106**
		(.048)	(.044)	(.047)
South		−.128***	−.085**	−.118***
		(.046)	(.042)	(.045)
Math skills		.073*	.033	.071*
		(.038)	(.035)	(.038)

Table 5 (*Continued*)

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)
Reading skills		.177***	.117***	.173***
		(.040)	(.037)	(.038)
R^2	.058	.360	.448	.509
Occupation controls	None	None	Two-digit	Four-digit
F-test: federal only = state only = local only	2.966	.620	.127	.233
F-test: *p*-value	.0518	.538	.881	.792

NOTE.—Observations = 1,702. Robust standard are errors in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

matter more in wage determination than the government merely giving its approval of a title for an occupation.

To further probe the role of occupational licensing, we next examine whether the level of governmental jurisdiction that issues occupational licenses matters for wage determination. Specifically, as shown in table 5, we allow for a differential effect of licensing at the county or city, state, or federal level. In our sample, 49% of the respondents reported that they were licensed at only one level of government, while the others reported that they had licenses from more than one governmental venue. A basis of comparison in our estimates are individuals who do not need a license for their jobs. One category also is for persons who have a license but do not use it for their job. For example, a manager in a large firm may be a licensed attorney, but his or her license is not required for the position. Our estimates are intended to examine the influence of having one or multiple jurisdictional levels of licensure on wages. Overall, licensing at the state level is associated with the largest and most consistent effect on wages. As shown in the first row of table 6, licensing at the state level is associated with 17% higher earnings.[16] Further, the interaction of state with either federal or local government levels of regulation is precisely estimated with coefficient estimates of about 25%. However, the full set of political jurisdictions is insignificantly different from one another when the full sets of covariates are included and are shown at the bottom of the table using an *F*-test.

Our results show the largest influence of the level of government licensing on wages is greatest at the state and federal levels. Local licenses are not associated with higher wages. Potential reasons for the decline in the precision of the estimates for licensing at the local level may be that licensing for low-paid jobs, such as taxi licenses and tattoo parlors, are

[16] Estimates with no occupational controls and those with four-digit SOC controls produced precisely estimated coefficient values for the licensing variables but with varying magnitudes.

Table 6
How Licensing Requirements Influence Wage Determination

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)	lwage (5)
Licensed	.136**	.076	.091	.109*	.064
	(.055)	(.065)	(.064)	(.060)	(.067)
College	.390***	.405***	.152**	.072	.048
	(.063)	(.083)	(.072)	(.080)	(.083)
High school diploma	.081	.071	.058	.042	.012
	(.066)	(.076)	(.072)	(.063)	(.082)
Internship		−.237***	−.100	−.009	−.022
		(.066)	(.061)	(.058)	(.070)
Test		.046	.042	.006	.032
		(.075)	(.070)	(.062)	(.073)
Specific tasks		−.059	−.070	.029	−.061
		(.071)	(.066)	(.062)	(.074)
Fees		.125**	.040	.039	.071
		(.056)	(.056)	(.052)	(.058)
Continuing education		.018	−.028	−.045	−.021
		(.060)	(.059)	(.055)	(.064)
Periodic tests		.114*	.038	.056	.001
		(.066)	(.059)	(.058)	(.063)
Year or longer internship		.105	.044	.044	.123*
		(.070)	(.069)	(.066)	(.068)
Female			−.236***	−.185***	−.192***
			(.036)	(.036)	(.037)
Hispanic			−.170***	−.147***	−.141**
			(.057)	(.053)	(.059)
Black			−.141***	−.158***	−.146***
			(.052)	(.044)	(.045)
Asian			.272**	.179	.239*
			(.123)	(.114)	(.130)
Education			.067***	.047***	.049***
			(.009)	(.009)	(.010)
Age/10			−.066*	−.044	−.063*
			(.034)	(.032)	(.033)
Work experience			.045***	.034***	.040***
			(.006)	(.006)	(.006)
(Work experience)^2/1,000			−.625***	−.493***	−.560***
			(.091)	(.088)	(.094)
Union member			.108**	.196***	.151***
			(.046)	(.045)	(.044)
Government			−.007	−.012	−.036
			(.048)	(.047)	(.048)
Service			.030	−.007	.014
			(.045)	(.051)	(.054)
Self-employed			.179**	.181**	.223**
			(.075)	(.077)	(.089)
Northeast			−.113**	−.070	−.110**
			(.049)	(.045)	(.048)
Midwest			−.118**	−.084*	−.112**
			(.048)	(.043)	(.045)

Table 6 (*Continued*)

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)	lwage (5)
South			−.117**	−.079*	−.111**
			(.046)	(.042)	(.045)
Math skills			.071*	.033	.068*
			(.038)	(.035)	(.039)
Reading skills			.171***	.118***	.171***
			(.040)	(.037)	(.039)
R^2	.064	.084	.358	.446	.505
Occupation controls	None	None	None	Two-digit	Four-digit
F-test: all requirements = 0	22.67	9.575	1.591	.491	1.059
F-test: *p*-value	1.91e-10	0	.112	.882	.390

NOTE.—Observations = 1,725. Robust standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

often left to local governments. Further, local licensing is less likely to be a restriction on competition than state or federal licensing, which covers a larger geographic area, since customers can call a taxi from an unlicensed jurisdiction at an airport or home or visit a neighboring town for a tattoo. Based on these estimates, we conclude that licensing is a labor market institution that matters in wage determination at least as much as unionization.

VII. Probing the Anatomy of Wage Effects

What elements of licensing requirements contribute to the wage advantage captured by licensed practitioners? In table 6 we probe the provisions of licensing regulations that enhance the wage premium of regulated practitioners. In order to obtain a license, individuals in occupations often are required to meet general education requirements, which include graduation from high school or college and occupation-specific requirements such as a long internship, some lasting more than a year, and attending continuing education classes following entry into the field. In addition, for entry into an occupation, passing an examination is generally required. The effects of testing for entry is an issue that has been raised by Milton Friedman and others, who hypothesized and provided evidence that the members of the occupation can manipulate the pass rate to restrict entry and raise wages (Friedman 1962; Maurizi 1974; Kleiner and Kudrle 2000; Kleiner 2006). Our results show that licensing enhances earnings but that the individual provisions, such as testing, education, and fees, do not produce an additive impact. None of the other specific requirements are robust in their statistical significance across all specifications, and the requirements together are not significant at p-value < 0.01 using an F-test for the joint significance of the requirements to obtain and

maintain a license in the specifications in the table. It appears that the additional requirements beyond becoming licensed do not contribute to enhanced wages.

VIII. Job Tasks of Regulated Practitioners

Do licensed occupations perform more sophisticated cognitive work tasks, such as doing difficult math and reading assignments? If so, perhaps the wage premium is economic returns to higher cognitive abilities and tasks. Moreover, are licensed or government-certified tasks more education-intensive, which would account for some of the wage premium obtained by regulated workers? In order to address this question using the data from the PDII survey, we examine question 25, which asks the self-reported use of math and reading abilities of the practitioners. For example, the reading question asks: "What (is/was) the longest document that you typically read as part of your job?" And the math question asks: "How often (do/did) you solve problems at your jobs using advanced mathematics such as algebra, geometry, trigonometry, probability, or calculus?" In appendix C, we show the use of these skills by licensure and certification status.[17]

Table 7 analyzes reading utilization, and table 8 examines math use when occupational regulation is taken into account. The estimates in these tables show that regulated practitioners are somewhat more likely to do more reading tasks at their workplace, controlling for standard human capital, demographic, and occupation variables that are available in the survey. Although licensed workers have a positive, albeit small, estimated impact on reading use, certified workers, such as librarians and technicians, are much more likely to engage in detailed reading relative to either unregulated or licensed practitioners. Table 8 shows that workers in regulated occupations do more math-related tasks. Although workers in licensed occupations appear to do somewhat more work that requires cognitive tasks, the estimated effect of occupational regulation varies in other specifications when more detailed occupation dummies are included.

IX. Does Licensing Influence Wage Dispersion?

In order to examine the influence of licensing on the variance in wages, we examine the mean within category squared residual from a log of wage regressions in both licensed and unlicensed occupations, controlling for human capital characteristics. We also compare union and nonunion earnings as a point of reference, since unions have been shown to reduce var-

[17] The estimates show that both licensed and certified workers have higher usage of math and reading skills than unregulated workers at the .01 level confidence level, but there is no difference in skill usage between licensed and certified workers.

Table 7
Influence of Learning and Certification on Reading Usage

	Reading Skills			
Variable	(1)	(2)	(3)	(4)
Licensed	.124***	.054**	.065**	.065**
	(.023)	(.023)	(.026)	(.026)
Certified	.193***	.163***	.144***	.139***
	(.044)	(.042)	(.042)	(.044)
Female		−.036*	−.017	−.055**
		(.021)	(.023)	(.024)
Hispanic		−.027	−.010	−.041
		(.038)	(.037)	(.040)
Black		−.012	.005	−.023
		(.037)	(.036)	(.038)
Asian		.013	−.036	−.037
		(.075)	(.074)	(.080)
Education		.059***	.037***	.048***
		(.004)	(.005)	(.005)
Age/10		−.028	−.022	−.038**
		(.018)	(.018)	(.019)
Work experience		.006*	.003	.007*
		(.003)	(.003)	(.004)
(Work experience)^2/1,000		−.078	−.050	−.082
		(.052)	(.052)	(.055)
Union member		−.068**	−.040	−.056*
		(.030)	(.030)	(.032)
Government		.105***	.070**	.074**
		(.027)	(.028)	(.030)
Service		.032	.018	.046
		(.028)	(.032)	(.032)
Self-employed		−.040	−.035	−.035
		(.030)	(.031)	(.033)
Northeast		−.004	.001	.017
		(.031)	(.031)	(.032)
Midwest		−.018	−.013	.007
		(.028)	(.028)	(.029)
South		.031	.035	.045
		(.027)	(.026)	(.028)
R^2	.018	.123	.180	.226
Occupation controls	None	None	Two-digit	Four-digit

NOTE.—Observations = 2,251. Standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

iations in wages (Card 1996).[18] Evidence from Freeman and Medoff (1984) shows that unions view reducing wage variance as a stated objective, and the empirical evidence suggests how unions reduce the variance between

[18] Estimates of a more traditional wage dispersion approach using only two groups found similar results (Freeman 1982).

Table 8
Influence of Learning and Certification on Math Usage

	Math Skills			
Variable	(1)	(2)	(3)	(4)
Licensed	.073***	.062***	.083***	.030
	(.023)	(.023)	(.026)	(.026)
Certified	.105**	.091**	.083**	.055
	(.044)	(.042)	(.042)	(.044)
Female		−.133***	−.093***	−.123***
		(.021)	(.023)	(.023)
Hispanic		.131***	.138***	.130***
		(.038)	(.038)	(.040)
Black		−.032	.006	−.011
		(.037)	(.037)	(.038)
Asian		.020	−.026	.000
		(.076)	(.074)	(.080)
Education		.041***	.028***	.033***
		(.004)	(.005)	(.005)
Age/10		−.074***	−.064***	−.066***
		(.018)	(.018)	(.019)
Work experience		.006*	.003	.005
		(.004)	(.004)	(.004)
(Work experience)^2/1,000		−.028	.004	−.033
		(.053)	(.052)	(.055)
Union member		−.054*	−.054*	−.035
		(.030)	(.030)	(.031)
Government		−.002	−.003	.027
		(.028)	(.028)	(.029)
Service		−.173***	−.106***	−.171***
		(.029)	(.032)	(.032)
Self-employed		−.024	−.033	−.020
		(.030)	(.031)	(.033)
Northeast		.024	.035	.035
		(.032)	(.031)	(.032)
Midwest		.030	.032	.043
		(.028)	(.028)	(.029)
South		.055**	.054**	.071**
		(.027)	(.027)	(.028)
R^2	.006	.102	.164	.225
Occupation controls	None	None	Two-digit	Four-digit

NOTE.—Observations = 2,251. Standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

the top and bottom wage earners that they represent in collective bargaining. There are no such clearly stated objectives for professional associations to reduce the wage variance of regulated occupations or for the state officials who monitor these jobs to be concerned with reductions in earnings variations (Kleiner 2006). Table 9 presents observations that are split into quartiles on the basis of predicted wage in the unlicensed sector.

Table 9
Impact of Licensing and Unions on Wage Dispersion

Panel A	Predicted Nonunion Wage Quartile (1)	(2)	(3)	(4)	Total
Conditional mean ln(wage):					
Nonunion	2.610	2.981	3.184	3.388	3.035
Union	2.756	3.118	3.351	3.508	3.179
Total	2.628	3.010	3.223	3.398	3.058
Union-non	.146	.137	.167	.120	.144
p-value	.000	.000	.000	.001	.000
Conditional mean squared error Ln(wage):					
Nonunion	.296	.358	.413	.482	.386
Union	.232	.211	.177	.194	.201
Total	.288	.327	.357	.458	.356
Union-non	−.064	−.147	−.236	−.288	−.185
p-value	.467	.069	.009	.132	.000
Observations:					
Nonunion	387	358	314	336	1,445
Union	53	95	97	35	280
Total	440	453	411	421	1,725

Panel B	Predicted Nonlicensed Wage Quartile 1	2	3	4	Total
Conditional mean ln(wage):					
Unlicensed	2.598	2.926	3.139	3.306	2.975
Licensed	2.84	3.142	3.377	3.592	3.261
Total	2.645	2.997	3.238	3.374	3.058
Licensed-unlicensed	.242	.216	.238	.286	.286
p-value	.000	.000	.000	.000	.000
Conditional mean squared error ln(wage):					
Unlicensed	.282	.372	.395	.439	.368
Licensed	.287	.313	.342	.358	.328
Total	.283	.352	.373	.42	.356
Licensed-unlicensed	.005	−.059	−.053	−.081	−.04
p-value	.937	.435	.548	.486	.346
Observations:					
Unlicensed	356	295	244	327	1,222
Licensed	86	144	172	101	503
Total	442	439	416	428	1,725

NOTE.—Observations are split into quartiles on the basis of predicted wage in the unlicensed sector. The conditional mean and squared error is estimated using the predicted values from regressions with covariates: age, education, sector of employment, race, work experience, and math and reading skills used on job. The observation numbers are not equal in each quartile because of missing values of ln(wage).

The observation numbers are not equal in each quartile because of missing values of wages, and the same basic procedure is used to estimate differences in the union and nonunion sector. The mean log wage and standard deviation of the log wage is calculated within each quartile to show how different parts of the wage distribution are affected by either licensing or unions. The mean wage of licensed and union workers is statistically significantly higher than their corresponding unlicensed and nonunion workers at each quartile. The measure of dispersion of wages among licensed jobs is about the same as unregulated ones, and the *p*-value for difference in the standard errors is not significant for all four earnings categories and for the overall measure of dispersion. In contrast, the upper part of the table shows that unionization reduces the variance in for the second and third quartile of wages and that it is significant for the overall measure of dispersion where the sample size is the largest. These results are similar to those found with a different data set in Kleiner and Krueger (2010), suggesting the robustness of the findings for the role of unions and licensing over time and across different surveys.

X. Conclusions

We show that occupational licensing is an important labor market phenomenon that is pervasive and likely has a large influence on wage determination. Using a specially designed survey of a nationally representative sample of Americans carried out by Westat, we provide an examination of the prevalence and influence of various forms of occupational licensing. We show that the consistency of reporting in having a license is high but that it is more difficult to externally verify licensing through government databases, in part due to the lack of on-line or computer-readable data of licensed practitioners by states and local governments.

Licensing is a growing phenomenon in the US economy, reaching almost 29% of workers in our 2008 survey. Workers who have higher levels of education are more likely to work in jobs that require a license, and most licensing is implemented at the state level. The requirement of government regulation, especially regulation at both the state and local levels or the state and federal levels, is associated with higher wages relative to those in jobs that only require local licensing. Certification, a weaker form of government regulation that allows others (noncertified workers) to work in the occupation, has a much smaller effect on wages. Workers who are licensed or certified do work that is associated with greater use of reading and somewhat more use of mathematical tasks. Unlike unions, which appear to reduce wage variation, licensing does not appear to diminish wage variation.

On balance, our results also lend support for the interpretation that occupational licensing often serves as a means to enforce entry barriers to a profession that raise wages. Furthermore, our finding that licensing is associated with a larger wage premium when the license is issued at the

state level as opposed to the local level suggests that competition is more effectively restricted when there is no possibility of obtaining a service from an unlicensed provider in a nearby locality. These estimates suggest a strong role for the monopoly face of licensing in the labor market. Indeed, the wage premium associated with licensing is strikingly similar to that found in studies of the effect of unions on wages (Freeman and Medoff 1984; Lewis 1986). It is possible, however, that omitted variables are correlated with both licensing and wages, which confounds our results. With the large and growing number of workers required to obtain an occupational license and the apparently large effect of licensing requirements on the labor market, we think it would be prudent for statistical agencies to measure and monitor the extent of occupational licensing. This can be accomplished in a manner similar to the way in which information is collected for unions in labor force surveys, such as the CPS. We have demonstrated how such questions can be asked in a labor force survey and have provided some indication of the reliability and utility of the resulting data. Adding these questions to a survey like the CPS would help to answer questions such as these: How much regulation is optimal for productivity growth? Does occupational licensing lead to better consumer protection and higher quality? How does the licensing premium vary across occupations, industries, and regions? Is the pace of occupational licensing rising or falling? And what is the interaction between licensing and unionization? Collecting additional micro data on occupational licensing for a large sample would also facilitate further econometric analysis of the causal impact of licensing on earnings.

Appendix A

Table A1
Comparing Log Wage Regressions: CPS and PDII

Explanatory Variable	CPS	PDII
Intercept	1.016	1.260
	(.019)	(.073)
Education	.110	.103
	(.001)	(.005)
Potential experience	.036	.036
	(.001)	(.003)
(Experience)^2/100	−.058	−.056
	(.002)	(.006)
Female	−.214	−.308
	(.007)	(.027)
R^2	.367	.326
Sample size	18,944	1,675

NOTE.—CPS = Current Population Survey. PDII = Princeton Data Improvement Initiative. Sample weights are used in both regressions. The CPS data are for the months of June and July of 2007. Standard errors are in parentheses.

Appendix B

Table B1
Estimates of the Influence of Licensing on the Returns to Education

Variable	lwage (1)	lwage (2)	lwage (3)	lwage (4)
High school education			.145*	.140*
			(.0753)	(.0763)
Some college education			.349***	.330***
			(.0716)	(.0728)
College (BA)			.685***	.667***
			(.0749)	(.0764)
Graduate education			.938***	.900***
			(.0779)	(.0793)
Education	.109***	.105***		
	(.00736)	(.00741)		
Licensed		.151***		.160***
		(.0316)		(.0316)
R^2	.330	.339	.350	.360

NOTE.—Observations = 1,841. Robust standard errors are in parentheses. All models include controls for gender, work experience, work experience squared, and a constant term.
* $p < .10$.
*** $p < .01$.

Appendix C

Table C1
Use of Math and Reading Skills by Licensing and Certification Status

	Math	Reading
Unlicensed	.377	.368
Licensed	.446	.484
Total	.397	.401
Licensed-Unlicensed	.069	.116
p-value	.001	.000
Uncertified	.393	.393
Certified	.455	.538
Total	.397	.401
Certified-uncertified	.062	.145
p-value	.140	.001
Licensed-certified	−.009	−.054
p-value	.235	.848

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