Analyzing Occupational Licensing Among the States

Morris M. Kleiner, University of Minnesota, NBER, and Federal Reserve Bank of Minneapolis

Evgeny Vorotnikov, Ph.D. Economist, Fannie Mae

August 9, 2016

ABSTRACT

The study provides new evidence of the influence of occupational regulations on the U.S. economy. Our analysis, unlike previous surveys, was able to obtain a representative sample of the population at the state level, which allowed us to estimate the cross-sectional effects of occupational licensing for each state. The results show the costs of licensure measured by economic returns on licensing regulations, simulated losses in jobs and output, and a potential misallocation of national resources at the state and national level. The national estimates suggest that occupational licensing raises wages by about 10 percent after controlling for human capital and other observable characteristics and creates potential deadweight losses in the economy that are estimated and discussed.

Introduction

The study of the regulation of occupations has a long and distinguished tradition in economics (Smith, 1937). Some economists have viewed such regulation through the prism of rent-seeking behavior and have empirically examined the economic effect of occupational licensing within that framework (Friedman and Kuznets, 1945; Friedman, 1962). In contrast, others have suggested that regulation provides incentives for workers to enhance their human capital through greater investments in their work life by limiting low skilled substitutes (Shapiro, 1986). The first perspective has dominated in the United States since World War II. The market for occupational oversight by government has grown significantly, as has the number of individuals in the U.S. labor market who have obtained or must obtain either a license or certification from some form of local, state, or federal government (Kleiner and Krueger, 2010). Since governmental occupational regulations vary greatly between states, the purpose of this study is to examine the level, effects, and potential costs of occupational regulations across states using a representative sample of the U.S. population specifically collected for this study.

Unlike previous surveys, we were able to obtain a representative sample of the population at the state level, which allowed us to estimate the cross-sectional effects of occupational licensing for each state. Further, we estimate the influence of licensing on the earnings of regulated practitioners and then, based on these findings, calculate deadweight loss and potential losses in jobs at the state and national level. This approach was developed and popularized by economist Arnold Harberger (Harberger, 1954). Further, using the discussion in Schmidt (2012),[1] we suggest that deadweight loss is a conservative estimate of actual economic

[1] Harberger (1954) argues that the losses are a small triangle as a consequence of lost output, but Schmidt (2012) states that the losses are a much larger trapezoid caused by an internal misallocation of societal resources. (Schmidt, 2012).

losses, and that the misallocation of resources should be used instead to evaluate the economic losses caused by these regulations. Therefore, in addition to providing deadweight loss estimates, we also show estimates of misallocation of economic resources.

Our results show that licensing raised the earnings of regulated workers in some states. Further, the results show that the average return was approximately 10 percent nationally in 2013. Based on these results, we estimated that the employment losses were approximately 1.3 percent of total nonfarm employment in 2013, deadweight losses were approximately $13 billion or 1.5 percent of total household consumption in that same year, and misallocation of resources exceeded $170 billion in 2013.

Defining Occupational Regulation

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 occupations. 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. The occupations can use the police powers of the state to enforce the monopoly for the licensed occupation. By 2003 the Council of State Governments estimated that more than 800 occupations were licensed in at least

one state, and more than 1,100 occupations were licensed, certified, or registered (CLEAR, 2004).

Rationale for Licensing

A simple theory of occupational licensing draws on principles of mechanics or administrative procedures. It envisions an essentially costless supply of unbiased and capable gatekeepers and enforcers. The gatekeepers screen entrants to the profession by barring those whose skills or characters suggest a tendency toward producing a low-quality output. The enforcers monitor incumbents and discipline those whose performance is below standards, with punishments that may include revocation of the licenses needed to practice. Assuming that entry and ongoing performance are controlled in these ways, the quality of service in the profession will almost automatically be maintained at or above standards.

Adding economics to this otherwise mechanical model, we note that a key discipline on incumbents—the threat of loss of their licenses—may not mean much if incumbents can easily reenter the profession by moving to a new firm or state or by shifting to an alternative occupation with little loss of income. For example, if sales skills are the key to both mortgage brokering and selling cars, then individuals may shift between these lines of work with little loss of income. Under these circumstances, meaningful discipline may require deliberate steps to ensure that loss of a license entails significant financial losses. These additional steps could include imposition of fines, improved screening to prevent expelled practitioners from reentering their occupations, or requiring all incumbents to put up capital that would be forfeited upon loss of a license. To offset the possibility that incumbents could shift to other occupations with little loss of income, entry requirements could be tightened to limit the supply of practitioners, which in this case creates monopoly rents within the licensed occupations. The threat of losing these monopoly rents could,

in principle, give incentives to incumbents to maintain standards. The rents also could motivate potential entrants to invest in higher levels of training in order to gain admittance. This suggests that licensing can raise quality within an industry by restricting supply and raising prices.

Friedman (1962) questioned the assumption of unbiased gatekeepers as well as enforcers and viewed licensing's entry restrictions and monopoly rents as negative. He argued that licensing systems are almost always run by and for incumbents, meaning that gatekeepers and enforcers are in reality self-interested. Their vested interests lead them not only to create monopoly rents through restrictions on entry but also to stifle complaints and impose disciplinary procedures against most incumbents. Weak discipline on incumbents, along with artificially high client-provider ratios, lead to a decrease in the overall quality of service that consumers receive. In other words, Friedman predicted that licensing would reduce the size of an occupation and lead to a combination of higher fees for providers and lower quality for consumers. Friedman also stressed that the proper measure of quality is the overall quality of services received by consumers, not the average quality of services provided by licensed providers. By raising prices within the licensed occupation, licensing may cause consumers to seek substitute services from unlicensed occupations that provide lower-quality output. Friedman's analysis concluded that licensing is not useful, except possibly in very limited circumstances involving significant externalities.

A key argument in this political economy approach to licensing is the term "the Cadillac effect." As presented in *Capitalism and Freedom*, licensing standards are set so high that only high-income individuals can purchase the service. Lower-quality services are forbidden under the police powers of the state. Since licensing provides state-sanctioned monopolies, and those in the occupation can set the standard, the entry barriers are set unnecessary high. In tying this

analogy to the car market, only expensive high-quality Cadillacs are allowed to be purchased or be on the road, and less expensive average-quality models are forbidden. One consequence for the service market is that the consumer could receive a high-quality service or nothing at all. The use of substitutes, such as nurse practitioners for physicians, for example, are forbidden or restricted by efforts of the physician's lobby in the legislature (Kleiner et al. 2016). In addition, the members of the occupation have major incentives to maintain and further increase these barriers, because their earnings will grow significantly as a result, as demonstrated by recent empirical evidence. Consumers, on the other hand, have few incentives to allocate their time toward stopping potentially restrictive practices, since the increase in the prices of services provided by licensed practitioners is small in comparison to the time necessary for reducing potentially restrictive policies. Moreover, Friedman also noted that licensing practices also reduce innovation, because new techniques or procedures are often prohibited by law or via administrative statements issued by the licensing boards.

All forms of government regulations of occupations from registration and certification to licensure were considered somewhat objectionable by Friedman. His argument was that if the information about providers is valuable, then consumers will seek private means of finding out about a product or service. For example, he stated that the Consumers Union and Good Housekeeping provide this kind of information. To update his example, Internet sites such as Angie's List, Yelp, Facebook, and other similar websites provide easily accessible and generally reliable information on services provided by licensed specialists.[2] However, information

[2] One potential problem is that these websites can be contaminated with bogus claims of either positive or negative reviews. For some examples of false information, see Danielle Bowling, "High-end restaurant embroiled in fake review crackdown," *Hospitality Magazine*, January 30, 2014, http://www.hospitalitymagazine.com.au/food/news/high-end-restaurant-embroiled-in-fake-review-crack, and Rachel Feltman, "Why people trust online reviews for dinner but not doctors," *Quartz*, February 19, 2014, http://qz.com/178348/why-people-trust-online-reviews-for-dinner-but-not-doctors/. Consequently, consumers may not trust these sites.

asymmetries may still exist for lower-income or less-educated members of society for whom registration and certification may still provide useful information for their selection of service providers.

The political economy work by Friedman focused in more detail on how the professions limit entry and thereby raise prices and limit access to consumers across a broad spectrum of occupations. Friedman proposed that any form of government regulation of occupations not only is unnecessary but also is a particularly onerous form of regulation. Beyond the impact on wages and prices, occupational licensing is likely to reduce innovation and put the members of the occupation, rather than consumers, in control of service market prices and access. Therefore, the influence of licensing on aggregated economic activity is likely to be negative, especially over the long run.

Basic Methodology

In order to estimate the influence of occupational regulation on wage determination, we use the results of a new workforce survey conducted by Harris Poll Interactive, a subsidiary of Nielsen Company. The survey asked detailed questions on occupational regulations as well as questions on the labor market status of individuals. The survey questions were initially developed as part of the Princeton Data Improvement Initiative (PDII) conducted by Westat (see Kleiner and Krueger, 2013). These questions probe the kind of government regulations required to perform a job, the process of becoming licensed, and the level of education and tests necessary to become licensed. Results of the Harris Survey, as well as separate validation results from a related Westat and Gallup survey, indicate that occupational licensing can be reasonably well

measured by labor force surveys.[3] Our study is the first to provide a general analysis of occupational licensing at the state level in the U.S. economy, as well as a way to link these data to similar questions that are now regularly asked in the Current Population Survey (CPS).

The Survey Instrument and Design

In 2013, the Harris polling organization conducted an interactive state survey on behalf of the Institute for Justice (IJ) funded by the Templeton Foundation. The IJ provided Harris with a draft of a questionnaire that was patterned after the PDII. The IJ and Harris collaborated in finalizing the questions' order and wording. Several questions regarding the respondents' employers, job activities, and demographics were taken from the CPS. Harris staff pretested the survey with dozens of volunteer respondents from their regular sample.

Harris conducted the survey in early and mid-2013. Individuals age 18 or older who were in the labor force were eligible for the survey. A total of 9,850 individuals were interviewed. We limit our analysis to those who were employed at the time of the survey or had a job during the previous 12 months. The Harris Survey was able to collect a representative sample of the population at the state level.

Harris developed survey weights to compensate for variation in selection probabilities, differential response rates, and possible under coverage 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, and so on).

[3] In the Appendix Table 1, we show the occupational distribution of individuals in the sample and they are largely similar to other national surveys such as the American Community Survey.

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

Question 11. 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

IN PROCESS/WORKING ON IT..... 3

Question 11a. Would someone who does not have a license or certificate be legally allowed to do your job?

YES 1

NO 2

Question 12. 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

Those who answered affirmatively to question 11 were asked additional questions about 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 objective was to obtain measures of licensing attainment rather than measures for individuals who may be covered by licensing laws but are not licensed (Gittleman and Kleiner, 2016).

The results of the analysis are shown in Table 1 and Figures 1 and 2. We find that 28.43 percent of the respondents answered that they were either licensed or certified. Approximately 6.75 percent were individuals who did not have a license but could do the work, which is the definition of government certification. Another 1.79 percent 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 30.22 percent. This value is lower than the 38 percent

found by Kleiner and Krueger (2013) in the survey conducted by Westat in 2008 for workers who are (or eventually must be) licensed or certified. This difference may reflect the larger sample size of the Harris data, which has 9,850 relative to the 2,449 observations in the Westat sample that was examined by Kleiner and Krueger (2013). Or it may reflect the sample selection criteria or the method of data collection (phone survey versus an online survey).

In Table 2 we show the percentage of the workforce that is licensed or certified and the rank order of the state relative to other states by the percentage that has an occupational license. Iowa has the highest percentage of licensed workers; more than one-third of the workforce has obtained a license from some level of government (see Table 3, panel A). Conversely, South Carolina, Rhode Island, New Hampshire, Indiana, and Kansas have the smallest percentage of licensed workers—about 14 percent in each case. West Virginia and Rhode Island have the highest percentage of certified workers (see Table 3, panel B); about 12 percent of the workforce has this lower level of governmental oversight. In contrast, Wisconsin and North Dakota have the lowest percentage of certified workers. These estimates show the wide range of percentages of licensed and certified workers in the United States.

Who Is Licensed?

To show the basic demographic and economic characteristics of regulated workers, we examine the distribution of licensed and certified practitioners by education, race, union status, public or private sector, and gender in Table 4. The results indicate that licensing rises with education: more than 41 percent of those with post college education have licenses compared with only 11 percent for those with less than a high school education. The results in the table also show that union members are more than twice as likely to be licensed, reflecting in part the large number of teachers and nurses who tend to be union members and licensed workers. Government

workers are more likely to have a license than nongovernment workers. We find slightly higher licensing rates for men (24 percent) relative to women (19 percent). The licensing rates for whites are 22 percent, 23 percent for Hispanics, and 19 percent for blacks. The table further shows that licensing rises with age and flattens over age 55. Individuals who provide services are almost twice as likely to be licensed compared with those who repair things.

In the last three columns of Table 4, we compare our results with an earlier survey by Kleiner and Krueger (K&K) (2013) conducted by Westat and completed in 2008. Many characteristics have similar values in both surveys. However, as was mentioned earlier, the rate of licensing is higher in their study. This difference could be explained by a higher representation of college and post-college-educated participants, a higher participation of whites, an older population, a higher percentage of individuals who work in the public sector, and a higher representation of individuals who provide services relative to those who make things in the K&K survey, since all of these characteristics of the population contribute to a higher percentage of individuals who are licensed.

Table 5 shows the requirements for becoming licensed using both the Harris Survey and the one developed by Westat and used in the K&K analysis. Some differences in the two surveys warrant some discussion. In the Harris Survey, the question was, "Did you require at least a high school education in order to become licensed?" and the response was 75 percent of the survey participants required that level of education or higher. In the K&K survey, the question was whether participants had a specific requirement for a high school diploma, and the response was 31 percent. The statistics for other requirements necessary for obtaining a license were similar across the two surveys.

Influence of Licensing on Earnings

In order to ensure the robustness of our estimates, we examine whether licensing prevalence is exogenous with respect to other factors that might also affect incomes of the regulated specialists. Therefore, we identify the presence of any signals or patterns in the distribution of the licensing prevalence that might suggest the existence of these underlying factors.

First, we develop control charts of the licensing and certification prevalence in the United States, in Figures 3 and 4 (Wheeler, 2000). These charts examine whether the difference in licensing and certification prevalence between the states could be explained by normal chance variation—also known as common cause variation—or whether it is a result of special cause variation.[4] Presence of the special cause variation would require us to conduct additional investigation and to identify the source of the variation. Figure 3 shows that the percentage of licensed workforce by state could vary between a lower control limit of 6.2 percent and an upper control limit of 37.1 percent without representing a real departure from the average of 21.6 percent. The control limits are determined by the variation within our point estimates. None of the states fall outside of the control limits or more than two standard deviations away from the mean, indicating that the difference in the percentage of the licensed workforce between states could be explained by natural variation. Figure 4 shows a similar picture for the percentage of certified workforce. All the states are within the control limits, and variation in certification prevalence between states could be explained by natural variation. These findings show that none

[4] The idea of common cause and special cause variations was initially developed by Deming and Shewhart and described in detail in Wheeler (2000). Common cause variation is a chance variation that is inherent in the process and stable over time, whereas special cause variation is a result of specific events.

of the states require an additional investigation or special attention because of a statistical anomaly.

Second, as a further robustness check of the potential regional bias of occupational licensing, we develop heat maps of the licensing and certification prevalence in the United States (Figures 5 and 6) in order to identify geographical patterns (Hastie, Tibshirani, and Friedman, 2009). Figures 5 and 6 show that more regulated or less regulated states do not cluster in any particular geographic regions. Further, a cross comparison of these figures also does not reveal any identifiable patterns. Although licensing or certification prevalence is not correlated with geography, prevalence might be correlated with other factors that could affect our results. Therefore, the next step would be to test whether change in the occupational mix affects the prevalence of licensed professionals across states. We do not perform this type of analysis in our study, but the U.S. Department of the Treasury's Office of Economic Policy, the Council of Economic Advisers, and the Department of Labor (2015) conducted such empirical analysis using our estimates of licensing prevalence and data from the Survey of Income and Program Participation. They found that "variation in licensing prevalence appears not to be driven by differences in occupational mix across States."[5]

All of the previous robustness checks suggest that there are no states that license or certify an unusually large or small number of practitioners and that variation in licensing or certification prevalence could be explained by common cause variations such as those shown in Tables 3 and 4. Further, none of the systematic patterns or underlying factors that might affect the estimates were identified, which suggests that the estimated models allow us to make valid inferences about the effects of occupational regulations on regulated workers' earnings.

[5] Additional details of the analysis can be found in "Occupational Licensing: A Framework for Policymakers".

Using the data collected by Harris, we estimated how occupational regulations influence hourly earnings. The ordinary least squares results shown in Table 6 and Table 7 demonstrate that occupational licensing regulations raise mean log hourly earnings by approximately 10.3 to 11.9 percent.[6] These estimates are lower than the 10 to 15 percent found by K&K (Kleiner and Krueger, 2010, 2013). The estimates in Table 7 show that licensing has a larger influence on earnings than certification. The licensing estimates presented in Tables 6 and 7 largely reflect the monopoly effect that occupational licensing likely creates.[7] The estimates suggest that licensing is associated with approximately 10 percent higher earnings even after accounting for human capital, labor market characteristics, and two digit occupation controls.[8] These results are similar to estimates presented by Kleiner using the Public-Use Microdata Samples through 2000 and using the Survey of Income and Program Participation (Kleiner, 2006, Gittleman, Klee, and Kleiner, 2015). Although the influence of other variables such as age, education, and unionization on hourly earnings is consistent with the economic and policy literature, the coefficients of race variables are not statistically significant. Perhaps this is because of our ability to better control for reading and math skills in our regression estimates (see Neal and Johnson, 1996).

Quantile Regression Results

The influence of licensing regulations on mean log hourly earnings is informative but may not reflect the relationship at other points in the hourly earnings distribution. In order to provide

[6] Tables 6, 7, and 9 report the unadjusted coefficients. Because the dependent variables were in logs, we make the appropriate adjustments in the text when we discuss the magnitude of the economic impact of the dummy variables: $100*(\exp(\hat{\beta})-1)$.

[7] Occupational licensing could raise wages if the right set of regulations were chosen to restrict supply and limit the tasks of unlicensed workers. Moreover, licensed workers could enhance demand by signaling that they are providing a higher-quality service to consumers (Friedman, 1962; Spence, 1973).

[8] We use the 2010 Standard Occupational Classification (SOC) system.

an additional perspective on the issue of earnings determination, we estimated quantile regressions to measure the impact of licensing across the earnings distribution. Table 8A and Table 8B show how licensing affects earnings of regulated practitioners across different parts of the earnings distribution. The estimates in Table 8A are produced without controlling for two digit occupation fixed effects, and the estimates in Table 8B are produced with occupation controls. The results in Table 8A suggest that compared with the overall licensing coefficient in the conditional mean model, which is 10.3 percent, the coefficient of the conditional median model is lower. This implies that the effect of licensing on the hourly earnings of regulated professionals would not be as substantial for most of the population. These results may require further investigation. Table 8A demonstrates that individuals in the lowest part of the income distribution— manicurists, for example—are associated with a gain only 3.6 to 5.6 percent due to licensing, but those in the middle of the income distribution gain 7 to 8 percent. Further, those individuals in the top 30 percent of the income distribution gain 11 to 23 percent. However, once we control for occupation effects, in panel Table 8B, licensing coefficients level out across the income distribution and vary between 7.9 percent in its lowest part to 9.5 in the top. The results suggest that licensing exacerbates relative income inequality, since higher wage occupations tend to gain more from the regulation relative to lower wage ones. These results underline the importance of examining the licensing effect throughout the earnings distribution.

The influence of educational attainment on hourly earnings does not change significantly across the earnings distribution in Tables 8A and 8B. The influence of our other two education proxy variables—reading skills and math skills—change by roughly 4 percent in Table 8A, increasing from 18.7 percent and 10.5 percent at lower quantiles to 22.6 percent and 14.4 percent at upper quantiles. In Table 8B signs and significance of the education proxy variables are

essentially the same, but the values of the coefficients diminish. This is expected since occupation fixed effects also indirectly control for reading skills and math skills. Union membership yields a higher return of 10.8 percent at the lower end of the hourly wage distribution than at the median, where it is equal to 6 percent in Table 8A. This result corresponds to earlier findings (Freeman, 1982; Chamberlain, 1994). After controlling for occupation fixed effects the union membership gradient increases to on average 16 percent and levels out across the income distribution.

The yield from being a government employee gradually decreases from 6.3 percent at the bottom quantiles to 4.5 percent at the upper quantiles. The measure of economic returns for being self-employed, increases from roughly 7 percent at the lower part of the earnings distribution to 28.7 percent at the 70^{th} quantile and to 53 percent at the 90^{th} quantile. Individuals who work in for-profit companies experience similar changes. Their hourly earnings increase from 7 percent at the lower end of the distribution to 17 percent at the upper end. In Table 8B, signs and significance of the different types of employment variables are essentially the same, but the values of the coefficients diminish. Again, this is expected since occupation fixed effects also indirectly control for the influence of these characteristics.

Estimation of State-Level Effects of Licensing Regulations

A unique part of our analysis is the ability to estimate the influence of occupational regulations on hourly earnings at the state level. Unlike previous surveys, the Harris Survey was able to obtain a representative sample of the population at the state level, which allowed us to estimate the cross-sectional effects of occupational licensing for each state.

We estimated a human capital model similar to the one in Table 6 for every state. Given the different social and economic characteristics of each state, we would expect considerable heterogeneity in the influence of occupational licensing in different institutional settings. Our state-by-state estimates are presented in Table 9.[9] We find that in some states, such as Alabama, occupational licensing has no statistically significant influence on hourly earnings. However, in other states, such as Connecticut, the influence of licensing regulations on earnings is substantial and statistically significant. Our estimates show that licensing has a positive and statistically significant impact on hourly earnings in 16 states and has no significant influence in 35 states.

The results in Table 9 show that the economic returns to licensing in the 16 states where it is statistically significant varies between 21 percent in Missouri to 47 percent in Maine. Given the heterogeneity in the returns to licensing, we examined these estimates in more detail. Table 10 provides additional insights on occupational licensing returns from our state-level regression models. In this table we group the 16 states based on their corresponding Gross Domestic Product (GDP) per capita and show their average returns to licensing in relative and real terms. The average real return to licensing, of the grouped state data, increases along with GDP per capita from $6.81 per hour to $9.88 per hour. At the same time, the average relative return on licensing of the state grouped data increases from 30.6 percent in states with low GDP per capita to its peak of 36.4 percent in states where GDP per capita ranges from $45,000 to $50,000 a year, and it diminishes in states that have GDP per capita above this threshold to 32.8 percent.[10] This parabolic pattern suggests that licensing has increasing returns to scale in states with GDP per

[9] These coefficients are estimated without controlling for occupation fixed effects because the relatively small number of state-level observations does not provide enough degrees of freedom to estimate these parameters.
[10] The last group, with wages ranging from $60,000 to $65,000, has a higher than expected average effect; however, this result could be a result of that group being represented by only one state—Connecticut.

capita below the $45,000–$50,000 annual threshold and decreasing returns to scale above this threshold.

Beyond the issue of state heterogeneity, another possible reason for the large variance among states is that the relatively small number of state-level observations has resulted in insufficient statistical power to identify the influence of occupational licensing in some states. The number of observations in each state varies from 146 in Tennessee to 222 in the District of Columbia, and it averages 193 per state. Nevertheless, these estimates provide a first approximation of the role of occupational licensing within and across states, which future analysis can probe in greater detail.

Structural Simulations of the Influence of Occupational Regulation

The state- and national-level estimates form the basis of our structural simulations of national- and state-level effects of occupational regulations such as simulated loss in jobs, loss in output (deadweight loss), and a misallocation of resources. Although it is not possible to precisely forecast what effect the elimination or substantial reduction of restrictions created by occupational licensing regulations would have on the economy, our structural models based on theory and the newly available data suggest that such a reduction could translate into higher employment, better job matches, and improved customer satisfaction. Low-income consumers, in particular, would benefit because reduced barriers to entry would lower the prices of services provided by regulated practitioners.[11]

We use the Kleiner (2011) example to illustrate this approach. Suppose that the entire 15 percent wage premium for licensing found in the K&K analysis (2013) was due to monopoly effects (as opposed to productivity gains), labor supply is perfectly elastic, and the labor demand

[11] See Shapiro (1986) and Cox and Foster (1990) for further theory and evidence on these results.

elasticity was 0.5 (Hammermesh, 1993). Kleiner estimated that the United States has approximately 38 million licensed workers with average annual earnings of $41,000. Under these assumptions, licensing resulted in 2.8 million fewer jobs with an annual cost to consumers of $203 billion.[12] Using the same approach and a newer and larger sample, we estimate the influence of licensing at the state and national level.

Using estimated licensing coefficients, we simulate the employment losses, deadweight losses, and misallocation of resources as a consequence of occupational licensing at the national level and for the 16 states where regulations were significant. These estimates are shown in Table 11.

In Table 12 we present three scenarios of potential annual costs of occupational regulations for the U.S. economy. The lower-bound results were calculated by using the effects of occupational licensing that were estimated based on the parameters generated from the Harris Survey data, and they are smaller than those found in the K&K study. We used the same approach for simulating the parameters of interest at the national level as the one that we used for states. The middle-level results were totals of the effects that were calculated for the 16 states where occupational regulations were statistically significant. Finally, the upper-bound simulations were calculated by using the Harris data, but with the average licensing effect parameter of 15 percent that was estimated in the K&K study.

The middle-level simulations from Table 12 show that the job losses due to occupational regulations are about 1.6 million jobs or approximately 1.3 percent of total nonfarm employment in 2013, and the lost output due to occupational regulation exceeds $13 billion or approximately

[12] Occupational licensing transfers income from consumers (who pay more in the form of higher prices) to licensed workers (who receive more income in the form of higher wages). In addition, evidence suggests that there can be a loss in overall output of about 0.1 percent of annual consumption expenditures that stems from the output that is lost as a consequence of occupational licensing (Kleiner, 2006).

1.5 percent of total household consumption in 2013. The latter simulations can be viewed as a lower bound for the potential economic effects of occupational licensing. We further estimate the Schmidt trapezoid (Schmidt, 2012), which takes into account the misallocation of both labor and capital due to the losses that these regulations create beyond the much smaller Harberger triangle. As expected, the simulated economic consequences of regulations are much larger. The calculated misallocation of economic resources due to occupational licensing is more than $170 billion. We consider the estimate of the misallocation of economic resources to be an accurate assessment of the effect that licensing regulations have on the U.S. economy.

Conclusions

This study provides new evidence on the influence of occupational regulations on the U.S. labor market. The estimates were developed based on a representative data set of individuals collected by the Harris Survey organization using questions from the PDII and CPS surveys.

We estimated the effect of licensing on hourly earnings and performed structural simulations of the potential losses to the economy in terms of employment, the losses in output, and the misallocation of resources. We found that occupational licensing increased wages on average by about 11 percent across the nation in 2013. Further, we found that in 16 states, licensing raised the earnings of regulated workers, and the return on licensing in these states ranged between 21 and 47 percent. Based on these results, we calculated the simulated employment losses (approximately 1.3 percent of total nonfarm employment in 2013), the deadweight losses (1.5 percent of total household consumption that same year), and the misallocation of economic resources (more than $170 billion in 2013). Occupational licensing continues to be an important issue for both jobs and resource allocation in the U.S. economy. We expect that the new government's effort to collect more comprehensive data will enhance our

knowledge about the role of these types of regulations in the labor market as well as the costs and benefits of this growing labor market institution.

References

Chamberlain, Gary. 1994. Quantile Regression, Censoring, and the Structure of Wages. In *Advances in Econometrics: Sixth World Congress*, Vol. 1, ed. Christopher A. Sims, 171–210. Cambridge: Cambridge University Press.

Council on Licensure, Enforcement, and Regulation (CLEAR). 2004. http://www.clearhq.org/mission.

Cox, Carolyn, and Susan Foster. 1990. The Costs and Benefits of Occupational Regulation. US Federal Trade Commission, Bureau of Economics. Available at https://www.ftc.gov/system/files/documents/reports/costs-benefits-occupational-regulation/cox_foster_-_occupational_licensing.pdf.

Freeman, Richard B. 1982. Union Wage Practices and Wage Dispersion within Establishments. *Industrial and Labor Relations Review* 36(1): 3–21.

Friedman, Milton. 1962. *Capitalism and Freedom*. Chicago: University of Chicago Press.

Friedman, Milton, and Simon Kuznets. 1945. *Income from Independent Professional Practice*. New York: National Bureau of Economic Research.

Gittleman, Maury, and Morris M. Kleiner. 2016. Wage Effects of Unionization and Occupational Licensing Coverage in the United States. *Industrial and Labor Relations Review,* 69(1): 142–172.

Gittleman, Maury, Mark A. Klee, and Morris M. Kleiner. 2015. *Analyzing the labor market outcomes of occupational licensing*. No. w20961. National Bureau of Economic Research.

Hammermesh, Daniel, 1993. *Labor Demand.* Princeton, New Jersey, Princeton, University Press.

Harberger, Arnold C. 1954. Monopoly and Resource Allocation. *American Economic Review Papers and Proceedings*, 44(2): 77–87.

Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. 2009. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd ed. New York: Springer Science + Business Media, LLC.

Kleiner, Morris M. 2006. *Licensing Occupations: Ensuring Quality or Restricting Competition?* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Kleiner, Morris M. 2011. Occupational Licensing: Protecting the Public Interest or Protectionism? Policy Paper No. 2011-009. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. http://dx.doi.org/10.17848/pol2015-009

Kleiner, Morris M., and Alan B. Krueger. 2010. The Prevalence and Effects of Occupational Licensing. *British Journal of Industrial Relations*, 48(4): 676–687.

Kleiner, Morris M., and Alan Krueger. 2013. Analyzing the Extent and Influence of Occupational Licensing on the Labor Market. *Journal of Labor Economics*, 31(2): S173–S202.

Kleiner, Morris M., Allison Marier, Kyoung Won Park, and Coady Wing. 2016. Relaxing Occupational Licensing Requirements: Analyzing Wages and Prices for a Medical Service. *Journal of Law and Economics*, May, forthcoming.

Neal, Derek A., and William R. Johnson. 1996. "The Role of Premarket Factors in Black-White Wage Differences." *Journal of Political Economy*, 104(5): 869-895.

Schmidt, James, A., Jr. 2012. New and Larger Costs of Monopoly and Tariffs. Economic Policy Paper 12-5, Federal Reserve Bank of Minneapolis.

Shapiro, Carl. 1986. Investment, Moral Hazard and Occupational Licensing. *Review of Economic Studies*, 53(5): 843–862.

Spence, Michael. 1973. Job Market Signaling. *Quarterly Journal of Economics*, 87(3): 355–374.

U.S. Department of the Treasury Office of Economic Policy, Council of Economic Advisers, and the Department of Labor. 2015. Occupational Licensing: A Framework for Policymakers. The White House, available at https://www.whitehouse.gov/sites/default/files/docs/licensing_report_final_nonembargo.pdf.

Wheeler, Donald. 2000. *Understanding Variation: The Key to Managing Chaos*, 2nd ed. Knoxville, TN: SPC Press.

Table 1. Regulated vs. Nonregulated Workers.

Variable	*%*	*S.D.*
Licensed Workers	21.68%	0.412
Certified Workers	6.75%	0.251
In Process of Obtaining License	0.39%	0.063
In Process of Obtaining Certificate	1.40%	0.118
Unionized Workers	11.38%	0.318
Nonregulated Workers	71.57%	0.451
Nonregulated Workers Who do not Plan to Become Regulated	69.78%	0.459

Table 2. State Values of Percentage Licensed, Percentage Certified, and Rank.

State	*Licensed†*	*Rank*	*Certified††*	*Rank*
Alabama	20.9%	29	6.9%	24
Alaska	25.5%	11	7.3%	20
Arizona	22.2%	22	8.7%	10
Arkansas	20.2%	36	5.3%	35
California	20.7%	30	6.1%	27
Colorado	17.2%	41	7.4%	18
Connecticut	24.6%	14	8.8%	9
Delaware	15.3%	45	3.5%	46
District of Columbia	19.7%	37	6.9%	25
Florida	28.7%	4	4.2%	39
Georgia	15.7%	44	5.9%	28
Hawaii	26.6%	6	11.3%	4
Idaho	22.8%	20	8.4%	12
Illinois	24.7%	13	5.0%	37
Indiana	14.9%	48	10.8%	5
Iowa	33.2%	1	5.1%	36
Kansas	14.9%	47	5.6%	31
Kentucky	27.8%	5	10.7%	6
Louisiana	22.3%	21	9.9%	8
Maine	20.7%	32	7.8%	15
Maryland	17.2%	40	4.8%	38
Massachusetts	21.3%	25	3.9%	42
Michigan	20.6%	34	3.3%	49
Minnesota	15.0%	46	3.4%	48
Mississippi	23.1%	18	7.2%	21
Missouri	21.3%	26	5.4%	33
Montana	21.3%	27	8.3%	14
Nebraska	24.6%	15	8.3%	13
Nevada	30.7%	2	5.4%	34
New Hampshire	14.7%	49	4.1%	41
New Jersey	20.7%	31	11.3%	3
New Mexico	25.9%	9	7.3%	19
New York	20.7%	33	5.5%	32
North Carolina	22.0%	23	8.4%	11
North Dakota	26.6%	7	2.6%	50
Ohio	18.1%	39	7.5%	17
Oklahoma	25.0%	12	7.2%	23
Oregon	26.1%	8	3.8%	43
Pennsylvania	20.2%	35	7.6%	16
Rhode Island	14.5%	50	11.8%	2
South Carolina	12.4%	51	3.5%	47
South Dakota	21.8%	24	5.6%	30
Tennessee	23.1%	19	4.2%	40
Texas	24.1%	16	3.7%	44
Utah	23.8%	17	5.9%	29
Vermont	16.8%	43	6.5%	26
Virginia	17.2%	42	3.7%	45
Washington	30.5%	3	7.2%	22
West Virginia	25.8%	10	12.3%	1
Wisconsin	18.4%	38	1.9%	51
Wyoming	21.2%	28	10.1%	7

† Average margin of error is 5.8% at 95% confidence.

†† Average margin of error is 3.4% at 95% confidence.

Table 3. States with Highest and Lowest Percentages of Licensed and Certified Workers.

Panel A.

Top 5		***Bottom 5***	
State	*Licensed*	*State*	*Licensed*
Iowa	33.25%	South Carolina	12.41%
Nevada	30.74%	Rhode Island	14.46%
Washington	30.51%	New Hampshire	14.71%
Florida	28.73%	Indiana	14.87%
Kentucky	27.77%	Kansas	14.91%

Panel B.

Top 5		***Bottom 5***	
State	*Certified*	*State*	*Certified*
West Virginia	12.26%	Wisconsin	1.93%
Rhode Island	11.85%	North Dakota	2.58%
New Jersey	11.34%	Michigan	3.26%
Hawaii	11.26%	Minnesota	3.44%
Indiana	10.79%	South Carolina	3.45%

Table 4. Characteristics of Licensed, Certified, and Nonregulated Workers.

	The Harris Data							*K & K Data*		
Variable	*Licensed*	*S.D.*	*Certified*	*S.D.*	*Not Regulated*	*S.D.*	*Observations*	*Licensed*	*Certified*	*Not Regulated*
Gender										
Male	23.9%	0.427	7.0%	0.254	69.1%	0.462	3946	28.4%	6.7%	64.6%
Female	19.4%	0.395	6.5%	0.247	74.1%	0.438	5904	28.7%	5.0%	66.0%
Education Level										
Less than HS	11.2%	0.317	10.5%	0.308	78.2%	0.414	134	14.5%	4.0%	81.6%
HS	14.9%	0.356	6.9%	0.254	78.2%	0.413	1097	19.9%	5.8%	74.0%
Some College	18.7%	0.390	6.7%	0.250	74.6%	0.435	3150	28.1%	5.9%	65.6%
College	20.4%	0.403	6.4%	0.244	73.2%	0.443	3351	29.2%	5.9%	64.6%
College +	41.3%	0.492	6.7%	0.249	52.1%	0.500	2118	44.1%	6.2%	49.5%
Earnings										
Average Yearly Earnings $	60,581	53524	47,710	44173	44,288	41387	9850	-	-	-
Average Hourly Earnings $	33.09	27.28	29.92	28.44	25.71	23.05	9850	-	-	-
Race										
White	21.8%	0.413	5.9%	0.236	72.3%	0.448	7782	29.5%	5.8%	64.5%
Hispanic	23.2%	0.423	10.7%	0.310	66.0%	0.474	548	29.2%	5.6%	65.2%
Black	19.4%	0.395	9.6%	0.294	71.1%	0.454	816	26.3%	7.0%	66.3%
Other	21.1%	0.409	7.1%	0.257	71.8%	0.450	704	23.0%	5.1%	70.9%
Age										
< =25	13.5%	0.342	7.4%	0.262	79.1%	0.407	1024	12.2%	2.7%	84.0%
26-54	22.4%	0.417	6.8%	0.251	70.8%	0.455	6475	30.0%	6.2%	63.6%
>55	23.4%	0.424	6.4%	0.244	70.2%	0.458	2351	28.8%	5.8%	65.1%
Union Status										
Union	45.3%	0.498	9.6%	0.294	45.1%	0.498	1103	44.7%	5.0%	49.9%
Non-Union	18.6%	0.389	6.4%	0.245	75.0%	0.433	8747	25.7%	6.0%	68.1%
Private or Public										
Private company	19.0%	0.392	6.2%	0.241	74.9%	0.434	7950	24.8%	5.9%	69.0%
Public company	34.2%	0.474	9.3%	0.291	56.5%	0.496	1900	44.2%	5.3%	50.3%
Type of Work										
Provide Services	22.8%	0.420	6.5%	0.247	70.7%	0.455	8775	31.2%	5.9%	62.7%
Make Things	19.2%	0.395	11.3%	0.317	69.5%	0.461	389	11.4%	5.1%	83.1%
Repair Things	11.1%	0.315	6.1%	0.240	82.7%	0.378	686	22.4%	7.2%	69.0%

Table 5. Requirements for Becoming Licensed.

Variable	*The Harris Data*				*K & K Data*	
	Licensed workers facing requirement		*Certified workers facing requirement*		*Licensed workers facing requirement*	
	%	*S.D.*	*%*	*S.D.*	*%*	*S.D.*
High School	75.05%	0.433	66.55%	0.472	31.20%	0.464
College	47.66%	0.500	28.54%	0.452	42.80%	0.495
Exam	88.94%	0.314	85.87%	0.349	85.00%	0.358
Performance Test	67.83%	0.467	61.11%	0.488	-	-
Continuing Ed	67.83%	0.467	52.93%	0.500	69.80%	0.459
Internship	46.54%	0.499	35.25%	0.478	33.60%	0.473
License/Certificate Renewal Test	34.52%	0.476	33.91%	0.474	-	-

Table 6. Estimates of the Impact of Licensing on Hourly Earnings (log).

	(1)		*(2)*		*(3)*		*(4)*	
Variables	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*
Constant	3.017***	0.018	-1.623***	0.497	-1.461***	0.307	-1.046***	0.304
Licensed	0.247***	0.024	0.089***	0.019	0.092***	0.019	0.098***	0.023
Female			-0.156***	0.014	-0.155***	0.014	-0.118***	0.015
Hispanic			0.070**	0.031	0.058*	0.034	0.050	0.034
Black			0.011	0.036	0.015	0.033	0.011	0.033
Other			0.024	0.023	0.027	0.026	0.025	0.025
Education			0.066***	0.006	0.065***	0.006	0.055***	0.006
Age			0.026***	0.009	0.026***	0.009	0.020**	0.009
Age^2			-0.0003***	0.000	-0.0004***	0.000	-0.0003***	0.000
Work Experience			0.017***	0.005	0.017***	0.005	0.015***	0.005
Work Experience^2			-0.0001	0.000	-0.0001	0.000	-0.0001	0.000
Union Member			0.115***	0.030	0.102***	0.029	0.180***	0.030
Work For Government			0.040	0.027	0.047*	0.026	0.047*	0.026
Self Employed			0.197***	0.038	0.196***	0.038	0.192***	0.038
Work For For-Profit			0.123***	0.017	0.120***	0.017	0.077***	0.017
Math Skills			0.112***	0.020	0.113***	0.019	0.064***	0.017
Reading Skills			0.211***	0.017	0.211***	0.017	0.156***	0.018
Children			0.030	0.020	0.031	0.020	0.035*	0.019
Divorced			-0.005	0.034	-0.005	0.034	-0.024	0.034
Married			0.082***	0.025	0.085***	0.025	0.057**	0.025
Log of Real GDP			0.253***	0.042	0.235***	0.020	0.244***	0.022
Occupation Fixed Effects	No		No		No		Yes	
State Fixed Effects	No		No		Yes		Yes	
R-squared	0.023		0.282		0.292		0.357	
Observations	9,850		9,850		9,850		9,827	

*** P-value < 0.01, ** P-value < 0.05, * P-value < 0.10;

Note. Robust standard errors clustered at the state level are reported.

Table 7. Estimates of the Impact of Licensing and Certification on Hourly Earnings (log).

	(1)		*(2)*		*(3)*		*(4)*	
Variables	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*	*Coefficients*	*S.E.*
Constant	3.006***	0.017	-1.645***	0.500	-1.401***	0.315	-1.008***	0.307
Licensed	0.258***	0.024	0.098***	0.020	0.102***	0.019	0.112***	0.023
Certified	0.123***	0.034	0.086**	0.033	0.087**	0.032	0.092***	0.031
Female			-0.155***	0.014	-0.155***	0.014	-0.117***	0.015
Hispanic			0.066**	0.030	0.053	0.033	0.046	0.033
Black			0.008	0.036	0.011	0.034	0.008	0.033
Other			0.023	0.023	0.027	0.025	0.025	0.024
Education			0.066***	0.006	0.065***	0.005	0.054***	0.006
Age			0.026***	0.009	0.026***	0.009	0.020**	0.009
Age^2			-0.0004***	0.000	-0.0004***	0.000	-0.0003***	0.000
Work Experience			0.017***	0.005	0.017***	0.005	0.015***	0.005
Work Experience^2			-0.0001	0.000	-0.0001	0.000	-0.0001	0.000
Union Member			0.111***	0.029	0.098***	0.028	0.176***	0.030
Work For Government			0.038	0.027	0.045	0.027	0.043	0.026
Self Employed			0.192***	0.039	0.191***	0.039	0.187***	0.039
Work For For-Profit			0.123***	0.017	0.121***	0.017	0.077***	0.017
Math Skills			0.110***	0.020	0.112***	0.019	0.062***	0.017
Reading Skills			0.209***	0.017	0.210***	0.017	0.154***	0.018
Children			0.029	0.020	0.029	0.020	0.034*	0.019
Divorced			-0.006	0.034	-0.005	0.034	-0.024	0.034
Married			0.081***	0.025	0.084***	0.025	0.056**	0.024
Log of Real GDP			0.254***	0.042	0.229***	0.020	0.240***	0.022
Occupation Fixed Effects	No		No		No		Yes	
State Fixed Effects	No		No		Yes		Yes	
R-squared	0.026		0.283		0.293		0.358	
Observations	9,850		9,850		9,850		9,827	

*** P-value < 0.01, ** P-value < 0.05, * P-value < 0.10;

Note. Robust standard errors clustered at the state level are reported.

Table 8A. Estimates of the Impact of Licensing on Earnings (log) by Quantile.

Variables	*OLS*	*Q_20*	*Q_30*	*Q_40*	*Q_50*	*Q_60*	*Q_70*	*Q_80*	*Q_90*
Constant	-1.328**	-1.484***	-1.633***	-1.752***	-1.965***	-1.866***	-1.599	-1.160	-0.231
Licensed	0.092***	0.036**	0.051***	0.055***	0.069***	0.080***	0.104***	0.157***	0.235***
Female	-0.155***	-0.132***	-0.126***	-0.139***	-0.161***	-0.178***	-0.186***	-0.175***	-0.183***
Hispanic	0.058	-0.016	0.002	0.003	0.038*	0.040	0.109***	0.118***	0.096***
Black	0.015	-0.002	-0.016	-0.005	0.006	-0.025	-0.002	0.042	0.080***
Other	0.027	-0.023	-0.002	0.043**	0.019	0.004	0.022	0.067**	0.126***
Education	0.065***	0.066***	0.069***	0.071***	0.077***	0.078***	0.079	0.080	0.062
Age	0.026***	0.010*	0.012**	0.013***	0.021***	0.019***	0.031	0.032	0.057
Age^2	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.001***
Work Experience	0.017***	0.027***	0.029***	0.031***	0.026***	0.026***	0.019	0.018	-0.004
Work Experience^2	-0.0001	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001**	-0.0001	-0.0001***	0.0001
Union Member	0.102***	0.108***	0.071***	0.079***	0.060***	0.072***	0.072***	0.127***	0.129***
Work for Government	0.047**	0.063***	0.061***	0.056***	0.033*	0.057**	0.045***	0.030	-0.016
Self Employed	0.196***	0.004	0.075***	0.101***	0.194***	0.265***	0.287***	0.366***	0.528***
Work in For-Profit	0.120***	0.071***	0.078***	0.090***	0.092***	0.130***	0.151	0.171***	0.180
Math Skills	0.113***	0.105***	0.120***	0.129***	0.144***	0.142***	0.127	0.144***	0.067
Reading Skills	0.211***	0.187***	0.197***	0.214***	0.201***	0.214***	0.226***	0.197	0.183***
Children	0.031*	0.032**	0.044***	0.033**	0.019	0.019	0.034	0.025**	-0.003
Divorced	-0.005	0.005	-0.003	0.011	0.045**	0.043*	0.025	-0.004	-0.068
Married	0.085***	0.111***	0.117***	0.124***	0.138***	0.120***	0.103	0.057	-0.001
Log of Real GDP	0.223***	0.230***	0.247***	0.255***	0.266***	0.267***	0.231	0.201	0.141
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared / Pseudo R-squared	0.292	0.205	0.221	0.223	0.220	0.210	0.196	0.171	0.142

*** P-value < 0.01, ** P-value < 0.05, * P-value < 0.10;

Table 8B. Estimates of the Impact of Licensing on Earnings (log) by Quantile.

Variables	*OLS*	*Q_20*	*Q_30*	*Q_40*	*Q_50*	*Q_60*	*Q_70*	*Q_80*
Constant	-0.447	-1.11	-0.546	-1.796	-3.316**	0.559	0.203	-1.067
Licensed	0.098***	0.079***	0.096***	0.090***	0.088***	0.084***	0.076***	0.095***
Female	-0.118***	-0.081***	-0.075***	-0.106***	-0.115***	-0.120***	-0.135***	-0.147***
Hispanic	0.050	0.012	0.001	0.010	0.001	0.035**	0.049***	0.108***
Black	0.011	-0.016	-0.036***	-0.036**	-0.015	-0.033	0.009	0.047***
Other	0.025	-0.012	-0.011	-0.016	-0.016	0.034	0.048*	0.077***
Education	0.055***	0.054	0.056***	0.059***	0.062***	0.069***	0.071***	0.065***
Age	0.020***	0.013	0.011***	0.016***	0.017***	0.021***	0.021***	0.025***
Age^2	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
Work Experience	0.015***	0.021	0.023***	0.022***	0.022***	0.019***	0.019***	0.014***
Work Experience^2	-0.0001	-0.0001***	-0.0001***	-0.0001**	-0.0001**	-0.0001	-0.0001**	-0.0001
Union Member	0.180***	0.166***	0.163***	0.162***	0.183***	0.150***	0.151***	0.166***
Work for Government	0.047**	0.043***	0.040***	0.033**	0.032**	0.022	0.031**	0.048***
Self Employed	0.192***	-0.02	0.044	0.105***	0.165***	0.233***	0.290***	0.322***
Work in For-Profit	0.077***	0.012	0.037***	0.037***	0.051***	0.069***	0.091***	0.108***
Math Skills	0.064***	0.055	0.058***	0.057***	0.081***	0.074***	0.083***	0.085***
Reading Skills	0.156***	0.136***	0.139***	0.142***	0.136***	0.135***	0.145***	0.168***
Children	0.035**	0.027***	0.013	0.016*	0.023**	0.033***	0.029***	0.039***
Divorced	-0.024	-0.023	0.003	0.02	0.014	0.02	-0.018	-0.029
Married	0.057***	0.069***	0.092***	0.095***	0.085***	0.086***	0.059***	0.025**
Log of Real GDP	0.187***	0.231	0.187***	0.307***	0.451***	0.079	0.117	0.249
Occupation Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared / Pseudo R-squared	0.357	0.263	0.275	0.276	0.270	0.256	0.237	0.209

*** P-value < 0.01, ** P-value < 0.05, * P-value < 0.10;

Table 9. State-Level Estimates of the Impact of Licensing on Hourly Earnings (log).

State	*Licensing Coefficient†*	*S.E.*	*R-squared*	*Observations*
Alabama	-0.105	0.129	0.339	173
Alaska	0.044	0.118	0.374	208
Arizona	0.039	0.109	0.299	186
Arkansas	0.226	0.221	0.185	157
California	0.152	0.196	0.298	197
Colorado	0.016	0.147	0.366	167
Connecticut	0.284***	0.097	0.394	216
Delaware	0.248	0.161	0.277	180
District of Columbia	0.195	0.121	0.360	222
Florida	0.304*	0.179	0.319	187
Georgia	0.258*	0.149	0.293	171
Hawaii	0.208*	0.109	0.269	188
Idaho	0.100	0.110	0.255	189
Illinois	0.293**	0.126	0.377	206
Indiana	0.035	0.129	0.288	198
Iowa	0.355**	0.142	0.013	211
Kansas	0.233*	0.140	0.316	206
Kentucky	-0.055	0.137	0.255	210
Louisiana	-0.036	0.116	0.439	186
Maine	0.387***	0.140	0.332	181
Maryland	-0.043	0.148	0.387	205
Massachusetts	0.056	0.134	0.335	212
Michigan	0.264*	0.140	0.335	191
Minnesota	-0.002	0.174	0.328	187
Mississippi	0.161	0.134	0.413	177
Missouri	0.196*	0.117	0.243	186
Montana	0.301**	0.117	0.290	200
Nebraska	0.102	0.160	0.244	201
Nevada	0.314***	0.112	0.315	178
New Hampshire	0.115	0.111	0.321	209
New Jersey	0.103	0.099	0.339	198
New Mexico	-0.025	0.105	0.328	181
New York	-0.155	0.134	0.248	216
North Carolina	-0.080	0.139	0.388	166
North Dakota	0.111	0.098	0.137	213
Ohio	-0.030	0.110	0.418	207
Oklahoma	-0.047	0.102	0.248	211
Oregon	0.152	0.141	0.329	202
Pennsylvania	0.310***	0.114	0.338	211

Rhode Island	0.028	0.103	0.163	203
South Carolina	0.176	0.175	0.366	194
South Dakota	0.025	0.123	0.186	190
Tennessee	0.239*	0.138	0.238	146
Texas	-0.059	0.120	0.359	168
Utah	-0.026	0.115	0.273	209
Vermont	0.140	0.107	0.278	191
Virginia	-0.187	0.166	0.378	195
Washington	-0.020	0.120	0.387	154
West Virginia	0.232*	0.124	0.321	205
Wisconsin	0.334**	0.133	0.368	198
Wyoming	-0.035	0.095	0.263	207

*** P-value < 0.01, ** P-value < 0.05, * P-value < 0.10;

Note. Robust standard errors are reported.

† Only coefficients of Licensed variable are reported for each state. Individual- level control variables (not reported) such as Female, Hispanic, Black, Other, Education, Age, Age^2, Work Experience, Work Experience^2, Union Member, Work For Government, Self Employed, Work For For-Profit are included in every regression.

Table 10. Effect of Licensing Regulations at Different Levels of State-Level GDP per Capita.

GDP per Capita Range	*GDP per Capita in 2012$*	*State*	*Return on Licensing %*	*Average Hourly Return %*	*Return on Licensing $*	*Average Hourly Return $*
$35K - $40K	$35,725	West Virginia	26.11		$6.12	
	$39,035	Montana	35.12	30.62	$7.50	$6.81
$40K - $45K	$40,672	Maine	47.26		$9.58	
	$40,913	Florida	35.53		$8.92	
	$41,496	Michigan	30.21		$7.97	
	$43,280	Missouri	21.65		$4.65	
	$43,796	Tennessee	27.00		$6.19	
	$44,322	Georgia	29.43	31.85	$7.00	$7.39
$45K - $50K	$46,210	Wisconsin	39.65		$9.06	
	$47,098	Pennsylvania	36.34		$9.03	
	$48,234	Nevada	36.89		$9.53	
	$48,282	Kansas	26.24		$6.50	
	$49,636	Iowa	42.62	36.35	$10.05	$8.83
$50K - $55K	$52,246	Hawaii	23.12		$6.21	
	$54,255	Illinois	34.04	28.58	$8.66	$7.43
$60K - $65K	$64,570	Connecticut	32.84	32.84	$9.88	$9.88

Because the dependent variables were in logs we make the appropriate adjustments in the table to show the magnitude of the economic impact of the dummy variables: $100*(\exp(\beta)-1)$.

Table 11. Employment Losses, Deadweight Losses, and Misallocation of Resources Due to Occupational Licensing.

State	*Adjusted Licensing Coefficient*	*Total Workers Employed*	*Average Annual Earnings of Licensed Workers*	*Number of Licensed Workers*	*Loss in Jobs due to Licensing*	*Deadweight Loss (In $M)*	*Misallocation of Resources (In $M)*
United States	9.64	133,739,000	$60,581	29,021,363	1,398,319	$3,723	$158,255
Connecticut	32.84	1,639,000	$74,619	403,960	66,337	$612	$8,064
Florida	35.53	7,400,100	$54,840	2,125,833	377,621	$2,714	$33,275
Georgia	29.43	3,952,800	$57,655	620,887	91,376	$599	$8,739
Hawaii	23.12	605,300	$74,952	161,234	18,640	$131	$2,401
Illinois	34.04	5,744,400	$67,368	1,418,308	241,426	$2,065	$26,333
Iowa	42.62	1,508,400	$79,948	501,486	106,862	$1,276	$13,257
Kansas	26.24	1,357,800	$64,545	202,415	26,555	$178	$2,894
Maine	47.26	597,600	$58,877	123,610	29,206	$276	$2,611
Michigan	30.21	4,024,200	$50,054	830,639	125,480	$729	$10,375
Missouri	21.65	2,669,400	$90,071	568,765	61,576	$494	$9,612
Montana	35.12	440,500	$59,121	93,786	16,469	$127	$1,568
Nevada	36.89	1,142,700	$73,913	351,267	64,789	$645	$7,642
Pennsylvania	36.34	5,729,700	$70,676	1,157,784	210,384	$1,982	$23,793
Tennessee	27.00	2,714,300	$56,712	626,333	84,548	$510	$8,061
West Virginia	26.11	765,300	$46,950	197,739	25,817	$125	$2,048
Wisconsin	39.65	2,784,600	$59,235	511,778	101,471	$853	$9,461
Total:				9,895,824	1,648,558	$13,317	$170,134

Table 12. Three Scenarios of Potential Annual Costs of Occupational Regulations for the United States.

State	*Loss in Jobs due to Licensing*	*Deadweight Loss (In $M)*	*Misallocation of Resources (In $M)*
Estimates with Licensing Coefficient at 9.75%	1,398,319	$3,723	$158,255
Sum of State Level Estimates	1,648,558	$13,317	$170,134
Upper Bound Estimates	2,176,602	$8,600	$237,923

Figure 1. Licensed, Certified, and Nonregulated Workers.

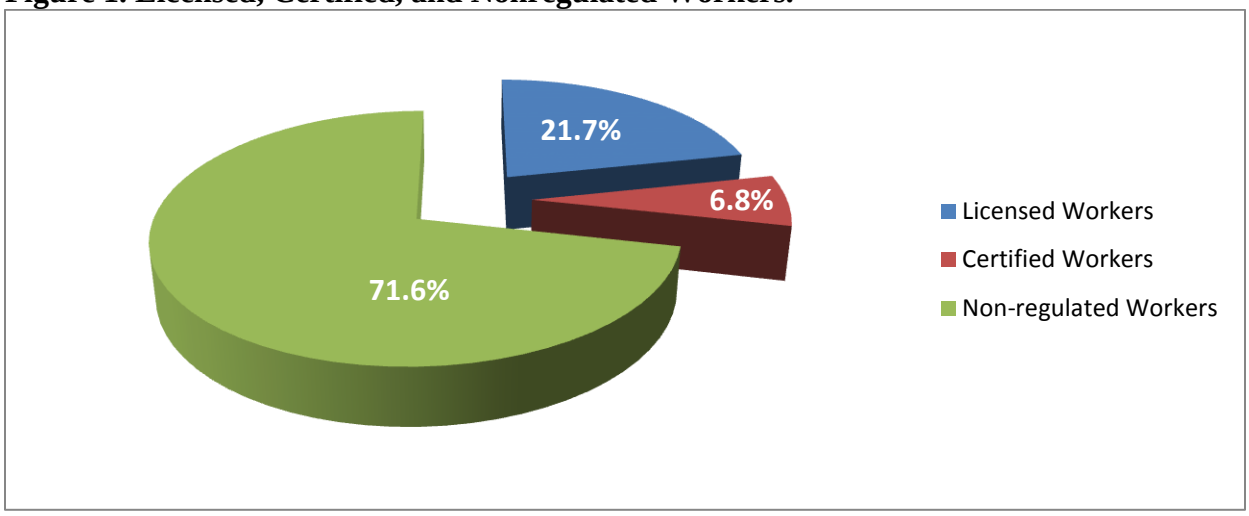


Figure 2. Licensed, Certified, In Process of Obtaining License, In Process of Obtaining Certificate, and Nonregulated Workers Who do not Plan to Become Regulated.

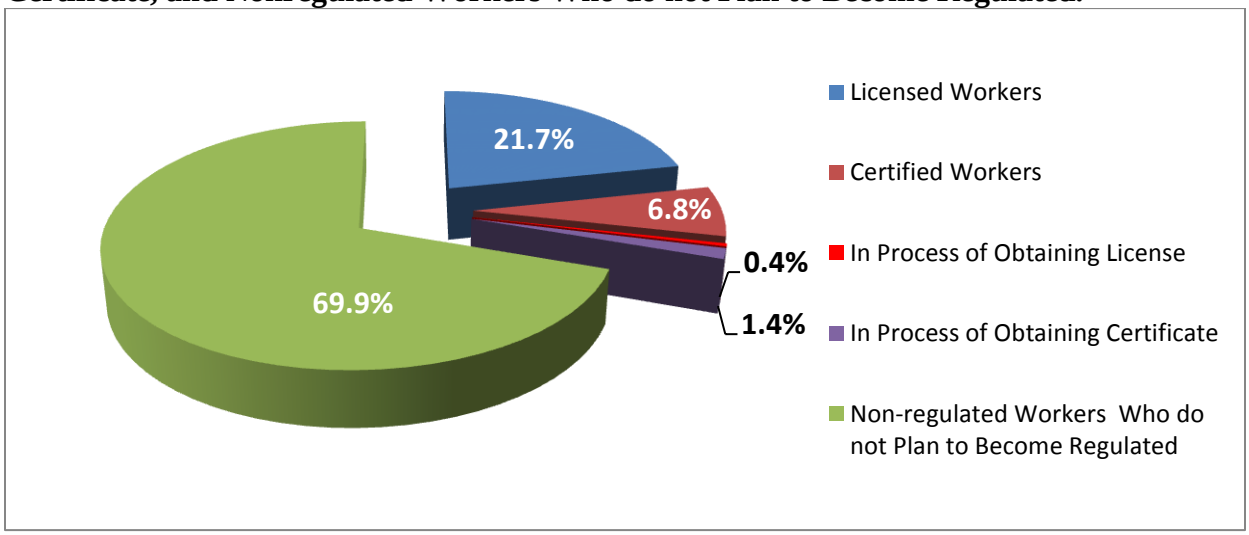


Figure 3. Control Chart for Percentage of Workforce Licensed by State.

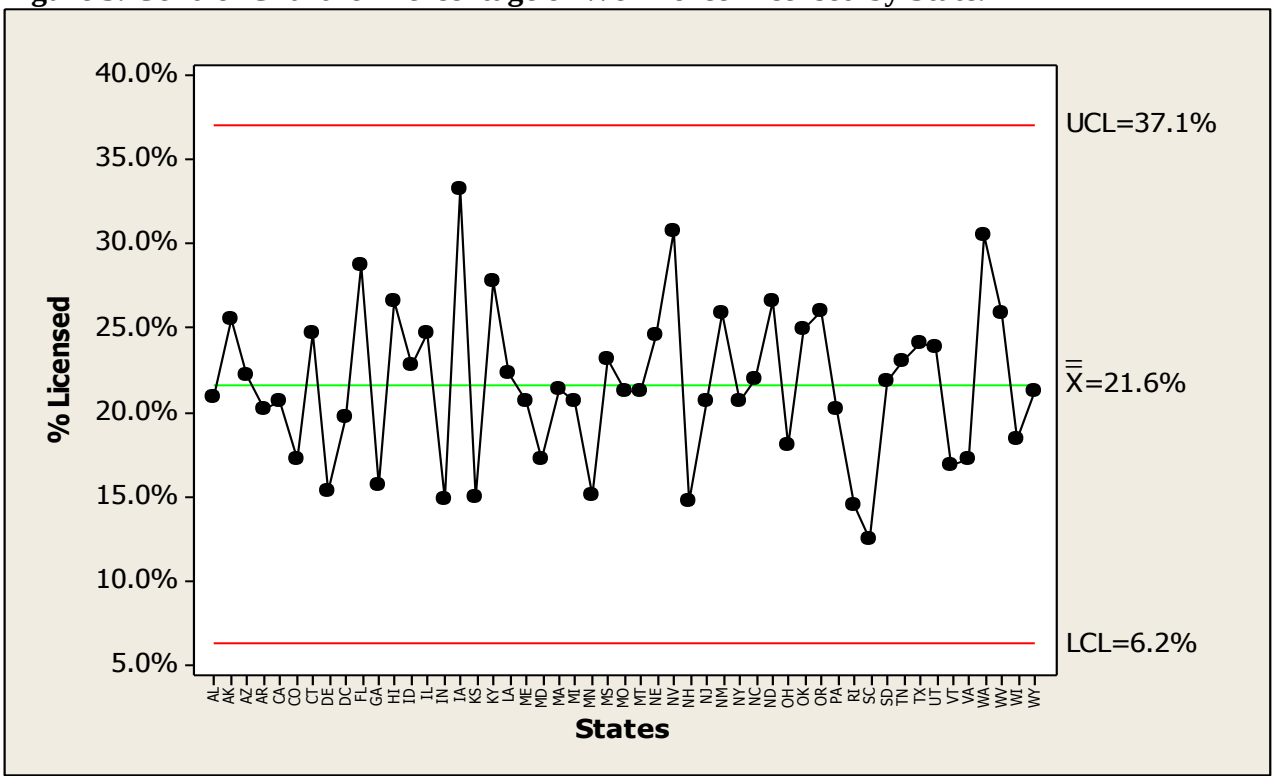


Figure 4. Control Chart for Percentage of Workforce Certified by State.

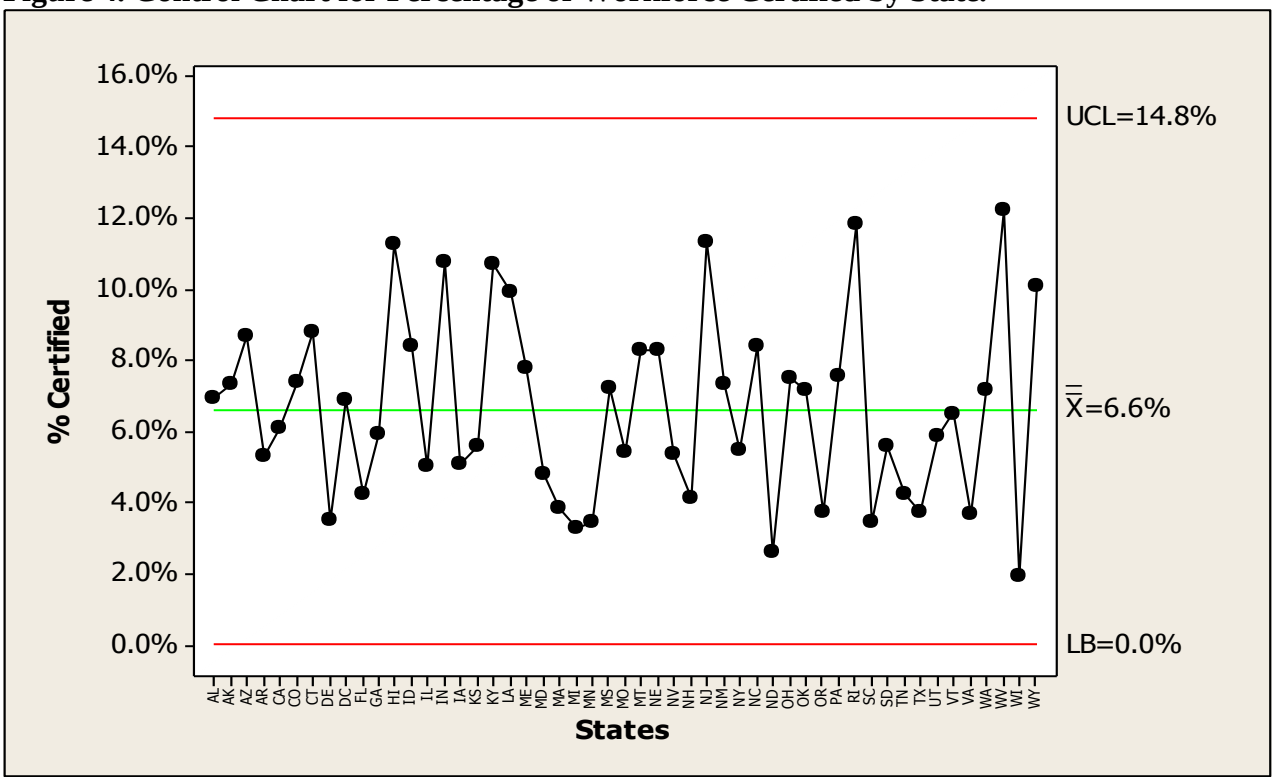


Figure 5. Percentage of Workforce Licensed by State.

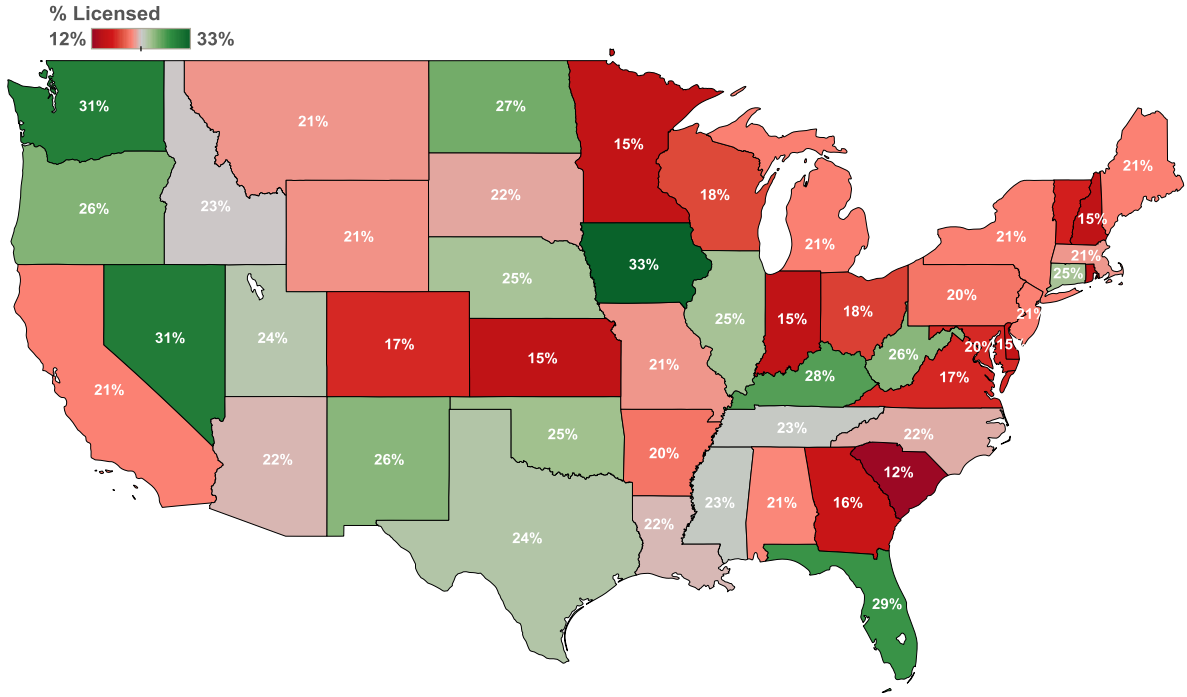
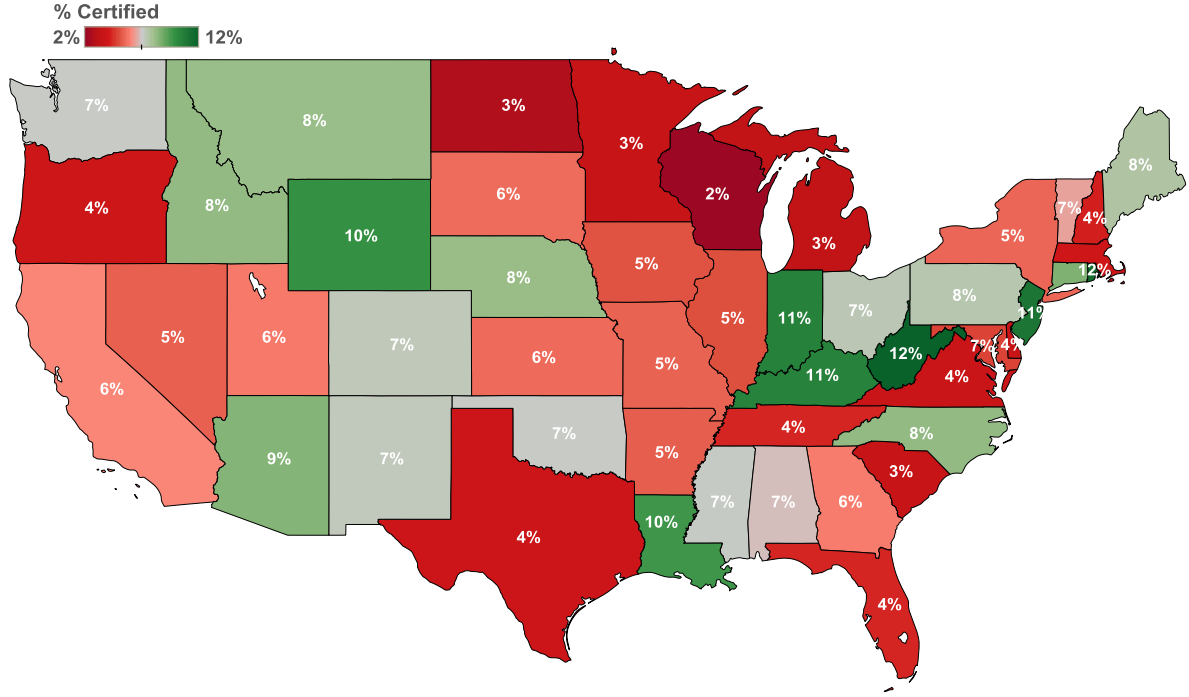


Figure 6. Percentage of Workforce Certified by State.



Appendix

Table: Occupational Distribution in the Harris Survey

SOC	%
Management	7.8%
Business and Financial Operations	11.8%
Computer and Mathematical	5.4%
Architecture and Engineering	2.4%
Life, Physical, and Social Science	2.6%
Community and Social Services	2.7%
Legal	2.0%
Education, Training, and Library	11.0%
Arts, Design, Entertainment, Sports, and Media	3.3%
Healthcare Practitioners and Technical	5.3%
Healthcare Support	2.3%
Protective Service	1.6%
Food Preparation and Serving Related	2.8%
Building and Grounds Cleaning and Maintenance	1.7%
Personal Care and Service	2.1%
Sales and Related	9.1%
Office and Administrative Support	17.0%
Farming, Fishing, and Forestry	0.5%
Construction and Extraction	1.5%
Installation, Maintenance, and Repair	1.7%
Production	3.0%
Transportation and Material Moving	2.2%
Military Specific	0.3%
Total:	100.0%