Occupational Licensing and Labor Market Outcomes across Different Skill Sets

April 18, 2019

Jacob Sherman[±]

Abstract: This paper examines the role of occupational licensing on labor market outcomes across different skill sets. I use occupational educational requirements and brain skill levels to divide occupations into low, middle, and high skill sets. I then estimate an occupational-level Mincerian wage equation for each sample and find that occupational licensing impacts low and high skill samples differently. I find that median earnings are positive for lower level jobs, negative for higher level jobs, and this effect is larger in magnitude for women. My results imply that licensing serves as an entry barrier only for low-skill level occupations.

Keywords: labor markets; earnings; licensing; occupation

JEL Classifications: J24, J31, J44, L51

[±] Corresponding author. Jacob Sherman, Department of Economics, California State University, Long Beach, CA 90803 USA. jacob.sherman@student.csulb.edu

1. Introduction

The effects of occupational licensing on labor market outcomes has risen in importance during the past 20 years. Occupational licensing is a form of a government regulation that attempts to correct any adverse market externalities for a labor industry; however, the associated cost produces an entry barrier that restricts workers from entering or pursuing a specific profession for compensation unless the individual obtains an occupational license. Furthermore, licensing can be viewed as a mechanism to control for quality in high skill jobs and protect public safety, such as a surgeon requiring a license to perform surgeries, or to restrict quantity for low skill jobs, such as requiring a barber or cosmetologist from entering an occupation unless a license is acquired. Regardless of the justifications, a deadweight loss is created in the labor market, where society loses out on economic activity due to a government regulation that does not allow the market to clear efficiently and distorts market outcomes. Ambiguous effects from this government regulation are prevalent in the labor market and researchers have focused on individual characteristics, industry dynamics, government influence, and a variety of other factors to determine the true extent of occupational licensing.

The social cost of an occupational license results in higher prices for consumers opposed to prices that would be present in a free market without this government regulation and forgone earnings for potential workers that are excluded from the market. In addition, incumbents in occupations allocate resources to convince policy makers to maintain licensing or certification, which is rent-seeking. Due to professions in occupations that require a license are small in number compared to the large number of consumers and potential competitors who do not have a license, rent-seeking activities can add to the deadweight loss in the labor market. Even though licensing can protect the public from low quality services or unsafe practices, rent-seeking can drown out

this effect by taking higher prices from consumers than what the free market would determine. Moreover, disadvantaged and minority groups can benefit from occupational licensing which can lower the social cost of the gender wage gap as well as perceptual discrimination; however, results have an equivocal nature due to personal or industry characteristics. Occupational licensing and certification have social benefits and costs, as empirical results have shown double meanings and the results come down to specific occupations as well as the influence this government regulation has on labor market outcomes for those jobs.

This paper seeks to expand the literature on occupational licensing by analyzing the impact of occupational brain skills on wages using an occupational level licensing variable. I first analyze the effects of occupational licensing across a broad range of occupations and find no significant effect on median earnings. I then break my sample into high skill and low skill occupations using educational requirements and brain skill levels. I find that for low skill occupations, licensing increases median earnings and acts as an entry barrier. However, unlike past studies, I find that licensing decreases median earnings for high skill occupations with a smaller effect in magnitude on women.

2. Literature Review

Previous research has analyzed the differences in labor market outcomes between licensed and non-licensed professions. The findings suggest positive and negative influences for wages in a variety of occupations, as human capital factors, educational attainment, and job training influence these outcomes (Kleiner 2000). Data on occupational licensing is quite limited, as researchers use data from surveys conducted independently, from the Bureau of Labor and Statistics (BLS), the Census Bureau—Consumer Population Survey (CPS), American Community Survey (ACS),

Consumer Expenditure Survey (CES)—and several other data sources in order to draw inferences on the true scope of licensing jobs and the effects in the labor market.

Occupational licensing and the associated labor market outcomes have ambiguous results, as the influences on a general demographic or minority groups is largely driven by education and personal characteristics that can influence wages and employment. However, state regulations can also distort the market equilibrium for a good or service which can adversely affect the demand for that good or service, which can lead to reductions in labor market employment. Jackson and Ekelund (2002) analyze the effects of job licensing on prices and quantity for the cosmetology industry using OLS and IV estimations. The author's results highlight that occupational licensing increases the cost of cosmological services by 14 percent which can lead to lower levels of employment for cosmologist and also produces a deadweight loss of roughly $111 million. Even though the deadweight loss is quite significant due to occupational licensing, researchers do highlight that licensing protects against moral hazard issues, where consumers have an abundant amount of choices and are not limited to only low cost and low-quality solutions. The conclusions for the influences of occupational licensing are positive and negative, as other factors play a larger role in order to empirically judge the true role this regulation plays on wages and labor employment. Furthermore, Occupational licensing is an expansive government regulation and is prevalent throughout a variety of occupations. Due to the requirements of obtaining a license or certificate to perform a job and receive pay can change on an individual's location or industry and does not necessarily depend on whether the occupation is low skill or high skill.

2.1 **Education**

Empirical models on a general population demographic give evidence that educational attainment impacts wages and labor supply for occupational licensing, as researchers focus on this

link. Kleiner (2000) performs an Oaxaca decomposition between regulated and non-regulated occupations in order to draw inferences on the role of licensing for the labor market between regulated and non-regulated industries. Findings suggest that licensing has a significant, negative effect on wages and labor supply for occupations with less education and training; while on the other hand, having a significant, positive effect on occupations that require more education and training. In a follow up study, Kleiner (2013) finds that occupational licensing is associated with an 18 percent higher wage. Licensing for occupations with a higher education requirement have a greater impact on wages and employment than occupations with lower education outcomes, as these studies and several others confirm this link.

2.2. Disadvantaged Groups

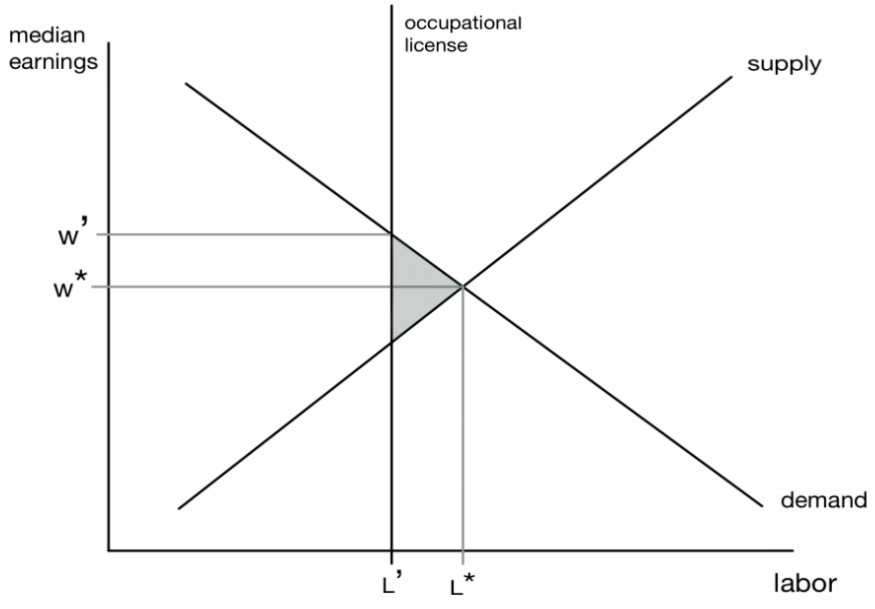
An abundance of research for occupational licensing's impact on labor market outcomes focuses on a general demographic; however, Law and Marks (2009) analyze the influences of this government regulation on minority workers. The authors use a difference-in-difference estimation method and explore the influences of the probability of an individual working in a particular occupation. Findings suggest that the influence of licensing on minority individuals has a significant, negative effect on jobs with less education, but a significant, positive impact on minority individuals working in an occupation with higher education requirements. Individuals or disadvantaged groups of people working in occupations that require a license can have effects on labor market outcomes, as education and a variety of other factors play a role in regards to licensing affecting these outcomes. Moreover, Redbird (2017) examines the economic and structural effects of occupational licensing and argues how licensing creates institutional mechanisms to enhance entry for an occupation, especially for disadvantaged groups. The findings from a fixed effects regression suggest that the proportion of occupational licensing is positive and significant. As a

result, licensing produces a positive effect on wages, with an even higher rate for disadvantaged groups that have a higher education level. Empirical evidence demonstrates that there is no evidence that occupational licensing explicitly harms competition or increases wages on these groups of workers for specific occupations. Additional factors, such as age and experience, as well as unobservable human capital factors, such as ability, play a larger role on the impact of labor market outcomes.

3. Theoretical Model

Occupational licensing can restrict the supply of labor into a particular job and increases the prices of the service to consumers, with the addition of creating a deadweight loss where society loses as a whole. For this outcome to occur, licensed occupations can use policy actions administrated by the government to direct entrance into an occupation and incumbent members

Figure 1



of the occupation receive a gain from less time pursuing the profession or financially due to being grandfathered in. This in turn will allow new members in the occupation the ability to obtain a

license with more difficulty and can further restrict the supply of labor to earn more money due to this barrier of entry. In addition, licensing restricts entry into occupations and can force individuals into a non-licensed profession, which will shift the supply curve outwards and lower wages for nonregulated occupations. As a result of this government regulation, licensing lessens the flow of new workers entering into an occupation and prices of services increase. For example, only competent professionals can obtain a license, therefore, the services for the goods are theoretically better. Due to this outcome, the prices of the service might increase towards consumers as members in the profession will justify charging higher prices because of obtaining a license. Quality of the service is often thought of being better due to this government regulation; however, empirical estimations on quality are difficult to measure as a result of many factors influencing these outcomes. Occupational licensing produces equivocal results where either the market supply of the labor force is restricted for individuals seeking entry into a profession and the labor market is distorted or quality is potentially enhanced, where consumers can benefit as a result.

4. Empirical Methodology

4.1 Main Specification

I estimate an occupation-level Mincerian wage equation to study the impact of occupational licensing on earnings:

$$(1)\ \ln(earnings_o) = \beta_0 + \beta_1\, license_o + \beta_2\, education_o + \beta_3\, age_o + \beta_4\, age^2_o + \varepsilon_o$$

where *o* indexes the occupation. The basic Mincerian equation specifies that *earnings* depend positively on years of *education* and *age* and negatively on age^2. The variable of interest, *license*, is a measure of the percentage of persons in the Westat Labor Force Survey that needs a license or certificate issued by the government to perform their job in order to receive compensation. The last term ε_o represents the margin of error within the statistical model and can

provide justification for the differences between the empirical estimates of the model and the actual real-world observed units due to other factors influencing *earnings*.

4.2 Education Requirements

Education requirements for an occupation are indicators previous literature widely uses in order to determine if occupational licensing can benefit or hurt a person working in a specific occupation and the individuals associated earnings. Empirical evidence demonstrates that licensing results in higher earnings for occupations with more education and produces a smaller effect for occupations with low education requirements (Kleiner 2000). To test this finding, I split the sample into low-education-requirement jobs, such as Maintenance Workers; medium-education-requirement jobs, like Animal Trainers; and high-education-requirement jobs, such as Physicians Assistants. Additionally, low skill and high skill occupations will have two additional specifications each: very low skill jobs, like Crossing Guards and very high skill jobs, such as Veterinarians. In my analysis, low skill occupations require an education of explicitly equal to twelve years of schooling or lower and very low skill jobs require an education specifically less than twelve years of schooling or lower. Furthermore, high skill jobs require an education of explicitly equal to 16 years of schooling or higher and very high skill jobs require an education of specifically more than 16 years of schooling or higher. Occupations are separated by education requirements in order to infer the true extent of licensing for jobs that have different education levels and the associated earnings for each detailed occupation.

4.3 Occupational Brain Skill Levels

Occupational licensing's influence on wages across brain skill occupational levels have not been examined previously. In this analysis, I use the O*NET database to determine different levels of brain skill occupations. I will restrict the sample where average brain skill occupational

levels are paired with human capital and licensing data to determine if licensing has positive or negative effects on occupations with low, medium, and high brain skill occupational levels, ranging from measures of 26.08 through 62.29. The mean of average brain skill occupational levels is 46.198, with a standard deviation of 8.67, as I split high and low ratings by one standard deviation of the mean; whereas, medium level features data between one standard deviation of the mean. Low average brain skill occupational levels range from 26.08 through 37 and have occupations such as barbers, telemarketers, and postal service clerks. Occupational levels for medium average brain skills range from 37 through 54 and some of these jobs include web developers, pest control workers, and head chefs. For high average brain skill job levels, values range from 54 through 62.29 and have occupations such as pharmacists, biological scientists, and emergency medical directors. Occupational brain skill levels will allow analysis of licensing's impact on *earnings* to be extended, as this measure provides an alternative lens to judge the influence of this government regulation.

4.4 Gender Specification

Previous literature analyzes the influence of occupational licensing and the effects on labor market outcomes across disadvantaged groups, such as minority groups and gender differences. The disadvantaged group I will be exploring in this model is the women population, as I will split the sample between males and females to infer if occupational licensing produces positive or negative effects on gender. Moreover, splitting the sample by gender will add to analysis opposed to looking at the entire sample population in order to judge the true effect for occupational licensing on earnings. I will use education requirements and occupational brain skill levels as my specifications and gauge what differences gender applies on median earnings. Empirical estimates produce results that give evidence that disadvantaged groups have no effect

from licensing for lower level jobs, but can even benefit for higher level jobs; however, studies have also produced results that females earn less than males when performing identical jobs. In addition, higher occupational brain skill levels have a 62.9 percent correlation with educational requirements, as I predict similar results will occur with this specification. I will verify if this evidence is valid for the average worker in an occupation needing a license or if a license produces larger or smaller earnings for the female sample using an alternative data set.

5. Data

The data set is national occupational-level data in 2010 and each variable is the average (or median) value for each occupation. The dependent variable *earnings* is median earnings drawn from U.S. Census Bureau's American Community Survey (ACS) in 2000. The independent variables *age* and *education* are average reported age and years of schooling from 2006-2010 five-year estimates. *F*or the licensing treatment variable, I use an unweighted average of individual responses of every occupation in the West Labor Force Survey (2008) to create an aggregate measure of occupational level licensing. This method is ideal for the data collection in this paper due to a systemic collection of comprehensive licensing data not readily being available at the state level for larger sample sizes of detailed occupations because only a limited amount of occupations are available. A representative national survey asking individuals if their current occupation requires a license or certificate is the best alternative. Nevertheless, limitations do exist as a result of occupations not being randomly distributed across states, as certain occupations are restricted at the state level, such as tech jobs in California or finance jobs in New York.

The aggregate measure for the first specification of occupational licensing is education requirements for a job, where individuals report their highest levels of education in the Westat

Labor Force Survey (2008) and the sample is split between low, medium, and high education jobs. Due to the survey being individual level, the averages for detailed occupations of each individual's highest level of education are calculated to produce an aggregate measure. This value determines the education requirements for each occupation and how the sample is split between low, medium, and high education occupations. Furthermore, low education jobs are education levels of a high school diploma or GED and below; whereas, high education jobs are education levels of a bachelor's degree and above. Medium education are occupations that fall in between low and high education jobs, such as an associates or technical degrees. Some of these occupations for all education levels include legal assistants, teaching assistants, detectives, retail salespersons, and tractor operators.

Figure 2: Licensing vs. Education Requirements by Occupation

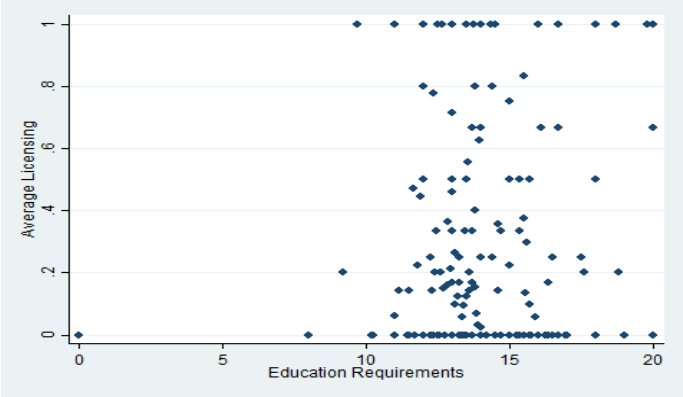


Figure 2 plots average licensing and education requirements for each occupation, where various occupations are spread out between low and high education requirements. Regardless of occupational licensing or certification status, this government regulation does not necessarily depend on high education requirements for an occupation, as a variety of different occupations at all education levels require a license for compensation. The occupations of interest are occupations that require a license, but have low education requirements—barbers, firefighters,

wholesale buyers—and occupations that do not require a license, but have high education requirements, such as research analysts, authors, and legislators.

For the second specification of occupational licensing, low, medium, and high brain skill job levels are determined by average occupational brain skill levels. Occupational Information Network (O*NET) provides 35 different brain skill ratings and each skill is aggregated and then averaged into one measure for 234 detailed occupation. O*NET defines brain skills or occupational skills as the more rapid addition of knowledge or the developed capacities that promote learning for an occupation. Hand Packers have the smallest rating of 26.08; while Chief Executive Officer have the highest rating at 62.29.

Figure 3: Licensing vs. Brain Skills by Occupation

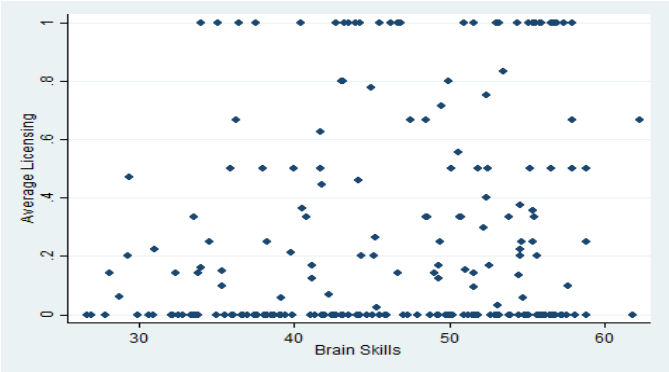


Figure 3 charts average licensing and brain skills for each occupation, where different jobs are between low, medium, and high brain skill levels across different rates of licensing, as occupational licensing does not necessarily depend on the level of the brain skills. The occupations of interest for this paper are the jobs that require a license and have low brain skill job levels—massage therapist, electricians, and earth drillers—as well as the occupations that do not require a license and have high brain skill job levels, such as editors, sales engineers, and public relations specialist.

6. Empirical Results

6.1 Education Requirement

Tables 2-4 provide empirical estimates for *earnings* broken down by education requirements with *licensing* as the variable of interest. The results for both sexes are shown in Table 2; women in Table 3 and men in Table 4. In each table, the columns are split by seven different outputs for each specification—(1) without licensing for all education requirements, (2) with licensing for all education requirements, (3) occupations that require less than 12 years of schooling (very low skill), (4) jobs that require equal to or less than 12 years of schooling (low skill), (5) occupations that require more than 12 years and less than 16 years of schooling (medium skill), (6) jobs that require equal to or greater than 16 years of schooling (high skill), and (7) occupations that require more than 16 years of schooling (very high skill).

Table 2, Column (1) estimate results that are consistent with previous literature for a Mincerian equation and all of the variables are significant. *Age* is positive with the highest magnitude in the output, age^2 squared is negative, and *education* is positive, as all of these factors influence *earnings* for an average person working in a specific occupation. The older an average worker is and the more education that worker receives both have positive influences on *earnings*; while age^2 is negative because of diminishing marginal returns due to age, experience, and on the job training having less and less effect on *earnings* as time progresses. Column (2) adds the aggregate licensing variable into the Mincerian wage equation and *license* is not significant, which gives evidence that licensing or certification does not have an effect on wages across the total sample population and other factors play a larger role. *Education* is positive and significant, as this variable increases *earnings* by 15.6 percent, which confirms previous literature that education attainment impacts wages. Column (3) analyzes very low skill jobs, as *license* is significant at the 10 percent level, where an occupational license can increase *earnings* by 18.5 percent for the average person

working in a very low skill occupation. Additionally, this finding confirms previous literature of how occupational licensing can restrict entry into occupations for low skill jobs and will therefore increase *earnings* for the average person working in that occupation due to less competition in the labor force. Higher *earnings* are likely due workers in these occupations charging higher prices for their services as a result of having an occupational license or certificate and the market being distorted due to rent-seeking activities. In addition, column (7) analyzes very high skill jobs, as *license* is significant at the 5 percent level and an occupational license decrease earnings by -30.4 percent. Even though licensing hurts the average worker in these occupations for this sample, consumers benefit due to having a qualified worker perform the service for compensation. The negative wage can be a result of a variety of factors, as economic theory suggests that wages would be positive due to this government regulation, but that is not the case with this outcome. This result can be attributed to a government regulation pushing wages down opposed to what the free market would determine, as individuals in these occupations earn less. The free market potentially might determine that price discrimination for these high skill professions would allocate resources more efficiently; however, this regulation might deter individuals from engaging in price discrimination and as a result, workers in these professions would earn less. *License* for very low skill and very high skill jobs are significant, as ambiguous results to workers and society are present and education requirements for specific occupations that fall into these categories play important roles for labor market outcomes.

Licensing or certification for jobs influence men and women differently, as previous studies have drawn parallels that this government regulation can help women and other disadvantaged groups where the education requirements are high. Table 3 is the women population in the sample; while Table 4 is the men population. *License* is insignificant for both men and women for low skill

occupations; however, *license* is significant for very high skilled occupations for females at the 10 percent level, where licensing produces a 23.8 percent decrease in earnings. Even though licensing produces a noteworthy decrease in earnings for women due to ensuring for quality in these jobs, compared to Table 1 that features both the men and women population samples, this value is 6.6 percent higher. As a result, licensing produces higher wages for women compared to the entire sample population and this result points toward occupational licensing benefitting disadvantaged groups. Women in very high skill occupations produce higher wages compared to men when licensing is present because societal factors can influence *earnings* and this government regulation can help narrow the wage gap, as the men sample for very highly skill jobs in Table 4 is insignificant. For all skill level occupations of men, licensing produces insignificant results for male *earnings*, which can be due to personal characteristics, industry characteristics, or perceptual discrimination, as these determinants add to the wage gap opposed to this government regulation influencing wages or labor market supply. In addition, *education* is positive and highly significant for men, women, and the entire sample, which further gives evidence that *education* plays a significant role on *earnings* when licensing is present, regardless of the skill level. Nevertheless, occupational licensing effects men and women differently, especially for high skill occupations and can be a mechanism for policy makers to use in order to narrow the wage gap between genders and also increase wages for disadvantaged groups.

6.2 Occupational Brain Skill Levels

Tables 5-7 represent estimations for *earnings* of 234 detailed occupations where licensing is the variable of interest and is broken down by occupational brain skill level measures. Table 5 is the entire sample of the population; whereas, Table 6 is the sample of women and Table 7 is the sample of the men. Each table contains five different outputs: (1) without licensing for all brain

skill levels, (2) licensing for all brain skill levels, (3) licensing and brain skill levels measures less than 47, (4) licensing and brain skill levels between 37 and 54, (5) licensing and brain skill levels greater than 54.

Similar to education requirements in the previous section, Table 5, column (1) produces estimates with outcomes that are all significant and consistent with education requirement outcomes in this paper; thus, giving further evidence that occupational brain skill levels and educational requirements for an occupation are correlated. Column (2) adds *license* into the estimation and this variable is not significant, as additional factors influence *earnings* more. Column (3) is occupational brain skill levels less than 37 and *license* is significant at the 10 percent level. In addition, *age*, age^2, and *education* are all significant at the 1 percent level. Occupations that require a license or certificate for low occupational brain skills result in a 25.7 percent increase in median earnings. Furthermore, workers in lower level jobs can benefit with the presence of an occupational license due to restricting entry of labor competition and raising wages, but this government regulation can increase the price to consumers for their services. Occupational brain skill levels are present in occupations with lower education requirements, such as locksmiths, nonfarm animal caretakers, and tractor operators, as entry should be easier for workers that can push earnings down. However, due to a license or certificate creating less competition in the labor market, workers can capture higher prices for their services, which can be one explanation of the higher median earnings outcome.

Table 6 is the women population in the sample and Table 7 exhibits the men population, as all the variables in column (1) that do not contain *license* are significant for both genders, besides *age* for the women sample population. *Age* is only significant for women in column (3) or low occupational brain skill levels, but *age* is significant across all occupational brain skills for men.

Due to workers growing older and gaining more experience as a result, salaries should increase, but this is not the case for the women population sample, which is likely a result of the wage gap or gender differences for occupational preferences, such as child care workers or information clerks, resulting in this labor market outcome. *Education* is also highly significant at the 1 percent level for both genders and regardless of the occupational brain skill level, as the more education an average worker in an occupation obtains results in higher *earnings*.

License is added in column (2) and this variable is not significant for the entire women and men sample population; however, *license* for column (3) or low occupational brain skill levels is significant at the 10 percent level for both genders. Additionally, column (5) or high occupational brain skill levels is only significant at the 10 percent level for the female sample population. For low occupational brain skill levels, a license or certificate increases female *earnings* by 39.1 percent and male *earnings* by 22.5 percent. Similar to Table 5, an inference can be drawn that restricting competition through this government mechanism produces higher *earnings* as a result of less competition in the labor market. However, for high occupational brain skill levels, female *earnings* decrease by 16.5 percent with the presence of a license or certificate being required to perform a job, which goes against the prediction that higher brain skill occupations will have higher median earnings due to the more complex the profession. In addition, the effect on males for *license* with higher brain skill professions is insignificant. Even though the presence of a license hurts *earnings* for females with more cognitive demanding professions, consumers benefit as a result, as these jobs can affect the consumer of the service more and a license ensures quality. For example, veterinarians or civil engineers are occupations that have high brain skill levels and even though female veterinarians or civil engineers will have higher wages if an occupational license is not required; the quality of the service is theoretically better due to the presence of licensing. The

net dead weight loss could be positive compared to if quality was worse and subsequently result in allocation of additional resources to mend any wrong doings of these high brain skill occupations.

Occupational licensing or certification impact on *earnings* have a similar effect whether measured across occupational brain skill levels or education requirements, as licensing across all occupations does not play a significant role. However, this government regulation impacts occupations that are either low skill or high skill and distorts the market equilibrium that can produce ambiguous results. Gender differences influence occupational licensing and the women sample population is more sensitive compared to men in both specifications for *earnings* when an occupational license is present. The extension of occupational brain skill levels produce empirical results that further confirm that policy makers can use licensing as a mechanism to restrict quantity or control for quality in the labor market.

7. Conclusion

Occupational licensing or certificates influence on *earnings* have a similar effect whether measured across educational requirements or occupational brain skill levels and licensing across the entire sample size for each specification does not play a significant role. This government regulation impacts occupations that are either low skill or high skill and distorts the market equilibrium that can create equivocal outcomes. Gender differences effect occupational licensing across both specifications and the women sample population is more sensitive compared to men in both specifications for *earnings* when an occupational license is present. For the entire sample population, education requirement outputs have empirical estimates with an 18.4 percent increase in *earnings* for very low skill jobs and a -30.4 percent decrease in *earnings* for very high skill jobs. As a result of the sample being split by gender, women have a -23.8 percent decrease in very high

skill occupations, which is 6.6 percent lower than the total sample population, giving evidence that licensing or certification helps women in high skill jobs. Furthermore, low occupational brain skill level outputs produce results with a 25.7 percent increase in earnings for low brain skill jobs across the total population and results are significant for both genders. On the other hand, women in high occupational brain skill level outputs have -16.5 percent decrease in wages and shows licensing hurts *earnings* for women in these professions. However, the effect is smaller in comparison to high brain skill levels for both genders and consumers benefit due to receiving higher quality services.

For this research paper, cross-sectional data has been collected at the aggregate level, as *earnings, license, age,* and *education* are averages of individual level occupations at the national level. The data for *license, age,* and *education* are available in the year 2010. Data for *earnings* is present in 2014 and *license* is available in the year 2008. Due to the lack of data for *license*, as this variable is only available in 2008, prevented the preferred method of a diff-in-diff empirical estimation. However, the occupational level Mincerian wage equation creates a snap shot approach with results consist with previous literature estimates, as licensing does not appear to have an overall relationship on wages across the entire sample, but does for high skill and low skill occupations. Theoretically, an occupational license increases wages due to decreasing potential entrants from freely entering a labor market and increasing prices for the services charged by workers, which in turn increases wages. This theoretical framework holds up for low skill occupations, as the coefficient on these jobs are positive; however, for high skill occupations, the coefficient values for these jobs are negative. Occupational licensing for higher skill jobs control for quality, but the negative wage value is an unexpected find, as this result goes against what theory suggest. One explanation could be that individuals in these professions could benefit from

price discrimination, but this government regulation does not allow for this to occur and wages decrease as a result. This begs the question of the role of licensing bodies, such as the American Medical Association (AMA) or the Bar for workers in these professions because results imply that wages are lower due to licensing. Even though consumers receive better services as a result and a moral hazard problem is avoided of only having low price and low-quality services in these occupations, the lower wages are concerning for workers because wages would be higher if these licensing bodies did not exist in these high skill professions. In addition, previous studies have analyzed individual occupations and results demonstrate that licensing influences labor market outcomes across the entire sample; however, this study refutes that claim due to findings from analyzing a comprehensive dataset of many detailed occupations opposed to just individual jobs.

A possible extension of this paper could be to collect aggregate individual level panel data of occupations to identify the residency state of each individual in order to produce better estimates of licensing and better control for omitted variable bias. For example, individuals that live in high income areas and where certain occupations are dominated, such as California with technology or New York with finance, have higher incomes and this can produce bias in the aggregate level estimates found in this paper. Introducing regional deflators with state level data can provide better measures for occupational licensing and can control for individual differences in purchasing power. Additionally, including state fixed effects with individuals can provide better estimates of licensing due to taking multiple years and different locations into account.

A possible extension estimate for an individual-level Mincerian wage equation could be

(2) $\ln(earnings_{i,j,s,t}) = \beta_0 + \beta_1\, license_{i,j,s,t} + \beta_2\, education_{i,j,s,t} + \beta_3\, age_{i,j,s,t} + \beta_4\, age^2_{i,j,s,t} + \alpha_i + \varepsilon_{i,j,s,t}$

where i indicates the individual, j indexes the occupation, s designates the state, and t denotes the time period. α_i indicates the unobserved time-invariant individual effect and $\varepsilon_{i,j,s,t}$ is the error term of the equation. The fixed effects Mincerian equation specifies that *earnings* depend positively on years of *education* and *age* and negatively on age^2. Furthermore, this empirical methodology can provide more optimal results than the methodology present in this paper, as additional variation and individual effects are captured that can give better estimates on the true extent of occupational license for labor market outcomes.

Policy makers can use occupational licensing as a mechanism to restrict quantity or control for quality in the labor market, where the largest recipients are on disadvantaged groups, as this government regulation can be a tool to promote social welfare. For example, policy makers can promote the use of occupational licensing where perceptual discrimination or a gender wage gap exists for various industries in order to benefit individuals in unfavorable circumstances. Another example could be to instill occupational licensing into professions that require additional resources by the government or third parties to mend negligence of workers or lack of skills. Requiring a license could theoretically improve the service for the occupation, by providing additional requirements to enter a profession that otherwise would not exist. Nevertheless, policy makers must tread lightly, as occupational licensing can be prone to abuse because of rent-seeking activities or a reduction of labor supply for groups this regulation aims to help could potentially surface. If occupational licensing is used as a tool by policy makers, a cost-benefit analysis must be implemented in order to judge if a license is necessary and the potential shortcomings that could be present that would hurt disadvantaged groups as well as other individuals more so than if the regulation did not exist in the first place.

References

Adams, A. F., III, Jackson, J. D., & Ekelund, R. B., Jr. (2002). Occupational Licensing in a "Competitive" Labor Market: The Case of Cosmetology. Journal of Labor Research, 23(2), 261–278.

Hirsch, B. T., Macpherson, D. A., & Hardy, M. A. (2000). Occupational Age Structure and Access for Older Workers. Industrial and Labor Relations Review, 53(3), 401-418.

Kleiner, M. M. (2000). Occupational Licensing. Journal of Economic Perspectives, 14(4), 189-202.

Kleiner, M. M., & Krueger, A. B. (2013). Analyzing the Extent and Influence of Occupational Licensing on the Labor Market. Journal of Labor Economics, 31(2), S173-202.

Kleiner, M. M., & Vorotnikov, E. (2017). Analyzing Occupational Licensing among the States. Journal of Regulatory Economics, 52(2), 132–158.

Law, M. T., & Marks, M. S. (2009). Effects of Occupational Licensing Laws on Minorities: Evidence from the Progressive Era. Journal of Law and Economics, 52(2), 351–366.

Occupational Information Network (O*NET). 2018. "Skills" https://www.onetonline.org/find/descriptor/browse/Skills/

Princeton Data Improvement Initiative (PDII). 2008. "Westat Labor Force Survey" https://krueger.princeton.edu/pages/princeton-data-improvement-initiative-pdii

Redbird, B. (2017). The New Closed Shop? The Economic and Structural Effects of Occupational Licensure. American Sociological Review, 82(3), 600–624.

United States Census Bureau. 2010 "EEO 8w. Detailed Census Occupation by Educational Attainment (5), Sex, and Race/Ethnicity for Worksite Geography, Total Population" https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=EEO_10_5YR_EEOALL8W&prodType=table

United States Census Bureau. 2010 "EEO 12w. Detailed Census Occupation by Older Age Groups, Sex, and Race/Ethnicity for Worksite Geography, Total Population" https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=EEO_10_5YR_EEOALL12W&prodType=table

United States Census Bureau. 2014. "Full-Time, Year-Round Workers and Median Earnings in the Past 12 Months by Sex and Detailed Occupation: 2013" https://www.census.gov/data/tables/time-series/demo/industry-occupation/median-earnings.html

Zapletal, M. (2017). The Effects of Occupational Licensing Evidence from Detailed Business-

Level Data, 1-55 https://www2.census.gov/ces/wp/2017/CES-WP-17-20.pdf

Tables

Table 1: Summary Statistics

		High Education			Low Education			Difference	
Variable	Description	**Obs.**	**Mean**	**Std. Dev**	**Obs.**	**Mean**	**Std. Dev.**	**Obs.**	**T-Statistic**
ln(earnings)	Median Earnings (2010 US $)	272	51463.51	24171.49	51	32758.45	11420.86	323	-5.409
age	Average Age	235	41.170	3.210	47	39.650	3.776	282	-2.874
education	Average Education	235	14.275	2.148	47	12.439	.718	282	-5.788
license	Licensing Requirement by Occupation	155	.441	.450	99	.269	.387	254	-3.123

Table 2: The Impact of Occupational License across Educational Requirements for Men and Women

Variables	(1) *full sample*	(2) *full sample*	(3) *ed. req.* < 12	(4) *ed. req.* ≤ 12	(5) *ed. req.* 12<×<16	(6) *ed. req.* ≥ 16	(7) *ed. req.* > 16
license		0.00785	0.185*	0.0995	0.0407	-0.110	-0.304**
		(0.0567)	(0.0920)	(0.127)	(0.0676)	(0.110)	(0.149)
age	0.305***	0.304***	0.195**	0.235***	0.531***	0.0403	0.173
	(0.0848)	(0.0851)	(0.0847)	(0.0738)	(0.155)	(0.322)	(0.532)
age squared	-0.00334***	-0.00333***	-0.00211*	-0.00258***	-0.00605***	-0.000256	-0.00174
	(0.00105)	(0.00106)	(0.00102)	(0.000886)	(0.00187)	(0.00390)	(0.00629)
education	0.156***	0.156***	0.213***	0.229***	0.152***	0.136***	0.154***
	(0.0115)	(0.0115)	(0.0587)	(0.0581)	(0.0169)	(0.0280)	(0.0397)
constant	1.599	1.613	3.147	2.214	-3.059	7.665	4.453
	(1.659)	(1.665)	(1.926)	(1.680)	(3.188)	(6.424)	(10.84)
Observations	231	231	20	47	133	51	36
R-squared	0.625	0.625	0.579	0.480	0.507	0.433	0.424

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Table 3: The Impact of Occupational License across Educational Requirements for Women

Variables	(1) *full sample*	(2) *full sample*	(3) *ed. req.* < 12	(4) *ed. req.* ≤ 12	(5) *ed. req.* 12<×<16	(6) *ed. req.* ≥ 16	(7) *ed. req.* > 16
license		-0.00563	0.0340	0.0846	0.0647	-0.128	-0.238*
		(0.0564)	(0.120)	(0.140)	(0.0636)	(0.0834)	(0.135)
age	0.0362	0.0363	0.0188	0.00194	0.108***	-0.000565	-0.0235
	(0.0223)	(0.0224)	(0.0210)	(0.0337)	(0.0324)	(0.0307)	(0.0432)
age squared	-0.00159*	-0.00159*	-0.000161	4.98e-05	-0.00428***	-0.000728	0.000427
	(0.000862)	(0.000861)	(0.000662)	(0.00107)	(0.00122)	(0.00119)	(0.00175)
education	0.186***	0.187***	0.208***	0.252***	0.202***	0.136***	0.150***
	(0.0116)	(0.0118)	(0.0679)	(0.0669)	(0.0166)	(0.0226)	(0.0378)
constant	7.743***	7.740***	7.294***	6.991***	7.072***	8.917***	8.804***
	(0.253)	(0.252)	(0.842)	(0.887)	(0.337)	(0.437)	(0.696)
Observations	230	230	20	46	133	51	36
R-squared	0.639	0.639	0.450	0.404	0.546	0.566	0.485

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Table 4: The Impact of Occupational License across Educational Requirements for Men

Variables	(1) *full sample*	(2) *full sample*	(3) *ed. req.* < 12	(4) *ed. req.* ≤ 12	(5) *ed. req.* 12<×<16	(6) *ed. req.* ≥ 16	(7) *ed. req.* > 16
license		-0.000287	0.0802	0.0864	0.0402	-0.0945	-0.255
		(0.0551)	(0.100)	(0.119)	(0.0653)	(0.116)	(0.156)
age	0.0745***	0.0745***	0.0544***	0.0486***	0.124***	0.0498	0.0132
	(0.0127)	(0.0128)	(0.0169)	(0.0180)	(0.0227)	(0.0388)	(0.0569)
age squared	-0.00192***	-0.00192***	-0.00112**	-0.00106**	-0.00374***	-0.00129	-0.000146
	(0.000434)	(0.000435)	(0.000395)	(0.000399)	(0.000806)	(0.00121)	(0.00164)
education	0.151***	0.151***	0.153**	0.211***	0.156***	0.122***	0.142***
	(0.0114)	(0.0113)	(0.0525)	(0.0476)	(0.0155)	(0.0271)	(0.0356)
constant	7.991***	7.991***	7.947***	7.359***	7.605***	8.766***	8.722***
	(0.159)	(0.159)	(0.674)	(0.552)	(0.248)	(0.395)	(0.515)
Observations	234	234	20	47	135	52	37
R-squared	0.653	0.653	0.586	0.503	0.578	0.421	0.371

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Table 5: The Impact of Occupational License across Brain Skill Levels for Women and Men

Variables	(1) *full sample*	(2) *full sample*	(3) *brain skill* < 37	(4) *brain skill* 37≤×≤54	(5) *brain skill* > 54
license		0.00785	0.257*	0.0781	-0.125
		(0.0567)	(0.131)	(0.0687)	(0.106)
age	0.305***	0.304***	0.308***	0.170	0.433
	(0.0848)	(0.0851)	(0.0706)	(0.166)	(0.349)
age squared	-0.00334***	-0.00333***	-0.00346***	-0.00176	-0.00476
	(0.00105)	(0.00106)	(0.000871)	(0.00202)	(0.00427)
education	0.156***	0.156***	0.236***	0.159***	0.118***
	(0.0115)	(0.0115)	(0.0780)	(0.0263)	(0.0197)
constant	1.599	1.613	0.631	4.385	-0.562
	(1.659)	(1.665)	(1.815)	(3.357)	(7.047)
Observations	231	231	44	117	70
R-squared	0.625	0.625	0.522	0.389	0.466

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Table 6: The Impact of Occupational License across Brain Skill Levels for Women

Variables	(1) *full sample*	(2) *full sample*	(3) *brain skill* < 37	(4) *brain skill* 37≤×≤54	(5) *brain skill* > 54
license		-0.00563	0.391*	0.0721	-0.165*
		(0.0564)	(0.228)	(0.0654)	(0.0972)
age	0.0362	0.0363	0.0574*	0.0555	0.0115
	(0.0223)	(0.0224)	(0.0305)	(0.0378)	(0.0283)
age squared	-0.00159*	-0.00159*	-0.00166	-0.00226	-0.00119
	(0.000862)	(0.000861)	(0.00116)	(0.00144)	(0.00119)
education	0.186***	0.187***	0.239**	0.208***	0.148***
	(0.0116)	(0.0118)	(0.102)	(0.0201)	(0.0222)
constant	7.743***	7.740***	6.730***	7.302***	8.670***
	(0.253)	(0.252)	(1.335)	(0.386)	(0.421)
Observations	230	230	43	117	70
R-squared	0.639	0.639	0.407	0.481	0.518

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Table 7: The Impact of Occupational License across Brain Skill Levels for Men

Variables	(1) *full sample*	(2) *full sample*	(3) *brain skill* < 37	(4) *brain skill* 37≤×≤54	(5) *brain skill* > 54
license		0.00223	0.225*	0.0770	-0.121
		(0.0552)	(0.130)	(0.0709)	(0.106)
age	0.0750***	0.0750***	0.0609***	0.0672***	0.117***
	(0.0125)	(0.0125)	(0.0133)	(0.0218)	(0.0367)
age squared	-0.00192***	-0.00192***	-0.00136***	-0.00172**	-0.00353**
	(0.000424)	(0.000425)	(0.000332)	(0.000738)	(0.00135)
education	0.151***	0.151***	0.172***	0.151***	0.131***
	(0.0115)	(0.0114)	(0.0608)	(0.0240)	(0.0220)
constant	7.982***	7.983***	7.726***	8.008***	8.180***
	(0.160)	(0.160)	(0.726)	(0.391)	(0.368)
Observations	231	231	44	117	70
R-squared	0.654	0.654	0.493	0.450	0.499

Notes: The dependent variable is the ln(median earnings). The robust standard errors are in parentheses where *** p<0.01, ** p<0.05, * p<0.1

Appendix A

U.S. Census Bureau's American Community Survey (ACS) is the Census Bureau's largest survey and is conducted periodically throughout the decade and sent to a smaller percentage of the population in one-year, three-year, or five-year estimates compared to the decennial census. *Earnings, age*, and *education* are obtained in this data set, where*, age*, and *education* are from five-year estimates; whereas, *earnings* are from one-year estimates. The survey is sent to 3.5 million respondents annually and captures information such as income, housing characteristics, educational attainment, employment and a variety of other categories that use to only be available in the census once every ten years. *Age* and *education* display weighted averages for analysis of the entire population in the sample.[1]

Alan Kruger provides licensing data from the Westat Labor Force Survey which the Princeton Data Improvement Initiative conducts. The data is a national random digit dial (RDD) survey taking place in the summer of 2008 and is broken down by detailed occupations, where the major topics in the survey are worker perceptions, affordability of an individual's job, occupational licensing, and the work experience throughout an adult's life time. The Westat Labor Force Survey sampled approximately 2,500 participants on topics such as worker perceptions, affordability of an individual's job, occupational licensing, and work experience. The treatment variable is an aggregate occupational licensing variable and a result of zero accounts for occupations that do not require licensing or a certificate, such as a grocery clerk, tax

[1]Age is obtained in five different samples: 16-39, 40-49, 50-59, 60-69, and 70< where the midpoint for each age group is multiplied by the sample size and added together, followed by being divided by the entire sample size. Education attainment is collected for individual education levels and then multiplied by one of six average education groups depending on the respondent's highest level of education: 10th grade, High School, Associates, Bachelors, Masters, and Professional/Doctorate, followed by being divided by the entire sample size.

examiner, or automotive body repairer; whereas, a result for one documents occupations that explicitly require a license, such as a doctor, gaming manager, or engineer. The variable for occupational licensing for results in between zero and one consist of a wide range of some individuals in the survey reporting needing to have a license or certificate and other individuals reporting not needing a license or certificate to perform their job. In addition, individual level data is combined into an average measure for detailed occupations due to licensing not being consistent across states or industries.

For an individual to be a participant in the survey, the person must be eighteen years or older and in the labor force. If a household has more than one adult who is in the labor force, then the household is randomly assigned for one person to participate in the full questionnaire. Survey results pertaining to occupational licensing provide data for the variable on interest, licensing. Three specific questions are used from this data set in order to construct a licensing variable and analyze the true extent of occupational licensing on labor market outcomes. The questions include:

1. Do you have a license or certification issued by a federal, state or local government agency to do your (most recent) job?
2. (Did/Do) you have to pass a test in order for you to obtain your license or certification?
3. What is the highest level of school you have completed or the highest degree you have received?

All three questions receive multiple responses from individuals in the same occupations, as the means are calculated for each occupation in order to perform analysis. In addition, the Westat staff attempted to fact check a random selection of one in twelve individuals who reported needing a license for their occupation, but 25 percent of respondents refused to provide their full name. Government websites and search engines were also used in order to verify licensing for specific occupations to respondents that did report needing one for their job.

Education requirement data is from the Westsat Labor Force Survey (2008) and questions asking individuals their education and training requirements for their occupation are of interest. In order to analyze the education requirements for a specific occupation, individuals report their highest level of education. More specifically, the survey question is "what is the highest level of school you have completed or the highest degree you have received?" Respondents either could answer the highest degree obtained or highest grade completed, and a total of 2,513 responses are recorded in the survey. Data is then converted into numerical format for years of education, where a high school diploma or GED equals 12 and a doctoral degree equals 20. Due to the data being individual level, the averages for detailed occupations of each individual's highest level of education are calculated to produce an aggregate measure. This aggregate measure for each detailed occupation is used as the education requirement variable and to distinguish between low skilled, medium skilled, and high skilled occupations. Low skilled occupations are jobs that have twelve years of schooling or lower and medium skilled jobs are occupations that require twelve to sixteen years of schooling. In addition, high skilled occupations are jobs that have sixteen years of schooling or higher.

Occupational brain skill level data is from the Occupational Information Network or O*NET, which is the United States primary source for job information that compiles data of detailed descriptions of occupations. The U.S. Department of Labor (USDOL) and the Employment and Training Administration (ETA) sponsor O*NET through funding from the North Carolina Department of Commerce. The database is constantly updated from the advice and input of a wide range of workers in a variety of occupations and used by millions of individuals every year, such as HR professionals, job seekers, researchers, students, and workforce developers. O*NET's data has work activities, work context, work values, ability, knowledge, skills, and a variety of

other areas; where skills will be the focus of this paper. A total of 35 different brain skills are in O*NET's database and broken down across 231 total occupations in the sample[2]. The skills measure occupational level rating, where the descriptor means are standardized from a 0 to 100 scale. O*NET defines occupational level as a rating that indicates the degree to which a particular descriptor is needed to perform an occupation. Each brain skill level is aggregated into one measure, average occupational level, for each detailed occupation in the sample. However, occupations in O*NET's database are much more detailed than what the ACS and RDD surveys provide, as the more detailed occupations in O*NET's database are averaged into one occupation that matches up with the ACS and RDD survey. For example, in O*NET's database, Accountant and Auditor are listed as different occupations; whereas, Accountant and Auditors are listed as the same occupation in ACS and RDD survey. In order for the data to match up and use for analysis, I took the average level of these two occupations in O*NET's database in order to create the same occupation for the entire sample.

[2] Brain skills: active learning, active listening, complex problem solving, coordination, critical thinking, equipment maintenance, equipment selection, installation, instructing, judgement and decision making, learning strategy, management of financial resources, management of material resources, management of personal resources, mathematics, monitoring, negotiation, operation and control, operation monitoring, operation analysis, persuasion, programming, quality control analysis, reading comprehension, repairing, science, service orientation, social perspectives, speaking, systems analysis, systems evaluation, tech design, time management, trouble shooting, and writing.