Kraus Thesis

License to Exclude: The Concentrated Costs of Occupational Licensing

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Abstract

The proliferation of occupational licensing in the U.S. in the past few decades has received increased attention from researchers. Most academic research focuses on the effects of licensing policies on wages and employment among licensed workers. This paper seeks to identify and quantify the supply-side costs faced by those excluded workers by examining how licensing changes the demographic characteristics of workers within an occupation and moreover, how specific licensing requirements can shift this distribution. I find that licensure of low-income occupations represents an effective barrier to entry for two of the most marginalized groups of American workers—immigrants and high school dropouts. Across a variety of specifications, and robust to the inclusion of many controls, immigrants and high school dropouts are persistently less likely to be employed in licensed occupations. An understanding of who is disproportionately affected by such regulations is necessary for an informed debate about the merits of such requirements and in order to construct a regulatory environment that is more inclusive.

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1 Introduction

The proliferation of occupational licensing over the past two decades has culminated in an economy where nearly 30% of U.S. workers now work in a licensed industry (White House, 2015). Some of this growth is due to the shifting occupational mix of U.S. workers, but most is the result of newly enacted legislation, especially that regulating low-skill occupations. Thus an examination of the rapidly changing occupational licensing landscape naturally leads to the question of why certain statues were enacted. There are two often-cited reasons: consumer protection, and the interests of professional lobbying groups seeking higher rents. Various theoretical models support the two hypotheses, which are not necessarily mutually exclusive. Imposing a licensing requirement creates a barrier to entry, thus restricting the supply of workers, increasing the price of labor and related services. However, if licensing increases the average quality of goods and services outputted by an occupation, or helps a market that suffers from sufficient adverse selection reach a separating equilibrium, it may actually increase consumers' willingness to pay for goods, and in doing so cause the same equilibrium effects.

More academic research, particularly in the past five years, has drawn its attention to the effects of licensing, galvanizing and shaping conversations around licensing policy in response to findings that licensing reduces employment in affected industries, raises wages of affected workers, and has no significant effect on quality of goods or services rendered (Kleiner and Soltas, 2018). Though the traditional and still generally advertised justification for licensing is consumer protection, policymakers now acknowledge that most licensing statutes are enacted at the behest of professional lobbying groups seeking rents for incumbents under the disguise of quality standards (Kleiner, 2000; Carpenter et al. 2012).

Considering the labor market distortions introduced by occupational licensing statues, it is plausible that expected variation in outcomes along a worker's educational attainment or immigration status would be more or less pronounced in licensed industries. In an example, immigrants particularly may face high resource costs navigating the regulatory landscape and

attaining recognition for credentials earned in another country. Further, it is possible that certain population groups differentially benefit from and are deterred by various licensing requirements, as has been found in the case of wages of licensed women and African-American workers (Blair and Chung, 2017).

The benefits of licensing are clear, and concentrated: licensed workers earn about 15% more than unlicensed workers with similar education, training, and experience (Kleiner and Krueger, 2010). The costs, in contrast, are more distributed, borne both by consumers facing higher prices and by would-be workers discouraged into other jobs. Additionally, the beneficiaries of licensing are easily identified: incumbent workers. It is difficult, on the other hand, to isolate those individuals who are harmed, particularly on the supply side. When employment decreases due to licensure, we cannot observe the counterfactual payroll.

The largely unchallenged growth of occupational licensing is understandable given the prominence of professional lobbying and facelessness of those harmed. In a similar vein, recent efforts to repeal licensing requirements spurred by lawmakers nebulously citing costs and a need for economic liberty have understandably failed without salient constituent support. This paper seeks to identify and quantify the supply-side costs faced by those unidentifiable excluded workers by examining how licensing changes the demographic characteristics of workers within an occupation and moreover, how specific licensing requirements can shift this distribution. Understanding where these costs are concentrated has the potential to change the dialogue around the passage and potential repeal of various licensing statutes. Should the effects be widely dispersed, as often suggested, critics of licensing may be glad to see that such policies are perhaps more efficient in promoting the welfare of interest groups than we might expect, with the demand-side costs borne by more wealthy service consumers and the supply side costs evenly distributed. Conversely, where groups are found to suffer disproportionately, such considerations may help to mobilize opposition to the offending statutes.

This paper proceeds as follows. Section 2 gives an overview of occupational licensing,

and relevant results in the literature. Section 3 describes the data I use. In Sections 4 and 5, I describe my methodology and then discuss the results of my empirical tests. Section 6 concludes.

2 Background and Literature Review

2.1 Recent Growth of Licensing

Since the 1950's, the share of U.S. workers who must obtain a government-issued licensed to do their jobs has climbed from about 5% to over 25% (The White House, 2015). While some of this change may be attributed to the changing occupational composition of the labor force, the majority of this increase is due to the rising number of occupations that are subjected to licensing policies. As of 2013, over 800 occupations were licensed in at least one state (Kleiner and Krueger, 2013). However, fewer than 60 are regulated in all 50 states, and occupation-specific licensing criteria vary widely across states. In contrast to certification, where the government may choose to endorse workers who have demonstrate a certain level of knowledge, one cannot work in a licensed profession without having acquired a license, creating a real barrier to entry. The heterogeneity of policies across states calls into question how appropriate some states' licensing practices are. State policies, as opposed to varying state occupational compositions, create a significant gradient in the share of licensed workers state-by-state (The White House, 2015).

Historically, licensing policies, purportedly enacted to ensure quality of services provided, have affected high skill occupations including medical, dental, and legal professionals. Indeed, licensing policies cover workers differentially across the education gradient, increasing coverage with the level of education. Kleiner and Krueger (2013) estimate that 44% of workers with above a college degree work in occupations that require licensure, compare to 29%, 20% and 15% of those with only a college degree, only a high school degree, and less than a high school education, respectively. However, recent trends in licensing policies have

increased regulation of low-skill occupations, creating potentially more significant barriers for low-income workers who may not be able to afford the explicit or opportunity cost of additional training and educational requirements to enter their profession of choice. Immigrants particularly may face high resource costs navigating the regulatory landscape and attaining recognition for credentials earned in another country. However, low-skill individuals may be better poised to reap the benefits of licensing as it affirms legitimacy and accelerates the professionalization of their industries.

Becker (1986) weighs the, at times competing, interests of producers and consumers by applying Peltzman's public interest hypothesis to occupational regulation. Peltzman's theory balances the supply and demand of regulation, offering a legislature that attempts to maximize likelihood of reelection given competing interest groups. In this framework, for any group's interests to be furthered, it is necessary for the group to collectively realize their aims and for the legislator too to be made aware of its goals. In the context of licensing, this theory would indicate that professional groups have more political influence than the public because they are able to band together, and are motivated by specific and clearly concentrated potential gains. The public, in contrast, has difficulty speaking with one voice, and faces costs that are presumably widely dispersed.

2.2 Effects on Quality

Licensing laws are estimated to increase the prices of goods and services somewhere between 3 and 16%, with no proven, tandem effect on quality (The White House, 2015). Leland (1979) advocates for licensing as a minimum quality constraint on goods and services particularly in markets plagued by informational asymmetry. However, in establishing quality standards there is a fine line between preventing market failures and trying to induce and protect monopoly rents, and Leland warns that if quality standards are set by individuals in the profession itself, the standard will be too high. This is a relevant note as we observe the current state of occupational oversight, where nongovernmental boards, typically composed

of members of the occupation in question, constitute the majority of statutory enforcement post licensing.

Considering the distinction between improving quality and reducing harm to consumers, Leland and Kleiner (2000) both advocate for government certification as a less imposing solution to the adverse selection problem. Under certification, practitioners may opt to seek governmental endorsement, and consumers can dictate the importance of such credentials for producers in each market.

2.3 Supply-Side Effects

An examination of the current occupational licensing landscape naturally leads to the question of why certain statues were enacted. There are two often-cited reasons: consumer protection, and the interests of professional lobbying groups seeking higher rents. Various theoretical models support the two hypotheses, which are not necessarily mutually exclusive. Adam Smith described higher wages as the motivation behind a movement to lengthen apprenticeship programs centuries ago. Imposing a licensing requirement creates a barrier to entry, thus restricting the supply of workers, increasing the price of labor and related services. Indeed, licensed workers earn 10-15% more than unlicensed workers with similar education, training, and experience. (Kleiner and Krueger, 2010). More recently, Kleiner and Soltas (2018) find that licensing raises wages by 12%, and decreases employment, but raises hours worked per worker. Blair and Chung (2018) use a boundary discontinuity design in order to exploit variation in licensing policies across state boundaries, finding that licensing reduces labor supply by between 17 and 27%.

While there is ample evidence that licensed workers earn higher wages than their unlicensed counterparts, even controlling for education and other demographic factors, such results may be subject to selection on unobservable into the licensed occupations. Han and Kleiner (2017) offer a robustness check to these findings, as they analyze the influence of licensing on grandfathered workers. Such workers are those who began working in an

occupation prior to its becoming licensed, and then continued working in that occupation after it became licensed, usually without having to meet the newly imposed requirements. The benefits to being grandfathered also apply to workers who faced some barriers to entry, but licensing requirements then became more costly after their entry. Across 13 universally licensed occupations over 75 years, the authors find that grandfathered workers see wage gains positively associated with the time over which the licensing requirement was imposed upon their occupation. Incumbent workers benefit from the imposition of licensing requirements, despite not having to demonstrate ability or incur any cost themselves.

While this paper will explore only the employment effects of licensing statutes, it is important to acknowledge the pervasiveness of licensing and second-order effects. In an analysis of twenty-two licensed occupations, Johnson and Kleiner (2017) found that the interstate migration rate for individuals working in occupations with state-specific licensing requirements was on average 36% lower than their unlicensed counterparts. This effect varied across occupations, and, notably, was connected to the obligation of specific licensing requirements; no effect on interstate migration was found among workers in licensed occupations who face national licensing procedures, and thus would not incur significant additional hurdles to continue working in their profession in another state. The authors estimate that increases in occupational licensing alone can explain 4% of the 50% decline in interstate migration between 1980 and 2010, taking the estimate from Molloy et al. (2011) that interstate migration had decreased from 3% to 1.5% annually over the same period.

2.4 Licensing Stringency

A California requirement that increased the hours of required training by 100 hours decreased the number of Vietnamese manicurists by almost 18%, suggesting that more involved licensing requirements decreases the likelihood of workers entering that occupation in that state (Federman et al., 2006). As various states increased education requirements for CPAs from 120 to 150 semester-hours of college, employment of CPAs in those states

fell. In employing education requirements as a screening mechanism to separate low and high quality CPAs through their willingness to undergo additional educational training, one could attribute the decrease in employment to fewer low-skilled CPAs entering the occupation. However, although accountants subject to the rule were more likely to be employed at "Big 4" accounting firms and earn higher wages than accountants not subject to the rule, quality did not improve (Barrios, 2018).

Kleiner and Krueger (2013) find that while there were significant wage gains to being in a licensed industry, individual requirements, such as additional education or exams required, did not have a significant additive effect on wages. This result is more consistent with the model of licensed wage premiums as stemming from decreased competition, as opposed to improved quality, since gains were higher where labor supply was restricted across a wider geographic area and there is no reason to suggest that local governments or state certification boards would be less equipped to monitor quality standards than state and federal licensing boards.

2.5 Effects on Population Subgroups

Analysis of wage premiums for licensed workers is similar to that of earnings for unionized workers, who also see a wage premium. However, while unionization decreases wage inequality within an occupation, licensing does not reduce wage inequality within licensed jobs (Kleiner and Krueger, 2010). Licensing does, however, reduce racial and gender wage gaps: it reduces the gap between whites and blacks by 43%, and reduces the gap between women and white men by 36 to 40% (Blair and Chung 2017). The authors attribute this effect to the information content of a license; licenses reduce informational asymmetry and thus decrease firms' need to rely on race and gender as productivity indicators. Their framework relies on the assumption that employers may believe the productivity distribution of female or black workers is noisier compared to that of white men, and thus are willing to pay less to workers from these populations. The licenses become an observable signal for unobserved

ability. For instance, women have higher returns to any educational attainment associated with occupational licenses, while black men see similar effects with licenses that serve as a an indicator of non-felony status. In hand with reducing the wage gap, licensing is associated with a higher wage premium for white women, black women, and black men (12%, 15%, and 14%, respectively) than for white men (4%), when these groups are compared to their unlicensed counterparts. The licensing premium is higher in occupations where licenses require additional education.

Licensing requirements can present a substantial hurdle to immigrants wishing to work in a licensed occupation, and especially so for those who have experience or credential received abroad that are not recognized by U.S. state licensing boards. In the United States, immigrants comprise 13.5% of the population and 17% of the workforce, with 57% of the immigrants in the workforce being naturalized citizens. The federal government issues visas for immigrants to live and work, both permanently and temporarily, in the U.S., while state governments largely are in charge of occupational regulations including licensing which can create employment barriers. As of the 2010 census, 30% of working-age immigrants had a college degree, and half of these immigrants are overqualified for their current jobs. In contrast, only one-third of native workers are similarly classified as over-qualified, suggesting that college-educated immigrants are disproportionately under-employed. Additionally, it is estimated that nearly two million highly-skilled immigrants are not working in their field, encountering a loss of $40 billion per year in forgone wages, according to the Migration Policy Institute (Morse and Chanda, 2018). Licensing may be a contributing factor.

One study on the effects of occupational licensing in Canada on the Canadian immigrant population found that working in a licensed industry is associated with a higher wage premium for immigrants than for non-immigrants. However, the probability of working in a licensed job is lower for immigrants by 3.2%, meaning that immigrants are 20% less likely overall to be in a licensed occupation (Gomez et al. 2015). One survey of 4,000 U.S immigrants with a college degree or higher reported that the main barriers they faced in entering

their professions were not having U.S work experience, and employers not recognizing foreign work experience or credentials (Morse and Chanda, 2018). In addition to experience requirements, educational requirements of licensing policies may disproportionately impact immigrants, who may have partially fulfilled the requirement, but must repeat the same education because there are no partial courses offered. An occupation non-specific example would be that even immigrants with high English proficiency may lack technical vocabulary, and would have difficulty finding a course to fill the gap. Additionally, immigrants are likely to be concerned with quickly finding employment as they assimilate, forgoing the opportunity to enroll in occupation-specific training that would delay their first paycheck.

In the U.S., the earnings and the occupational distribution of foreign-born workers differ from those of native-born workers significantly. Earnings of foreign-born workers are lower than those of natives, and earnings of foreign-born workers who are naturalized citizens are higher than those of foreign-born workers who are not citizens (Census Bureau, 2000). Naturalized citizen workers and native workers have similar occupational distributions, but non-citizen foreign-born workers are less likely to be employed in managerial and professional specialty occupations or technical, sales, and administrative support occupations; and more likely to be employed in service occupations.

These summary statistics indicate that both immigration status and citizenship status influence labor market outcomes. Considering the labor market distortions introduced by occupational licensing statues, it is plausible that these effects are more or less pronounced in licensed industries; and further, that immigrants differentially benefit from and are deterred by various licensing requirements, as has been found with other population groups. Understanding and streamlining the assimilation of this fast growing contingent of the labor force within the current licensing landscape is of especial importance given rapidly changing demographics, increasing retirements and potential labor shortages.

3 Data

My data mainly come from two sources: the American Community Survey (ACS) administered by the United States Census Bureau, and a dataset collected by Carpenter et al. of 102 low-income occupations that were licensed in at least one state in the period between 2012 and 2017. The Carpenter dataset consists of two separate cross-sections: one for 2012, and one for 2017. In order to construct panel data, I additionally drew upon a variety of resources from which I compiled regulatory data for the intervening years.

3.1 The American Community Survey

Both my population data at the individual level and my data concerning state-level unemployment and demographic statistics come from the ACS. The ACS is a nationally representative survey for which information is collected continuously throughout the year. The Census Bureau mails questionnaires monthly to around 295,000 addresses, and survey data from one calendar year are pooled to produce estimates for that year. The ACS also makes available pooled 5-year estimates, constructed from the corresponding one-year estimates. My state-level statistics are derived from both the five-year estimates for 2013-2017 and the one-year estimates for 2017, where available; state-level summary statistics can be found in Table 1. The individual-level data the ACS reports includes occupation, state of work, immigration status, citizenship status, age, educational attainment, and other individual characteristics I employ both as variables of interest and as demographic controls. Importantly, the ACS provides information on an individual's English proficiency, which many comparable surveys, including the Current Population Survey, do not. I use ACS data for the years 2012 through 2017, to match the licensing requirements I have. I limit my sample to individuals aged 18 to 65. Individual-level summary statistics can be found in Table 2.

3.2 Occupational Licensing Requirements

My data on occupational licensing requirements was initially assembled by Carpenter et al. (2012) for a study of the national landscape of occupational licensing. State-specific licensing requirements were recorded from state administrative codes, publications by state licensing boards and professional associations, and direct contact with licensing authorities. Five licensure requirements are reported: fees, education and experience (in days, serving as a proxy for the requisite number of "days lost" in order to meet the requirement), number of exams, minimum grade level, and minimum age. The authors included these five types of requirements because they are common requirements across many occupations and states; less commonly required requirements such as character references or net worth requirements are not recorded. Throughout this analysis I do not consider minimum age requirements, which where in place typically require a licensee to be 18 years old. They are not relevant to most of my sample, which is restricted to those over the age of 18. In addition, the authors provide a ranking of each state based on the burn imposed by the aggregate licensing regulations in each state. This measure of licensure considers both how many of the 102 low-income occupations each state licenses as well as the stringency of the specific licensing requirements in each state.

This study was updated in 2017 in order to study the changes in regulatory requirements as well as to revise some of the previously collected data. Both the 2012 and 2017 studies include licensing requirements for 102 occupations nationwide that are recognized by the Bureau of Labor Statistics and for which the average income in the occupation is below the national average income. However, while there is much overlap between the occupations covered in each year, the occupations are not all the same. Moreover, some occupations are covered in both years, but are classified differently. As a result, upon an initial comparison of the two data sets it appears that many regulatory requirements were repealed between 2012 and 2017; in fact, the researchers merely redefined the scope of the occupation to better represent the work and regulated tasks performed by workers in each occupation, taking care

to underreport any hurdles imposed by licensing requirements when ambiguities arose.

The researchers provided me with a list of 45 occupations that were consistently recorded between the 2012 and 2017 study. I chose from this list the 24 occupations that (1) are uniquely identifiable using ACS (SOC 2010) occupations codes and (2) if licensed, require all members to be licensed in order to work in the occupation. This allows me to impute an individual's licensure status given their state of work and occupation, which is necessary since the ACS does not ask respondents questions about license attainment. For example, many types of contractors are licensed, but in most states only the individual who owns a business is required to have a license, while his or her employees are not required to. Even among sole proprietors, many are permitted to work on contracts below a certain dollar value without needing to obtain a license. Given such an individual's occupation and place of work, one could not confidently assume his or her licensure status, and thus I exclude such cases from my sample.

From the 2012 and 2017 Carpenter data on consistently recorded occupations, I constructed panel data for 2013 to 2016 by observing which occupations in which states saw a change in licensing status over that five-year period. When such a change was found, I researched the year in which the relevant state bill was enacted, and thus would mark this occupation-state cell as being unlicensed all years before that year, and then licensed beginning in that year. The appendix details the changes I introduced to the Carpenter data, as well as the various references for each change. It is surprisingly difficult to find licensing requirements or related state administrative codes in the public domain, and this lack of transparency no doubt contributes to the entry costs associated with licensing requirements. My most fruitful sources were LexisNexis, a legal database, and phone conversations with representatives from state licensing boards.

As reported in Table 3, the 24 occupations I examine constitute 6.1% of U.S. employment. Each occupation is licensed in a mean of 27 states, with 6 being universally licensed—that is, licensed in all 50 states and Washington, D.C. On average, these occupa-

tions require one exam, $112 in fees, and 159 days in some form of educational or experiential training in order to obtain a license to work.

4 Methodology

4.1 Determining Licensure Status

I merge my two data sources in order to match individuals to the licensing requirements to which I expect them to be subjected. I keep only the individual observations whose occupation is one of the 24 for which I have regulatory data. Then, based on the individuals' place of work, reported occupation, and the year in which he or she was surveyed, I can determine the licensing requirements he or she faces. For individuals who work in multiple states, or did not report separately their place of work, I use their home state. I assume all workers in a state-occupation that requires a license have obtained a license; I do not account for noncompliance. This leaves me with approximately 447,000 individual observations, of which 77% overall require a license to work. 19% of this total sample are immigrants, 70% of whom require a license to work. The percentage of my sample that is licensed is between two and three times higher than the national estimates discussed in the first section of this paper, but this is to be expected since I include only individuals in occupations I know to be licensed in at least one state. The percentage of individuals who are immigrants is higher than the national number, but is again in line with expectations since I consider only occupations that nationally rank below the median income and immigrants, particularly those who are not naturalized citizens, are more likely to earn below the median income (ACS, 2017). The reasonableness of this assumption is underlined by the fact that a lower percentage of immigrants than non-immigrants face a licensed profession in my dataset, suggesting that they are disproportionately represented in unskilled professions as opposed to semi-skilled ones that are more likely to have licensing.

4.2 Licensing and Unemployment

I initially investigate the relationship between licensure and state demographic characteristics by regressing the Licensure Rank for 2017, provided by Carpenter et al. (2017) against the fraction of a state's population that has at least a high school degree, the fraction that has at least a bachelor's degree, and the fraction that are immigrants. The Licensure Rank reflects how onerous a state's licensing regime is relative to other states, incorporating both the number of low-income occupations that are licensed in that state as well as the stringency of particular requirements. This regression sheds light what types of state-level factors are correlated with having a heavy occupational licensing regime. Next, I regress unemployment in each state against two dummy variables that indicate whether the state ranks in either the bottom or top quartile in terms of licensing burden. I then investigate the relationship between unemployment and the same two licensure rank dummies among two population subgroups, immigrants and high school dropouts, adding controls for the immigrant and high school dropout fractions of the population, respectively, as well as controlling for the overall state unemployment level. The results of this regression are reported in Table 4. Given that licensing requirements vary widely among states and among occupations, I next investigate which, if any, components of occupational licensing requirements create the greatest barriers to entry for immigrants and high school dropouts. I perform this analysis by regressing the fraction of workers in a particular state-occupation cell that are immigrants on some of the requirements one faces in order to work in that occupation in that state. I estimate the following equation for each state-occupation cell:

$$\begin{aligned} ImmigrantPct_{s,o} = \beta_1 Licensed_{s,o} + \beta_2 Fees_{s,o} + \beta_3 Exams_{s,o} + \beta_4 DaysLost1week_{s,o} \\ + \beta_5 DaysLost1month_{s,o} + \beta_6 DaysLost1year_{s,o} + FE_s + \epsilon_{s,o} \end{aligned} \quad (1)$$

In the above equation, the estimated number of days lost to required educational or experiential training is bucketed into three dummy variables, representing days lost between

0 and 7 days, between 8 and 30 days, and between 31 and 365 days. Some state-occupations cells do require more than one year of training, but I omit this dummy since it is collinear given the other three. Of the two other requirements given in the equation above, fees is in dollars, and exams refers to the number of distinct exams required. I include state-fixed effects, since there is wide variation in the immigrant percentage of the population across states which would likely be reflected in the immigrant percentage of employment. I also estimate this same equation with $DropoutPct_{s,o}$ as the dependent variable. The results of this analysis are presented in Table 2.

4.3 Likelihood of Being Licensed: Immigration Status

After examining the effects of licensure on aggregated immigrant statistics, I now turn my attention to micro-level data in order to understand what individual-level characteristics might be driving the gap in licensure between immigrants and non-immigrants. I consider the role of how long an immigrant has been living in the United States, his or her citizenship status, and his or her level of English proficiency. I estimate the following equation:

$$\begin{aligned} Licensed_{i,s,t} = {} & \beta_1 Immigrant0_{i,s,t} + \beta_2 Immigrant5_{i,s,t} + \beta_3 Immigrant10_{i,s,t} \\ & + \beta_4 Citizenship_{i,s,t} + \beta_5 EnglishProficiency_{i,s,t} + \mathbf{X_i} \\ & + FE_s + FE_t + \epsilon_i \end{aligned} \tag{2}$$

The dependent variable is a dummy for whether or not the individual works in a licensed occupation, and I offer as explanatory variables dummies for whether the individual has been in the United States for between 0 and 5 years, between 5 and 10 years, or over 10 years, in addition to dummies for citizenship and English proficiency. X_i is a vector of individual-level controls including quadratics in age and education. I include state and year

fixed effects. As the outcome is binary, I use a logistic regression, and consequently report marginal effects at the mean. The results of this regression and the marginal effects can be found in Tables 6 and 7.

4.3.1 Non-Parametric Methods

I employ two non-parametric methods in order to further explore the relationship between immigration and licensing status: a permutation test, shown in Figure 1, and a propensity score weighting method, the results of which are reported in Table 8.

I conduct the permutation test at the state level and then aggregate the results. For each of the 50 U.S. states, I preserve the number of immigrants in each state, and randomly assign immigrant-status to individuals. After permuting the immigrant-status of each individual, I calculate the fraction of permuted immigrants that are licensed. I do this 1,000 times per state. In order to collapse my state-level data, I calculate the difference between every placebo estimate and the observed value in that state, and plot these 50,000 differences on the above graph. A vertical line at zero shows where the observed estimate falls in the CDF, as I benchmarked the observed value in each state to zero. If most of the differences between the placebo estimates and the actual value observed in the state are positive, then it would indicate that the fraction of immigrants that are licensed in reality is lower than we would expect it to be if immigration status had no effect on licensure. Therefore, it would be likely that being an immigrant has a negative treatment effect on licensing outcomes. If most of the differences are negative, then the opposite is likely true.

While I control for education in my regressions, I am curious to what extent the education gradient can explain the differences in licensure among immigrants and non-immigrants. Immigrants in my sample are both more likely to have less than a high school degree (22% versus 7% of natives) and more likely to go to college or beyond (14% verse 12% of natives). I therefore use propensity score weighting, following Dinardo-Fortin-LeMieux (1996), to decompose the difference in licensure rates among immigrants and non-immigrants along

the axis of educational attainment. I divide the educational distribution into buckets with corresponding indicators, and regress the immigrant dummy on these observables. I can then predict immigrant propensity scores for the non-immigrants based on their educational attainment, and use these propensity scores to assign weights to non-immigrants in order to match covariates accross groups, giving the non-immigrants the same educational distribution as immigrants. In matching the education gradient, I also include year fixed effects, as I use data from years 2012 through 2017, and preserve ACS sampling weights throughout. I then recalculate the implied licensure rates, reweighting by educational attainment, in order to estimate the role of educational difference in driving the gap between immigrant and non-immigrant licensure.

I repeat the above analysis, but reweighting by English proficiency instead of education, for another result. The results of both analyses are reported in Table 8.

4.4 Likelihood of Being Licensed: Educational Characteristics

Having examined the effects of licensure on aggregated dropout statistics, I again turn my attention to micro-level data in order to understand what individual-level characteristics might be driving the gap in licensure between dropouts and non-dropouts. I have two main questions. First, I wonder if the gap is driven by the mere lack of a high school degree, which could serve as a signal in a competitive labor market. I investigate this potential "sheepskin effect," made prominent by Hungerford et al. (1987) by regressing individual licensing status on an indicator for dropout status as well as an indicator for having attended some high school. If there is no significant effect to having completed some high school, then it would seem that a degree effect does exist even in the low-income occupations I include, and might be driving licensing outcomes or even labor market outcomes more generally as in Hungerford et al. Second, since some state-occupation cells require a minimum grade level in order to obtain a license, looking at the effect of licensing requirements on the employment of high school dropouts across the entire universe of state-occupation cells biases me toward finding

a larger exclusionary effect than should be associated with the presence of any licensing requirement alone. Therefore, I run all variants of the below regression twice: once on the entire universe, and then again excluding all state-occupation cells that have any minimum grade requirement, in order to see if the relationship between dropout and licensing status persists. I estimate the following equation:

$$\begin{aligned} Licensed_{i,s,t} = \beta_1 Dropout_{i,s,t} + \beta_2 DropoutSomeHS_{i,s,t} + \mathbf{X_i} \\ + FE_s + FE_t + \epsilon_i \end{aligned} \tag{3}$$

X_i is a vector of individual-level controls including quadratics in age and education, following Hungerford et al. I include state and year fixed effects. As the outcome is binary, I use a logistic regression, and consequently report marginal effects at the mean. The results of this regression and the marginal effects can be found in Tables 9 and 10.

4.5 Wage Premiums for Immigrants

Previous literature shows that licensing helps to close persistent wage gaps among demographically different groups (Kleiner and Krueger, 2010; Law and Marks, 2009). Blair and Chung (2017) ascribe the differential returns to licensing to the fact that women and minorities may see a differentially high benefit to the signal that individual licensure attainment sends to prospective employers. This hypothesis motivates an investigation into whether wage premiums from licensing differ among immigrants and non-immigrants, which could indicated that licensing is a stronger signal of worker quality for immigrants than for

non-immigrants. I estimate the following regression:

$$\begin{aligned} log(Wages)_{i,s,t} = & Licensed_{i,s,t} + Immigrant0_{i,s,t} + Immigrant5 * Licensed_{i,s,t} \\ & + Immigrant5_{i,s,t} + Immigrant5 * Licensed_{i,s,t} + Immigrant10_{i,s,t} \\ & + Immigrant10 * Licensed_{i,s,t} + X_i + FE_s + FE_t + \epsilon_i \end{aligned} \tag{4}$$

The dependent variable is an individual's logged wages, and I control for licensing status, standard demographic controls X_i including quadratics in age and education, and include state and year fixed effects. The coefficients on the immigration dummies, and the interaction terms thereof with licensing status, indicate the shift in the conditional mean logged wage for each immigrant tenure, as well as the differential wage returns to licensure each of these immigrant tenures observe. The results of this regression may be found in Table 11

5 Results and Discussion

5.1 Licensing and Unemployment

Using the Licensure Rank for 2017 provided by Carpenter, I find that the measure of a state's licensing burden is significantly negatively correlated with the fraction of the state population who has at least a bachelor's degree, and significantly positively correlated with the fraction of the state population that is an immigrant.[1] That is, states that are more educated tend to have lower licensing burdens, and states with a higher share of immigration are likely to see higher licensing burdens. A 1% increase in the immigrant share of the population is associated with a 1.7-state decrease Licensure Rank. The latter result in particular motivates the question, in line with a barriers-to-entry model of occupational licensing, of whether licensing laws might be enacted in order to exclude immigrants from

[1]The most onerously licensed state has a Licensure Rank of 1, while the state with the least burdensome licensing regime as a Licensure Rank of 51.

certain professions. Further, this result highlights space for future research to investigate the effects of the flows, instead of the stock, of immigration into a particular state on the prevalence and proliferation of licensing requirements. I find next that immigrant unemployment within a state bears no significant relationship to its licensing regime: the coefficients on the dummies for both low licensure rank and high licensure rank are insignificant. This would indicate that even though immigrants do tend to face more licensing requirements in their states, either these licensing requirements do not pose a particular burden to their entry, or there are available unlicensed substitute occupations in which they can continue to work, albeit likely for lower pay, especially given the wage premium seen by licensed workers, which would of course not be reflected in pure employment statistics. High school drop-outs, on the other hand, do see significantly higher unemployment rates in states with high Licensure Rankings, and so too see significantly lower unemployment rates in states with low Licensure Rankings.

While both immigrants and high school dropouts are less likely to be employed in licensed occupations, the role of specific licensing requirements as a barrier to entry are quite different among the two groups. I find that within each state-occupation cell the fraction of employment composed of immigrants as well as the fraction of employment composed of high school dropouts is significantly negatively associated with that occupation being licensed: licensing an occupation is associated with a 3.8 percentage point decrease in the immigrant-employment percentage and a 1.7 percentage point decrease in the high school dropout-employment percentage. However, while the immigrant-employment percentage is significantly negatively associated with the number of exams, the dropout-employment percentage is significantly negatively associated with fees. Possibly, exams are only offered in English, or offerings in other languages are far and few between. Meanwhile, regarding differences in sensitivity to fees, my results suggest that immigrants are either wealthier or more highly motivated to enter licensed professions than high school dropouts generally. Introducing an additional exam is associated with a one percentage point decrease in the

immigrant-employment percentage; increasing the fees associated with licensure by $100 decreases the dropout-employment percentage by about one percentage point.

State-occupations cells that require between a week and a month of educational or experiential training see on average a six percentage point decrease in the immigrant-employment percentage. While such a negative association, which is significant at the 1% level, may be due to a mismatch in the occupations requiring such training and the employment preferences of immigrants, it is also quite likely that many immigrants do not have the luxury of spending up to one month in a training program, and so such requirements pose a large barrier to entry for immigrants. Moreover, it likely that many such training programs are only offered in English, creating another way in which language barrier-based differences in employment outcomes are exacerbated by occupational licensing. In examining the relationship between dropouts and days lost, I find that the dropout-employment percentage is actually positively associated with losing up to one week to some form of training. Evidently dropout employment is concentrated in state-occupation cells that require little to no formal training or experience.

In addition to statutory requirements, there is also wide state-level variation in procedural hurdles such as learning what the requirements are, navigating the application process, and having the flexibility to wait for the application to be processed. While the econometrician hopes that much of this is captured by state fixed effects, it is important to note the many intangible costs and informational barriers erected by occupational licensing regulations, which quite plausibly are felt harder by some groups than others. Such informational barriers would include the search costs of researching relevant requirements, and if necessary finding and enrolling in a training or apprenticeship program.

5.2 Likelihood of Being Licensed: Immigration Status

In line with my previous findings, I find that immigrant status is negatively correlated with working in a licensed occupation. Even when controlling for citizenship and English

proficiency, holding them at their mean values across the sample, immigrants are 5% less likely to be licensed than non-immigrants. This disparity decreases to 4% and 3.3% for those who have lived in the United States for over 5 and 10 years, respectively.

In looking at both Tables 6 and 7, I note that the coefficient on $Immigrant0$ is significantly negatively related to the probability of being licensed when citizenship and English proficiency controls are not included, but is not significant when controlling for citizenship and English proficiency. This might be due to the fact that more recent immigrants are heuristically least likely to be citizens or be proficient in English compared to others who have lived in the United States for a while; indeed, the coefficients on $Citizenship$ and $EnglishProficiency$, which are significant in every specification in Table 7, are both greatest in magnitude when included with $Immigrant0$. In contrast, the coefficients on $Immigrant5$ and $Immigrant10$ remain significant at the 1% level when citizenship and English controls are added, and the magnitude of the coefficient on $Immigrant5$ is greater, indicating that the longer one lives in the United States, the less predictive their immigration status is of the probability that they are licensed. However, this result still demonstrates the hindrance to immigrant assimilation imposed by occupational licensing, since even as immigrants learn English and acquire citizenship, their immigration status alone still makes them less likely to enter better remunerated licensed professions as many as ten years after arrival.

5.2.1 Non-Parametric Methods

The permutation test looks for a causal link between immigration and licensing status by considering the counterfactual: if immigration status is unrelated to licensing outcomes, then the observed distribution of immigrants who are licensed is a good as random. However, I find that permuting the immigrant-status of individuals yields test statistics that are greater than the observed value 88% of the time; under randomization, we could expect to see an immigration-based licensing gap as large as we do only 12% of the time. The graph in Figure 1 reflects this p-value of 0.12 as the vertical line at zero, my observed value, crosses

the empirical CDF at that cumulative density. Moreover, I am able to calculate a p-value for each state by seeing where the observed state estimate falls within the distribution of placebo estimates before aggregating the differences. On a state-by-state basis, the p-value is 0.1 or greater in 39 of the 50 states. That the observed fraction of immigrants who are licensed is in the lower tail of the distribution strongly indicates that immigration status has a significant effect on licensure, confirming earlier parametric results.

The Dinardo-Fortin-LeMieux decomposition of the differences in licensure rates among immigrants and non-immigrants using individual-level ACS data yields two relevant results. We see that education accounts for a mere 2% of the licensing-immigration gradient, while reweighting by English proficiency can account for 38% of the licensing-immigration gradient. One reason that reweighting on education may not explain much of the gap is if the relationship between educational attainment and occupational mix, and therefore licensure status, is different for immigrants and non-immigrants; if so, then reweighting based on education would match educational attainment covariates across the two groups but might not make the occupational distribution of the two groups be more similar, and thus neither would be the licensure distribution. This is likely the case given the number of highly-educated immigrants who are considered underemployed by the BLS (2016).

The result concerning English proficiency echoes that of the previous logistic regression that considered English proficiency as a positive predictor of licensure status among immigrants. Moreover, the significance of English proficiency in later regressions informs our understanding of the results in Table 5, where I found that exams as part of licensing requirements were a strong negative predictor of immigrant employment in an occupation. Presumably, the exams are in English, so the impact of English proficiency on licensing outcomes is more pervading than it may appear upon first glance. However, as the propensity score results show, reweighting for English proficiency does not completely close the gap: a 5% difference persists.

5.3 Likelihood of Being Licensed: Educational Characteristics

In line with my previous findings, I find that dropout status is negatively associated with working in a licensed occupation, whether one has completed some high school or not. There is little evidence from this specification that there is a degree effect in play; in fact, when including both the *Dropout* dummy and the *DropoutSomeHS* dummy (the former of which is necessarily equal to one if the latter is equal to one), I see that, contingent on being a dropout, having attended some high school is significantly positively associated with licensing status. Moreover, when I restrict the sample to exclude grade-restricted occupations, I find that the coefficients on both *Dropout* and *DropoutSomeHS* decrease slightly in magnitude, but remain significant at the 1% level. This indicates that while including occupations with minimum grade requirements was, expectedly, biasing my result toward finding a steeper dropout-licensing gradient, my results are robust to excluding these cases. The implication of this robustness is that the licensing policies in themselves, as opposed to specifically targeted requirements, are discouraging or preventing dropouts from entering licensed occupations. Looking at only occupations that do not have minimum grade requirements, I find that being a high school dropout is associated with a 8.9% decrease in the probability of being licensed; for those high school dropouts who have completed some high school, the dropout-licensing gradient is reduced to 5.5%.

5.4 Wage Premiums for Immigrants

Finally, I analyze the effect of licensure on wages. My results show that licensed workers earn higher wages than non-licensed workers, that immigrants earn lower wages than non-immigrant workers, and that licensed immigrants earn higher wages than their non-licensed peers.

The coefficients on the immigration tenure dummies estimate the shift in the conditional mean logged wage as an immigrant spends more time living in the U.S. I find that these coefficients are all statically significant at the 1% level and are negative, and decreas-

ing in magnitude as tenure in the U.S. increases. This indicates that the wage gap between immigrants and non-immigrants closes somewhat as immigrants assimilate. Only the interaction term of the $Immigrant10$ dummy with licensure status is statistically significant. It is positive, indicating that immigrants who have been in the U.S. for over ten years do see a significant wage gain to licensure. The wage premium of licensing for those who immigrated within the past 10 years is not statistically significant, indicating that the overall licensing premium observed for immigrants is likely driven by that seen for immigrants who have been in the U.S. for over ten years.

6 Conclusion

This work was originally motivated by the observation that states without large highly educated populations and with large immigrant populations have the most stringent licensing requirements for low-income occupations. This would seem to support a barriers-to-entry model of occupational licensure, whereby more stringent occupational licensing increases the barriers to entry into an occupation thereby excluding groups that are unable to advocate against the passage of such laws. Additionally, considering the labor market distortions that arise from occupational licensing requirements, I sought to investigate whether not only the presence of a licensing requirement, but the particular types of requirements imposed, affect employment outcomes disproportionately along demographic lines.

The results of this paper are consistent with the barriers-to-entry model as my findings suggest that immigrants and high school dropouts are less likely to be employed in licensed occupations. These results are robust to a variety of specifications and inclusion of various controls. In decomposing the differences in licensure rate among these demographic groups and the wider population, I note that English proficiency, the number of exams, citizenship status, and time in the United States are all significantly related to immigrant licensure outcomes. I attempt to better estimate the permeating effect of English proficiency on immi-

grant outcomes using a propensity score weighting method, finding that English proficiency differences can account for 38% of the licensing-immigration gradient. However, gaps persist. For high school dropouts, unemployment rates are significantly associated with the level of low-income licensure in a state, suggesting that states that implement such regulations have additional unobservable characteristics that create negative outcomes for dropouts. High school dropouts are a particularly interesting case, since many regulations include minimum grade requirements that necessarily keep dropouts out. However, my results are robust to excluding such state-occupation cells and thus it suggests that even if requirements do not include explicit grade requirements, they still have a negative effect on dropout outcomes.

As the national debate over the merits of occupational licensing continues, understanding how licensing can have varied impacts across different constituencies is important for estimating the true costs and benefits. Informed policy decisions about the merits of such requirements will need to consider these disproportionate effects in order to construct regulatory environment that is more inclusive.

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8 Tables

Table 1: State-Level Summary Statistics

Variables	Mean	Std. Dev.	Min	Max	Obs.
Licensure Rank (2017)	26	14.86607	1	51	51
State Unemployment	4.145234	.961198	2.43549	6.531309	51
Immigrant Unemployment	3.503922	.6049664	2.5	5.2	51
Dropout Unemployment	8.687017	2.567139	4.073034	16.92667	51
Percent Immigrant	9.482353	6.229244	1.6	26.9	51
Percent Dropout	11.10588	2.892709	7	17.5	51
Civilian Population in Labor Force	2586563	2994896	236432	16400000	51
Percent Bachelor's Degree	30.63333	6.229917	19.9	56.6	51
Percent High School	88.89412	2.892709	82.5	93	51

Note: Table reports summary statistics for state-level data presented in section 3.

Table 2: Individual-Level Summary Statistics

Variables	Mean	Std. Dev.	Min	Max	Obs.
Licensed	.7705779	.4204616	0	1	446867
Fees	90.81265	112.8314	0	3150	446867
Exams	2.209963	1.834912	0	5	446867
Days Lost 1 Week	.7287354	.4446128	0	1	446867
Days Lost 1 Month	.0363483	.1871554	0	1	446867
Days Lost 1 Year	.1301949	.3365182	0	1	446867
Dropout	.1049575	.306499	0	1	446867
Dropout Some HS	.0887636	.2844026	0	1	446867
Immigrant	.2166037	.4119307	0	1	446867
Immigrant0	.0225525	.1484719	0	1	446867
Immigrant5	.025335	.1571408	0	1	446867
Immigrant10	.1687162	.3745015	0	1	446867
Citizenship	.9038238	.2948331	0	1	446867
English Proficiency	.9412266	.2352004	0	1	446867
Wage	24671.17	28127.28	0	714000	446867

Note: Table reports summary statistics for individual-level data presented in section 3. Observations are weighted using ACS sampling weights.

Table 3: Occupation-Level Summary Statistics

Occupation	ACS Code	States Licensed	Employment per 1000 Jobs	Exams	Fees	Days	Require 12th
Animal Breeder	6020	28	0.01	0	81	0	0
Barber	4500	51	0.13	2	154	368	13
Bartender	4040	13	4.30	0	2	0	0
Bus Driver	9120	51	4.80	5	99	100	0
Cosmetologist	4510	51	2.47	2	177	386	17
Crane Operator	9510	18	0.31	1	79	78	0
Dental Assistant	3640	9	2.37	0	24	16	3
Emergency Medical Technician	3400	51	1.77	2	108	35	13
Forest Worker	6120	1	0.05	0	6	0	0
Gaming Cage Worker	5130	29	0.11	0	99	0	0
Gaming Supervisor	4300	30	0.21	0	272	0	0
Locksmith	7540	14	0.12	0	46	15	1
Massage Therapist	3630	44	0.73	1	321	122	19
Mobile Home Installer	7550	39	0.02	1	263	237	1
Optician	3520	22	0.53	1	194	308	21
Packer	9640	6	4.92	0	4	0	0
Preschool Teacher	2300	51	3.86	0	59	6	3
Security Guard, Unarmed	3930	34	7.76	0	1	14	0
Social and Human Service Assistant	2016	1	2.69	0	15	47	0
Taxi Driver/Chauffeur	9140	16	1.39	0	29	0	0
Travel Agency	4830	7	0.47	0	21	0	0
Truck Driver	9130	51	21.42	0	30	0	0
Upholsterer	8450	10	0.23	2	482	2010	1
Weigher	5630	25	0.51	4	106	79	0

Note: Exams, Fees, and Days Lost are averages across states. States Licensed and states that require 12th grade reflect the total number of states in each category. Employment per 1000 jobs taken from the BLS (2017).

Table 4: State-Level Correlations Between Licensure Ranking and Unemployment (2017)

	(1) Licensure Rank (2017)	(2) State UE	(3) Immigrant UE	(4) Dropout UE
% High School	0.190	-0.213***		
	(0.890)	(0.047)		
% Bachelor's Degree	0.657**			
	(0.284)			
State Population	0.113	-0.005	-0.000	-0.009
	(0.069)	(0.003)	(0.004)	(0.008)
Licensure Rank Low		0.001	-0.057	-1.301**
		(0.211)	(0.219)	(0.574)
Licensure Rank High		-0.042	0.098	1.300**
		(0.386)	(0.192)	(0.615)
% Immigrant Population	-1.703***		0.046**	
	(0.364)		(0.021)	
State UE			0.104	2.044***
			(0.106)	(0.262)
% Dropout Population				-0.190
				(0.114)
R^2	0.272	0.339	0.247	0.577
N	51	51	51	51

Note: Table reports regression coefficients with robust standard errors reported in parentheses. In column (1) the dependent variable, Licensure Rank (2017), reflects how onerous a state's licensing regime is relative to other states (1 being the most onerous, and 51 the least), and comes from Carpenter et al. (2017)'s methodology, which considers both the number of low-income occupations licensed in a state as well as the stringency of the existing requirements. In columns (2) through (4) the dependent variables are the overall state unemployment rate, state unemployment rate among immigrants, and state unemployment rate among high school dropouts, respectively. This regression includes the 50 U.S. states and Washington, D.C. and looks only at the year 2017. State-level data for dropout unemployment and overall unemployment is taken from ACS 2017 1-year estimates, while all other demographic data is taken from ACS 2013-2017 pooled 5-year estimates. High School and Bachelor's Degree reflect the share of a state's population with at least that level of education. Thus the fraction of a state's population having completed high school and the fraction that dropped out sum to one. Licensure Rank Low is a dummy variable reflecting whether an occupation's Licensure Rank is in the bottom quartile; Licensure Rank High is a dummy variable reflecting whether an occupation's Licensure Rank is in the top quartile. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Effects of Licensing Requirements on Immigrant and High School Dropout Employment (2017)

	(1) Immigrant	(2) Immigrant	(3) Immigrant	(4) Dropout	(5) Dropout	(6) Dropout
Licensed	-3.831***	-2.571*	-1.920	-1.707*	0.241	1.657
	(1.009)	(1.472)	(1.692)	(0.855)	(1.355)	(1.601)
Fees		0.005	0.005		-0.010***	-0.008***
		(0.004)	(0.004)		(0.002)	(0.002)
Exams		-1.067**	-1.032**		0.003	0.086
		(0.402)	(0.391)		(0.319)	(0.299)
Days Lost 1Week			1.473			3.310***
			(1.834)			(1.123)
Days Lost 1Month			-5.991***			0.583
			(1.846)			(3.805)
Days Lost 1Year			1.096			-0.420
			(1.674)			(1.067)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.268	0.275	0.280	0.052	0.067	0.075
N	970	970	970	970	970	970

Note: Table reports regression coefficients with standard errors clustered at the state level in parentheses. In columns (1) through (3), the dependent variable is the percent of workers in a state-occupation cell that are immigrants. In columns (4) through (6), the dependent variable is the percent of workers in a state-occupation cell that are high school dropouts. All above regressions consider only the year 2017. Employment statistics are constructed by aggregating individuals surveyed in the 2017 ACS in the 24 occupations in my universe, and licensing requirements are for the year 2017. This regression includes the 970 state-occupation cells that are represented (i.e. there exists at least one individual) in the 2017 ACS across the 51 states (including Washington, D.C.) and 24 occupations. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: Logistic Regression: Likelihood of Working in a Licensed Occupation by Immigration Characteristics

	(1) Licensed	(2) Licensed	(3) Licensed	(4) Licensed	(5) Licensed
Immigrant	-0.539***		-0.383***	-0.414***	
	(0.080)		(0.092)	(0.084)	
Immigrant0		-0.731***			-0.375***
		(0.097)			(0.107)
Immigrant5		-0.738***			-0.465***
		(0.110)			(0.116)
Immigrant10		-0.473***			-0.309***
		(0.079)			(0.095)
Citizenship			0.347***		0.210***
			(0.074)		(0.056)
English Proficiency				0.544***	0.467***
				(0.102)	(0.090)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.062	0.063	0.063	0.064	0.065
N	446867	446867	446867	446867	446867

Note: Table reports regression coefficients with standard errors clustered at the state level in parentheses. The dependent variable in each column reflects the likelihood of being licensed. All above regressions include state and year fixed effects, as well as controls for standard demographic characteristics including quadratics in age and education, and all observations are weighted using ACS sampling weights. The results are for the years 2012 through 2017. The dummy variables Immigrant0, Immigrant5, and Immigrant10 indicate that an individual immigrated to the U.S. between 0 and 5 years ago, between 5 and 10 years ago, or over 10 years ago, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 7: Marginal Effects: Likelihood of Working in a Licensed Occupation by Immigration Characteristics

	(1) Licensed	(2) Licensed	(3) Licensed	(4) Licensed
Immigrant	-0.054***			
	(0.016)			
Immigrant0		-0.014		
		(0.009)		
Immigrant5			-0.040***	
			(0.010)	
Immigrant10				-0.033***
				(0.012)
Citizenship	0.038***	0.072***	0.069***	0.062***
	(0.009)	(0.008)	(0.007)	(0.007)
English Proficiency	0.078***	0.092***	0.090***	0.087***
	(0.015)	(0.014)	(0.014)	(0.014)
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	446867	446867	446867	446867

Note: This table reports marginal effects at the mean, with standard errors clustered at the state level. The dependent variable in each column is a dummy indicator for being licensed, such that the marginal effects can be considered the change in the conditional probability of being licensed. I regress and report the marginal effects separately for each immigrant indicator because the three time-related indicators are mutually exclusive. Margins above taken from a logistic regression that includes state and year fixed effects, as well as controls for standard demographic characteristics including quadratics in age and education, and all observations are weighted using ACS sampling weights. The results are for the years 2012 through 2017. The dummy variables Immigrant0, Immigrant5, and Immigrant10 indicate that an individual immigrated to the U.S. between 0 and 5 years ago, between 5 and 10 years ago, or over 10 years ago, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8: Immigrant Licensure Gap: Propensity Score Weighting Methods

Reweighting on Education	Licensing Rate	Gap Relative to Immigrants
Immigrants	0.705	—
Non-Immigrants	0.790	8.5%
Non-Immigrants, reweighted	0.788	8.3%
% of gap accounted for by reweighting		2.0%

Reweighting on English Proficiency	Licensing Rate	Gap Relative to Immigrants
Immigrants	0.703	—
Non-Immigrants	0.789	8.6%
Non-Immigrants, reweighted	0.756	5.3%
% of gap accounted for by reweighting		38.0%

Note: This is a DFL (1996) decomposition of the differences in licensure rates among immigrants and non-immigrants using individual-level ACS data. For the first table, I divide the educational distribution into buckets with corresponding indicators, in order to calculate weights that give non-immigrants the same educational distribution as immigrants. I also include year fixed effects, as I use data from years 2012 through 2017, and preserve ACS sampling weights throughout. I then recalculate the implied licensure rates, reweighting by educational attainment, in order to estimate the role of educational difference in driving the gap between immigrant and non-immigrant licensure. I repeat this analysis, reweighting by English proficiency instead of education, for the second table. When reweighting on education, I drop observations for which educational attainment is unknown, resulting in slightly different baseline licensing rates for each group between the two propensity score methods.

Table 9: Logistic Regression: Likelihood of Working in a Licensed Occupation by Educational Characteristics

	(1) Licensed	(2) Licensed	(3) Licensed	(4) Licensed	(5) Licensed	(6) Licensed
Dropout	-0.679***		-1.210***	-0.514***		-0.991***
	(0.066)		(0.049)	(0.066)		(0.057)
Dropout Some HS		-0.448***	0.567***		-0.316***	0.508***
		(0.048)	(0.062)		(0.050)	(0.064)
Excludes Grade-Restricted Occupations	No	No	No	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.054	0.052	0.055	0.083	0.082	0.084
N	446867	446867	446867	397285	397285	397285

Note: Table reports regression coefficients with standard errors clustered at the state level in parentheses. The dependent variable in each column reflects the likelihood of being licensed. All above regressions include state and year fixed effects, as well as controls for standard demographic characteristics including quadratics in age and education, and all observations are weighted using ACS sampling weights. The results are for the years 2012 through 2017. The dummy variables Dropout and Dropout Some HS indicate that an individual did not graduate from high school, and that an individual attended some high school but did not graduate, respectively. Since some state-occupation cells require a minimum grade level in order to obtain a license, looking at the effect of licensing requirements on the employment of high school dropouts across the entire universe of state-occupation cells biases me toward finding a larger exclusionary effect than should be associated with the presence of any licensing requirement alone. Therefore, I run the above regressions twice: once on the entire universe, and then again excluding all state-occupation cells that have any minimum grade requirement. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 10: Marginal Effects: Likelihood of Working in a Licensed Occupation by Educational Characteristics

	(1) Licensed	(2) Licensed	(3) Licensed	(4) Licensed
Dropout	-0.113***		-0.089***	
	(0.011)		(0.012)	
Dropout Some HS		-0.075***		-0.055***
		(0.008)		(0.009)
Excludes Grade-Restricted Occupations	No	No	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	446867	446867	397285	397285

Note: This table reports marginal effects at the mean, with standard errors clustered at the state level. The dependent variable in each column is a dummy indicator for being licensed, such that the marginal effects can be considered the change in the conditional probability of being licensed. Margins above taken from a logistic regression that includes state and year fixed effects, as well as controls for standard demographic characteristics including quadratics in age and education, and all observations are weighted using ACS sampling weights. The results are for the years 2012 through 2017. The dummy variables Dropout and Dropout Some HS indicate than an individual did not graduate from high school, and that an individual attended some high school but did not graduate, respectively. Since some state-occupation cells require a minimum grade level in order to obtain a license, looking at the effect of licensing requirements on the employment of high school dropouts across the entire universe of state-occupation cells biases me toward finding a larger exclusionary effect than should be associated with the presence of any licensing requirement alone. Therefore, I run the above regressions twice: once on the entire universe, and then again excluding all state-occupation cells that have any minimum grade requirement. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

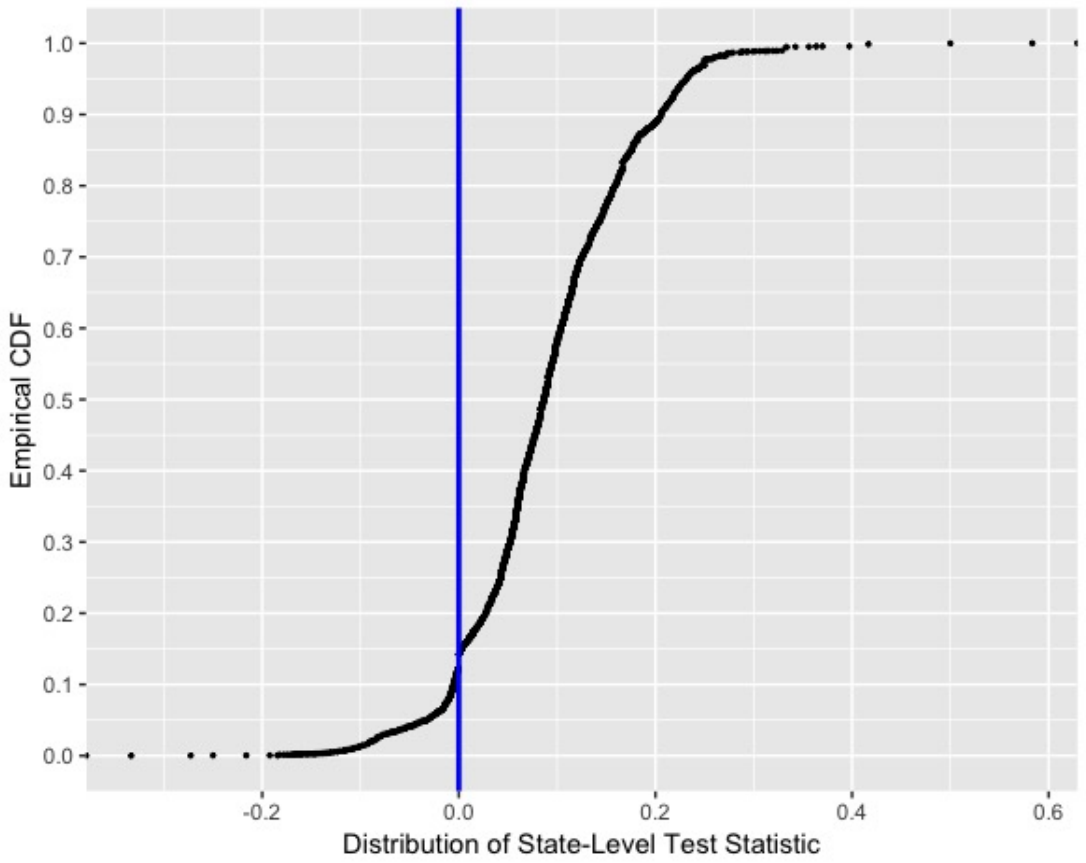
Table 11: Wage Effects of Licensing and Immigration

	(1) log(Wage)	(2) log(Wage)	(3) log(Wage)
Licensed	0.129***	0.109***	0.110***
	(0.027)	(0.025)	(0.025)
Immigrant		-0.108***	
		(0.030)	
Immigrant x Licensed		0.060**	
		(0.029)	
Immigrant0			-0.312***
			(0.036)
Immigrant0 x Licensed			0.044
			(0.038)
Immigrant5			-0.094**
			(0.046)
Immigrant5 x Licensed			-0.015
			(0.044)
Immigrant10			-0.069**
			(0.032)
Immigrant10 x Licensed			0.056**
			(0.028)
State Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
R^2	0.194	0.195	0.196
N	354907	354907	354907

Note: Table reports regression coefficients with standard errors clustered at the state level in parentheses. The dependent variable in each column is logged wages. There are fewer observations in this regression than the other individual-level regressions due to the number of wages reported as zero, which I do not transform and thus are dropped when I take the log. All above regressions include state and year fixed effects, as well as controls for standard demographic characteristics including quadratics in age and education, and all observations are weighted using ACS sampling weights. The results are for the years 2012 through 2017. The dummy variables Immigrant0, Immigrant5, and Immigrant10 indicate that an individual immigrated to the U.S. between 0 and 5 years ago, between 5 and 10 years ago, or over 10 years ago, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

9 Figures

Figure 1: Distribution of Differences in State-Level Placebo Estimates and Observed Values: Percentage of Immigrants Who are Licensed



Note: This figure plots the empirical distribution of the difference between the placebo effects and observed value of the percentage of immigrants who are licensed within a state. For each of the 50 U.S. states, I preserve the number of immigrants in each state, and randomly assign immigrant-status to individuals. After permuting the immigrant-status of each individual, I calculate the fraction of permuted immigrants that are licensed. I do this 1,000 times per state. (This allows me to calculate a p-value for each state by seeing where the observed estimate falls within the distribution of placebo estimates; these p-values are not reported but are discussed in my results section.) In order to collapse my state-level data, I calculate the difference between every placebo estimate and the observed value in that state, and plot these 50,000 differences on the above graph. The vertical line at zero shows where the observed estimate falls in the CDF, as I benchmarked the observed value in each state to zero. The overall p-value, corresponding to the above graph, is 0.12.

10 Appendix

As mentioned in my Data section, I impute licensure status and the licensing requirements faced by an individual based on their year-state-occupation cell. Therefore, I chose only occupations that uniquely matched to ACS occupational codes in order to minimize imputation error.

However, some closely related occupations that share an ACS code see very similar licensing requirements in many states. I therefore include four pairs of occupations that share an ACS occupational code: bus drivers and school bus drivers, fire and security alarm installers, gaming supervisors and slot key persons, and truck drivers which include both general truck drivers as well as tractor-trailer truck drivers. Each of these pairs of occupations face very similar requirements in each state, so I group them together in order to increase my sample size, always taking the least burdensome requirement in every category for each state-occupation cell. That is, where a state's licensing requirements did differ between the two occupations that I group together, I record the less burdensome requirement in each category, and then construct my licensing requirements assuming all workers within that state-occupation cell face these least imposing burdens. By always taking the lesser of the requirements, I bias my results against finding costs associated with licensure.

In order to include fees, exams, and days lost in my panel data, I took a weighted average of the fees, exams, and days lost between 2012 and 2017. For each intermediate year, the fees and exams calculated reflect the 2012 data point weighted by the number of years since 2012 plus the 2017 data point weighted by the number of years before 2017. I do not attempt to research the fees or exams or estimate the days lost on my own in order not to stray from the consistent approach by which Carpenter et al. reported the data (2012, 2017).

For occupations that are reported as changing over the two editions, I researched the year

in which the change took place. In some cases, I found that occupations classified as newly regulated had in fact been regulated in years prior to 2012. When this was the case, I change the data from 2012 to reflect the 2017 requirements. Note that when a mistake was found, I corrected it, but I did not exhaustively check every state-occupation cell for accuracy. For occupations that did in fact change regulatory status between 2012 and 2017, I code them as being unregulated before the change, and impute fees, exams, and education backward from the reported 2017 data until they year in which the change was implemented.

Year Regulatory Changes Implemented

Occupation	State	Became Unregulated	Became Regulated	Exams	Year
Barber	Alabama		1	2014	
Security Guard	Alabama		1	2009	
Massage Therapist	Alaska		1	2014	
Packager	Arizona	1		2016	
Massage Therapist	Colorado		1	2014	
Dental Assistant	D C		1	2013	
Security Guard	Hawaii		1	2010	
Massage Therapist	Idaho		1	2012	
Animal Breeder	Maryland		1	2017	
Gaming Cage Worker	Maryland		1	2013	
Gaming Supervisor	Maryland		1	2013	
Dental Assistant	Massachusetts		1	2010	
Gaming Cage Worker	Massachusetts		1	2015	
Gaming Supervisor	Massachusetts		1	2015	
Massage Therapist	Michigan		1	2009	
Animal Breeder	Minnesota		1	2014	
Massage Therapist	Montana		1	2010	
Gaming Cage Worker	New York		1	2014	
Gaming Supervisor	New York		1	2014	
Dental Assistant	Oklahoma		1	2013	
Locksmith	Oregon		1	2010	
Massage Therapist	Pennsylvania		1	2011	
Animal Breeder	Tennessee	1		2014	
Animal Breeder	Wisconsin		1	2009	

For preschool teachers, the 2012 data looked only at temporary licenses, while the 2017 data looked at consistently renewable licenses. The latter better reflects the type of license that most preschool teachers have, so I use the 2017 requirements for all previous years. After calling certain states Departments of Education (Alabama, Alaska, Arizona, and Connecti-

cut), I was given the impression that the requirements do not frequently change so I did not attempt to research the requirements of the continually renewable licenses in 2012.