THE SURVEY OF INCOME AND PROGRAM PARTICIPATION

ANALYZING THE LABOR MARKET OUTCOMES OF OCCUPATIONAL LICENSING

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Abstract: Recent assessments of occupational licensing have shown varying effects of the institution on labor market outcomes. This study revisits the relationship between occupational licensing and labor market outcomes by analyzing a new topical module to the Survey of Income and Program Participation (SIPP). Relative to previously available data, the topical module offers more detailed information on occupational licensing from government, with a larger sample size and access to a richer set of person-level characteristics. We exploit this larger and more detailed dataset to examine the labor market outcomes of occupational licensing and how workers obtain these licenses from government. More specifically, we analyze whether there is evidence of a licensing wage premium, and how this premium varies with aspects of the regulatory regime such as the requirements to obtain a license or certification and the level of government oversight. After controlling for observable heterogeneity, including occupational status, those with a license earn higher pay, are more likely to be employed, and have a higher probability of retirement and pension plan offers.

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1. Introduction

The study of the regulation of occupations has a long and distinguished tradition in economics (Smith, 1937). Some economists have viewed such regulation through the prism of rent-seeking behavior and have empirically examined the economic effect of occupational licensing within that framework (Friedman and Kuznets, 1945 and Friedman, 1962). In contrast, others have suggested that regulation provides incentives for workers to enhance their human capital through greater investments in their work life (Shapiro, 1986).

As an empirical issue, occupational licensing has become an increasingly important factor in the regulation of services in the United States. The number of occupations that require a license from government has grown since the 1970s and the percentage licensed has been increasing as well (Greene, 1969, Kleiner, 2006). The number of studies analyzing the labor market institution of occupational regulation, however, has not been growing proportionately.

Perhaps one of the largest barriers standing in the way of analyzing occupational licensing has been that there is no well-organized national dataset available for examination. No national or state data exist to assess the wage effects of occupational licensing. Although the Bureau of Labor Statistics surveys workers on their union status, and also asks whether they are displaced through the Current Population Survey, no information is currently collected about whether individuals are certified or licensed as a condition of employment. Although occupational associations, such as the American Bar Association and the American Dental Association, collect wage and salary data, and the number of new entrants and pass rates by state through the early 1980s, the state pass rate information is no longer tabulated or released to the public. Moreover, state licensing boards often are reluctant to or do not have reliable data to provide this information to researchers.

New data to address important licensing issues have, however, recently become available. Specifically, we analyze the 2008 panel of the Survey of Income and Program Participation (SIPP). This panel is a large, nationally representative dataset covering the period May 2008 through November 2013. This is the first time a large government survey specifically asked questions about licensing and certification. Moreover, our examination of the role of licensing is extended beyond wage determination to include the analysis and evaluation of employee benefits.

Because estimates about the potential costs and benefits of licensing are difficult to obtain, our ability to use these new data should advance knowledge about the labor market effects of certification and licensing. For the most part, economists interested in studying occupational licensing have needed to find ways to pull together their own data and approaches (Kleiner and Krueger, 2010 and 2013 and Kleiner and Vorotnikov, 2012). An example of one approach is examining why states or countries have different occupational licensing requirements. Why does Massachusetts currently license almost three times as many occupations as Rhode Island (Wheelan, 1999)? Is occupational licensing endogenous to the industrial, occupational, demographic or political composition of a state? Recent empirical work in political economy suggests that political influence and funding of licensing initiatives by the professions are the most important factors influencing whether an occupation becomes regulated by the states (Graddy, 1991; Wheelan, 1999).

Another approach to examining licensing might be to seek to find ways to examine the actual skill levels of certain occupations. Although regulated occupations routinely require license-holders to attend continuing education seminars, examinations on the contents are rarely given to the persons that attend, and denial of permission to work in the occupations once an

individual passes the initial licensing exam is highly unusual. Finally, thinking about the policy implications of empirical research in this area, it is important to keep in mind the policy option of certification. This potential substitute for licensing allows consumers or employers to choose whether they are willing to pay a higher wage for someone with greater state or private-documented skills. It is plausible to think that certification would have lesser effects on labor market outcomes within an occupation, because it would not restrict supply as tightly, and also that it would have lesser effects on quality. Thus, certification offers an intermediate choice between the extremes of no state or private role in qualifications at all and the absolute requirement of having a license before working at certain occupations. Our study also examines the influence of certification.

Prior to 2006, the data available on occupational licensing in the U.S. were restricted to classifications as to whether various occupations were licensed at the state level, often based on the America's Career InfoNet data (Kleiner and Krueger, 2010 and 2013). These classifications could be linked to Census occupational employment data to derive estimates of the proportion of workers in licensed jobs. While informative, there are clear limitations of such data. First, compliance with state licensing requirements could be less than complete; some of those classified as working in licensed occupations may not in fact be licensed. Moreover, many of the workers may be covered by occupational licensing statutes but not have attained one (Gittleman and Kleiner, 2013). Second, in some occupations there is a trial period when workers can work in a job before becoming licensed. For example, accountants may work in an accounting firm prior to obtaining their license. Third, and probably most important, the state data miss licensing that takes place at the local and federal level. Kleiner and Krueger (2013) report that restricting analysis to state licensing would miss 10.5 percent of licensed workers, while another 49.8

percent of licensed workers had a credential that was issued by the state and some other jurisdiction.

As employment in the United States shifted from manufacturing to service industries, the members of the occupations established a formal set of standards that governed members of the occupation. Wheelan (1999) argues that, for a professional association, obtaining licensing legislation meant raising funds from members to lobby the state legislature, particularly the chairs of appropriate legislative committees. In addition, the occupation association often solicits volunteers from its membership to work on legislative campaigns. With both financial contributions and volunteers, the occupational association has a significant ability to influence legislation and its administration, especially when opposition to regulatory legislation is absent or minimal.

Occupational regulation refers to mechanisms to impose minimum standards (often educational standards) for entry and the ability to continue working in an occupation. These regulations range from less restrictive (e.g., requirements to register their names, addresses, and qualifications with a government agency), having an exclusive right to a title, known as certification, to very restrictive (e.g., licensure, where it is illegal to practice for pay without meeting government standards). We are able to examine these concepts with the data we use from the SIPP.

We contrast the results from the SIPP with those obtained from the Princeton Data Improvement Initiative (PDII) (Kleiner and Krueger, 2013). The PDII used the results of a telephone survey of the workforce conducted by Westat that asked detailed questions on occupational regulation as well as questions on the labor market status of individuals in 2008. These questions probe the kind of government regulation required to perform a job, the process

of becoming licensed, and the level of education and tests necessary to become licensed. The results of the Westat survey, as well as separate validation results from a related Gallup survey, indicate that occupational licensing can be reasonably well measured in labor force surveys. However, the small sample of slightly more than 2,200 individuals and the resulting lack of representativeness for some groups may bias some of those results. We expect that using the SIPP with its larger sample size and more detailed set of labor market questions would further our analysis of the role of occupational licensing in the labor market. We next, however, provide a background for our empirical results, by examining the rationale for occupational regulation within different institutional frameworks.

2. Theories of Occupational Licensing

Here we review the evolution of theories of occupational licensing, ranging from the mechanistic ones to those that utilize human capital theory. We begin by outlining the simplest theory of occupational licensing, which draws more heavily on administrative procedures than on economics. We then incorporate insights from more complex theoretical models that challenge some of the straightforward assumptions of the simple theory and which thereby provide richer insights into the operation and effects of regulation.

A simple theory of occupational licensing envisions a costless supply of unbiased, capable gatekeepers and enforcers. The gatekeepers screen entrants to the occupation, barring those whose skills or character suggest a tendency toward low-quality output. The enforcers monitor incumbents and discipline those whose performance is below standard with punishments that may include revocation of the license needed to practice. Assuming that entry and performance are controlled in these ways, the quality of service in the profession will almost automatically be maintained at or above standards that are set by the gatekeeper to the

profession. Within this approach only those who have the funds to invest in training and the ability to do the work are able to enter the occupation.

Introducing economics to this otherwise mechanical model by noting that a key discipline on incumbents — the threat of revoking one's license — may not mean much if incumbents can easily re-enter the profession, such as by moving to a new firm, or by shifting to an alternative occupation with little loss of income. Since grandfathering (i.e., allowing current workers to bypass the new requirements) is the norm when occupations seek to become licensed, incumbent workers are usually supportive of the regulation process. In the absence of grandfathering, lower skilled workers in the occupation may have to seek alternative employment. For example, if sales skills are the key to both providing licensed sales of heart monitors and the unlicensed selling of shoes or cars, then individuals may shift between these lines of work with little loss of income.

Under these circumstances, meaningful discipline for license holders may require deliberate steps to ensure that the loss of license entails significant financial loss. Such additional steps could include imposition of fines, improved screening to prevent expelled practitioners from re-entering the occupation, or requiring all incumbents to put up capital that would be forfeited upon loss of the license. To offset the possibility that incumbents could shift to other occupations with little loss of income, entry requirements could be tightened to limit supply and create monopoly rents within the licensed occupation. The threat of losing these monopoly rents could, in principle, give incentives to incumbents to maintain quality standards. This may also result in some increases in human capital investments in order to attain the additional requirements. The rents could also motivate potential entrants to invest in high levels of training in order to gain admittance. This suggests that licensing can raise quality within an industry by restricting supply, raising labor wages.

State-regulated occupations can use political institutions to restrict supply and raise the wages of licensed practitioners. There is assumed to be a once-and-for-all income gain that accrues to current members of the occupation who are grandfathered in, and do not have to meet the newly established standard (Perloff, 1980). Generally, workers who are grandfathered are not required to ever meet the standards of the new entrants. Individuals who attempt to enter the occupation in the future will need to balance the economic rents of the field's increased monopoly power against the greater difficulty of meeting the entrance requirements.

Once an occupation is regulated, members of that occupation in a geographic or political jurisdiction can implement tougher statutes or examination pass rates and may gain relative to those who have easier requirements by further restricting the supply of labor and obtaining economic rents for incumbents. Restrictions would include lowering the pass rate on licensing exams, imposing higher general and specific requirements, and implementing tougher residency requirements that limit new arrivals in the area from qualifying for a license. Moreover, individuals who have finished schooling in the occupation may decide not to go to a particular political jurisdiction where the pass rate is low because both the economic and shame costs may be high.

One additional effect of licensing is that individuals who are not allowed to practice at all in an occupation as a consequence of regulation may then enter an unlicensed occupation, shifting the supply curve outward and driving down wages in these unregulated occupations. If licensing requirements contain elements of required general human capital, then it is possible that these workers may raise the average skill level in their new occupation.

3. Data

To analyze a range of labor market effects of occupational regulation, we employ data from the 2008 panel of the Survey of Income and Program Participation (SIPP). This panel is a large, nationally representative dataset covering the period May 2008 through November 2013. Every four months, respondents answer a core group of questions about the preceding four months. These responses provide detailed monthly information about demographics, employment situations, earnings, and a variety of other characteristics. Respondents also answer a separate group of topical questions that vary from one interview or "wave" to the next. We primarily utilize the Professional Certifications, Licenses, and Educational Certificates topical module linked with Core data from the thirteenth wave of the 2008 panel, collected between September and December 2012. In addition, we refer to previous topical modules to SIPP in order to estimate the impact of license and certification attainment on non-wage benefits. Specifically, we exploit the Employer-Provided Health Benefits topical module in the sixth wave and the Retirement and Pension Plan Coverage topical module in the eleventh wave.

3.1 Professional Certifications, Licenses, and Educational Certificates Topical Module[1]

This topical module offers data about the most recent license or certification that a respondent earned. To begin, all respondents aged 16 and over answered the question:

> *"Do/Does you/he/she have a professional certification or a state or industry license?"*

Responses to this question are of primary interest for our analysis, as they enable us to investigate how labor market outcomes differ for those who obtain these credentials. Individuals who had attained a professional certification or license then answered:

> *"Who awarded this certification or license?"*

[1] See Ewert and Kominski (2014) for a description of this dataset. The Federal Interagency Working Group on Expanded Measures of Enrollment and Attainment developed and tested the survey questions which constitute this topical module. See Bielick, et. al. (2013) for details regarding the development process.

Finally, these respondents replied whether the awarding body required three common minimum standards in order to earn and maintain the credential: taking courses or training, demonstrating skills while on the job or passing a test or exam, and taking periodic tests or continuing education classes or earning CEUs (continuing education units).

Our data bear several important advantages for our analysis. First, the topical module contains a direct measure of credential attainment. Other large, nationally representative datasets including the decennial census and the Current Population Survey lack such measures. Studies that employ these datasets infer license attainment from occupational affiliation and, sometimes, state; if regulations require a license to perform an occupation, then any respondent in that occupation is imputed to have achieved a license. Consequently, previous examinations of the labor market impacts of licensing in large, nationally representative datasets limit themselves to relatively few institutional settings, thereby diminishing their external validity.[2] A second issue with this imputation strategy is that Kambourov and Manovskii (2008) and others have documented evidence of substantial measurement error in occupational affiliation. Measurement error in occupational affiliation could create measurement error in licensure status.

Kleiner and Krueger (2013) also emphasize the importance of direct measures of license and certification attainment. In explaining the relative inattention given to these prevalent

[2] Law and Marks (2009) use the decennial census to document how the introduction of licensing regulations during the Progressive Era affected outcomes in eleven detailed occupations. Kleiner (2006) and Klee (2013) exploit variation across states and over time in the stringency of licensing regulations to analyze wage effects for four detailed occupations in the decennial census and Current Population Survey, respectively. Kleiner (2000) compares average earnings across four licensed occupations and similar unlicensed occupations. Kleiner (2006) presents average wage changes from National Longitudinal Study of Youth, 1979 (NLSY79) respondents who moved into and out of licensed occupations. One notable exception is Gittleman and Kleiner (2013). They construct a comprehensive list of licensed occupations and categorize each state-by-occupation pair along two dimensions: whether no, some or all workers must have a license and how long this licensing policy has been in effect. They estimate the licensing wage effect using the NLSY79. While their regulatory data improve external validity, a direct measure of license attainment would facilitate identifying the licensing wage premium in occupations that were only partially licensed. In the absence of such a direct measure, the authors report a range of wage effects under extreme assumptions about the fraction of workers in the occupation that has a license and the starting date of the licensing regulation.

policies, they claim "a major reason for the lack of empirical work has been the absence of national data that clearly defines whether a worker is regulated and the extent of regulation". Our data help fill that void. Kleiner and Krueger (2013) find that attaining a license confers a significant wage premium. This relationship persists when they attempt to mitigate selection bias by using only within-occupation wage variation to identify this effect. However, their sample size was relatively small, at about 2,200 respondents, with a low response rate compared to government labor force surveys. SIPP's large sample size, its second advantage, allows for more externally valid and more precise estimates of the wage benefits of professional licenses. Increased precision is especially advantageous when estimating models that include occupation fixed effects.

A third advantage of SIPP is that Core data include a breadth of information about individuals and their labor market outcomes. This improves our ability to control for observable heterogeneity which might be correlated with both attainment and labor market outcomes.[3] This variety of data also expands our ability to analyze how the attainment of licenses and certifications relates to non-wage benefits. Many surveys lack information about these forms of compensation, perhaps explaining why this relationship remains an understudied topic.[4]

Our data also have some limitations for our analysis. First, the Professional Certifications, Licenses, and Educational Certificates topical module does not allow us to distinguish confidently between respondents who have earned licenses and respondents who

[3] Kleiner and Krueger (2010, 2013) report that, on average, workers who have attained a license are more educated, more likely to belong to a union, and more likely to work for a public employer. Kleiner and Krueger (2013) also note that workers who have attained a license are older on average and more likely to work in the services sector. Ewert and Kominski (2014) conclude that licenses and certifications are more common among individuals who are more educated, non-Hispanic White, aged 30 through 49, native born, and employed.

[4] To our knowledge, Gittleman and Kleiner (2013) is the only previous examination of the relationship between licensing and non-wage benefits, though their analysis, because it used the NLSY79, is cohort-specific and does not cover the entire prime working age range.

have earned certifications.[5] Both credentials signal a worker's quality to potential employers in markets characterized by asymmetric information. The fundamental difference between a license and a certification is that a licensed worker may not practice by law without a license, whereas a certified worker may practice by law without a certification.

Our main explanatory variable of interest indicates whether an individual had attained either a license or a certification. We refer to this classification as "Definition 1". We also use characteristics of respondents' credentials to construct a classification of licensed and certified workers. In particular, we assume that a respondent had attained a license if a federal, state, or local government issued that respondent's credential. By contrast, we assume that a respondent had attained a certification if a private agency issued that respondent's credential.[6] We refer to this classification as "Definition 2". This definition assumes that licensing regulations may require practitioners to obtain only government-issued credentials, and that privately issued credentials may not serve as a legal basis for restricting the right to practice. While this assumption is likely invalid for some occupations, it is generally consistent with the current institutional context across the United States. One disadvantage of this criterion is that the topical module only asked respondents about the characteristics of their newest credential. Therefore, our classification will suffer from measurement error to the extent that workers obtained both a license and a certification.

[5] By contrast, Kleiner and Krueger (2013) distinguish confidently between licensed and certified workers utilizing the question: "*Would someone who does not have a license or certificate be legally allowed to do your job?*" The SIPP topical module does include the following question: "*Is this certification or license required for your/his/her current or most recent job?*" Some respondents might have interpreted this question as asking whether the credential was a legal requirement. Differences in legal requirements would allow us to distinguish licensed from certified workers. Other respondents might have interpreted this question as asking whether the credential was an informal requirement. Examples of such informal requirements occur when employers require the credential to consider a job candidate qualified or when completing a task requires some proficiency that only credentialed workers possess. To the extent that informal requirements and legal requirements do not align, this interpretation would not allow us to distinguish licensed from certified workers. We lack sufficient information to determine the relative prevalence of these two interpretations and, consequently, do not use this question to define licensing status.

[6] Private organizations that issue credentials in our data include industries, businesses, companies, nonprofit organizations, professional associations, and other private associations.

.A second limitation of our data is that SIPP collects information on up to two jobs and up to two businesses, but respondents did not indicate the job or business for which their credential was relevant.[7] We assume that the credential was relevant only for the job or business on which a respondent earned the most income during a particular reference month, which we refer to as the "main" job or business in that month. We drop all other jobs and businesses in that month, regardless of a respondent's licensure or certification status. Regressions include job- or business-level information on hourly wages (derived from monthly earnings, usual weekly hours worked and weeks worked), union status, occupation, broad industry affiliation, establishment size, and employer type.[8] These variables will suffer from measurement error to the extent that respondents held credentials which were not relevant for "main" jobs or businesses.

Demographics, job- or business-level information, and employment status come from Core data in the same wave of SIPP. We also use these Core data to derive an employer-sponsored health insurance outcome that we employ to examine the impact of licenses and certifications on non-wage benefits. Specifically, respondents with employer-sponsored health insurance chose whether their employer paid all, part, or none of that plan's premium. We use this question to create a variable which takes a value of 1 for respondents whose employers paid the entire health insurance premium and 0 for all other respondents who had health insurance through their employer.[9] One problem with this variable is that respondents with multiple jobs or businesses did not identify which employer sponsored their health insurance plan. Consequently, this variable will suffer from measurement error to the extent that workers

[7] By contrast, the survey described by Kleiner and Krueger (2013) specifically asked about licenses and certifications that were relevant for respondents' main job.
[8] Monthly earnings include regular hourly pay and salary, tips, overtime, commissions, bonuses, and cash awards. For business owners, monthly earnings also include profits.
[9] Note that this variable is undefined for respondents with health insurance coverage through a spouse's plan only.

provided information about health insurance obtained through jobs or businesses for which their licenses and certifications were irrelevant.

Our sample contains respondents aged 18 through 64 who worked in the civilian labor force. For all analyses, we restrict our sample to individuals who provided valid data for the dependent variable.[10] When we classify a worker's licensure or certification status according to Definition 1, we restrict the sample to respondents who provided valid data about credential attainment. When we classify a worker's licensure or certification status according to Definition 2, we also restrict the sample to respondents who provided valid data about the source of their credential.[11] Finally, in models that include occupation fixed effects, we restrict the sample to respondents who provided valid data on their occupational affiliation.

Table 1 reports summary statistics for licensed and certified civilian workers. Of civilian workers aged 18 through 64, 27.97 percent had attained a license or certification in Fall 2012. Sample attrition likely biases this estimate upwards. By Wave 13, a considerable portion of initial respondents has exited the sample.[12] Zabel (1998) provides evidence that sample attrition was more likely among respondents of the 1990 SIPP panel who were unemployed or out of the labor force in the previous wave. Ewert and Kominski (2014) illustrate that respondents who were unemployed or out of the labor force for each of the previous four months were less likely

[10] Because we drop observations with imputed dependent variables, our results are not representative of the entire U.S. population of civilian workers aged 18 through 64. The Census Bureau does not account for licensure or certification status in the imputation process. Including observations with imputed dependent variables without modeling non-response would bias estimates toward zero according to Hirsch and Schumacher (2004). Future work should consider more carefully the impact of non-response on the estimated wage benefits and non-wage benefits accruing to licensed and certified workers.

[11] Typically, the Census Bureau imputes data for individuals who provided an invalid response to a question in SIPP. However, these invalid responses remain in the Professional Certifications, Licenses, and Educational Certificates topical module. Item non-response rates were relatively small at 2.462 percent for the direct measure of credential attainment and 1.370 percent for the source of the credential.

[12] Of the 105,663 respondents who participated in Wave 1 of SIPP, only 66,034 participated in Wave 13 of SIPP. An additional 10,954 Wave 13 respondents entered the sample after Wave 1.

to have attained a license or certification.[13] Table 1 also presents summary statistics when we classify licensure and certification status according to Definition 2. Under this assumption, 19.75 percent of civilian workers aged 18 through 64 had attained a license and 7.96 percent of this population had attained a certification. Table 2 describes who issued the credential and how workers achieved the credential. Among licensed or certified workers, 64.10 percent received their credential from the state. In order to obtain their credential, 93.05 percent of workers needed to complete courses or training.

Table 3 lists the most common occupations for licensed or certified individuals in our data. Table 4 lists the analogous occupations when we classify licensure and certification status according to Definition 2. The most commonly regulated occupations in our data are commonly regulated in practice, which suggests that our data are reliable. Nevertheless, the relatively low percentage of workers in some universally licensed occupations who report having a credential suggests that the data remain imperfect. Consider the 138 individuals whose responses classify them as physicians or surgeons on their "main" job or business. Absent measurement error in occupational affiliation, regulations predict that all of these respondents had obtained a professional license. Of the 138 physicians or surgeons, only 107 reported that they had attained a license or certification.[14] Of these 107 respondents, Definition 2 would classify only 86 as licensed. This deviation from predicted attainment likely reflects measurement error in attainment data in some cases.[15] However, direct measures of attainment could help us identify

[13] Beginning with Wave 1 of the 2014 panel, SIPP will offer a direct measure of credential attainment and information about who issued these credentials. Consequently, it will be possible to estimate the percentage licensed and certified based on a sample that minimizes attrition bias.
[14] Kleiner and Krueger (2013) report that all fourteen physicians and surgeons in their data had attained a license.
[15] One potential source of measurement error is proxy response. If a household member is absent at the interview, SIPP allows a household member who is present at the interview to answer on behalf of the absent household member. This form of data collection is known as a proxy interview. Proxy respondents might have relatively poor knowledge of other household members' occupations or credential attainment status. To gauge the degree to which proxy response explains the deviation from predicted attainment that we observe in the data, we compared the

measurement error in occupational affiliation in other cases. This example suggests that it is unclear whether direct measures of license attainment dominate indirect measures that are implied by occupational affiliation when all practitioners must achieve a license. However, direct measures of license and certification attainment likely dominate these indirect measures when practitioners may exercise their occupation legally without a credential.

3.2 Topical Modules in Earlier Waves of 2008 SIPP

As noted, another advantage of our data is the capability to link the Professional Certifications, Licenses, and Educational Certificates topical module to other topical modules that accompanied previous waves of SIPP. This substantially expands the set of outcomes that we can analyze. For instance, Core SIPP data contain very little information about access to employer-sponsored retirement and pension plans.[16] To improve upon this information, we utilize data from the Retirement and Pension Plan Coverage topical module, collected between January and April 2012 in Wave 11 of SIPP. The availability of previous topical modules also enables us to expand our estimation sample for some analyses. Core SIPP data contain information on employer-sponsored health insurance offers only for respondents who have no coverage. To expand our estimation sample, we utilize data from the Employer-Provided Health Benefits topical module, collected between May and August 2010 in Wave 6 of SIPP.

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incidence of proxy response across workers with and without a credential in various universally licensed occupations. While 43.0 percent of physicians and surgeons with a license or certification resulted from a proxy response, 32.3 percent of physicians and surgeons with no license or certification resulted from a proxy response. This evidence seems inconsistent with the hypothesis that proxy responses play a disproportionate role in explaining the deviation from predicted attainment. We also found a generally comparable incidence of proxy response among cosmetologists, lawyers, and registered nurses with a credential and those without a credential.

[16] In the Core SIPP, there is no direct information on retirement and pension plan offers. We can infer that respondents who received income from retirement or pension plans must have been offered such a plan. However, we cannot distinguish those who were not offered a retirement or pension plan from those who chose not to participate. Moreover, Core SIPP data include no characteristics of the job or business that sponsored respondents' plans. Consequently, we cannot infer whether a respondent's credential was relevant for this job or business.

The Retirement and Pension Plan Coverage topical module asked all respondents aged 15 and over who held a job or owned a business as of the end of the reference period whether their "main" job or business offered a pension or retirement plan to anyone.[17] If a respondent replied affirmatively, the topical module then asked whether the respondent participated in one of these plans. Respondents who did not participate then selected all of the reasons why they had no coverage. Several of these reasons indicate ineligibility to receive a retirement or pension plan offer.[18] We use these responses to derive a variable which takes a value of 1 for respondents who participated in or were eligible for a retirement or pension plan through their "main" job or business and a value of 0 for all other respondents aged 15 and over who worked in the civilian labor force at the end of the reference period. We link this variable to licensing and certification variables from Wave 13 and to demographics and characteristics of the "main" job or business from Wave 11 Core SIPP data.

Our expanded measure of employer-sponsored health insurance offers stems from both Core SIPP and the Employer-Provided Health Benefits topical module. Core SIPP asked all respondents whether they had health insurance coverage in their own name or in someone else's name. Respondents with health insurance then replied whether a current employer sponsored this health insurance plan. The topical module asked working respondents aged 15 and over without health insurance sponsored by their current employer whether their employer offered health insurance to anyone. Respondents answering affirmatively then chose the reason why they did not participate. One of these reasons indicates ineligibility to receive a health insurance offer. We use these responses to derive a variable which takes a value of 1 for respondents who

[17] This topical module defines the respondent's "main" job or business as the largest earnings source during the four month reference period.

[18] The reasons that indicate ineligibility are: the employer offered no plan to anyone in the respondent's type of job, the respondent was not working at the job long enough to qualify, the respondent was too old or too young to qualify, and the respondent was ineligible by virtue of being a part-time or temporary employee.

participated in or were eligible for an employer-provided health insurance plan and a value of 0 for all other respondents aged 15 and over who worked in the civilian labor force at the end of the reference period. We link this variable to the licensing and certification variables from Wave 13 and to demographics and characteristics of jobs or businesses from Wave 6 Core SIPP data.

While these previous topical modules afford the benefit of expanding the set of labor market outcomes that we can examine, one key obstacle impedes our use of these data. Specifically, the Professional Certifications, Licenses, and Educational Certificates topical module does not offer data regarding when respondents attained their credentials. Consequently, we can observe licensure and certification status as of September through December 2012, but this information is unobservable as of January through April 2012 and May through August 2010. One potential solution is to assume that workers' licensure and certification status remained unchanged across all three reference periods. This assumption seems more likely to hold for the reference period January through April 2012 than for May through August 2010. Under this assumption, our primary explanatory variable of interest would suffer from measurement error to the extent that respondents attained credentials or allowed credentials to lapse between these three reference periods.

We pursue an alternative solution that restricts the estimation sample, likely resulting in less measurement error but also diminished external validity. In particular, we assume that a worker's licensure and certification status in Wave 13 matched that worker's status in a previous wave if that respondent's "main" occupational spell in Wave 13 was ongoing in that preceding wave. Workers in a licensed occupation may not practice by law without the credential, so workers whose licenses lapse likely change occupations. Similarly, employers might view a certification as a signal of a worker's quality, so workers whose certifications lapse may be more

likely to change occupations. Thus, we restrict our sample to include only those workers whose "main" occupational spell in Wave 13 was ongoing in the relevant previous wave. For the Retirement and Pension Plan Coverage topical module, we further require that a worker's occupation on the "main" job or business was the same in Wave 13 and Wave 11. Note that the Employer-Provided Health Benefits topical module collects information about benefits on any job or business. Consequently, our indicator variable for health insurance offers will suffer from measurement error to the extent that workers provide information about health insurance plans on jobs or businesses for which their licenses and certifications were irrelevant.

4. Empirical Approach

Before turning to our results, we briefly sketch the empirical approach that we take. The main goal of this study is to assess the impact of holding a license on various labor market outcomes. The first question we will address is whether those obtaining a license earn a wage premium. To do so, we will estimate regressions of the following form:

$$lnWage_{mi} = \beta_0 + \beta_1 License_i + \beta_2 X_i + \beta_3 Z_{mi} + \varepsilon_{mi} \quad (1)$$

where the dependent variable, $lnWage_{mi}$, is the log of hourly wages in month m for individual i, $License_i$ indicates whether individual i holds a license (under definition 1 or definition 2), X_i is a vector of independent variables that does not vary by month, Z_{mi} is a vector of explanatory variables that does vary by month, and ε_{mi} is the error term.

Besides hourly wages, as noted, we are also interested in assessing licensing status's impact on other outcomes, including the probability of employment, of being offered employer-sponsored health insurance and of being offered a retirement plan. Representing these 1-0 outcomes as Y_i, we estimate regressions of the following form:

$$Y_i = \beta_0 + \beta_1 License_i + \beta_2 X_i + \beta_3 Z_{mi} + \varepsilon_i \quad (2)$$

If ε_i is drawn from a normal distribution, then equation 2 implies a probit. Regardless of whether we are estimating a wage regression or a regression for a limited dependent variable, sample weights are used, and standard errors are estimated via balanced repeated replication (BRR) in order to take into account the complex survey design of the SIPP.

One must be cautious about interpreting the coefficient β_1 as causal, given that those with a license may differ from those without a license in ways unobserved by the econometrician.[19] With our cross-sectional data, we control as best as we can for observable heterogeneity. For each of our outcomes, we estimate specifications with no occupation controls, with 2-digit occupation fixed effects and then with 3-digit occupation fixed effects. In these cases, identification is coming from within-occupation comparisons, which may be across states with different licensing requirements or within a state between those who have attained a license and those who have not. It should also be noted that to the degree there is measurement error in determining licensing status, the coefficient on licensing will be biased toward zero.[20] While it is likely that the SIPP module has less measurement error in licensing status than would be the case if we imputed licensing status on the basis of regulations, we have noted anomalies that suggest the presence of measurement error nonetheless.

5. Results

In this section, we assess the benefits accruing to workers with a professional license or certification. We first report the wage gains associated with these credentials. We then examine whether the source of a credential or the requirements to earn or maintain a credential matter for

[19] See Kleiner and Krueger (2013) for some discussion of the difficulty of finding viable instruments for licensing.
[20] To gauge an aspect of this attenuation bias, we estimate average wage differentials across workers with and without a credential in various universally licensed occupations. Physicians and surgeons without a license or certification do not earn significantly less than physicians and surgeons with a license or certification, although this coefficient was estimated relatively imprecisely (standard error 16.6 percent). However, registered nurses without a license or certification earn 24.7 percent (standard error 8.3 percent) lower wages than registered nurses with a license or certification after controlling for observable characteristics. We find qualitatively similar results when we classify license attainment status according to Definition 2.

wages. Next, we consider the non-wage benefits of license and certification attainment. We study these effects both in Wave 13 Core data and in data from previous topical modules. After documenting the average impact of professional licenses and certifications on wages and non-wage benefits, we close by analyzing the distributional effects of these credentials.

5.1 Wages

We begin in Tables 5 through 8 by performing a wage analysis similar to that in Kleiner and Krueger (2013). We restrict the sample to person-month observations from respondents who were employed in the civilian labor force at the end of the month. We additionally restrict the sample to observations from respondents who provided valid data on union status and whose implied hourly wages fell between $5 and $100. Kleiner and Krueger (2013) employ sample selection criteria that differ from ours along two dimensions: they set a different standard for outliers in the upper tail of the hourly wage distribution and they allow for almost no imputed data. While the estimation sample in Kleiner and Krueger (2013) contains only one wage observation per respondent, our sample contains up to four. We also control for the same set of observables to the extent possible; our explanatory variables do not include measures of math and reading skills, we replace a quadratic in work experience with a quadratic in age, and we create a service worker indicator variable based on industry codes. Finally, we assume that a worker's licensure and certification status remained unchanged over the reference period of May through November 2012.

First, we estimate the impact of professional license and certification attainment on wages.[21] Panel A of Table 5 presents the results of regressions that do not distinguish between

[21] The dependent variable is hourly wage on the "main" job or business implied by monthly earnings, usual weekly hours worked, and number of weeks worked during that month.

licensed and certified workers.[22] Column (1) illustrates that workers who have attained either of these credentials earn approximately 23.6 percent higher wages on average.[23] Columns (2) through (4) document that once we account for observable heterogeneity the wage premium associated with these credentials falls. Estimates in column (4) suggest that workers with a license or certification earn approximately 6.5 percent (standard error 0.9 percent) higher wages on average controlling for detailed occupation. By comparison, union workers earn approximately 18.2 percent (standard error 1.1 percent) higher wages on average than non-union workers after accounting for observable heterogeneity including detailed occupation. While Gittleman and Kleiner (2013) also conclude that the union wage effect outstrips the licensing wage effect, they find no evidence of a licensing wage premium in models that include 3-digit occupation fixed effects.

We favor the estimates in column (4) of Table 5. These estimates exploit only wage variation within 3-digit occupations to identify the effect of a credential, thereby mitigating potential selection bias. This strategy yields a comparable interpretation of the estimated wage premium relative to the corresponding estimate in existing studies that focus on a more limited set of occupations. Since our identification strategy relies on variation in credential attainment within 3-digit occupations, we do not interpret our estimate of 6.5 percent as the wage premium accruing to all licensed or certified individuals.[24] In the absence of measurement error, wage

[22] Unless otherwise stated, all comparisons in the text are significant at the 90 percent level. The estimates discussed here are based on responses from a sample of the population and may differ from the actual values because of sampling variability and other factors. For information on sampling and nonsampling error see: http://www.census.gov/programs-surveys/sipp/tech-documentation/source-accuracy-statements.html.

[23] Throughout, as an approximation, we equate log points with percentage differences.

[24] Note that the variation in credential attainment that we exploit in this paper may be either within-state variation or across state variation. We also estimated the regressions in Tables 5, 6, 10, 11, 12, and 13 including state fixed effects to exploit only within-state variation in credential attainment. Only one coefficient estimate changed in sign or statistical significance; after controlling for observables including detailed occupation, licensed workers were more likely than unlicensed and uncredentialed workers to receive employer-sponsored health insurance offers in Panel B of Table 13. Estimates are available from the authors upon request.

variation within universally licensed 3-digit occupations (e.g. physicians and surgeons, lawyers) would not contribute to the identification of our preferred estimate of the effect of a credential. Only wage variation within certified or partially licensed 3-digit occupations (e.g. accountants and auditors, elementary and middle school teachers) would contribute to the identification of our preferred estimate of the effect of a credential. However, Table 3 shows that some workers in universally licensed 3-digit occupations report having no license or certification, which suggests that we do not identify the true effect of a credential due to measurement error.

Our inability to distinguish confidently between licensed and certified workers according to Definition 1 implies that the estimated wage premium in Panel A of Table 5 is a weighted average of the gains accruing to licensed and certified workers. Kleiner and Krueger (2013) fail to reject the hypothesis of no certification wage premium, while they do show evidence that workers with a license earn a wage premium. These conclusions suggest that the wage premium according to Definition 1 underestimates the wage effect of a license. This might explain why our estimate falls below the consensus range of licensing wage premia between 10 percent and 15 percent that Kleiner and Krueger (2013) cite. In Panel B of Table 5, we utilize the source of a worker's credential to distinguish between licensed and certified workers. Column (4) implies that, according to Definition 2, licensed workers earn approximately 5.0 percent higher wages on average relative to workers who have no credential and workers who have a certification.

Table 6 summarizes the results of regressions that include indicators for licensed and certified workers according to Definition 2. Column (4) notes that after controlling for observable heterogeneity including detailed occupation, licensed workers earn approximately 6.2 percent (standard error 1.0 percent) higher wages on average than unlicensed and uncertified workers. Certified workers earn approximately 7.3 percent (standard error 1.3 percent) higher

wages on average than unlicensed and uncertified workers. One potential reason why these results differ from those in Kleiner and Krueger (2013) is that SIPP yields relatively precise estimates of certification wage effects, owing to its large sample size. We cannot reject the hypothesis that the coefficient estimates on the indicators for licensed and certified workers are equal. These estimates should differ only because licenses are required for entry into an occupation while certifications are not. To the extent that we accurately classify workers' licensure and certification status, this finding suggests that the signal that a credential sends might influence wages more than the labor supply restrictions which licensing policies impose.

Tables 7, 8, and 9 decompose the wage effects of professional licenses and certifications. In particular, Table 7 analyzes how the wage gain varies with the level of the jurisdiction that issues the credential. We restrict the estimation sample to individuals who provided valid data about the source of their credential. Respondents selected only one issuing body, so we cannot determine how levels of jurisdiction interact to impact wages.[25] Table 7 reports evidence that only credentials issued by local governments are not associated with higher wages on average, regardless of whether we control for observable heterogeneity. Estimates in column (4) control for detailed occupational affiliation. Relative to workers with no credential, workers with a federally-issued credential earn 8.9 percent (standard error 2.7 percent) higher wages, workers with a state-issued credential earn 6.1 percent (standard error 1.1 percent) higher wages, and workers with a privately-issued credential earn 7.3 percent (standard error 1.3 percent) higher wages on average. Thus, we join Kleiner and Krueger (2013) in concluding that federally-issued and state-issued credentials exert a significant influence on wages, while locally-issued

[25] By contrast, Kleiner and Krueger (2013) employ data that allowed respondents to select all relevant levels of jurisdiction. They show how each type of jurisdictional interaction affects wages. They conclude that, after controlling for observable heterogeneity including detailed occupation, only state-issued credentials have any wage effect in isolation. They estimate significant wage premia associated with credentials that were issued by both the state and federal government and credentials that were issued by both the state and local government.

credentials do not appear to influence wages. However, our data also reveal that privately-issued credentials are associated with a comparable wage premium relative to federally-issued credentials and state-issued credentials. This underscores an advantage of the SIPP topical module relative to the survey which Kleiner and Krueger (2013) use, as that survey did not request information about privately-issued credentials.

Table 8 investigates how various requirements to attain a license impact wages[26]. We restrict the estimation sample to individuals who provided valid data about these requirements. Column (5) of Panel A shows that after controlling for observable heterogeneity including detailed occupation, workers who take courses or training to achieve the credential earn 6.6 percent (standard error 2.3 percent) higher wages on average. Similarly, workers who take periodic exams or continuing education classes to maintain the credential earn 5.5 percent (standard error 1.4 percent) higher wages on average. Panel B demonstrates that these requirements are also associated with a wage premium when we classify licensed workers according to Definition 2. Workers who demonstrate skills on the job or pass an exam to obtain their credentials do not seem to earn higher wages on average. We reject the hypothesis that none of these three licensing requirements helps determine wages. Moreover, column (4) of Panel A suggests that workers with a credential who do not need to meet any of these three requirements earn lower wages than workers with no credential. Column (5) of Panel B yields a corresponding inference when we classify licensed workers according to Definition 2. Kleiner and Krueger (2013) find no evidence of higher wages among workers who must meet these

[26] In the appendix, we examine the relationship between whether or not a respondent indicated a license was required and wages. Although we do not know if respondents are interpreting this as a legal requirement, the exercise is similar to an analysis in Kleiner and Krueger (2013). The results in the appendix show that having a license when it is not required has no influence on wage determination, but, when it is required, licensing raises wages by 8.4 percent. This wage premium is larger than the one associated with a certification requirement, although the difference is not statistically significant at the 90 percent confidence level.

requirements to attain their licenses. They fail to reject the hypothesis that no licensing requirement helps determine wages in models that control for observable heterogeneity. The contrast in our inferences relative to those of Kleiner and Krueger (2013) might stem from the relative precision with which we estimate the wage effects of licensing requirements.

Some policymakers and policy analysts claim that licenses and certifications are particularly important for individuals with lower levels of traditional educational attainment. For example, a credential might signal high quality especially effectively in labor market segments where potential service providers have lower than average levels of traditional educational attainment. To evaluate this hypothesis, Table 9 allows for heterogeneous licensing wage effects by quartile in the distribution of average education levels by occupation.[27] We restrict the estimation sample to individuals who provided valid occupation data. Column (4) of Panel A reveals that licensed or certified workers in each quartile of the distribution of average education levels by occupation earn more on average relative to workers with no credential.[28] We cannot reject the hypothesis that the coefficient estimates for each quartile are equal. On the other hand, Column (4) of Panel B reports that according to Definition 2 licensed workers in the second, third, and fourth quartiles earn, respectively, 5.4 percent, 2.9 percent, and 8.1 percent more than unlicensed workers. In testing for the presence of heterogeneous effects, we reject the hypotheses that the coefficients on the fourth and first quartiles are equal and that the coefficients on the fourth and third quartiles are equal.

5.2 Non-Wage Benefits from Wave 13 Core Data

[27] To our knowledge, no existing study has allowed explicitly for heterogeneous licensing wage effects by occupation. Ewert (2014) concludes that there are heterogeneous wage effects of a credential by own education.
[28] Sample weights were used to calculate average education levels by occupation. The quartile cutoffs for this distribution are located at 12.73, 13.67, and 15.08 years of education.

We next exploit SIPP data on non-wage benefits in order to determine whether licenses and certifications confer gains along these dimensions as well. In this section, we discuss the results of analyses for the reference period of May through November 2012 using Wave 13 Core data. These analyses assume that a worker's licensure and certification status remained unchanged over the reference period.

Table 10 presents the estimated coefficients and marginal effects of a probit regression which explains monthly employment status as a function of person-level and job-level observables. We restrict the estimation sample to respondents aged 18 through 64 who worked in the civilian labor force in Wave 13 and those who did not work in wave 13 but were on layoff, looked for work, or were unable to find work. Estimation sample members who did not work in wave 13 worked in at least one previous wave of the 2008 SIPP panel. The dependent variable takes a value of 1 for individuals who were employed during a particular reference month and 0 for all other individuals. While existing studies have examined the relationship between licensing and employment at the macroeconomic level, we are aware of no examinations of this relationship at the microeconomic level.[29] Panel A reports that individuals with a professional license or certification are 1.5 percent more likely on average to be employed in a particular month, controlling for observable characteristics of the current or most recent job including detailed occupation. Panel B decomposes this result by licensure and certification status according to Definition 2. Both licensed and certified individuals bear a significantly higher likelihood of employment on average than individuals with no credential. We cannot reject the hypothesis that the coefficient estimates on the indicators for licensed and certified workers are equal.

[29] See Adams, Jackson, and Ekelund (2002) for one study of the relationship between licensing and employment at the macroeconomic level. They estimate labor supply and labor demand functions for cosmetologists.

Finally, we investigate in Table 11 whether licensed or certified workers benefit from more generous employer-provided health insurance. We restrict the sample to respondents who were employed at the end of any reference month. Among the set of civilian workers aged 18 through 64 who had health insurance coverage through their employer, our dependent variable indicates whether this employer paid for the entire health insurance premium. Panel A reveals that workers with a professional license or certification are 3.6 percent more likely on average to receive more generous employer-provided health insurance offers. This advantage is 2.0 percent after controlling for observable heterogeneity including detailed occupation. Panel B decomposes this result by licensure and certification status according to Definition 2. Both licensed and certified workers are more likely to receive more generous employer-provided health insurance offers relative to workers without these credentials. We cannot reject the hypothesis that the coefficient estimates on the indicators for licensed and certified workers are equal.

5.3 Non-Wage Benefits from Previous Topical Modules

We now link the Professional Certifications, Licenses, and Educational Certificates topical module to previous topical modules in order to expand the set of non-wage benefits and broaden our estimation sample. Recall that we restrict the sample to individuals whose "main" occupational spell in wave 13 was ongoing in the relevant previous wave.[30] We then assume that a respondent's observed licensure or certification status in Wave 13 matched the unmeasured, corresponding status in that previous wave. Regressions include demographics and the characteristics of jobs or businesses using Core SIPP data from that previous wave. Our examination of the Retirement and Pension Plan Coverage topical module and the Employer-

[30] Restricting the estimation sample to individuals who had the same occupation on the "main" job or business in Wave 13 and Wave 11 reduces sample size from 39,822 to 17,966. Restricting the estimation sample to individuals whose "main" occupational spell in Wave 13 was ongoing in Wave 6 reduces sample size from 53,849 to 13,573.

Provided Health Benefits topical module assumes a reference period of January through April 2012 and May through August 2010, respectively.

Table 12 details results from the Retirement and Pension Plan Coverage topical module from Wave 11 of SIPP. Among the set of individuals aged 18 through 64 who were employed in the same civilian occupation on the "main" job or business in Wave 13 as in Wave 11, the dependent variable indicates whether respondents received a retirement or pension plan offer. Panel A documents that workers with a professional license or certification are 10.7 percent more likely to receive retirement and pension plan offers on average. Workers with these credentials are 3.4 percent more likely to receive such offers on average after we control for observable heterogeneity including detailed occupation. Panel B of Table 12 decomposes this estimate by licensure and certification status according to Definition 2. Both licensed and certified workers are more likely to receive retirement or pension plan offers than workers without these credentials. By contrast, Gittleman and Kleiner (2013) find no evidence that licensed workers have better access to retirement or pension plans. We cannot reject the hypothesis that the coefficient estimates on the indicators for licensed and certified workers are equal.

Table 13 contains evidence from the Employer-Provided Health Benefits topical module to Wave 6 of SIPP. Among the set of individuals aged 18 through 64 whose "main" civilian occupational spell in Wave 13 was ongoing in Wave 6, the dependent variable indicates whether respondents received an employer-provided health insurance offer. Recall that Core SIPP data include information on such offers only for respondents who had no health insurance coverage. Utilizing a previous topical module more than doubles the sample size. This revised estimation sample yields different inferences about the impact of professional licenses and certifications on

employer-provided health insurance offers.[31] Panel A of Table 13 notes that workers with a license or certification are 5.0 percent more likely to receive employer-provided health insurance offers on average. This advantage is 2.2 percent after controlling for observable heterogeneity including detailed occupation. Panel B of Table 13 analyzes how this effect varies by licensure and certification status according to Definition 2. Only certified workers appear more likely to receive these non-wage benefits than workers without a license or certification. By contrast, Gittleman and Kleiner (2013) find no evidence that licensed workers have better access to employer-provided health insurance plans. We cannot reject the hypothesis that the coefficient estimates on the indicators for licensed and certified workers are equal.

Our decision to restrict the sample to occupation stayers would bias the preceding estimates if workers with a license or certification were differentially likely to change occupations in response to non-wage benefits. Two countervailing tendencies might give rise to such behavior. First, to the extent that non-wage benefits are distributed uniformly across workers in occupations we expect credentialed workers without these benefits to be less likely to change occupations relative to uncredentialed workers without these benefits. Higher average non-wage benefit offer rates suggest that credentialed workers would be more likely to gain access to these benefits by switching employers; switching occupations might require abandoning the credential. Second, to the extent that non-wage benefits are distributed disproportionately within occupations to workers with high ability we expect credentialed workers without these benefits to be more likely to change occupations relative to uncredentialed workers without these benefits. Higher average non-wage benefit offer rates suggest that credentialed workers without non-wage benefits are more likely to be of low ability than

[31] When we use Core SIPP data only, we find no evidence that licensed or certified individuals are differentially likely to receive employer-sponsored health insurance offers. Estimates are available from the authors upon request.

uncredentialed workers without these benefits. Groes, Kircher, and Manovskii (2014) note that workers who are relatively low or relatively high in the within-occupation distribution of wages are more likely to change occupations than workers in the middle of this distribution. This suggests that among those with no non-wage benefits credentialed workers are more likely to change occupations than uncredentialed workers. Consequently, the direction of any sample selection bias is ambiguous *a priori*.

5.4 Distributional Effects

We have documented that professional licenses and certifications are associated with significant wage and non-wage benefits on average. We also might consider whether these credentials affect workers differentially across the wage distribution. To that end, our final exercise examines the distributional effects of licenses and certifications, following Kleiner and Krueger (2013). Tables 14 and 15 present the results when we classify workers' licensure and certification status according to Definition 1 and Definition 2, respectively. In particular, we compute the predicted log wage and squared error for each person-month observation. We then compare the conditional mean log wage and mean squared error both overall and within quartiles of the predicted wage distribution resulting from a regression that omits licensure and certification status. We refer to this distribution as the predicted uncredentialed wage distribution in Table 14 and the predicted unlicensed wage distribution in Table 15. As a benchmark, we report these findings in tandem with the results of an analogous analysis of the distributional effects of unions.[32]

Panel B of Table 14 demonstrates that licensed or certified workers have significantly larger conditional log wages overall than workers who do not have these credentials. This trend

[32] Card (1996) and Freeman (1982) show that unions reduce wage dispersion. Freeman and Medoff (1984) argue that unions view reducing wage variance as a stated objective. Kleiner (2006) states that neither professional associations nor regulatory officials aim to explicitly reduce wage dispersion.

is also evident within each quartile of the predicted uncredentialed wage distribution. Note that licenses and certifications are associated with the largest conditional log wage gain for person-month observations in the bottom quartile of the predicted uncredentialed wage distribution.[33] Panel B of Table 15 leads to the same qualitative inferences. To the extent that we accurately classify these individuals' licensure and certification status, this finding suggests at least two potential explanations. First, the signal that a credential sends might be an especially effective wage determinant among workers whose observable characteristics suggest the lowest earnings. Alternatively, licensing regulations might restrict the supply of practitioners most among workers whose observable characteristics suggest the lowest earnings. Panel A of Tables 14 and 15 illustrates that union membership also appears to increase conditional mean log earnings, both overall and within each quartile of the predicted non-union wage distribution. However, the union conditional log wage gains exhibit no systematic pattern across the quartiles of this distribution. Our conclusions generally corroborate the evidence of Kleiner and Krueger (2013), with the exception that their estimated conditional log wage differential displays no discernible pattern across the predicted unlicensed wage distribution.

Panel B of Tables 14 and 15 reveals a more nuanced impact of professional licenses and certifications on wage dispersion. Contrasting the mean squared error across workers with a license or certification and workers without these credentials, Table 14 suggests that these credentials increase wage dispersion overall. However, this statistic obscures differential impacts of a credential on wage dispersion across the predicted uncredentialed wage distribution. In particular, wage dispersion appears to be higher in the bottom quartile of this distribution

[33] These findings are consistent with the evidence in Timmons and Thornton (2010). They examine the wage effects of licensing among barbers, who are relatively likely to be in the bottom quartile of the predicted uncredentialed wage distribution. Timmons and Thornton (2010) conclude that "certain licensing provisions may have increased barber earnings by between 11 and 22 percent." They note that the magnitude of these estimates is "somewhat higher than those found in studies examining the effects of licensing in similar professions."

among workers with a license or certification. On the other hand, wage dispersion appears to be lower in the top quartile of the predicted uncredentialed wage distribution for workers with a license or certification. Table 15 documents the same qualitative effect of licensing on wage dispersion when we classify workers' licensure status according to Definition 2, except licensing seems not to impact wage dispersion overall. Panel A of Tables 14 and 15 yields the anticipated inference that unions reduce wage dispersion both overall and at the top of the predicted non-union wage distribution. Kleiner and Krueger (2010, 2013) find no evidence that licensing impacts wage dispersion either overall or in any quartile of the predicted unlicensed wage distribution.

6. Conclusions

Taking advantage of the Professional Certifications, Licenses, and Educational Certificates topical module in the thirteenth wave of the 2008 SIPP, we have examined a number of labor market outcomes to see if they differ by licensing status. The use of SIPP offers a number of advantages over other datasets, including a direct measure of attainment, a large sample size, and a rich set of explanatory variables. The ability to link to previous topical modules has also enabled us to extend the analysis beyond just merely estimating a wage premium. Nonetheless, the SIPP topical module does have an important limitation, in that it is sometimes difficult to distinguish between those who have a license and those who have a certification. As a result, throughout our analysis we have used two definitions for licensing status, one where we try to distinguish between license and certification holders and one where we do not. It turns out, however, that the results are broadly consistent across the two definitions. After controlling for observable heterogeneity, including occupational status, those

with a license earn higher pay, are more likely to be employed, and have a higher probability of retirement and pension plan offers.

While the SIPP data enables us to say much about the direction and magnitude of the impact of credentials on various labor market outcomes, unavoidably, in part because of the difficulty in distinguishing between the licensed and the certified, we have less to say about the mechanisms leading to our results. As a result, there is ample scope for other researchers using a variety of datasets and approaches to continue to try to better understand this important labor market institution.

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Table 1
Characteristics of Licensed and Certified Workers

	Definition 1		Definition 2		
Variable	Percent Licensed or Certified	*N*	Percent Licensed	Percent Certified	*N*
Total	27.969	25,703	19.745	7.960	25,601
Gender:					
Male	26.056	13,035	16.799	8.912	12,971
Female	30.059	12,668	22.956	6.913	12,630
Education level:					
Less than H.S.	8.392	1,672	4.978	2.943	1,665
High school	15.340	6,220	9.708	5.379	6,197
Some college	29.741	9,016	19.906	9.535	8,969
College (BA)	32.376	5,669	24.145	8.065	5,655
Post-Graduate	49.607	3,126	38.474	10.894	3,115
Race and Ethnicity:					
White	31.352	18,010	22.411	8.700	17,943
Hispanic	16.817	2,652	11.093	5.401	2,640
Black	24.739	2,540	17.340	6.948	2,523
Other	23.280	2,501	15.734	7.389	2,495
Age:					
25 or under	14.452	3,318	9.508	4.762	3,310
26 - 54	29.789	17,442	20.876	8.658	17,375
55 or older	31.325	4,943	23.286	7.690	4,916
Union status:					
Union	43.127	2,712	34.610	8.222	2,698
Nonunion	26.133	22,321	17.922	7.970	22,242
Private or public:					
Private company	25.670	21,572	16.894	8.507	21,486
Public	40.845	3,974	35.667	4.930	3,958
Industry:					
Service-Providing	30.168	20,692	22.012	7.897	20,608
Goods-Producing	18.670	4,799	10.025	8.355	4,782

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: This table presents means and standard deviations of binomially distributed variables within demographic groups. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month. Summary statistics exclude imputed values. The reference period is May through November 2012. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. "White", "Black", and "Other" categories include both Hispanic and non-Hispanic workers. Union status, public or private employer, and type of work represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. Industry represents supersector according to industries in the 2000 Census industry classification system. We employed balanced repeated replication using a Fay's adjustment factor of 0.5 to estimate the standard deviations. The weighted count of the entire population of U.S. workers aged 18-64 is 123,056,903. The weighted count of U.S. workers aged 18-64 who provided valid data on licensure or certification status is 111,353,769 under Definition 1 and 110,947,820 under Definition 2. We dropped no additional observations due to missing data on gender, education, race, ethnicity, or age. The weighted count of U.S. workers aged 18-64 who provided valid data on licensure or certification status and union status is 108,448,521 under Definition 1 and 108,075,863 under Definition 2. The weighted count of U.S. workers aged 18-64 who provided valid data on licensure or certification status and employer type is 110,714,075 under Definition 1 and 110,308,126 under Definition 2. The weighted count of U.S. workers aged 18-64 who provided valid data on licensure or certification status and supersector is 110,466,028 under Definition 1 and 110,063,034 under Definition 2.

Table 2
Requirements for Becoming Licensed or Certified

	Definition 1		Definition 2		
Variable	% of Licensed or Certified Workers Facing Requirement	*N*	% of Licensed Workers Facing Requirement	% of Certified Workers Facing Requirement	*N*
Requirement:					
Courses or Training	93.0	7,211	93.4	92.1	7,133
Skills or Exam	92.0	7,183	91.9	91.8	7,111
Continuing Education	69.5	7,080	73.4	60.3	7,019
Level of government:					
Federal only	4.8	7,160	6.8	0	7,160
State only	64.1	7,160	89.9	0	7,160
Local only	2.3	7,160	3.3	0	7,160
Private only	28.7	7,160	0	1	7,160

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: This table presents means and standard deviations of binomially distributed variables within demographic groups. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month. Summary statistics exclude imputed values. The reference period is September through December 2012. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. We employed balanced repeated replication using a Fay's adjustment factor of 0.5 to estimate the standard deviations. The weighted count of the entire population of U.S. workers aged 18-64 is 123,056,903. The weighted count of U.S. workers aged 18-64 who provided valid data on licensure or certification status is 111,353,769 under Definition 1 and 110,947,820 under Definition 2. The weighted count of licensed or certified U.S. workers aged 18-64 who provided valid data on course or training requirements is 30,932,728 under Definition 1 and 30,620,715 under Definition 2. The weighted count of licensed or certified U.S. workers aged 18-64 who provided valid data on skill or exam requirements is 30,807,925 under Definition 1 and 30,518,287 under Definition 2. The weighted count of licensed or certified U.S. workers aged 18-64 who provided valid data on continuing education requirements is 30,379,474 under Definition 1 and 30,127,288 under Definition 2. The weighted count of licensed or certified U.S. workers aged 18-64 who provided valid data on the source of their credential is 30,725,219.

Table 3
Most Common Occupations for Credentialed Workers: Definition 1

Rank	Occupation	*N*	Percent Licensed or Certified
1	Registered nurses	1854	85.714
2	Elementary and middle school teachers	1783	75.200
3	Nursing, psychiatric, and home health aides	845	56.072
4	Driver/sales workers and truck drivers	767	40.820
5	Secondary school teachers	719	77.646
6	Lawyers	598	77.161
7	Managers, all other	526	23.556
8	Hairdressers, hairstylists, and cosmetologists	437	89.366
9	Physicians and surgeons	421	81.431
10	Accountants and auditors	363	33.333

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month. Summary statistics exclude imputed values. The reference period is May through November 2012. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Occupations represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. Most common occupations have the largest number of person-month observations with a license or certification within the occupation.

Table 4
Most Common Occupations for Credentialed Workers: Definition 2

Rank	Occupation	*N*	Percent Licensed	Occupation	*N*	Percent Certified
1	Elementary and middle school teachers	1683	71.1	Registered nurses	279	13.0
2	Registered nurses	1563	72.7	Managers, all other	226	10.1
3	Secondary school teachers	693	75.2	Driver/sales workers and truck drivers	194	10.4
4	Nursing, psychiatric, and home health aides	636	42.8	Nursing, psychiatric, and home health aides	189	12.7
5	Driver/sales workers and truck drivers	560	30.0	Automotive service technicians and mechanics	141	22.8
6	Lawyers	491	63.7	Electricians	129	26.9
7	Hairdressers, hairstylists, and cosmetologists	351	71.8	Retail salespersons	125	5.3
8	Physicians and surgeons	337	66.2	Computer scientists and systems analysts	116	17.4
9	Managers, all other	300	13.4	Lawyers	103	13.4
10	Accountants and auditors	264	24.3	Insurance sales agents	100	24.0

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month. Summary statistics exclude imputed values. The reference period is May through November 2012. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Occupations represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. Most common occupations have the largest number of person-month observations with a license or certification within the occupation.

Table 5
The Effect of Licensing and Certification on Wages

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.236***	0.080***	0.076***	0.065***
	(0.010)	(0.010)	(0.009)	(0.009)
R^2	0.033	0.340	0.441	0.514
N	77,294	75,793	75,605	75,605
Panel B: Definition 2				
Licensed	0.217***	0.061***	0.067***	0.050***
	(0.010)	(0.010)	(0.009)	(0.009)
R^2	0.022	0.338	0.440	0.513
N	77,059	75,562	75,374	75,374
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, and union status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.

Table 6
The Effect of Licensing and Certification on Wages

Variable	(1)	(2)	(3)	(4)
Definition 2:				
Licensed	0.240***	0.072***	0.078***	0.062***
	(0.011)	(0.010)	(0.010)	(0.010)
Certified	0.229***	0.100***	0.075***	0.073***
	(0.018)	(0.014)	(0.013)	(0.013)
R^2	0.033	0.340	0.441	0.514
N	77,059	75,562	75,374	75,374
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, and union status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.

Table 7
The Effect of Licensing and Certification Jurisdiction on Wages

Variable	(1)	(2)	(3)	(4)
Federal Government	0.287***	0.144***	0.114***	0.089***
	(0.031)	(0.030)	(0.028)	(0.027)
State Government	0.244***	0.071***	0.077***	0.061***
	(0.011)	(0.011)	(0.011)	(0.011)
Local Government	0.040	-0.033	0.046	0.036
	(0.048)	(0.040)	(0.039)	(0.034)
Private	0.229***	0.100***	0.075***	0.073***
	(0.018)	(0.015)	(0.013)	(0.013)
R^2	0.034	0.340	0.441	0.514
N	77,059	75,562	75,374	75,374
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, credential status, source of credential, and union status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Private organizations include industries, businesses, companies, nonprofit organizations, professional associations, and other private associations. Other controls in columns (2)-(4) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.

Table 8

The Effect of Licensing Requirements on Wages

Variable	(1)	(2)	(3)	(4)	(5)
Panel A: Definition 1					
Licensed or Certified	0.109***	0.070*	-0.061*	-0.069**	-0.034
	(0.030)	(0.042)	(0.036)	(0.030)	(0.028)
Courses or Training	0.137***	0.096***	0.069**	0.093***	0.066***
	(0.029)	(0.029)	(0.028)	(0.025)	(0.023)
Skills or Exam		-0.023	0.009	0.017	0.007
		(0.035)	(0.029)	(0.024)	(0.021)
Continuing Education		0.145***	0.103***	0.071***	0.055***
		(0.018)	(0.016)	(0.014)	(0.014)
R^2	0.034	0.038	0.343	0.443	0.516
N	77,226	76,831	75,342	75,158	75,158
F-test: all requirements = 0 (p-value)	0.000	0.000	0.000	0.000	0.000
Panel B: Definition 2					
Licensed	0.030*	0.003	-0.046***	-0.014	-0.020*
	(0.016)	(0.017)	(0.014)	(0.012)	(0.012)
Courses or Training	0.223***	0.133***	0.052**	0.061***	0.054***
	(0.015)	(0.027)	(0.024)	(0.021)	(0.019)
Skills or Exam		0.007	-0.006	-0.009	-0.003
		(0.025)	(0.023)	(0.020)	(0.018)
Continuing Education		0.147***	0.108***	0.070***	0.056***
		(0.019)	(0.016)	(0.015)	(0.014)
R^2	0.034	0.038	0.343	0.443	0.516
N	77,022	76,669	75,184	75,000	75,000
F-test: all requirements = 0 (p-value)	0.000	0.000	0.000	0.000	0.000
Controls?	N	N	Y	Y	Y
Occupation Fixed Effects?	N	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, licensing requirements, and union status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential. Other controls in columns (3)-(5) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (4) and (5), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.

Table 9
The Heterogeneous Effects of Licensing and Certification on Wages

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified × 1st (Bottom) Quartile	-0.049**	-0.084***	0.031	0.061***
	(0.022)	(0.021)	(0.021)	(0.021)
Licensed or Certified × 2nd Quartile	-0.071***	-0.082***	0.018	0.062***
	(0.018)	(0.016)	(0.016)	(0.018)
Licensed or Certified × 3rd Quartile	0.226***	0.131***	0.065***	0.054***
	(0.015)	(0.015)	(0.014)	(0.015)
Licensed or Certified × 4th (Top) Quartile	0.492***	0.215***	0.160***	0.081***
	(0.013)	(0.014)	(0.015)	(0.018)
R^2	0.079	0.352	0.443	0.514
N	77,294	75,793	75,605	75,605
Panel B: Definition 2				
Licensed × 1st (Bottom) Quartile	-0.097***	-0.128***	-0.003	0.012
	(0.026)	(0.025)	(0.025)	(0.024)
Licensed × 2nd Quartile	-0.117***	-0.108***	0.001	0.054***
	(0.022)	(0.019)	(0.020)	(0.019)
Licensed × 3rd Quartile	0.185***	0.102***	0.050***	0.029*
	(0.018)	(0.018)	(0.016)	(0.017)
Licensed × 4th (Top) Quartile	0.462***	0.185***	0.154***	0.081***
	(0.013)	(0.015)	(0.016)	(0.019)
R^2	0.057	0.347	0.442	0.513
N	77,059	75,562	75,374	75,374
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, union status, and occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Quartiles reflect position in the distribution of average education levels by occupation. Quartile cutoffs for this distribution are 12.73, 13.67, and 15.08 years of education. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.

Table 10

The Effect of Licensing and Certification on the Likelihood of Employment

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.342***	0.245***	0.232***	0.235***
	(0.043)	(0.047)	(0.052)	(0.057)
	[0.026]	[0.015]	[0.013]	[0.015]
N	103,191	101,249	99,975	84,117
Panel B: Definition 2				
Licensed	0.385***	0.308***	0.294***	0.306***
	(0.053)	(0.061)	(0.067)	(0.070)
	[0.029]	[0.018]	[0.017]	[0.019]
Certified	0.275***	0.167**	0.161**	0.168*
	(0.065)	(0.077)	(0.079)	(0.087)
	[0.021]	[0.010]	[0.009]	[0.011]
N	102,791	100,849	99,579	83,805
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who worked in wave 13 and those who did not work in wave 13 but were on layoff, looked for work, or were unable to find work. Sample members who did not work in wave 13 worked in at least one previous wave of the 2008 SIPP panel. Regressions exclude person-month observations with imputed licensure status and employment status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. Regressions also exclude individuals who were contingent workers on their main job and individuals who responded that their usual number of hours worked varied on the main job. The reference period is May through November 2012. The estimates in this table result from probit regressions. The dependent variable takes value 1 for employed person-month observations and 0 for unemployed observations and not-in-the-labor-force observations according to the Current Population Survey definitions. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Other controls in column (2)-(4) include a quadratic in age, years of education, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, region fixed effects, a married indicator, a disabled indicator, a school enrollment indicator, an indicator for any own children in the household, number of own children in the household, number of own children in the household under age 18, union status, a government worker indicator, a service worker indicator, a self-employed indicator, establishment size effects, and a full-time worker indicator. Union status, government worker, service worker, self-employed worker, establishment size, full-time worker and occupation represent characteristics of workers' "main" job or business. For respondents who did not work any month in the reference period, these variables represent characteristics of the most recent job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses. We present marginal effects in brackets.

Table 11

The Effect of Licensing and Certification on the Generosity of Employer-Provided Health Benefit Offers

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.157***	0.119***	0.103***	0.089**
	(0.029)	(0.032)	(0.034)	(0.037)
	[0.036]	[0.026]	[0.023]	[0.020]
N	13,497	13,470	13,340	12,578
Panel B: Definition 2				
Licensed	0.160***	0.113***	0.100***	0.088**
	(0.031)	(0.035)	(0.038)	(0.042)
	[0.037]	[0.025]	[0.022]	[0.019]
Certified	0.170***	0.158***	0.128**	0.111**
	(0.051)	(0.052)	(0.052)	(0.055)
	[0.039]	[0.035]	[0.028]	[0.024]
N	13,450	13,423	13,294	12,532
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month and who had employer-sponsored health insurance. Regressions exclude person observations with imputed licensure status and health insurance premium information. Regressions in columns (3) and (4) also exclude observations with imputed occupation. Regressions also exclude individuals who were contingent workers on their main job and individuals who responded that their usual number of hours worked varied on the main job. The reference period is May through November 2012. The estimates in this table result from probit regressions. The dependent variable takes value 1 if a respondent's employer paid the entire health insurance premium and 0 for all other respondents with employer-provided health coverage. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, region fixed effects, a married indicator, union status, self-employed status, establishment size effects, a full-time worker indicator, an indicator for any own children in the household, number of own children in the household, and number of own children in the household under age 18. Union status, establishment size effects, full-time worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses. We present marginal effects in brackets.

Table 12

The Effect of Licensing and Certification on the Likelihood of Employer-Provided Retirement and Pension Plan Offers

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.277***	0.078***	0.106***	0.127***
	(0.022)	(0.028)	(0.032)	(0.036)
	[0.107]	[0.022]	[0.029]	[0.034]
N	17,966	16,739	16,662	16,307
Panel B: Definition 2				
Licensed	0.286***	0.072**	0.101***	0.122***
	(0.024)	(0.031)	(0.037)	(0.043)
	[0.110]	[0.021]	[0.028]	[0.032]
Certified	0.257***	0.095**	0.118**	0.144***
	(0.042)	(0.048)	(0.048)	(0.052)
	[0.099]	[0.028]	[0.033]	[0.038]
N	17,906	16,683	16,608	16,256
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 11 Core and Topical Module and Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force at the end of the reference period and who worked in the same occupation on the "main" job in Waves 11 and 13. We determine the "main" job in a particular month of Wave 13 as the primary source of earnings in that month. SIPP determines the "main" job in Wave 11 as the primary source of earnings in that wave. Regressions exclude person observations with imputed licensure status and retirement and pension plan offers. Regressions in columns (3) and (4) also exclude observations with imputed occupation. Regressions also exclude individuals who were contingent workers on their main job in wave 11 and individuals who responded that their usual number of hours worked varied on the main job in wave 11. The reference period is January through April 2012. The estimates in this table result from probit regressions. The dependent variable takes value 1 for workers who were offered retirement and pension plans on the "main" job and 0 for workers who were not offered these plans. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, region fixed effects, a married indicator, union status, self-employed status, establishment size effects, a full-time worker indicator, an indicator for any own children in the household, number of own children in the household, and number of own children in the household under age 18. Union status, establishment size effects, full-time worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business in Wave 11. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses. We present marginal effects in brackets.

Table 13

The Effect of Licensing and Certification on the Likelihood of Employer-Provided Health Benefit Offers

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.161***	0.039	0.105**	0.117**
	(0.031)	(0.043)	(0.047)	(0.050)
	[0.050]	[0.008]	[0.020]	[0.022]
N	13,573	12,358	12,335	11,486
Panel B: Definition 2				
Licensed	0.142***	0.003	0.071	0.083
	(0.033)	(0.044)	(0.051)	(0.055)
	[0.044]	[0.001]	[0.014]	[0.016]
Certified	0.202***	0.127*	0.171**	0.181**
	(0.047)	(0.068)	(0.069)	(0.073)
	[0.063]	[0.025]	[0.033]	[0.034]
N	13,521	12,312	12,289	11,443
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 6 Core and Topical Module and Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force at the end of the reference period and whose occupation in the "main" job in Wave 13 was also ongoing in Wave 6. We determine the "main" job in a particular month as the primary source of earnings in that month. Regressions exclude person observations with imputed licensure status and health insurance offers. Regressions in columns (3) and (4) also exclude observations with imputed occupation. Regressions also exclude individuals who were contingent workers on their job in wave 6 and individuals who responded that their usual number of hours worked varied on the job in wave 6. The reference period is May through August 2010. The estimates in this table result from probit regressions. The dependent variable takes value 1 for workers who received employer-provided health insurance offers and 0 for workers who did not receive these offers. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential and certified if a private body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, region fixed effects, a married indicator, union status, self-employed status, establishment size effects, a full-time worker indicator, an indicator for any own children in the household, number of own children in the household, and number of own children in the household under age 18. Union status, establishment size effects, full-time worker, self-employed worker, and occupation represent characteristics of workers' "main"

job or business in Wave 6. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses. We present marginal effects in brackets.

Table 14

The Distributional Wage Effects of Licensing and Unionization: Definition 1

Variable	(1)	(2)	(3)	(4)	(5)
Panel A					
	Predicted Nonunion Wage Quartile				
	(1)	(2)	(3)	(4)	Total
Conditional mean ln(wage):					
- Nonunion	2.455	2.809	2.995	3.186	2.856
- Union	2.654	2.962	3.205	3.342	3.078
- Total	2.471	2.832	3.033	3.201	2.884
- Union-non	0.198	0.152	0.210	0.156	0.222
- *p*-value	0.000	0.000	0.000	0.000	0.000
Conditional mean squared error Ln(wage):					
- Nonunion	0.175	0.224	0.257	0.277	0.233
- Union	0.208	0.170	0.165	0.194	0.178
- Total	0.177	0.216	0.240	0.269	0.226
- Union-non	0.033	-0.055	-0.092	-0.084	-0.054
- *p*-value	0.030	0.000	0.000	0.000	0.000
Observations:					
- Nonunion	16,907	16,566	15,596	17,230	66,299
- Union	1,370	2,739	3,484	1,713	9,306
- Total	18,277	19,305	19,080	18,943	75,605
Panel B					
	Predicted Uncredentialed Wage Quartile				
	(1)	(2)	(3)	(4)	Total
Conditional mean ln(wage):					
- Uncredentialed	2.437	2.796	2.983	3.170	2.818
- Credentialed	2.644	2.906	3.095	3.306	3.054
- Total	2.472	2.823	3.022	3.219	2.884
- Credentialed-uncredentialed	0.207	0.110	0.112	0.137	0.237
- *p*-value	0.000	0.000	0.000	0.000	0.000
Conditional mean squared error Ln(wage):					
- Uncredentialed	0.170	0.222	0.240	0.267	0.221
- Credentialed	0.198	0.244	0.244	0.244	0.237
- Total	0.175	0.227	0.242	0.259	0.226
- Credentialed-uncredentialed	0.028	0.022	0.004	-0.023	0.016
- *p*-value	0.026	0.107	0.730	0.039	0.012
Observations:					
- Uncredentialed	15,139	14,623	12,296	12,007	54,065
- Credentialed	3,237	4,561	6,809	6,933	21,540
- Total	18,376	19,184	19,105	18,940	75,605

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, union status, and occupation. The reference period is May through November 2012. Panel A presents the distributional impact of unions on both wages and wage dispersion. Columns (1) through (4) present mean conditional log wages and mean squared errors within the first through fourth quartiles of the non-union wage distribution. Panel B presents the distributional impact of licenses and certifications on both wages and wage dispersion. Columns (1) through (4) present mean conditional log wages and mean squared errors within the first through fourth quartiles of the uncredentialed wage distribution. In both panels, column (5) presents these statistics for the entire sample. Conditional mean log wage and mean squared error of log wage result from averages of predicted values from an OLS regression which controls for a quadratic in age, years of education, union status, licensure and certification status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Implied hourly wage, union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. The predicted non-union wage quartile results from a regression that drops union status from the set of controls and adds 2-digit occupation fixed effects. The predicted uncredentialed wage quartile results from a regression that drops licensure and certification status from the set of controls and adds 2-digit occupation fixed effects. Definition 1 does not distinguish between workers who have a certification and workers who have a license. We use 2-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate *p*-values.

Table 15

The Distributional Wage Effects of Licensing and Unionization: Definition 2

Variable	(1)	(2)	(3)	(4)	(5)
Panel A					
	Predicted Nonunion Wage Quartile				
	(1)	(2)	(3)	(4)	Total
Conditional mean ln(wage):					
- Nonunion	2.457	2.810	2.995	3.183	2.856
- Union	2.656	2.963	3.205	3.337	3.078
- Total	2.472	2.833	3.034	3.198	2.884
- Union-non	0.199	0.153	0.210	0.154	0.222
- *p*-value	0.000	0.000	0.000	0.000	0.000
Conditional mean squared error Ln(wage):					
- Nonunion	0.174	0.223	0.261	0.278	0.233
- Union	0.200	0.176	0.166	0.194	0.179
- Total	0.176	0.216	0.244	0.270	0.227
- Union-non	0.026	-0.047	-0.095	-0.085	-0.054
- *p*-value	0.075	0.000	0.000	0.000	0.000
Observations:					
- Nonunion	16,902	16,452	15,540	17,210	66,104
- Union	1,352	2,766	3,481	1,671	9,270
- Total	18,254	19,218	19,021	18,881	75,374
Panel B					
	Predicted Unlicensed Wage Quartile				
	(1)	(2)	(3)	(4)	Total
Conditional mean ln(wage):					
- Unlicensed	2.449	2.810	2.997	3.185	2.840
- Licensed	2.638	2.901	3.090	3.313	3.059
- Total	2.472	2.825	3.021	3.219	2.884
- Licensed-unlicensed	0.189	0.092	0.093	0.128	0.218
- *p*-value	0.000	0.000	0.000	0.000	0.000
Conditional mean squared error Ln(wage):					
- Unlicensed	0.171	0.226	0.246	0.265	0.225
- Licensed	0.202	0.239	0.235	0.244	0.234
- Total	0.175	0.228	0.243	0.260	0.227
- Licensed-unlicensed	0.031	0.013	-0.010	-0.021	0.010
- *p*-value	0.057	0.415	0.422	0.075	0.160
Observations:					
- Unlicensed	16,093	16,017	14,140	13,890	60,140
- Licensed	2,178	3,119	4,950	4,987	15,234
- Total	18,271	19,136	19,090	18,877	75,374

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module
Note: Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of at least one reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, union status, and occupation. The reference period is May through November 2012. Panel A presents the distributional impact of unions on both wages and wage dispersion. Columns (1) through (4) present mean conditional log wages and mean squared errors within the first through fourth quartiles of the non-union wage distribution. Panel B presents the distributional impact of licenses on both wages and wage dispersion. Columns (1) through (4) present mean conditional log wages and mean squared errors within the first through fourth quartiles of the unlicensed wage distribution. In both panels, column (5) presents these statistics for the entire sample. Conditional mean log wage and mean squared error of log wage result from averages of predicted values from an OLS regression which controls for a quadratic in age, years of education, union status, licensure status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Implied hourly wage, union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. We determine the "main" job in a particular month as the primary source of earnings in that month. The predicted non-union wage quartile results from a regression that drops union status from the set of controls and adds 2-digit occupation fixed effects. The predicted unlicensed wage quartile results from a regression that drops licensure status from the set of controls and adds 2-digit occupation fixed effects. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 2 identifies a worker as licensed if a governmental body issued the credential. We use 2-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate p-values.

Appendix Table

The Effects of Required Licensing and Certification on Wages

Variable	(1)	(2)	(3)	(4)
Panel A: Definition 1				
Licensed or Certified	0.151***	0.016	0.012	0.017
	(0.017)	(0.015)	(0.013)	(0.012)
Licensed or Certified × Required	0.109***	0.083***	0.088***	0.068***
	(0.019)	(0.016)	(0.015)	(0.014)
R^2	0.035	0.341	0.442	0.515
N	77,190	75,689	75,501	75,501
Panel B: Definition 2				
Licensed	0.114***	-0.024	-0.010	-0.002
	(0.022)	(0.021)	(0.018)	(0.016)
Licensed × Required	0.152***	0.117***	0.112***	0.084***
	(0.023)	(0.021)	(0.018)	(0.018)
Certified	0.205***	0.070***	0.044**	0.045**
	(0.028)	(0.023)	(0.022)	(0.020)
Certified × Required	0.039	0.049*	0.054*	0.049*
	(0.034)	(0.029)	(0.028)	(0.025)
R^2	0.035	0.341	0.443	0.515
N	76,994	75,497	75,309	75,309
Controls?	N	Y	Y	Y
Occupation Fixed Effects?	N	N	2-digit	3-digit

Source: Authors' calculation from the 2008 panel of the Survey of Income and Program Participation, Wave 13 Core and Topical Module

Note: * denotes significant at the 10% confidence level, ** denotes significant at the 5% confidence level, and *** denotes significant at the 1% confidence level. Sample includes all respondents aged 18-64 who were employed in the civilian labor force as of the end of a reference month with implied hourly wages on the "main" job between $5.00 and $100.00. Regressions exclude person-month observations with imputed implied hourly wage, licensure status, credential requirement, and union status. Regressions in columns (3) and (4) also exclude observations with imputed occupation. The reference period is May through November 2012. The estimates in this table result from OLS regressions. The dependent variable is hourly wage on the "main" job as implied by monthly earnings and profits, weeks worked at the "main" job in that month, and usual weekly hours worked on the "main" job. We determine the "main" job in a particular month as the primary source of earnings in that month. Definition 1 does not distinguish between workers who have a certification and workers who have a license. Definition 2 identifies a worker as licensed if a governmental body issued the credential. Other controls in columns (2)-(4) include a quadratic in age, years of education, union status, a government worker indicator, a service worker indicator, a self-employed indicator, a female indicator, a Hispanic indicator, a Black indicator, an Asian indicator, and region fixed effects. Union status, government worker, service worker, self-employed worker, and occupation represent characteristics of workers' "main" job or business. In columns (3) and (4), respectively, we use 2-digit and 3-digit occupational affiliation according to the 2000 Census occupational classification system. We employed 160 balanced repeated replicate weights using Fay's adjustment factor 0.5 to estimate the standard errors listed in parentheses.