The Impact of Occupational Licensing on Labor Market Outcomes of College-Educated Workers

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Abstract

More than one third of college-educated workers have a license that provides the right to practice a particular occupation. In contrast to certificates, these licenses—serving either as a productivity signal or acting as a restrictive practice—are associated with significantly higher earnings. Thus, it is possible that some part of the returns to college are in fact returns to licensing. Here we identify the effects of licenses on a set of labor market outcomes for the college-educated workforce. We use newly available national Current Population Survey data merged with U.S. Department of Labor state-level occupation-specific licensing requirements. We find significant discrepancies between individual self-reported licensing rates and state-mandated licensing requirements across occupations. We find significant advantages from licensing in terms of earnings and labor market participation (hours worked). Moreover, controlling for licensing does not significantly reduce the measured returns to college. Licenses convey economic benefits even in occupations where they are not required. In contrast to prior studies, we also find that licenses reduce wage dispersion across the college-educated workforce.

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1. Introduction

Occupational licensing—the procurement of a license issued by a state or other government agency that provides a right to practice in a particular occupation—is increasingly required for many U.S. jobs: approximately one quarter of workers claim that a license is required to do their job (Cronen, McQuiggan, & Isenberg, 2017; Department of the Treasury Office of Economic Policy, the Council of Economic Advisers, and the Department of Labor [DTOEP, CEA, DOL], 2015; Kleiner & Krueger, 2013). In a series of studies, licensing has been found to increase workers' earnings, often by a substantial amount (Gittleman & Kleiner, 2016; Kleiner & Vorotnikov, 2017). This consistent and strong licensing premium has been attributed to restrictive practices and barriers to occupational entry and mobility (Carpenter, Knepper, Erickson, & Ross, 2012). According to this view, by restricting the supply of workers with the right to practice an occupation, the licensing regulation drives up earnings. With licensing becoming more common, alongside anecdotal claims of spurious regulations in ostensibly low-skill occupations, licensing boards are increasingly under scrutiny to justify their licensing requirements for each occupation (Kleiner, 2015; Thornton & Timmins, 2015).

Given its growing prevalence, the economics of licensing merits further investigation. First, most research has examined wage premiums for licensing. But such premiums—clearly predicted from a basic labor market model with supply constraints—are not the only potential impact of licensing. Instead, a critical issue is whether licensing—by signaling the quality of the service being provided—increases its demand and thereby serves to increase employment. If employment goes up, licensing resolves an important market failure by signaling worker (and thereby product) quality and by guaranteeing a threshold level of service for consumers (DTOEP, CEA, DOL, 2015). Second, limited evidence is available on the interaction between the returns to licensing and the returns to postsecondary education. This absence is particularly notable for community college graduates who have the highest rate of licensing and typically lack professional qualifications that are more common among four-year degree graduates (such as law or medical degrees). Although many studies find significant wage returns to completing community college, these returns might be partially or even wholly

attributable to omitted variable bias from having a license. Finally, there is increasing variety in how workers can signal their skills. Postsecondary certificates have become more important, along with industry certifications; some of these credentials may be stacked together or with degrees (Bailey & Belfield, 2017a). Workers may prefer these credentials in lieu of a license, although these alternatives might not be as beneficial as a license for the individual worker. If workers are accumulating different awards for work within a given occupation, this may lead to greater variation in earnings.

Here, we investigate each of these research issues using newly available national data from the Annual Social and Economic Supplement of the Current Population Survey. As a precursor to analyzing labor market impacts, we examine the patterns of licensing across the U.S. workforce and especially the association between postsecondary awards and licensing. For our labor market analysis, we focus on college-educated workers and in particular on community college graduates: as well as being licensed at the highest rates, the vocational focus of community college may mean that this group is the most influenced by licensing practices. We begin our analysis by reestablishing earnings premiums from licensing and by comparing these premiums with the returns to associate degrees. Next, we consider the employment effects of licensing to see if licensing solves a form of market failure or serves as a restrictive practice. Finally, we examine wage dispersion across licensed and unlicensed workers.

2. How Licensing Affects Labor Market Outcomes

A license conveys a legal right to practice an occupation. To obtain a license, workers must meet a set of prescribed standards, such as having a college degree, completing a vocational/training course, and/or passing an exam.[1]

Until recently, national data on licensing has not been available. Research analysis has relied on bespoke or small-scale surveys or occupation-specific datasets.[2]

[1] In contrast, industry certification is awarded by any organization, is not legally required for work, and often only requires some demonstration of competency (but a license may require a certification).
[2] Kleiner and Krueger (2013) use a Westat survey. Gittleman and Kleiner (2015) use the National Longitudinal Survey of Youth (NLSY79). Gittleman, Klee, and Kleiner (2015) use the Survey of Income and Program Participation (SIPP), which does not clearly distinguish certificates from licenses. Kleiner and

These studies typically report licensing rates of 10–30 percent with an average estimate around one quarter (Kleiner & Krueger, 2013; Gittleman & Kleiner, 2015; Kleiner & Vorotnikov, 2017). However, as well as the data used in this study, new descriptive evidence is forthcoming from the Adult Training and Education Survey (ATES) component of 2016 National Household Education Survey (NHES). In their summary of ATES across all workers, Cronen, McQuiggan, and Isenberg (2017) report that only 18 percent are licensed (with 6 percent of the total having certification and 8 percent having a postsecondary certificate).[3] Rates of licensing vary significantly by occupation, with the highest rates being in health-related occupations and industries (Kleiner & Krueger, 2013). Also, licensing rates vary considerably across states, depending on the policies of each state's regulatory boards or commissions. Interestingly, these state-specific differences do not appear to be attributable to occupational differences (Kleiner & Vorotnikov, 2017).

Critically, a license is intended to regulate entry into a profession—unlike certification or a college degree. Potentially, there are several justifications for this restriction serving as a public good (DTOEP, CEA, DOL, 2015). With better qualified workers, licenses may be associated with improved product or service quality. With better trained workers, health and safety in the workplace may be increased. With minimum standards, licenses may protect consumers from incompetent practitioners. With standardized product/service quality, licenses may reduce within-occupation wage inequality. Overall, however, the justification for licensing is that it should increase the confidence that consumers have in the quality of the good or service when it is provided by licensed workers. The increased consumer confidence should increase the demand for the end product. Licensed workers should therefore earn more and have higher rates of employment. The contrary position is that licensing is a restrictive practice that restricts entry into and therefore employment in an occupation (Kleiner, 2006). This restriction has several effects: it increases wages for licensed workers; increases end-product prices (controlling for quality); reduces worker mobility; and, by standardizing work practices,

Vorotnikov (2017) use a Harris survey. Important occupation-specific studies are Federman, Harrington, and Krynski (2006) and Timmins and Thornton (2013, 2015).

[3] These rates cannot be summed: some persons have more than one credential.

dampens entrepreneurship or innovation (e.g., where new tasks are not undertaken because the worker's license does not address that task). With substantial evidence of earnings advantages for licensed workers (reviewed below), this restrictive practice argument is often propounded.

Critically, wages for licensed workers are predicted to be higher regardless of the mechanism (in fact, the public goods theory predicts a greater increase in wages than does the restrictive practice argument). Indeed, evidence on earnings premiums is consistent, with large gains for licensed workers of approximately 15 percent over unlicensed workers (Gittleman & Kleiner, 2015; Kleiner & Krueger, 2013; Kleiner & Vorotnikov, 2017). Earnings premiums for licensed workers also vary by occupation and, modestly, by state (on health care, see Law & Marks, 2017; Stange, 2014; on patterns by state, see Kleiner & Vorotnikov, 2017).[4]

However, to differentiate between the arguments, the main issue is the direction of change in employment. If licensing serves as a restrictive practice, the demand for the end product will be unchanged and employment in that occupation will be reduced as each worker is paid more. But if licensing improves product quality and consumers are willing to pay for that quality, demand may shift outward and employment will be increased—and earnings will be increased further (Lowenberg & Tinnin, 1992).[5] Thus, employment effects are critical for evaluating the optimal degree of licensing.

Few studies have looked at employment effects. Kleiner (2006) finds negative labor supply effects across selected occupations. Law and Marks (2017) find no association between licensing and employment of nurses as licenses were tightened over time; and, investigating the healthcare market for office-based workers, Stange (2014)

[4] Recently, licensing requirements have been changing with more inter-state reciprocity agreements whereby one state accepts the right to practice of license-holders from another state and vice versa. By increasing labor supply, these agreements should reduce the wage premium. However, an important pressure for reciprocity agreements is the growth of teleworking, where professionals provide services both in their origin state and outside their own state. Thus, reciprocity allows licensed workers to respond to increased demand for services (Chaudry, Robin, Fish, Polk, & Gifford, 2015). For the Nurse Licensing Compact, DePasquale and Stange (2014) find that a positive licensing wage premium remains.

[5] The direct evidence on licensing and product quality does not clearly show product quality is higher with licensing (DTOEP, CEA, DOL, 2015; on prices for medical services, see Kleiner, Marier, Park, & Wing, 2016). However, there are few studies; most examine the teaching profession, where licensing rates are high, postsecondary education is a strong substitute for a license, and where conditions in unlicensed, typically private, schools are quite different from the licensed, typically public, sector.

finds some modest negative labor supply effects. However, with demographic changes, the health services market has experienced a long-run upward trend in demand. Nationally, looking across all occupations, there is limited evidence on labor supply effects from licensing.

A third potential effect of licenses is on intra-occupational wage dispersion. Two mechanisms may influence wage dispersion. One mechanism is "skill compression." By mandating that all workers receive similar training and meet a threshold competency, skill levels—and hence earnings—should be less variable. Also, given that licenses are (minimum) competency standards, earnings gains should be greater for lower-earning workers: the licensing requirements force them to upgrade their skills to meet the standard. The other mechanism is "service constraint." By restricting the practices licensed workers can perform in their jobs, service prices—and hence earnings—should be less variable.

Again, both arguments predict that licensing will reduce wage dispersion. From a restrictive practice argument, the reduction may be *prima facie* evidence of lower rates of intra-occupational entrepreneurship. From a public goods argument, any reduction in wage dispersion should be desirable for workers who are risk-averse about acquiring occupation-specific skills. However, the evidence on wage dispersion is in fact contrary. Based on quantile regression estimates, Kleiner and Vorotnikov (2017, Tables 8A and 8B) find that licensing increases wage dispersion, with larger earnings gains for those in higher wage occupations relative to those in lower wage occupations. Based on estimated mean squared errors across income quartiles, Gittleman and Kleiner (2017) also conclude that the licensed sector has higher wage dispersion, although the differences are not statistically significant. These unexpected findings remain to be explained.

As well as the direct effect of licensing, an important question is how licensing affects the labor market value of college. To our knowledge there has been little investigation into the relationship between licensing and postsecondary education. This is surprising because many licenses require a college credential, and therefore licensing is strongly positively associated with postsecondary attainment and is especially high for individuals from community colleges. As reported by Cronen et al. (2017, Table 1), the highest rates are for associate degree holders at 25 percent, then bachelor's degree-

holders at 23 percent, and then persons with some college at 15 percent. The interaction between licensing and college remains to be explored.

Certainly, the labor market returns to a four-year degree are very high, and a series of recent studies have found significant wage returns to community college (Bailey & Belfield, 2017b; Jepsen, Troske, & Coomes, 2014; Stevens, Kurlaender, & Grosz, 2017). But, rather than reflecting increased human capital, these returns might be partially or even wholly attributable to omitted variable bias from licensing status. It may be the license that is causing earnings gains and not the award itself. Although the two are related, a license may require knowledge and skills not obtained in college, and in fact, not all licenses require a college education: just under half (43–48 percent) require any college degree (Kleiner & Krueger, 2013; Kleiner & Vorotnikov, 2017, Table 4). Thus, it is important to investigate whether associate degrees and licenses are complements or substitutes.

Finally, there are important questions about adherence to licensing regulations. Within a licensed occupation, some workers may be able to work under "accepted practice" rules, or via certification or registration. The proliferation of vocational awards, certificates, and certifications may facilitate unlicensed work. Of course, non-compliance is a possibility: if licensed work pays well, some workers may (illegally) work in licensed occupations even if they do not have a license; if licensed workers are expensive, some consumers may hire unlicensed contractors. Finally, as licensing rules are complex and vary across states, workers may not know that they need a license or may acquire a license even though one is not required. (Non-compliance is the difference between having a license and that license being needed as a right to practice; this is not the same as the measurement error of licensing). Thus far, there has been little inquiry into how many workers comply with the licensing requirements of their occupation.

With new Current Population Survey (CPS) data on licensing, we are able to investigate each of these issues. We begin by looking at compliance and within-occupation licensing rates—these provide context on how to measure licensing. We then look at the labor market impacts of licensing. Initially, we estimate earnings differences; we then identify employment differences; and finally, we examine wage dispersion issues. For each labor market domain, we focus on the impacts for associate degree-

holders; this allows us to identify the extent to which licenses and degrees are complements or substitutes.

3. Data and Descriptive Frequencies

3.1 Data

The main dataset is the CPS 2017 Annual Social and Economic Supplement (ASEC). Derived as an annual file from the CPS, the ASEC universe is the civilian non-institutional population based on household sampling.[6] In addition to CPS information, the ASEC includes detailed labor market information on earnings, hours and weeks worked, and labor market participation for over 80,000 working-age persons.[7] ASEC also includes occupational status using the Standard Occupational Classification at the six-digit level.

As of 2017, the ASEC includes three questions on licensing. These questions are: (1) Do you have a currently active professional certification or a state or industry license? (2) Were any of your certifications or licenses issued by the federal, state, or local government? (3) Is your certification required for your job [job from which you are on lay-off/job at which you last worked]? Conventionally, as only a government agency can convey a legal right, affirmative answers to question (2) are indicative of worker licensing. However, in order to be sure that these licenses are work-related, we perform all estimates using answers to question (3).[8] Hence, we can identify the impact of licensing on employment outcomes across a representative sample of the U.S. workforce.[9]

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[6] The ASEC does not include information on ability. However, omitted variable bias may not be significant: Kleiner and Vorotnikov (2017) identify ability bias; Gittelman and Kleiner (2015) do not.
[7] ASEC also includes information on income from self-employment; analysis using this variable yields equivalent conclusions to using annual income.
[8] The results are very similar—and the conclusions identical—if we use answers to question (2). Details are available from the authors.
[9] These licensing questions have been criticized. They do not allow us to clearly distinguish certification from licensing. They only refer to government-issued right to practice; it is unclear what respondents declare if they have a license from a private agency. Finally, they only refer to current licenses. See Kleiner and Vorotnikov (2017).

Separate from the ASEC survey, we collect data on whether a license is needed for an occupation within a given state. Records on licensing requirements are merged in from the U.S. Department of Labor's Employment and Training Administration (DOLETA) Career One-Stop services. These licensing requirements are reported per six-digit Standard Occupational Classification (SOC) code and per state. They are collected from web-based and documentary reviews compiled by Labor Market Information Units in each state.[10] There are 484 six-digit SOC codes and 50 states (plus Washington, DC), and so there are thousands of state–occupation "dyads." We label a license as being "needed" if, according to the DOLETA database, workers in that state–occupation dyad should have a license.

An alternative record of licensing is derived from aggregation of the ASEC responses. For each state–occupation dyad, we calculate the mean response to question (3) above ("Is your certification required for your job?"). When more than 50 percent of workers within a state–occupation dyad positively report that a license is required for doing their job, it is reasonable to expect that all workers in that dyad should have a license. Thus, we label a license as being "expected" based on majority-positive records per ASEC dyad.

We match the direct CPS individual-level responses on licensing to the DOLETA and ASEC-aggregate measures of licensing need and expectation. The match is done by state–occupation dyad.

3.2 The Prevalence of Licensing Across the U.S. Workforce

Table 1 shows the full information on the prevalence of licensing across U.S. college-educated workers aged 18-64 based on ASEC data. Exactly one quarter of workers indicate they have a license or certification issued by a federal or state agency that is required for their job. This incidence accords with prior data from the ATES descriptive frequencies in Cronen et al. (2017); see also Gittleman and Kleiner (2017).

[10] Licensing information is collated by the National Crosswalk Center into a single database, with states submitting license information biennially (see www.careeronestop.org/toolkit/training/find-licenses.aspx). Although some (unnamed) states are declared as non-participants, the database includes information from every state. For validation, we check the database against alternative compendia of licensing (e.g., Carpenter et al., 2012) and, for selected occupations, against occupation-specific national licensing boards (Aragon, 2017). These data are also used by Gittelman and Kleiner (2015) for the NLSY samples.

Notably, workers with associate degrees are licensed at the highest rates (35 percent), slightly above workers with bachelor's degrees or advanced degrees. Licensing rates vary significantly across occupations. For example, three quarters of healthcare practitioners and three fifths of education professionals have licenses.

Table 1
Licensing Rates: U.S. College-Educated Workforce

	Mean
License [a]	
All college-educated workers	0.25
Some college	0.20
Associate degree	0.35
Vocational associate degree	0.37
Academic associate degree	0.28
Bachelor's or advanced degree	0.34
Occupations with highest license rates	
Healthcare practitioners	0.74
Education, training, libraries	0.58
Protective services	0.46
License requirements	
License or certification	0.30
License "federal/state Issue" (self-reports)	0.27
License needed (DOLETA dyads) [b]	0.27
License expected (ASEC dyads) [c]	0.18
License compliance (self-reports)	
License and required	0.23
License/not Required	0.02
No license/required	0.04
License compliance (DOLETA dyads)	
License and needed	0.13
License/not needed	0.14
No license/needed	0.14
License compliance (ASEC dyads)	
License and expected	0.14
License/not expected	0.13
No license/expected	0.04
Observations	48,350

Note. Source: ASEC 2017, unweighted; DOLETA data from careeronestop.org. Persons aged 18–64. Sample excludes persons in college and not in the labor force. License refers to federal/state issue.
[a] From ASEC self-reports if license is "required for job."
[b] From DOLETA data occupation-state requirements.
[c] From ASEC self-reports of "required for job" per occupation-state dyad average > 0.5.

Licensing status can be determined in several ways. If certification and licensing are counted jointly, 30 percent of workers have a credential that relates to their "right to practice." The correspondence between licensing and work can be seen using various metrics. Based on self-reports in the ASEC, 25 percent of workers have licenses that are "required for their job." Based on the DOLETA data matched to each worker's state–occupation dyad, 27 percent of workers have licenses that are "needed." Finally, based on ASEC percentage dyads, only 18 percent of workers are "expected" to have licenses. Although these metrics yield similar rates as when using the preferred definition (license issued by a government agency), the overlap between them is moderate. Below, we examine non-compliance directly and test the sensitivity of our results to alternative measures of licensing.

The bottom panel of Table 1 shows the discrepancies between whether the worker has or should have a license. Unsurprisingly, of those who self-report having a license, almost all say it is required. Applying DOLETA dyads, we find that only half of all licenses are needed; also, there are equal numbers who have licenses that are not needed and who do not have licenses that are needed. The discrepancy for expected licenses is substantial. Most of the workers with licenses are expected to have a license. But there is a large percentage of license holders for whom a license is not expected. Rates of expected licensing are not symmetric: there are many occupations for which it is generally agreed that a license is not required, but there are few occupations for which all workers are agreed that a license is required (see Figure A1 in the Appendix). As a third check, we correlate the statewide averages of individual licensing rates with those reported by Kleiner and Vorotnikov (2017), who use a differently worded question about licensing. (The pairwise correlations are shown in Figure A2.) The relationship is modestly positive, although statewide rates in ASEC are less variable (mostly at 20–25 percent) than rates from Kleiner and Vorotnikov. Overall, there appear to be many occupations for which licensing compliance is open to question.

As a preliminary investigation, we investigate worker characteristics associated with licensing. In Table A1 we report descriptive statistics for the college-educated sample. In Table A2 we report coefficients from a logistic regression on the associate degree sample with licensing as the dependent variable. These tables show that, looking across the college-educated sample, licensees have some distinct characteristics relative

to persons without a license. White workers are much more likely to have licenses, as are female workers, those working in government jobs, and the self-employed. These findings broadly corroborate evidence from prior studies, although the prior studies typically find higher licensing rates for male workers.[11] Overall, the logistic regression shows few statistically significant differences for the associate degree sample: only self-employment is a strong predictor of licensing.

Table 2 shows descriptive frequencies for the earnings and employment measures. There are large gaps in earnings between license holders and those without licenses. Table 2 also shows nontrivial differences by licensing in hours worked, part-time work status, and unemployment rules.

Table 2
Outcome Variables: College-Educated Workforce

	Does Not Have License		Has License	
	Mean	(S.D.)	Mean	(S.D.)
Wage pay				
All college-educated workforce	$58,777	(72,022)	$62,290	(69,688)
Associate degree	$44,872	(46,173)	$47,383	(43,148)
Vocational associate degree	$44,875	(48,503)	$45,935	(48,040)
Academic associate degree	$44,870	(44,580)	$48,833	(37,583)
Hours per week	40.6	(10.4)	41.7	(11.3)
Part-time	0.13		0.12	
Unemployed	0.03		0.02	
Observations	35,206		13,144	

Note. License refers to federal/state issue. Source: ASEC 2017, unweighted.

4. Method

We apply OLS estimation to identify the effects of licensing on labor market outcomes. We estimate a series of regression equations with *j* dependent variables: earnings, hours worked, employment status, and part-time work status. (All estimates are performed separately by gender.) These outcomes depend on a set of covariate controls $\boldsymbol{X}$ and college education *EDUC* at the individual *i* level, and the licensing status *LICENSE*

[11] See Gittelman and Kleiner (2015); Kleiner and Krueger (2013); Kleiner and Vorotnikov (2017). These studies are not restricted to the college-educated population.

of the worker.[12] The primary version of this last variable is the individual self-reported licensing status. Thus, the first specification shows the independent impacts of college and licensing:

$$Y_j = f(\mathbf{X}_i, EDUC_i, LICENSE_i) \quad (1)$$

We expect the coefficient on licensing to be strongly positive for earnings. To distinguish between the public good and restrictive practice arguments, we focus on the effect of licensing on labor market participation at the individual worker level. As a validation check, we also estimate employment rates by occupation and state.

Next, to separate out impacts by college attainment, we estimate versions of specification (1) for the sample of workers with associate degrees and by subgroup according to whether the associate degree is in a vocational or academic field. These versions yield information on how licenses affect the returns to college.

To more clearly identify the relationships between postsecondary education and licensing, we estimate an omnibus model with interactions between college attainment and licensing:

$$Y_j = f(\mathbf{X}_i, EDUC_i, \times LICENSE_i) \quad (2)$$

Equation (2) yields the direct effects of licensing for each education level. In particular, we are interested in the effects on labor market outcomes of licenses and postsecondary degrees both independently and interacted together. If the education coefficients are substantially attenuated for workers who do hold licenses, this suggests substantial omitted variable bias in prior estimates of the returns to college.

Next, we test for the effects of licenses accounting for the possibility of noncompliance. We apply state- and occupation-specific dyadic measures from the DOLETA data and from the aggregated responses of the individuals in the ASEC ($LICENSE_{s\_occ1}$ and $LICENSE_{s\_occ2}$). Initially, we interpret these measures as alternative ways to identify licensing across the workforce and estimate versions of equation (1):

[12] Some prior studies control for two-digit occupational codes. We do not. These additional controls typically do not affect the findings and conclusions (Gittelman & Kleiner, 2015; Kleiner & Krueger, 2013; Kleiner & Vorotnikov, 2017).

$$Y_j = f(\mathbf{X}_i, EDUC_i, LICENSE_{s\_occk}) \quad k = 1, 2 \tag{3}$$

Next, we divide licensing into four groups based on need/expectation and possession of a license. Labor market outcomes are predicted to be superior for workers who have licenses and for those licenses that are needed/expected. In addition, we treat the dyadic licensing measures as exogenous determinants of whether an individual should have a license or not.[13] We estimate a first-stage equation where licensing status is determined by licensing need/expectation and then instrumental variables estimates as per equation (1):

$$Y_j = f(\mathbf{X}_i, EDUC_i, LICENSE_i = LICENSE_{s\_occk}) \; k = 1, 2 \tag{4}$$

Finally, we examine wage dispersion for license holders. We apply two methods that have been used in similar contexts. The first is estimation of the conditional earnings differentials between licensed and non-licensed workers by quartile and the corresponding differentials in the conditional mean squared errors. Where the mean squared errors are inflated, wage dispersion is increased. This method has been applied by Gittelman and Kleiner (2015). The second method is quantile regression. This method shows how the returns to licensing vary across the earnings distribution (Kleiner & Vorotnikov, 2017). Larger coefficients in the lower part of the earnings distribution indicate reduced wage dispersion. As with all preceding analyses, we apply both methods to the full college-educated sample and to associate degree holders separately.

5. Results

5.1 Earnings and Employment Effects

Table 3 shows gains in earnings for different samples of college-educated workers. The top panel shows that, across all college-educated workers, a license is associated with gain in earnings for 20 percent and 8 percent for female and male

[13] The license expected instrument is continuous, based on the probability of affirmative answers per state-occupation dyad on whether the license is required.

workers respectively. These gains are substantial and are comparable to those from an associate degree at 12 percent and 11 percent respectively.[14] (Returns for persons with bachelor's degrees are substantially higher). The returns to degrees reported in Table 3 are very close to those reviewed from transcript data across seven state systems in Belfield and Bailey (2017c). Importantly, Table 3 shows that associate degrees and licenses have value independently.

Table 3
Earnings Gains From Licensing

	Earnings Gains	
	Female	Male
A. ***College-educated***		
Associate degree	0.108***	0.096***
	[0.017]	[0.016]
Bachelor's degree	0.547***	0.512***
	[0.015]	[0.013]
License	0.183***	0.082***
	[0.012]	[0.012]
R-squared	0.131	0.199
Observations	24,341	22,820
B. ***Associate degree***		
License	0.273***	0.102***
	[0.024]	[0.027]
R-squared	0.083	0.111
Observations	4,568	3,954
C. ***Vocational associate degree***		
License	0.263***	0.071
	[0.039]	[0.037]
R-squared	0.091	0.104
Observations	1,812	1,858
D. ***Academic associate degree***		
License	0.299***	0.135***
	[0.031]	[0.039]
R-squared	0.087	0.122
Observations	2,756	2,096

Note. Source: ASEC 2017, ages 18–64. Unweighted estimation. Robust standard errors in brackets. Dependent variable: log annual earnings in 2017. Separate estimation for models A–D. Specification includes controls for: region, race/ethnicity, sector (2); union status; marital status; native status; experience/squared; and for all workers, education (4).

*** $p < .01$, ** $p < .05$, * $p < .1$.

[14] These estimates are close to the full worker sample estimates of Gittelman and Kleiner (2015) of 13 percent and 9 percent and of Kleiner and Vorotnikov (2017) of 11 percent (pooled gender).

The lower panels of Table 3 show that workers with associate degrees have significantly higher earnings if they also have a license. The average licensing premium is 30 percent for women and 12 percent for men. Notably, the premium is much larger for academic associate degrees (at 33 percent and 15 percent) than for vocational associate degrees (at 28 percent for female license holders but with no statistically significant premium for male license holders).

To clearly identify the relationship between postsecondary education and licensing, Table 4 shows earnings gaps from interactions within an omnibus specification, where the omitted category is workers with some college but no degree and no license. For persons with some college, having a license is associated with a gain in earnings of 18 percent for women and 23 percent for men. For associate degree holders, those without licenses gain almost the same as college non-completers with licenses (with gains over the omitted category of 9 percent and 13 percent). Hence, we find that a worker who obtains a license when in college might consider that equivalent to getting an associate degree. Nevertheless, it is still preferable to complete an associate degree: not only is the individual more likely to then get a license, but the earnings gains are larger at 39 percent versus 18 percent for women (for men the gains are identical at 23 percent). Estimates by degree field highlight the different effects of licenses. For vocational associate degrees, the college advantage is modest unless the worker also has a license. For academic associate degrees, the licensing effects are much larger, perhaps because the academic degree itself conveys weak signals to employers of a worker's vocational skills.

Table 5 shows the employment effects of licensing. These results provide a discriminatory test between the public goods and restrictive practice arguments. Workers with licenses have significantly higher labor market participation. Controlling for college, they report more hours of work and lower unemployment. The results for part-time work are inconclusive (as only a few workers report part-time status directly). At 1.96 and 1.89 hours per week for the full college sample, these employment effects are substantively large: they exceed the effects of having an associate degree. Again, licenses and associate degrees convey employment advantages independently of each other. Indeed, the gains from licenses are even greater for persons with associate degrees (at 1.25 and 2.95 hours

respectively). As with the results for earnings, the employment effects are stronger for licensed workers with academic associate degrees than for those with vocational associate degrees.[15]

Table 6 shows results from the omnibus specification for hours worked.[16] Workers with both postsecondary education and licenses work more hours than those with only postsecondary education. This advantage is 3.56 and 3.46 hours for workers with some college, which is slightly above the advantage just from having an associate degree. As with our results on earnings, we can infer that obtaining a license might be viewed as at least equivalent—and perhaps superior—to completing an associate degree. Similarly, though, getting an associate degree with a license yields significant advantages (at 3.14 and 3.72 hours respectively). The greater advantage in hours worked for academic associate degrees over vocational associate degrees is another consistent finding.

[15] As an alternative measure, unemployment may be aggregated to the local labor market rather than measured at the individual worker level. In the few studies that have looked at employment, the measure has been aggregated rather than individualized. Pasquale and Stange (2014) use the American Community Survey for nursing occupations; Stange (2014) uses a nurse-specific database; and Law and Marks (2017) use the decennial Census. To test for labor market effects using aggregated data, we created an occupation–state dataset using 2016 Occupational Employment Statistics (OES) data from the Bureau of Labor Statistics. The OES is a semiannual mail survey of employment and wages across 800 occupations nationally (but the survey excludes the self-employed, see www.bls.gov/oes/oes_emp.htm#overview). We merged these OES data with occupation–state level rates of licensing from the CPS and regressed occupation–state employment against licensing rates, controlling for workforce compositions and unemployment rates. However, the results were inconsistent across aggregated licensing measures. Using the main definition of licensing, employment rates were significantly negatively affected in occupation–states with high rates of licensing. Based on licensing need, however, employment and licensing were strongly positively correlated. (Details available from the authors.)

[16] Results for unemployment and part-time status yield similar conclusions (not reported).

Table 4
Earnings Gains From Licensing Interacted With College Education

	Female		Male	
	(1)	(2)	(1)	(2)
Relative to group "Some college, no license"				
Some college + license	0.169***	0.169***	0.215***	0.215***
	[0.028]	[0.028]	[0.024]	[0.024]
Bachelor's degree + no license	0.554***	0.554***	0.551***	0.551***
	[0.017]	[0.017]	[0.015]	[0.015]
Bachelor's degree + license	0.709***	0.709***	0.564***	0.564***
	[0.018]	[0.018]	[0.019]	[0.019]
Associate degree + no license	0.076***		0.113***	
	[0.021]		[0.019]	
Associate degree + license	0.351***		0.221***	
	[0.022]		[0.025]	
Vocational associate degree + no license		0.018		0.103***
		[0.031]		[0.024]
Vocational associate degree + license		0.282***		0.185***
		[0.030]		[0.032]
Academic associate degree + no license		0.110***		0.121***
		[0.024]		[0.023]
Academic associate degree + license		0.414***		0.264***
		[0.026]		[0.035]
R-squared	0.132	0.132	0.200	0.201
Observations	24,341	24,341	22,820	22,820

Note. Source: ASEC 2017, ages 18—64, college sample only. Unweighted estimation. Robust standard errors in brackets. Dependent variable: log annual earnings in 2017. Specification includes controls for: education (4); region, race/ethnicity, sector (2); union status; marital status; native status; experience/squared.

*** $p < .01$, ** $p < .05$, * $p < .1$.

Table 5
Employment Effects from Licensing

	Hours Worked per Week		Unemployment		Part-Time Status	
	Female	Male	Female	Male	Female	Male
College-educated						
Associate degree	0.52*	0.80**	-0.02	-0.338***	-0.148***	-0.292***
	[0.29]	[0.31]	[0.112]	[0.114]	[0.049]	[0.079]
Bachelor's degree	2.06***	1.44***	-0.225**	-0.489***	-0.468***	-0.545***
	[0.24]	[0.24]	[0.094]	[0.090]	[0.041]	[0.063]
License	1.96***	1.89***	-1.018***	-0.523***	-0.140***	-0.274***
	[0.21]	[0.25]	[0.126]	[0.122]	[0.040]	[0.077]
R-squared	0.018	0.026				
Observations	25,106	23,244	24,640	22,873	25,106	23,244
Associate degree						
License	1.25***	2.95***	-0.504**	-0.650**	-0.046	0.032
	[0.45]	[0.58]	[0.205]	[0.275]	[0.078]	[0.150]
R-squared	0.021	0.025				
Observations	4,712	4,016	4,672	3,950	4,712	4,016
Vocational associate degree						
License	2.16***	1.63*	-0.705**	-0.113	-0.204*	0.01
	[0.69]	[0.85]	[0.357]	[0.331]	[0.121]	[0.207]
R-squared	0.018	0.021				
Observations	1,863	1,886	1,848	1,854	1,863	1,863
Academic associate degree						
License	2.85***	4.05***	-1.125***	-1.131**	-0.236**	-0.545**
	[0.60]	[0.80]	[0.343]	[0.532]	[0.111]	[0.271]
R-squared	0.028	0.035				
Observations	2,849	2,130	2,824	2,096	2,849	2,096

Note. Source: ASEC 2017, ages 18–64, college sample only. Excludes persons with zero hours and not in labor force. Unweighted estimation. Robust standard errors in brackets. Specification includes controls for: education (4); region, race/ethnicity, sector (2); union status; marital status; native status; experience/squared.

*** $p < .01$, ** $p < .05$, * $p < .1$.

Table 6
Employment Effects From Licensing Interacted With College Education

	Female		Male	
	(1)	(2)	(1)	(2)
Relative to group "Some college, no license"				
Some college + license	3.56***	3.56***	3.46***	3.46***
	[0.51]	[0.51]	[0.53]	[0.53]
Bachelor's degree + no license	2.51***	2.51***	1.96***	1.96***
	[0.26]	[0.26]	[0.27]	[0.27]
Bachelor's degree + license	3.80***	3.80***	2.79***	2.79***
	[0.31]	[0.31]	[0.37]	[0.37]
Associate degree + no license	0.57*		0.82**	
	[0.34]		[0.35]	
Associate degree + license	3.14***		3.72***	
	[0.42]		[0.557]	
Vocational associate degree + no license		0.76		0.81*
		[0.47]		[0.47]
Vocational associate degree + license		2.82***		2.58***
		[0.58]		[0.76]
Academic associate degree + no license		0.45		0.84**
		[0.40]		[0.42]
Academic associate degree + license		3.42***		5.05***
		[0.53]		[0.75]
R-squared	0.021	0.021	0.028	0.028
Observations	25,106	25,106	23,244	23,244

Note. Source: ASEC 2017, ages 18–64, college sample only. Unweighted estimation. Robust standard errors in brackets. Dependent variable: weekly hours worked in 2017. Specification includes controls for: education (4); region, race/ethnicity, sector (2); union status; marital status; native status; experience/squared.

*** $p < .01$, ** $p < .05$, * $p < .1$

5.2 Compliance With Licensing Requirements

The descriptive frequencies reported above highlight ambiguity over the importance of licenses for each occupational category. Here we estimate earnings and employment effects across alternative licensing metrics for all college-educated workers and workers with associate degrees.

Table 7 shows the earnings effects of licensing. The upper panel is based on whether a license is needed (i.e., whether the DOLETA database reports a license is needed). The lower panel is based on whether a license is expected (i.e., whether a majority of ASEC respondents in that dyad report a license being required). The conclusions are consistent across licensing metrics and across the two samples.

Model A shows the gains from working in a state–occupation where a license is needed/expected, regardless of whether the worker has a license. This estimation corresponds to earlier studies where licensing is imputed. As shown, the effects of a license being needed/expected are substantial and are similar to the gains from having a license. However, the gains vary depending on the correspondence between working in the state–occupation where a license is needed/expected and the worker actually having that license. As given in Model B, having a license that is needed/expected is associated with very large earnings gains of 42 percent and 15 percent for associate degree holders (and 34 percent and 17 percent respectively for the college-educated sample).

Nevertheless, there are still earnings gains from having a license that is not needed. Therefore, licenses convey earnings gains even when there is no overt restrictive practice of occupation-wide licensing. As well, there are only small—but still significant—gains for workers who are not licensed but work in dyads where licenses are needed (as found by Gittelman & Kleiner, 2015). This last group may be either non-compliers or they may be performing specific tasks which are ancillary to the occupation and which do not need a license. These results for needing a license are the same for persons with associate degrees as for across the college population, again with the consistent caveat that earnings gaps for male workers are significantly attenuated.

Finally, Model C shows results where the worker's license is instrumented using whether a license is needed/expected. For all the instrumental variable estimates across the samples, the earnings benefits from licensing are substantially higher than those reported in Table 3. (Again, as shown by the results from the endogeneity tests, the licensing effects are more weakly identified for male workers.) These larger gains from the instrumental variables specification are also suggestive of both an inward supply shift and an outward demand shift from improvements in product quality.

Table 7
Earnings Effects From Licensing: Occupational Requirements

	Associate Degree Holders		All College-Educated Workers	
	Female	Male	Female	Male
License needed (DOLETA)				
Model A				
License Needed	0.251***	0.067**	0.140***	0.051***
	[0.026]	[0.030]	[0.012]	[0.013]
Model B				
Licensed + needed	0.356***	0.126***	0.312***	0.145***
	[0.029]	[0.040]	[0.015]	[0.019]
Licensed + not needed	0.107**	0.046	0.116***	0.101***
	[0.043]	[0.041]	[0.018]	[0.017]
Not licensed + needed	0.052	0.056*	0.081***	0.045***
	[0.034]	[0.031]	[0.017]	[0.015]
Model C				
License (IV is needed)	0.594***	0.333**	0.400***	0.241***
	[0.062]	[0.151]	[0.035]	[0.061]
Endogeneity test F(1, N-K)	33.3	2.4	44.5	7.3
Adjusted ***R***-squared 1st stage	0.183	0.049	0.190	0.092
License expected (ASEC)				
Model A				
License expected	0.427***	0.204***	0.244***	0.088***
	[0.035]	[0.043]	[0.017]	[0.021]
Model B				
Licensed + expected	0.319***	0.101***	0.260***	0.054***
	[0.027]	[0.038]	[0.014]	[0.018]
Licensed + not expected	0.080	0.097*	-0.002	-0.051
	[0.062]	[0.057]	[0.027]	[0.034]
Not licensed + expected	0.046	0.062*	0.078***	0.069***
Model C				
License expected IV	0.409***	0.202***	0.243***	0.089***
	[0.033]	[0.042]	[0.017]	[0.021]
Endogeneity test F(1, N-K)	34.5	8.6	21.0	0.2
Adjusted *R*-squared 1st stage	0.537	0.384	0.516	0.410
Observations	4,568	3,954	24,341	22,820

Note. Source: ASEC 2017, ages 18–64, college sample only. Unweighted estimation. Robust standard errors in brackets. Dependent variable: ln(earnings). Specification includes controls for: education (4); region; race/ethnicity; sector (2); union status; marital status; native status; experience/squared.

*** $p < .01$, ** $p < .05$, * $p < .1$

For hours worked, Table 8 reports results across the different licensing requirements. (Results for unemployment and part-time status are similar in sign, but few coefficients are statistically significant). The same models A–C are estimated as per Table 7. There is a strong association between hours worked and needing/expecting a license for female workers; the results for male workers are inconsistent, with no effect from working in a dyad where a license is needed. As with earnings, there are very strong and consistent effects for workers in dyads where a license is needed/expected and the individual worker has a license. These workers report between one and three hours more work per week. By contrast, there are no clear effects for licensed workers in dyads where a license is not needed/expected. Interestingly, there are some positive employment effects for workers who are unlicensed but work in dyads where a license is needed/expected. Finally, applying either instrumental variable, we see that licenses are associated with large gains in hours worked.

Table 8
Hours Worked Effects From Licensing: Occupational Requirements

	Associate Degree Holders		All College-Educated Workers	
	Female	Male	Female	Male
License needed (DOLETA)				
Model A				
License needed	0.86*	0.01	0.81***	-0.01
	[0.47]	[0.60]	[0.21]	[0.24]
Model B				
Licensed + needed	2.157***	1.798**	2.321***	1.579***
	[0.564]	[0.916]	[0.260]	[0.362]
Licensed + not needed	0.433	-0.079	0.498*	-0.147
	[0.715]	[0.743]	[0.281]	[0.290]
Not Licensed + needed	3.306***	3.221***	2.239***	2.145***
	[0.626]	[0.701]	[0.309]	[0.324]
Model C				
License needed IV	2.05*	0.04	2.32***	-0.04
	[1.11]	[3.04]	[0.59]	[1.12]
Endogeneity test F(1, N-K)	0.2	0.8	0.42	3.0
Adjusted *R*-squared 1st stage	0.181	0.049	0.189	0.091
License expected (ASEC)				
Model A				
License expected	1.88***	2.53**	1.16***	1.59***
	[0.64]	[0.99]	[0.31]	[0.40]
Model B				
Licensed + expected	1.13**	2.78***	1.01***	1.36***
	[0.53]	[0.95]	[0.25]	[0.37]
Licensed + not expected	-1.33	-1.13	-0.84*	-1.71***
	[1.08]	[1.59]	[0.44]	[0.63]
Not licensed + expected	1.17*	2.97***	1.18***	1.67***
	[0.66]	[0.68]	[0.31]	[0.31]
Model C				
License expected IV	1.80***	2.51***	1.16***	1.59***
	[0.62]	[0.98]	[0.30]	[0.40]
Endogeneity test F(1, N-K)	2.84	0.12	12.5	0.85
Adjusted *R*-squared 1st stage	0.536	0.382	0.515	0.406
Observations	4,712	4,016	25,106	23,244

Note. Source: ASEC 2017, ages 18–64, college sample only. Unweighted estimation. Robust standard errors in brackets. Dependent variable: weekly hours worked in 2017. Specification includes controls for: education (4); region; race/ethnicity; sector (2); union status; marital status; native status; experience/squared.

*** $p < .01$, ** $p < .05$, * $p < .1$

5.3 Earnings Dispersion

Licensing should reduce wage dispersion either by compressing skills or constraining services.[17] However, prior evidence has found increased wage dispersion. We calculate wage dispersion for two samples (college-educated and associate degrees only) split by gender.

Tables 9 and 10 show the effect on wage dispersion based on the method in Card (1996). For each quartile of the female college-educated sample, predicted wages of licensed workers exceed those of unlicensed workers, and the gaps are statistically significant; across the quartiles for male workers, the gaps are slightly smaller and not always positive, but on average the gap is significant. However, the mean squared error is substantially smaller for all college-educated workers with licenses: these results indicate that licensing reduces wage dispersion across the distribution of earnings. Looking at the associate degree sample, the earnings gaps are not statistically significant per quartile. Nevertheless, the mean squared error is much smaller, which is further evidence of the effect of licensing on wage dispersion.

[17] As an illustration (see Figure A2), we draw a scatterplot of the returns to licensing across states; we also correlate these returns with those from Kleiner and Vorotnikov (2017). The returns per state are clustered around 20–25 percent, with only a few outliers; estimates from Kleiner and Vorotnikov exhibit more variation. Also, as shown in Figure A3, there is no clear association between the proportion licensed in each state and the returns to licensing.

Table 9
Wage Dispersion Across License Holders: College-Educated Sample

	Predicted Unlicensed Wage Quartile				Total
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Sample
Female					
Conditional mean ln(earnings)					
No license NL	9.9835	10.3059	10.5674	10.8470	10.3930
Licensed L	10.0086	10.3239	10.5846	10.8508	10.5056
Difference L–NL	0.0251	0.0180	0.0172	0.0038	0.1126
p-value	***	***	***	***	***
Conditional mean squared error					
No license NL	0.9968	0.8059	0.8552	0.8966	0.8900
Licensed L	0.6989	0.6526	0.6330	0.5683	0.6287
Difference L–NL	-0.2979	-0.1533	-0.2222	-0.3282	-0.2613
p-value	***	***	***	***	***
Observations	5,966	6,072	6,143	6,160	24,341
Male					
Conditional mean ln(earnings)					
No license NL	10.3128	10.7504	11.0471	11.3520	10.8447
Licensed L	10.3657	10.7559	11.0476	11.3472	10.9359
Difference L–NL	0.0529	0.0055	0.0005	-0.0047	0.0912
p-value	***	**	NS	**	***
Conditional mean squared error					
No license NL	0.8695	0.6349	0.6058	0.6343	0.6907
Licensed L	0.6419	0.4767	0.4757	0.6069	0.5442
Difference L–NL	-0.2276	-0.1582	-0.1301	-0.0274	-0.1465
p-value	**	**	***	NS	***
Observations	5,811	5,809	5,771	5,853	23,244

Note. Sources: ASEC 2017, unweighted. License refers to federal/state issue. Specification approach as per Gittleman and Kleiner (2016, Table 11). Predicted unlicensed wage quartiles estimated from model specification as per Table 3 (pooled genders) on unlicensed sample. Conditional mean ln(earnings) and mean squared error from model specification as per Table 3. T-test difference in means unlicensed-licensed *p*-values.

*** $p < .01$, ** $p < .05$, * $p < .1$; NS = not significant.

Table 10
Wage Dispersion Across License Holders: Associate Degree Sample

	Predicted Unlicensed Wage Quartile				Total
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	Sample
Female					
Conditional mean ln(earnings)					
No license NL	9.9228	10.2334	10.3676	10.4608	10.2491
Licensed L	9.9171	10.2240	10.3702	10.4630	10.2402
Difference L–NL	-0.0056	-0.0094	-0.0026	0.0022	-0.0088
p-value	NS	**	NS	NS	NS
Conditional mean squared error					
No license NL	0.9504	0.8495	0.7949	0.7090	0.8234
Licensed L	0.5663	0.6350	0.6268	0.4010	0.5598
Difference L–NL	-0.3840	-0.2146	-0.1680	-0.3080	-0.2636
p-value	**	*	**	***	***
Observations	1,178	1,178	1,175	1,181	4,712
Male					
Conditional mean ln(earnings)					
No license NL	10.3129	10.6476	10.8207	10.9882	10.6824
Licensed L	10.3276	10.6538	10.8157	10.9962	10.7215
Difference L–NL	0.0147	0.0062	-0.0050	0.0080	0.0391
p-value	NS	**	NS	**	***
Conditional mean squared error					
No license NL	1.0300	0.5190	0.5671	0.3421	0.6211
Licensed L	0.7868	0.3931	0.5421	0.3589	0.5071
Difference L–NL	-0.2432	-0.0250	-0.0250	0.0168	-0.114
p-value	NS	NS	NS	NS	NS
Observations	1,004	1,004	1,001	1,007	3,954

Note. Sources: ASEC 2017, unweighted. License refers to federal/state issue. Specification approach as per Gittleman and Kleiner (2016, Table 11). Predicted unlicensed wage quartiles estimated from model specification as per Table 3 (pooled genders) on unlicensed sample. Conditional mean ln(earnings) and mean squared error from model specification as per Table 3. T-test difference in means unlicensed-licensed p values.

*** $p < .01$, ** $p < .05$, * $p < .1$; NS = not significant

Figures 1–4 show quantile regression estimates of earnings (as per specifications in Table 3). The dotted line is the median estimated returns from licensing; the unbroken line (with confidence intervals shaded) shows the estimated returns across the distribution of earnings. The overall pattern affirms the conclusion that licensing reduces earnings dispersion. Across Figures 1–4, there is a clear downward slope as we move up the earnings distribution: the gains from licensing are greater for lower earnings workers. The effect is especially strong for female workers and extends across the full distribution of earnings such that licensing has no statistically significant effect for the very highest percentiles of workers. For male workers, the patterns are less precise as shown by the broad confidence intervals.

This finding is in contrast with findings of greater wage dispersion in prior studies by Gittleman and Kleiner (2015) and Kleiner and Vorotnikov (2017). The sample sizes for these studies differ from the CPS data. Also, these studies are not focused on the college-educated workforce and do not report separate results by gender. Finally, Kleiner and Vorotnikov report that their results are sensitive to occupational controls.

Figure 1
Wage Dispersion Across License Holders: Associate Degree Sample, Female

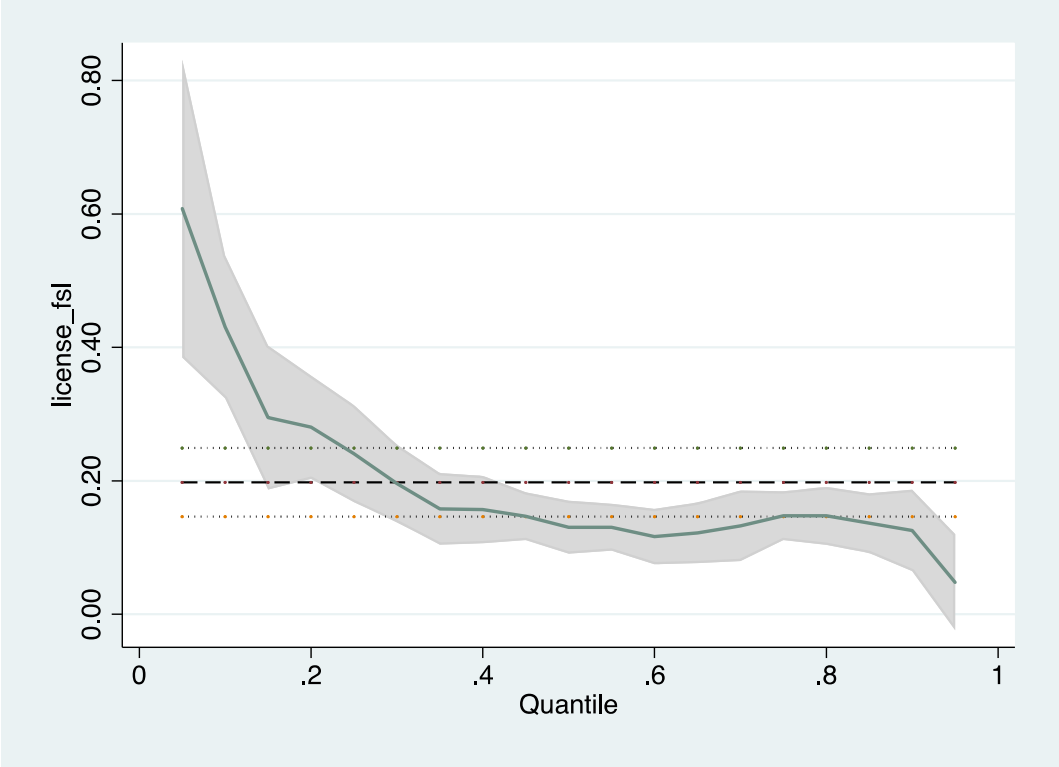


Figure 2
Wage Dispersion Across License Holders: Associate Degree Sample, Male

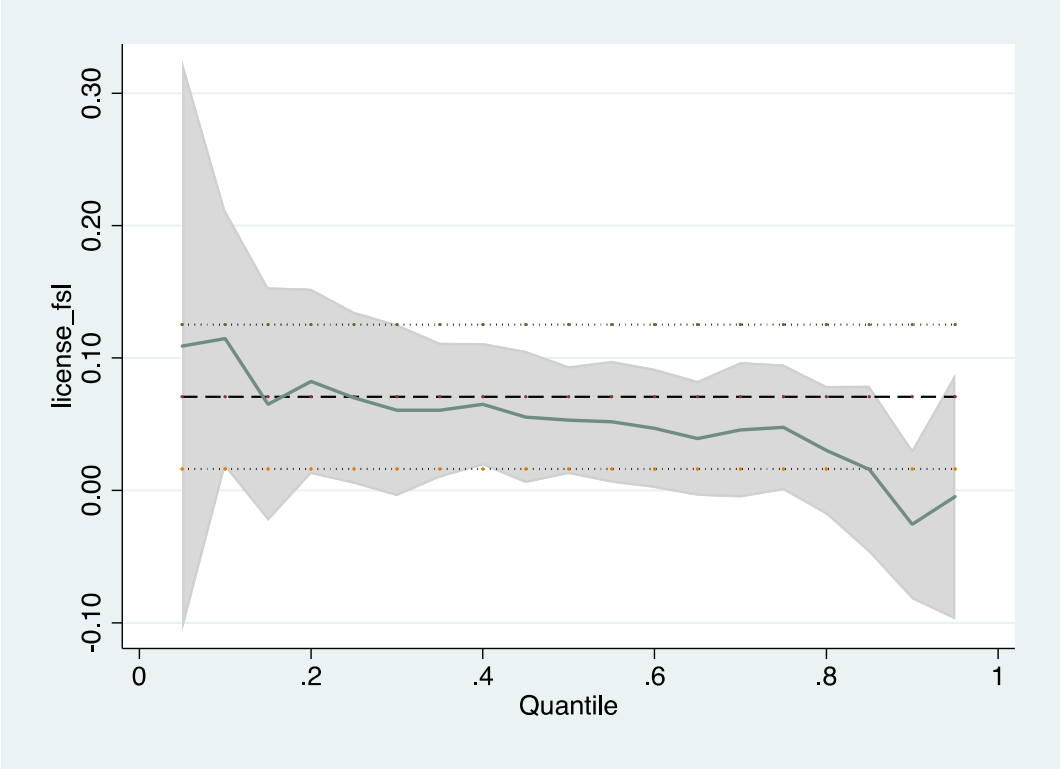


Figure 3
Wage Dispersion Across License Holders: All College-Educated, Female

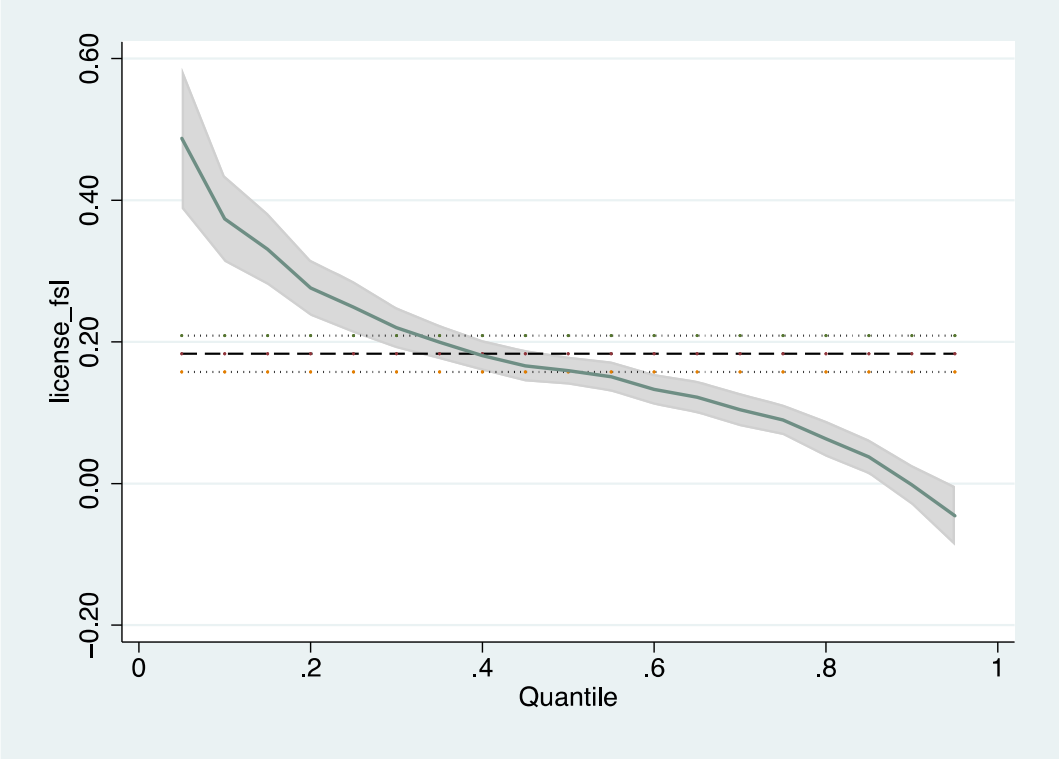
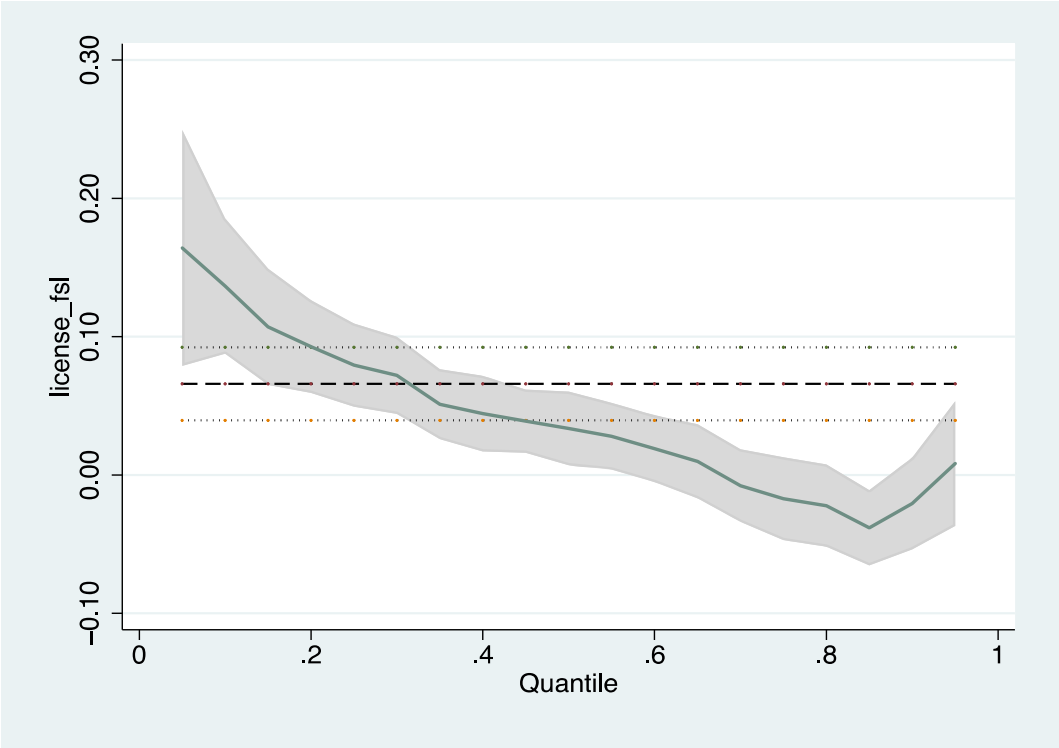


Figure 4
Wage Dispersion Across License Holders: All College-Educated, Male



6. Conclusion

Growing interest in licensing is a response to a series of recent labor market trends. First, as the workforce has become dominated by workers with postsecondary education, workers are accumulating more and varied signals of their productivity—getting a license is one of these signals. Hence, rates of licensing have increased over recent decades. Second, there is a renewed emphasis on apprenticeships and competency-based education—workers can use licenses to establish these competencies. Third, the economy is continuing to move toward trade in services—licenses can play an important role in establishing service quality. Finally, completing college is taking longer and becoming ever more expensive—workers may attempt to bypass this commitment of time and money by obtaining a competency-based license that demonstrates degree-level skills. Hence, licenses are now common and may grow in prevalence over time if the price of college keeps increasing.

Our analysis finds that licensing conveys significant benefits to workers in terms of higher earnings and greater labor market participation. At the aggregate level, licensing is associated with reduced wage dispersion. Although the effects are stronger for female workers, they extend across all college-educated samples. Together, these findings—especially with respect to labor market participation—point toward licensing as a solution to a public goods theory of market failure due to imperfect information rather than as a restrictive practice.

Importantly, licensing does not undercut the economic value of a college degree. Having a license only trivially reduces the returns to college: these returns are only 2–3 percentage points lower when we control for licensing. This finding remains to be explained: one possibility is that the degree generates long-term human capital across all work activities, whereas the license reflects worker competency at a specific set of tasks. Indeed, there is a clear pinnacle in returns: workers with degrees and licenses report the best labor market outcomes—both in terms of earnings and labor market participation. Below this, licenses and associate degrees appear to be approximately equivalent in their effects on labor market outcomes. We therefore speculate that licensing opportunities may in part explain high dropout rates from community colleges. Moreover, licensing may be preferable to obtaining a certificate, a certification, or stacked credentials. These awards convey weak-to-modest effects on earnings, and any advantages they do convey appear to be short-lived. In conclusion, there is some support for an optimistic interpretation of licensing: even as a license may serve as a potential substitute for certificates and certification, it appears to complement degree attainment by providing occupation-specific skills and by signaling worker productivity.

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Appendix

Table A1
Demographic Characteristics: College-Educated Workforce

	Does Not Have License	Has License
White	0.64	0.72
Black	0.11	0.09
Hispanic	0.15	0.11
Female	0.49	0.59
Sector: Government	0.14	0.28
Sector: Self-employed	0.09	0.10
Experience	20.2 (12.3)	19.9 (11.0)
Wage pay	$58,777 (72,022)	$62,290 (69,688)
Hours per week	40.6 (10.4)	41.7 (11.3)
Unemployed	0.03	0.02
Part-time	0.13	0.12
Observations	35,206	13,144

Note. License refers to federal/state issue. Sources: ASEC 2017, unweighted. College-educated workforce.

Table A2
Determinants of Licensing: Associate Degree Sample

	Female	Male
White	0.1316	0.1669
	[0.1273]	[0.1539]
African American	-0.0044	-0.3279*
	[0.1537]	[0.1960]
Hispanic	-0.0459	-0.1503
	[0.1380]	[0.1686]
Experience	0.0094	0.0061
	[0.0105]	[0.0131]
Experience-squared	-0.0005*	-0.0002
	[0.0002]	[0.0003]
Married	0.0189	0.2353***
	[0.0656]	[0.0853]
U.S. born	0.0931	0.037
	[0.1071]	[0.1296]
Union	0.4538	0.376
	[0.3217]	[0.2620]
Sector: Government	-0.1179	0.5746***
	[0.0920]	[0.1016]
Sector: Self-employed	0.3197***	0.2444**
	[0.1148]	[0.1164]
Observations	4,708	4,016

Note. Source: ASEC 2017. Ages 18–64, associate degree sample only. Unweighted estimation. Logit estimation. Robust standard errors in brackets. Dependent variable: has a license. Specification also includes controls for region (3).

*** $p < .01$, ** $p < .05$, * $p < .1$.

Figure A1
Licensing Rates by Occupation-State Dyad (ASEC Reports)

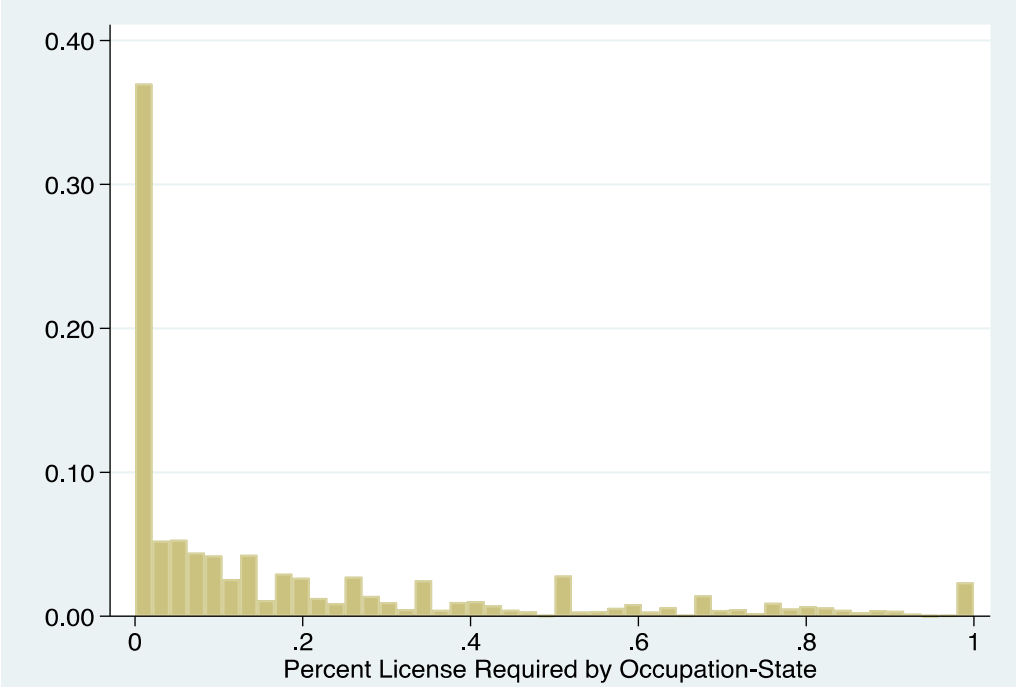

Figure A2
Comparison of State Average Licensing Rates

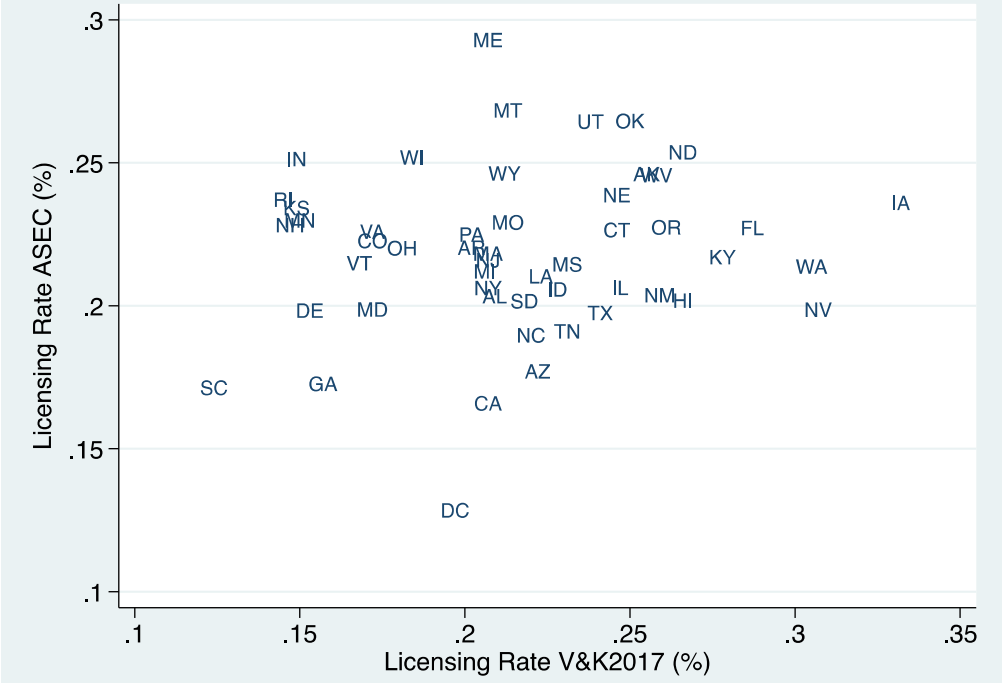

Figure A3
Comparison of State Average Licensing Earnings Premiums

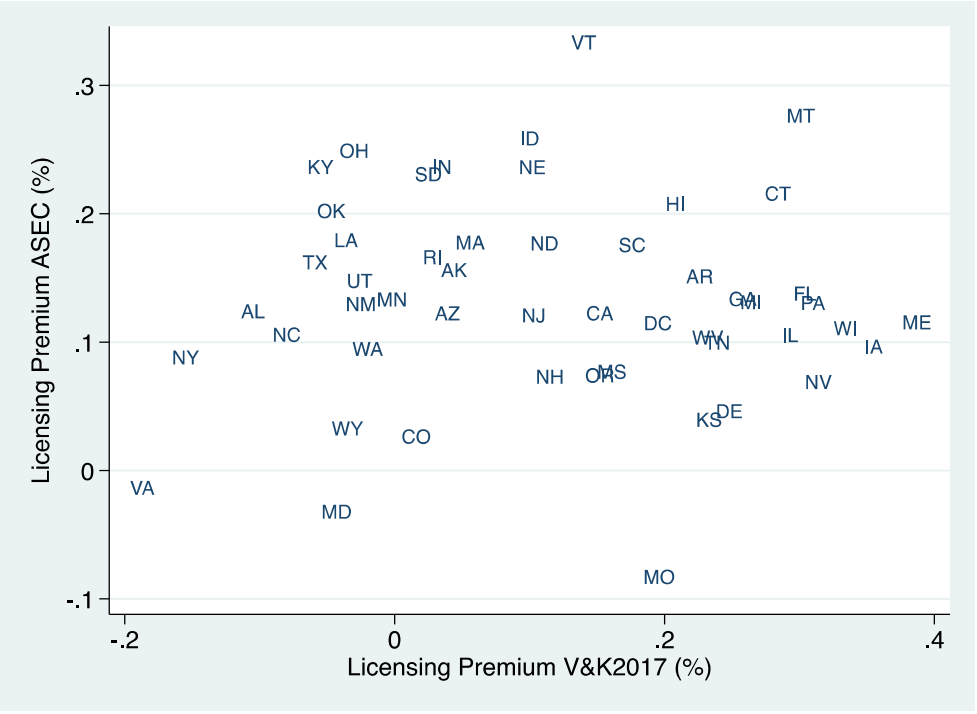

Figure A4
Comparison of State Average Licensing Earnings Gains and Licensing Rates