

WHAT ARE THE LONG RUN EFFECTS OF NURSE OCCUPATIONAL LICENSURE?

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ABSTRACT

Most theories of occupational regulation posit that the effects of occupational licensure regulations—laws that require members of an occupation to possess a license in order to practice—increase with time. In this paper, we take advantage of a quasi-experiment afforded by the fact that different US states adopted mandatory licensing of registered and practical nurses at different times to estimate the effects of licensing on wages and participation, allowing for licensing laws that have been in place longer to have larger effects. We investigate these impacts on the profession as a whole, and on minority workers in particular, using individual-level data taken from four waves of the US decennial censuses. While we find some evidence that wages of nurses increased with the duration of licensing, there is no systematic evidence that participation declined. Additionally, for registered nurses, we find that minority wages rose faster than non-minority wages, and that the participation of minority workers increased with time relative to non-minorities following licensure. Taken as a whole, these findings are more consistent with the public interest theory than the capture theory.

I. INTRODUCTION

In principle, the effects of occupational licensure regulations—laws that require members of an occupation to possess a license in order to practice—should increase with time. Because incumbent practitioners are invariably grandfathered when licensing laws are introduced, it may take several years or even decades before licensing has an observable impact on labor market outcomes like wages and employment.

Different theories of occupational licensure have somewhat different implications with respect to the longer run impacts of licensing. According to capture theorists, licensing laws function as entry barriers that gradually restrict supply and decrease competition (Stigler 1971). Over time, wages of practitioners should rise and participation in the occupation should fall. The public interest theory, in contrast, posits that licensing, by providing a signal of quality, gradually increases the demand for professional services (Leland 1979). Wages of practitioners should rise but so should participation. Accordingly, while both theories posit that wages should increase with the duration of licensure, the two views of licensing diverge when it comes to predicting the long run impacts on participation in the profession as a whole. This divergence should be even stronger for occupations that where it is more difficult to observe worker quality *ex ante*.

The two theories also have different predictions when it comes to minority worker participation relative to the dominant group. Under the capture theory, licensing may harm minority participation either because minority workers are less able to meet the licensing requirements, or because the licensing regime allows the

dominant group to indulge in its taste for discrimination (Alchian and Kessel 1962; Dorsey 1983; Federman *et al* 2006). In contrast, under the public interest theory, licensing may increase the participation of minority workers if licensing serves as a signal of quality that disproportionately benefits minority workers (Lundberg and Startz 1983; Law and Marks 2009). However, both theories posit that the relative wages of minorities should rise following licensure. If minority workers are less skilled than non-minority workers prior to licensing, licensing requirements that impose minimum educational or skills requirements will equalize the relative wages of minorities who qualify for a license. Additionally, the relative wages of minority workers may increase even further rise if licensing helps minority workers solve their lemons problem.

While there is a substantial empirical literature that estimates the effects of occupational regulation on labor market outcomes like wages and employment (see Kleiner 2006 for an overview), relatively few studies account for the fact that the impact of licensing should be greater the longer that licensing has been in place. The bulk of the empirical literature treats all licensed jurisdictions as the same, regardless of how long the licensing regime has existed. A handful of studies provide suggestive evidence that the positive impact of licensing on wages grows over time. Kleiner (2006) and Timmins and Thornton (2010) furnish evidence that occupations that have been regulated for many decades, such as lawyers, dentists, and barbers, enjoy significant wage premia relative to unregulated occupations. Bryson *et al* (2012) and Kleiner and Vorotnikov (2012) provide further evidence that wages increase with the duration of licensing. Using cross-sectional UK data on

the wages of individual workers across a wide range of occupations, Bryson *et al* (2012) find that impact of licensing on current wages depends on the decade in which an occupation became licensed, with the premium becoming larger the earlier the decade in which licensing was adopted. Kleiner and Vortnikov (2012), examining US data on interior designers, find that the impact of licensing on wages increases with the duration since the passage of restrictive interior designer licensing laws.

Our study contributes to this literature on the longer-term impacts of licensing. Taking advantage of the fact that different US states moved from a voluntary certification to a mandatory licensure regime at different times for two US nursing professions (registered and practical nurses), we use four census waves to identify impact of licensure on wages and participation. Our analysis uses a difference-in-differences (DD) framework to identify the impact of licensing on nurses as a whole, and a difference-in-differences-in-differences (DDD) estimator to determine the impact on minority workers. Because we know the year in which a state switched from a certification to a licensure regime, we can determine how long practical or registered nurse licensing has been in place in a given state in a given census year. Our analysis therefore allows us to control for the length of time that licensing has been in place.

We build on the literature in the following ways. First, unlike Bryson *et al* (2012), Timmins and Thornton (2010) and Kleiner (2006), we use variation in the duration of licensing within an occupation across US states as opposed to variation across different occupations that were licensed at different times. If higher income

occupations were licensed earlier than lower income occupations, the cross-occupational approach will conflate the timing of licensing with inherent differences across occupations. Second, nursing, unlike interior designing (Kleiner and Vortnikov 2012), is a large occupation that has been licensed for several decades. Hence, we are able to examine the impact of licensing over a longer period of time than Kleiner and Vortnikov. Third, in addition to analyzing the impact of wages, we look at overall participation in nursing professions, and participation of minority workers in particular. By including participation as an outcome, our approach allows us to more cleanly distinguish among the competing theories of licensure.

Our basic results are as follows. While we find some evidence that wages of nurses increase with the duration of licensing, we do not find effects for participation. Additionally, for registered nurses, we find that minority wages rose faster than non-minority wages, and that participation of minority workers increased with the duration of licensing. Taken as a whole, these results are more consistent with the public interest theory than the capture theory.

The remainder of this paper is structured as follows. We first discuss the evolution of professional regulation for registered and practical nursing, present information on our data set, as well as some descriptive evidence suggesting that the switch from certification to mandatory nursing constitutes a valid quasi-experiment from which we can draw causal inferences regarding the impact of mandatory licensing on labor market outcomes. We then outline our empirical strategy and present our regression results, first for each nursing profession overall, and then focusing on minority workers. This is followed by a conclusion.

II. BACKGROUND AND DATA

Since the late 1800s there have been two nursing professions in the United States: registered and practical nurses. Registered nurses require more education and training than practical nurses. Often, practical nurses work under the supervision of registered nurses.¹

For both nursing professions, regulation evolved in two stages. The first stage involved the adoption of laws that introduced (voluntary) certification. During this time, states began to set the standards for what was required for a nurse to be certified; however, uncertified practitioners were still permitted to practice. By approximately 1950 for registered nurses and 1960 for practical nurses a certification regime was in place in most states. During the subsequent decades states began to move towards a mandatory licensing regime that precluded the participation of nurses who did not possess a license (White 1983). Table 1 presents information on the year in which each state switched from voluntary certification to mandatory licensure taken from Monheit (1982) who compiled information on state-level occupational regulations for nursing. Mandatory licensing of registered nurses began in California in 1939 followed by Arkansas and Montana in 1947. By 1980 all but two states (Georgia and Massachusetts) and the District of Columbia had adopted licensing. A glance at the table reveals that while many states adopted mandatory licensing of both nursing professions in the same year, states licensing of registered nurses generally preceded licensing of practical nurses.

¹ See Law and Kim (2005) a more detailed analysis of the rise of occupational regulation across a wide range of professions during the late 1800s and early 1900s.

Data on participation and wages of registered and practical nurses are taken from the Integrated Public Use Microdata Series (IPUMS), a sample of individual returns from the decennial United States censuses (Ruggles *et al*, 2010). We use the 1950 through 1980 decennial censuses, inclusive, and we convert all monetary variables into constant 2014 dollars.² We also limited our attention to individuals from the ages of 16 and 65 and are in the labor force. To minimize measurement error we dropped from the sample the top and bottom one percent of nurse wage earners in each census year. For each individual in our data set we gathered information on their current state of residence, country of birth, metropolitan residence, education, earnings, sex, race, hours and weeks worked, age, marital status, and number of children. To be classified as a registered or practical nurse a respondent had to self-identify as either a practical or registered nurse when asked about occupation. We categorize a worker as a minority if she reports her race as anything other than white. We then matched this individual-level data with the data in Table 1 on the year in which each state switched from a certification to a mandatory licensing regime.

We will be conducting two separate analyses for each nursing occupation: one on wages and the other on participation. For the participation analysis, we use all labor force participants. In the decennial censuses, all respondents are asked about labor force participation in the current year. To ensure that mandatory

² For 1950 and 1960 we have a one percent random sample of individual census returns. For 1970 we combined Form 1 and Form 2 state samples to get a 2 percent sample. For 1980 we use the 5 percent state sample. All regressions include sample weights. Earnings data from the 1950 decennial census are limited to “sample-line” individuals (Ruggles *et al* 2010). Hence, for the wage regressions sample sizes are much smaller for 1950 than for later years.

licensing regulation has already been enacted by the time participation is measured we allow for a one-year lag. Our treatment variable is the number of years in which mandatory licensing has been in place in a given year in a given state, allowing for a one-year lag. For example, an individual in Iowa, which adopted mandatory licensing in 1963, is coded as having been exposed to 6 years of licensing in 1970 (allowing for a one-year lag, licensing has been in place in Iowa for 6 years). On the other hand, for individuals in Indiana, which did not adopt licensing until 1971, this variable is coded as 0.

In the decennial censuses, earnings data are based on the previous calendar year. Accordingly, for our wage analysis we restrict our attention to nurses that reported positive wage income in the previous year. For the earnings regressions, we therefore classify a state as having adopted licensure if its mandatory licensing law is enacted *two years* earlier. Hence, for a registered nurse in Iowa in the 1970 Census, we code this variable as 5, whereas if registered nurse licensing was not in place by 1968, then the variable is coded as 0.

In order for us to make valid causal inferences, it is helpful to establish that the wages and participation of nurses in states that adopted mandatory licensing earlier were not systematically different from those from states that adopted mandatory licensing in later decades. Figure 1 plots the year in which registered nurse licensing was introduced in a state on the x-axis against the average wages in 1950 of registered nurses in that state on the y-axis (each dot in the scatterplot therefore represents a state). We use 1950 since only four states had mandatory licensing by that year and it is the earliest census year in which wage data was

reported. This allows us to determine whether there was a relationship between wages in the profession and the timing of licensure. There is no apparent relationship between the two variables (the correlation coefficient is -0.0567). The corresponding scatterplot for practical nurses is shown in Figure 2. Again, the relationship between the year in which mandatory licensing was adopted and average wages is very weak (the correlation coefficient is -0.0743). Hence, it would seem that the timing of the switch to mandatory licensing and the initial wages of registered and practical nurses is unrelated.

Figures 3 and 4 present scatterplots of the year in which mandatory licensing was introduced in each state graphed against the share of the labor force in 1950 participating in registered and practical nursing, respectively. For registered nurses, there is a negative relationship implying that the states that adopted mandatory licensing earlier had a larger share of the labor force employed as registered nurses (the correlation coefficient is -0.28). This finding is, perhaps, not too surprising. One might expect that the likelihood that an occupation becomes regulated within a state is a function of its size. In contrast, however, for practical nurses, the relationship is positive (the correlation coefficient is 0.29); states that adopted practical nurse licensing earlier had a smaller share of the labor force in practical nursing than those that adopted licensing later. While these figures suggest that mandatory licensing of nurses may have been endogenous to labor force participation, the fact that the sign of the correlation is different for the two professions suggests that there is no obvious account for the nature of this endogeneity. Additionally, the inclusion of state and year fixed effects should allow us to sweep out year and state-

specific factors that may be driving underlying trends in labor force participation in these two professions.

Tables 2 and 3 present summary statistics for registered and practical nurses, respectively. For each profession, we report summary statistics for the overall sample, as well as separately for states that were “early” and “late” adopters of mandatory licensing regulation of nurses. In order to split the sample into roughly equal numbers of “early” and “late” adopters, we use the median year that mandatory licensing is introduced as our cutoff date. For registered nurses, the cutoff year is 1958 (“early” adopters are those states that adopted mandatory licensing before 1958; “late” adopters are those that adopted it on or after 1958) while for practical nurses 1968 is the cutoff year.

As shown in Table 2A, it would appear that registered nursing professions in early and late adopting states were very similar in most dimensions. Early and late adopting states were similar in terms of average age, share female, education level, marital status, number of children, and intensity of work. Nurses in early adopting states are more likely to reside in metro areas and are more likely to be foreign born. Table 3A shows that practical nurses in early and late adopting states are also very similar in terms of observable characteristics. Hence, as a first pass, it seems reasonable to think that variation across early and late adopting states may provide a useful quasi-experiment for examining the impact of nurse occupational licensing.

Tables 2B and 3B show simple difference-in-differences estimates of whether the impact of licensing is larger for states that adopted licensing earlier. The first two rows of Table 2B suggest that while 1950 wages were slightly higher in late

adopting states than early adopting states, by 1980, the situation had reversed. Participation in registered nursing, however, changed by a similar (positive) amount in both early and late adopting states. For minority registered nurses, real wages were higher in 1950 in early adopting states than late adopting states and remained higher in 1980. The share of registered nurses that was minority was lower in early adopting states than late adopting states (3.6 percent vs. 4.8 percent) in 1950 but by 1980, early adopting states had a higher share of minority registered nurses than late adopting states (12.9 percent vs. 9.6 percent).

The corresponding simple difference-in-difference estimates for practical nurses are shown in Table 3B. There is no evidence that wages increased by a greater amount for early adopting states. Participation overall increased by a similar magnitude in early and late adopting states. Minority participation increased by more in early adopting than late adopting states. However, minority wages increased by a similar amount in both groups of states.

III. EFFECTS OF MANDATORY LICENSING ON REGISTERED AND PRACTICAL NURSES OVERALL

To investigate the impact of licensing we estimated the following regression equation for each nursing profession:

$$(1) W_{njt} = \beta_0 + \beta_1 YL_{jt} + \beta_2 T_t + \beta_3 S_j + X_{njt}\beta_4 + \varepsilon_{njt}$$

where W_{njt} is the real annual wage of nurse n in state j in census year t ; YL_{jt} is the number of years that occupational licensing has been in place in state j by census year t ; X_{njt} is a vector of individual-nurse level control variables; and S_j and T_t are

state and census year fixed effects. The variable of interest in this regression is β_1 , the coefficient on the number of years licensing has been in place in a given state by a given census year. We can interpret β_1 as the impact that one additional year of mandatory licensing has on the real wages of nurses in a given state.

For each nursing profession we estimate two regression models, each using a different set of individual level controls: the first controls for, age, age squared, and dummies for gender, minority, and foreign born (all truly exogenous variables), while the second includes all of these variables as well as number of children and categorical variables for metropolitan residence, hours worked per week and number of weeks worked per year, marital status, and education levels, all variables that are potentially influenced by licensing and impact wages. For instance, licensing requirements often include educational components; therefore may increase wages solely by raising education levels of participants.

Coefficient estimates are presented in Table 4. Columns (1) and (2) show the results for registered nurses while columns (3) and (4) show the estimates for practical nurses. For registered nurses, the coefficient on the number of years that licensing has been in place is positive for both regression models and statistically significant in the less parsimonious regression model. Taken at face value, the point estimate from column (2) suggests that each additional year that registered nurse licensing is in place raises average real wages by almost \$100 (in 2014 dollars), or alternatively, that 10 years of occupational licensing raises registered nurse wages by \$1,000. While this effect is economically significant, it is worth noting that the cumulative impact of mandatory licensing on real wages over a ten-year horizon is

small relative to overall wage growth as implied by the year fixed effects.

Controlling for the impact of licensing and other factors, the real wages of nurses increased by \$6,424 between 1950 and 1960, and \$9,461 between 1960 and 1970 (note that 1950 is the omitted year). Hence, the impact of ten years of licensing being in place relative to ten years of overall wage growth in practical nursing was only 15.7 percent between 1950 and 1960 and 10.6 percent between 1960 and 1970. The fixed effects also indicate that real wages of registered nurses fell by \$4,715 between 1970 and 1980, controlling for other factors, an impact that is still substantially larger (in absolute value) than 10 additional years of mandatory licensing. Hence, the cumulative impact of licensing was relatively small compared with overall decade-by-decade trends in nursing compensation.

For practical nurses, the coefficient estimate is positive but not statistically significant, regardless of which controls variables are included. Additionally, the magnitude of the yearly impact of licensing on practical nurse wages is smaller than for practical nurses. Hence, while the results from registered nurse wages are consistent with both the capture and public interest theories of licensing, the results for practical nurses are only weakly consistent with these hypotheses.

In order to test whether the effects of licensing on participation increased over time, we estimated the following regression model for each nursing occupation:

$$(2) N_{ijt} = \alpha_0 + \alpha_1 YL_{jt} + \alpha_2 T_t + \alpha_3 S_j + X_{ijt} \alpha_4 + \varepsilon_{ijt}$$

where N_{ijt} is an indicator variable equal to 1 if individual i in state j in census year t self-declares as a (registered or practical) nurse and 0 otherwise, and all other

variables are defined as before. This regression is distinguished from the wage regression in two important ways. First, because our goal is to determine whether licensing affected the participation in nursing occupations relative to all other occupations, for this regression, our sample includes all members of the labor force. Second, this regression omits controls for hours worked per week and weeks worked per year. As before, however, our interest is in the coefficient on YL_{jt} (the number of years that licensing has been). We can interpret α_1 as the impact that one additional year of occupational licensing has on the probability that an individual is a registered or practical nurse in a given state. If $\alpha_1 < 0$, then occupational licensing reduces labor force participation in nursing over time, which is consistent with the capture theory. On the other hand, if $\alpha_1 > 0$, we have evidence consistent with the public interest theory, which argues that licensing should raise participation over time.

Table 5 shows the coefficient estimates. As before, we estimate a more and less parsimonious model for each nursing occupation. In no instance is the coefficient on the number of years licensed statistically significant. The effects of licensing on overall participation in registered or practical nursing do not appear to vary with time. Given that the theories have opposite predictions with respect to participation, it is possible that the two effects are cancelling each other out, or that neither hypothesis is correct.

IV. EFFECTS OF MANDATORY LICENSING ON MINORITY NURSES

We next turn our attention to how mandatory licensing affected minority workers in the two nursing professions. To do this, we use a difference-in-difference (DDD) estimator, which estimates the impact of licensing on minorities relative to non-minorities. In order to determine whether the effects of licensing on wages of minorities increased relative to non-minorities, we estimate the following regression:

$$(3) W_{njt} = \chi_0 + \chi_1 YL_{jt} M_n + \chi_2 YL_{jt} + \chi_3 M_n S_j + \chi_4 M_n T_t + \chi_5 M_n + \chi_6 S_j + \chi_7 T_t + X_{njt} \chi_8 + \varepsilon_{ijt}$$

In this regression, M_n is an indicator equal to 1 if a nurse n is a minority and 0 otherwise; YL_{jt} is the number of years licensing has been in place in state j by census year t ; $YL_{jt} M_{ijt}$ is the interaction of the number of years licensing has been in place and minority status; $M_n S_j$ is the minority-state interaction; $M_n T_t$ is the minority census year interaction; and the remaining variables are defined as before. The coefficient on the χ_1 is the variable of interest: it tells us the amount by which minority wages fall or rise relative to non-minority wages in nursing for each year that licensing is in place in a state. Recall that both theories predict that χ_1 should be positive (i.e. that the gap between minority and non-minority wages should narrow with time).

Coefficient estimates are presented in Table 6. As before, for each nursing profession, we estimate a more and less parsimonious specification. For registered nurses, the coefficient estimate of the interaction term is positive for both regression models and also statistically significant for the less parsimonious specification. The estimates from column (2) imply that the real wages of minority registered nurses rose relative to non-minority registered nurses by \$200 dollars

each year mandatory licensing was in place (or by \$200 for each additional decade of mandatory licensing). For practical nurses, the coefficient on the interaction term is positive and statistically significant for the more parsimonious specification, but positive and not statistically significant once the additional, potentially endogenous, controls variables are included. Hence, there is some evidence that occupational licensing gradually narrowed the wage gap between minority and non-minority nurses.

We finally turn our attention to how licensing affected participation of minorities in nursing relative to non-minorities. To do this, we estimated the following regression:

$$(4) N_{ijt} = \phi_0 + \phi_1 YL_{jt} M_i + \phi_2 YL_{jt} + \phi_3 M_i S_j + \phi_4 M_i T_t + \phi_5 M_i + \phi_6 S_j + \phi_7 T_t + X_{ijt} \phi_8 + \varepsilon_{ijt}$$

The variables are defined as before. Once again, the parameter of interest is the coefficient on the triple interaction term (ϕ_1), which tells us whether the probability that a minority individual is a nurse is increasing or decreasing relative to non-minorities with the number of years nurse licensing has been in place. Under the capture theory, ϕ_1 should be negative. The public interest theory makes the opposite prediction.

Coefficient estimates are displayed in Table 7. For registered nurses (column 1) the coefficient on the interaction term is positive and statistically significant in the more parsimonious specification; statistical significance is lost, however, once more potentially endogenous controls are added, although the sign of the coefficient remains positive. Accordingly, there is some, albeit weak, evidence that the probability that a minority individual was a registered nurse was increasing relative

to non-minorities with the number of years that licensing of registered nursing was in place. In contrast, for practical nurses, the coefficient on the interaction term is negative but not significant in either specification.

The results from minority workers suggest the following. Consistent with both theories of licensure, the wages of minorities narrowed relative to the wages of non-minorities with the number of years that licensing was in place in a given state. This was true for both nursing professions (although only statistically significant for registered nurses). However, for registered nurses, we also find some evidence that as the number of years of licensing increases, the likelihood a minority worker is a registered nurse rises (relative to a non-minority worker). In contrast, the impact of years of licensing on participation of minorities in practical nursing is negative but not significant relative to non-minorities. Our findings are therefore more consistent with the public interest theory than the capture theory, which posits that licensing may help minorities signal their worth in higher skilled occupations that results in their wages and participation rising relative to non-minorties. The fact that these results are stronger for registered than practical nurses is also consistent with this view since registered nursing is the more skilled and higher status occupation, and initial minority participation in registered nursing was much lower than in practical nursing. In such a setting there may be potentially a role for licensing to help minorities overcome statistical discrimination over worker quality.

V. CONCLUSION

The US nursing professions provide a useful setting for investigating the

longer-run impacts of occupational licensing on wages and participation. First, mandatory licensing of registered and practical nurses was introduced gradually across US states, allowing us to examine the effects of licensing over several decades. Second, there are two nursing professions in the US that involve different levels of skills and training. Accordingly, we can compare the long run effects of licensing on a high and low skilled occupation, which may have implications for our interpretation of whether licensing is more consistent with a capture or public interest theory. Third, nurses are quantitatively important, accounting for approximately 2 percent of the US labor force in 1980.

Our approach differs from much of the empirical literature on licensing in three important respects. First, unlike most studies, which treat all licensed regimes as the same, regardless of how long licensing has been in place, we allow the impact to depend linearly on the length of time since licensing was adopted. This is more consistent with both theories of licensure, which posit that it may take time for licensing to affect observable outcomes. Second, we examine the impact of licensing not only on wages, but also on participation. This allows us to more cleanly distinguish between the two theories of licensing. Third, we examine the effects of licensing on each profession as a whole as well as on the relative wages and participation of minority workers.

Consistent with both theories of licensure, we find that the wages of nurses overall rise with the duration of licensure. These findings are statistically significant for registered nurses but not for practical nurses. However, our point estimates suggest that the cumulative impact of licensing over time is small relative to decade-

by-decade trends in nursing wages. In terms of overall participation, we do not find that licensing mattered for either practical or registered nurses.

The relative wages of minority registered nurses rise with the duration of mandatory licensure as does the relative participation of minority workers. We do not, however, find this, however, for minorities in practical nursing, the lower skilled of the two occupations. Overall, the results are therefore supportive of the public interest theory, which predicts that licensing should raise the relative participation of minorities in higher skilled occupations for which it is more costly to discern worker quality.

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Figure 1: Average registered nurse wages in 1950 and the year of registered nurse licensing

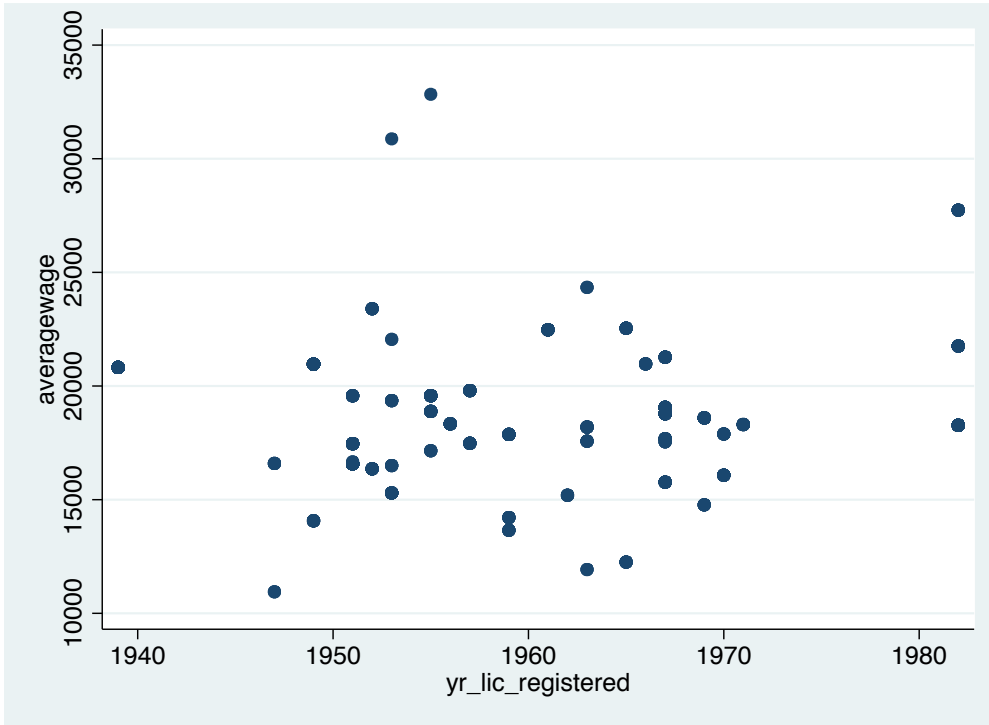


Figure 2: Average practical nurse wages in 1950 and the year of practical nurse licensing

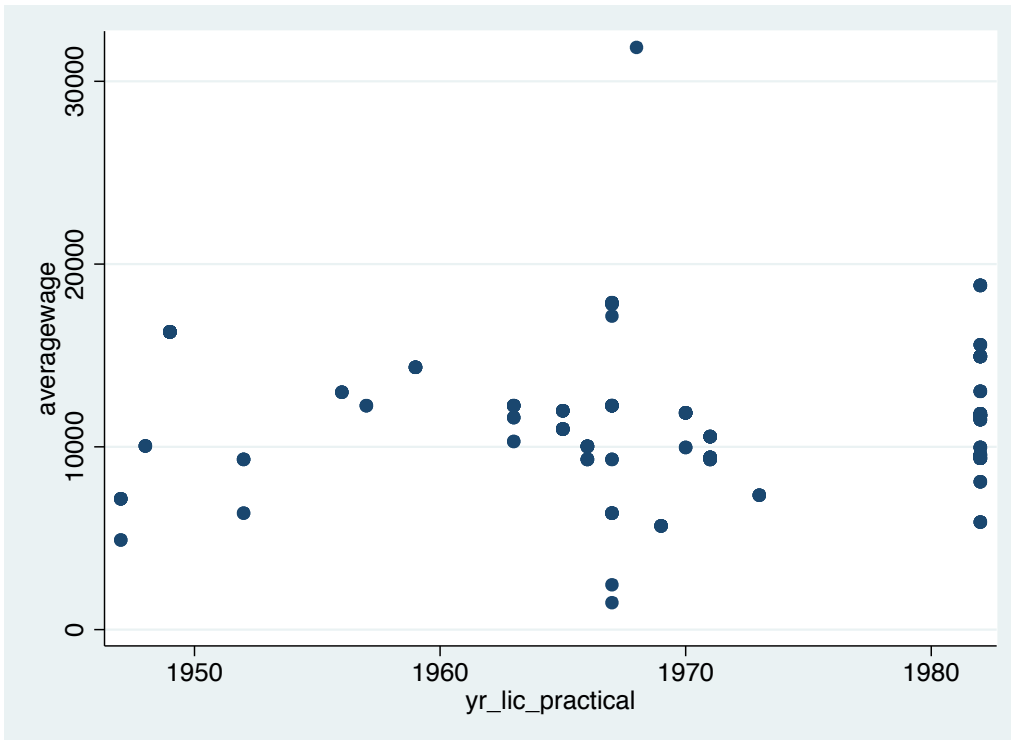


Table 1: Year of mandatory licensure of registered and practical nurses

State	Registered Nurses	Practical Nurses
Alabama	1967	1971
Alaska	1957	1957
Arizona	1953	
Arkansas	1947	1947
California	1939	
Colorado	1957	1957
Connecticut	1956	1956
Delaware	1963	1963
District of Columbia		
Florida	1952	1952
Georgia		
Hawaii	1959	1959
Idaho	1951	1947
Illinois	1951	1965
Indiana	1971	1971
Iowa	1963	1963
Kansas	1949	
Kentucky	1966	1966
Louisiana	1951	1948
Maine	1959	1967
Maryland	1967	1967
Massachusetts		
Michigan	1967	
Minnesota	1959	
Mississippi	1970	1970
Missouri	1953	
Montana	1947	1967
Nebraska	1953	
Nevada	1953	1949
New Hampshire	1959	1967
New Jersey	1955	1959
New Mexico	1953	1968
New York	1949	1949
North Carolina	1965	1965
North Dakota	1963	
Ohio	1967	1971
Oklahoma	1967	1967
Oregon	1957	1973
Pennsylvania	1951	1966
Rhode Island	1952	1952
South Carolina	1969	1969
South Dakota	1955	1967
Tennessee	1967	1967

Texas	1969	
Utah	1963	1963
Vermont	1962	1962
Virginia	1970	1970
Washington	1961	
West Virginia	1965	1967
Wisconsin	1955	
Wyoming	1955	1967

Source: Monheit (1982). States that had not adopted licensing by 1982 are left blank.

Table 2: Summary statistics of registered nurses (RN) in “early” and “late” adopting states

Panel A	All states	“Early” adopting states	“Late” adopting states
Share female	0.94 (0.24)	0.94 (0.25)	0.94 (0.24)
Share foreign born	.068 (0.25)	0.088 (.28)	0.043 (0.20)
Age	38.00 (12.14)	38.20 (12.12)	37.75 (12.15)
Years of education	13.96 (2.21)	14.03 (2.20)	13.87 (2.24)
Married	0.62 (0.49)	0.60 (0.49)	0.64 (0.48)
Number of children	1.06 (1.38)	1.04 (1.38)	1.08 (1.37)
Metro	0.62 (0.48)	0.69 (0.46)	0.54 (0.49)
Share working part time (less than 35 hours/week)	0.28 (0.45)	0.28 (0.45)	0.28 (0.45)
Share working year round (at least 50 weeks/year)	0.63 (0.48)	0.62 (0.48)	0.65 (0.48)
Year licensed	1958 (11.13)	1949.5 (5.43)	1968.5 (6.42)

Panel B	All states	“Early” adopting states	“Late” adopting states
RN wages in 1950 (2014 dollars)	18,875 (10,339)	18,843 (10,097)	18,918 (10,655)
RN wages in 1980 (2014 dollars)	35,115 (17,292)	35,872 (17,688)	34,171 (16,738)
RN share of the labor force 1950	.0081 (0.090)	0.0087 (0.093)	0.0074 (0.086)
RN share of the labor force 1980	0.0136 (0.116)	0.0144 (0.119)	0.0128 (0.113)
Minority RN wages in 1950 (2014 dollars)	15,657 (10,876)	16,832 (11,469)	14,478 (10,112)
Minority RN wages in 1980 (2014 dollars)	38,963 (17,477)	40,564 (17,416)	36,299 (17,254)
Minority RN share in 1950	0.041 (0.199)	0.036 (0.186)	0.048 (0.214)
Minority RN share in 1980	0.114 (0.318)	0.129 (0.335)	0.096 (0.295)
Number of states plus DC	51	24	27
Observations	89,392	49,551	39,841

Notes: Early adopting states are those that adopted mandatory RN licensing by 1958. We code as 1982 those that had not adopted licensing by the end of the sample period. Data are weighted using population weights.

Table 3: Summary statistics of practical nurses (PN) in “early” and “late” adopting states

Panel A	All states	“Early” adopting states	“Late” adopting states
Share female	0.96 (0.19)	0.97 (0.18)	0.96 (0.19)
Share foreign born	.050 (0.22)	0.052 (.22)	0.049 (0.22)
Age	39.50 (13.05)	39.50 (13.09)	39.50 (13.02)
Years of education	12.68 (2.19)	12.61 (2.18)	12.73 (2.20)
Married	0.56 (0.50)	0.55 (0.50)	0.56 (0.50)
Number of children	1.05 (1.37)	1.03 (1.36)	1.07 (1.38)
Metro	0.56 (0.50)	0.51 (0.50)	0.59 (0.49)
Share working part time (less than 35 hours/week)	0.26 (0.44)	0.25 (0.43)	0.26 (0.44)
Share working year round (at least 50 weeks/year)	0.61 (0.49)	0.62 (0.49)	0.61 (0.49)
Year licensed	1970.1 (11.59)	1959.2 (7.56)	1978.8 (5.14)

Panel B	All states	“Early” adopting states	“Late” adopting states
PN wages in 1950 (2014 dollars)	11,698 (7,234)	12,257 (7,683)	11,301 (6,871)
PN wages in 1980 (2014 dollars)	23,691 (10,852)	23,580 (10,847)	23,780 (10,856)
PN share of the labor force 1950	.0024 (0.049)	0.0021 (0.046)	0.0026 (0.051)
PN share of the labor force 1980	0.0041 (0.064)	0.0039 (0.063)	0.0043 (0.065)
Minority PN wages in 1950 (2014 dollars)	12,550 (7,774)	12,535 (7,925)	12,563 (7,647)
Minority PN wages in 1980 (2014 dollars)	26,891 (11,425)	27,440 (11,787)	26,439 (11,096)
Minority PN share in 1950	0.099 (0.298)	0.108 (0.311)	0.092 (0.289)
Minority PN share in 1980	0.204 (0.403)	0.207 (0.405)	0.202 (0.402)
Number of states plus DC	51	28	23
Observations	25,895	11,513	14,382

Notes: Early adopting states are those that adopted mandatory RN licensing by 1968. We code as 1982 those that had not adopted licensing by the end of the sample period. Data are weighted using population weights.

Effects of mandatory licensure on real wages in nursing (in 2014 dollars)

	(1) Registered nurses	(2) Registered nurses	(3) Practical nurses	(4) Practical nurses
Years of licensing	64.46 (39.20)	99.94 (31.98)**	23.48 (56.30)	16.56 (36.99)
Y1960	3,810.34 (445.19)**	6,424.05 (500.29)**	4,374.26 (720.59)**	3,392.93 (556.61)**
Y1970	14,058.76 (582.424)**	15,885.74 (628.216)**	13,337.47 (523.831)**	10,871.16 (590.18)**
Y1980	13,123.37 (765.57)**	11,170.96 (639.39)**	12,813.71 (600.32)**	9,948.420 (554.46)**
Constant	27,842.26 (2,178.71)**	5,614.70 (3,931.84)	2,566.43 (1,985.16)	-8,709.24 (2,605.90)**
Observations	89392	89392	25895	25895
R-squared	0.19	0.51	0.19	0.53

Notes: Each column represents a separate regression. Columns (1) and (3) include year and state fixed effects, age, age squared, dummies for gender, minority, and foreign born. Columns (2) and (4) include all controls in (1) and (3) as well as education indicators, dummies for size of metropolitan area, dummies for hours of work and weeks worked, marital status, and number of children. Robust standard errors clustered at state-level are shown in parentheses. * denotes significance at 5 percent level and ** denotes significance at 1 percent level.

Table 5: Effects of mandatory licensing on participation in nursing

	(1) Registered nurses	(2) Registered nurses	(3) Practical nurses	(4) Practical nurses
Years of licensing	0.000020 (0.000031)	-0.000010 (0.000034)	0.000017 (0.000015)	0.000017 (0.000014)
Y1960	0.000076 (0.000162)	-0.004465 (0.000442)**	0.000156 (0.000183)	-0.000518 (0.000240)*
Y1970	0.001041 (0.000321)**	-0.005266 (0.000616)**	-0.000315 (0.000232)	-0.001158 (0.000313)**
Y1980	0.001591 (0.000571)**	-0.007392 (0.000866)**	0.000443 (0.000321)	-0.000553 (0.000371)
Constant	-0.047942 (0.001759)**	-0.044605 (0.001323)**	-0.011316 (0.000751)**	-0.009575 (0.000786)**
Observations	8055361	8055361	8055361	8055361
R-squared	0.02	0.04	0.01	0.01

Notes: Each column represents a separate regression. Columns (1) and (3) include year and state fixed effects, age, age squared, dummies for gender, minority, and foreign born. Columns (2) and (4) include all controls in (1) and (3) as well as education indicators, dummies for size of metropolitan area, marital status, and number of children. Robust standard errors clustered at state-level are shown in parentheses. * denotes significance at 5 percent level and ** denotes significance at 1 percent level.

Effects of licensing on the wages of minority nurses

	(1)	(2)	(3)	(4)
	Registered nurses	Registered nurses	Practical nurses	Practical nurses
(Years of licensing)*(Minority)	40.43 (94.993)	200.61 (82.338)*	121.44 (54.795)*	36.54 (54.333)
Minority	708.29 (1,240.33)	-2,590.90 (1,043.98)*	1,128.59 (1,636.01)	-2,212.47 (1,080.15)*
Years of licensing	51.344 (40.873)	78.257 (30.961)*	-0.999 (59.987)	3.051 (38.173)
Y1960	3,730.11 (450.370)**	6,384.93 (525.424)**	4,423.27 (770.434)**	3,441.99 (558.049)**
Y1970	14,125.38 (586.285)**	16,026.24 (645.541)**	13,255.56 (612.713)**	10,462.19 (629.651)**
Y1980	12,949.39 (745.031)**	11,085.18 (686.397)**	12,759.34 (701.893)**	9,460.39 (555.533)**
Constant	28,371.54 (2,145.14)**	5,158.62 (3,728.75)	3,746.04 (1,997.61)*	-6,846.61 (2,693.72)*
Observations	89392	89392	25895	25895
R-squared	0.20	0.51	0.20	0.53

Notes: Each column represents a separate regression. Columns (1) and (3) include year and state fixed effects, age, age squared, dummies for gender, minority, and foreign born. Columns (2) and (4) include all controls in (1) and (3) as well as education indicators, dummies for size of metropolitan area, dummies for hours of work, marital status, and number of children. Robust standard errors clustered at state-level are shown in parentheses. + denotes significance at 10 percent level, * denotes significance at 5 percent level and ** denotes significance at 1 percent level.

Table 7: Effects of licensing on the participation of minorities in nursing professions

	(1) Registered nurses	(2) Registered nurses	(3) Practical nurses	(4) Practical nurses
(Years of licensing)*(Minority)	0.000152 (0.000083)+	0.000096 (0.000077)	-0.000015 (0.000039)	-0.000014 (0.000038)
Years of licensing	0.000000 (0.000035)	-0.000019 (0.000039)	0.000017 (0.000015)	0.000017 (0.000015)
Minority	-0.007032 (0.001031)**	-0.004873 (0.000913)**	0.001524 (0.000526)**	0.001491 (0.000521)**
Y1960	-0.000011 (0.000198)	-0.004780 (0.000462)**	-0.000037 (0.000185)	-0.000725 (0.000240)**
Y1970	0.000898 (0.000393)*	-0.005695 (0.000662)**	-0.000713 (0.000252)**	-0.001551 (0.000322)**
Y1980	0.001478 (0.000711)*	-0.007670 (0.000949)**	0.000123 (0.000338)	-0.000846 (0.000379)*
Constant	-0.047160 (0.001715)**	-0.043546 (0.001274)**	-0.010629 (0.000755)**	-0.008875 (0.000792)**
Observations	8055361	8055361	8055361	8055361
R-squared	0.02	0.04	0.01	0.01

Notes: Each column represents a separate regression. Columns (1) and (3) include year and state fixed effects, age, age squared, dummies for gender, minority, and foreign born. Columns (2) and (4) include all controls in (1) and (3) as well as education indicators, dummies for size of metropolitan area, marital status, and number of children. Robust standard errors clustered at state-level are shown in parentheses. + denotes statistical significance at the 10 percent level, * denotes significance at 5 percent level and ** denotes significance at 1 percent level.