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From Certification To Licensure: Evidence From Registered And Practical Nurses In The United States, 1950-1970

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Abstract

In this paper we use individual-level census data on registered and practical nurses in the United States from 1950-70 to determine the effect that the switch from certification to licensure had on wages and participation in the registered and practical nurse professions. We examine these occupations to take advantage of a quasi-experiment afforded by the fact that, by the beginning of our sample, all states already had certification in place and some states already required a license. During the subsequent decade several states switched from certification to a mandatory licensing regime while others did not. Accordingly, we infer the effect of licensure in a differences-in-differences framework that uses states that did not change their regulatory regime as a control. Interestingly, we find that the shift from certification to mandatory licensing had little to no effect on the wages or the participation rate of practical and registered nurses.

JEL: K2, J2, J44, J88

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1. Introduction

In Chapter 9 of *Capitalism and Freedom*, Milton Friedman discussed how government certification (sometimes called "voluntary licensure") and mandatory licensure function as alternative mechanisms for solving the asymmetric information problem about professional quality. The key distinction between certification and licensure is that licensure imposes a strict entry barrier but certification does not. Under government certification, the state (usually in concert with professional associations) determines what it takes to be "certified" but any individual may practice that occupation regardless of whether they meet the certification requirements.[3] In contrast, a licensure regime mandates that all practioners meet the government's requirements, which normally include satisfying minimum educational or training requirements and passing a licensing exam. Those who do not comply with the government's regulations are excluded from participation.[4] For many professions, mandatory licensure has

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[3] For example, in the US, engineers, house cleaners, and special education teachers are subject to a certification regime.

[4] For example, in the US physicians, dentists, and lawyers are subject to mandatory licensure.

historically been preceded by government certification (White 1979, 1983).

Among economists and policy makers there is some debate regarding the welfare effects of a shift from certification to licensure. One view, which has been advanced by Friedman (1962) among others, is that licensing reduces welfare relative to certification. A certification regime sends a signal about professional quality because only certified practitioners can claim certification but this does not allow the profession to establish monopolistic control over entry. Practitioners who are not certified may continue to operate and supply their services to consumers who do not wish to pay a premium for a certified professional. Licensure, on the other hand, facilitates monopolistic control over entry because competition from those who do not meet with the regulatory requirements is foreclosed. Unlicensed professionals are shut out of the market and consumer choice is reduced for those who are unwilling to pay the premium for a licensed professional.

A second view is that licensure increases welfare relative to certification. According to proponents of this view, an advantage of licensure is that it imposes discipline on a profession. Under licensure, failure to behave according to professional standards is punished harshly through the loss of the right to practice. In contrast, under a certification regime, professionals who do not perform according to the standard merely lose their certification, and hence, only lose the right to charge a premium associated with certification. Arrow (1963) has argued that the strict discipline imposed by licensure fosters "trust," which, in turn, increases both the demand and supply of professional services and raises welfare. Certification may be insufficient as a solution to the asymmetric information problem if it is not easy for consumers to distinguish among certified and uncertified practitioners.

A third possibility is that licensure will have no impact on efficiency. Implicit in the argument against licensing is an assumption that the demand for professional quality is heterogeneous, or, in other words, that given the information provided by certification, the market segments into those that are certified and those that are not. In this setting, mandatory licensing, by shutting down the lower-end of the market, prevents market segmentation, reduces competition, and lowers economic efficiency. If, on the other hand, certification provides information that is demanded by most consumers (i.e. if few consumers, when given the choice, opt to go to an uncertified professional), then a move from certification to licensure will have little effect on welfare because the market was not segmented in the first place. To the extent that licensing simply renders mandatory the certification that was already supplied by most practitioners, licensing will have no anti-competitive effects relative to certification, and welfare is not affected.

In this paper we use data from American states to examine the consequences of the move from certification to mandatory licensure for two occupations. Since the late nineteenth century there have been two types of nurses in the United States: registered nurses and practical nurses. Registered nurses possess more education and training than practical nurses. Indeed, practical nurses often work under the supervision of registered nurses. Regulation of these two professions, like most occupational regulation in the United States, is at the state-level (Kleiner 2006). We examine these two occupations in order to take advantage a quasi-experiment afforded by the fact that, by the beginning of our sample (the 1950 census for registered nurses; the 1960 census for practical nurses), all states already had certification in place (and some already required a license) but during the subsequent decade several states switched to a mandatory licensing

regime while others did not.[5] Accordingly, we infer the effect of licensure in a difference-in-differences framework that uses states that did not change their regulatory regime as a control. We investigate the effects of this shift from certification to licensure using individual-level census data. Our goal is to uncover the effect that this shift had on wages and participation in the two nursing professions. Our approach is methodologically superior to some of the existing literature on the effects of nurse occupational licensure on wages and participation (for instance, Monheit 1982) that only use cross-sectional data. An advantage of a difference-in-differences research design is that it allows us to better control for unobservable time-invariant, state-specific, factors that might affect the nursing profession.

Our investigation of the wage and participation effects allows us to distinguish among the three competing hypotheses regarding the effect of mandatory licensing in an environment where certication is already in place. If licensing reduces welfare because it is anti-competitive, wages should rise and participation should fall in those states that switch from certification to licensure relative to a control group of non-switching states. If licensing fosters trust and increases both the demand and supply for professionals, participation should rise but the effect on wages is ambiguous. Finally, if licensing has little to no effect on welfare because the market for professional services was not sufficiently segmented to begin with, then neither wages nor participation should change after the introduction of mandatory licensing.

This investigation is important because we believe ours to be among the few studies that examine the effects of a shift to mandatory licensure in an environment where government certification is already in place. Most scholarship on the wage and participation effects of professional regulation examines the effect of regulation relative to no regulation at all (for a survey of this literature see Kleiner 2006). Alternatively, wages and participation are compared across regimes among which licensing is already in place but the "strictness" (variously measured) of licensing differs (see, for instance, Kleiner and Kudrle 2000). Given that, in many instances, professional regulation evolves in stages, it behooves us to examine the effects of the intermediate stages in the evolution of these regulations.

We recognize that this study is not "comparative" in the usual sense that is implied by the term comparative economics, and therefore may seem an odd contribution to a special issue of a comparative economics journal. Nevertheless, we believe that our paper will be of interest to the readership of this journal. First, occupational regulation in the United States, like many federal countries, is at the sub-

[5] Other papers that have analyzed the effects of US state regulation on various aspects of the nursing profession include Monheit (1982), White (1979; 1983; 1987), and Kalist and Spurr (2004). Monheit (1982) estimates a structural demand and supply model for the markets for registered and practical nurses using data from the 1960 census and finds weak evidence that licensing affects wages and participation. White (1979; 1983) discusses the historical origins of nursing regulation. White (1987) estimates a model of the diffusion of regulation across states and argues that the pattern of adoption is consistent with a desire to restrict entry. Professional regulation of nurses continues to be an important issue with the rise of nurse practitioners as physician substitutes in general practice medicine. Kalist and Spurr examine how state laws have affected the supply of advanced practice nurses (for instance, nurse practitioners and nurse anaesthetists). They find that enrollment in advanced practice nurse programs is greater in states where nurses have greater professional independence. Kleiner et al (2012) and Stange (2011) analyze of how changes in licensing laws permitting nurse practitioners to perform tasks normally reserved for physicians has affected wages of nurse practitioners as well as the prices and utilization of medical services.

national level. Accordingly, our study may offer lessons for other federal countries like Canada and Australia, where some professions are regulated at the level of provinces or states. Indeed, variation across US states in professional regulation is not dissimilar to variation across European Union countries, given that professional regulations do still vary within the EU, in spite of efforts to integrate labor market standards across member nations. Second, the nursing profession in the US is similar to many other countries in that it is separated into two tiers that face different regulatory standards, both of which we study: first tier nurses ("registered" nurses) and second tier nurses ("practical" nurses). According to data presented by Robinson and Griffths (2007), the nursing professions in Belgium, Finland, Germany, the Netherlands, Sweden, Australia, Canada, Japan, and New Zealand are also divided into two tiers that face different regulatory standards. As part of our empirical analysis we examine whether mandatory licensing of one nursing profession affects wages and participation in the other.

The remainder of this paper is structured as follows. We begin by describing our data set on registered and practical nurses. We argue that the shift from certification to licensure during this period constitutes a quasi-experiment that will allow us to make valid inferences about the effects of licensure relative to certification on wages and participation in the two nursing professions. We then turn to an empirical analysis of the impact of licensure on the wages and participation. This is followed by a conclusion.

2. Data

State-level regulation of the two nursing professions began in the late nineteenth and early twentieth centuries, contemporaneously with the rise of occupational regulation of a wide variety of other professions (Law and Kim 2005). Historically, the introduction of occupational regulation of registered nurses preceded the regulation of practical nurses (Council of State Governments 1952; White 1979, 1983). Regulation of the two nursing professions has evolved in stages, diffusing gradually across states and also becoming stricter over time. This pattern follows the development of occupational licensing regulation for other health professions like medicine and dentistry (White 1979; 1983; Fraundorf 1983) and was accompanied by an expansion of government regulation of health professions more generally (for instance, state-level Samaritan Acts) as well as increased government involvement in the provision and financing of health care (Medicare and Medicaid were introduced in 1965). By 1950 for registered nurses and by 1960 for practical nurses, the diffusion of certification (i.e. voluntary licensing) was complete. During the subsequent decades, regulation of both nursing professions moved towards mandatory licensure. Since different states made the switch to mandatory licensure at different times, we can take advantage of this variation to estimate the effects of mandatory licensure relative to certification.

Table 1 displays information on the passage of mandatory licensing for registered nurses (Panel A) and practical nurses (Panel B).[6] Column (1) lists the states that switched from certification to licensure. These will serve as out treatment states. Column (2) list our control states, which did not change their licensing regime between 1949 and 1958 for registered nurses and between 1959 and 1968 for practical nurses. These states either had licensing in place at the beginning of the sample, or had certification in place during both sample periods.[7] Our data on nurses come from the

[6] Throughout this paper we treat the District of Columbia as a state since it has its own licensing regime.

[7] If we do not allow for the one-year lag to introduce regulation, for registered nurses, Hawaii, Maine,

1950, 1960 and 1970 decennial censuses. Because the decennial censuses collect information on earnings from the previous calendar year, and because we want to allow for a one-year lag for the introduction of regulation, we use 1958, and 1968 as cutoffs for treatment. Our data on the timing of licensing laws come from Monheit (1982) who compiled and categorized information on state-level nursing regulations. We verified these data with information from the Council of State Governments (1952). While a handful of states had already adopted mandatory licensing by the beginning of the sample most had not.[8] In the subsequent decade, approximately two-fifths of the states (21 states for registered nurses; 20 states for practical nurses) switched from certification to a mandatory registered nurse licensing regime.

A glance at Table 1 reveals a few interesting facts. First, for both nursing professions, the states that adopted mandatory licensing come from all regions of the United States. Second, large and small states are represented among states that switched to mandatory licensure as well as among states that that did not alter their regulatory regime. Third, there is surprisingly little overlap between the states that adopted mandatory licensing for registered nurses and those that adopted mandatory licensing for practical nurses. The only states that adopted mandatory licensing for both nursing professions are Illinois, New Mexico, Pennsylvania, and Wyoming. Combined these facts suggest that the adoption of mandatory licensing may be sufficiently random across states to serve as a quasi-experiment for estimating the effects of mandatory licensing on outcomes in the two nursing professions.

Data on participation and wages of registered and practical nurses are taken from the Integrated Public Use Microdata Series (IPUMS) one-percent sample of individual returns from the decennial United States censuses (Ruggles *et al*, 2010). To be classified as a registered or a practical nurse in our data set, a respondent had to self-identify as either a practical or registered nurse, had to report positive wage income during the previous calendar year, and also had to declare being currently in the labor force. We also limited attention to individuals between the ages of 14 and 65. For registered nurses we use data from the 1950 and 1960 censuses.[9] For practical nurses our data are from the 1960 and 1970 censuses. For each individual in our data set we gathered information on their state of residence, location of birth, metropolitan residence, education, earnings, sex, race, hours worked, age, marital status, and number of children. We then matched this with the data in Table 1 on licensing status by state. Although our variation is at the state-level, the unit of observation is the person-year.

Minnesota and New Hampshire (which adopted mandatory licensing in 1959) become treatment states; for practical nurses, South Carolina (which adopted mandatory licensing in 1969) becomes a treatment state. Overall our results are unchanged by this reclassification, except, in one regression specification, we find that mandatory licensing increases the labor force participation of young registered nurses, and in another regression we find a weakly significant and positive impact of mandatory licensing on the wages of practical nurses.

[8] Since our identification strategy relies on changes in licensing regime (i.e. switch from certification to mandatory licensing), we treat states that already had licensing by the beginning of the sample as the same as states that stuck to a certification regime throughout the decade. We experimented with excluding the states that were already licensed at the beginning of the sample period from our regression analysis (those states denoted with an * in column 2 of Table 1) and find qualitatively similar results. The exception is for the wages of practical nurses for which we find that licensing had a positive and marginally statistically significant effect, relative to those states that did not adopt licensing.

[9] Earnings data from the 1950 decennial census are limited to "sample-line" individuals. Hence, sample sizes are much smaller for 1950 than for later years.

Table 2 shows summary statistics on registered nurses in 1950 (Panel A) and practical nurses in 1960 (Panel B), our pre-treatment periods. For each nursing profession we display summary statistics separately for nurses in states that switched from certification to mandatory licensure ("treatment" states) and for nurses in states that did not adopt licensure ("control" states) during the subsequent decade. A glance at the table reveals that both nursing occupations were overwhelmingly female and registered nurses have more years of schooling and are less likely to be married or non-white. During the pre-treatment period, wages appear to be somewhat higher for both practical nurses and registered nurses in control states, although the standard errors are so large that the differences are not statistically significant.

For each sample we also computed average wages in other medical professions (the *other* nursing profession and physicians) in treatment and control states during the pre-treatment period. This is to shed light on the possibility that licensing occurred in the treatment states in response to inequality in the relative wages of related occupations, which would threaten our identification strategy. Wages for the other medical professions can be found in the second and third rows of Panels A and B. Registered nurses in treatment states appear underpaid relative to practical nurses but overpaid relative to physicians; thus it is not clear that low wages were driving the switch from licensing to certification for registered nurses. Practical nurses in treatment states do appear slightly underpaid relative to the other medical profession. However, for practical nurses we are able to compute pre-treatment trends in wages in both treatment and control states. We cannot, unfortunately, perform this exercise for registered nurses since the 1940 Census does not contain wage information. As shown in the fifth row of Panel B, the ratio of 1949 to 1959 practical nurse wages is similar in both treatment and control states. Accordingly, the data suggest that wages of practical nurses in treatment and control states were on similar pre-treatment growth trajectories.

In terms of other observable characteristics, nurses in treatment and control states appear to be very similar during the pre-treatment period. Registered nurses in treatment states are more likely to live in a central city (of a metropolitan area) than registered nurses in control states. The opposite is the case for practical nurses. Registered nurses in control states are more likely to be married than those in control state. However, in terms of years of schooling, age, sex, race, and number of children, there are no major differences among nurses in treatment and control states, which further buttresses our belief that the switch from certification to mandatory licensure may constitute a valid quasi-experiment.

3. Simple difference-in-differences estimates

As a first pass at determining the effects of licensing relative to certification on wages and participation in the two nursing professions we present simple difference-in-differences (DID) estimates, without controlling for other factors that influence wages and participation. The simple DID estimator is computed as the difference in the change in an outcome (wages or participation, in our context) across treatment states (states that switched from certification to licensure) and control states (states that did not change their regulatory regime). Let Y denote the outcome of interest. If T denotes the treatment group, C denotes the control group, 0 denotes the pre-treatment period, and 1 denotes the post treatment period, then the simple difference-in-difference estimator is computed as:

$$DID = (Y_{T1} - Y_{T0}) - (Y_{C1} - Y_{C0}). \quad (1)$$

To the extent that other factors that influence Y (apart from the treatment itself) are evolving similarly in treatment and control states, the simple DID estimator will yield an unbiased estimate of the effect of the treatment on the outcome of interest.

a. Wages

Panels A and B of Table 3 present the simple DID estimates of the effects of the switch from certification to mandatory licensing on average wages of registered and practical nurses, respectively. For registered nurses, between 1949 and 1959 wages in treatment states increased by $1,098 on average while those in control states increased by $1,000, suggesting a wage increase of $98. The corresponding figures for practical nurses in treatment and control states between 1959 and 1969 were $1,971 and $2,011, respectively. Accordingly, while the simple DID estimate of the effect of the switch from certification to mandatory licensing of registered nurses is a small gain of $98, for practical nurses it is a loss of $40 (see the bottom right cell in each panel of Table 3). Neither of these differences is large enough to be statistically significant. Hence, it does not appear that the switch from certification to licensure affected the average wages of nurses.

b. Participation

Table 4 presents simple DID estimates of the effects of the adoption of mandatory licensing on participation in registered and practical nursing. As shown in Table 4, both practical and registered nurses represented less than one percent of the labor force, although their shares increased slightly over the sample period. It is noteworthy that the labor force shares of practical and registered nurses are similar across both treatment and control states during the pre-treatment year.

The registered nurse share of the labor force in both treatment and control states increased by almost exactly the same amount between 1950 and 1960 (0.369 percent in treatment states versus 0.361 percent in control states), yielding a DID estimate of a barely-perceptible 0.008 percent. It appears that the switch from certification to mandatory licensure had at most a very small positive effect on participation in the registered nursing profession. Between 1960 and 1970, practical nurses in treatment states increased their share of the labor force by 0.030 percent. Meanwhile, the share for practical nurses in control states declined by 0.013 percent. Accordingly, the simple DID estimate for practical nurses is 0.043 percent which suggests that the move from certification to licensure increased participation. In sum, the simple DID estimates suggest that the move from certification to mandatory licensure is unlikely to have substantially affected participation in either the registered or practical nursing professions. [10]

[10] In a related vein, Pagliero and Timmons (2011) examine certification versus licensure of lawyers across European countries and find little difference in the number of lawyers per capita between certification and licensing countries. Their methodology is different than ours, however. While we examine the effects of switching from certification to mandatory licensure Pagliero and Timmons compare lawyer populations under different regulatory regimes at a given point in time.

4. Regression analysis

a. Wages

Of course, other factors like education, place of residence, sex, marital status, and so forth may also influence the wages and participation of registered and practical nurses. To the extent these factors are correlated with the adoption of licensing regulation, the simple DID estimates will be biased. To control for these factors in our analysis of the effects of mandatory licensure on wages, we estimated the following regression equation separately for each nursing profession:

$$ln(wage_{ijt}) = \beta_1 L_j + \beta_2 T_t + \beta_3 LT_{jt} + \beta_4 X_{ijt} + \varepsilon_{ijt} \quad (2)$$

Here $ln(wage_{ijt})$ is the natural log of annual wage earnings for individual nurse i in state j in census year t; L_j is a licensing indicator variable that equals 1 if a state switched from certification to licensing regulation (i.e. equals 1 for treatment states) for the occupation between census year t and $t+10$ and zero otherwise; T_t is indictor variable equal to one for the later census period (1960 for registered nurses; 1970 for practical nurses) and zero otherwise. This variable should capture national trends in wage growth in the nursing occupations. LT_{jt} is an interaction of the L_j and T_t variables. The coefficient of interest is β_3, the coefficient on the interaction term. It tells us whether wages grew faster or slower in treatment states relative to control states. Accordingly, it is the regression-adjusted DID estimate of the effects of mandatory licensure relative to certification on wages. X_{ijt} is a vector of other individual controls including age of the respondent, age squared, race, gender, and foreign-born indictors, dummy variables for married, widowed, and single (the excluded category is separated/divorced), the number of children, categorical indictors for education levels, hours worked, and residence in a metropolitan area. Finally, ε_{ijt} is the error term. All specifications include robust standard errors clustered at the state level.[11] Since our goal is to estimate the effect of licensing on average wages of registered or practical nurses, to be included in our sample for this regression analysis an individual had to self-identify as a registered or practical nurse, had to declare a positive annual wage in the previous calendar year, and had to report being in the labor force.

Coefficient estimates are shown in Table 5. Panel A shows the results for registered nurses; panel B displays the corresponding estimates for practical nurses. Each column represents a separate regression. Standard errors clustered at the state level are shown in parentheses. In column (1) we include no additional controls apart from the variables listed in the table, in essence replicating the simple DID exercise using log wages. In column (2) we also include age, age squared, and indicators for race, foreign-born, and sex. Finally, column (3) adds indicator variables for education, hours worked, and metropolitan residence. While the covariates included in the regressions reported in columns (1) and (2) are likely to be exogenous with respect to licensure, those included in column (3) may be somewhat less so, perhaps because licensure increases educational attainment or alters the demand for part-time workers.

[11] Since the number of states plus DC is 51, we have a sufficient number of clusters to correctly estimate the covariances.

For both nursing occupations, the coefficients on the interaction term are positive and perhaps economically significant but are not statistically significant. This finding is robust across the three different regression specifications. Controlling for other factors, it appears that the adoption of mandatory licensing of practical and registered nurses did not have a statistically significant impact on average wages paid to nurses, although the estimated coefficients are economically large, positive, and consistent with licensing either reducing competition (Friedman's hypothesis) or increasing the demand for nurses (Arrow's hypothesis).

Effects on wages in the other nursing profession

Given that the two nursing professions are, to some extent, substitutes for one another, it is worth investigating whether regulation of one profession affects wages in the other. This allows us to determine whether regulation of one nursing profession has spillover effects on the other. Column (4) of Table 5, Panel A shows the effects of a switch from certification to licensing of registered nurses on the wages of practical nurses. Column (4) of Table 5 Panel B shows the effects of practical nurse licensing on registered nurse wages. In neither of these regressions is the interaction term statistically significant. Accordingly, it does not appear that there are spillover effects.

Robustness checks

Our investigation so far has assumed that the timing of when a state adopts mandatory licensing within a census decade does not matter. For instance, states that switch to mandatory licensing of registered nurses in, say, 1952, are treated the same as those that switch in 1957. One might imagine that the effect of this switch on wages in 1960 might be larger for states that adopted earlier in the decade between 1949 and 1959 than in those that adopted later, perhaps because it takes time for licensure to affect wages. To allow for this possibility, we estimated equation (3) where we separate states into two treatment groups: those that adopted in the first half of the decade (*Le*) and those that adopted in the second half (*Ll*):

$$ln(wage_{ijt}) = \beta_1 Le_j + \beta_2 Ll_j + \beta_3 T_t + \beta_4 LeT_{jt} + \beta_e LlT_{jt} + \beta_6 X_{ijt} + \varepsilon_{ijt} \quad (3)$$

The coefficients of interest are β_4 and β_5. β_4 is the effect of licensure on wage growth for those states that switched during the first half of the census period (1949-53 for registerd nurses; 1959-63 for practical nurses) while β_5 is the impact for those states that switched in the second half (1954-58 for registered nurses; 1964-68 for practical nurses). If licensure takes time to affect wages then β_4 should be greater than β_5.

Panels A and B of Table 5A display coefficient estimates from these regressions. In terms of magnitudes, the wage effect of switching to mandatory licensing earlier in the decade is bigger for registered nurses but smaller for practical nurses. In none of these regressions, however, are the interaction terms statistically significant. Hence, it appears that, in terms of statistical significance, not much is lost by grouping early and late adopters together.

b. Participation

To investigate the effect of mandatory licensing on participation, we estimated the following linear probability regression equation separately for registered and practical

nurses:

$$Nurse_{ijt} = \beta_1 L_j + \beta_2 T_t + \beta_3 LT_{jt} + \beta_4 X_{ijt} + \varepsilon_{ijt} \quad (4)$$

$Nurse_{ijt}$ is an indicator variable equal to 1 if an individual i in state j reports being a nurse (registered or practical) in census year t and zero otherwise; L_j is the same treatment state indicator we used earlier; T_t is an indicator that equals 1 for the later census year and zero otherwise; and LT_{jt} is the interaction term. As before β_3 is the coefficient of interest. Finally, X_{ijt} is a vector of individual-state-year controls, and ε_{ijt} is the error term.

There are a few key differences between this regression model and that described by equation *(2)*. First, while for the wage regression we restricted our sample to individuals who were gainfully employed as either a registered or practical nurse, to estimate equation *(4)* we include in our sample all individuals who were in the labor force, regardless of occupation. Since our goal is to determine the effect of nurse licensing on participation in the nursing profession (relative to other occupations), we need to include in our sample any individual who was in the labor force. In this regression, the interaction term tells us whether the probability of working as a registered or practical nurse increased or decreased in treatment states relative to control states. In other words, it is the regression-adjusted DID estimate of the effects of mandatory licensing of nursing on the probability of being employed in one of the two nursing professions. If mandatory licensure reduces competition and lowers welfare, β_3 should be negative and statistically significant. If, instead, licensing increases "trust" and raises welfare, the interaction term should be positive and statistically significant. Finally, if there is no welfare effect because the nursing market was not segmented to begin with, the interaction term should be close to zero.

Second, for each nursing profession, we estimate the regression separately for young and old individuals. Because licensing laws often grandfather existing practitioners (i.e. they do not apply to those already in the profession), the impact of mandatory licensing on participation may depend on whether an individual is an existing practitioner or a new entrant. Although we cannot distinguish existing practitioners from new entrants, younger workers are more likely to be new entrants and mandatory licensing requirements will therefore be more binding for the young than the old. To be counted as young an individual has to be 35 years of age or less.[12] Finally, our vector of control variables includes the same set of controls as before except we omit the hours worked indicators.

Table 6 shows the regression results for young (Panel A) and old (Panel B) registered nurses. As before, each column represents a separate regression and we gradually add more covariates, with the regressions in column (3) including variables like education and metropolitan residence that are less likely to be exogenous. In only one instance (second column of Panel A) is the interaction term statistically significant, but in this case it is only at the 10 percent level. The positive sign on the coefficient is consistent with the hypothesis that licensing, by increasing trust, increases the demand for and supply of registered nurses. For the older workers, mandatory licensing did not

[12] Similar results were obtained when we experimented with alternative age thresholds.

affect participation, although, in contrast to young registered nurses, the coefficient on the interaction term is negative (but never statistically significant). It would therefore seem that the switch from certification to mandatory licensure either had little effect on participation or perhaps increased it slightly among new entrants. Columns (1) through (3) of Table 7 show the corresponding estimates for young and old practical nurses. Once again, the coefficient on the interaction term is positive but not significantly different from zero in all regressions.[13] In terms of magnitudes, the effects are similar for young and old practical nurses, which is suggestive of an overall increase in the demand for nurses following the switch from certification to licensure.

Participation in the other nursing occupation

Finally, we examined how the switch from certification to licensure in one nursing profession affected participation in the other. These results are shown in Column (4) of Tables 6 and 7. For the most part, the switch from certification to licensure of one occupation does not have a statistically significant effect on participation in the other occupation. A stricter regulatory regime for practical nurses does have a positive and significant effect on the participation of older registered nurses, which is consistent with these occupations being substitutes. Curiously, however, we do not find this for younger workers or the other nursing profession.

Summary

Taken as a whole, our empirical analysis suggests that the shift from certification to mandatory licensure of registered nurses had a positive but not statistically significant effect on wages and a positive and occasionally statistically significant effect on participation of young workers. These findings are not supportive of the hypothesis that mandatory licensing necessarily reduces competition relative to certification and therefore harms welfare. Instead, they are more consistent with the two alternative hypotheses that posit that licensing either increases welfare by increasing the demand and supply of nurses, or that licensing has no effect on welfare because the market for nurses was not highly segmented prior to the switch to mandatory licensure.

5. Conclusions

In this paper we test three hypotheses of the effects of switching from certification to mandatory licensure. We do so by examining the effects of the shift from certification to mandatory licensure on the wages and participation of individuals in the registered and practical nursing professions, taking advantage of the fact that different states adopted mandatory licensing at different times. This approach allows us to control for unmeasured state-level factors that may affect wage growth or the growth rate of the occupation.

Our analysis suggests that the switch from certification to mandatory licensing

[13] Using state-level data from 1960, Monheit (1982) finds evidence that mandatory licensure of practical nurses reduced supply. He also finds that mandatory licensure of registered nurses increased registered nurse wages. While we can replicate these results if we restrict our sample to 1960, as discussed above we do not find this effect when we use changes in regulatory regime (which more cleanly identifies the effects of mandatory licensing) to estimate the effect of mandatory licensing on nursing supply or wages. Monheit also suggests that restrictions on the supply of practical nurses may have affected the demand for registered nurses. We find no such effects.

had a positive but not statistically significant effect on wages and a positive but generally not statistically significant effect on participation. Accordingly the evidence from the two nursing occupations is not consistent with the hypothesis that licensing is strongly anticompetitive relative to certification. Instead, our results are more consistent with the two alternative hypotheses, which posit that licensing either increases "trust" and therefore increases both the demand for and supply of nurses (and, hence, has a weakly positive effect on wages and participation), or that licensing has simply no effect. To the extent that licensing mandates the same standards as certification, and that the market for uncertified is sufficiently small, licensing may not have much impact on average wages or participation. These conditions may have held in the nursing profession if most nurses were employed by institutions that required certification on the part of their nurse-employees even prior to the adoption of mandatory licensure.

Our analysis has several interesting implications for our understanding of the effects of occupational licensure. First, the effects of mandatory licensure relative to certification depend critically on the extent to which there is a robust market for the services provided by uncertified workers. A mandatory licensing regime is unlikely to have much impact on average wages or participation if the market for lower-skilled uncertified workers is small. In other words, if there is little competition from low-skilled, uncertified workers, mandatory licensing will not affect wages or participation by much. Second, since the effects of mandatory licensure are likely to be greater the larger the market for less-skilled uncertified workers, a shift from certification to mandatory licensure is likely to have a bigger impact on (raising) wages and (lowering) participation in professions where workers are less skilled than in professions where workers are highly skilled. Future work should test this hypothesis by comparing the effects of mandatory licensure across different professions. Third, for precisely the same reason, a switch from certification to licensure is likely to have more negative consequences for economic efficiency in professions where workers are less-skilled than in those where most workers are highly skilled and the demand for low-cost alternatives is small. If the information provided by occupational regulation is not important for consumers, perhaps because education and training do not confer great advantages, then mandatory licensing is likely to have more negative consequences for efficiency. In other words, the welfare losses from licensure of manicurists and cosmetologists may be greater than the welfare loses arising from mandatory licensure of physicians and other health professionals. Finally, for highly skilled occupations, mandatory licensing may eventually have negative effects on competition and efficiency if it ultimately results in licensing standards being set "too high."[14] If licensing standards creep up over time, the disadvantages of licensing relative to certification may become more apparent because the licensing regime—by virtue of it being mandatory—precludes a competitive fringe from ever emerging.

[14] In a classic theoretical paper on occupational licensing, Leland (1979) showed that a welfare maximizing licensing authority needs to trade off the welfare gain from imposing a higher quality standard (which solves an adverse selection problem) with the welfare loss arising from decreased availability (which results in less competition and higher prices). If licensing standards are set too high, the marginal benefit of higher a standard will be less than the marginal cost. In this instance, efficiency would be increased if the licensing authority were to lower the standard.

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Appendix: tables

Table 1: Registered and practical nurse licensing status by state

Panel A: Registered Nurses

(1) States that **switched** from certification to licensure between 1948 and 1958 (Treatment states)	(2) States that **did not** change their regulatory regime between 1948 and 1958 (Control states)
AK-57, AZ-53, CO-57, CT-56, FL-52, ID-51, IL-51, KS-49, LA-51, MO-53, NE-53, NJ-55, NM-53, NV-53, NY-49, OR-57, PA-51, RI-52, SD-55, WI-55, WY-55	AL, AR*, CA*, DC, DE, GA, HI, IN, IA, KY, ME, MD, MA, MI, MN, MS, MT*, NC, ND, NH, OH, OK, SC, TN, TX, UT, VT, VA, WA, WV

Panel B: Practical Nurses

(2) States that **switched** from certification to licensure between 1958 and 1968 (Treatment states)	(1) States that **did not** change their regulatory regime between 1958 and 1968 (Control states)
DE-63, HI-59, IL-65, IA-63, KY-66, ME-67, MD-67, MT-67, NH-67, NJ-59, NM-68, NC-65, OK-67, PA-66, SD-67, TN-67, UT-63, VT-62, WV-67, WY-67	AK*, AL, AR*, AZ, CA, CO*, CT*, DC, FL*, GA, ID*, IN, KS, LA*, MA, MI, MN, MS, MO, NE, ND, NV*, NY*, OH, OR, RI*, SC, TX, VA, WA, WI

Notes: In column (1) the numbers refers to the year in which the state required mandatory licensing.* indicates that the state already had licensing by the beginning of the sample period. Other states in column (2) had certification throughout the sample period.

State abbreviations: Alabama (AL), Alaska (AK), Arizona (AZ), Arkansas (AR), California (CA), Colorado (CO), Connecticut (CT), Delaware (DE), District of Columbia (DC), Florida (FL), Georgia (GA), Hawaii (HI), Idaho (ID), Illinois (IL), Indiana (IN), Iowa (IA), Kansas (KS), Kentucky (KY), Louisiana (LA), Maine (ME), Maryland (MD) Massachusetts (MA), Michigan (MI), Minnesota (MN), Mississippi (MS), Missouri (MO), Montana (MT), Nebraska (NE), Nevada (NV), New Hampshire (NH), New Jersey (NJ), New Mexico (NM), New York (NY), North Carolina (NC), North Dakota (ND), Ohio (OH), Oklahoma (OK), Oregon (OR), Pennsylvania (PA), Rhode Island (RI), South Carolina (SC), South Dakota (SD), Tennessee (TN), Texas (TX), Utah (UT), Vermont (VT), Virginia (VA), Washington (WA), West Virginia (WV), Wisconsin (WI), Wyoming (WY).

Table 2: Summary statistics on registered and practical nurses

Panel A: Registered nurses (RN) in 1950 (Pre-treatment period)

	All states	**States that adopted licensure (Treatment states)**	**States that did not adopt licensure (Control states)**
RN wages	$1922.99 (1164.10)	$1914.64 (1125.24)	$1930.52 (1198.98)
PN wages	$1183.67 (783.79)	$1319.26 (845.49)	$1127.26 (751.21)
Physician wages	$2990.84 (2740.41)	$2768.81 (2788.67)	$3215.58 (2685.88)
Years of schooling	13.34 (2.56)	13.44 (2.50)	13.25 (2.65)
Age	35.53 (12.79)	36.34 (13.39)	34.79 (12.20)
Percent female	97.57 (15.41)	96.51 (18.36)	98.52 (12.08)
Percent white	95.79 (20.01)	96.14 (19.27)	95.46 (20.83)
Percent married	29.09 (45.43)	26.74 (44.30)	31.20 (46.37)
Percent foreign-born	6.05 (23.84)	6.74 (25.10)	5.42 (22.65)
Number of children	0.19 (0.55)	0.16 (0.51)	0.21 (0.58)
Lives in central city	42.86 (49.51)	48.71 (41.10)	37.59 (48.48)
Percent part-time	9.20 (0.39)	8.38 (0.34)	9.93 (0.30)
N	1079	504	575

Notes: An individual is counted as living in a central city if the individual lives in the main city within a metropolitan area. Part-time workers work for fewer than 35 hours. Wage data is from 1949. The sample size for the practical nurse data is 333 and for physicians it is 203.

Panel B: Practical nurses (PN) in 1960 (Pre-treatment period)

	All states	**States that adopted licensure (Treatment states)**	**States that did not adopt licensure (Control states)**
PN wages	$2042.12 (1307.4)	$1806.00 (1285.50)	$2129.33 (1305.19)
RN wages	$2967.80 (1780.68)	$2802.31 (1693.20)	$3038.23 (1812.28)
Physician wages	$9044.02 (7923.80)	$9534.96 (8207.13)	$8825.14 (7790.41)
PN wages in 1949	$1238.94 (1046.97)	$1158.39 (801.96)	$1264.99 (1114.84)
Ratio of 1949/1959 PN wages	60.7	64.1	59.3
Years of schooling	10.27 (2.49)	10.09 (2.50)	10.33 (2.48)
Age	44.09 (12.69)	44.00 (12.50)	44.11 (12.76)
Percent female	94.91 (21.99)	94.14 (23.52)	95.19 (21.40)
Percent white	82.50 (38.00)	80.24 (39.86)	83.33 (37.28)
Percent married	52.72 (49.94)	52.49 (50.00)	52.80 (49.94)
Percent foreign born	6.00 (23.70)	5.00 (21.80)	6.33 (24.36)
Number of children	0.95 (1.38)	0.94 (1.27)	0.95 (1.42)
Lives in central city	31.18 (46.33)	21.47 (41.10)	34.77 (47.64)
Percent part-time	13.34 (0.34)	13.23 (0.34)	13.38 (0.34)
N	1709	461	1248

Notes: An individual is counted as living in a central city if the individual lives in the main city within a metropolitan area. Part-time workers work for fewer than 35 hours. Wage data is from 1959. The sample size for the registered nurse data is 5268 and for physicians it is 973. The sample size for the 1949 wage data is 334.

Table 3: Difference-in-differences tables for wages in practical and registered nursing

Panel A: Registered Nurses (RN)

	RN wages in 1959	**RN wages in 1949**	**Difference**
States that had certification in 1949 and mandatory licensure by 1958 (Treatment states)	$3013 (1770)	$1915 (1124)	$1098
States that were same in 1949 and 1958 (Control states)	$2931 (1788)	$1931 (1198)	$1000
Difference	$82	$-16	$98

Panel B: Practical Nurses (PN)

	PN wages in 1969	**PN wages in 1959**	**Difference**
Sates that had certification in 1959 and mandatory licensure by 1968 (Treatment states)	$3777 (1942)	$1806 (1284)	$1971
States that were same in 1959 and 1968 (Control states)	$4140 (2132)	$2129 (1305)	$2011
Difference	$-363	$-323	$-40

Notes: Standard errors are shown in parentheses.

Table 4: Difference-in-differences tables for participation in practical and registered nursing

Panel A: Registered Nurses (RN)

	RN share of Labor Force in 1960	**RN share of Labor Force in 1950**	**Difference**
States that had certification in 1949 and mandatory licensure by 1958 (Treatment states)	0.996%	0.627%	0.369%
States that were same in 1949 and 1958 (Control states)	0.894%	0.533%	0.361%
Difference	0.102%	0.094%	0.008%

Panel B: Practical Nurses (PN)

	PN share of Labor Force in 1970	**PN share of Labor Force in 1960**	**Difference**
States that had certification in 1959 and mandatory licensure by 1968 (Treatment states)	0.293%	0.263%	0.030%
States that were same in 1959 and 1968 (Control states)	0.296%	0.309%	-0.013%
Difference	0.003%	0.046%	0.043%

Table 5: Effects of licensing on wages

Panel A: Registered nurses, 1949-59

	(1) RN wage	**(2) RN wage**	**(3) RN wage**	**(4) PN wage**
Added licensing indicator	0.004	-0.012	-0.063	0.149
	(0.107)	(0.085)	(0.070)	(0.091)
Late period indicator	0.445***	0.365***	0.471***	0.471**
	(0.048)	(0.045)	(0.045)	(0.073)
(Added licensing)*	0.032	0.061	0.090	-0.002
(Late period indicator)	(0.085)	(0.078)	(0.069)	(0.107)
N	6,347	6,347	6,347	2,043
R-squared	0.041	0.181	0.340	0.304

Panel B: Practical Nurses, 1959-69

	(1) PN wage	**(2) PN wage**	**(3) PN wage**	**(4) RN wage**
Added licensing indicator	-0.206*	-0.217**	-0.179**	-0.018
	(0.112)	(0.105)	(0.080)	(0.031)
Late period indicator	0.745***	0.791***	0.718***	0.697***
	(0.054)	(0.050)	(0.042)	(0.153)
(Added licensing)*	0.105	0.139	0.114	-0.018
(Late period indicator)	(0.094)	(0.090)	(0.074)	(0.032)
N	3,900	3,900	3,900	13,970
R-squared	0.168	0.211	0.332	0.401

Notes: Each column represents a separate regression. Column (1) has no additional controls. Column (2) includes age, age squared, foreign-born, race, and sex. Columns (3) and (4) have all the controls in column (2) as well as indicator variables for education, hours worked, and metropolitan residence. Robust standard errors clustered by state are in parentheses. Finally, *** denotes $p<0.01$, ** denotes $p<0.05$, and * denotes, $p<0.1$.

Table 5a: Effects of licensing on wages for early and late switchers

Panel A: Registered nurses, 1949-59

	(1)	(2)	(3)
Added licensing indicator (1949-1953)	0.000	-0.026	-0.072
	(0.130)	(0.105)	(0.083)
Added licensing indicator (1954-1958)	0.0169	-0.041	-0.033
	(0.086)	(0.095)	(0.093)
Late period indicator	0.445***	0.365***	0.471***
	(0.048)	(0.044)	(0.0445)
(Added licensing 1949-1953)*	0.040	0.089	0.102
(Late period indicator)	(0.100)	(0.090)	(0.079)
(Added licensing 1954-1958)*	0.003	-0.0311	0.047
(Late period indicator)	(0.101)	(0.110)	(0.098)
N	6,347	6,347	6,347
R-squared	0.041	0.181	0.340

Panel B: Practical Nurses, 1959-69

	(1)	(2)	(3)
Added licensing indicator (1959-1963)	-0.112	-0.114	-0.058
	(0.137)	(-1.03)	(0.097)
Added licensing indicator (1964-1968)	-0.227*	-0.241**	-0.203**
	(0.127)	(0.121)	(0.091)
Late period indicator	0.745***	0.791***	0.718***
	(0.0543)	(0.050)	(0.042)
(Added 1959-1963 licensing)*	0.018	0.089	0.100
(Late period indicator)	(0.129)	(0.118)	(0.106)
(Added licensing 1964-1968)*	0.124	0.150	0.116
(Late period indicator)	(0.107)	(0.102)	(0.082)
N	3,900	3,900	3,900
R-squared	0.168	0.211	0.333

Notes: Each column represents a separate regression. Column (1) has no additional controls. Column (2) includes age, age squared, foreign-born, race, and sex. Column (3) has all of the controls included in column (2) as well as indicator variables for education, hours worked, and metropolitan residence. Robust standard errors clustered by state are in parentheses. Finally, *** denotes $p<0.01$, ** denotes $p<0.05$, and * denotes, $p<0.1$.

Table 6: Effects of registered nursing licensing on participation in nursing for young and old workers

Panel A: Young (35 and under)

	(1) RN	**(2) RN**	**(3) RN**	**(4) PN**
Added licensing indicator	0.00222***	0.00066	0.00049	-0.00051***
	(0.000806)	(0.000608)	(0.000663)	(0.000154)
Late period indicator	0.000638	0.000101	-0.00750***	0.00044
	(0.000455)	(0.000468)	(0.000888)	(0.000309)
(Added licensing)* (Late period indicator)	0.000347	0.00124*	0.00128	-0.000202
	(0.000688)	(0.000729)	(0.000836)	(0.000302)
N	614,972	614,972	614,972	614,972
R-squared	0.000	0.024	0.048	0.004

Panel B: Old (36 and older)

	(1) RN	**(2) RN**	**(3) RN**	**(4) PN**
Added licensing indicator	0.00041	0.00010	0.00014	-.00131***
	(0.000681)	(0.000517)	(0.000454)	(0.000374)
Late period indicator	0.00221***	0.000538*	-0.00120***	-0.00077**
	(0.000285)	(0.000281)	(0.000443)	(0.000404)
(Added licensing)* (Late period indicator)	-0.000358	-0.000312	-0.000208	-0.00023
	(0.000472)	(0.000440)	(0.000530)	(0.000534)
N	725,179	725,179	725,179	725,179
R-squared	0.000	0.017	0.030	0.010

Notes: Each column represents a separate regression. The dependent variable is an indicator equal to 1 if the individual worked as a registered nurse. Column (1) has no additional controls. Column (2) includes age, age squared, race, and sex. Columns (3) and (4) have all the controls in column (2) as well as indicator variables for education, hours worked, and metropolitan residence. Robust standard errors clustered by state are in parentheses. Finally, *** denotes $p<0.01$, ** denotes $p<0.05$, and * denotes, $p<0.1$.

Table 7: Effects of practical nurse licensing on participation in nursing for young and old workers

Panel A: Young (35 and under)

	(1) PN	(2) PN	(3) PN	(4) RN
Added licensing indicator	-0.00039	-0.00037	-0.00038	0.00226
	(0.000247)	(0.000267)	(0.000269)	(0.00126)
Late period indicator	0.00087***	0.00053***	0.00042**	-0.00336***
	(0.000184)	(0.000194)	(0.000190)	(0.000341)
(Added licensing)*	0.000360	0.00033	0.00031	-0.00076
(Late period indicator)	(0.000291)	(0.000316)	(0.000325)	(0.00057)
N	650,124	650,124	650,124	650,124
R-squared	0.000	0.004	0.005	0.041

Panel B: Old (36 and older)

	(1) PN	(2) PN	(3) PN	(4) RN
Added licensing indicator	-0.00056	-0.00047	-0.00047	-0.00043
	(0.000433)	(0.000439)	(0.000443)	(0.000543)
Late period indicator	-0.00084***	-0.00130***	-0.00141***	0.00094***
	(0.000228)	(0.000238)	(0.000250)	(0.000286)
(Added licensing)*	0.00050	0.00041	0.00037	0.00117**
(Late period indicator)	(0.000499)	(0.000494)	(0.000495)	(0.000444)
N	822,194	822,194	822,194	822,194
R-squared	0.000	0.006	0.007	0.033

Notes: Each column represents a separate regression. The dependent variable is an indicator equal to 1 if the individual worked as a practical nurse. Column (1) has no additional controls. Column (2) includes age, age squared, foreign-born race, and sex. Columns (3) and (4) have all of the controls included in column (2) as well as indicator variables for education and metropolitan residence. Robust standard errors clustered by state are in parentheses. Finally, *** denotes $p<0.01$, ** denotes $p<0.05$, and * denotes, $p<0.1$.