

# Is Occupational Licensing a Barrier to Interstate Migration?

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Occupational licensure may limit the interstate movement of workers because it adds to the cost of moving between states. However, the interstate migration of these workers may be reduced by occupation characteristics independent of licensure. We exploit the detailed migration information available in the American Community Survey to analyze the interstate migration of 22 licensed occupations, employing an empirical strategy that reduces negative bias from unobservable characteristics of members of licensed occupations. This bias is significant, and the between-state migration rate for members of licensed occupations is 5 percent lower relative to members of other occupations, a much smaller difference than the initial, unadjusted difference of -28 percent. The size of this effect varies across occupations, from over -20 percent to no difference in interstate migration rates, and appears tied to the state specificity of licensing requirements. Based on our results, we estimate that the rise in occupational licensing can explain only a small part of the documented decline in interstate migration in the United States.

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## **1. Introduction**

Occupational licensing has become one of the most significant forms of labor market regulation in the United States (U.S. Department of the Treasury Office of Economic Policy, Council of Economic Advisers, and Department of Labor 2015). Recent estimates suggest that about 25 percent of the workforce requires a license to work; in 1950, that figure was only 5 percent (U.S. Department of Labor, Bureau of Labor Statistics 2016; Kleiner and Krueger 2010, 2013). Proponents of occupational licensing contend that it protects consumers, ensuring high service quality and protecting the public from harm by ensuring that all service providers have attained a government-mandated minimum qualification level. Previous work has shown that requiring such qualifications restricts entry into these occupations and increases their earnings (Kleiner 2006, 2013), but little work has been done to examine the potential of occupational licensing to limit the geographic mobility of individuals. As the majority of licenses are granted at the state level, licensing may limit the ability of workers to move between states, affecting their capacity to take advantage of job opportunities in other places (Roback 1943). Our research is consistent with the more general analysis of labor market barriers that could be erected by both firms and occupational associations (Krueger and Posner 2018; Krueger and Ashenfelter 2018). We provide new, detailed comprehensive evidence of the influence of occupational licensing on the interstate migration of licensed workers across a variety of occupations.

Economists have long recognized the ability of workers to move to different labor markets without restriction as being fundamental to the efficient functioning of those markets (Smith 1776; Friedman 1962). As most occupational licenses are granted at the

state level,<sup>1</sup> the cost of attaining licensure in another state can often be significant, even for those already licensed in another state. Despite the growing importance of occupational licensing, the existing literature investigating the link between occupational licensing and geographic mobility is limited (Mulholland and Young 2016). Several earlier studies showed reduced interstate migration for members of some licensed occupations.<sup>2</sup> More recent work considers the migration of two universally licensed occupations: lawyers and nurses. Tenn (2001) examines the links between the interstate migration of lawyers and their wages, finding that wages are higher in states with lower migration rates. In contrast, DePasquale and Stange (2016) show that the adoption of the Nurse Licensure Compact, which enables registered nurses to practice across state lines without obtaining additional licensure, does not affect the labor supply or the geographic mobility of nurses.

With the exception of DePasquale and Stange's (2016) work on nurse licensure, most existing research on the effects of occupational licensing on migration is descriptive in nature, likely because of the lack of available information on changes in licensing requirements that could be used in a more causal framework. In our case, this information would ideally be the requirements for currently licensed individuals to obtain licensure in another state, which are often lower than the requirements for initial licensure

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<sup>1</sup> A White House report (U.S. Department of the Treasury 2015) estimated that over 1,100 occupations are licensed in at least one state and 60 are licensed in every state, with more than two-thirds of the growth of licensed workers due to the regulation of new occupations.

<sup>2</sup> Holen (1965) showed that dentists and lawyers have limited between-state mobility relative to physicians in the 1950 census. Pashigian (1979) considered the interstate migration of multiple universally licensed occupations, and occupations with little reciprocity between states had lower interstate mobility between 1965 and 1970. In a study of 14 universally licensed occupations using the 1970 census, Kleiner, Gay, and Greene (1982) found a negative relationship between licensing "restrictiveness" (based on state exam and experience requirements) and interstate mobility, as well as a positive correlation between expanded reciprocity and interstate migration rates.

and referred to as licensing “reciprocity” or “endorsement.” Several characteristics of the administration of occupational licensing make accurate identification of these state requirements extremely difficult to obtain. Within each state, the licensing of each occupation is overseen by a licensing board or agency specific to a particular occupation or small group of related occupations. The boards or agencies have little incentive to maintain records of historic changes in reciprocity requirements. Perhaps most importantly, in many occupations and states, licensing reciprocity requirements are determined on a case-by-case basis, where individuals currently licensed in another state must work with the licensing board to determine what they must do to transfer their license. These requirements are often based on characteristics such as the individual’s current state of licensure and years of experience in the occupation. Given the idiosyncratic nature of boards and their record keeping for these requirements, it is difficult to determine the current requirements for licensure reciprocity, much less what they were in previous years—information required for a causal analysis of the effect of occupational licensing on interstate migration.

Given the inability to pursue a traditional causal analysis, our study takes a different approach. Two characteristics of licensed occupations, unrelated to licensing costs, could lead to licensed individuals having lower interstate migration rates, negatively biasing estimates of the effect of licensing on interstate migration. First, many licensed occupations, such as barbers/cosmetologists and real estate brokers, involve the development of a local clientele or network. Moving to another labor market, as often occurs with an interstate move, would result in the elimination of this “local capital,” increasing the cost of making such a move for licensed individuals. Second, members of

licensed occupations could have a lower taste for interstate migration due to the self-selection of risk-averse individuals into these occupations, which often provide a clear career path and stable employment. Our empirical strategy exploits the detailed migration information in the American Community Survey, as well as state of birth information, to mitigate the influence of these two sources of negative bias in the estimation of the relationship between interstate migration and occupational licensure.

We study the geographic mobility of 22 occupations licensed in every state. Our preferred estimates, using only individuals who move 50 or more miles and reside outside their state of birth, show that individuals in these occupations move between states at a 5 percent lower rate compared to members of other, unlicensed occupations. Our strategy appears effective at reducing bias, as the unadjusted difference in migration rates is estimated at -28 percent. We approximate re-licensure costs by dividing these occupations into two groups based on whether initial licensure requires passage of an exam that varies from state to state (a “state-specific” licensed occupation) or only national standardized exams (“quasi-national” licensed occupations). There appears to be a correlation between even this simple proxy of the difficulty of transferring licenses between states and interstate migration, as members of state-specific licensed occupations have 7 percent lower interstate migration rates on average, and those of quasi-national occupations are 2 percent lower. We proceed to examine each occupation individually, finding variation in the existence of significantly lower interstate migration rates across the occupations but surprisingly little heterogeneity in the size of the effect for those occupations with reduced migration: point estimates for nearly all affected occupations

are approximately -10 percent.<sup>3</sup> We show that our results are robust to changes in the definition of a long-distance move and the specification of control variables, and we find nearly identical results using another, independent dataset: the Annual Social and Economic Supplement of the Current Population Survey (CPS ASEC).

While the limiting effect of licensing on interstate migration is substantial for affected occupations, it is unlikely that the large increase in occupational licensing over the last few decades explains much of the decline in interstate migration experienced over the same period, as shown in Figure 1. If occupational licensing decreases interstate migration by 5 percent on average, as our results indicate, the increase in occupational licensing since 1980 can account for only 1 percent of the decline in interstate migration since that time.

Our study proceeds as follows. Section 2 presents a simple theoretical framework relating occupational licensing and geographic mobility. Section 3 describes the data. Section 4 outlines the empirical strategy, and Section 5 presents our results, including numerous tests of the robustness of the results to both issues of selection by distance, type of licensure, and the propensity to remain in one's state of birth. In Section 6 we summarize, conclude, and present directions for future research.

## **2. Modeling Occupational Licensing and Geographic Mobility**

The potential restrictive effect of occupational licensing on interstate migration can be modeled using classic models of migration decision making developed by Sjaastad

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<sup>3</sup> Previous research uncovers a similar pattern in the earnings effects of occupational licensing. The addition of covariates and controls for selection into the occupation substantially reduces the influence of licensing on wages, also estimated to be in the neighborhood of 10 percent (Kleiner and Krueger 2013; Gittleman, Klee, and Kleiner 2018).

(1962). In these models, an individual decides whether to migrate based on expected utility differences (usually modeled as a function of wages or trade-offs of wages for other nonpecuniary items) between the origin and destination. They migrate if, given their information and preferences, they have a higher expected utility from migrating than from not migrating:

$$E[u(w_D)] - C \geq E[u(w_O)]. \quad (1)$$

While expected utility  $u$  is a function of wages in the origin and destination ( $w_O$  and  $w_D$ , respectively), migrating also incurs a cost  $C$ . This cost is often thought of as including onetime moving costs, such as transportation, finding a home and job and other fixed costs incurred at the destination, as well as so-called psychic costs, such as being farther from family, finding new friends, and other associated costs. For moves where the origin and destination are both within a state, members of licensed occupations incur no additional cost to migration relative to unlicensed workers. Licensed individuals considering a move to a destination in another state face the additional cost of re-licensure, an issue that unlicensed individuals considering the same move do not face. If re-licensure costs are high enough, the interstate migration rates of licensed individuals will be lower than that of others, but their within-state migration rates should be unaffected.

Although the exact requirements for licensure vary by occupation, most include training, experience, and exam obligations, as well as the payment of licensing fees and participation in continuing professional development activities and monitoring by licensed practitioners (Sass 2015). The requirements for an individual seeking re-licensure in another state may range from completing more training and exams or merely

filling out forms and paying a fee. The specific requirements vary not only by occupation but also by destination and origin state. For particular occupations, some states have reciprocity agreements with other states, which recognize licenses granted in another state as valid for practice. Institutional costs are associated with these regulations. In some cases, re-licensure costs can be high. For example, a licensed public schoolteacher with a decade of teaching experience in New Hampshire is not legally allowed to teach in an Illinois public school without completing significant new coursework and apprenticeships (Sass 2015). In other cases where the explicit conditions of re-licensure are left up to licensing board discretion, there is also additional uncertainty about the economic payoffs to the interstate migration decision. The existence of such requirements could constitute a significant cost to migration across state lines for those in licensed occupations, and these costs could prevent individuals from moving if the costs of re-licensure had been lower.

### **3. Data**

For our empirical analysis, we rely on the American Community Survey (ACS) as available through IPUMS-USA (Ruggles et al. 2017). As the largest nationally representative survey that contains detailed migration and occupation measures, the ACS is the existing dataset most suited to studying the relationship between licensing coverage and migration.<sup>4</sup> We use the ACS from 2005 to 2015 for our main analyses as the detailed migration information we use is first available in 2005. Since we focus on the migration of currently employed and employable individuals, we limit our sample to those aged 18

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<sup>4</sup> We use the Annual Social and Economic Supplement of the Current Population Survey (CPS ASEC) for supplementary analyses in Section 5.3. We rely on the ACS for our main analysis as it contains more detailed migration information than the CPS ASEC, and this information is key for our empirical strategy.



to 64. The data available through the ACS have information on occupational licensing coverage, but not if the individual attained a license (Gittleman and Kleiner 2016). However, for the occupations we study, licensing coverage and attainment are largely indistinguishable: to be a legally practicing member of these occupations, one must hold a license.<sup>5</sup>

The 22 licensed occupations we examine are shown in Table 1. We chose these occupations based on the following criteria: (1) they were uniquely identifiable using ACS occupation codes, (2) they were universally licensed in all states, and (3) entry into the occupation requires licensure, so all members of an occupation must be licensed. These occupations cover a wide variety of skill and income levels, from barbers and cosmetologists, electricians, and pest control workers to lawyers, physicians, and dentists, and represent a range of industries. Some occupations with largely similar tasks, such as occupational and physical therapists, were merged by combining two or more ACS occupation categories to increase sample size.

As shown in Table 1, we divide these occupations into two groups: “state-specific” and “quasi-national” occupations. As discussed, requirements for attaining licensure vary substantially both across occupations and states within occupations. Since we are interested in the relationship between state licensing requirements and interstate migration, we require a way to distinguish occupations by their potential ability to transfer an existing license from state to state. Given the lack of information on the exact requirements to do so, we base this classification on a licensing requirement common to

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<sup>5</sup> This contrasts with other occupations such as accounting and engineering, where individuals may be a largely practicing accountant or engineer without holding a license (see Hur, Kleiner, and Wang 2018).

all 22 occupations: the passage of a licensing exam. The exam(s) required for licensure take two forms: a common national exam with a single passing standard or an exam with varying content and difficulty from state to state. As well as being a concrete method of classification, licensing exam requirements are much easier to identify than other requirements that potentially vary from state to state, such as additional training and practical experience requirements or board discretion in granting licenses. We ignore such requirements in our classification.<sup>6</sup> Occupations for which at least one licensing exam varies between states are “state-specific” licensed occupations, and those with only national exams (but licenses granted at the state level) are “quasi-national” licensed occupations. Some occupations, such as pharmacists and veterinarians, have both a national licensing exam as well as a state-specific exam that tests either clinical skills or knowledge of relevant state laws (often called a “jurisprudence” exam). Since the passage of this state exam is required for licensure, we have placed these occupations in the state-specific category. Details on the exam requirements for licensure for each occupation are shown in Appendix Table A1. The 22 occupations we analyze make up 11 percent of the U.S. labor force, with the state-specific licensed occupations accounting for 7 percent and the quasi-national licensed occupations accounting for 4 percent.

Our empirical strategy relies on the ability to distinguish long-distance from short-distance moves. Starting in 2005, the ACS provides location of current residence, as well as last year’s residence for movers, at geography below the state level: the Public Use

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<sup>6</sup> Completion of these additional requirements is often waived for existing license holders seeking to transfer existing licenses between states, another reason to exclude these requirements from our classification scheme. This waiver process is usually done on an individual basis at the discretion of the state licensing board. However, it is unlikely that such a waiver would cover passage of a state-specific exam, such as the pharmacy jurisprudence exam.

Microdata Area of migration (MIGPUMA), a unit of approximately 100,000 or more residents. MIGPUMAs roughly correspond to a county for densely populated areas and a larger area for more rural areas, and all MIGPUMAs are contained within a single state.

<sup>7</sup> For movers between MIGPUMAs, we measure move distance as the straight-line distance between the centroids of the current and former MIGPUMA of residence.

#### **4. Empirical Strategy**

As we have no source of exogenous variation to identify a causal relationship between occupational licensing and interstate migration, we must turn to other, indirect empirical methods. While our strategy does not allow for identification of a causal effect, it does allow us to mitigate two main sources of unobservable bias: the correlation between unobservable occupation characteristics and migration, and the self-selection of individuals with lower propensity to migrate into licensed occupations, particularly state-specific occupations.

Many occupations listed in Table 1 have characteristics that would lead members to be less likely to move between states. Success in these occupations relies on developing and maintaining a local reputation or clientele network (or both), such as that for lawyers, real estate agents and appraisers, barbers/cosmetologists, veterinarians, and so on.<sup>8</sup> A move between states would result in the loss of this valuable “local capital” if such a move also involved changing geographic labor markets. Therefore, the reduced interstate

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<sup>7</sup> Some MIGPUMAs combine two or more Public Use Microdata Areas (PUMAs) of residence, so the two do not perfectly correspond. For more information, see IPUMS-USA, MIGPUMA1, “Description,” [https://usa.ipums.org/usa-action/variables/MIGPUMA1#description\\_section](https://usa.ipums.org/usa-action/variables/MIGPUMA1#description_section).

<sup>8</sup> Elementary and secondary teachers do not have a local clientele or network like lawyers and real estate agents, but often tenure and other benefits are specific to seniority in each school district, which could also strongly deter teachers from moving out of their local area.

mobility of members of licensed occupations could be due to this local capital and not due to the effects of licensing.

In addition to having reduced geographic mobility due to occupation characteristics, members of these occupations may also be self-selected on individual characteristics that lead them to move at a lower rate. Most of these licensed occupations have clear career paths with a high probability of employment once licensure is attained and a strong likelihood of continued stable employment, as labor demand for these occupations is relatively unaffected by macroeconomic conditions (particularly for those in the medical field) (Gittleman, Klee, and Kleiner 2018). These characteristics could lead to members of these occupations having higher average risk aversion than those in unlicensed occupations. If those with higher risk aversion are also less likely to migrate, this self-selection may account for the lower geographic mobility of members of licensed occupations. Individuals could also select into these occupations based on an affinity for the state in which they grew up. For example, if a young person knows they are very likely to stay in their current state, consequently they may be more likely to become a teacher, nurse, or lawyer.

Evidence of the presence of these biases is apparent in Table 2, which shows descriptive statistics for the full ACS sample, for unlicensed and licensed individuals, and for the two categories of licensed occupations. Fifteen percent of the full sample makes a move of any distance within a year. Around two-thirds of these moves are “local” moves, as they take place within a MIGPUMA. The other moves are split approximately

equally between between-MIGPUMA moves within a state and moves between states.<sup>9</sup> Licensed individuals are less likely to move at all compared to unlicensed individuals, but most of this difference is due to a lower fraction of licensed individuals making within-MIGPUMA moves; approximately equal fractions of unlicensed and licensed individuals move between MIGPUMAs within a state as well as between states. However, state-specific licensed individuals are much less likely to move between states than quasi-national licensed occupations (2.0 percent per year vs. 2.8 percent per year), while they move within states (both between and within MIGPUMAs) at similar rates (2.8 vs. 2.6 percent between MIGPUMAs, 7.8 percent for both groups within MIGPUMA).

As licensed occupations are less likely to move at all, we limit our sample to those who chose to move and consider the fraction of all moves that are long-distance. We define a long-distance move, which is likely accompanied by a change of job as well as the loss of local capital, to be a move of 50 or more miles.<sup>10</sup> Table 2 also shows the fraction of movers who make a move of 50 or more miles by occupation group. Among movers, licensed individuals are more likely to move 50 or more miles than unlicensed individuals, but state-specific licensed individuals make many fewer long-distance moves than those in quasi-national licensed occupations, potentially due to the migration-limiting effect of the local capital component of (many) state-specific occupations.<sup>11</sup>

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<sup>9</sup> Recall that all MIGPUMAs are contained within a single state, so a move between states is also a move between MIGPUMAs.

<sup>10</sup> We repeat our analysis using 100-mile moves and find similar results, as shown in Appendix Table A5.

<sup>11</sup> Some of the quasi-national occupations, such as physicians, occupational and physical therapists, and psychologists, may also incur a loss of local capital with a long-distance move, particularly if the individual is self-employed. In our ACS sample, about 25 percent of physicians and 33 percent of psychologists are self-employed, compared to 65 percent and 74 percent of (state-specific licensed) dentists and chiropractors, respectively.

To remove the influence of this local capital, we next consider only those individuals who moved 50 or more miles and calculate the fraction of these long-distance moves that were made across state lines. As all these moves are long-distance, all should result in the loss of local capital. The fraction of these movers who move between states is identical for licensed and unlicensed occupations, but very different between the two types of licensed occupations: 70 percent of long-distance moves were between states among quasi-national licensed occupations, but only 61 percent for state-specific licensed occupations.

Even among those who move a long distance, individuals in state-specific licensed occupations are less likely to move between states than unlicensed or quasi-national licensed occupations. However, as is also apparent in Table 2, individuals in these occupations are also much less likely to reside outside their state of birth, meaning that some of the difference in between-state migration rates could be due to members of state-specific licensed occupations having greater preference for staying in the area of their birth.

The descriptive data in Table 2 also show that members of licensed occupations are highly educated, with an average of over 16 years of education, compared to the 13-year average of unlicensed individuals. As most licensed occupations require a minimum level of education to achieve licensure, this is to be expected. In addition, licensed occupations are less likely to identify as a member of a minority racial and ethnic group, are slightly older, and have higher incomes than members of unlicensed occupations. Both the state-specific and quasi-national licensed occupation groups are relatively female-dominated, as nearly 63 percent of state-specific licensed occupations and 80

percent of quasi-national occupations are women. The high proportion of women in these groups is due to the large size of two female-dominated occupations: teachers and nurses, which comprise over half of the state-specific and quasi-national licensed groups, respectively. Appendix Table A2 shows the descriptive statistics for the 22 specific occupations that make up each group.

Our empirical specification takes the following general form:

$$Y_{ist} = \delta D_{ist} + X_{ist}\beta + \alpha_s \times \eta_t + \varepsilon_{ist}, \quad (2)$$

where  $Y_{ist}$  is an indicator for migration of individual  $i$  residing in state  $s$  in year  $t$ ,  $D_{ist}$  is an indicator for belonging to a licensed occupation or group of occupations,  $X_{ist}$  is a vector of observable controls,  $\alpha_s \times \eta_t$  are state-year fixed effects (defined based on last year's state of residence), and  $\varepsilon_{ist}$  is a conventional error term.<sup>12</sup> In our preferred specification, the dependent variable  $Y_{ist}$  is an indicator for moving between states, and the sample is limited to individuals who moved at least 50 miles and were residing outside their state of birth. We also estimate equation (2) using other dependent variables and sample definitions to illustrate the size and direction of bias addressed by our preferred specification.

Our main analysis for the licensed occupation groups estimates equation (2) using OLS. However, as is evident in Table 2, licensed occupations comprise a select subset of

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<sup>12</sup> The vector  $X_{ist}$  consists of controls for education (dummies for high school completion, some college, 4 years of college, and more than 4 years of college, with less than high school the excluded group), age (dummies for 5-year age group (20–24, 25–29, . . . ,60–64) with ages 18–19 the excluded group), income (quartile dummies), race (dummies for non-Hispanic white, non-Hispanic black, Hispanic white, and other), marital status (dummies for married, divorced, widowed, single), employment status (dummies for employed, unemployed, not in labor force), citizenship status, and number of children (dummies for 0, 1, 2, 3, 4+). State\*year fixed effects are based on last year's state of residence. We show the sensitivity of our specification to the included controls, including the fixed effects, in Section 5.2.

the full U.S. working-age population based on observable characteristics; in particular, they are more highly educated, more non-Hispanic white, and have higher incomes. These differences become even more apparent when we consider each of the 22 occupations separately. To identify a more appropriate comparison group for our occupation-specific analysis, we employ a cell-matching estimator based on the vector of observables  $X_{ist}$  (Black 2015). This approach ensures that the individuals in the comparison group for each occupation include only those with similar observable characteristics to members of each occupation.

## 5. Results

We begin with our results comparing migration rates of licensed occupations to unlicensed occupations, and for the state-specific and quasi-national licensed groups. We then show the sensitivity of our main specification to the inclusion of different control variables and provide evidence of the robustness of the results to changing definitions of long-distance migration, estimation procedure, and perform a supplementary analysis using the CPS ASEC. Finally, we present our occupation-specific results.

### 5.1 Licensing group results

Results using the full ACS sample are shown in Table 3. Panel A defines treatment as belonging to one of the 22 universally licensed occupations, and the comparison group contains all other individuals.<sup>13</sup> All specifications include control variables and state-year fixed effects. In column (1), the dependent variable is an indicator for moving

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<sup>13</sup> As many other occupations are licensed in at least one state besides these 22, the comparison group contains some licensed occupations. However, if they experience migration effects similar to occupations in the treatment group, their presence in the comparison group biases our results toward zero.



between states. Members of licensed occupations have an interstate migration rate that is 0.7 percentage points lower than members of other occupations. When scaled by the dependent variable mean of 0.025, this translates to a 28 percent lower interstate migration rate for licensed occupations. However, this specification compares the probability of moving between states to the probability of not doing so, which includes moving within a state or not moving at all. Column (2) estimates the difference in the probability of making a move of any distance between licensed and unlicensed occupations and confirms that licensed occupations are less likely to move at all. Among those who do move, those in licensed occupations are 8 percent less likely to move 50 or more miles, as shown in column (3). Column (4) is our main specification, where the dependent variable is an indicator for moving between states and the sample is limited to individuals who moved at least 50 miles. Given they make a long-distance move, members of licensed occupations are nearly 9 percent less likely to move between states than members of unlicensed occupations.

The contrast between the 28 percent lower interstate migration rate uncovered by the base estimator and the 9 percent lower rate in our preferred specification illustrates the substantial size of the likely bias in the naïve estimator from self-selection of risk-averse individuals into licensed occupations as well as occupation-specific local capital. Much of the 28 percent difference in interstate migration rates between licensed and unlicensed individuals is due to a lower propensity of licensed occupations to move at all and, given a move is made, to move a long distance. Higher risk aversion of members of licensed occupations could account for their lower overall migration rates. The lower long-distance migration rate for licensed individuals could also be due to their higher risk

aversion but may also be explained by the local-capital-specific nature of many licensed occupations. The specification in column (4) mitigates both of these biases by limiting the sample to individuals who have chosen to move 50 or more miles, a potentially “riskier” move in that it likely results in a change of local area (city/area of residence) and the loss of local networks and clientele.

To interpret this lower interstate migration among members of licensed occupations as a causal effect of the cost of re-licensure, we must assume that by limiting our sample to those who make a move of 50 or more miles and including our chosen controls, we have eliminated observable potential sources of endogeneity. Particularly concerning would be any remaining unobservable characteristics in the error term correlated with being in a licensed occupation that reduce the likelihood of moving between states (given a long-distance move). Without any source of exogenous variation in licensing requirements, we cannot claim that our preferred specification has isolated the causal effect of re-licensure costs on interstate migration of licensed individuals. However, we have likely mitigated, and potentially eliminated, two major sources of unobservable bias in our analysis, given two assumptions: (1) all moves of 50 or more miles result in the loss of local capital, and (2) using only individuals who make such a long-distance move removes bias from potential self-selection of more risk-averse (and therefore less geographically mobile) individuals into licensed occupations. We show that our results are robust to several tests of these assumptions in Section 5.2.

The remainder of Table 3 repeats the analysis separately for the two licensed groups. Panels B and C define the treatment group as state-specific and quasi-national licensed occupations, respectively, with the comparison group containing all other occupations.

We exclude state-specific occupations from the analysis for quasi-national occupations and vice versa, to ensure that the comparison group in each case does not contain any members of the identifiable universally licensed occupations.

The results for state-specific and quasi-national occupations indicate that the lower interstate migration rates among licensed individuals in panel A were largely driven by the state-specific occupations. State-specific occupations migrate at a 46 percent lower rate between states in the base naïve specification (column (1)), but the interstate migration rate for quasi-national occupations is equivalent to those in unlicensed occupations. The probability of moving at all is also much lower for state-specific occupations (12 percent) but hardly lower for quasi-national occupations (2 percent). Among movers, state-specific licensed occupations are over 17 percent less likely to move a long distance, but quasi-national licensed occupations are nearly 7 percent more likely to do so, indicating that the local-capital-loss effect may play less of a role in the migration decisions of nurses, physicians, social workers, occupational and physical therapists, psychologists, and physician assistants than those of the state-specific licensed occupations. However, among those who move 50 or more miles, both licensed occupation groups are less likely to move between states than other occupations, although this difference is much larger for state-specific occupations than quasi-national (13 vs. 3 percent). It appears that licensing may even restrict the ability of quasi-national licensed occupations to move between states.

The final panel of Table 3 uses only licensed occupations and defines the treatment group as state-specific licensed occupations. Here, both the treatment and comparison groups consist only of universally licensed occupations. The results are in line with those

in panels B and C: state-specific licensed occupations are much less likely to move at all and move a long distance. Among those who do move more than 50 miles, those in state-specific licensed occupations are approximately 12 percent less likely to move between states than members of quasi-national occupations.

While our preferred specification alleviates bias from the effects of local capital and self-selection of risk-averse individuals into licensed occupations, it still may be that members of licensed occupations choose these occupations based on an affinity for staying within a particular state, particularly the state in which they were born. If this were the case, the reduced interstate migration of licensed occupations even among long-distance movers could be due to this preference for remaining in one's "home" state, and not due to re-licensure costs. We test this possibility by repeating our analysis using only individuals residing outside their state of birth. While state of birth is an imperfect proxy for one's home state, it is the only information on location in early life available in the ACS.<sup>14</sup> Repeating our analysis using only those who have already chosen to leave their state of birth may help reduce this potential bias.

Results using individuals residing outside their state of birth in the previous year are shown in Table 4. The difference in migration rates between licensed and unlicensed individuals (panel A) is still present but is reduced in magnitude by approximately half compared to the full sample results in Table 3. The unadjusted difference in interstate migration rates is now 14 percent, compared to 28 percent in the full sample results, and the difference among those moving 50 or more miles is 5 percent rather than 9 (column

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<sup>14</sup> Approximately 80 percent of U.S.-born individuals aged 17 lived in their state of birth in the 1990 and 2000 censuses.

(4)). This pattern is repeated in the remaining panels considering state-specific licensed occupations separately from quasi-national licensed occupations. The difference in migration rates between licensed and unlicensed groups (or, as in panel D, state-specific and quasi-national licensed occupations) is reduced in magnitude, but the difference in the likelihood of moving between states among long-distance movers remains strongly statistically significant and negative. These patterns also mirror the influence of occupational licensing on wage determination. Specifically, initial wage gaps between the licensed and unlicensed are high but are reduced when covariate controls are included in the models (Kleiner and Krueger 2013; and Gittleman, Klee, and Kleiner 2018).

The results in Tables 3 and 4 show that licensed occupations do appear to have reduced interstate migration rates, but this difference is much smaller than it initially appears. Much of the “effect” is likely attributed to self-selection of risk-averse individuals into licensed occupations, the migration-deterring influence of local capital, and the preference of licensed individuals to remain in their state of birth. However, even after accounting for these biases, members of licensed occupations are approximately 5 percent less likely to move between states compared to unlicensed occupations, given that they move 50 or more miles.

### *5.2 Robustness to control variable choice and migration definition*

All specifications in Tables 3 and 4 include all control variables and state-year fixed effects. Table 5 shows the robustness of our main specification (column (4) of Tables 3 and 4) to the included controls. To remain more succinct, we show results for the full licensed occupation group only; results for the other treatment group definitions are similar. Panel A of Table 5 uses the full sample, and panel B uses only individuals

residing outside their state of birth. Column (5) is a direct replication of our main results from Tables 3 and 4 estimating the difference in the likelihood of moving between states for those who move 50 or more miles including all controls and state-year fixed effects. The first column is the bivariate regression of this outcome on an indicator for being a member of a licensed occupation. In both panels, there is no significant difference in the probability of moving between states when we include no control variables. Recall from the descriptive statistics in Table 2 that members of licensed occupations were much more highly educated on average than those in unlicensed occupations. Higher-educated individuals have been shown to have higher interstate migration rates (Molloy, Smith, and Wozniak 2011). Once we control for education (using a vector of dummy variables) in column (2) of Table 5, we see a difference in interstate migration rates between licensed and unlicensed individuals of -8 and -4 percent for all individuals and those outside of their state of birth, respectively. Columns (3), (4), and (5) add controls for age and sex, the remainder of our control variables (including income, race, marital status, employment status, citizenship status, and number of children), and state-year fixed effects in progression, and the results are nearly identical to those in column (2). Once the difference in education levels between licensed and unlicensed individuals is accounted for, the results are very stable to the addition of other observable control variables.

Table 5 includes an additional column showing results using a cell-matching estimator (Black 2015). Cells are formed based on the full vector of control variables used in column (5), and weights are formed to match the distribution of controls among the comparison group to that of the treatment group. We do not claim that this “exact

matching” estimator uncovers a causal effect any more than the OLS model does, but it helps to ensure that the comparison and treatment groups are more similar based on their observable characteristics, as unlicensed individuals with observable characteristics that do not “match” any licensed individuals are excluded from the sample and vice versa. We include the full vector of controls in the matching specification, as well as state-year fixed effects. Results, shown in column (6), are nearly identical to those in column (5). Appendix Tables A3 and A4 repeat the full analyses in Tables 3 and 4 using this matching estimator, producing nearly identical results to those using OLS.

In addition to being robust to control variable choice, our results are also robust to changes in the definition of a long-distance move. Appendix Table A5 repeats our main specification for individuals residing outside their state of birth using 100 or more miles as the definition of a long-distance move, rather than 50 miles. Results are very similar. To test whether changing from MIGPUMAs defined using the 2000 census to those based on 2010, as the ACS did in 2012, affected our results, we repeat our initial 50-mile analysis for those outside their state of birth for two time periods: 2005–2011 and 2012–2015. Results using the two periods separately are nearly identical and are shown in Appendix Table A6.

### *5.3 Results using the CPS ASEC*

Our analysis so far assumes that all current members of licensed occupations incur re-licensure costs when they move between states. However, this is only true for individuals who were already licensed in another state. The ACS only allows us to identify the current occupation of individuals, meaning our sample of licensed individuals contains both “continuing” members of the occupation (those who were employed in the same

occupation in the previous year) and new entrants (those who were in a different occupation or out of the labor force in the previous year). While continuing members of the occupation would pay re-licensure costs when moving between states, new entrants would pay initial licensure costs, as they were not previously licensed in that occupation in any state. The effect of initial licensure costs on migration of newly licensed individuals may differ from that of re-licensure costs on migration of continuing members of occupations. To evaluate the impact of including new entrants on our main results, we turn to a dataset that allows us to identify new entrants into licensed occupations: the Annual Social and Economic Supplement of the Current Population Survey (CPS ASEC).

While the CPS ASEC contains information on an individual's occupation last year, allowing us to distinguish new entrants from continuing members of an occupation, it has several disadvantages compared to the ACS that led us to not use it in our primary analysis. First, the CPS ASEC has a much smaller sample size than the ACS, about 100,000 observations per year compared to 1.4 million per year in the ACS. Since our analysis focuses on a small subset of the population, the small sample size of the CPS ASEC limits its usefulness, particularly for our occupation-specific analysis by states. Second, the CPS ASEC does not allow for the identification of long-distance moves, as it does not contain information on sub-state place of residence in the prior year. Third, the CPS ASEC does not report state of birth.<sup>15</sup> The lack of detailed sub-state location and

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<sup>15</sup> The CPS ASEC does contain a birthplace variable, but it only identifies country of birth and does not identify state of birth for those born in the United States.



state of birth in the CPS ASEC means we cannot implement our main empirical strategy to mitigate bias from local capital and self-selection as we can with the ACS.

We calculate migration rates using the CPS ASEC from 2005 to 2015, the same years we use in our ACS analysis, and limit our sample to individuals aged 18–64. The CPS ASEC migration variable distinguishes four types of movers: non-movers (same house), movers within county, movers within a state between counties, and movers between states. The fraction of the sample in each of these four categories is shown in Table 6, for the full population, unlicensed and licensed occupations, and for state-specific and quasi-national occupations. The overall migration rate (12.2 percent) and the interstate migration rate (1.6 percent) are lower than in the ACS, consistent with previous research (Kaplan and Schulhofer-Wohl 2012).<sup>16</sup> However, the patterns across the different licensing categories are similar: licensed individuals are less likely than unlicensed individuals to move any distance, but are approximately equally likely to move between states, and those in quasi-national licensed occupations are much more likely to move between states than those in state-specific licensed occupations.

Within each of the four move categories, we use the CPS ASEC information on occupation last year to compute the fraction employed in the same occupation in the previous year, employed in a different occupation last year, and not employed last year. Those in the first group are continuing members of that occupation, and the latter two are new entrants (either from employment in a different occupation or from non-employment). We define occupation using the 3-digit CPS occupation code, so a

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<sup>16</sup> The CPS ASEC within-county and between-county, within-state migration rates are not comparable to the ACS within-MIGPUMA and between-MIGPUMA, within-state migration rates, as counties and ACS MIGPUMAs do not necessarily correspond.

continuing member of an occupation has exactly the same occupation code for their current occupation as well as last year's. As evident in Table 6, non-migrant members of licensed occupations are more likely to be continuing members of their occupation overall (95 percent) compared to those in unlicensed occupations (90 percent). Licensed occupations tend to be stable, easily defined occupations, while members of unlicensed occupations could potentially switch occupations as defined by the 3-digit occupation code without changing the nature of their job (for example, there are around 30 codes for various types of managers).

Considering the differences in the fraction of continuing occupation members by migration category, non-movers are the most likely to be in the same occupation this year as last year, followed by within-county migrants, migrants between counties within a state, and migrants between states. In all migration categories, unlicensed occupations are less likely to be continuing members of their occupation than licensed occupations, and state-specific licensed occupations are slightly less likely than quasi-national licensed occupations.

Most concerning for our analysis would be a large difference in the fraction of continuing occupation members between migrants who moved a long distance within a state (which we can only proxy for by using migrants between counties within a state) and those who moved between states within an occupation category. Such a difference could indicate that the migration patterns of new entrants and continuing members are differently affected by licensing costs. While quasi-licensed occupations are more likely to be continuing in that occupation than members of state-specific licensed occupations, the difference in this fraction for migrants between counties (86 percent for state-specific

vs. 90 percent for quasi-national) is similar to that for migrants between states (82 vs. 86 percent). New entrants make up a relatively small fraction of licensed interstate migrants (around 15 percent), and this number is roughly equivalent to the fraction of new entrants into these occupations among migrants within a state between counties. We therefore find it unlikely that the inability to distinguish continuing members of an occupation from new entrants affects our ACS results substantially.

To further test for bias due to the inclusion of new entrants, we repeat our main ACS analysis using the CPS ASEC. While we can use the same years, occupations, and control variables in the CPS ASEC as the ACS, we cannot define move distance for migrants, nor do we have information on state of birth. These results are shown in Table 7. We use the same specifications and treatment/comparison groups as we do with the ACS, with the exception of the measure of long-distance moves. The only proxy for long-distance moves available in the CPS ASEC is moving between counties (a relatively poor such proxy, as many between-county moves are “short” in that they do not involve a change of local area or labor market). The first four columns use the full CPS ASEC sample. Columns (1) and (2) show results for moving between states and moving at all, and the percentage differences between the migration rates of licensed and unlicensed occupations are remarkably similar to those using the ACS. ACS and CPS ASEC results are also very similar for the other treatment/comparison group combinations. Columns (3) and (4) show the difference in the probability of moving between counties for movers, and the probability of moving between states for those who move between counties.<sup>17</sup> In the CPS ASEC, members of licensed occupations move between counties at a rate

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<sup>17</sup> All moves between states are also moves between counties.

statistically indistinguishable from that of members of unlicensed occupations (although the point estimate is -4 percent), while the difference in the probability of moving 50+ miles using the ACS was -8 percent. The difference between the CPS ASEC and ACS results is likely due to many between-county moves being moves of less than 50 miles, which do not result in a loss of local capital. Similarly, the larger point estimate in the CPS ASEC for the probability of moving between states for those who move between counties (-16 percent vs. -9 percent in the ACS) could be because a larger fraction of between-state moves are 50+ mile moves than within-state, between-county moves, meaning that more of the between-state moves also result in a loss of local capital. However, the CPS ASEC results for all specifications are quite similar to those in the main ACS results.

The last four columns of Table 7 repeat the analysis using only continuing members of an occupation (regardless of whether they are licensed or unlicensed). Results are very similar to those using the full CPS ASEC sample, leading us to conclude that the inclusion of new entrants in our ACS sample likely does not substantially affect our main results.

#### *5.4 Occupation-specific results*

We now turn to analyzing each of our 22 occupations separately to test for heterogeneity in the relationship between licensing and migration across occupations. Our empirical specification is identical to that in equation (2) with two differences: the key independent variable is an indicator for belonging to one of our 22 licensed occupations (e.g. teacher, lawyer, or nurse), and we employ a cell-matching estimator. The cells are defined using the same vector of observable characteristics previously

employed, and we form Average Treatment on the Treated (ATET) weights for each cell. As we exclude individuals who, based on the cells formed by these characteristics, do not have at least one equivalent “match” in the treatment/comparison group, use of the cell-matching estimator allows us to identify a more appropriate comparison group for members of each licensed occupation. For example, in the specification for lawyers, the comparison group only includes unlicensed individuals who have at least one matching lawyer with the same vector of observable characteristics, as well as only including lawyers who have such a match among the unlicensed group.<sup>18</sup> Note that we do not claim that using this matching estimator allows us to identify a causal effect of licensing on migration; we only employ it as a method to identify a suitable comparison group for the occupation in question.

Results for the 22 occupations are shown in Figure 2. We show the estimated percentage difference in migration rates between members of the occupation and unlicensed individuals and the 95 percent confidence interval.<sup>19</sup> The diamonds in the table are the estimates from the base specification using an indicator of migration between states as the dependent variable (analogous to the results in column (1) of Table 3), and occupations are sorted in ascending order of this percentage difference. Solid markers indicate state-specific licensed occupations, and hollow markers quasi-national licensed occupations. Based on these results, real estate appraisers have the lowest relative interstate migration rate, 60 percent lower than comparable unlicensed individuals. Three other state-specific licensed occupations (teachers, lawyers, and

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<sup>18</sup> In all specifications, we exclude members of the other 21 licensed occupations from the sample.

<sup>19</sup> Full occupation-specific results are shown in Appendix Tables A7 (state-specific licensed occupations) and A8 (quasi-national licensed occupations).

pharmacists) have approximately 40 percent lower migration rates, and nine other state-specific licensed occupations have differences between -10 and -20 percent (although the confidence intervals for chiropractors, pest control workers, and optometrists include zero). The remaining three state-specific licensed occupations have raw interstate migration rates that are statistically equivalent to or higher than comparable members of unlicensed occupations. Among the six quasi-nationally licensed occupations, all but one have differences of zero or interstate migration rates higher than their comparison group. The exception is social workers, whose difference in interstate migration rates (-35 percent) is similar to that for pharmacists and lawyers.

The squares in Figure 2 show results from our preferred specification limiting the sample to individuals who moved 50 or more miles (the analogue of column (4) in Table 3). Recall that, given assumptions, this specification mitigates bias from local capital effects as well as self-selection of relatively geographically immobile individuals into licensed occupations. For most occupations, the estimated differences from this model are closer to zero than those from the naïve specification. Occupations for which local capital likely plays an important role, such as teachers, real estate appraisers and brokers, and barbers and cosmetologists, are among those occupations with the largest differences between the two estimates. For example, the unadjusted difference for teachers is over 50 percent, but that in the preferred specification is approximately 15 percent. Note that among the occupations with the highest unadjusted differences, pharmacists have the smallest change in the estimated migration rate difference, from approximately -40 to -30 percent. Local capital is unlikely to be as important for the career success of pharmacists,

who largely work for large firms, as it is for other occupations such as lawyers and teachers (Goldin and Katz 2016).

Two other important findings emerge in Figure 2. First, the occupations for which the naïve estimator produced positive interstate migration rate differences all have differences conditional on a move of 50 or more miles that are either zero or negative, indicating likely positive self-selection on migration propensity into these occupations. Second, while four of the six quasi-nationally licensed occupations have preferred specification percentage differences around zero, two occupations—social workers and physician assistants—have interstate migration rate differences of around 15 to 20 percent, similar to that of many state-specific licensed occupations. Social workers do have a national exam but no system of reciprocity between states, and many states require additional state-specific courses for licensure.<sup>20</sup> The reduced interstate migration of physician assistants is more puzzling, as licensure only requires a national exam, with no state-specific training requirements, but as with social workers, there is no system of reciprocity or state compacts for physician assistants.

Overall, while there is much heterogeneity in the naive difference in interstate migration rates between members of these licensed occupations and unlicensed individuals, there is much less variation in this difference once we limit the sample to individuals who moved 50 or more miles. Thirteen of the 22 occupations have significantly lower interstate migration rates, and 10 of these occupations have point estimates of between -16 and -10 percent. However, these estimates may still be biased

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<sup>20</sup> See Social Work License Map, “Frequently Asked Questions,” <https://socialworklicensemap.com>.

downward if individuals with strong preferences for their home state self-select into licensed occupations.

Figure 3 shows estimates from our preferred specification for the full sample as well as for individuals residing outside of their state of birth in the previous year. The occupations have been re-sorted in ascending order of the percentage difference for the full sample. Conditioning on residing outside one's state of birth moves the estimates closer to zero for the occupations with the largest negative differences, although the 95 percent confidence intervals overlap for all occupations except teachers. Now, 10 occupations have a significantly lower likelihood of moving between states, with nearly all estimates lying between -12 and -7 percent (the differences for pharmacists and pest control workers are -20 and -18 percent, respectively). All these occupations are state-specific licensed occupations, again with the exception of physician assistants and social workers.<sup>21</sup> Figure 4 shows only the results using individuals residing outside their state of birth, our preferred estimates, re-sorted from smallest to largest.

## **6. Conclusion**

Initially, occupational licensing appears to substantially reduce the ability of state licensed individuals to move between states. The interstate migration rates of licensed occupations are 28 percent lower than that of unlicensed workers, even after controlling for observable differences between the groups. However, this difference is likely influenced by unobservable characteristics of members of licensed occupations that

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<sup>21</sup> Appendix Table A9 repeats the occupation-specific analysis conditioning on a 100-mile move, producing similar results to those using a 50-mile move. Appendix Table A10 repeats the 50-mile specification using OLS, and results are similar to those using matching.



reduce their propensity to move between states, independent of licensure costs. Without exogenous variation in licensing requirements with which we could implement a causal framework, we instead use information on move distance and state of birth to mitigate the effects of two large sources of bias: the local capital component of many licensed occupations and the self-selection of risk-averse individuals into licensed occupations. The negative bias caused by these unobservable characteristics appears substantial, as our preferred specification, using only individuals who have moved 50 or more miles residing outside their state of birth, shows that members of licensed occupations move between states at a 5 percent lower rate than unlicensed occupations. This difference is larger on average for occupations with state-specific initial licensing requirements, but even those requiring passage of only national exams show a small reduction in the probability of licensed long-distance migrants moving across state lines. There is heterogeneity in the effect size across occupations, from no discernable difference in migration rates to over 20 percent lower interstate migration among long-distance movers for pharmacists, but most affected occupations experience reductions in interstate migration of 10 percent. Our empirical strategy is a major improvement over the simple descriptive difference and is robust to changes in the definition of migration, the specification of control. Estimates produced using our strategy are similar in two independent datasets. However, these estimates are likely not completely free of negative bias and may be considered an “upper bound” on the reduction in interstate migration experienced by licensed occupations.<sup>22</sup>

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<sup>22</sup> In Appendix B, we investigate the effect of initial adoption of a reciprocity agreement on the interstate migration of lawyers using an event study framework. While there is some evidence that the in-migration of lawyers increases in the year after adoption, the overall results are too noisy to be conclusive.

Based on these results, the increase in occupational licensing likely does not explain a substantial amount of the decrease in overall interstate migration rates between 1980 and 2015. To illustrate, assume unlicensed individuals migrated at the population average rate of 3 percent per year in 1980, and licensed individuals migrated at a 5 percent lower rate, or 2.85 percent per year. Assuming no change in these underlying rates over time, an increase in licensing from 15 to 25 percent of the population (the increase experienced between 1980 and 2015) would result in a decrease in overall population migration rates from 2.98 percent in 1980 (the weighted average of the licensed and unlicensed migration rates) to 2.96 percent in 2015, a decrease of only 0.02 percentage points, or 1.3 percent of the total actual decrease in interstate migration of 1.5 percentage points (from 3 to 1.5 percent per year).<sup>23</sup>

While the increase in occupational licensing does not explain the broader trend in interstate migration, our results show that for individuals in affected occupations, the limiting effect of licensing costs on interstate migration can be substantial, up to 20 percent for some occupations. This finding is relevant to policymakers currently considering revising licensure requirements to reduce the cost of re-licensure for individuals licensed in other states. Economists have long held that restrictions on geographic mobility limit the ability of the labor market to operate efficiently. Within this context, occupational licensing provisions that restrict job entry through interstate migration could also be a barrier to economic opportunity and labor market efficiency for

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<sup>23</sup> Using the unadjusted estimate of 28 percent lower migration for licensed occupations increases this amount to only 0.08 percentage points, or 5.6 percent of the total decrease in interstate migration rates between 1980 and 2015.

affected occupations. Our results may also have legal implications. For example, in 1941, the U.S. Supreme Court held against a California statute, making it illegal to restrict indigent individuals from migrating to the state during the Great Depression.<sup>24</sup> The Court ruled that the California statute “prevent[ed] a citizen because he was poor from seeking new horizons in other States (Roback 1943). In this way, limits on occupational entry might withhold the ability to migrate across states from large segments of the population.

While our empirical strategy reduces negative bias in the estimate of the effect of occupational licensing on interstate migration, it is not as effective in doing so as a traditional causal model based on exogenous variation in re-licensure requirements. We hope that additional information on such requirements will become available in the future for causal analysis of the effect of occupational licensing on geographic mobility.

Our analysis examines the migration of individuals and may therefore miss an additional important effect of re-licensure costs incurred as a result of interstate migration. For many, migration is not an individual decision; instead, it is a choice made based on overall household or family well-being. As our analysis is limited to the individuals we observe in an occupation after their move, we do not capture the effect on individuals who are forced out of an occupation or out of the labor force entirely as a result of moving between states. An example is so-called trailing spouses—those who move because their partner obtains a better job in another state. If these spouses were in a licensed occupation prior to the move, they may have had to switch careers as a result. The effect of licensure on career changes or labor force exits that were made as a result of

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<sup>24</sup> Edwards v. People of State of California, 314 U.S. 160 (1941).

household migration is potentially important, and because we cannot identify individuals affected by these phenomena in the ACS, we also leave this analysis for future research.

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## Tables and Figures

Table 1: Universally licensed occupations identifiable in the ACS

State-specific licensed occupations		Quasi-national licensed occupations	
Occupation name	ACS code(s)	Occupation name	ACS code(s)
Elementary/secondary teacher	2300, 2310, 2320, 2330, 2340	Nurse (RN/LPN)	3130, 3255, 3256, 3258, 3500
Lawyer	2100, 2105	Physician	3060
Barber/cosmetologist	4500, 4510	Social worker	2010
Real estate broker/sales agent	4920	Occupational and physical therapist	3150, 3160
Electrician	6350, 6355	Psychologist	1820
Insurance agent	4810	Physician assistant	3110
Pharmacist	3050		
EMT/paramedic	3400		
Dental hygienist	3310		
Dentist	3010		
Real estate appraiser/assessor	810		
Veterinarian	3250		
Pest control worker	4240		
Chiropractor	3000		
Optometrist	3040		
Podiatrist	3120		

Note: Codes listed are 2003-2015 ACS codes. Teacher sample also conditional on industry code 7860 (Elementary and secondary schools). State-specific licensed occupations have state licensing exams of varying content and difficulty; quasi-national licensed occupations are licensed at the state level, all requiring passage of a national exam for licensure. For more details see Appendix Table A1.

Table 2: Descriptive statistics, 2005-2015

	Full sample	Unlicensed individuals	Licensed individuals	State-specific licensed individuals	Quasi-national licensed individuals
Moved at all	0.150	0.152	0.128	0.126	0.132
Moved within MIGPUMA	0.098	0.100	0.078	0.078	0.078
Moved between MIGPUMA, within state	0.028	0.028	0.027	0.028	0.026
Moved between states	0.025	0.025	0.023	0.020	0.028
Moved 50+ miles, given moved at all	0.237	0.235	0.261	0.245	0.287
Moved between states, given moved 50+ miles	0.646	0.646	0.647	0.609	0.702
Living outside state of birth	0.472	0.472	0.467	0.443	0.510
Mean years of education	13.42	13.14	16.14	16.16	16.11
<i>Education</i>					
Less than high school	10.15	11.11	0.75	1.09	0.16
High school graduate	34.82	37.35	10.17	12.98	5.18
Some college	25.56	26.07	20.61	14.75	30.99
Bachelor's degree	19.12	17.87	31.31	30.99	31.86
More than Bachelor's degree	10.36	7.60	37.16	40.19	31.82
<i>Race</i>					
Non-Hispanic white	67.79	66.74	77.95	80.28	73.82
Non-Hispanic black	10.62	10.88	8.07	6.74	10.43
Hispanic white	8.98	9.39	5.04	5.54	4.17
Other	12.61	12.99	8.94	7.45	11.58
Male	48.31	50.10	30.97	37.35	19.67
Female	51.69	49.90	69.03	62.65	80.33
Mean age	41.13	41.13	43.05	42.82	43.46
Mean labor income (2015\$)	37,518	34,694	64,967	59,345	74,916
<i>Marital status</i>					
Married	57.78	56.66	68.74	69.34	67.67
Divorced	11.16	11.16	11.23	10.23	12.99
Widowed	1.71	1.74	1.42	1.24	1.76
Single	29.34	30.45	18.61	19.19	17.58
Percent U.S. citizen	91.45	90.89	96.94	97.34	96.22
<i>Number of children</i>					
0	56.28	57.06	48.73	49.73	46.96
1	18.08	17.84	20.36	19.87	21.22
2	16.32	15.86	20.76	20.70	20.88
3	6.58	6.47	7.67	7.38	8.18
4+	2.74	2.77	2.48	2.33	2.76
<i>Employment status</i>					
Employed	71.09	69.27	88.81	87.26	91.54
Unemployed	5.68	6.04	2.13	2.43	1.59
Not in labor force	23.23	24.69	9.06	10.31	6.86
Observations	15,269,276	13,719,882	1,549,394	992,757	556,637

Note: Sample includes all individuals aged 18-64 residing in the 50 US states and DC not residing in group quarters with nonimputed values for migration status, education, income, occupation, age, sex, race, citizenship status, marital status, and employment status, excluding those who lived outside the 50 US states and DC in the previous year. Sample also excludes individuals residing in the PUMAs of migration affected by hurricane Katrina in Louisiana and those residing in PUMA of migration 51000 in Virginia in the current or previous year. Move distance calculated as distance between centroids of current and previous PUMA of migration.



Table 3: Migration and occupational licensing, 2005-2015 ACS

	Moved between states	Moved at all miles	Moved 50+ miles   moved at all miles	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)
<i>A. All licensed occupations</i>				
Licensed	-0.007 (0.0004)	-0.012 (0.001)	-0.019 (0.002)	-0.057 (0.006)
Dep var mean	0.025	0.150	0.237	0.646
Percentage effect	-28.00	-8.00	-8.02	-8.82
R <sup>2</sup>	0.016	0.073	0.050	0.108
Observations	15,269,276	15,269,276	1,927,568	484,171
<i>B. State-specific licensed occupations</i>				
State-specific licensed	-0.011 (0.001)	-0.018 (0.001)	-0.041 (0.003)	-0.084 (0.010)
Dep var mean	0.024	0.151	0.235	0.644
Percentage effect	-45.83	-11.92	-17.45	-13.04
R <sup>2</sup>	0.016	0.072	0.050	0.108
Observations	14,712,639	14,712,639	1,863,329	465,079
<i>C. Quasi-national licensed occupations</i>				
Quasi-national licensed	0.001 (0.001)	-0.003 (0.001)	0.016 (0.004)	-0.021 (0.005)
Dep var mean	0.025	0.152	0.236	0.648
Percentage effect	4.00	-1.97	6.78	-3.24
R <sup>2</sup>	0.016	0.072	0.050	0.108
Observations	14,276,519	14,276,519	1,819,896	456,793
<i>D. State-specific vs. quasi-national licensed occupations</i>				
Licensed	-0.014 (0.001)	-0.021 (0.001)	-0.071 (0.004)	-0.075 (0.010)
Dep var mean	0.023	0.128	0.261	0.647
Percentage effect	-60.87	-16.41	-27.20	-11.59
R <sup>2</sup>	0.0245	0.0895	0.0671	0.137
Observations	1,549,394	1,549,394	171,911	46,470

Note: Sample described in notes to Table 2. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Panel B excludes members of quasi-national licensed occupations, and sample in Panel C excludes members of state-specific licensed occupations. Sample in Panel D includes only members of licensed occupations. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.

Table 4: Migration and occupational licensing, 2005-2015 ACS, individuals residing outside their state of birth in the previous year

	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)
<i>A. All licensed occupations</i>				
Licensed	-0.005 (0.001)	-0.010 (0.001)	-0.008 (0.003)	-0.037 (0.006)
Dep var mean	0.037	0.160	0.284	0.769
Percentage effect	-13.51	-6.25	-2.82	-4.81
R <sup>2</sup>	0.027	0.077	0.056	0.086
Observations	7,019,824	7,019,824	973,039	294,674
<i>B. State-specific licensed occupations</i>				
State-specific licensed	-0.011 (0.001)	-0.017 (0.001)	-0.035 (0.004)	-0.055 (0.009)
Dep var mean	0.037	0.161	0.282	0.768
Percentage effect	-29.73	-10.56	-12.41	-7.16
R <sup>2</sup>	0.027	0.077	0.056	0.086
Observations	6,739,677	6,739,677	937,918	281,976
<i>C. Quasi-national licensed occupations</i>				
Quasi-national licensed	0.003 (0.001)	-0.0002 (0.001)	0.029 (0.004)	-0.015 (0.004)
Dep var mean	0.038	0.161	0.284	0.771
Percentage effect	7.89	-0.12	10.21	-1.95
R <sup>2</sup>	0.027	0.076	0.057	0.086
Observations	6,584,398	6,584,398	921,002	278,594
<i>D. State-specific vs. quasi-national licensed occupations</i>				
Licensed	-0.017 (0.001)	-0.021 (0.001)	-0.078 (0.005)	-0.052 (0.009)
Dep var mean	0.036	0.138	0.321	0.771
Percentage effect	-47.22	-15.22	-24.30	-6.74
R <sup>2</sup>	0.040	0.093	0.073	0.118
Observations	715,573	715,573	87,158	28,778

Note: Sample described in notes to Table 2 and further limited to individuals residing outside their state of birth last year. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children.

Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Panel B excludes members of quasi-national licensed occupations, and sample in Panel C excludes members of state-specific licensed occupations. Sample in Panel D includes only members of licensed occupations. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.

Table 5: Sensitivity of moved between states, given moved 50 miles specification to control variable choice

	OLS					Matching
	(1)	(2)	(3)	(4)	(5)	(6)
<i>A. Full sample</i>						
Licensed	0.001 (0.008)	-0.054 (0.010)	-0.061 (0.010)	-0.061 (0.009)	-0.057 (0.006)	-0.057 (0.006)
Dep var mean	0.646	0.646	0.646	0.646	0.646	0.647
Percentage effect	0.15	-8.36	-9.44	-9.44	-8.82	-8.81
Education		X	X	X	X	X
Age, Sex			X	X	X	X
Other controls				X	X	X
State*year fixed effects					X	X
R <sup>2</sup>	0.000	0.014	0.024	0.032	0.108	0.117
Observations	484,171	484,171	484,171	484,171	484,171	465,941
<i>B. Those living outside their state of birth</i> □						
Licensed	0.001 (0.006)	-0.030 (0.007)	-0.033 (0.007)	-0.038 (0.006)	-0.037 (0.006)	-0.035 (0.006)
Dep var mean	0.769	0.769	0.769	0.769	0.769	0.772
Percentage effect	0.12	-3.90	-4.29	-4.94	-4.81	-4.53
Education		X	X	X	X	X
Age, Sex			X	X	X	X
Other controls				X	X	X
State*year fixed effects					X	X
R <sup>2</sup>	0.000	0.007	0.009	0.019	0.086	0.093
Observations	294,674	294,674	294,674	294,674	294,674	281,924

Note: Sample described in notes to Table 2 and is limited to individuals who moved at least 50 miles or more. Sample in panel (B) further limited to individuals residing outside their state of birth last year. Controls for education are dummies for high school completion, some college, 4 years of college, and more than 4 years of college, with less than high school the excluded group. Controls for age are dummies for 5 year age group (20-24, 25-29,...,60-64) with age 18-19 the excluded group. Other controls include income (quartile dummies), race (dummies for non-Hispanic white, non-Hispanic black, Hispanic white, and other), marital status (dummies for married, divorced, widowed, single), employment status (dummies for employed, unemployed, not in labor force), citizenship status, and number of children (dummies for 0, 1, 2, 3, 4+). State\*year fixed effects based on last year's state of residence. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Percentage effects calculated as coefficient/dependent variable mean\*100. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.

Table 6: Migration rates and fraction continuing occupation members by migration status, 2005-2015 CPS ASEC

	Full sample	Unlicensed individuals	Licensed individuals	State-specific licensed individuals	Quasi-national licensed individuals
Moved at all	0.122	0.124	0.102	0.101	0.103
Moved within county	0.085	0.087	0.066	0.067	0.065
Moved between county, within state	0.021	0.021	0.021	0.022	0.020
Moved between states	0.016	0.016	0.014	0.012	0.018
<i>Fraction continuing members of occupation</i>					
Non-movers	0.895	0.889	0.952	0.947	0.960
Movers within county	0.841	0.835	0.914	0.908	0.924
Movers between county, within state	0.777	0.767	0.872	0.857	0.900
Movers between states	0.685	0.667	0.853	0.828	0.881
Observations	1,135,152	1,042,924	92,228	57,633	34,595

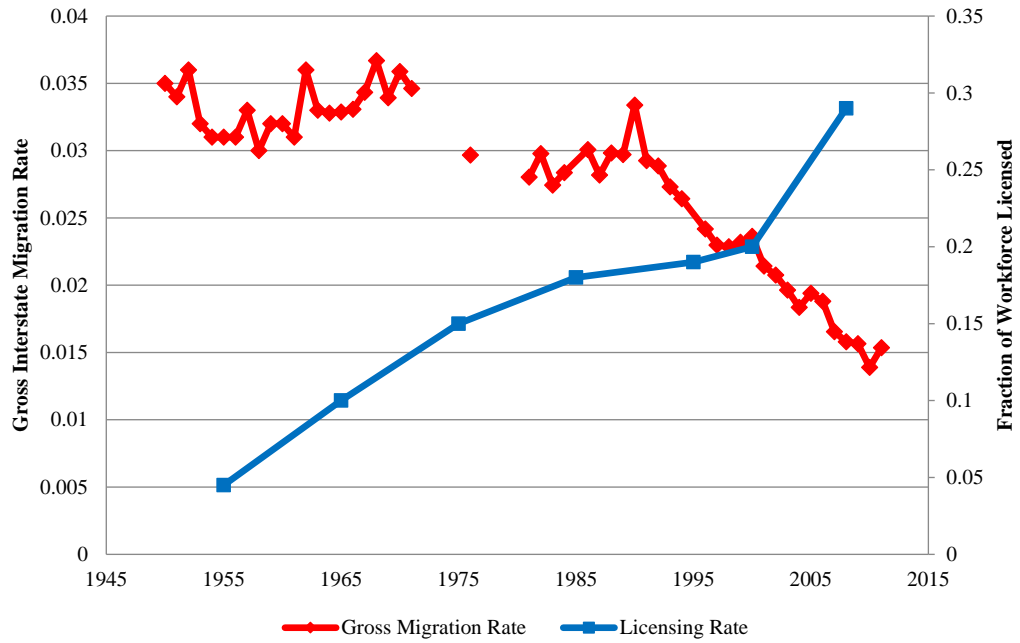
Note: Sample includes all individuals aged 18-64 residing in the 50 US states and DC not residing in group quarters with nonimputed values for migration status, education, occupation, age, sex, race, marital status, and employment status, excluding those who lived outside the 50 US states and DC in the previous year and non-civilians (i.e., those outside of the universe of the CPS labor force status question). Continuing members of occupation defined as individuals reporting same CPS occupation code for last year's and current occupation. Sample excludes individuals out of the labor force in current year. Licensing categories based on the same occupations listed in Table 1. Unweighted observation counts and weighted percentages reported, calculated using sample weights.

Table 7: Migration and occupational licensing, 2005-2015 CPS ASEC

	All individuals				Continuing members of occupation			
	Moved between states	Moved at all	Moved between counties   moved at all	Moved between states   moved between counties	Moved between states	Moved at all	Moved between counties   moved at all	Moved between states   moved between counties
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>A. All licensed occupations</i>								
Licensed	-0.005 (0.001)	-0.012 (0.002)	-0.012 (0.006)	-0.070 (0.012)	-0.002 (0.001)	-0.008 (0.002)	0.005 (0.008)	-0.043 (0.014)
Dep var mean	0.016	0.122	0.305	0.428	0.012	0.112	0.277	0.398
Percentage effect	-31.45	-9.84	-3.93	-16.36	-16.26	-7.14	1.81	-10.55
R <sup>2</sup>	0.013	0.062	0.063	0.103	0.011	0.059	0.063	0.117
Observations	1,135,152	1,135,152	118,464	37,049	996,142	996,142	94,567	26,771
<i>B. State-specific licensed occupations</i>								
State-specific licensed	-0.008 (0.001)	-0.016 (0.002)	-0.027 (0.006)	-0.112 (0.018)	-0.005 (0.001)	-0.012 (0.003)	-0.011 (0.008)	-0.088 (0.019)
Dep var mean	0.016	0.123	0.303	0.426	0.012	0.112	0.274	0.395
Percentage effect	-50.00	-13.01	-8.78	-26.29	-40.98	-10.71	-4.01	-20.25
R <sup>2</sup>	0.013	0.062	0.063	0.104	0.011	0.058	0.062	0.119
Observations	1,100,557	1,100,557	115,415	35,900	963,571	963,571	91,850	25,790
<i>C. Quasi-national licensed occupations</i>								
Quasi-national licensed	-0.0004 (0.001)	-0.007 (0.003)	0.011 (0.011)	-0.009 (0.017)	0.002 (0.001)	-0.003 (0.003)	0.032 (0.012)	0.023 (0.019)
Dep var mean	0.016	0.123	0.303	0.431	0.013	0.113	0.275	0.401
Percentage effect	-2.48	-5.69	3.63	-2.09	16.00	-2.65	11.64	5.74
R <sup>2</sup>	0.013	0.062	0.064	0.105	0.011	0.058	0.064	0.120
Observations	1,077,519	1,077,519	113,568	35,354	942,335	942,335	90,288	25,381
<i>D. State-specific vs. quasi-national licensed occupations</i>								
Licensed	-0.010 (0.002)	-0.015 (0.004)	-0.055 (0.015)	-0.120 (0.030)	-0.009 (0.001)	-0.014 (0.004)	-0.063 (0.014)	-0.127 (0.031)
Dep var mean	0.014	0.101	0.350	0.405	0.013	0.096	0.337	0.400
Percentage effect	-71.43	-14.85	-14.29	-29.63	-69.23	-14.55	-18.69	-31.75
R <sup>2</sup>	0.033	0.088	0.145	0.306	0.035	0.087	0.155	0.340
Observations	92,228	92,228	7,945	2,844	87,524	87,524	7,114	2,435

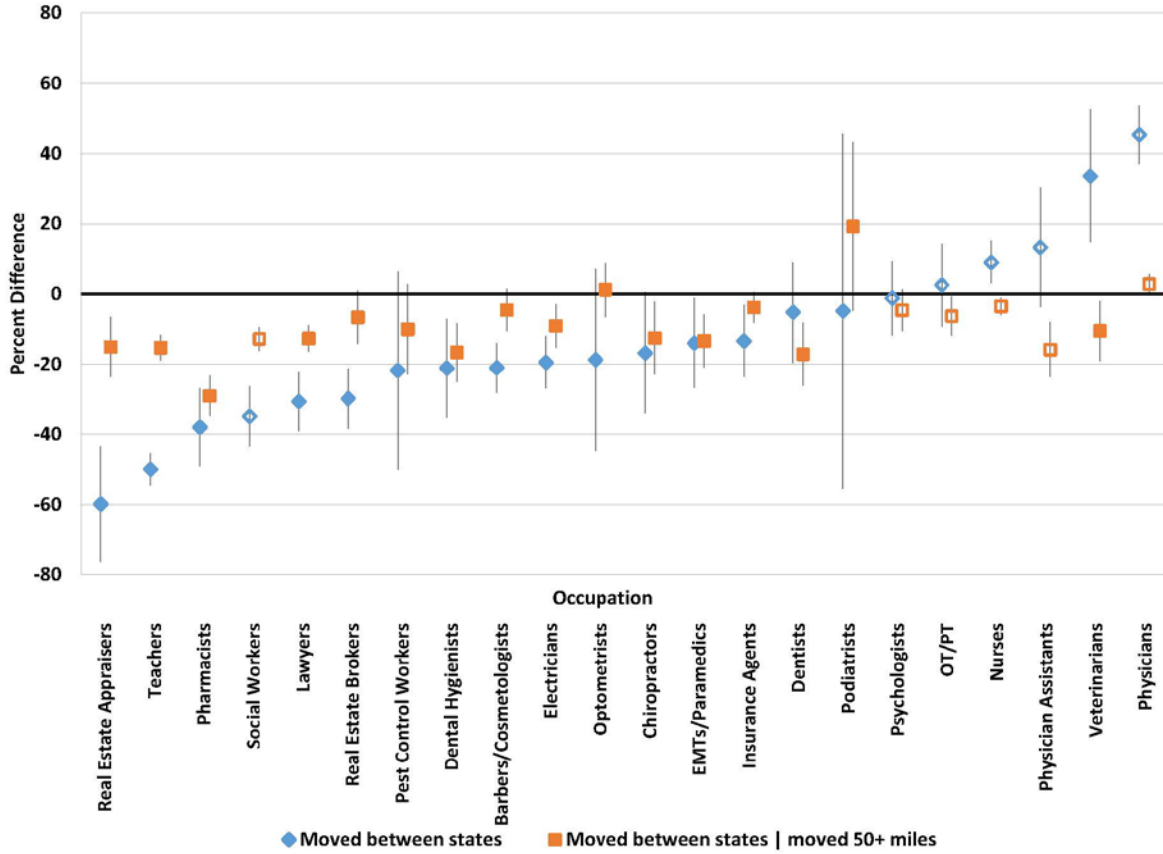
Note: Sample described in notes to Table 6. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in panel (B) excludes members of quasi-national licensed occupations, and sample in panel (C) excludes members of state-specific licensed occupations. Sample in panel (D) includes only members of licensed occupations. Column (9) reports p-value of test of equality of estimates reported in columns (4) and (8), calculated using logistic regressions. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.

Figure 1: Interstate Migration Rates and Occupational Licensure, 1950-2008



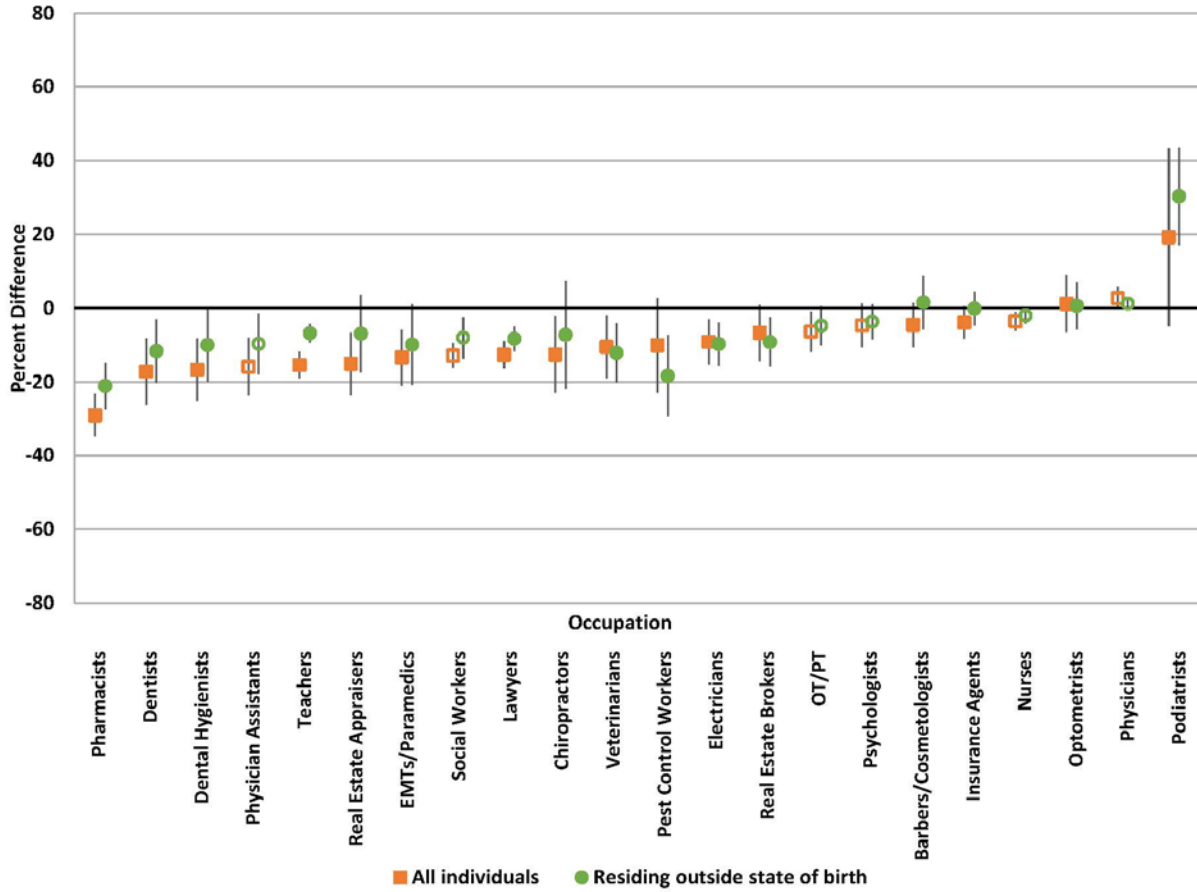
Notes: Gross interstate migration rates from Kaplan and Schulhofer-Wohl (2012). Occupational licensure rates from Kleiner and Krueger (2013).

Figure 2: Occupation-specific results, Pr(moved between states) and Pr(moved between states | moved 50+ miles), 2005-2015 ACS



Note: Sample described in notes to Table 2. Sample for “moved between states” includes all individuals; sample for “Moved between states | moved 50+ miles” includes only individuals who moved 50 or miles in last year. Point estimates of percentage differences (coefficient/dependent variable mean\*100) and 95 percent confidence intervals shown. Sample in each specification excludes all members of other licensed occupations. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Estimated using matching estimator formed using cells based on all control variables and estimated using ATET weights. Solid markers indicate state-specific licensed occupation; hollow markers indicate quasi-national licensed occupation. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence. Full results shown in Appendix Tables A7 and A8.

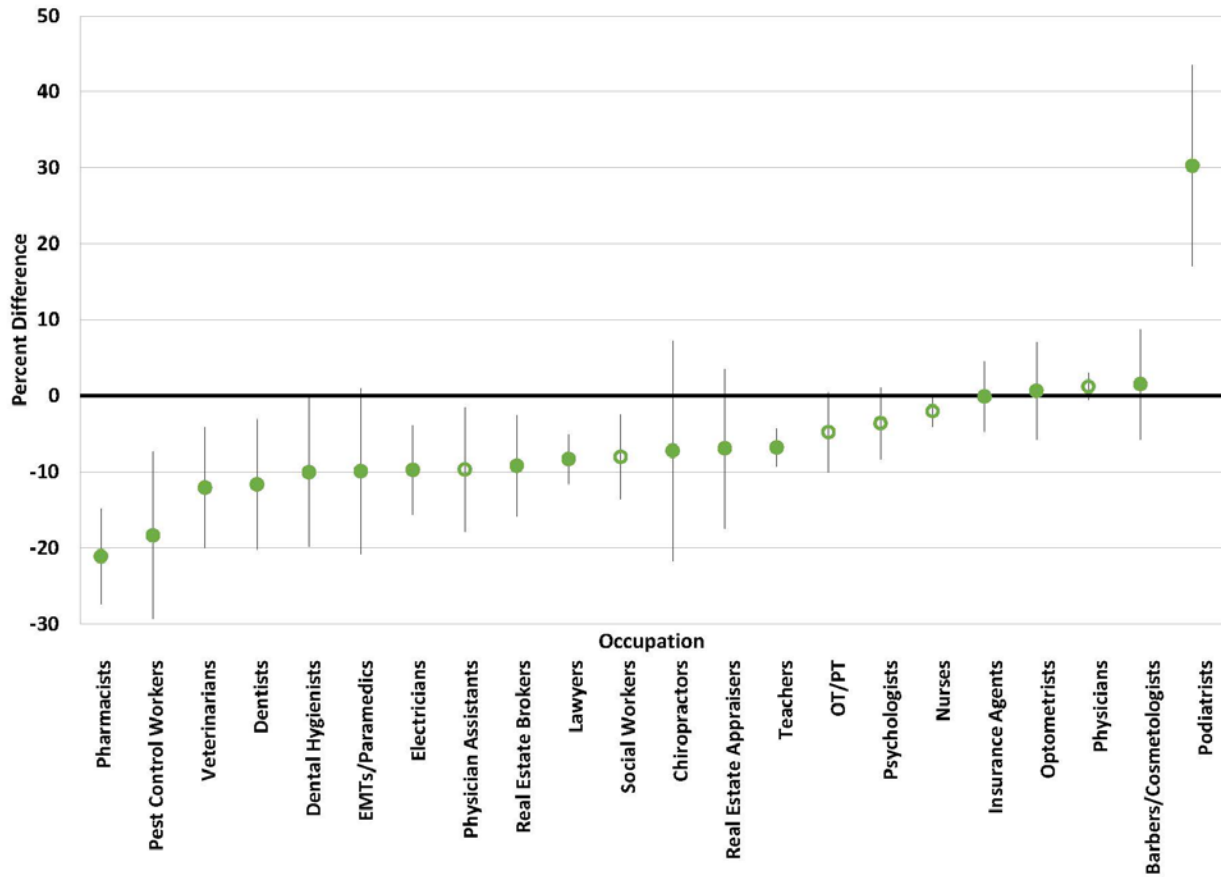
Figure 3: Occupation-specific results, Pr(moved between states | moved 50+ miles) for all individuals and those residing outside their state of birth last year, 2005-2015 ACS



Note: Sample described in notes to Table 2 and limited to those who moved 50 or more miles in the last year. Sample for “All individuals” includes all individuals; sample for “Residing outside state of birth” includes only individuals who were living outside their state of birth in the previous year. Point estimates of percentage differences (coefficient/dependent variable mean\*100) and 95 percent confidence intervals shown. Sample in each specification excludes all members of other licensed occupations. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Estimated using matching estimator formed using cells based on all control variables and estimated using ATET weights. Solid markers indicate state-specific licensed occupation; hollow markers indicate quasi-national licensed occupation. Estimated using sample weights. Standard errors clustered on last year's state of residence. Full results shown in Appendix Tables A7 and A8.



Figure 4: Occupation-specific results, Pr(moved between states | moved 50+ miles) for those residing outside their state of birth last year, 2005-2015 ACS



Note: Sample described in notes to Table 2 and limited to those who moved 50 or more miles in the last year and resided outside their state of birth last year. Point estimates of percentage differences (coefficient/dependent variable mean\*100) and 95 percent confidence intervals shown. Sample in each specification excludes all members of other licensed occupations. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Estimated using matching estimator formed using cells based on all control variables and estimated using ATET weights. Solid markers indicate state-specific licensed occupation; hollow markers indicate quasi-national licensed occupation. Estimated using sample weights. Standard errors clustered on last year's state of residence. Full results shown in Appendix Tables A7 and A8.

## Appendix A: Supplementary Tables

Appendix Table A1: Exams required for licensure

Occupation	Exam	Source
<i>"State-specific" licensed occupations</i>		
Elementary/secondary teachers	Number and content of exams vary by state	www.teach.org
Lawyers	State Bar Exam	National Conference of Bar Examiners
Barbers/cosmetologists	State cosmetology/barber licensing exam	www.cosmetology-license.com
Real estate brokers/agents	State real estate licensing exam	National Association of Realtors
Electricians	Exam and apprenticeship requirements vary by state	National Electrical Contractors Association
Insurance agents	State insurance licensing exam, often specific to insurance type	National Insurance Producer Registry
Pharmacists	North American Pharmacist Licensure Examination and state-specific Multistate Pharmacy Jurisprudence Exam	National Association of Boards of Pharmacy
EMTs/paramedics	National Registry Emergency Medical Technician or Paramedic cognitive exam and state-specific psychomotor exam	National Registry of Emergency Medical Technicians
Dental hygienists	National Board Dental Hygiene Examination, plus regional or state clinical exam and state jurisprudence exam	American Dental Hygienists' Association
Dentists	National Board Dental Examinations, Parts I and II, plus regional or state clinical exam and state jurisprudence exam	American Dental Association
Real estate appraisers	State real property appraiser exam	Appraisal Institute
Veterinarians	North American Veterinary Licensing Examination plus state-specific jurisprudence and clinical exams	International Council for Veterinary Assessment; American Association of Veterinary State Boards
Pest control workers	State pesticide applicator licensing exam	U.S. Environmental Protection Agency
Chiropractors	National Board of Chiropractic Examiners exam plus state licensing exam	American Chiropractic Association
Optometrists	National Board of Examiners in Optometry exams, Parts I, II, plus either Part III and/or state law/jurisprudence exam	National Board of Examiners in Optometry
Podiatrists	American Podiatric Medical Licensing Examination, Parts I, II, plus either Part III and/or state law/jurisprudence exam	Federation of Podiatric Medical Boards
<i>"Quasi-national" licensed occupations</i>		
Nurses	NCLEX-RN (registered nurses) or NCLEX-PN (practical nurses)	National Council of State Boards of Nursing
Physicians	US Medical Licensing Exam, Steps 1, 2, and 3	Federation of State Medical Boards
Social workers	Association of Social Work Boards exam, varies by level (Bachelors, Masters, Advanced Generalist, Clinical)	Association of Social Work Boards
Occupational and physical therapists	OT: NBCOT exam; PT: NPTE	National Board for Certification in Occupational Therapy; Federation of State Boards of Physical Therapy
Psychologists	Examination for Professional Practice in Psychology	Association of State and Provincial Psychology Boards
Physician assistants	Physician Assistant National Certifying Examination	National Commission on Certification of Physician Assistants

## Appendix Table A2: Descriptive statistics by occupation, 2005-2015 ACS

### A. State-specific licensed occupations

	All state-specific licensed individuals	Teachers	Lawyers	Barbers/cosmetologists	Real estate brokers/agents	Electricians	Insurance Agents	Pharmacists	EMTs/paramedics	Dental hygienists	Dentists	Real estate appraisers	Veterinarians	Pest control workers	Chiropractors	Optometrists	Podiatrists
Moved at all	0.126	0.116	0.127	0.154	0.130	0.139	0.133	0.128	0.199	0.109	0.104	0.107	0.145	0.163	0.139	0.098	0.105
Moved within MIGPUMA	0.078	0.069	0.072	0.109	0.089	0.092	0.084	0.065	0.128	0.066	0.050	0.074	0.058	0.112	0.075	0.054	0.054
Moved between MIGPUMA, within state	0.028	0.027	0.027	0.029	0.024	0.028	0.028	0.037	0.045	0.027	0.025	0.021	0.034	0.033	0.030	0.018	0.023
Moved between states	0.020	0.019	0.028	0.017	0.018	0.018	0.021	0.026	0.026	0.017	0.029	0.012	0.052	0.018	0.033	0.025	0.027
Moved 50+ miles, given moved at all	0.245	0.261	0.280	0.160	0.201	0.208	0.225	0.344	0.222	0.258	0.389	0.182	0.481	0.164	0.333	0.342	0.350
Moved between states, given moved 50+ miles	0.609	0.591	0.678	0.607	0.624	0.581	0.648	0.552	0.562	0.575	0.675	0.588	0.715	0.588	0.688	0.759	0.706
Living outside state of birth	0.443	0.419	0.543	0.407	0.539	0.380	0.433	0.519	0.350	0.396	0.581	0.406	0.604	0.416	0.558	0.554	0.582
<i>Race</i>																	
Non-Hispanic white	80.28	81.68	85.22	68.31	79.95	77.20	79.43	73.37	82.56	87.46	75.32	87.68	92.12	72.68	89.18	80.15	83.22
Non-Hispanic black	6.74	7.32	4.48	11.95	5.12	5.70	6.88	5.26	4.92	2.33	2.92	3.47	1.20	8.49	1.58	1.82	4.82
Hispanic white	5.54	5.17	3.62	7.99	6.32	8.66	6.42	2.57	5.97	3.73	4.79	3.38	2.39	9.77	2.13	2.22	2.08
Other	7.45	5.84	6.68	11.75	8.60	8.43	7.27	18.80	6.55	6.48	16.97	5.47	4.30	9.07	7.12	15.80	9.88
Male	37.35	22.20	61.88	13.07	41.86	97.75	51.10	43.34	67.98	2.45	72.25	63.37	43.71	94.93	72.30	58.72	74.45
Female	62.65	77.80	38.12	86.93	58.14	2.25	48.90	56.66	32.02	97.55	27.75	36.63	56.29	5.07	27.70	41.28	25.55
Mean years of education	16.16	16.84	19.85	12.47	14.46	12.60	14.37	18.29	13.47	14.74	20.10	14.59	20.14	12.56	20.06	20.19	20.16
Mean age	42.82	42.95	44.48	39.78	45.84	40.98	43.56	41.32	35.23	41.52	46.50	46.21	43.41	40.69	43.52	44.17	45.85
Mean labor income (2015\$)	59,345	42,704	147,683	21,986	63,360	45,808	70,741	98,322	39,471	43,822	186,309	58,440	99,515	34,008	88,553	113,164	145,741
Fraction U.S. citizen	0.973	0.983	0.986	0.936	0.966	0.939	0.976	0.965	0.989	0.984	0.954	0.989	0.971	0.960	0.966	0.987	0.997
<i>Education</i>																	
Less than high school	1.09	0.05	0.01	5.15	0.86	6.28	0.74	0.00	0.53	0.18	0.00	0.46	0.00	7.49	0.10	0.00	0.00
High school graduate	12.98	1.35	0.48	57.72	21.51	49.86	22.89	0.34	24.28	2.74	0.09	19.33	0.12	53.55	0.95	0.33	0.00
Some college	14.75	5.23	0.83	32.19	31.79	37.42	30.56	3.55	59.40	61.59	0.17	30.54	0.14	29.56	1.26	0.12	0.10
Bachelor's degree	30.99	45.36	1.99	3.92	36.12	5.57	39.00	39.33	13.71	31.35	0.17	40.67	0.20	8.36	1.81	0.27	0.30
More than Bachelor's degree	40.19	48.00	96.69	1.01	9.72	0.87	6.82	56.78	2.07	4.13	99.57	9.00	99.54	1.03	95.88	99.27	99.61
<i>Marital status</i>																	
Married	69.34	71.28	72.10	57.73	68.16	64.45	69.00	70.89	54.91	74.95	82.72	70.77	73.51	62.86	75.29	80.73	79.62
Divorced	10.23	9.22	8.19	14.09	14.26	11.66	12.42	6.41	11.58	11.12	6.80	12.51	7.67	12.38	9.89	6.11	8.07
Widowed	1.24	1.40	0.69	1.65	1.56	0.73	1.19	0.82	0.61	1.14	0.56	1.15	0.67	0.64	0.69	0.54	0.22
Single	19.19	18.09	19.02	26.53	16.01	23.16	17.39	21.88	32.90	12.79	9.92	15.57	18.15	24.11	14.13	12.62	12.09
<i>Number of children</i>																	
0	49.73	48.22	50.97	49.54	54.49	53.23	50.60	51.51	55.94	41.92	43.38	54.02	55.06	54.81	43.39	45.36	43.75
1	19.87	20.44	18.39	21.77	18.53	18.38	20.37	17.67	17.70	23.22	19.49	18.69	17.09	17.55	18.27	18.30	18.54
2	20.70	21.58	20.92	19.14	18.54	18.23	19.69	21.16	16.89	24.94	24.15	19.37	18.58	18.15	23.90	24.46	23.44
3	7.38	7.52	7.51	7.10	6.28	7.44	7.08	7.49	6.77	8.05	9.07	6.03	7.30	6.58	10.41	8.63	9.85
4+	2.33	2.24	2.21	2.44	2.16	2.72	2.27	2.17	2.69	1.87	3.90	1.89	1.98	2.92	4.04	3.25	4.43
<i>Employment status</i>																	
Employed	87.26	85.28	93.68	86.80	85.16	85.16	89.58	93.73	90.19	91.14	95.81	91.59	96.20	87.57	95.15	97.34	95.82
Unemployed	2.43	1.77	1.63	2.88	3.19	7.47	3.25	0.93	2.52	1.62	0.48	2.13	0.45	5.30	1.19	0.28	0.75
Not in labor force	10.31	12.95	4.69	10.32	11.65	7.37	7.17	5.34	7.29	7.25	3.71	6.28	3.36	7.13	3.66	2.37	3.43
Observations	992,757	526,991	100,238	71,358	70,189	69,104	48,905	25,569	16,572	15,861	14,983	9,875	7,837	5,751	5,094	3,533	897

Appendix Table A2, continued: Descriptive statistics by occupation, 2005-2015 ACS

B. Quasi-national licensed occupations							
	All quasi-national licensed individuals	Nurses (RN/LPN)	Physicians	Social workers	Occupational and physical therapists	Psychologists	Physician assistants
Moved at all	0.132	0.125	0.143	0.148	0.139	0.123	0.174
Moved within MIGPUMA	0.078	0.078	0.061	0.096	0.074	0.064	0.093
Moved between MIGPUMA, within state	0.026	0.025	0.025	0.030	0.029	0.028	0.040
Moved between states	0.028	0.023	0.057	0.021	0.035	0.031	0.041
Moved 50+ miles, given moved at all	0.287	0.254	0.463	0.212	0.337	0.317	0.336
Moved between states, given moved 50+ miles	0.702	0.665	0.828	0.616	0.703	0.728	0.640
Living outside state of birth	0.510	0.469	0.745	0.433	0.526	0.604	0.529
<i>Race</i>							
Non-Hispanic white	73.82	75.54	68.79	64.72	82.78	85.43	77.44
Non-Hispanic black	10.43	10.67	4.63	19.49	3.50	4.54	6.34
Hispanic white	4.17	3.60	4.48	6.62	2.81	4.21	6.10
Other	11.58	10.18	22.11	9.18	10.92	5.82	10.11
Male	19.67	9.00	63.88	18.85	22.54	29.37	31.39
Female	80.33	91.00	36.12	81.15	77.46	70.63	68.61
Mean years of education	16.11	14.97	20.07	16.04	17.25	19.35	16.63
Mean age	43.46	43.78	44.45	42.09	40.24	46.52	39.33
Mean labor income (2015\$)	74,916	53,214	216,136	39,859	61,068	67,159	70,504
Fraction U.S. citizen	0.962	0.966	0.924	0.981	0.956	0.982	0.973
<i>Education</i>							
Less than high school	0.16	0.13	0.00	0.52	0.06	0.00	0.26
High school graduate	5.18	6.32	0.04	7.77	0.97	0.01	6.21
Some college	30.99	45.63	0.16	13.63	7.67	0.31	17.30
Bachelor's degree	31.86	37.20	0.13	43.15	40.60	3.80	24.95
More than Bachelor's degree	31.82	10.72	99.66	34.92	50.70	95.89	51.28
<i>Marital status</i>							
Married	67.67	67.20	78.80	57.16	72.26	68.17	66.23
Divorced	12.99	14.76	5.97	14.56	7.76	12.43	9.67
Widowed	1.76	2.18	0.57	1.69	0.69	1.26	0.86
Single	17.58	15.87	14.66	26.60	19.29	18.15	23.24
<i>Number of children</i>							
0	46.96	45.95	44.30	52.41	44.62	56.21	50.81
1	21.22	22.13	18.45	21.65	18.63	19.35	18.48
2	20.88	20.74	23.74	17.86	24.68	18.08	20.92
3	8.18	8.33	9.94	6.04	9.39	5.28	7.38
4+	2.76	2.84	3.56	2.04	2.68	1.08	2.41
<i>Employment status</i>							
Employed	91.54	90.78	96.78	88.62	93.73	92.76	91.89
Unemployed	1.59	1.62	0.57	2.92	0.65	1.08	1.74
Not in labor force	6.86	7.59	2.65	8.46	5.62	6.16	6.37
Observations	556,637	348,018	76,626	75,394	29,505	17,861	9,233

Note: Sample includes all individuals aged 18-64 residing in the 50 US states and DC not residing in group quarters with nonimputed values for migration status, education, income, occupation, age, sex, race, citizenship status, marital status, and employment status, excluding those who lived outside the 50 US states and DC in the previous year. Sample also excludes individuals residing in the PUMAs of migration affected by hurricane Katrina in Louisiana and those residing in PUMA of migration 51000 in Virginia in the current or previous year. Move distance calculated as distance between centroids of current and previous PUMA of migration.

Appendix Table A3: Migration and occupational licensing, 2005-2015 ACS, cell-matching estimator

	Moved between states	Moved at all miles   Moved at all miles	Moved 50+ miles   moved at all miles	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)
<i>A. All licensed occupations</i>				
Licensed	-0.005 (0.0003)	-0.007 (0.001)	-0.017 (0.003)	-0.057 (0.006)
Dep var mean	0.026	0.132	0.269	0.680
Percentage effect	-19.23	-5.30	-6.32	-8.38
R <sup>2</sup>	0.023	0.090	0.057	0.117
Observations	14,698,321	14,698,321	1,834,071	465,941
<i>B. State-specific licensed occupations</i>				
State-specific licensed	-0.010 (0.0004)	-0.013 (0.001)	-0.041 (0.003)	-0.085 (0.009)
Dep var mean	0.025	0.132	0.267	0.665
Percentage effect	-40.00	-9.85	-15.36	-12.78
R <sup>2</sup>	0.023	0.092	0.061	0.125
Observations	14,034,836	14,034,836	1,753,630	443,397
<i>C. Quasi-national licensed occupations</i>				
Quasi-national licensed	0.003 (0.001)	0.005 (0.001)	0.023 (0.004)	-0.020 (0.005)
Dep var mean	0.027	0.131	0.274	0.706
Percentage effect	11.11	3.82	8.39	-2.83
R <sup>2</sup>	0.027	0.088	0.063	0.117
Observations	12,300,649	12,300,649	1,519,164	396,469
<i>D. State-specific vs. quasi-national licensed occupations</i>				
Licensed	-0.013 (0.001)	-0.018 (0.001)	-0.062 (0.005)	-0.071 (0.011)
Dep var mean	0.026	0.132	0.281	0.665
Percentage effect	-50.00	-13.64	-22.06	-10.68
R <sup>2</sup>	0.029	0.093	0.078	0.145
Observations	1,505,838	1,505,838	165,385	44,790

Note: Sample described in notes to Table 2. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Panel B excludes members of quasi-national licensed occupations, and sample in Panel C excludes members of state-specific licensed occupations. Sample in Panel D includes only members of licensed occupations. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Estimated using sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A4: Migration and occupational licensing, 2005-2015 ACS, individuals residing outside their state of birth in the previous year, cell-matching estimator

	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)
<i>A. All licensed occupations</i>				
Licensed	-0.003 (0.001)	-0.004 (0.001)	-0.008 (0.003)	-0.035 (0.006)
Dep var mean	0.039	0.141	0.327	0.791
Percentage effect	-7.69	-2.84	-2.45	-4.42
R <sup>2</sup>	0.036	0.094	0.058	0.093
Observations	6,644,048	6,644,048	914,461	281,924
<i>B. State-specific licensed occupations</i>				
State-specific licensed	-0.009 (0.001)	-0.011 (0.001)	-0.036 (0.003)	-0.055 (0.008)
Dep var mean	0.039	0.142	0.324	0.784
Percentage effect	-23.38	-7.75	-11.11	-7.02
R <sup>2</sup>	0.037	0.096	0.065	0.097
Observations	6,303,400	6,303,400	870,010	266,857
<i>C. Quasi-national licensed occupations</i>				
Quasi-national licensed	0.005 (0.001)	0.007 (0.001)	0.034 (0.005)	-0.012 (0.005)
Dep var mean	0.040	0.139	0.332	0.802
Percentage effect	12.66	5.04	10.24	-1.50
R <sup>2</sup>	0.038	0.091	0.063	0.107
Observations	5,420,407	5,420,407	744,526	239,000
<i>D. State-specific vs. quasi-national licensed occupations</i>				
Licensed	-0.016 (0.002)	-0.017 (0.002)	-0.069 (0.008)	-0.054 (0.008)
Dep var mean	0.041	0.141	0.347	0.791
Percentage effect	-46.34	-12.06	-19.88	-6.83
R <sup>2</sup>	0.048	0.101	0.086	0.132
Observations	689,688	689,688	83,144	27,620

Note: Sample described in notes to Table 2 and further limited to individuals residing outside their state of birth last year. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Panel B excludes members of quasi-national licensed occupations, and sample in Panel C excludes members of state-specific licensed occupations. Sample in Panel D includes only members of licensed occupations. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Estimated using sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A5: Probability moved interstate given 100-mile move, 2005-2015 ACS, individuals residing outside their state of birth

	All licensed	State-specific	Quasi-national	State-specific vs. quasi-national
	(1)	(2)	(3)	(4)
Licensed occupation group	-0.029 (0.006)	-0.043 (0.009)	-0.013 (0.004)	-0.038 (0.009)
Dep var mean	0.853	0.852	0.854	0.852
Percentage effect	-3.40	-5.05	-1.52	-4.46
R <sup>2</sup>	0.089	0.090	0.090	0.119
Observations	253,432	242,370	239,734	24,760

Note: Sample described in notes to Table 2 and further limited to individuals residing outside their state of birth last year and who moved at least 100 miles since the previous year. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Column 2 excludes members of quasi-national licensed occupations, and sample in Column 3 excludes members of state-specific licensed occupations. Sample in Column 4 includes only members of licensed occupations. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A6: Migration and occupational licensing, individuals residing outside their state of birth, 2005-2011 vs. 2012-2015 ACS

	2005-2011				2012-2015			
	Moved between states	Moved at all	Moved 50+ miles at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>A. All licensed occupations</i>								
Licensed	-0.005 (0.001)	-0.010 (0.001)	-0.008 (0.003)	-0.037 (0.007)	-0.005 (0.001)	-0.011 (0.001)	-0.008 (0.004)	-0.037 (0.007)
Dep var mean	0.038	0.164	0.282	0.768	0.037	0.154	0.290	0.772
Percentage effect	-13.30	-6.10	-2.84	-4.82	-13.66	-7.14	-2.76	-4.79
R squared	0.027	0.080	0.057	0.085	0.026	0.071	0.054	0.088
Observations	4,580,086	4,580,086	640,815	193,622	2,439,738	2,439,738	332,224	101,052
<i>B. State-specific licensed occupations</i>								
State-specific licensed	-0.011 (0.001)	-0.017 (0.001)	-0.036 (0.004)	-0.055 (0.010)	-0.011 (0.001)	-0.018 (0.002)	-0.032 (0.005)	-0.056 (0.009)
Dep var mean	0.038	0.164	0.279	0.767	0.036	0.154	0.287	0.770
Percentage effect	-29.33	-10.37	-12.90	-7.17	-30.22	-11.69	-11.15	-7.27
R squared	0.027	0.080	0.057	0.085	0.026	0.071	0.054	0.088
Observations	4,402,056	4,402,056	618,775	185,561	2,337,621	2,337,621	319,143	96,415
<i>C. Quasi-national licensed occupations</i>								
Quasi-national licensed	0.003 (0.001)	0.0004 (0.001)	0.034 (0.006)	-0.014 (0.005)	0.002 (0.001)	-0.001 (0.002)	0.022 (0.006)	-0.017 (0.008)
Dep var mean	0.038	0.165	0.281	0.769	0.037	0.155	0.289	0.773
Percentage effect	7.92	0.24	12.10	-1.82	5.43	-0.65	7.61	-2.20
R squared	0.027	0.080	0.058	0.085	0.026	0.071	0.055	0.089
Observations	4,292,426	4,292,426	606,586	183,034	2,291,972	2,291,972	314,416	95,560
<i>D. State-specific vs. quasi-national licensed occupations</i>								
State-specific licensed	-0.017 (0.001)	-0.021 (0.001)	-0.082 (0.006)	-0.050 (0.010)	-0.017 (0.001)	-0.021 (0.002)	-0.069 (0.007)	-0.056 (0.011)
Dep var mean	0.036	0.137	0.322	0.768	0.037	0.138	0.321	0.775
Percentage effect	-46.96	-15.33	-25.47	-6.51	-46.20	-15.22	-21.50	-7.74
R squared	0.039	0.096	0.075	0.118	0.041	0.089	0.074	0.121
Observations	465,690	465,690	56,269	18,649	249,883	249,883	30,889	10,129

Note: Sample described in notes to Table 2 and further limited to individuals residing outside their state of birth last year. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Sample in Panel B excludes members of quasi-national licensed occupations, and sample in Panel C excludes members of state-specific licensed occupations. Sample in Panel D includes only members of licensed occupations. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.



Appendix Table A7: Occupation-specific results, state-specific licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>A. Teachers</i>								
Teacher	-0.013 (0.001)	-0.022 (0.001)	-0.055 (0.005)	-0.102 (0.012)	-0.013 (0.001)	-0.020 (0.001)	-0.051 (0.004)	-0.054 (0.010)
Dep var mean	0.026	0.127	0.288	0.663	0.039	0.136	0.343	0.791
Percentage effect	-50.00	-17.32	-19.10	-15.38	-33.33	-14.71	-14.87	-6.83
R squared	0.028	0.103	0.071	0.138	0.043	0.108	0.077	0.100
Observations	11,180,190	11,180,190	1,355,092	362,336	4,885,314	4,885,314	662,029	216,165
<i>B. Lawyers</i>								
Lawyer	-0.010 (0.001)	-0.003 (0.002)	-0.070 (0.007)	-0.093 (0.013)	-0.010 (0.002)	-0.003 (0.003)	-0.062 (0.009)	-0.068 (0.013)
Dep var mean	0.033	0.128	0.315	0.734	0.045	0.140	0.359	0.815
Percentage effect	-30.67	-2.34	-21.90	-12.67	-22.17	-2.14	-17.27	-8.34
R squared	0.037	0.101	0.070	0.169	0.051	0.107	0.080	0.154
Observations	6,352,722	6,352,722	652,449	190,216	2,912,489	2,912,489	345,598	119,701
<i>C. Barbers/cosmetologists</i>								
Barber/cosmetologist	-0.004 (0.001)	-0.010 (0.002)	-0.030 (0.004)	-0.028 (0.019)	-0.006 (0.001)	-0.016 (0.004)	-0.034 (0.006)	0.0116 (0.028)
Dep var mean	0.019	0.160	0.175	0.620	0.031	0.164	0.229	0.763
Percentage effect	-21.05	-6.25	-17.14	-4.52	-19.42	-9.76	-14.85	1.52
R squared	0.017	0.077	0.062	0.169	0.032	0.079	0.088	0.172
Observations	10,212,110	10,212,110	1,259,337	302,186	4,275,973	4,275,973	583,847	173,781
<i>D. Real estate brokers/sales agents</i>								
Real estate broker/sales agent	-0.006 (0.001)	0.008 (0.002)	-0.0560 (0.006)	-0.044 (0.025)	-0.008 (0.001)	0.007 (0.003)	-0.066 (0.008)	-0.069 (0.025)
Dep var mean	0.020	0.125	0.230	0.658	0.029	0.134	0.271	0.751
Percentage effect	-29.85	6.40	-26.09	-6.69	-27.78	5.22	-24.35	-9.19
R squared	0.022	0.078	0.077	0.194	0.034	0.080	0.104	0.195
Observations	11,078,163	11,078,163	1,330,901	347,648	4,780,732	4,780,732	639,164	205,595

Appendix Table A7, continued: Occupation-specific results, state-specific licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>E. Electricians</i>								
Electrician	-0.004 (0.001)	-0.011 (0.002)	-0.011 (0.005)	-0.056 (0.019)	-0.004 (0.001)	-0.008 (0.003)	0.011 (0.008)	-0.072 (0.022)
Dep var mean	0.021	0.144	0.213	0.614	0.035	0.162	0.274	0.736
Percentage effect	-19.51	-7.64	-5.16	-9.12	-11.46	-4.94	4.01	-9.78
R squared	0.018	0.079	0.058	0.184	0.036	0.086	0.090	0.213
Observations	8,896,712	8,896,712	1,085,961	272,177	3,700,962	3,700,962	509,105	157,362
<i>F. Insurance agents</i>								
Insurance agent	-0.003 (0.001)	0.0004 (0.002)	-0.025 (0.010)	-0.026 (0.014)	0.001 (0.002)	0.002 (0.004)	-0.007 (0.018)	-0.001 (0.018)
Dep var mean	0.022	0.132	0.236	0.664	0.036	0.144	0.300	0.787
Percentage effect	-13.45	0.30	-10.59	-3.92	2.75	1.39	-2.33	-0.13
R squared	0.023	0.093	0.073	0.192	0.041	0.098	0.103	0.199
Observations	10,458,705	10,458,705	1,255,887	325,916	4,448,042	4,448,042	595,586	191,711
<i>G. Pharmacists</i>								
Pharmacist	-0.012 (0.002)	-0.017 (0.002)	0.005 (0.012)	-0.188 (0.019)	-0.013 (0.003)	-0.020 (0.003)	0.009 (0.016)	-0.159 (0.023)
Dep var mean	0.032	0.136	0.333	0.647	0.044	0.147	0.370	0.753
Percentage effect	-37.97	-12.50	1.50	-29.06	-29.75	-13.61	2.43	-21.12
R squared	0.044	0.119	0.114	0.302	0.067	0.122	0.143	0.331
Observations	4,734,149	4,734,149	635,101	186,892	2,281,452	2,281,452	327,390	113,158
<i>H. EMTs/paramedics</i>								
EMT/paramedic	-0.005 (0.002)	0.003 (0.005)	-0.005 (0.007)	-0.080 (0.023)	-0.005 (0.005)	0.006 (0.007)	-0.002 (0.017)	-0.074 (0.041)
Dep var mean	0.029	0.199	0.227	0.598	0.051	0.222	0.291	0.750
Percentage effect	-13.94	1.51	-2.20	-13.38	-9.77	2.70	-0.69	-9.87
R squared	0.035	0.087	0.113	0.244	0.069	0.130	0.160	0.302
Observations	8,700,566	8,700,566	1,078,508	279,749	3,487,838	3,487,838	488,331	159,160

Appendix Table A7, continued: Occupation-specific results, state-specific licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>I. Dental hygienists</i>								
Dental hygienist	-0.004 (0.001)	-0.018 (0.003)	0.019 (0.016)	-0.104 (0.026)	-0.003 (0.003)	-0.017 (0.005)	0.030 (0.021)	-0.077 (0.037)
Dep var mean	0.019	0.118	0.240	0.624	0.032	0.131	0.301	0.765
Percentage effect	-21.16	-15.25	7.92	-16.67	-9.40	-12.98	9.97	-10.07
R squared	0.040	0.109	0.156	0.343	0.066	0.126	0.202	0.324
Observations	5,338,647	5,338,647	647,100	172,443	2,298,034	2,298,034	306,013	100,467
<i>J. Dentists</i>								
Dentist	-0.002 (0.002)	-0.003 (0.004)	0.022 (0.014)	-0.125 (0.032)	0.0003 (0.003)	-0.001 (0.005)	0.008 (0.014)	-0.095 (0.035)
Dep var mean	0.030	0.106	0.367	0.728	0.040	0.118	0.388	0.814
Percentage effect	-6.64	-2.83	5.99	-17.17	0.76	-0.85	2.06	-11.67
R squared	0.055	0.108	0.149	0.329	0.078	0.113	0.171	0.339
Observations	1,350,827	1,350,827	137,473	46,032	786,406	786,406	92,064	34,497
<i>K. Real estate appraisers/assessors</i>								
Real estate appraiser/assessor	-0.010 (0.001)	-0.005 (0.004)	-0.074 (0.012)	-0.098 (0.027)	-0.010 (0.002)	-0.011 (0.006)	-0.073 (0.018)	-0.054 (0.041)
Dep var mean	0.017	0.109	0.221	0.648	0.028	0.119	0.285	0.780
Percentage effect	-59.88	-4.59	-33.48	-15.12	-35.71	-9.24	-25.61	-6.92
R squared	0.034	0.105	0.174	0.312	0.065	0.118	0.209	0.281
Observations	7,854,435	7,854,435	860,873	226,612	3,293,881	3,293,881	408,523	134,232
<i>L. Veterinarians</i>								
Veterinarian	0.015 (0.004)	0.012 (0.006)	0.120 (0.022)	-0.078 (0.032)	0.019 (0.006)	0.018 (0.008)	0.111 (0.023)	-0.097 (0.031)
Dep var mean	0.045	0.139	0.411	0.740	0.059	0.154	0.454	0.801
Percentage effect	33.63	8.63	29.20	-10.54	32.31	11.69	24.45	-12.11
R squared	0.095	0.148	0.212	0.388	0.125	0.166	0.244	0.449
Observations	1,241,130	1,241,130	196,389	63,675	684,455	684,455	106,098	39,634

Appendix Table A7, continued: Occupation-specific results, state-specific licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>M. Pest control workers</i>								
Pest control worker	-0.004 (0.003)	0.005 (0.005)	-0.052 (0.016)	-0.062 (0.039)	-0.008 (0.005)	-0.007 (0.011)	-0.038 (0.025)	-0.134 (0.040)
Dep var mean	0.020	0.159	0.186	0.612	0.031	0.165	0.234	0.730
Percentage effect	-20.20	3.14	-27.96	-10.13	-25.81	-4.24	-16.24	-18.36
R squared	0.045	0.099	0.169	0.351	0.085	0.130	0.232	0.403
Observations	5,913,496	5,913,496	697,080	175,391	2,250,552	2,250,552	304,410	96,307
<i>N. Chiropractors</i>								
Chiropractor	-0.006 (0.003)	-0.0004 (0.007)	-0.045 (0.018)	-0.092 (0.038)	-0.010 (0.006)	-0.012 (0.009)	-0.058 (0.033)	-0.060 (0.060)
Dep var mean	0.037	0.137	0.348	0.731	0.047	0.144	0.380	0.822
Percentage effect	-16.35	-0.29	-12.93	-12.59	-21.32	-8.33	-15.26	-7.30
R squared	0.090	0.132	0.255	0.362	0.125	0.147	0.287	0.371
Observations	2,015,205	2,015,205	231,172	73,631	1,023,892	1,023,892	128,417	48,054
<i>O. Optometrists</i>								
Optometrist	-0.005 (0.004)	-0.021 (0.006)	0.004 (0.031)	0.009 (0.030)	-0.006 (0.006)	-0.019 (0.008)	0.028 (0.046)	0.005 (0.027)
Dep var mean	0.029	0.108	0.337	0.769	0.040	0.122	0.382	0.833
Percentage effect	-17.06	-19.44	1.19	1.17	-14.85	-15.57	7.33	0.60
R squared	0.093	0.145	0.255	0.382	0.127	0.164	0.308	0.387
Observations	1,016,101	1,016,101	114,438	37,491	586,552	586,552	70,891	26,833
<i>P. Podiatrists</i>								
Podiatrist	-0.001 (0.007)	-0.009 (0.010)	0.092 (0.065)	0.142 (0.088)	0.005 (0.012)	-0.010 (0.016)	0.130 (0.074)	0.246 (0.053)
Dep var mean	0.029	0.107	0.348	0.738	0.042	0.123	0.395	0.812
Percentage effect	-3.42	-8.41	26.44	19.24	11.90	-8.13	32.91	30.30
R squared	0.137	0.201	0.407	0.549	0.204	0.254	0.469	0.582
Observations	648,098	648,098	62,612	22,325	406,627	406,627	42,937	17,056

Note: Sample described in notes to Table 2. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Samples in each specification exclude all other licensed occupations. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Estimated using sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A8: Occupation-specific results, quasi-national licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>A. Nurses</i>								
Nurse	0.002 (0.001)	0.004 (0.001)	0.020 (0.005)	-0.024 (0.008)	0.004 (0.001)	0.006 (0.001)	0.031 (0.005)	-0.016 (0.008)
Dep var mean	0.022	0.124	0.244	0.673	0.033	0.132	0.301	0.779
Percentage effect	9.09	3.23	8.20	-3.57	12.08	4.55	10.30	-2.05
R squared	0.021	0.084	0.061	0.123	0.033	0.085	0.068	0.117
Observations	11,566,156	11,566,156	1,417,218	367,749	5,048,123	5,048,123	687,245	219,801
<i>B. Physicians</i>								
Physician	0.021 (0.002)	0.019 (0.003)	0.113 (0.009)	0.022 (0.010)	0.019 (0.002)	0.014 (0.003)	0.096 (0.011)	0.011 (0.008)
Dep var mean	0.046	0.134	0.406	0.811	0.055	0.142	0.429	0.859
Percentage effect	45.36	14.18	27.83	2.71	34.61	9.86	22.38	1.28
R squared	0.058	0.104	0.077	0.142	0.063	0.103	0.082	0.150
Observations	2,520,578	2,520,578	336,005	98,215	1,282,455	1,282,455	182,982	63,854
<i>C. Social workers</i>								
Social worker	-0.009 (0.001)	-0.001 (0.002)	-0.055 (0.009)	-0.085 (0.011)	-0.011 (0.002)	0.0001 (0.002)	-0.060 (0.011)	-0.062 (0.021)
Dep var mean	0.026	0.149	0.241	0.663	0.039	0.158	0.293	0.773
Percentage effect	-34.88	-0.67	-22.82	-12.82	-28.57	0.06	-23.21	-8.02
R squared	0.028	0.093	0.086	0.163	0.045	0.104	0.100	0.186
Observations	10,273,793	10,273,793	1,224,134	319,709	4,423,981	4,423,981	587,976	190,553
<i>D. Occupational/physical therapists</i>								
Occupational/physical therapist	0.001 (0.002)	-0.002 (0.002)	0.031 (0.011)	-0.046 (0.020)	0.003 (0.003)	-0.002 (0.003)	0.036 (0.016)	-0.039 (0.021)
Dep var mean	0.035	0.141	0.316	0.725	0.049	0.153	0.364	0.812
Percentage effect	2.87	-1.42	9.81	-6.34	6.16	-1.31	9.89	-4.80
R squared	0.044	0.117	0.102	0.234	0.064	0.127	0.129	0.234
Observations	6,402,225	6,402,225	784,424	219,226	2,952,379	2,952,379	398,445	134,405

Appendix Table A8, continued: Occupation-specific results, quasi-national licensed occupations, 2005-2015 ACS

	All individuals				Living outside state of birth			
	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles	Moved between states	Moved at all	Moved 50+ miles   moved at all	Moved between states   moved 50+ miles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>E. Psychologists</i>								
Psychologist	-0.0004 (0.002)	0.004 (0.003)	-0.023 (0.012)	-0.035 (0.022)	-0.00002 (0.002)	0.005 (0.005)	-0.024 (0.014)	-0.030 (0.019)
Dep var mean	0.032	0.122	0.329	0.740	0.043	0.132	0.371	0.816
Percentage effect	-1.25	3.28	-6.99	-4.73	-0.05	3.79	-6.47	-3.68
R squared	0.056	0.118	0.138	0.258	0.081	0.138	0.173	0.273
Observations	2,602,860	2,602,860	360,544	115,264	1,348,831	1,348,831	194,125	71,473
<i>H. Physician assistants</i>								
Physician assistant	0.005 (0.003)	0.015 (0.006)	0.035 (0.010)	-0.108 (0.027)	0.011 (0.006)	0.018 (0.008)	0.041 (0.020)	-0.078 (0.033)
Dep var mean	0.038	0.167	0.311	0.679	0.056	0.179	0.355	0.804
Percentage effect	13.02	8.98	11.25	-15.91	19.75	10.06	11.55	-9.70
R squared	0.063	0.114	0.165	0.353	0.104	0.140	0.210	0.369
Observations	6,652,655	6,652,655	797,025	217,620	2,892,900	2,892,900	383,855	128,577

Note: Sample described in notes to Table 2. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Samples in each specification exclude all other licensed occupations. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Estimated using sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A9: Occupation-specific results, probability moved interstate given 100-mile move, 2005-2015 ACS, individuals residing outside their state of birth

A. State-specific licensed occupations

	Teachers	Lawyers	Barbers/ cosme- tologists	Real estate brokers/ sales agents	Electri- cians	Insurance agents	Pharma- cists	EMTs/ para- medics	Dental hygienists	Dentists	Real estate appraisers /assessors	Veterin- arians	Pest control workers	Chiroprac- tors	Optome- trists	Podiatrists
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Occupation	-0.033 (0.010)	-0.044 (0.009)	0.0004 (0.021)	-0.080 (0.025)	-0.045 (0.024)	-0.003 (0.012)	-0.146 (0.028)	-0.026 (0.037)	-0.039 (0.031)	-0.101 (0.028)	-0.055 (0.040)	-0.088 (0.027)	-0.058 (0.037)	-0.072 (0.063)	-0.011 (0.023)	0.175 (0.040)
Dep var mean	0.867	0.882	0.852	0.826	0.835	0.864	0.826	0.858	0.864	0.868	0.859	0.860	0.839	0.886	0.881	0.933
Percentage effect	-3.83	-4.93	0.05	-9.67	-5.37	-0.33	-17.68	-3.07	-4.48	-11.64	-6.43	-10.21	-6.87	-8.14	-1.29	18.76
R squared	0.095	0.145	0.184	0.217	0.237	0.212	0.346	0.275	0.343	0.337	0.303	0.498	0.387	0.359	0.414	0.285
Observations	186,735	104,314	148,309	177,034	134,456	164,873	98,505	136,483	86,389	30,814	115,578	34,821	81,831	42,252	23,860	15,240

B. Quasi-national licensed occupations

	Nurses	Physicians	Social workers	Occupa- tional/ physical therapists	Psycholo- gists	Physician assistants
	(1)	(2)	(3)	(4)	(5)	(6)
Occupation	-0.018 (0.007)	0.002 (0.006)	-0.033 (0.015)	-0.047 (0.021)	-0.005 (0.017)	-0.038 (0.031)
Dep var mean	0.862	0.911	0.863	0.875	0.891	0.877
Percentage effect	-2.09	0.22	-3.82	-5.37	-0.56	-4.33
R squared	0.119	0.151	0.170	0.249	0.271	0.390
Observations	189,389	56,061	164,428	116,683	62,741	111,088

Note: Sample described in notes to Table 2 and further limited to individuals who moved at least 100 miles in the last year and who resided outside their state of birth last year. Dependent variable is indicator for moving between states. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Samples in each specification excludes all other licensed occupations. Matching estimator formed using cells based on all control variables and estimated using ATET weights, including all controls and fixed effects in specification. Estimated using sample weights. Standard errors clustered on last year's state of residence in parentheses.

Appendix Table A10: Occupation-specific results, 2005-2015 ACS, individuals residing outside their state of birth, OLS estimator

A. State-specific licensed occupations

	Teachers	Lawyers	Barbers/ cosme- tologists	Real estate brokers/ sales agents	Electri- cians	Insurance agents	Pharma- cists	EMTs/ para- medics	Dental hygienists	Dentists	Real estate appraisers /assessors	Veterin- arians	Pest control workers	Chiroprac- tors	Optome- trists	Podiatrists
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Occupation	-0.058 (0.011)	-0.078 (0.014)	0.013 (0.029)	-0.055 (0.025)	-0.055 (0.023)	0.011 (0.017)	-0.152 (0.029)	-0.052 (0.032)	-0.050 (0.034)	-0.049 (0.029)	-0.028 (0.042)	-0.079 (0.038)	-0.085 (0.049)	-0.030 (0.052)	0.007 (0.037)	-0.043 (0.161)
Dep var mean	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769	0.769
Percentage effect	-7.54	-10.14	1.69	-7.15	-7.15	1.43	-19.77	-6.76	-6.50	-6.37	-3.64	-10.27	-11.05	-3.90	0.91	-5.59
R squared	0.085	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086
Observations	273,734	268,208	266,675	266,993	266,855	266,650	266,523	266,218	266,111	266,288	266,008	266,247	265,969	266,031	265,986	265,920

B. Quasi-national licensed occupations

	Nurses	Physicians	Social workers	Occupa- tional/ physical therapists	Psycholo- gists	Physician assistants
	(1)	(2)	(3)	(4)	(5)	(6)
Occupation	-0.017 (0.008)	0.015 (0.008)	-0.077 (0.021)	-0.027 (0.023)	-0.032 (0.021)	-0.037 (0.034)
Dep var mean	0.769	0.771	0.769	0.769	0.769	0.769
Percentage effect	-2.21	1.95	-10.01	-3.51	-4.16	-4.81
R squared	0.085	0.086	0.086	0.086	0.086	0.086
Observations	271,962	269,738	267,098	266,683	266,378	266,215

Note: Sample described in notes to Table 2. Sample further limited to individuals residing outside their state of birth last year. All specifications include last year's state of residence \* year fixed effects and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Percentage effects calculated as coefficient/dependent variable mean\*100. Samples in each specification exclude all other licensed occupations. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence in parentheses.



## **Appendix B: Lawyers**

Ideally, we would have information on historical changes in state requirements for re-licensure for all of our licensed occupations—information that would enable a causal analysis. Unfortunately, this information is not available. States have broad discretion to set their own licensing requirements for each occupation, and often the specifics are delegated to a licensing board, making collection of reliable data, particularly on historical licensing requirements, impossible.

One exception is lawyers. Unlike many other occupations, lawyers have a large national association, the American Bar Association (ABA), and a national organization, the National Conference of Bar Examiners (NCBE), both of which oversee a major component of lawyer licensure: the bar exam. The websites for these two entities provide current information on state licensing requirements and a listing of ABA-accredited law schools, as well as historic information for the last 5–15 years.

One aspect of lawyer licensure for which we have information is the presence of reciprocity agreements. Entering into reciprocity agreements, which accept individuals holding licenses in specific other states as qualified to practice with few or no additional requirements, is one way that states can lower the barriers to re-licensure. The licensing guides published by the NCBE provide the year in which states entered into reciprocity agreements for the first time for lawyers. Importantly, we do not have information on the specific states covered by reciprocity agreements—we only know the first year a state adopted a reciprocity agreement with any state. We use this information to attempt to draw a more concrete link between the limited between-state migration of lawyers and the presence of reciprocity agreements.

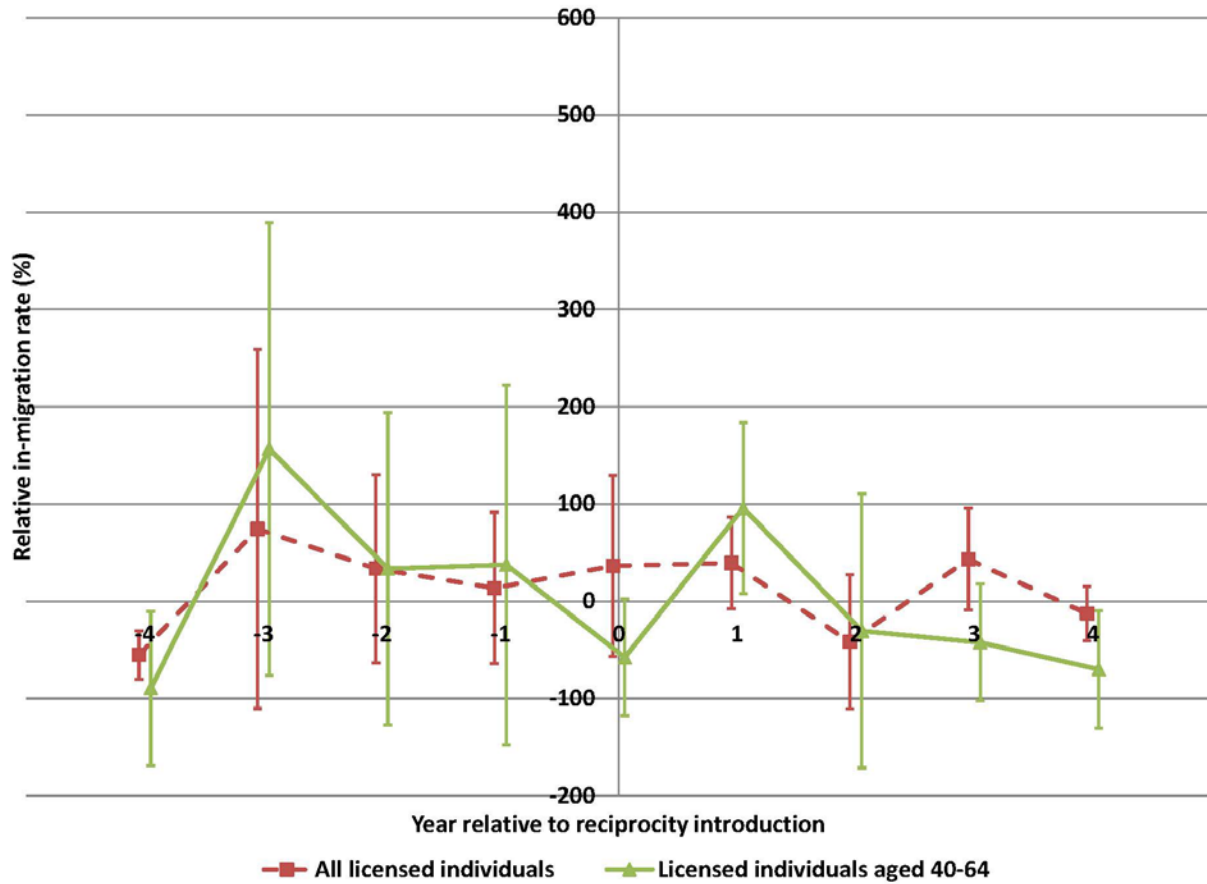
Ten states adopted reciprocity agreements for lawyers between 2001 and 2015. As of 2015, 7 states had no such agreement, and the remaining 34 states already had reciprocity agreements in place in 2001. The introduction of reciprocity potentially increases the ability of lawyers to migrate to a state, as the barriers to re-licensure are much lower. We test whether this is the case using an event study framework:

$$Y_{ist} = \gamma_1 lawyer_{ist} + \gamma_2 reciprocity_{st} + \sum_{t=-4}^4 \delta_t lawyer_{ist} \times reciprocity_{st} + X_{ist}\beta + \alpha_s \times t + \varepsilon_{ist} \quad (B1)$$

where  $Y_{ist}$  is an indicator for moving between states in the last year for individual  $i$  residing in state  $s$  in year  $t$ ,  $lawyer_{ist}$  is an indicator for being a lawyer,  $reciprocity_{st}$  is an indicator for having a reciprocity agreement in place,  $\alpha_s \times t$  are state-specific linear trends, and  $X_{ist}$  and  $\varepsilon_{ist}$  are as in equation (2). The vector  $\delta_t$  captures the difference in migration rates for lawyers relative to others in the year state  $s$  adopted its first lawyer reciprocity agreement ( $t = 0$ ) and the four years before and after. We use this event study framework to examine both in-migration and out-migration of lawyers to and from states that adopt reciprocity agreements. In-migration specifications define the reciprocity variable using the current state of residence, and out-migration uses last year's state of residence. We repeat the analysis using two different samples: all licensed individuals (defined using members of the 22 occupations in Table 1) and all licensed individuals aged 40–64. As all reciprocity agreements only apply to lawyers meeting a minimum years of practice (usually 3 of the last 5 or 5 of the last 7 years), individuals aged 40 and older are more likely to meet this requirement and be covered by the reciprocity agreement.

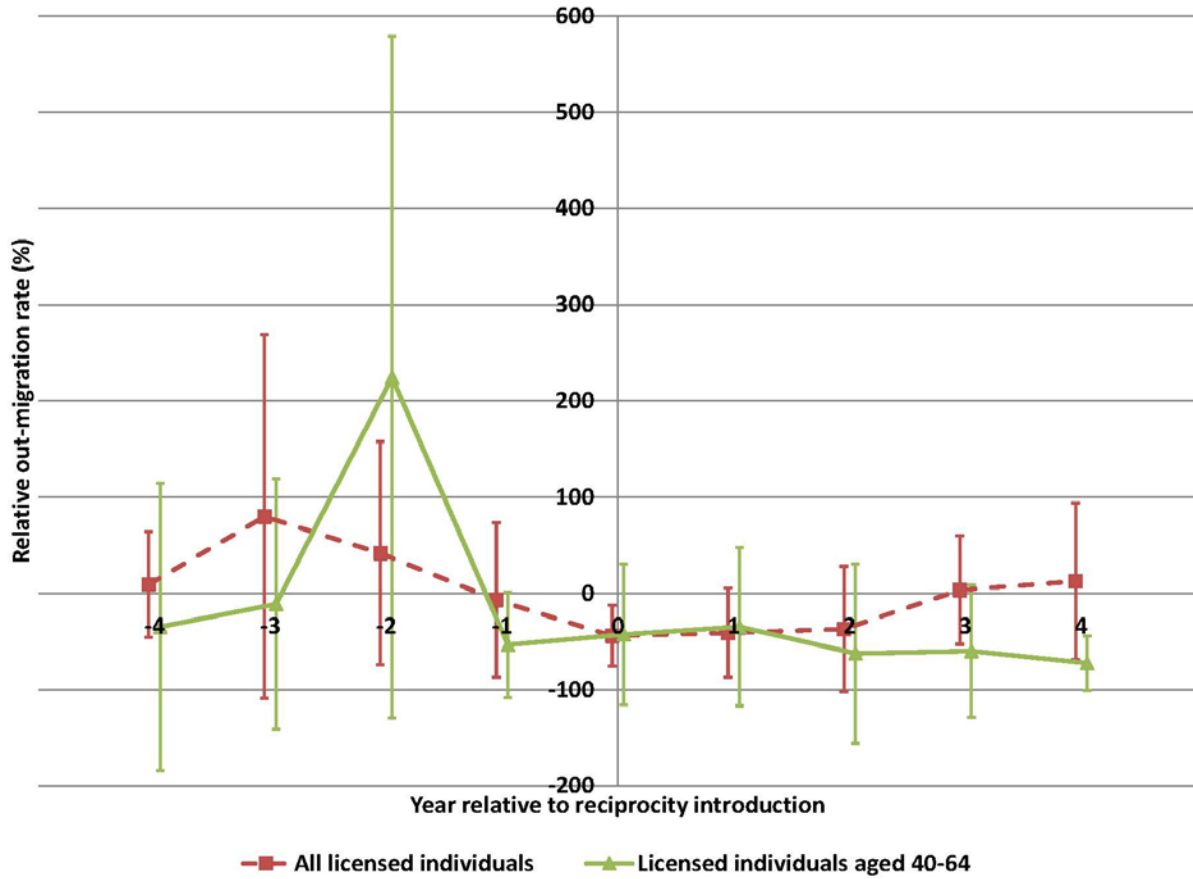
Figure B1 shows the results for interstate in-migration of lawyers. There is some evidence of an increase in in-migration of lawyers aged 40–64 in the year after the adoption of a first reciprocity agreement, but overall results are noisy. The results for out-migration in Figure B2 show no evidence that a state adopting its first reciprocity agreement experiences increased out-migration of lawyers relative to members of other licensed occupations, but again, the point estimates are noisy and the confidence intervals wide.

Figure B1: Event study of interstate in-migration of lawyers relative to year of adoption of first reciprocity agreement, 2001-2015 ACS



Note: Sample described in notes to Table 2 and further limited to either all licensed individuals or all licensed individuals aged 40-64. Point estimates of percentage differences between lawyers and the comparison group (coefficient/dependent variable mean\*100) and 95 percent confidence intervals shown. All specifications include state-specific linear trends (defined using current state of residence) and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Estimated using OLS and sample weights. Standard errors clustered on current state of residence. Full results available upon request.

Figure B2: Event study of interstate out-migration of lawyers relative to year of adoption of first reciprocity agreement, 2001-2015 ACS



Note: Sample described in notes to Table 2 and further limited to either all licensed individuals or all licensed individuals aged 40-64. Point estimates of percentage differences between lawyers and the comparison group (coefficient/dependent variable mean\*100) and 95 percent confidence intervals shown. All specifications include state-specific linear trends (defined using last year's state of residence) and controls for income, race, sex, education, marital status, age, employment status, citizenship status, and number of children. Estimated using OLS and sample weights. Standard errors clustered on last year's state of residence. Full results available upon request.