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Public interest or policy diffusion: Analyzing the effects of massage therapist municipal licensing¹

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Abstract: Massage therapy is widely licensed by the states. However, municipalities also often passed massage therapist licensing, motivated by preventing prostitution. Using a novel dataset on municipal licensing and crime data from the FBI, we test if local massage therapist licensing reduced prostitution. We also test a policy diffusion hypothesis, in which cities pass responsive massage therapist licensing. We find that municipal massage therapist licensing does not lead to a reduction in prostitution, but we find support for the policy diffusion hypothesis, with municipalities up to 65% more likely to pass responsive licensing within three years of their neighbor doing so.

Keywords: economics of crime, occupational licensing, policing

JEL: J44, K29, K42

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Occupational licensing remains a widespread yet costly regulatory tool in the legislative toolkit. A large body of research affirms that licensing reduces market competition, restricts labor market opportunities, and raises consumer costs. Further evidence indicates that licensing does not protect the public, either from fraudulent or low-quality practitioners. This finding is perhaps unsurprising given that licensing requirements often have no clear connection to public health or safety outcomes. For example, while high licensing fees may deter low-quality providers (Shapiro 1983), they can also deter low-income providers for whom \$100 represents a significant cost relative to their earnings or savings. Licensing exams are set by licensing boards often composed of the applicant’s future competitors. Education requirements may include years of school on material unrelated to the occupation, as with practitioners of African-style hair braiding who have found that none of what they practice is taught at the cosmetology schools they must attend – and pay tuition to – to meet licensing requirements.

Beauty and personal services are a widely licensed group of occupations, including cosmetology, makeup artists, and massage therapists. In contrast to many other occupational licenses, policy advocates have pointed to a clear public health and safety goal for massage therapist licensing: the prevention of prostitution and human trafficking (Woilsaw 2022). However, there is little empirical evidence on whether massage therapist licensing achieves this goal (The Department of the Treasury 2015). Throughout the United States, both states and municipalities regulate the practice of massage therapy. As of 2022, all but four states—Kansas, Minnesota, Wyoming, and Vermont—have statewide licensing or certification requirements. Cities and counties have been licensing massage therapists from at least the early twentieth century.⁶ In contrast to many occupational licenses, municipal licensing was also often passed over the

⁶ The earliest municipal licensure date in our sample is from Tulsa, Oklahoma in 1935.

objections of practicing massage therapists, as they prefer standardized statewide licensing (Harper v Lindsey 1980). State licensing supersedes municipal licensing when state licensing requirements are stricter than municipal licensing, but municipalities may impose even higher licensing requirements than states. Most licensing studies focus on state-level licensing (Kleiner and Krueger, 2013). Municipal licensing and its effects are understudied in comparison, primarily due to the burdensome task of data collection at the municipal level. The task is made more difficult by the frequency and scope of municipal licensing, and a recent study identified 1,832 cases of municipal licensing in just the 50 largest cities in the United States (Carpenter et al., 2019; Deyo et al., 2021). Municipal licensing may exacerbate the welfare-reducing effects of state licensing on the local level, and it may more easily reflect and empower local biases from insider groups against outsider groups (Allensworth, 2017). Municipal licensing may also be sensitive to policy diffusion effects, in which municipalities pass a law or regulation after and because their neighbors do.

Municipal licensing has a limited scope compared with state licensing and, as with state licensing, exhibits large variation in requirements. If licensing deters indoor prostitution or human trafficking in one city, it may simply push it into neighboring cities and counties. Municipal massage therapist licensing thus provides a useful vehicle to consider whether licensing achieves its clear public health and safety goal and to consider the effects of municipal occupational licensing more generally. We consider two factors that may impact the spread of municipal licensing for massage therapists: the incidence of prostitution, and the policies of municipal neighbors. More broadly, we consider whether municipal licensing benefits consumers or special interests.

We use municipalities in Kansas, Minnesota, and Oklahoma to estimate the factors influencing the spread of municipal licensing between 2000 and 2019. Kansas and Minnesota do not license massage therapists at the state level and

Oklahoma did not license massage therapists at the state level until 2016. However, dozens of cities and counties in these states have passed licensing requirements for massage therapists dating back to 1935. We use Kansas, Minnesota, and Oklahoma as our sample as these states share many demographic and regional characteristics. They also share similar urban and rural concentrations and all fit within the Midwestern region of the United States. Although other states did not have massage therapist licensing during our study period, such as Massachusetts (which passed state-level massage therapist licensing in 2006) and Vermont (which does not license massage therapists at the state level), these states also lack other major similarities with our sample that would limit the generalizability of findings related to municipal licensing.

Our paper provides a unique contribution to the occupational regulation literature. First, we provide evidence on the link between municipal licensing and a clear public health and safety outcome, i.e., prostitution offenses. We also provide the first study on occupational licensing and policy diffusion, using the case study of massage therapists regulated at the municipal level. In order to answer these questions, we developed a novel time-series dataset of the passage of municipal licensing laws in 87 cities and counties in Kansas, Minnesota, and Oklahoma. We then conducted a staggered adoption difference-in-difference analysis for each model and performed additional event study analysis on whether licensing deters or prevents prostitution in a robustness test. Additional robustness tests were performed on the incidence of rape, based on previous literature (Bisschop, Kastoryano, and van der Klaauw 2017; Cunningham and Shah 2018).

In order to test whether municipal licensing laws have reduced the incidence of prostitution, we identified a sample of licensed cities and compared outcomes in these cities with unlicensed cities. We focus on yearly cohorts of municipal licensure between 2000 to 2019 and match them with agency-level data on prostitution offenses from the FBI Uniform Crime Reports Summary Reporting

System (UCR). We first perform a within-state analysis between licensed and unlicensed municipalities in Kansas, Minnesota, and Oklahoma, and conduct an additional between-state analysis of licensed cities. Even though massage therapist licensing has a clear policy goal of preventing indoor prostitution, the licensing requirements do not directly address the underlying causes of prostitution. We therefore expect that licensing does not significantly affect this public health and safety outcome. Both our primary results and robustness tests support this conclusion.

We next test the policy diffusion model for the spread of municipal massage therapist by evaluating whether a municipality is more likely to pass massage therapist licensing when one of the cities in its shared county requires massage therapist licensing. Across all three states, we find that cities are 15.4% more likely to pass municipal massage therapist licensing within three years after a shared-county city licenses massage therapists, and between 15% and 18% more likely to pass municipal massage therapist licensing within five years of a shared-county city passing licensing. The effects are heterogenous by state, and driven mostly by Minnesota, where the likelihood of adoption within three years is between 32.9% and 64.7% (depending on the inclusion of county and year fixed effects) and 20.2% within five years. We also find no evidence that this result is driven by crime rates, but it is associated with an increase in the proportion of the city's Asian population.

2 Occupational background and literature

Massage therapy has a long history and is one of the world's oldest professions (Thornton and Timmons 2013). Sex work has historically been linked to massage therapy since massage therapists use skin-to-skin contact to manipulate muscles and tissue. For example, in ancient Rome, massages were often provided in bathhouses as both a therapeutic and sexual service (Thornton and Timmons 2013). When the United States began an effort to end prostitution in bathhouses in

the late 1800s, much of it moved to massage parlors (Thornton and Timmons 2013). When massage therapist licensing is being considered, both policymakers and industry members mention human trafficking as a major concern (Holman 2016).⁷

Massage therapy regulations contain provisions focusing on criminal history. Often, these regulations exclude aspiring massage therapists with misdemeanors on their record, especially those related to sex crimes and prostitution. In most states, applicants for a massage therapist license must submit fingerprints and undergo a criminal background check. Regulations require the regular inspection of facilities, and even dictate the design of facilities, like increasing visibility to make illegal acts more difficult. Finally, cross-sex massage is banned in many states.

In general, massage therapists traditionally support licensing to increase the legitimacy of the profession and remove the stigma of an association with prostitution (Snyder 2015). Professional associations tend to prefer statewide licensing to local municipal licensing to provide a uniform standard. This holds true for massage therapists who lobby against local licensing laws in favor of statewide licensing laws (Thomas 2012). The motivation for licensure as a means to discourage prostitution is wholly dependent on the illegality of the practice. This is the case for the vast majority of the United States, where all forms of prostitution are illegal.

At first glance, designing massage therapy licensing to prevent indoor prostitution may suggest that licensing is a means of improving consumer welfare. However, this may not be the case. First, licensing massage therapy is an indirect method of reducing indoor prostitution. Sex workers may still choose to undergo

⁷ Evaluating the effects of massage therapist licensing on human trafficking is a good area for future studies. However, very few agencies report human trafficking data to the FBI data. Only 355 agencies matched on human trafficking out of our base sample of 1,778 agencies.

the required training and take exams to become a massage therapist if the potential earnings are high enough. Alternatively, sex workers may choose to purchase a diploma and licensing exam answers from a fraudulent school, allowing them to pose as a licensed massage therapist (Quintana 2021). Massage parlors that are fronts for indoor prostitution could also evade the law by simply moving just outside the municipality's enforcement area. In contrast, setting standards for education and training do not directly prevent indoor prostitution from occurring. Direct prevention methods like increased law enforcement attention would likely have a more effective result.

Although massage therapist licensing may support the perceived legitimacy of massage parlors, thus increasing demand for massage services, licensing also has other well-known effects. Thornton and Timmons (2013) use a natural experiment of changes in states' non-licensed cities to estimate the impact of licensing on massage therapist wages. They find evidence that occupational licensing is associated with a 16.2 percent earnings premium. Deyo et al. (2021) provide a first look at local massage therapist licensing and find no evidence that municipal licensing was associated with lower STD rates or prostitution offenses. Trudeau (2021) also finds evidence that increased competition from massage therapists located in jurisdictions with less stringent requirements mitigates the licensing premium. For businesses that hire licensed professionals, the cost of complying with licensing requirements can affect firm location and entry decisions (Plemmons 2022), including for personal care services (Zapletal 2018).

Only a few other studies have examined the effects of local licensing. Kleiner and Krueger (2013) use survey data to explore the scope and effects of municipal licensing and find it has negligible effect on wages. Additionally, it tends to impact lower income professions rather than the higher income professions that tend to have a greater earnings premium from licensing (Kleiner 2000). Timmons and Thornton (2019) examine local barber licensing in Alabama and found

suggestive evidence that state licensing has a larger impact than county licensing, increasing wages and decreasing the number of barbershops and barbers.

Over time, municipal massage therapist licensing ordinances have become more popular, spreading within unlicensed states in a process called policy diffusion. Much of the work on policy diffusion, beginning with Walker (1969) focuses on state level policies because of the difficulties of working with local level data. Early work on local level diffusion of policy includes water fluorination (Crain 1966), the adoption of municipal reforms (Knoke 1982), local gun control ordinances in California (Godwin and Schroedel 2000) and living wage laws (Martin 2001). More recent work, beginning with Shipan and Volden (2008), has overcome the previous data limitations and more rigorously explored the specific mechanisms of policy diffusion between local governments.

3 Theoretical frameworks for the spread of licensing regulation

The motivation for creating massage therapist licensing ordinances can help determine whether they are intended to benefit consumers or special interests (Persico 2014). Typically, local law enforcement is involved in the regulation of massage therapy, and the ordinances may be passed in response to crimes related to indoor prostitution. Conversely, these laws could be designed to restrict entry into the profession, allowing professionals to earn higher wages. A sunrise review report from Vermont found no evidence that there was significant risk of harm to the public from unlicensed massaged therapists (Vermont Secretary of State Office of Professional Regulation, 2016). A review of 12 sunrise review reports for massage therapist licensing from 1989 to 2016 found that a recommendation of no licensing was issued in 8 of those case (Sanchez et al 2022). Despite this, the legislature created a new license in 5 of those 8 cases.

Two competing models provide a theoretical framework for new regulation. The public interest view argues that legislators and regulators seek to maximize consumer welfare. Licensing laws and regulations are designed to ensure services

meet a minimum level of quality and protect public health and safety. When competition between professionals is unable to prevent a market failure, professional regulation can be used to improve outcomes. Regulation can be sought by consumers to remedy low quality services or by professionals who are able to recognize the proliferation of lower quality professionals. Licensing laws are passed by state and municipal legislators, and the profession is overseen by licensing boards comprised of industry professionals and sometimes members of the public. The public interest theory suggests that licensing requirements should be consistent across states if public safety or maximizing consumer welfare is the goal (Smith, 1982). However, in practice there is wide variation in standards between jurisdictions. Differences in licensing standards related to the composition of licensing boards or interest group strength would provide some evidence that the special interest theory plays a role in shaping occupational licensing standards.

An alternative explanation for the spread of licensing is policy diffusion, which uses the four mechanisms of learning, competition, coercion, and emulation (Berry and Baybeck, 2005). Policy diffusion can occur among neighboring localities within a geographic region or between cities with similar characteristics (Walker 1969; Case, Rosen, and Hines 1993; DellaVigna and Kim 2022). We see some evidence of this in our novel dataset sample. For example, nearly every municipality in Johnson County, Kansas licenses massage therapists, with city counselors quoted as copying their neighbors' statutes (Thomas 2012; Branson 2016). Conversely, policymakers may consider peer cities located outside of their region and use them as a model for new ordinances. More recent work on policy diffusion has considered this alternative (Brooks 2005; Weyland 2007; DellaVigna and Kim 2022).

Only learning and emulation are likely to have an active role with municipal licensing. Under learning, when facing a problem, policymakers choose among

alternatives that have been used successfully elsewhere. Under emulation, governments seek to imitate another government to appear similar, regardless of the impact of the action. However, the fact that a policy that spreads to a new municipality does not indicate efficiency or effectiveness. For instance, some policies that appear effective or are popular among voters can be ineffective or costly. When a municipality adopts a new policy based on imitation of a high-status municipality rather than learning from successful policies, ineffective policies can begin to spread. Late adopters may assume that the policy's prevalence is due to its success, but it could be based on imitating a high-status municipality with a poorly designed policy. Licensing ordinances typically are instituted in the largest municipalities of the state first and begin to spread. Early adoption by the largest municipalities may result from a higher risk of problems associated with massage therapy, or it could be a result of imitation of the larger, higher status cities that grows over time.

Little work has made the connection specifically between occupational licensing and policy diffusion. Karch, et al. (2016) find evidence that professional associations play a role in policy diffusion between states for the adoption of interstate compacts. Our study adds to the existing literature by estimating if there is a causal relationship between local massage therapist licensing and the incidence of prostitution. We also test the competing theory of policy diffusion as an alternative explanation for the spread of municipal licensing, considering whether geographic diffusion can explain the spread of these ordinances.

4 Data

To estimate the effect of massage therapist licensing on prostitution, we link novel municipal licensing data for Kansas, Minnesota, and Oklahoma with data on prostitution offenses from the FBI Uniform Crime Reports Summary Reporting System (UCR SRS). Police agencies were cross-checked against cities and counties to verify that the police agency was associated with the correct

municipality. Our final panel dataset includes 94 police agencies in cities both with and without municipal massage therapist licensing from 2000 to 2019. We report descriptive statistics for municipality characteristics in Table 1 for the 2000 municipality cohort (61 licensed; 75 not licensed) and in Table 2 for the 2019 municipality cohort (60 licensed; 83 not licensed). We use individual yearly cohorts from 2000 to 2019 within Kansas, Minnesota, and Oklahoma throughout the analysis. We report the number of licensed and unlicensed cities by state, population data, city size, offense data, the years since cities passed licensing for each cohort, the number of police officers, an indicator for city suburban status, and an indicator for whether cities are in a metropolitan statistical area (MSA).

4.1 Novel municipal licensing dataset

We include cities and counties in Kansas, Minnesota, and Oklahoma that passed massage therapist licensing from 2000 to 2019 in our study sample. Neither Kansas nor Minnesota license massage therapists at the state level; Oklahoma passed state-level licensing in 2016. We restricted our sample across the states to cities with more than 10,000 residents in 2019. Data on a city's licensing requirements was determined by accessing each municipality's code through the official municipal website. We recorded the year the city passed its massage therapist licensing ordinance as the year of licensing. When the year of passage was unclear, we contacted the municipal department overseeing the municipality's licensing, which was typically the licensing and permits department.⁸ In total, we identified 70 municipalities that require licensing and focus on the subset in Kansas (13), Minnesota (47), Oklahoma (10) during our

⁸ We also recorded the education requirements and fees that were often explicitly included in the ordinance. When the education and fees were not included in the ordinance, we used the information from the official massage therapist licensing application on the municipality website or contacted the municipality's licensing and permits department.

study period.⁹ Our final sample includes 164 cities – including 90 unlicensed cities – in Kansas, Minnesota, and Oklahoma that license massage therapists and cities that do not license massage therapists as the control group.¹⁰

Figures A1, A2, and A3 in Appendix A show the adoption of massage therapist licensing in Kansas, Minnesota, and Oklahoma, respectively. Darker colors indicate more recent adoption of licensure. Cities without licensing are shaded in green. Licensed cities tend to have larger population sizes and cluster around a metropolitan area. For example, in Minnesota, the licensed cities are clustered around the Twin cities. The average population of licensed cities with at least 10,000 residents was 45,400 in Kansas in 2000 and 70,000 in 2019; 41,300 in Minnesota in 2000 and 46,600 in 2019; and 130,400 in Oklahoma in 2000 and 86,200 in 2019. Among unlicensed cities, the average population was 18,400 in Kansas in 2000 and 18,700 in 2019; 29,500 in Minnesota in 2000 and 31,900 in 2019; and 26,200 in Oklahoma in 2000 and 27,800 in 2019. The cities varied on some other dimensions. For example, the mean poverty rate is higher in unlicensed cities, except for cities with more than 100,000 residents (Appendix A, Figure A4).

4.2 Prostitution data

Cities often pass massage therapist licensing under the auspices of preventing indoor prostitution and human trafficking in massage parlors. To estimate the effect of municipal massage therapist licensing on this outcome, we use offense data on prostitution offenses from Part II of the FBI Uniform Crime Reports Summary Reporting System (UCR).¹¹ Our sample includes prostitution offenses under the Prostitution and Commercialized Vice category (Offense Code 16). The

⁹ 11 cities were either licensed before the beginning of the UCR data or the licensure year could not be identified.

¹⁰ We do not include home-based massage registration in Minneapolis.

¹¹ Although human trafficking data is available, we discuss the limitations to this data in Section 7.

FBI defines prostitution as “The unlawful promotion of or participation in sexual activities for profit, including attempts to solicit customers or transport persons for prostitution purposes; to own, manage, or operate a dwelling or other establishment for the purpose of providing a place where prostitution is performed; or to otherwise assist or promote prostitution”.¹² We also use data on rape offenses for a robustness test and violent crimes to adjust for crime trends in each municipality.

The UCR data is at the police agency level, such as city police departments, the county sheriff’s office, university police agencies, and tribal police agencies. It also includes data on the population and city size associated with the police agency from the American Community Survey (ACS). We restricted our sample of police agencies to city police departments and county sheriff’s offices with 12 months of data in a given year. We then matched licensed municipalities to their corresponding police agencies by manually verifying the city affiliation of the police agency.

Figure 4 shows the number of crimes per 100,000 for prostitution offenses in the three states. We observe no differences in trends between licensed and unlicensed cities. Figure 5 reports combined prostitution offenses for only the licensed cities before and after the implementation of the licensing requirements. Prostitution offenses in Kansas followed a declining trend in the pre-treatment period, briefly spiked after the introduction of municipal licensing, and then returned to the long-run trend. There is no observable difference in Minnesota between the pre- and post-treatment periods. Prostitution offenses in Oklahoma briefly spiked before the introduction of municipal licensing and then returned to the long-run trend in the post-treatment period.

12 <https://ucr.fbi.gov/crime-in-the-u.s/2010/crime-in-the-u.s.-2010/offense-definitions>

4.3 Massage parlor establishments

We employ a proprietary dataset of massage therapist establishments from Data Axle to test the policy diffusion hypothesis for the spread of municipal licensing. This dataset contains the list of establishments in various sectors as defined by the North American Industry Classification System (NAICS), in conjunction with additional variable and permits analysis of spatial models by using both firm location and the number of firms. The data includes indicators for firm location information by latitude and longitude, the number of employees by firm, NAICS codes, and detailed descriptions of the business type. These data include firms categorized as massage, massage schools, massage therapists, and skin treatment. We collapsed the number of establishments by county and year and merged this data with our novel municipal licensing dataset. In some cases, counties had zero massage parlors in any given year. Our sample includes massage parlor establishments which were operating in counties in Kansas, Minnesota, and Oklahoma from 2000-2029. As a robustness check, we use establishment data from the Census Bureau's County Business Patterns (CBP) dataset. Descriptive statistics for Data Axle and CBP dataset are reported in Table 3.

4.4 Other explanatory variables

We include violent crimes in the analysis to account for the underlying crime trends in the licensed and unlicensed cities in our sample. We also include several control variables that are available in the UCR data. We account for the number of police officers, the size of the city (based on category bins created by the UCR), indicators for suburban status and metropolitan statistical area (MSA). It is evident that licensing is primarily occurs in large cities, especially in Oklahoma, and it is therefore important to control for population size. We address this by group cities into four bins based on population: cities with populations between 10,000 and 25,000; 25,001 to 50,000; 50,001 to 100,000; and cities with more

than 100,000 residents¹³. We also include 3-year lags for prostitution and violent crime offenses in each estimation and the poverty rate in the county. In addition, we include the proportion of Asian residents by county and year using the ACS data when testing the policy diffusion model.

4.5 Additional data for robustness checks

We include data on forcible rape offenses (Code 02) from the Part I of the UCR data FBI in a robustness test for the effects of municipal licensing on prostitution. Although massage therapist licensing may not directly affect the incidence of rape, previous research has found that when governments legalize prostitution, the incidence of rape decreases (Bisschop, Kastoryano, and van der Klaauw 2017; Cunningham and Shah, 2018). If municipal massage therapist licensing effectively reduces the availability of prostitution, the inverse relationship may hold. We also use the CBP data as an alternative measure of the number of establishments by county. We use firms in the category of “other personal services,” which is the most detailed firm description that most closely matches massage therapy parlors.

5 Identification and estimation

Cities in Kansas, Minnesota, and Oklahoma adopted massage therapist licensing requirements at different times between 1935 and 2019, creating a natural experiment for us to examine the effects of municipal licensing requirements on the incidence of prostitution and then test the policy diffusion hypothesis. Given the differences in timing of the adoption of licensing, the staggered difference-in-differences (DID) with heterogeneous and dynamic treatment effects is perhaps the most suitable way to examine the effects of massage therapy licensure on prostitution offenses. We use recent DID methodological tools that account for differences in timing of treatment to estimate the effects of licensure.

¹³ In addition, we grouped municipalities into quartiles. The results are qualitatively similar.

5.1 Modeling the effects of licensing on prostitution

Using the difference-in-differences approach, we estimate within-state effects of licensing on prostitution offenses. We organize the sample into individual yearly cohorts between 2000 and 2019 for Kansas, Minnesota, and Oklahoma. We then test the results with a between-state analysis using the same cohorts. To account for the possibility of attenuation in the effects over time, we include three different models for the between-state analysis, first limiting the post-licensure period to five years after enactment, then up to ten years, and finally including all available years. We also conduct additional robustness tests using an event study design, an alternative outcome, the incidence of rape, based on previous literature. We also drop police agencies with incomplete information from our sample.

Difference-in-differences is perhaps the most popular approach to estimating the effects of receiving a treatment. In its standard implementation, there are two periods in which some observations receive a treatment. However, in practice, it is rarely the case that treatment happens in only one period. The implementation of the standard DID approach when adoption of treatment is staggered over time is by using a two-way fixed effects (TWFE) model where indicator variables are included for time and the units. However, Goodman-Beacon (2021) and others have shown that there are some uncertainties with the interpretation of TWFE coefficients when the treatment varies in timing and has heterogeneous effects. When the treatment effects are heterogeneous, the TWFE yields biased estimates. Athey and Imbens (2018), de Chaisemartin and D'Haultfœuille (2020), Goodman-Bacon (2021), Sun and Abraham (2021) and others propose solutions to obtain unbiased estimates of the treatment effects when treatment is staggered and effects heterogeneous. In particular, Sun and Abraham (2021) show that when estimating the average treatment effect on the treated (ATT), unbiased group-time estimators can be derived by using controls that are never treated. We adopt cohort average treatment effect (CATT), which is the weighted average estimates

of the treatment cohorts with the weight determined by the share of each cohort in the sample.

We first use the standard difference-in-differences approach to estimate the effects of massage therapist licensing laws on prostitution with the ATT.

$$Prost_{i,t} = \alpha_i + \mu_t + \beta_1 LicensedCity_{i,t} + \beta_2 X_{i,t} + Crimes_{i,t-n} + \epsilon_{i,t} \quad (1)$$

$Prost$ is the incidence of prostitution (crimes per 100,000 residents) in a city and a given year. $LicensedCity$ is a binary indicator (0,1) for a city i that is licensed in year t . Treatment is absorbing, which means that no licensed city switches to unlicensed in the study period. Our parameter of interest is β_1 , which measures the effects of licensure on prostitution crimes. We also include a vector of control variables ($X_{i,t}$) for each city, including city size, the county poverty rate, the number of police officers, suburban status, and metropolitan status. Finally, we include a 3-year moving average of the lagged crime variable ($Crimes_{i,t-n}$, where $n = 3$) to account for pre-treatment crime trends for both the incidence of prostitution and overall violent crime for each city. We cluster standard errors at the state and city levels. We logarithmically transform the dependent variables and the crime variables because of wide variations across cities.¹⁴ $\alpha_i + \mu_t$ are year and city fixed effects. Under the TWFE DID approach, the parameter β_1 captures the dynamic treatment effects of licensure, where the treatment effects can change over time. The typical control group in equation 1 comprises units that are *not yet treated* and *never treated*.

In the CATT model, specification is similar to equation 1. However, the right-hand side is the average treatment effect on the treated for a cohort. We average the left-hand side to generate the average treatment effect. The CATT model allows the treatment effects to be heterogeneous across cohorts.

¹⁴ In addition, we tried zero-inflated negative binomial and zero-inflated Poisson specifications. However, these models did not converge due to the small sample size, and thus were not appropriate for this study.

5.2 Modeling policy diffusion for municipal licensing

We next employ the same TWFE and staggered adoption difference-in-differences approach as above to model the diffusion of licensing policy between cities. To identify cities treated by licensure adoption in other cities, we again organize the sample by city and year. We identify cities located in counties in which another city has adopted licensure. For example, Lenexa, Kansas is in Johnson County. Lenexa did not license massage therapists until 2014, but seven other cities in its county adopted licensure before it. The earliest year of adoption was 1967 (Merriam), followed by 1976 (Overland Park), 1990 (Gardner), 1994 (Mission), 2000 (Leawood), 2009 (Prairie Village), and 2012 (Roeland Park). We use the number of cities in each county that have already adopted massage therapist licensing before year t as the explanatory variable for the spread of licensing. This number varies over time, as it reflects the number of cities that had adopted massage therapist licensing in $t-1$. We then test the likelihood that the unlicensed city adopts licensing in year t using a logistic regression with a binary outcome for each licensed or unlicensed city in an observed year. When a city becomes licensed, it is no longer included as an observation in the following year and instead adds to the count of licensed cities in a county in the following year.¹⁵ We also exclude cities that were licensed prior to the year 2000. We permit counties to have zero licensed cities. We again analyze within-state effects for Kansas, Minnesota, and Oklahoma and then test the effects with the between-state model using a sample from 2000-2019. We first test the model using a 1-year forward lag, a 3-year, and a 5-year forward moving average of the lag on the likelihood of a city adopting licensing. Equation 2 represents the model of licensing diffusion:

¹⁵ We drop cities that cross multiple counties from the analysis. No cities in our sample are the only city in their county.

$$Licensed_{i,t} = \alpha_i + \mu_t + \beta_1 NumberLicensed_{i,t-n} + X_{i,t-1} + Crimes_{i,t-n} + \epsilon_{i,t} \quad (2)$$

Where *Licensed* is a binary indicator for whether a city is licensed in year *t* and *NumberLicensed* is a count variable for how many cities in its county were already licensed in year *t-1*. We include a vector of control variables, relative size of the city, measured as the share of the city's population in the total county population, the number of massage therapist establishments and employment in massage parlors from the proprietary Data Axle data, the proportion of Asian residents in a county using ACS data, and the incidence of prostitution crimes for the previous 3-years in a city.

In addition to testing the policy diffusion model, this analysis also addresses concerns about policy spillovers when cities adopt licensing. For example, massage parlors that are fronts for prostitution might move to nearby unlicensed cities after a city adopts licensing. Law-abiding parlors might also find the licensing requirements onerous and relocate or close their establishments. Cities could also be enticed to implement licensure simply because neighboring cities are licensed, or to deter prostitution from relocating into their localities.

6 Results

We present the results of the models, starting with the effects of massage therapist licensing on prostitution crimes and the policy diffusion hypothesis. In addition, we include some robustness checks using alternative data sets and specifications.

6.1 The effects of municipal massage therapist licensing

6.1.1 The effects on prostitution

We first report the results from the standard difference-in-differences (TWFE) estimate from Equation 1 using licensed cities. Table 4 reports the within-state estimates in Columns 1-3. The between-state estimates with the post-licensure period are reported Columns 4-6. Column 4 shows the results for all periods while Columns 5 and 6 restrict the sample to 10 and 5 years pre- and post-licensing

periods respectively. There are no significant effects on prostitution in either the within or between-state analysis. The results are qualitatively similar all models. We do find a statistically significant association between the incidence of prostitution and the number of police officers and the poverty rate in the between-state analysis, consistent with the literature.

6.1.2 The spread of municipal massage therapist licensing

We report the results for the within-state policy diffusion logistic regression model using the number of licensed cities in a county as a predictive variable for the passage of licensing in unlicensed cities in that county. The spread of licensing is heterogeneous across states. Table 5 shows the results using a 3-year moving average lag of the independent variables (number of other licensed cities, proportion of massage therapist establishments, and prostitution crimes). In the model without county or year fixed effects, the likelihood of licensure adoption if another city within the county adopts increases by 32% in Minnesota, has no significant effects Kansas, and is 97% less likely in Oklahoma. These effects are larger with stepwise inclusion of county and year fixed effects. The effects of other city and county characteristics on adoption are mixed but they have no effect in the fixed effects models. The effects are largely the same between states in Table 6, also reported as the 3-year lag of the moving averages. We next report the results for the between-state staggered adoption policy diffusion logistic regression model in Table 7, using the same organization as in Tables 5 and 6.

We find evidence in all three models that the passage of municipal licensing is significantly associated with increases in the proportion of Asian residents in a county, lending support to an insider-outsider hypothesis for the passage of licensing, as well as evidence that massage therapist licensing is passed in response to social stigmas towards Asian women working in massage parlors (Bungay et al 2013; Brown 2020).

6.1.3 Indirect effects on rape

In addition to our primary analysis consider the effects of licensing on prostitution, we also test the effects of this policy on the incidence of rape, using the same models as for prostitution. Cunningham and Shah (2018) and Bisschop, Kastoryano, and van der Klaauw (2017) found that legalization of prostitution is associated with a reduction in sexual assaults by 30 to 40 percent and female gonorrhea by 39 percent. If licensing removed massage parlors that were fronts for prostitution, we might expect to find effects on rape in the opposite direction. We report these findings in the Appendix A. Figure A5 shows the number of crimes per 100,000 for rape offenses in the three states. We observe no differences in trends between licensed and unlicensed cities before and after the licensing treatment. Figure A6 reports rape offenses for only the licensed cities before and after the implementation of the licensing requirements. We report these results of the TWFE difference-in-differences analysis in Table A1. We find that the passage of municipal licensing has no effects on the number of rape offenses in the TWFE specification. In Table A2, when we allow for dynamic and heterogeneous treatment effects, we also see no effects on rape offenses.

6.2 Robustness tests for the effects of licensing on prostitution

6.2.1 Event study on prostitution offenses

The results presented in 2.1 and 2.2 assume homogeneous treatment effects. In addition, the effects could be dynamic, changing over time for the same treated groups. We follow the approach of Sun and Abraham (2021), implemented in the R programming language by Berge (2018), to estimate the effect of municipal massage therapist licensing on crimes among a cohort of cities with the cohort average treatment effect. In addition to the CATT, we also estimate the ATT. The pooled estimates assume homogeneous treatment effects. Standard errors for all models are robust and clustered at the county and state levels. Solid

lines represent the treatment units while the broken lines represent the control units.

The implementation of Sun and Abraham (2021) involves identifying controls for each cohort. We only report cohorts with enough control units and organize the estimates in figures by decade group. We present individual years within each figure's decade group. Each figure represents the CATT for prostitution and the number of offenses three periods prior to the treatment and for up to four years after. We first conduct the within-state analysis, which uses licensed and unlicensed cities within each state. We estimate the same models for each state. We also repeat the between-state analysis, which uses licensed cities in Kansas, Minnesota, and Oklahoma and compares the results between the three states.

In general, we find no consistent story about the effects of municipal massage therapists licensing on prostitution. Overall, both the ATT and CATT estimates indicate that there are no differences in prostitution that can be attributed to the adoption of massage therapist licensing

The cities included in this study vary widely in terms of observable characteristics and it is likely that the effects of massage therapist licensing requirements consequently also vary. We estimate a two-way fixed effects model which allows for the control of unobserved city- and time- specific effects (Imai and Kim, 2021). We also include a lag of the dependent variable (Ding and Li, 2019). In the two-way fixed effects approach, we control for group- and time fixed effects, including the interactions between the two. The treated unit is the city that adopted licensing. The cohort is represented by the year a city adopted the treatment. The control units are cities that never adopted the treatment, cities that adopted the treatment later and therefore matched to a treatment unit at an earlier date, and cities which are both never treated and not-yet-treated. As another check, we also implemented control groups that included currently licensed cities that were viable control group units for a licensed cohort and

another control group that combined both this group with the untreated unlicensed cities group. We modify the standard difference-in-differences specification to account for heterogeneity in cohorts.

The estimation of the CATT means that each treatment cohort has its own estimates. Non-homogeneity in treatment effects is plausible in the case of massage therapist licensing because the requirements and their enforcement necessarily differ over time and by city. In addition, it is possible that some treatment units anticipate the treatment and therefore adjust their behavior (Athey and Imbens 2018). We assume that treated units anticipate licensing requirements two years before implementation. This is a plausible assumption given that in most jurisdictions, enacted laws may not take effect immediately. When there is anticipation, it means there is a treatment effect in the pre-treatment period, which would violate the parallel trends assumption in the baseline period. We cluster standard errors at the county and city levels. Our results are consistent with the standard and the staggered adoption difference-in-differences approaches.

6.2.2 Additional tests on offenses related to prostitution

The UCR data from the FBI has several known limitations, including incomplete reporting by police agencies between and within years. To further address these concerns, we dropped police agencies which did not report every year from 2000-2019. In a separate test, we dropped observations for county sheriff's offices that covered both licensed and unlicensed cities. Our results did not meaningfully change in magnitude, direction, or significance. We also aimed to evaluate the effects of massage therapist licensing on human trafficking. However, very few agencies report human trafficking data to the FBI data. Only 355 agencies matched on human trafficking out of our base sample of 1,778 agencies. This limits the potential for empirical analysis of human trafficking but is a potential area for future study.

We were also concerned that the UCR data were not fully capturing potential prostitution offenses and public concerns related to prostitution. We first checked Google Trends for spikes in search queries for “prostitution” and “human trafficking” for each licensed city-state combination in our sample, from 2004, the first year Google Trends data is available to 2020, the end of our policy diffusion sample. We found no evidence of spikes in search queries in these cities related to prostitution or human trafficking. Even when the UCR or Google Trends data does not fully capture the incidence of prostitution in a city, we expect that police agencies have an incentive to publicize successful operations through press releases. We therefore also searched the police agencies attached to the licensed cities for press releases publicizing successful operations or stings breaking up prostitution or human trafficking rings. We found no press releases publicizing any such successful operations or stings, including during our sample period, pre-treatment period, or post-treatment period.

The FBI UCR data is the most comprehensive dataset on crime in cities, but the OpenData project also provides detailed crime and arrest data at the street address level. We downloaded and organized data from Minneapolis (which is unlicensed) and St. Paul (which is license), Minnesota to evaluate the viability of this data. However, there were only eight observations for prostitution across the two cities, which did not permit analysis. We also aimed to evaluate the effects of massage therapist licensing on human trafficking. However, very few agencies report human trafficking data to the FBI data. Only 355 agencies matched on human trafficking out of our base sample of 1,778 agencies. This limits the potential for empirical analysis of human trafficking but is a potential area for future study.

6.3 Robustness test of the policy diffusion hypothesis

To account for the prevalence of massage parlors as a determinant of the adoption of licensure, we approximate the relevance of the massage parlor sector

by using the number of establishments from the County Business Patterns (CBP) data. The CBP data from the Census Bureau include the number of establishments by NAICS industry. Massage parlors fall under the “other personal services” industry (81299). We report these results in the Appendix A, Tables A3 and A4, which follows the same approach as in Tables 5 and 6. We find statistically comparable results to the model using the proprietary Data Axle data.

7 Conclusion

Municipal licensing presents a policy challenge between the flexibility of local governments to protect the public’s health and safety, the effectiveness of regulation which has such a limited regional scope, and the burdens placed upon labor market entrants who face a myriad of requirements when moving from city to city. Massage therapists in particular face licensing requirements from city and county licensing agencies even when there are no state licensing requirements. Although massage therapist licensing is often passed to prevent prostitution, we find no evidence that municipal licensing achieves this result. We believe our study is the first to attempt an answer to this question using a novel dataset on municipal licensing requirements for massage therapists.

Our study has a few limitations. We cannot use human trafficking data, as few agencies report human trafficking data to the FBI data. Only 355 agencies matched on human trafficking out of our base sample of 1,778 agencies. Our study also faces the usual constraints faced by all studies which rely on the FBI UCR data, including reporting standards and non-requirements among reporting police agencies. However, our results do not change when we check the robustness of these results by restricting the sample to police agencies which report for all the years in our study, or when we remove county sheriff agencies from our sample.

Although we find no evidence to support the hypothesis that municipal massage therapist licensing reduces crime, we do find evidence to support the

policy diffusion hypothesis. More specifically, we find that municipalities are up to 65% more likely to pass responsive licensing within three years, and 20% within five years of their within-county neighbor doing so. This result is not consistent, however, and adoption is heterogeneous across states. Taken together, there is little support for massage therapist licensing serving its intended public interest purpose.

Licensing is an indirect method of regulating prostitution, and perhaps our result should not be very surprising. Licensing requirements may not be met by people working as prostitutes, prostitution moves to nearby unlicensed cities, or a combination of both. However, we find evidence supporting the policy diffusion hypothesis, lending credence to the argument that licensing does not improve public health and safety outcomes but is passed in response to special interests rather than public interests. If municipalities want to prevent prostitution in massage parlors, other more targeted policy tools such as regular inspections of massage parlors, registration, and background checks may better achieve this regulatory objective.

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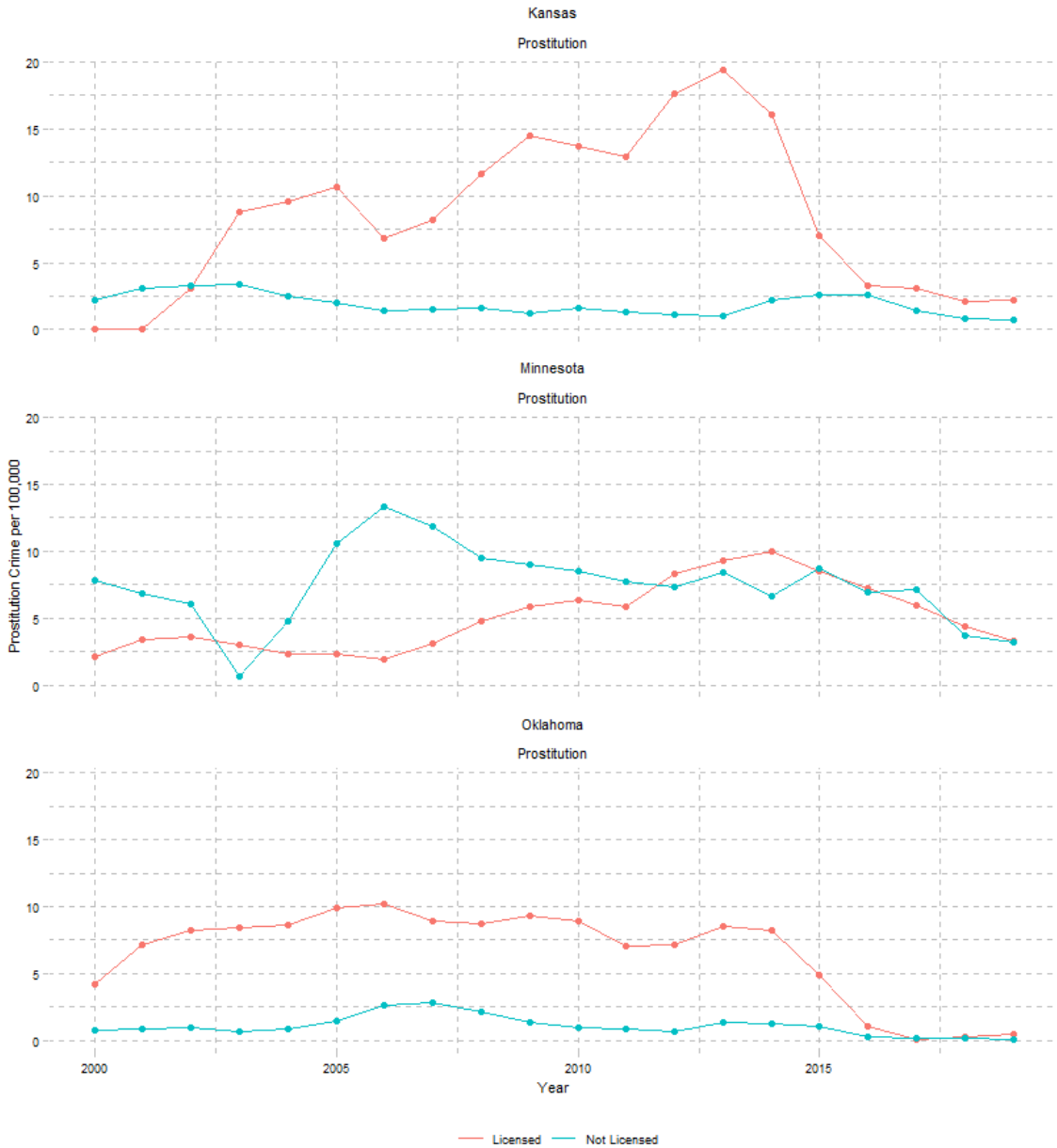
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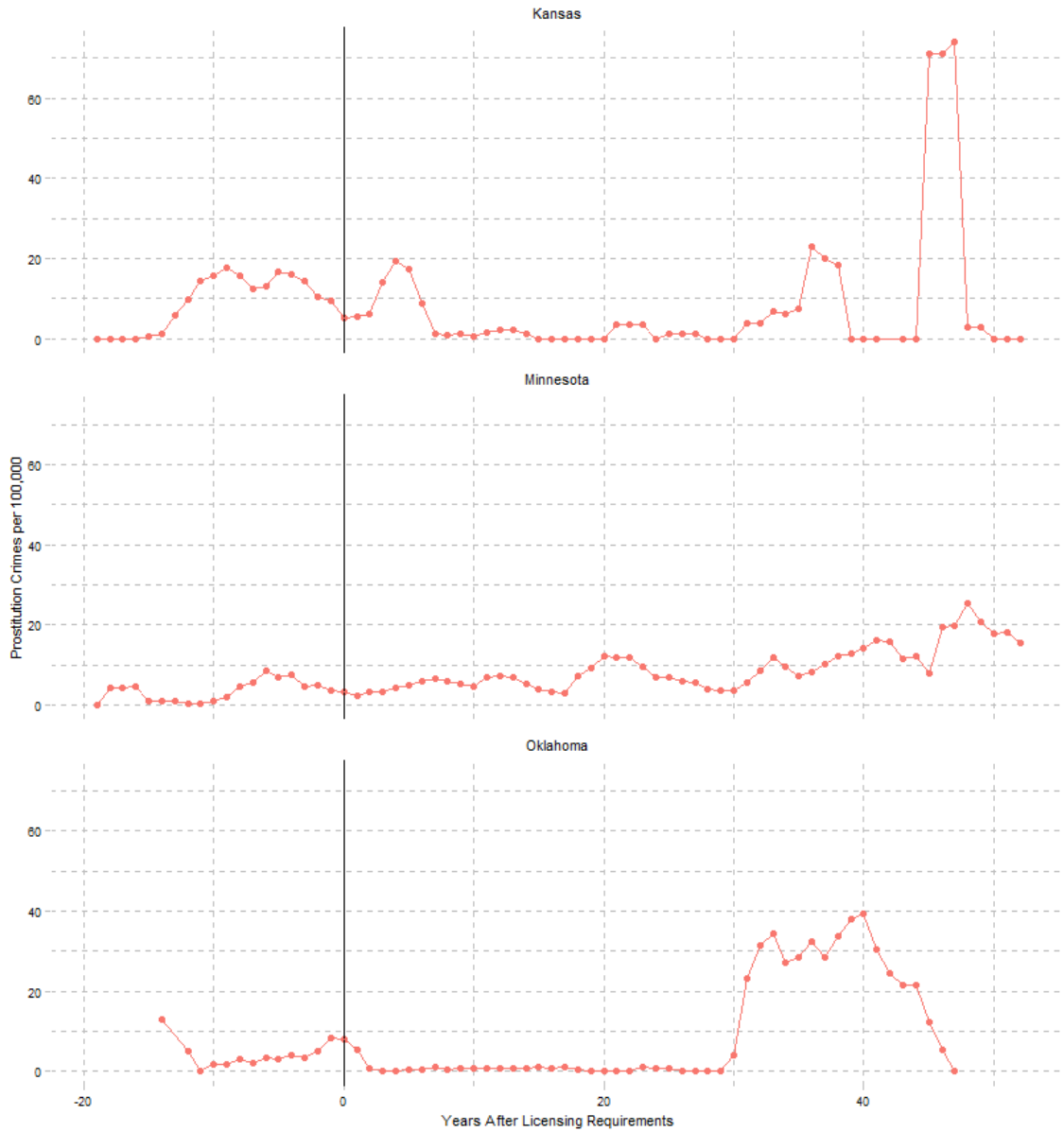
Figures and Tables

Figure 1: Prostitution Offense Trends in Kansas, Minnesota, and Oklahoma, 2000-2019 (3-year MVA)



Notes: Crime rate (3-year moving average) in cities with at least 10,000 residents from 2000-2019.
 Sources: Uniform Crime Reporting (UCR) Program, Federal Bureau of Investigations. Accessed March, 2021; Authors' primary data on city licensure.

Figure 2: Prostitution Offenses Pre- and Post- Massage Therapist Licensing Laws



Notes: Crime rate (3-year moving average) before and after licensure in cities with at least 10,000 residents from 2000-2019. Years after licensure is computed as current year minus the date massage therapist licensure was introduced in the city. Sources: Uniform Crime Reporting (UCR) Program, Federal Bureau of Investigations. Accessed March, 2021; Authors' primary data on city licensure.

Table 1: Descriptive Statistics for the 2000 Cohorts in Kansas, Minnesota, and Oklahoma

	Kansas		Minnesota		Oklahoma	
	Licensed	Not Licensed	Licensed	Not Licensed	Licensed	Not Licensed
Population (k)	45.4 (28.3)	18.4 (8.1)	41.3 (43.4)	29.5 (68.6)	130.4 (184.0)	26.2 (22.6)
City Size (k)						
10 – 25	2 (25%)	13 (76%)	22 (50%)	24 (83%)	3 (33%)	21 (72%)
25 – 50	4 (50%)	4 (24%)	10 (23%)	3 (10%)	2 (22%)	5 (17%)
50 – 100	2 (25%)	0 (0%)	11 (25%)	1 (3.4%)	2 (22%)	3 (10%)
Over 100	0 (0%)	0 (0%)	1 (2.3%)	1 (3.4%)	2 (22%)	0 (0%)
Prostitution	2.7(6.4)	3.5(6.2)	5(9)	17(88)	7(12)	1(6)
Rape	5(6)	10(9)	14(9)	17(15)	9(7)	12(13)
Violent Crime	93(69)	163(94)	126(71)	147(101)	190(173)	144(98)
Years Since Licensing						
Pre-Licensure	6 (75%)	.	34 (77%)	.	6 (75%)	.
0 - 5 Years	0 (0%)	.	3 (6.8%)	.	0 (0%)	.
6 - 10 Years	0 (0%)	.	2 (4.5%)	.	1 (12%)	.
11 - 15 Years	0 (0%)	.	4 (9.1%)	.	0 (0%)	.
16 – 20 Years	0 (0%)	.	0 (0%)	.	1 (12%)	.
20+ Years	2 (25%)	.	1 (2.3%)	.	0 (0%)	.
Unknown	6 (75%)	.	2	23	1	29
Officers	173(29)	191(28)	121(26)	142(31)	178(30)	183(41)
Suburban	5 (62%)	3 (18%)	27 (61%)	14 (48%)	3 (33%)	10 (34%)
MSA	7 (88%)	3 (18%)	40 (91%)	17 (59%)	7 (78%)	14 (48%)
N	8	17	44	29	9	29

Note: Mean values are reported for each statistic; standard deviations are reported in parentheses. Population and city size are reported in thousands.

Source(s): Crime and city characteristics data – UCR (FBI); licensing status – authors' primary data collection.

Table 2: Descriptive Statistics for the 2019 Cohorts in Kansas, Minnesota, and Oklahoma

	Kansas		Minnesota		Oklahoma	
	Licensed	Not Licensed	Licensed	Not Licensed	Licensed	Not Licensed
Population (k)	70.0 (113.9)	18.7 (7.8)	46.6 (47.8)	31.9 (74.8)	86.2 (121.8)	27.8 (26.7)
City Size (k)						
10 – 25	4 (40%)	15 (79%)	14 (34%)	25 (81%)	4 (44%)	23 (70%)
25 – 50	3 (30%)	4 (21%)	14 (34%)	3 (9.7%)	0 (0%)	7 (21%)
50 – 100	2 (20%)	0 (0%)	12 (29%)	2 (6.5%)	3 (33%)	2 (6.1%)
Over 100	1 (10%)	0 (0%)	1 (2.4%)	1 (3.2%)	2 (22%)	1 (3.0%)
Prostitution	2.12 (5.58)	1.29 (3.21)	2.9(6.1)	3.3(12.1)	0.4 (1.3)	0.0 (0.2)
Rape	3(3)	10(13)	16(14)	15(13)	5.3(8.6)	4.6(5.5)
Violent Crime	93(69)	163(94)	126(71)	147(101)	190(173)	144(98)
Years Since Licensing						
Pre-Licensure	1 (10%)	.	3 (7.7%)	.	0 (0%)	.
0 - 5 Years	3 (30%)	.	8 (21%)	.	1 (12%)	.
6 - 10 Years	1 (10%)	.	7 (18%)	.	1 (12%)	.
11 - 15 Years	1 (10%)	.	2 (5.1%)	.	1 (12%)	.
16 – 20 Years	1 (10%)	.	6 (15%)	.	1 (12%)	.
20+ Years	3 (30%)	.	13 (33%)	.	4 (50%)	.
Unknown	1 (10%)	.	2	23	0 (0%)	29
Officers	170(34)	196(32)	127(29)	143(32)	164(36)	183(36)
Suburban	6 (60%)	6 (32%)	24 (59%)	17 (55%)	3 (33%)	15 (45%)
MSA	9 (90%)	6 (32%)	37 (90%)	21 (68%)	7 (78%)	20 (61%)
N	10	19	41	31	9	33

Note: Mean values are reported for each statistic; standard deviations are reported in parentheses. Population and city size are reported in thousands.

Source(s): Crime and city characteristics data –UCR (FBI); licensing status – authors’ primary data collection.

Table 3: Descriptive Statistics for Businesses for the 2000 and 2019 Cohorts in Kansas, Minnesota, and Oklahoma

	Kansas		Minnesota		Oklahoma	
	2000	2019	2000	2019	2000	2019
# Cities in County	1.80 (1.63)	2.45 (1.96)	8.3 (7.0)	8.7 (7.7)	2.92 (2.02)	3.20 (2.69)
# Licensed Cities in County	1.12 (2.01)	1.52 (2.37)	5.5 (4.5)	5.5 (4.4)	1.22 (1.21)	1.20 (1.46)
Proportion of Asian Residents	0.017 (0.012)	0.028 (0.018)	0.032 (0.023)	0.053 (0.036)	0.013 (0.011)	0.022 (0.014)
Poverty Rate in County	8.716 (3.13)	10.66 (3.67)	6.11 (8.29)	8.29 (2.61)	12.86 (3.25)	14.13 (3.64)
Proportion of Other Personal Services (Data Axle)	0.0012 (0.0013)	0.0009 (0.0014)	0.0022 (0.0011)	0.0025 (0.0017)	0.0025 (0.0011)	0.0011 (0.0014)
Establishments (Data Axle)	13 (18)	26 (35)	44 (52)	63 (69)	19 (28)	31 (42)
Employees (Data Axle)	55 (85)	119 (190)	265 (355)	301 (332)	117 (220)	118 (171)
N (Data Axle)	25	29	76	76	49	50
Proportion of Other Personal Services (CBP)	0.0017	0.0017	0.0026	0.0031	0.0028	0.0018
Establishments (CBP)	17 (14)	29 (27.9)	45 (45)	60 (54)	28 (25)	29 (25)

Note: Mean values are reported for each statistic; standard deviations are reported in parentheses. Population and city size are reported in thousands.
 Source(s): Crime and city characteristics data –UCR (FBI); licensing status – authors’ primary data collection; business establishments – Data Axle, CBP (US Census Bureau).

Table 4: The Effects of Massage Therapists Licensing on Prostitution (TWFE Model)

	(1)	(2)	(3)	(4)	(5)	(6)
	Kansas	Minnesota	Oklahoma	All Years	10 Years	5 Years
Licensed City	0.343 (0.286)	-0.231 (0.194)	-0.778 (0.672)	-0.185 (0.169)	-0.306 (0.254)	-0.606 (0.629)
Poverty Rate	-0.021 (0.036)	0.017 (0.016)	0.026 (0.015)	0.027* (0.012)	0.0001 (0.014)	-0.001 (0.014)
# Officers	0.003 (0.003)	0.006 (0.003)	0.001 (0.002)	0.003* (0.001)	0.004 (0.002)	0.009* (0.005)
Observations	570	1,551	824	2,945	785	671
R2	0.57	0.52	0.75	0.54	0.50	0.52
Within R2	0.22	0.14	0.35	0.14	0.16	0.15

Note: $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. (4) All years after the introduction of massage therapist licensure; (5) Up to ten years after the introduction of massage therapist licensure; (6) Up to five years after the introduction of massage therapist licensure. All models include city (agency), year, state fixed effects, and lag of crimes; lag of crimes and the number of officers variables are defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data collection; poverty rate – Small Area Poverty Estimates, 2000-2019 (US Census Bureau).

Table 5: Adoption of Massage Therapist Licensure, Within State (3-year MVA Lag)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Kansas	Minnesota	Oklahoma	Kansas	Minnesota	Oklahoma	Kansas	Minnesota	Oklahoma
# Licensed Cities	0.121 (0.228)	0.285*** (0.079)	-3.50*** (0.510)	-0.407 (0.626)	0.499** (0.167)	-3.08*** (0.879)	-1.64* (0.703)	0.485** (0.166)	-23.0*** (1.96)
% Asian Residents	23.2 (28.8)	18.8*** (0.057)	-331.5*** (64.3)	57.0 (252.1)	55.1*** (11.0)	-58.5 (88.3)	316.1 (587.7)	45.0 (43.4)	
# Other Personal Services Est.	-0.016 (0.019)	-0.013*** (0.003)	0.085*** (0.008)	0.009 (0.108)	0.008 (0.009)	0.064*** (0.019)	-0.275 (0.362)	-0.020 (0.026)	0.911 (0.843)
Relative City Size (%)	-7.14 (5.10)	1.83*** (0.475)	-660.3*** (150.3)	-53.8 (55.8)	1.80 (1.14)	-676.9*** (164.6)	-85.5 (56.8)	2.31* (1.11)	-3,251.2 (4,333.6)
Prostitution Crimes	-0.185*** (0.018)	0.026 (0.258)	1.97*** (0.216)	-0.083 (0.058)	0.009 (0.264)	2.30*** (0.223)	-0.070 (0.590)	-0.080 (0.309)	3.80 (4.43)
Population	0 (0)	0 (0)	0.0009*** (0.0002)	0.0001 (0.0001)	0 (0)	0.0009*** (0.0002)	0 (0)	0 (0)	0.004 (0.006)
County FE	N	N	Y	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	N	N	Y	Y	Y
Observations	237	942	488	165	868	248	55	610	40
Pseudo R2	0.08	0.04	0.44	0.14	0.07	0.39	0.16	0.06	0.56
BIC	89.8	262.7	63.7	90.5	299.2	64.1	87.8	363.1	42.6

Note: p < 0.001; ** p < 0.01; * p < 0.05. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. All independent variables shown are lagged 3-year moving averages. All models include data for 2000-2019.

Source(s): Crime and city characteristics data – Uniform Crime Reporting, 2000-2019, (FBI); licensing status – authors’ primary data; additional demographic data – Small Area Income and Poverty Estimates, 2000-2019 (US Census Bureau).

Table 6: Adoption of Massage Therapist Licensure Between States (3-year MVA Lag)

	(1)	(2)	(3)
# Licensed Cities	0.143*** (0.029)	0.011 (0.151)	0.234 (0.123)
% Asian Residents	12.3*** (3.56)	62.2*** (3.08)	23.4 (29.9)
# Other Personal Services Est.	-0.008*** (0.002)	-0.0008 (0.011)	-0.010 (0.008)
Relative City Size (%)	-0.152 (0.240)	2.18 (1.13)	2.27* (1.11)
Prostitution Crimes	0.140 (0.145)	0.068 (0.164)	0.009 (0.190)
Population	0 (0)	0 (0)	0 (0)
County FE	N	Y	Y
Year FE	N	N	Y
Observations	1,667	1,281	974
Pseudo R2	0.04	0.06	0.06
BIC	363.4	424.7	497.7

Note: $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. All independent variables shown are lagged 3-year moving averages. All models include data for 2000-2019.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data; additional establishment data – County Business Patterns (US Census Bureau), Data Axle.

Table 7: Effects of Licensure on Prostitution (Staggered Adoption Model)

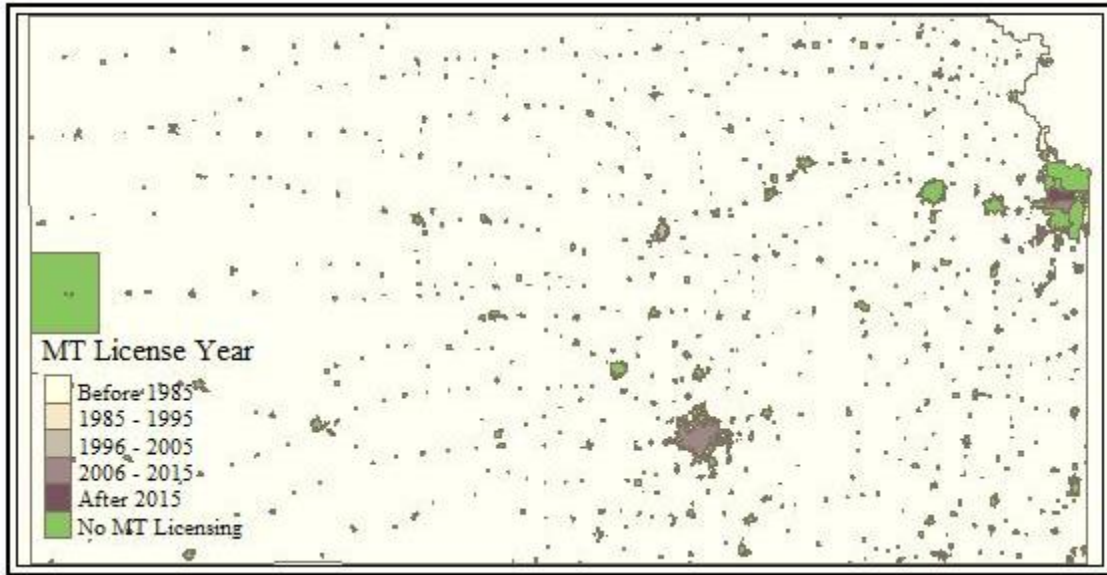
	(1)	(2)	(3)	(4)	(5)	(6)
	Kansas	Minnesota	Oklahoma	All Years	10 Years	5 Years
Licensed City	0.405 (0.439)	0.098 (0.114)	0.102 (0.179)	0.183 (0.136)	0.065 (1,366.8)	-0.257 (0.239)
Poverty Rate	-0.428 (0.261)	0.016 (0.024)	0.024 (0.040)	0.027 (0.019)	0.011 (0.026)	0.011 (0.025)
# Officers	-0.017 (0.013)	-0.009 (0.008)	0.008 (0.011)	0.002 (0.005)	0.002 (0.007)	0.001 (0.012)
Observations	183	907	220	1,310	784	670
R2	0.89	0.61	0.91	0.64	0.67	0.67
Within R2	0.72	0.38	0.66	0.34	0.44	0.43

Note: $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. All models show effects for all years after licensure. All models include city (agency), year, state fixed effects, and lag of crimes; lag of crimes and the number of officers variables are defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. Models (4), (5), and (6) restrict crime data to all available data, pre-licensing and up to 10 years after licensure, and pre-licensing and up to five years after licensure respectfully.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data; poverty rates – Small Area Income and Poverty Estimates, 2000-2019 (US Census Bureau).

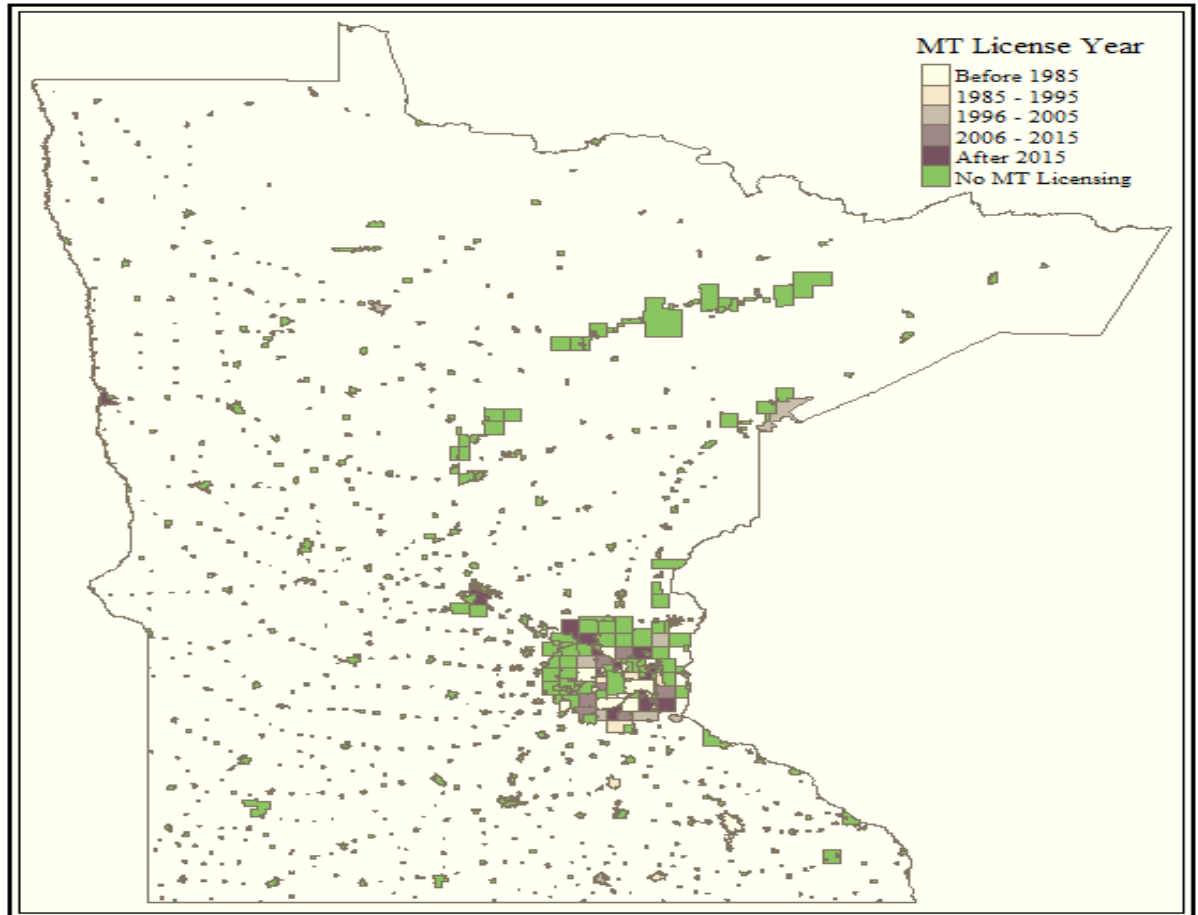
Appendix A

Figure A1: Licensed Cities in Kansas by Year of Licensure



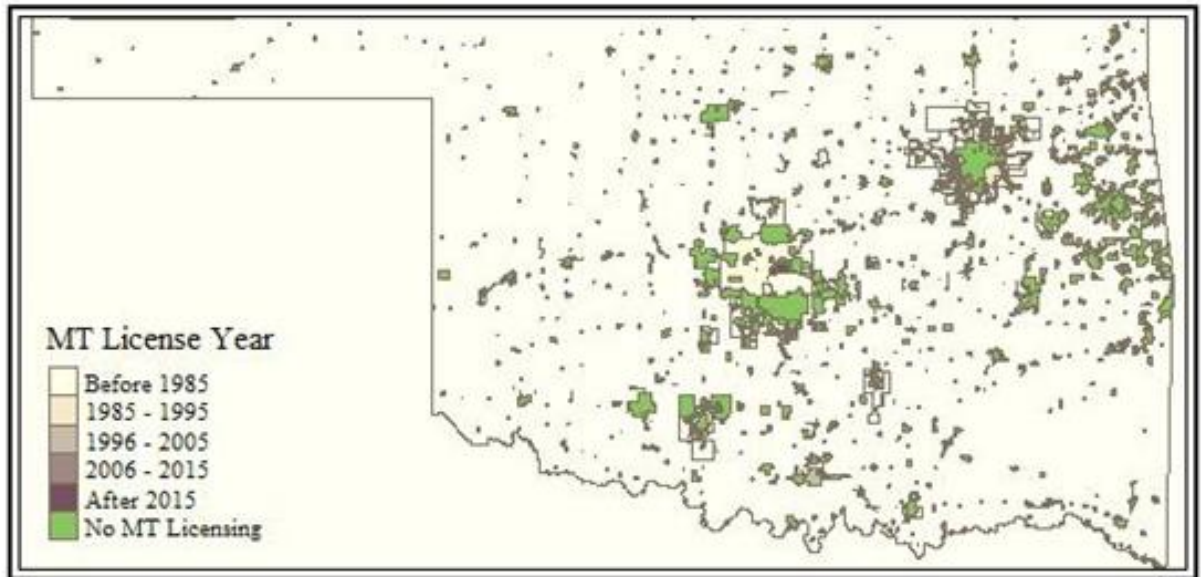
Note: Cities in darker browns were licensed more recently. Cities in green are unlicensed.

Figure A2: Licensed Cities in Minnesota by Year of Licensure



Note: Cities in darker browns were licensed more recently. Cities in green are unlicensed.

Figure A3: Licensed Cities in Oklahoma by Year of Licensure



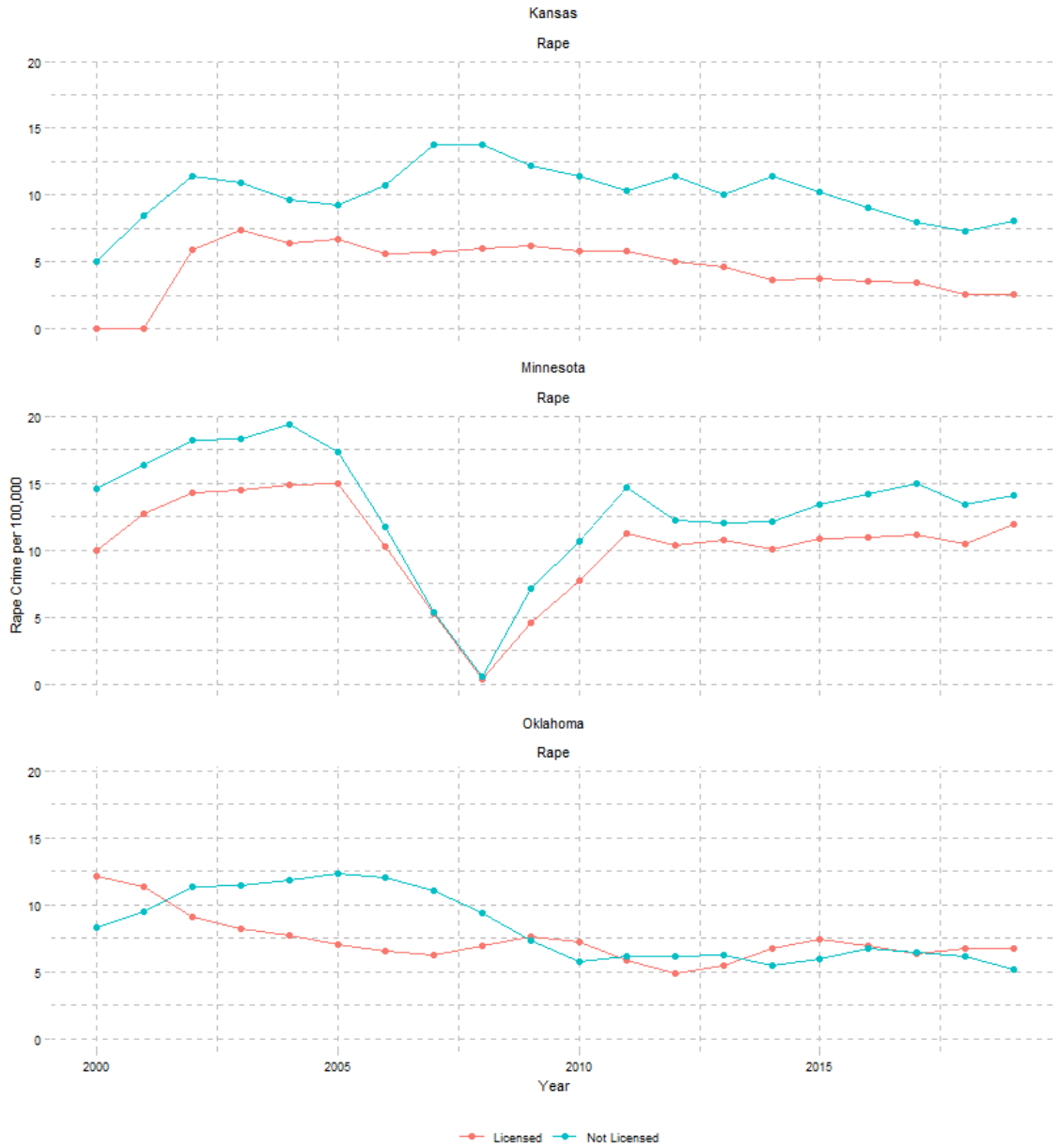
Note: Cities in darker browns were licensed more recently. Cities in green are unlicensed.

Figure A4: Poverty Rate by Licensure Status and City Size



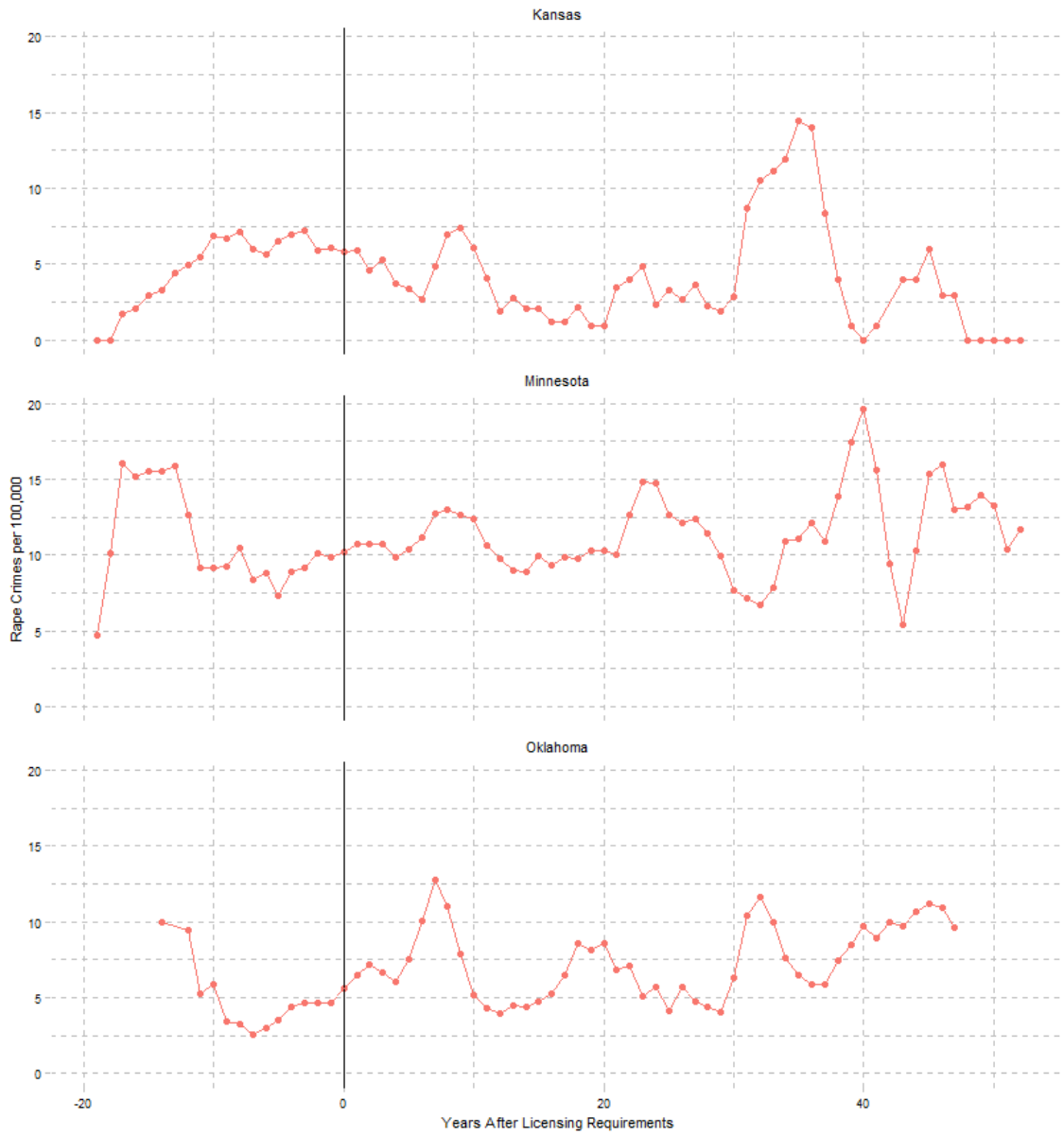
Notes: County poverty rate from 2000 to 2019.
 Source: Small Area Poverty Estimates, 2000-2019, (US Census Bureau); Authors' primary data on city licensure.

Figure A5: Rape Offense Trends in Kansas, Minnesota, and Oklahoma, 2000-2019



Notes: Crime rate (3-year moving average) in cities with at least 10,000 residents from 2000-2019.
Sources: Uniform Crime Reporting (UCR) Program, Federal Bureau of Investigations. Accessed March, 2021; Authors' primary data on city licensure.

Figure A6: Rape Offenses Pre- and Post- Massage Therapist Licensing Laws



Notes: Crime rate (3-year moving average) before and after licensure in cities with at least 10,000 residents from 2000-2019. Years after licensure is computed as current year minus the date massage therapist licensure was introduced in the city. Sources: Uniform Crime Reporting (UCR) Program, Federal Bureau of Investigation. Accessed March, 2021; Authors' primary data on city licensure.

Table A1: Robustness Test - Effects of Massage Therapists Licensing on Rape

	(1)	(2)	(3)	(4)	(5)	(6)
	Kansas	Minnesota	Oklahoma	All Years	10 Years	5 Years
Licensed City	0.211 (0.263)	0.097 (0.257)	0.586 (0.680)	0.186 (0.208)	0.298 (0.262)	0.875 (0.536)
Poverty Rate	0.091 (0.066)	-0.012 (0.014)	0 (0.022)	0.016 (0.015)	-0.01 (0.024)	-0.007 (0.023)
# Officers	0.004 (0.003)	-0.002 (0.003)	0.002 (0.006)	0.001 (0.001)	-0.001 (0.003)	-0.002 (0.004)
Observations	570	1,551	824	2,945	785	671
R2	0.43	0.58	0.42	0.4	0.56	0.56
Within R2	0.14	0.05	0.09	0.06	0.07	0.08

Note: *** p < 0.001; ** p < 0.01; * p < 0.05. All models show effects for all years after licensure. All models include city (agency), year, state fixed effects, and lag of crimes; lag of crimes and the number of officers variables are defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. Models (4), (5), and (6) restrict crime data to all available data, pre-licensing and up to 10 years after licensure, and pre-licensing and up to five years after licensure respectfully.

Source(s): Crime and city characteristics data – UCR , 2000-2019, (FBI); licensing status – authors’ primary data; poverty rates – Small Area Income and Poverty Estimates, 2000-2019 (US Census Bureau)

Table A2: Robustness Test - Indirect Effects of Licensure on Rape Offenses

	(1)	(2)	(3)	(4)	(5)	(6)
	Kansas	Minnesota	Oklahoma	All Years	10 Years	5 Years
Licensed City	0.089 (0.512)	-0.001 (0.072)	0.130 (0.151)	-0.236* (0.087)	-0.024 (609.8)	0.281 (451.1)
Poverty Rate	-0.278 (0.501)	-0.003 (0.023)	-0.016 (0.032)	-0.008 (0.018)	-0.004 (0.022)	-0.003 (0.022)
# Officers	-0.007 (0.013)	0.008 (0.008)	0.0002 (0.009)	0.001 (0.004)	-0.004 (0.006)	0.001 (0.009)
Observations	183	907	220	1,310	784	670
R2	0.86	0.76	0.86	0.67	0.74	0.74
Within R2	0.72	0.40	0.68	0.35	0.46	0.46

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. All models show effects for all years after licensure. All models include city (agency), year, state fixed effects, and lag of crimes; lag of crimes and the number of officers variables are defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. Models (4), (5), and (6) restrict crime data to all available data, pre-licensing and up to 10 years after licensure, and pre-licensing and up to five years after licensure respectfully.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data; poverty rates – Small Area Income and Poverty Estimates, 2000-2019 (US Census Bureau)

Table A3: Robustness Test – Adoption of Massage Therapist Licensure (CBP Data), Within States, 3-year lag

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Kansas	Minnesota	Oklahoma	Kansas	Minnesota	Oklahoma	Kansas	Minnesota	Oklahoma
# Licensed Cities	0.088 (0.345)	0.269* (0.133)	-7.10 (5.97)	-0.805 (0.524)	0.652*** (0.197)	-12.6*** (3.73)	-1.68 (2.01)	0.573 (0.294)	-11.6 (7.17)
% Asian Residents	-21.0 (46.9)	19.1* (8.82)	1,502.3 (1,250.6)	232.4 (232.1)	43.1* (17.7)	4,162.8*** (596.6)	10.0 (465.8)	14.1 (28.5)	
# Other Personal Services Est.	0.006 (0.088)	-0.019 (0.010)	-0.837 (0.809)	-0.149 (0.154)	-0.013 (0.017)	-2.63*** (0.268)	-0.192 (0.181)	-0.074* (0.034)	0.819 (1.00)
Relative City Size (%)	-8.71 (8.35)	1.67 (0.873)	-429.3 (339.5)	-64.1 (49.5)	1.74 (1.38)	-1,159.3** (440.2)	-116.7 (93.4)	2.45 (1.37)	-3,251.3 (3,299.0)
Prostitution Crimes	-0.188 (0.468)	-0.008 (0.247)	1.30 (1.03)	-0.249 (0.221)	-0.001 (0.169)	1.36*** (0.052)	-0.124 (0.684)	-0.173 (0.371)	3.80 (3.55)
Population	0 (0)	-0 (0)	0.0006 (0.0005)	0.0001 (0)	-0 (0)	0.002** (0.0006)	0.0002 (0.0002)	-0 (0)	0.004 (0.004)
County FE	N	N	N	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	N	N	Y	Y	Y
Observations	237	942	488	165	868	248	55	610	40
Pseudo R2	0.08	0.04	0.43	0.16	0.06	0.50	0.17	0.07	0.56
BIC	89.8	262.5	64.3	89.1	302.2	60.3	87.6	360.7	42.6

Note: *** p < 0.001; ** p < 0.01; * p < 0.05. All models show effects for all years after licensure. All models include lag of variables defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. All models use all available data.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data; establishment data – County Business Patterns, 2000-2019 (US Census Bureau).

**Table A4: Robustness Test - Adoption of Massage Therapist Licensure (CBP Data),
Between States**

	(1)	(2)	(3)
# Licensed Cities	0.144* (0.072)	12.1*** (0.366)	12.1*** (0.670)
% Asian Residents	14.5* (6.29)	56.7*** (13.1)	26.5 (21.9)
# Other Personal Services Est.	-0.008 (0.005)	0.018 (0.019)	0.013 (0.025)
Relative City Size (%)	-0.185 (0.385)	2.20 (1.86)	2.35 (1.45)
Prostitution Crimes	0.131 (0.156)	0.059 (0.150)	0.029 (0.133)
Population	0 (0)	0 (0)	0 (0)
County FE	N	Y	Y
Year FE	N	N	Y
Observations	1,548	1,064	827
Pseudo R2	0.04	0.06	0.06
BIC	349.3	395.2	471.0

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. All models show effects for all years after licensure. All models include city (agency), year, state fixed effects, and lag of crimes; lag of crimes and the number of officers variables are defined as the three-year moving average for each variable. All standard errors are robust (heteroskedasticity-and autocorrelation consistent), and clustered by state and agency. All models use all available data.

Source(s): Crime and city characteristics data – UCR, 2000-2019, (FBI); licensing status – authors’ primary data; establishment data – County Business Patterns, 2000-2019 (US Census Bureau).