Does Universal Occupational Licensing Recognition Improve Patient Access? Evidence from Physician Labor Supply and Healthcare Utilization

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Abstract

This study examines the effects of universal reciprocity of out-of-state physician licenses on state-level physician labor supply, healthcare access, and utilization. We provide new evidence on how expanding legal eligibility for licensing reciprocity affects these outcomes. Using variations from staggered policy adoption across states in a difference-in-differences framework, we show that adopting universal reciprocity increases the share of out-of-state practice physicians but not interstate migration and increases access and utilization of healthcare services. In addition, we show that residency requirements for licensing reciprocity prevent increases in these outcomes and provide evidence that the estimated effects are driven by physician-specific reciprocity rather than broader contemporaneous policy changes. Our findings suggest that expanding legal eligibility for interstate practice facilitates cross-state physician practice and increases access and utilization of healthcare services.

Keywords: occupational licensing, universal licensing recognition, healthcare access, healthcare utilization, physician labor supply

JEL Classification: I11, I18, J44, J48, J61

1 Introduction

State- and local-level policies on occupational licenses that restrict licensed workers' ability to supply labor across jurisdictions are often criticized for limiting labor mobility and reducing market competition (Kleiner, 2000). Such restrictions may be particularly acute in healthcare, where demand for physician services is growing faster than the physician workforce as a consequence of an aging population and regulations (Kirch and Petelle, 2017). Although it does not increase the overall number of physicians, adopting reciprocity of physician licenses may increase the regional availability of physicians by allowing cross-state practice without state-specific re-licensure (Steinbrook, 2014).

Universal licensing recognition (ULR) is a comprehensive policy reform that allows out-of-state licensed workers to practice without a state-specific re-licensure process. Recent studies show that ULR increases interstate migration and thereby increases the state-level labor supply of licensed workers (Deyo and Plemmons, 2022). Yet, little is known about how ULR affects labor supply adjustments and consumer welfare in highly regulated professional labor markets such as physician services. Furthermore, the Interstate Medical Licensure Compact (IMLC), a preexisting and less comprehensive reform with more restrictive eligibility requirements for reciprocity, makes measuring the impact of ULR more difficult.

In this study, we evaluate the impact of universal reciprocity of physician licenses on the state-level physician labor supply and healthcare access and utilization at the extensive margin. Leveraging staggered adoption of ULR across states that previously adopted IMLC, we implement a Callaway-Sant'Anna (2021) staggered difference-in-differences design to estimate the effect of expanding legal eligibility for physician license reciprocity outcomes. We use physician-level datasets from the Centers for Medicare & Medicaid Services to examine changes in state-level

physician labor supply via interstate migration and out-of-state practices and use the Behavioral Risk Factor Surveillance System and the Survey of Income and Program Participation datasets to examine changes in healthcare access and utilization at the state level.

To preview our findings, we show that the share of out-of-state practice physician services increased after adopting the universal reciprocity of physician licenses but not interstate migration. We also show increases in the shares of individuals who report having a personal healthcare provider and who have visited a doctor at least once in the past 12 months. Our results show that residency requirements for licensing reciprocity serve as barriers to increasing out-of-state practice physicians and healthcare access and utilization. We also provide evidence that the estimated effects are driven by universal reciprocity of physician licenses rather than other contemporaneous factors associated with broader ULR adoption.

Our study provides three contributions to the literature on occupational regulations and health and labor policy. First, we provide theoretical and empirical evidence that the healthcare sector's unique regulatory barriers and job characteristics lead to labor market outcomes that differ from those of other licensed occupations. Although the healthcare sector provides essential services that require high standards of consumer protection, some regulations in this sector may be overly restrictive, leading to reduced labor supply, limited access to healthcare, and lower consumer welfare. On the other hand, physicians are capable of remote service (i.e., telehealth) and traveling physician practices across states (i.e., locum tenens) that are less common work options among other occupations. Reflecting these sector-specific factors, we show that reciprocity of physician licenses increases the state-level labor supply through physicians who generate greater out-of-state workers through traveling temporary physicians rather than through interstate migration.

Second, this is the first study to provide evidence of the consumer-welfare consequences of reciprocity of out-of-state licenses. Although the first licensing reciprocity program, the Nurse Licensure Compact, was implemented in 2000, its impact on consumer welfare had only been theorized. We utilize multiple datasets to provide empirical evidence of the influence of these policies.

Third, our theoretical and empirical evidence adds to the economic literature that relaxing regulatory constraints increases labor supply. Incorporating both ULR and IMLC is a more comprehensive approach to capturing the effect of relaxing regulatory constraints at the extensive margin – physicians from both IMLC member and non-member states become eligible – and at the intensive margin – eligibility requirements for reciprocity become substantially less stringent – resulting in greater availability of physician services through fewer regulations. Reflecting this comprehensive approach, our study provides results at the state level that are consistent with what previous literature has shown; greater relaxation of regulatory barriers can increase labor supply and enhance consumer welfare.

The remainder of this paper is organized as follows. In Section 2, we present a background on recent changes in physician licensing reciprocity regulations. In Section 3, we provide our theoretical explanations of how universal reciprocity of physician licenses increases state-level physician labor supply by increasing out-of-state practices and present our hypotheses. In Section 4, we explain the data and empirical strategies. In Section 5, we outline the results and their implications. In Section 6, we summarize the findings and potential policy implications and discuss the limitations and suggestions for future studies.

2 Background on Reciprocity Policies of Physician Licenses

The supply restriction effects of occupational licensing requirements are well documented, both at the national and occupation levels (Kleiner, 2016; Bae et al., 2025; Carollo et al., 2025; Oh, 2025). Economic theory suggests that occupational licensing restricts labor supply, produces a wage premium for licensed workers, and increases prices for consumers (Kleiner and Krueger, 2013; Oh and Kleiner, 2025). By contrast, relaxing licensing requirements has resulted in a reduction in prices, with no effect on service quality in healthcare (Kleiner et al., 2016).

Over the last decade, there have been multiple efforts to introduce reciprocity of out-of-state physician licenses. The Interstate Medical Licensure Compact (IMLC) was the earlier reform that allows physicians licensed in other IMLC member states to practice without completing state-specific re-licensure processes (Steinbrook, 2014). These processes involve multiple administrative procedures (e.g., fingerprint-based background checks), various fees, and a long processing time. Therefore, policymakers expected that the compact would reduce interstate licensing barriers and increase the regional availability of physician services (Peterson et al., 2014; Chaudhry et al., 2015).

However, the coverage of this reciprocity is limited to the physicians licensed in IMLC member states. Therefore, physicians licensed in non-member states are not eligible for interstate reciprocity, although the IMLC board recognizes that approximately 80% of U.S. physicians meet the IMLC's reciprocity requirements (Adashi et al., 2021). Furthermore, stringent eligibility requirements, such as no history of disciplinary actions and exam attempt limits, permanently disqualify a significant proportion of physicians from license reciprocity through IMLC (Jolin et al., 2024).

From the late 2010s onward, an increasing number of states adopted the Universal

Licensing Recognition (ULR), a policy reform that allows out-of-state licensed workers in selected occupations to practice without having to go through state-specific re-licensure processes (Norris, 2024). The ULR is a similar policy reform to the IMLC in that it waives the re-licensure processes for out-of-state licensed workers. However, ULR is a more comprehensive reform that expands legal eligibility for reciprocal licensure beyond the set of physicians covered by IMLC. It adopts the reciprocity of licenses for the selected occupations regardless of the states of licensure, as long as licensees meet the qualifications, such as a similar scope of practice, substantially equivalent education and experience, and, sometimes, in-state residency (Shakya et al., 2024). Table 1 provides more detailed information about the similarities and differences between the Interstate Licensure Compact and ULR.

Furthermore, because ULR's eligibility requirements are substantially less stringent than those for IMLC, physicians licensed in IMLC member states but ineligible for reciprocity under IMLC could nevertheless qualify for reciprocity under ULR. Table 2 provides a more detailed comparison of the regulations, eligibility requirements, and application processes between IMLC and ULR. Therefore, adopting ULR increases the share of physicians eligible for license reciprocity by expanding legal eligibility, both at the extensive (i.e., physicians licensed in IMLC non-member states) and intensive margin (i.e., physicians licensed in IMLC member states but not eligible for reciprocity through IMLC).

Previous studies show that ULR increases labor supply primarily through interstate migration and reduces labor costs among licensed occupations (Deyo and Plemmons, 2022). However, these studies evaluated the impact of ULR on licensed occupations in general and therefore did not address the unique aspects – the regulatory and institutional barriers and job characteristics – of a single occupation such as physicians. For instance, more than 50 percent of

physicians are bound by full or partial no moonlighting clauses: full clauses completely ban secondary employment, while partial clauses restrict physicians from working for nearby hospitals or healthcare providers during their employment (Novinson and Kim, 2021). The partial clauses lead physicians to seek secondary employment opportunities by providing healthcare services to geographically distant patients, likely in locations outside physicians' primary states of employment (Oh and Kleiner, 2026).

Furthermore, compared to other occupations, physicians can supply services across jurisdictions without changing their state of residence. Advances in technology allow physicians to provide telehealth services to patients without physically traveling across state lines (Shachar et al., 2024). Furthermore, although locums still travel to different states, hospitals are willing to cover the travel expenses because they are still able to profit from locums (Cross et al., 2024). ULR contributes to simplifying the state-specific re-licensure process required for these out-of-state practices and increasing the number of physicians eligible for license reciprocity. This may increase the effective state-level supply of physician-provided healthcare services, physically or virtually, through increased out-of-state practices without requiring interstate migration.

However, there are two additional questions related to ULR. First, some states impose residency requirements for universal reciprocity. These requirements would not be a significant issue for most licensed workers, because they permanently migrate to those states; ULR serves as a time-saver by removing the state-specific re-licensure processes (Deyo and Plemmons, 2022). Yet, because we hypothesize that adoption of ULR increases physicians' out-of-state practice that does not involve interstate migration, residency requirements may serve as a barrier to universal reciprocity and thereby limit state-level labor supply. Second, some states that adopted ULR did not include physician licenses for universal reciprocity. If the estimated effects of ULR are driven

by the universal reciprocity of physician licenses but not other contemporaneous factors associated with broader ULR adoption, then these states may not experience an increase in state-level physician labor supply. Therefore, we hypothesize that we do not observe an increase in state-level physician labor supply through out-of-state practices among the states that imposed residency requirements or adopted ULR but did not include physician licenses for universal reciprocity.

3 Theoretical Models

In this section, we present a theoretical model explaining how the adoption of ULR increases the regional labor supply of physicians by changing physicians' decision to start out-of-state practices. This is a simple partial equilibrium model that is an adaptation of Johnson and Kleiner's (2020) model, explaining the role of occupational licensing in interstate migration. In this model, physicians choose whether to (a) stay in the current labor market, (b) migrate to a new labor market, and (c) start out-of-state practices. We assume that physicians are perfectly certain about the earnings from staying (w_s), migrating (w_m), and starting out-of-state practices (w_t). Costs are involved in choosing migration or starting out-of-state practices. For simplicity, we assume that there is no cost related to the loss or accumulation of human capital and a monetary cost related to traveling for out-of-state practices and migrating: a one-time cost covered by employers. Then, physicians' costs of migration include the re-licensure ($c_{relicense}$) and other time costs and disutility from migration ($c_{migration}$). Similarly, physicians' cost of starting out-of-state practices includes $c_{relicense}$.

Because of the restrictions on moonlighting for nearby healthcare providers, starting out-of-state practices is the only option to raise earnings by working more. If physicians decide to start out-of-state practices, they spend additional work hours $T_t > 0$ for the out-of-state employers they

work for. In addition, physicians are subject to idiosyncratic preference shocks ε_s, ε_m, and ε_t, which tilt preferences toward staying, migrating, and starting out-of-state practices, respectively, and these preference shocks are dispersed at the scale of γ, which follows standard Gumbel distributions, independently of each other and identically distributed across groups. Lastly, δ_{time} is an increasing function of time that denotes the disutility from working longer: $\delta_{time} > 0$ if $1 + T_t > 1$. Note that $\delta_{time} < c_{migration}$, indicating that the disutility from out-of-state practices is smaller than the disutility from migrating.

Then, the utilities of staying (U_s), migrating (U_m), and starting out-of-state practices (U_t) are given by the following expressions:

$$U_s = w_s + \gamma\varepsilon_s$$

$$U_m = w_m - c_{relicense} - c_{migration} + \gamma\varepsilon_m$$

$$U_t = w_s + T_t w_t - c_{relicense} - \delta_{time} + \gamma\varepsilon_t.$$

Before adopting the reciprocity of out-of-state licenses, $c_{relicense} > 0$ and is large enough to discourage physicians from migrating or starting out-of-state practices (i.e., $U_s > U_m$ and $U_s > U_t$). Assume the preference shocks ε_s, ε_m, and ε_t are zero at means, then we can express as

$$U_s > U_m \;\Rightarrow\; c_{relicense} + c_{migration} > w_m - w_s, \text{ and}$$

$$U_s > U_t \;\Rightarrow\; c_{relicense} + \delta_{time} > T_t w_t.$$

In other words, the disutility and cost associated with migrating or starting out-of-state practices outweigh the additional earnings generated by these alternatives, making physicians more likely to remain in their current labor market. On the other hand, adopting reciprocity removes the re-licensure cost (i.e., $c_{relicense} = 0$), making migration and out-of-state practices more attractive. Because $\delta_{time} < c_{relocation}$, physicians start out-of-state practices instead of migrating to potential destinations (i.e., $U_t > U_s$ and $U_t > U_m$). Assume that the preference shocks ε_s, ε_m, and

ε_t are zero at the means; then we can express as

$$U_t > U_s \;\Rightarrow\; T_t w_t > \delta_{time}, \text{ and}$$

$$U_t > U_m \;\Rightarrow\; w_s + T_t w_t - w_m > \delta_{time} - c_{migration}.$$

In other words, removing re-licensure costs increases the net return to out-of-state practices, making it more attractive than both remaining in the current labor market or migrating to another state.

We can calculate the log rates of starting out-of-state practices before and after adopting the reciprocity of out-of-state licenses as:

$$\log(OSP_{Before}) = (1/\gamma)[(1 - T_s)w_s + T_t w_t - c_{relicense} - \delta_{time} - w_s]$$

$$= (1/\gamma)[T_t w_t - T_s w_s - c_{relicense} - \delta_{time}]$$

$$\log(OSP_{After}) = (1/\gamma)[(1 - T_s)w_s + T_t w_t - \delta_{time} - w_s] = (1/\gamma)[T_t w_t - T_s w_s - \delta_{time}].$$

where $\log(OSP_{After}) > \log(OSP_{Before})$. Suppose α denotes the proportion of physicians who are eligible for interstate reciprocity through IMLC and start out-of-state practices, and $1 - \alpha$ denotes the proportion of physicians who are not eligible for IMLC and start out-of-state practices. Then, we can write the changes in the rate of starting out-of-state practices in the IMLC states after adopting the universal reciprocity of physician licenses as

$$\Delta \log(OSP) = (1/\gamma)[T_t w_t - T_s w_s - \delta_{time}] - \alpha(1/\gamma)[T_t w_t - T_s w_s - \delta_{time}]$$

$$-(1 - \alpha)(1/\gamma)[T_t w_t - T_s w_s - c_{relicense} - \delta_{time}] = (1/\gamma)(1 - \alpha)c_{relicense} > 0,$$

highlighting that ULR continues to affect labor supply even after adopting IMLC because ULR expands legal eligibility for reciprocity beyond physicians already covered by IMLC. The magnitude of this effect depends on the proportion of physicians, denoted by $(1 - \alpha)$, who are excluded from IMLC reciprocity, including both physicians licensed in IMLC non-member states and physicians who are licensed in IMLC member states but do not meet IMLC eligibility

requirements.

Based on these models, we hypothesize that universal reciprocity of physician licenses increases the state-level labor supply of physicians by increasing the number of tasks provided by out-of-state practitioners but not by interstate migration. In addition, within the model, an increase in the labor supply may improve consumer welfare by increasing production of medical services and reducing the prices of goods and services. Thus, we also hypothesize that universal reciprocity of physician licenses increases the access and utilization of healthcare services.

4 Data and Methods

4.1 Physician Labor Supply Measures

We use two datasets to examine the changes in state-level physician labor supply. First, using the Medicare Physician & Other Practitioners by Provider 2017-2023 from the Centers for Medicare & Medicaid Services (CMS), we obtain the share of physicians migrating from other states. This dataset allows us to identify the states where each physician had the highest number of Medicare Part B non-institutional claim line items, indicating the highest volume of services provided. Assuming the states in this dataset indicate the primary state of practice, we compare each physician's primary state of practice between two consecutive years. We identify physicians as migrants if their primary state of practice differs between the two years. Lastly, we divide the number of migrants in each state by the total number of physicians in each state to obtain the proportion of physicians who moved from other states. In this step, we obtain three measures that indicate the changes in interstate migration: the overall share of migrating physicians, the share of physicians that migrated from other IMLC member states, and the share of migrating physicians from non-IMLC member states. Since these datasets are available once a year, we obtain yearly

measures.

Second, using the CMS Doctors and Clinicians National Downloadable File 2018-2023, we obtain the share of out-of-state practice physicians. It provides information on where each healthcare practitioner works, including their primary and non-primary work locations. We first identify each physician's primary state of practice using the CMS Medicare Physician & Other Practitioner by Provider datasets from corresponding years. This identification strategy resolves the 'ghost data' issue – physicians' previous practice locations are identified as primary practice locations after moving to different establishments – by identifying primary practice locations based on actively billed claims in each calendar year. Then, using each physician's unique identification, the National Provider Identifier (NPI), we identify physicians practicing outside their primary states of practice and the locations of their out-of-state practices. Lastly, we divide the number of out-of-state practice physicians by the total number of physicians in each state to obtain the proportion of out-of-state practice physicians. Similar to the interstate migration measures, we obtain three measures that indicate the changes in out-of-state practices: the overall share of out-of-state practice physicians, the share of out-of-state practice physicians from other IMLC member states, and the share of out-of-state practice physicians from non-IMLC member states. Since these datasets are available multiple times per year, we obtain these measures every 6 months.

4.2 Healthcare Access and Utilization Measures

We use two datasets to examine the changes in healthcare access and utilization. The first dataset is the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023, measuring changes in healthcare access. The BRFSS, publicly available from the Centers for Disease Control and Prevention (CDC), is an annual cross-sectional telephone survey that provides health-related information, including healthcare access and health outcomes, on a nationally representative

sample of Americans aged 18 and older. The benefit of using the BRFSS is that it provides both the state of residence and the month of survey for each respondent; this is particularly important for distinguishing the time before and after the adoption of the ULR in each state.

Our sample consists of respondents aged 25 and older. As demand and access to healthcare services vary by age (Card et al., 2008), we also conduct analyses by age groups: working-age group (age 25-64) and older adults (age 65 and older). We choose age 65 as a threshold because this determines Medicare eligibility; as Card et al. discuss, healthcare demand substantially increases once individuals are covered by Medicare. This institutional distinction contributes to differences in healthcare access dynamics across age groups and supports analyzing these groups separately. Then, we use respondent-level healthcare access measures to obtain state-level shares based on the corresponding healthcare access measures during each 6-month period. We choose the half-year time interval to ensure that each share is obtained from a sufficiently large number of respondents (more than 1,000 observations per cell, which substantially reduces sampling variability in state-level measures), so that our dependent variables reflect the state-level healthcare access measures without significant variation due to respondent-level variations or measurement errors.

We carefully select two healthcare access measures that are collected across all survey years and states. These measures are particularly suitable given our study window because they are not critically influenced by COVID-19, a possible confounder. First, "having one or more personal doctors or healthcare providers[1] (Personal Doctor)" is a measure that captures whether a

[1] Note that the 'healthcare provider' includes not only physicians but also other healthcare practitioners such as nurses, motivating additional analyses to validate the impact of physician licenses' universal reciprocity; we do this by using another dataset introduced in the next paragraph: the Survey of Income and Program Participation.

respondent had a personal doctor or healthcare provider at the time of the survey. Although a minor change in the wording of this survey question in 2021 led to an increase in the proportions across all subsequent years, this increase was observed at a similar rate across all states[2] (Hest, 2022). Second, "could not see a doctor because of cost (Cost Issue)" is a measure that captures whether a respondent did not see a doctor because of high healthcare costs.

The second dataset we use is the Survey of Income and Program Participation (SIPP) 2019-2024, covering 2018-2023. The SIPP, publicly available from the Census Bureau, is a monthly panel survey that provides information on various sources of income and program participation. Similar to the BRFSS, our sample consists of respondents aged 25 and older. However, due to the smaller number of respondents relative to the BRFSS, we do not conduct analyses by age groups; we calculate the shares from at least 100 observations per cell, which allows us to construct stable state-level utilization measures despite the smaller sample size of the SIPP. In addition, due to the insufficient sample size, we exclude New Hampshire, South Dakota, and Wyoming from the analyses using the SIPP.

We select two healthcare utilization measures that are available across all years and surveys: "at least one medical visit (1+ Medical Visits)" and "at least one doctor's office visit (1+ Doctor's Office Visits)." "1+ medical visits" include visits to see any healthcare practitioners, including physicians and nurse practitioners, while "1+ doctor's office visits" only include visits to see physicians. Collected at the end of each year, these measures are originally available as continuous measures indicating utilization frequencies in the past 12 months. We convert these measures to binary indicators of corresponding healthcare service utilization in the past 12 months. We provide

[2] In Online Appendix B, we provide a comparison of this measure separately by ULR adoption status, presenting no statistically significant difference in the changes in the proportion due to this survey question change.

more information about these measures in Online Appendix A.

4.3 Estimation Procedures

In this study, we use the event-study framework to estimate the reduced-form effect of the universal reciprocity of physician licenses. We select the treatment and control groups that exhibit comparable pre-treatment trends, supporting the plausibility of the parallel trend assumption. To do so, we restrict the sample to 20 states[3] that implemented the IMLC before 2018, the initial wave of our study window and IMLC being fully operational (O'Reilly, 2026). Of these states, 11 adopted ULR during the study window.

Of the ULR-adopting states, three (Arizona, Kansas, and Mississippi) imposed residency requirements, and three (Colorado, Utah, and Wyoming) did not include physician licenses for universal reciprocity. The remaining five states (Idaho, Iowa[4], Montana, New Hampshire, and South Dakota) adopted ULR without these restrictions and constitute the primary treatment group. The remaining nine states serve as the baseline control group.

Because our analysis focuses on a subset of IMLC early-adopting states, the results may not fully generalize to all U.S. states. Still, these states represent the relevant institutional setting for evaluating ULR because physician reciprocity is already feasible under IMLC, allowing us to isolate the marginal effects of expanding legal eligibility through ULR. In addition, these states

[3] For the analyses using the SIPP, we use 17 states because three states do not have enough observations (at least 100 observations per year) to obtain robust state-level measures. These states are New Hampshire, South Dakota, and Wyoming.

[4] Iowa initially imposed residency requirements when adopting ULR in June 2020 and then removed these requirements in July 2022. We treat Iowa as a true treatment group state that adopted universal reciprocity of physician licenses in July 2022. See Table 3 for more information.

represent a substantial share[5] of physician licensing activity and capture settings where cross-state practice is most relevant. Furthermore, this design prevents violating the stable unit treatment value assumption (SUTVA); because physicians eligible for IMLC reciprocity in both treatment and control group states can start an out-of-state practice without state-specific re-licensure processes via IMLC's interstate reciprocity, this design avoids a mechanical reallocation of physicians from control group states to treatment group states, which could otherwise bias the estimated effects upward. Note that the states that adopted universal reciprocity of physician licenses impose the same rules and requirements for physicians with the Medical Doctor degree and those with the Doctor of Osteopathic Medicine degree. Table 3 shows the list of states used as treatment and control groups in this study. Table 4 provides descriptive statistics and the sociodemographic characteristics of respondents from the initial wave by their states' statuses of universal reciprocity of physician licenses.

For the estimation, we use a Callaway and Sant'Anna (2021) staggered difference-in-differences (C-S). There are two reasons we use this method. First, we expect that the impact of this policy reform unfolds gradually over time, and therefore, an event study framework is more appropriate to capture changes in the magnitude of the effect over time. Second, the conventional event study framework may produce biased and inconsistent estimates due to heterogeneity in treatment effects and staggered treatment adoption (De Chaisemartin and D'Haultfœuille, 2020;

[5] In 2023, there are 40 states that have adopted IMLC, and 37 states actively process out-of-state physician licenses. Given that 20 states are the early-adopter states (adopted before 2018), we cover more than 50% of the IMLC member states. On the other hand, the states that have adopted IMLC during our study window, 2018-2023, may introduce the effect of IMLC into our estimation, which is similar to that of ULR. We discuss this issue and its solution in Section 4.4.

Goodman-Bacon, 2021). C-S allows us to address these issues and obtain causal estimates of the effect of this policy reform on state-level physician labor supply and healthcare access and utilization. The simplified representation of the C-S estimation model is

$$Y_{st} = \alpha + \sum_{\tau} \beta_{\tau} U_{st}^{\tau} + \theta_s + \theta_t + \varepsilon_{st}, \quad (1)$$

where Y_{st} represents the dependent variable from the state s in time t, U_{st}^{τ} represents the indicators for treatment status and event time, denoted by τ, relative to the adoption of universal reciprocity of physician licenses, and θ_s and θ_t are the state and time fixed effects. Estimation follows the group-time average treatment effects ($\mathrm{ATT}(g,t)$) framework of Callaway and Sant'Anna. We estimate dynamic effects up to four periods before and six periods after treatment using the datasets with half-year time intervals, and up to two periods before and four periods after treatment using the datasets with one-year time intervals for the baseline estimations[6]. In addition, taking advantage of a robust pool of never-treated states, we restrict our control group exclusively to these never-treated states and exclude not-yet-treated states. This approach mitigates the risk of anticipation effects contaminating the control group and ensures a stable and consistent counterfactual baseline across the study window.

4.4 Threats to Validity and Solutions

The policies for ULR may coincide with other state-level policy changes that could affect healthcare access and utilization. To address this concern, our empirical framework focuses on physician-specific reciprocity and exploits variation across states and time; staggered adoption of ULR across states further reduces the likelihood that common policy shocks explain our findings.

[6] The test of residency requirements and the falsification test obtain up to five and three post-treatment effects using the datasets with half-year time intervals and one-year time intervals, respectively, because the policy adoption timings of the alternative/placebo treatment groups are later than those of the true treatment group states.

Yet, one policy issue that coincides with ULR is the adoption of IMLC during our study window (i.e., intercurrent IMLC adoption); 12 states[7] have adopted IMLC between 2018 and 2023. Because both ULR and IMLC are to reciprocate occupational licenses issued by other states, our estimates of state-level labor supply will capture the effects from both universal reciprocity of physician licenses and additional interstate reciprocity from these intercurrent IMLC-adopting states. We separately measure interstate migration and out-of-state practices of the physicians from IMLC member states and non-member states. The intercurrent IMLC adoption may inflate the estimates that capture the changes in state-level labor supply due to the physicians from IMLC member states, while it may deflate the estimates due to the physicians from non-member states.

We address this issue by excluding physicians from the intercurrent IMLC-adopting states when calculating the state-level labor supply measures. In other words, the numerator and denominator of our state-level labor supply measures only include physicians whose primary states of practice are either the states that adopted IMLC before 2018 or the states that have not adopted IMLC until 2023. This isolates variation attributable to ULR from variation generated by the expansion of IMLC during the study period. We also conduct the same analyses including physicians from intercurrent IMLC-adopting states, and the results from these analyses are provided in the Online Appendix D.

In addition, to validate our theoretical predictions and main findings, we conduct four robustness checks. First, we use the states that imposed residency requirements for license reciprocity as an alternative treatment group. Our theoretical framework predicts that residency requirements may limit the increase in state-level labor supply through out-of-state practices and

[7] Delaware, District of Columbia, Georgia, Indiana, Kentucky, Louisiana, Maryland, Michigan, North Dakota, Oklahoma, Ohio, and Texas have adopted IMLC between 2018 and 2023.

thereby limit the increases in healthcare access and utilization. We test this prediction by replicating the analyses using this alternative treatment group.

Second, we conduct a falsification (placebo) test to validate whether the estimated effects are from the universal reciprocity of physician licenses or other contemporaneous factors related to ULR. We create a placebo treatment group composed of states that adopted ULR but did not include physician licenses for universal reciprocity. This placebo design exploits variation across states that adopted ULR but differ in whether physician licenses are included for reciprocity, holding constant the broader adoption of ULR and its associated policy changes, allowing us to isolate physician-specific effects from broader regulatory changes that may accompany ULR adoption.

Third, we conduct a validation test by accounting for Medicaid expansion and state-specific public health insurance programs, which may affect healthcare access and utilization. Differences in eligibility thresholds and coverage[8] across states may introduce variation in healthcare demand and utilization. To address this issue, we calculate state-level healthcare access and utilization measures using respondents who are unlikely to be eligible for or covered by public health insurance. The SIPP 2019-2024 has a set of variables indicating individuals' health insurance coverage from various sources, and therefore we directly identify respondents covered by private insurance but not public insurance, including Medicaid and Medicare.

For the BRFSS, however, the availability of health insurance coverage measures is not consistent. The BRFSS re-engineered the survey and questions in 2021, leading to a change in the

[8] After the Affordable Care Act of 2010, many states expanded Medicaid eligibility, while other states did not or expanded at different time points. Some states, such as Illinois and Minnesota, operate their own programs with substantially relaxed eligibility criteria, while other states impose different eligibility criteria for pregnant women.

response rate[9] for some of the questions, including the primary source of healthcare coverage. Because the survey response rates are drastically different between the two time periods, utilizing the BRFSS's health insurance coverage measures would lead to inconsistent estimates. Note that the survey response rate for the question on "covered by any health insurance" is consistent before and after the re-engineering.

Therefore, we construct a comparable restricted sample based on income eligibility thresholds. Specifically, we limit the sample to non-pregnant respondents aged between 25 and 64 who are covered by any health insurance and have household income above 150% of the federal poverty level (FPL), using states with Medicaid and state-operated public health insurance eligibility thresholds at or below this level. We then calculate the state-level healthcare access measures using this restricted sample and conduct the analyses. For consistency, we exclude states with substantially higher eligibility thresholds: Illinois and Minnesota; these states were also excluded from the SIPP sample for this test. Detailed sample selection procedures are provided in Online Appendix C.

Last, given that our study window includes the COVID-19 Public Health Emergency, from January 2020 to May 2023 (U.S. Department of Health and Human Services, Office of Inspector General, 2025), we conduct additional validation tests that account for pandemic-related healthcare demand shocks. We use the COVID-19 Reported Patient Impact and Hospital Capacity by State dataset from the U.S. Department of Health and Human Services (2024) to obtain the total number of confirmed cases of COVID-19 for each state and time point and then calculate the patient-physician ratio and patient-population ratio (i.e., proportion of state population that is diagnosed

[9] The response rates of the survey question on the primary source of healthcare coverage in the BRFSS 2018–2020 are below 15%; those in the BRFSS 2021–2023 are above 95%.

as COVID-19 positive). Each state's total number of physicians for the calculation of the patient-physician ratio is from the CMS National Downloadable File, and annual state population measures are from the U.S. Census Bureau (2026), retrieved from the Federal Reserve Bank of St. Louis. We calculate and use two separate ratios to avoid the 'denominator trap,' avoiding the correlation between the denominator of the covariate and dependent variables (Kronmal, 1993); using these measures allows us to distinguish healthcare demand shocks from changes in physician supply that mechanically affect physician-based ratios. As robustness checks, we include patient-population ratio measures in the specifications for state-level physician labor supply estimations and include patient-physician ratio measures in the specifications for healthcare access and utilization estimations; these ratios control the relative intensity of pandemic-related healthcare demand across states and time. Analyses using these specifications are provided in the Online Appendix E.

5 Results

5.1 Changes in Regional Labor Supply

5.1.1 Interstate Migration versus Out-of-State Practices

Figure 1 presents the results from the C-S of Equation (1) using the CMS Medicare Physician & Other Practitioners by Provider dataset, illustrating the changes in state-level physician labor supply through interstate migration. The first three sub-figures in the top row use the baseline control group (i.e., states that never adopted ULR until 2023) as a control group, and the next three sub-figures in the bottom row use both the baseline control group and alternative/placebo treatment groups (i.e., states that adopted ULR but imposed residency requirements or did not include physician licenses for universal reciprocity) as a control group.

The sub-figures in each column use the shares of migrated physicians from different state groups: overall migrated physicians (left), those from IMLC member states (center), and those from IMLC non-member states (right). Results from the analyses including physicians from the intercurrent IMLC-adopting states are provided in Online Appendix Figure D2, and results from the analyses controlling for pandemic-related healthcare demand are provided in Online Appendix Figure E1.

Results in this figure reveal no statistically significant increase in interstate migration after adopting universal reciprocity of physician licenses, suggesting that the reform did not increase physician labor supply through geographic relocation. Instead, there is some evidence that the share of physicians migrating from IMLC member states decreased by 0.4 percentage points; however, because the corresponding specification exhibits statistically significant pre-treatment dynamics, this estimate should be interpreted with caution.

Figure 2 presents the results from the C-S of Equation (1) using the CMS National Downloadable File, illustrating the changes in state-level physician labor supply through out-of-state practices. The format of this figure follows that of Figure 1. Results from the analyses including physicians from the intercurrent IMCL-adopting states are provided in Online Appendix Figure D3, and results from the analyses controlling pandemic-related healthcare demand are provided in Online Appendix Figure E2.

Results show that adopting universal reciprocity of physician licenses increased state-level physician labor supply through out-of-state practices rather than interstate migration. Figure 2A shows that this share increased by 1.7 percentage points. Figures 2B and 2C show that the shares of out-of-state practice physicians from both IMLC member states and non-member states increased by 0.9 percentage points each. Furthermore, even after including alternative/placebo treatment groups in the control group, there is an increase in the share of out-of-state practice

physicians from IMLC non-member states by 0.8 percentage points; this result is particularly important because these physicians were not broadly eligible for reciprocity before ULR. Results in the Online Appendix provide consistent results both in direction and magnitude. Overall, these results indicate that expanding legal eligibility for license reciprocity through adopting the universal reciprocity of physician licenses increased the state-level labor supply at the extensive margin through out-of-state practices but not interstate migration.

5.1.2 Robustness Check and Falsification Test

Figure 3 presents the results from a set of robustness checks discussed in the previous section. The sub-figures on the top row, Figures 3A-3C, show the results from the analyses using an alternative treatment group: states that impose residency requirements for universal reciprocity of physician licenses. Although one of the pre-treatment coefficients is statistically significant at the 95% confidence level, stable pre- and post-treatment coefficients without a systematic trend or statistical significance suggest that states imposing residency requirements for license reciprocity did not experience an increase in out-of-state practice physicians. These results are consistent with our theoretical prediction that residency requirements restrict eligibility for reciprocity among out-of-state practice physicians and therefore serve as barriers to increasing state-level labor supply through out-of-state practices. Results in the Online Appendix Figures D4 and E3 are consistent with these findings.

The sub-figures on the bottom row, Figures 3D-3F, show the results from the analyses using a placebo treatment group: states that adopted ULR but did not include physician licenses for universal reciprocity. The results are broadly consistent with our prediction; there is no statistically significant increase in the share of out-of-state practice physicians after adopting ULR. Instead, Figure 3F shows a reduction in the share of out-of-state practice physicians by 0.2 percentage

points immediately after adopting ULR without including physician licenses for reciprocity. Although the estimated effect is negative and statistically significant, it is still consistent with our theoretical prediction that excluding physician licenses from universal reciprocity does not increase out-of-state practice among physicians from non-IMLC states. Results in the Online Appendix Figures D4 and E3 are consistent with these findings. The absence of effects in the placebo treatment group suggests that contemporaneous policy variations unrelated to universal reciprocity of physician licenses are unlikely to drive our results.

In summary, adopting universal reciprocity of physician licenses increases state-level physician labor supply at the extensive margin through out-of-state practices rather than interstate migration. We observe these increases only among the states that adopted the universal reciprocity of physician licenses that expanded eligibility for reciprocity without imposing residency requirements. Our results provide additional evidence that the increase in state-level labor supply at the extensive margin is driven by the expanded legal eligibility for license reciprocity following the adoption of universal reciprocity of physician licenses rather than other contemporaneous factors related to ULR.

5.2 Changes in Healthcare Access and Utilization

In this sub-section, we provide the results from the analyses using healthcare access and utilization measures. We estimate the effects of universal reciprocity of physician licenses on healthcare outcomes separately from those on state-level physician labor supply measures, and therefore, our results should be interpreted as reduced-form evidence. They are consistent with the theoretical mechanism linking reciprocity-driven changes in physician labor supply to changes in healthcare access and utilization rather than direct causal estimates of the relationship between physician supply and healthcare outcomes.

5.2.1 Healthcare Access and Utilization

Figure 4 shows the results from the C-S of Equation (1) using healthcare access measures from the BRFSS (Figures 4A-4F) and healthcare utilization measures from the SIPP (Figures 4G-4H). Similarly, Figure 5 shows the results from the C-S of Equation (1) using healthcare access measures from the BRFSS (Figures 5A-5F) and healthcare utilization measures from the SIPP (Figures 5G-5H) after including alternative/placebo treatment groups as a control group. Results from the corresponding analyses controlling for pandemic-related healthcare demand are provided in Online Appendix Figures E4 and E5, respectively.

The two sub-figures on the top row are the results from the estimation using the healthcare access measures that cover respondents aged 25 and older. Although the post-treatment effects in these sub-figures are consistent with our theoretical predictions, the unstable pre-treatment dynamics in Figure 4A limit their usefulness for causal interpretation. Furthermore, the results in the Online Appendix show that statistically significant reductions in the cost issues, shown in Figure 4B, mostly disappeared after controlling for pandemic-related healthcare demand.

Yet, the results from analyses by age groups are consistent with our predictions. In contrast to the full sample, pre-treatment coefficients for analyses by age group are relatively more stable and do not display systematic trends. Although a pre-treatment coefficient in Time -4 (i.e., 2 years before adopting ULR) is statistically significant at the 95% confidence level, Figure 4C (and Figure 5C) shows that the share of respondents aged between 25 and 64 who have personal doctors or healthcare providers increased by 5.9 percentage points (and 5.5 percentage points in Figure 5C) after adopting the universal reciprocity of physician licenses. Similarly, Figures 4E and 5E show that this share among older respondents increased by 2.0 percentage points. Furthermore, after controlling for pandemic-related healthcare demand, the pre-trends are more stable without a

systematic trend, and the magnitudes of the estimated coefficients are larger: 6.5 and 2.5 percentage points for ages 25-64 and 65+, respectively, in Online Appendix Figures E4C and E4E. These results are consistent with the hypothesis that healthcare access increased after the adoption of universal reciprocity of physician licenses, expanding the legal eligibility for license reciprocity.

On the other hand, although the post-treatment effects are negative and statistically significant in the baseline results (Figures 4D and 5D), these effects disappear once we control for pandemic-related healthcare demand (See Online Appendix Figure E4D). Overall, results suggest that universal reciprocity of physician licenses improved healthcare access primarily through increasing the share of respondents with personal doctors or healthcare providers, while the evidence for reductions in cost-related barriers is less robust to alternative specifications.

Figures in the bottom row are the results from the estimation using the healthcare utilization measures that cover respondents aged 25 and older. While the results for 1+ medical visits present statistically significant pre-treatment coefficients with no consistent post-treatment coefficients estimated (Figures 4G and 5G), those for 1+ doctor's office visits present stable pre-treatment coefficients and the positive and statistically significant post-treatment effects: an increase in the share of respondents visiting a doctor's office at least once in the past 12 months by 2.6 percentage points (and 2.5 percentage points in Figure 5H) after adopting the universal reciprocity of physician licenses. Results after controlling the pandemic-related healthcare demand are consistent as well (see Online Appendix Figures E4H and E5H). These findings are particularly important because this study focuses on the legal and regulatory changes associated with physicians; consequently, physician-specific utilization measures provide a more direct link between changes in legal eligibility for reciprocity and healthcare utilization outcomes. Overall, the results suggest that healthcare utilization increased after adopting universal reciprocity of physician licenses,

particularly for physician-provided services. This pattern is consistent with our hypothesis that expansion of legal eligibility for interstate physician practice contributes to greater utilization of services provided by physicians.

5.2.2 Robustness Check: Residency Requirements and Falsification Test

Figure 6 shows the results from the C-S of Equation (1) using healthcare access and utilization measures and the alternative treatment group consisting of states that adopted ULR but imposed residency requirements for license reciprocity. The format of this figure follows that of Figure 4. Results from the analyses controlling for pandemic-related healthcare demand are provided in Online Appendix Figure E6.

Results generally show no systematic increase in healthcare access and utilization among states that imposed residency requirements for reciprocity. This pattern is consistent with our theoretical prediction that residency requirements restrict eligibility for reciprocity and therefore limit increases in healthcare access and utilization. Although some pre-treatment coefficients are statistically significant and nontrivial in magnitude, the absence of consistent positive post-treatment effects distinguishes these states from the primary treatment group.

Because our sample design aggregates state-level cross-sectional data into a single measure of the state-level share of healthcare access and utilization, and because policy adoption is staggered across states, the amount of identifying variation contributing to each coefficient varies across event times, making some estimates sensitive to the number and composition of treated and comparison states used for identification. Furthermore, unlike the estimation of state-level labor supply that effectively excluded physicians from intercurrent IMLC-adopting states, the healthcare access and utilization measures are collected from consumer surveys and therefore cannot isolate the effect of ULR from contemporaneous changes associated with intercurrent IMLC adoption in

other states. Consequently, the estimates should be interpreted with caution because both limited identifying variation and potential policy contamination may contribute to the observed pre-treatment patterns. Nevertheless, the overall pattern of results, including Figures 6D, 6G, and 6H, remains broadly consistent with the hypothesis that residency requirements serve as barriers to increasing healthcare access and utilization.

Figure 7 shows the results from the C-S of Equation (1) using healthcare access and utilization measures and the placebo treatment group consisting of states that adopted ULR but did not include physician licenses for universal reciprocity. The format of this figure follows that of Figure 4. Results from the analyses controlling for pandemic-related healthcare demand are provided in Online Appendix Figure E7.

Most of the results display no systematic trend or statistically significant pre-treatment coefficients, suggesting no meaningful changes in healthcare access and utilization among the states that adopted ULR but did not include physician licenses for universal reciprocity. However, once controlling for pandemic-related healthcare demand, some results show statistically significant pre-treatment coefficients with nontrivial magnitude, suggesting caution in interpreting individual coefficients. Similar to the results in Figure 6, the healthcare measures cannot fully isolate the effects of ULR from contemporaneous changes associated with intercurrent IMLC adoption in other states. In addition, the amount of identifying variation contributing to each coefficient varies across event times, requiring caution when interpreting individual estimates. Despite these limitations, the absence of systematic positive effects among states that excluded physician licenses from reciprocity remains consistent with the interpretation that the healthcare access and utilization results are driven by the universal reciprocity of physician licenses rather than broader contemporaneous policy changes.

5.2.3 Robustness Check: Among Those Not Affected by Public Health Insurance Programs

Figure 8 shows the results from the C-S of Equation (1) using healthcare access and utilization measures from the respondents who are not eligible for public health insurance programs. The format of this figure follows that of Figure 4. Results from the analyses controlling for pandemic-related healthcare demand are provided in Online Appendix Figure E8.

The two sub-figures in the top row are the results from the estimation using healthcare access measures from the BRFSS, which are broadly consistent with our theoretical prediction. Other than the statistically significant pre-treatment coefficient in Time -4, Figure 8A presents pre-treatment coefficients that do not display a systematic trend and show an increase in the share of respondents who have personal doctors or healthcare providers by 4.3 percentage points. Similarly, other than the statistically significant pre-treatment coefficient in Time -1, Figure 8B presents pre-treatment coefficients that do not display a systematic trend and show a reduction in the share of respondents who could not see a doctor because of cost by 1.0 percentage point. These patterns are clearer once we control for pandemic-related healthcare demand, as shown in Online Appendix Figures E8A and E8B: substantially less or no statistically significant pre-treatment coefficient, with larger post-treatment effects in magnitude: 4.4 and 1.4 percentage points for personal doctor and cost issue measures, respectively. These results support our baseline findings that adopting universal reciprocity of physician licenses increased access to healthcare services at an extensive margin.

Similarly, the two sub-figures in the bottom row are the results from the estimation using healthcare utilization measures from the SIPP, which are also consistent with our theoretical prediction. Figure 8D shows an increase in the share of respondents visiting a doctor's office by 6.8 percentage points after adopting universal reciprocity of physician licenses. This pattern

remains after controlling for pandemic-related healthcare demand (see Online Appendix Figure E8D), reinforcing the interpretation that expanded legal eligibility for physician license reciprocity increased utilization of physician-provided services. This result provides additional evidence consistent with our baseline findings that adopting universal reciprocity of physician licenses increased utilization of healthcare services at an extensive margin.

In summary, adopting universal reciprocity of physician licenses increases access to and utilization of healthcare services. These findings remain broadly consistent after accounting for pandemic-related healthcare demand and differences in state public health insurance programs, providing additional support for the baseline results.

6 Conclusions

In this study, we show that universal reciprocity of physician licenses increases state-level physician labor supply and healthcare access and utilization at the extensive margin. Our results show that adopting universal reciprocity of physician licenses increases state-level physician labor supply through largely temporary out-of-state practices rather than interstate migration and increases access and utilization of healthcare services. Residency requirements for licensing reciprocity act as barriers to increasing out-of-state practice physicians, healthcare access, and utilization. Our falsification test provides additional robustness evidence that these findings are driven by physician-specific reciprocity rather than other contemporaneous factors related to ULR.

The main reasons given for occupational licensing are to protect the health and safety of consumers and to ensure a sufficiently high level product or service quality by sorting out unqualified service providers that do not meet occupational qualifications (Kleiner, 2015; Hall et al., 2026). However, state-level differences and strict eligibility requirements for interstate

licensing reciprocity often restrict the labor supply by limiting interstate worker mobility and cross-state practices, with potential consequences for consumer welfare. Our findings suggest that reducing barriers to cross-state practices can increase the state-level labor supply and improve access to and utilization of healthcare services, highlighting a channel through which such reforms may improve both consumer and worker welfare in the healthcare sector.

There are several limitations in this study. First, this study does not examine the change in service quality, because the service quality measures are not available in the datasets. Second, as explained in Section 4.4, our robustness check using the BRFSS that accounts for public health insurance programs provides the estimates only by utilizing an approximate subsample of respondents who are likely not to be financially eligible for these programs. Lastly, our estimates of healthcare access and utilization do not provide a direct causal estimate of the relationship between state-level physician labor supply and healthcare access and utilization but reduced-form evidence that is consistent with the theoretical models.

Therefore, future research should utilize relevant datasets and econometric methods, such as structural modelling, to examine the direct causal relationship between physician labor supply and healthcare access and utilization. We also suggest utilizing other healthcare datasets to examine the influence of ULR on actual healthcare costs and service quality, especially the outcomes among economically vulnerable populations. Lastly, it would be fruitful to examine the change in access and utilization of services from other occupational sectors, as ULR includes many other occupations. Nevertheless, our analysis contributes to the literature on how changes in statutes affecting physicians' ability to work across state lines can enhance patient well-being and consumer welfare.

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Table 1. Comparison Between Interstate Licensure Compact and Universal Licensing Recognition

	Interstate Licensure Compact	Universal Licensing Recognition

Similarity	• Reciprocity of occupational licenses for certain occupations.
	  ○ "Reciprocity" means giving out-of-state licensed workers the "right to practice" without going through the state-specific re-licensure processes.
	• There are separate compacts for each occupation that administer the matters for corresponding occupations.
	  ○ For instance, the Interstate Medical Licensure Compact administers the matters related to physician licenses, while the Nurse Licensure Compact administers the matters related to nurse licenses.
	  ○ Therefore, some of the occupational licenses are eligible for reciprocity while others are not, depending on whether the corresponding state is in the compact for corresponding occupations or not.
		• Reciprocity of occupational licenses for selected occupations.
		  ○ "Reciprocity" means giving out-of-state licensed workers the "right to practice" without going through the state-specific re-licensure processes.
		  ○ The occupations for recognition are selected at the time of adopting ULR; other occupations can be added later via amendments.
		  ○ Therefore, some of the occupational licenses are eligible for reciprocity while others are not, depending on whether the corresponding occupation is included in the occupation list for universal reciprocity or not.

Difference	• Only the licenses that are issued by the member states are eligible for reciprocity. • The application process duration is relatively shorter than Universal Licensing Reciprocity, but stricter regulations and requirements are imposed for eligibility (Check Table 2).	• Licenses that are issued by any U.S. state qualify for reciprocity. ○ Some states (e.g., Montana and South Dakota) also adopt reciprocity for the licenses issued in Canada. • The application process duration is relatively longer than the Interstate Medical Licensure Compact, but the regulations and requirements for eligibility are less stringent (Check Table 2).
Example	• Physicians (Interstate Medical Licensure Compact) • Nurses (Nurse Licensure Compact) • Dentists and Dental Hygienists (Dentist and Dental Hygienist Compact) • Social Workers (Social Work Licensure Compact)	• Physicians, nurses, dentists, physician assistants, plumbers, electricians, cosmetologists, barbers, etc • Note that the list of occupations varies by state. Some states do not include physician licenses for reciprocity, although other occupations do (e.g., Iowa, Utah, and Wyoming)

Table 2. Comparison of Regulations, Eligibility Requirements, and Application Process

	Interstate Medical Licensure Compact	Universal Licensing Recognition
Active Licensure & Certification	• Must have a full, unrestricted license from an IMLC member state. • Active American Board of Medical Specialties (ABMS) or American Osteopathic Association (AOA) specialty board certification is required.	• Must have a full, unrestricted license from any state for at least 1 year. • Board certification is not required.
Exam Retake Limits	• Must pass every single step of the licensing exams in three attempts or fewer; 4+ attempts on a single step leads to permanent disqualification.	• No limits.
Past Disciplinary Actions	• Any history of disciplinary action, including minor or completely resolved actions, permanently disqualifies IMLC.	• Disqualification is imposed only if the discipline is active, unremedied, or results in license revocation.
State of Principal License (SPL)	• One of the following requirements should be met: being a primary resident of the state of principal license (SPL), at least 25% of practice of medicine occurs in the SPL, the employer is located in the SPL, or using the SPL as a state of residence for US Federal Income Tax purposes.	• Not required, as long as the physician is licensed in any state in the United States. o Some states (e.g., Montana and South Dakota) also adopt reciprocity for the licenses issued in Canada.
Application Process	• A Letter of Qualification (LOQ) is required. It takes 4-8 weeks to get it and is valid for 1 year. To get the LOQ, the following are required: (1) A non-refundable $700 administrative fee to SPL. (2) Fingerprinting or an electronic code to complete an FBI criminal background check is required. (3) The SPL medical board must pull the record from the Federation of State Medical Boards to verify one's active board certification with the ABMS/AOA. • After getting an LOQ, the process takes 1-7 business days; a $100 IMLC handling fee per state is required. • The whole process takes 5 to 9 weeks on average.	• Verification of state-specific eligibility: scope of practice, substantially equivalent education and experience, and in-state residency (if required). • A localized licensing/endorsement fee, ranging from $300 to $800. • Request a home state's medical board to send an official verification of good standing. • Depending on the state, request a primary source of verification from the third parties (e.g., medical school or residency hospital) to mail one's credentials • Submit fingerprinting card to target state's law enforcement division for background check. • The whole process takes 8 to 16 weeks on average.

Table 3. Interstate Medical Licensure Compact and Universal Licensing Recognition Status of U.S. States

State		IMLC Month/ Year	ULR					Note
			Impl. by 2023	Bill #	Month/ Year	Residency Required	Physician License Excluded	
Arizona	AZ	08/2016	Yes	HB 2569	04/2019	Yes	No	ULR was implemented in 08/2019
Colorado	CO	06/2016	Yes	HB 1326	06/2020	N/A	Yes	ULR was implemented in 01/2021
Idaho	ID	03/2015	Yes	SB 1351	07/2020	No	No	
Iowa	IA	07/2015	Yes	HF 2627	06/2020	Yes	No	Residency requirement removed in 07/2022; we treat Iowa as a true treatment group that adopted ULR in July 2022.
Kansas	KS	05/2016	Yes	HB 2066	07/2021	Yes	No	
Mississippi	MS	05/2016	Yes	HB 1263	07/2021	Yes	No	
Montana	MT	04/2015	Yes	HB 105	03/2019	No	No	
New Hampshire	NH	05/2016	Yes	HB 594	08/2023	No	No	
South Dakota	SD	03/2015	Yes	HB 1077	02/2021	No	No	
Utah	UT	03/2015	Yes	SB 23	05/2020	N/A	Yes	
Wyoming	WY	02/2015	Yes	SF 18	07/2021	No	Yes	
Alabama	AL	05/2015	No					
Illinois	IL	07/2015	No					
Maine	ME	11/2017	No	PL 2021	07/2021	No	No	ULR was implemented in 01/2025
Minnesota	MN	05/2015	No					
Nebraska	NE	04/2017	No	LB 390	03/2024	No	No	ULR was implemented in 07/2024
Tennessee	TN	01/2017	No					
Washington	WA	07/2017	No					
West Virginia	WV	03/2015	No					
Wisconsin	WI	12/2015	No					

Note: IMLC – Interstate Medical Licensure Compact; ULR – Universal Licensing Recognition; Impl. - Implemented. We select the states that implemented the IMLC before 2018, the initial time of our analytic sample. Nevada was excluded from the analytic sample because it passed the ULR before our study window (pre-2018). Residency requirements being N/A indicates that those states impose residency requirements for universal reciprocity, but they are not applicable since physician licenses are not subject to universal reciprocity.

Table 4. Descriptive Statistics

	Universal Recognition of Physician Licenses							
	No		Yes					
			Placebo Groups					
	Control Group (9 States)		Residency Required (3 States)		Physician Licenses Not Included (3 States)		True Treatment Group (5 States)	
	Prop/ Mean	SD	Prop /Mean	SD	Prop/ Mean	SD	Prop /Mean	SD
CMS Medicare Physician & Other Practitioners by Provider 2018 Proportion of Physicians In-migrated								
From Other States	0.017	0.005	0.018	0.006	0.029	0.015	0.025	0.008
From IMLC States	0.007	0.004	0.008	0.002	0.015	0.008	0.013	0.006
From Non-IMLC States	0.010	0.004	0.010	0.005	0.014	0.008	0.012	0.006
CMS National Downloadable File, January/February 2018 Proportion of Physicians Conducting Out-of-State Practices								
From Other States	0.098	0.030	0.153	0.055	0.203	0.193	0.182	0.021
From IMLC States	0.047	0.029	0.072	0.053	0.156	0.190	0.118	0.052
From Non-IMLC States	0.052	0.030	0.081	0.063	0.047	0.007	0.064	0.036
BRFSS, January-June 2018								
Healthcare Utilization Measures								
Personal Doctors or Healthcare Providers	0.848	0.359	0.840	0.366	0.796	0.403	0.843	0.364
Having Issues with Paying Medical Costs	0.097	0.296	0.110	0.313	0.107	0.309	0.081	0.272
Sociodemographic Characteristics								
Has Health Insurance	0.933	0.251	0.916	0.278	0.909	0.287	0.937	0.243
Women	0.560	0.566	0.571	0.536	0.539	0.581	0.560	0.614
Age	56.817	15.613	57.430	15.612	54.882	16.071	57.988	15.323
Non-White or Hispanic	0.144	0.351	0.243	0.429	0.157	0.364	0.119	0.323
Some Colleges or Higher	0.665	0.472	0.663	0.473	0.711	0.453	0.658	0.474
SIPP 2019 (Covering 2018)								
Healthcare Utilization Measures								
At least one Medical Visit	0.851	0.356	0.866	0.340	0.839	0.368	0.894	0.308
At least one Doctor's Office Visit	0.825	0.380	0.844	0.363	0.806	0.395	0.856	0.351
Sociodemographic Characteristics								
Women	0.527	0.499	0.548	0.498	0.517	0.500	0.524	0.500
Age	55.473	16.765	56.613	16.691	54.227	16.623	56.249	16.986
Non-White or Hispanic	0.185	0.388	0.358	0.479	0.138	0.345	0.087	0.282
Some Colleges or Higher	0.642	0.479	0.615	0.487	0.746	0.435	0.672	0.470

Note: IMLC – Interstate Medical Licensure Compact; CMS – Centers for Medicare & Medicaid Services; BRFSS - Behavioral Risk Factor Surveillance System; SIPP – Survey of Income and Program Participation; Prop – proportion; SD – standard deviation. The above descriptive statistics are from the CMS Medicare Physician & Other Practitioners by Provider 2018, CMS National Downloadable File January/February 2018, BRFSS January–June 2018, and SIPP 2019. "Control group" states include Alabama, Illinois, Maine, Minnesota, Nebraska, Tennessee, Washington, West Virginia, and Wisconsin. "Residency required" states include Arizona, Kansas, and Mississippi. "Physician licenses not included" states include Colorado, Utah, and Wyoming. "True treatment group" states include Idaho, Iowa, Montana, New Hampshire, and South Dakota. Check Table 3 for more information about these groups and states.

Figure 1. Changes in State-Level Labor Supply: Interstate Migration

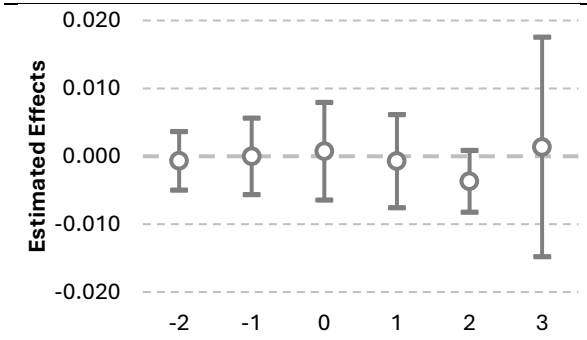


Figure 1A. Baseline, Overall

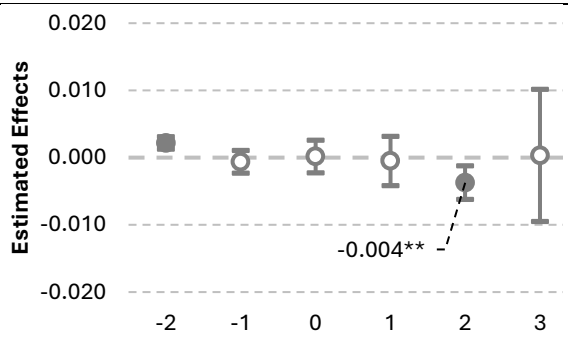


Figure 1B. Baseline, IMLC

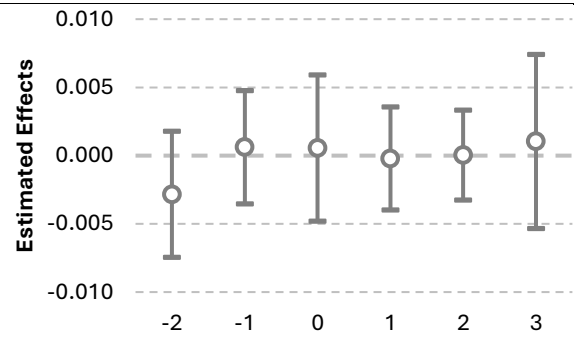


Figure 1C. Baseline, Non-IMLC

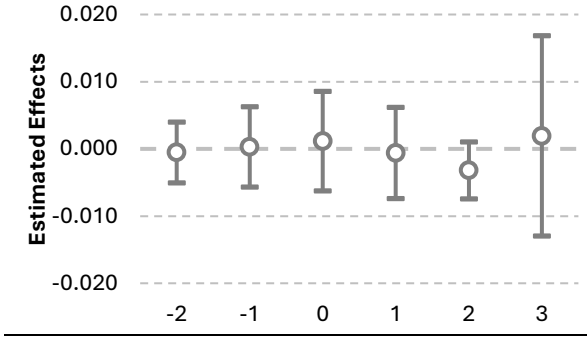


Figure 1D. + Alternative/Placebo Groups in Control Group, Overall

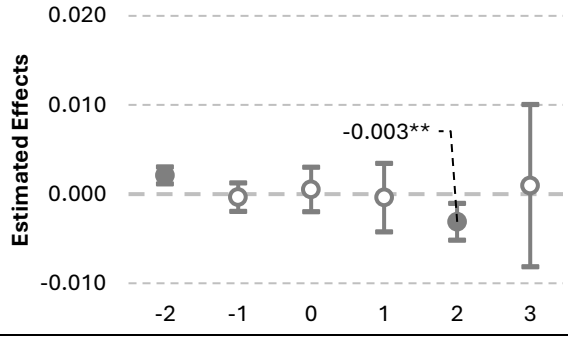


Figure 1E. + Alternative/Placebo Groups in Control Group, IMLC

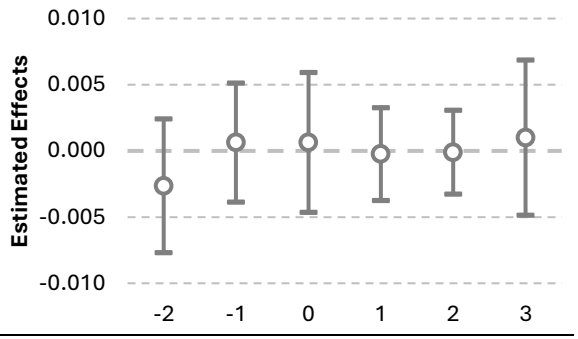


Figure 1F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Medicare Physician & Other Practitioners by Provider. N = 84 (14 States × 6 years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 120 (20 States × 6 years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Figure 2. Changes in State-Level Labor Supply: Out-of-State Practices

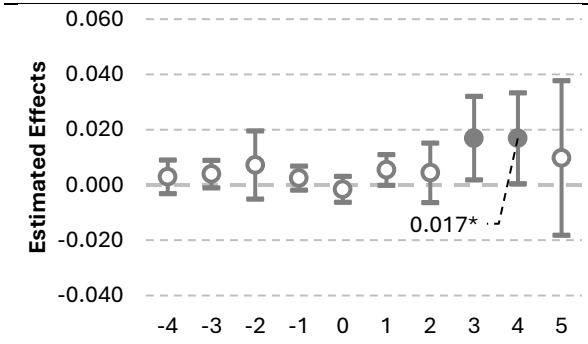


Figure 2A. Baseline, Overall

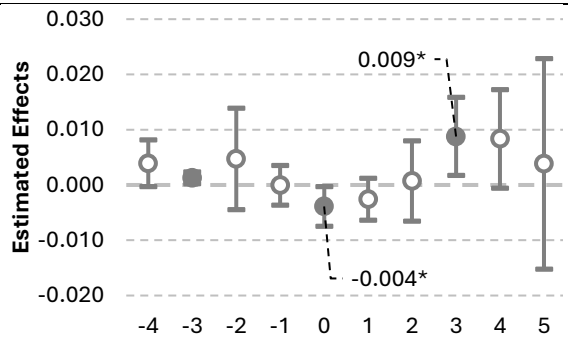


Figure 2B. Baseline, IMLC

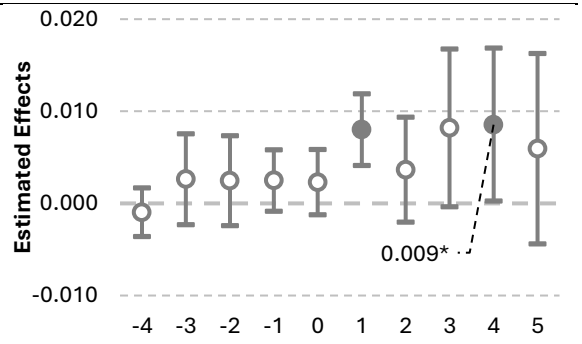


Figure 2C. Baseline, Non-IMLC

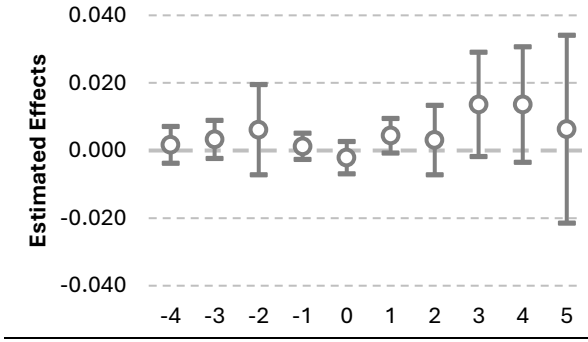


Figure 2D. + Alternative/Placebo Groups in Control Group, Overall

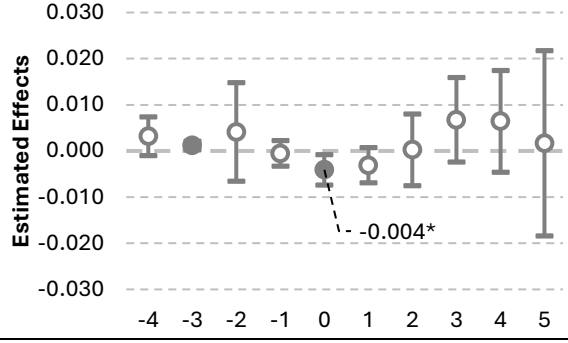


Figure 2E. + Alternative/Placebo Groups in Control Group, IMLC

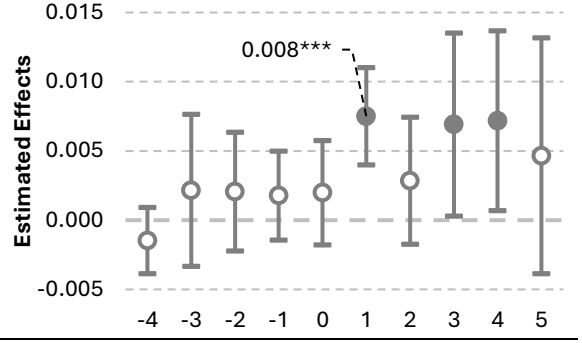


Figure 2F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 168 (14 States × 12 half-years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 240 (20 States × 12 half-years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Figure 3. Changes in State-Level Labor Supply: Out-of-State Practices, Residency Requirements & Falsification Test

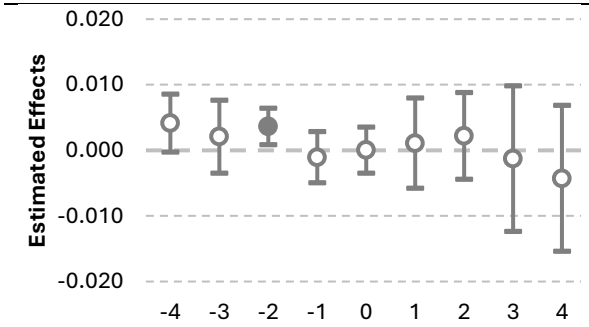


Figure 3A. Out-of-State Practices, Overall, Residency Requirement Alternative Treatment Group

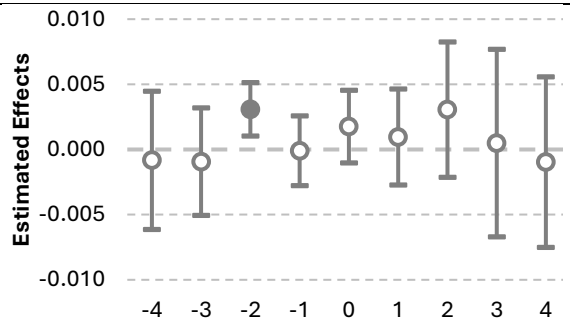


Figure 3B. Out-of-State Practices, IMLC, Residency Requirement Alternative Treatment Group

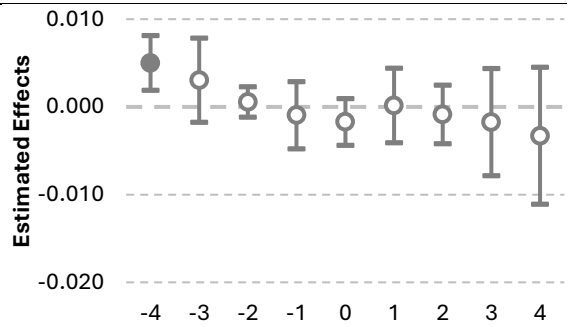


Figure 3C. Out-of-State Practices, Non-IMLC, Residency Requirement Alternative Treatment Group

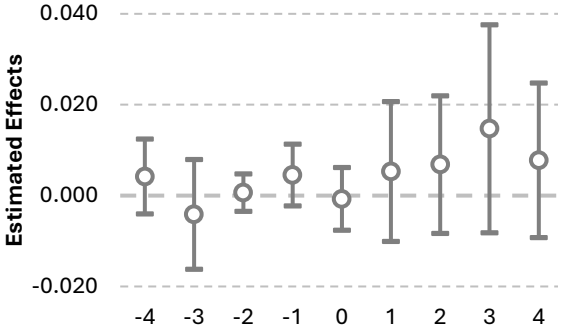


Figure 3D. Out-of-State Practices, Overall, Placebo Treatment Group

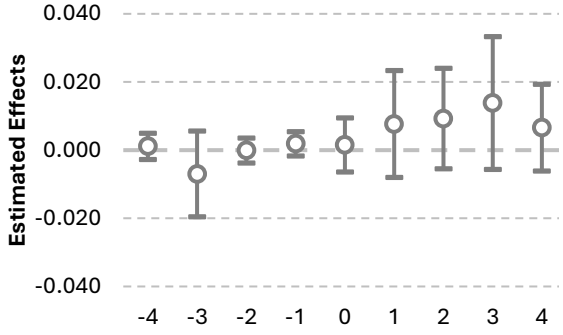


Figure 3E. Out-of-State Practices, IMLC, Placebo Treatment Group

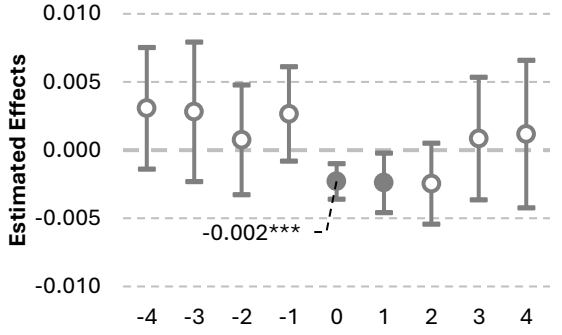


Figure 3F. Out-of-State Practices, Non-IMLC, Placebo Treatment Group

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 180 (15 States × 12 half-years) for the results in the top row, using the states that adopted the universal reciprocity of physician licenses with residency requirements as the alternative treatment group. N = 180 (15 States × 12 half-years) for the bottom row, using the states that adopted ULR but did not include physician licenses for universal reciprocity as the placebo treatment group. *** p<.001, ** p<.01, * p<.05.

Figure 4. Changes in Healthcare Access and Utilization

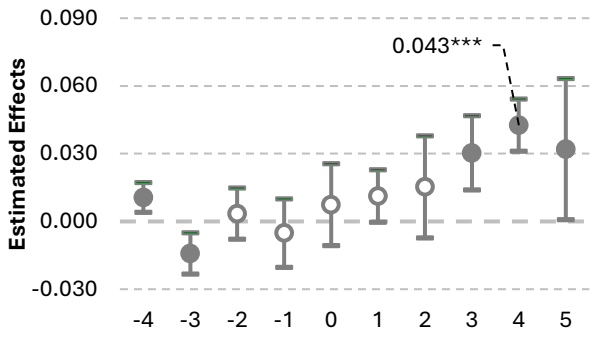


Figure 4A. Personal Doctor, All Ages

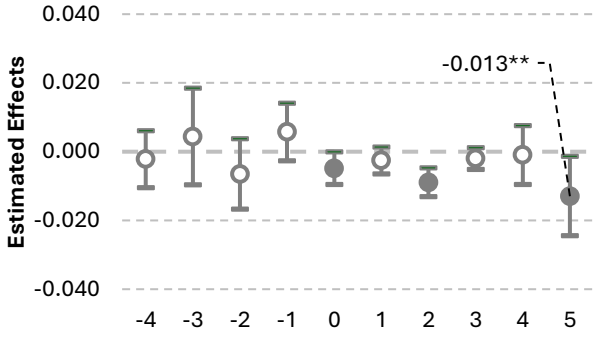


Figure 4B. Cost Issue, All Ages

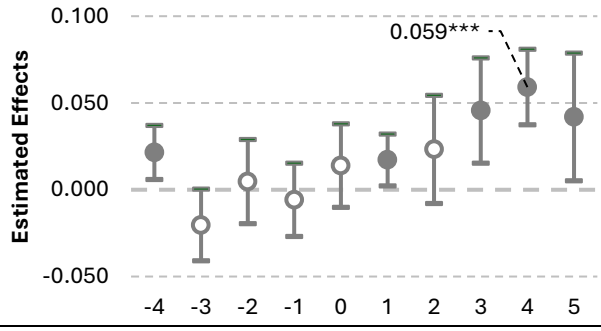


Figure 4C. Personal Doctor, Ages 25-64

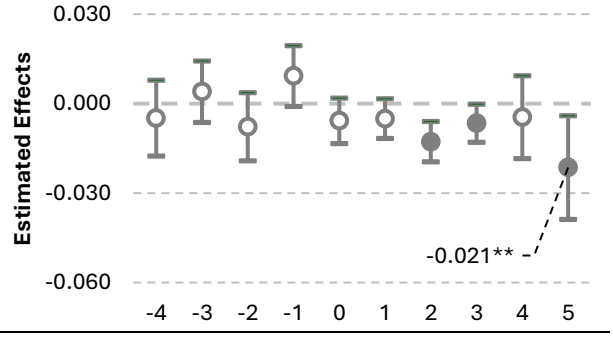


Figure 4D. Cost Issue, Ages 25-64

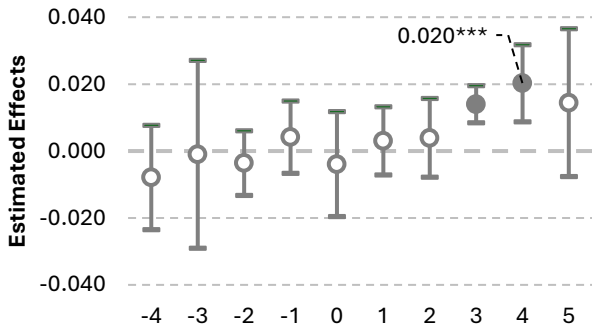


Figure 4E. Personal Doctor, Ages 65+

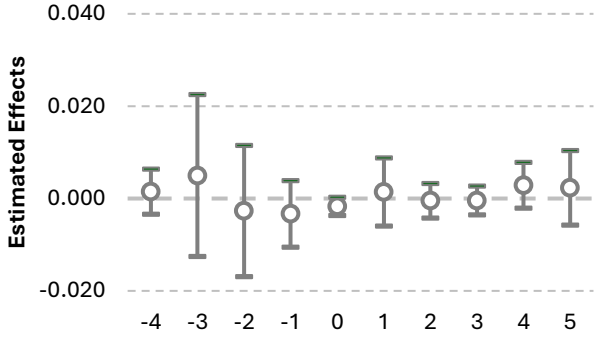


Figure 4F. Cost Issue, Ages 65+

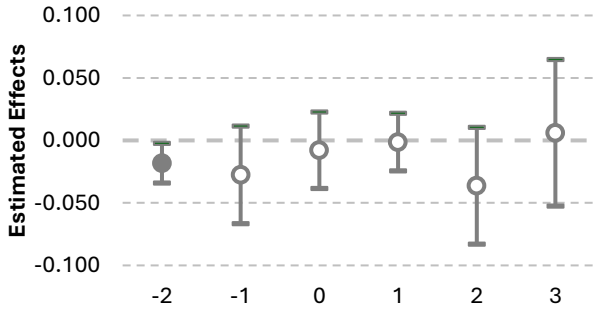


Figure 4G. 1+ Medical Visits

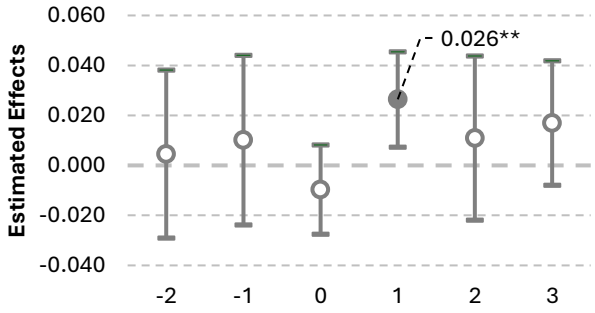


Figure 4H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures 4A-4F), N = 168 (14 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures 4G-4H), N = 72 (12 States × 6 years), using the baseline control group: states that never adopted ULR until 2023. *** p<.001, ** p<.01, * p<.05.

Figure 5. Changes in Healthcare Access and Utilization, Alternative/Placebo Groups Added

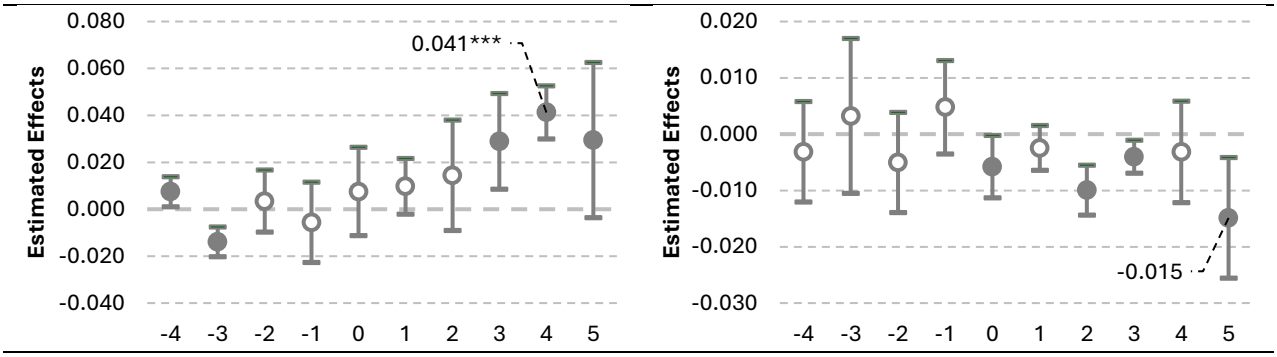


Figure 5A. Personal Doctor, All Ages

Figure 5B. Cost Issue, All Ages

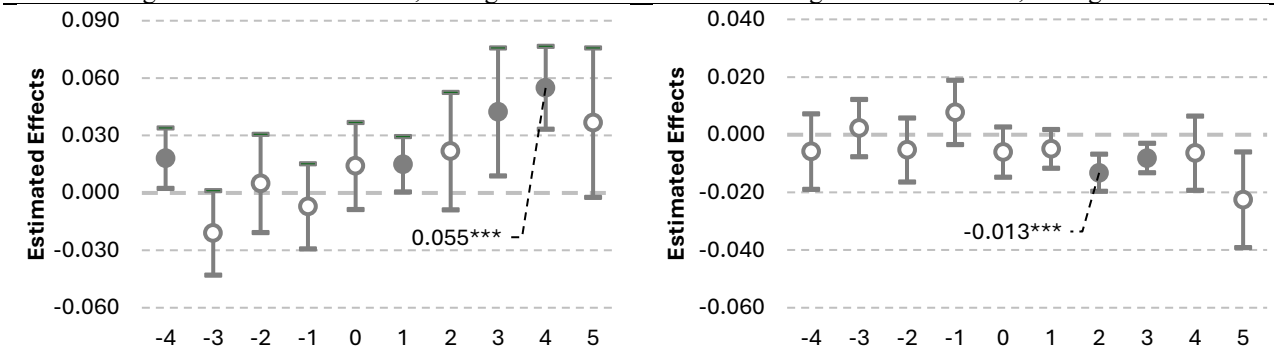


Figure 5C. Personal Doctor, Ages 25-64

Figure 5D. Cost Issue, Ages 25-64

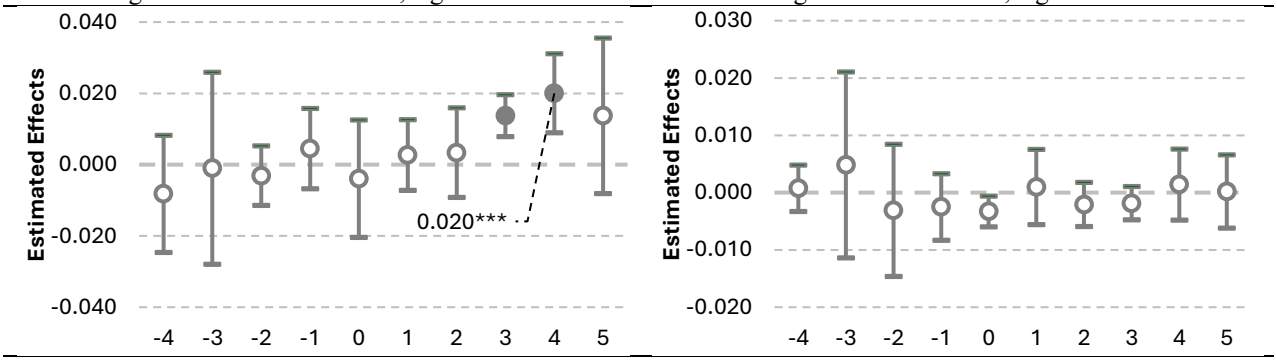


Figure 5E. Personal Doctor, Ages 65+

Figure 5F. Cost Issue, Ages 65+

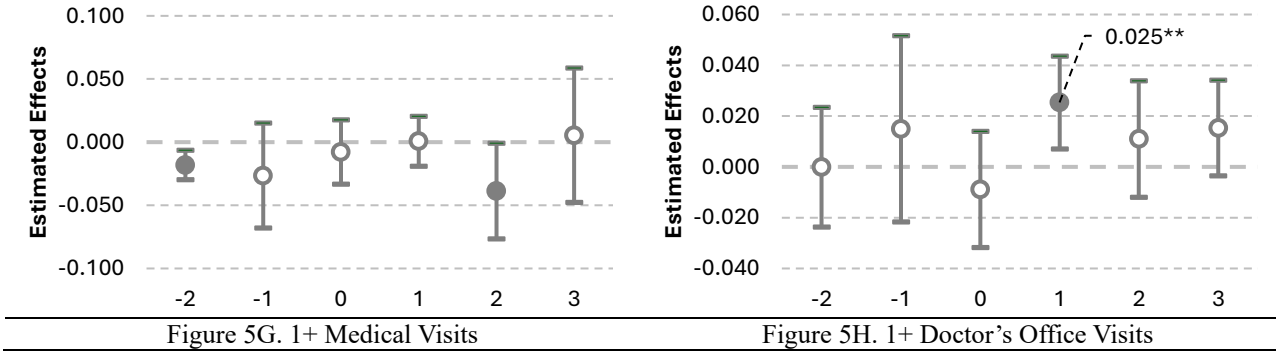


Figure 5G. 1+ Medical Visits

Figure 5H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures 5A-5F), N = 240 (20 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures 5G-5H), N = 102 (17 States × 6 years), using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Figure 6. Changes in Healthcare Access and Utilization: Residency Requirements

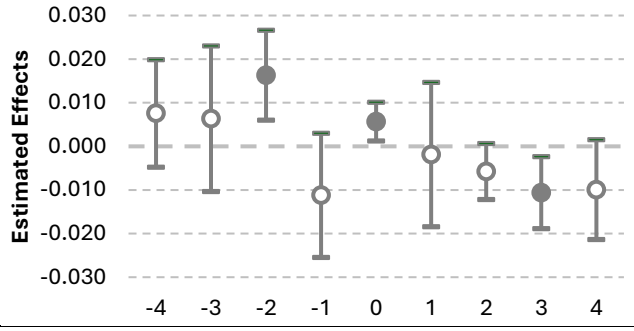


Figure 6A. Personal Doctor, All Ages

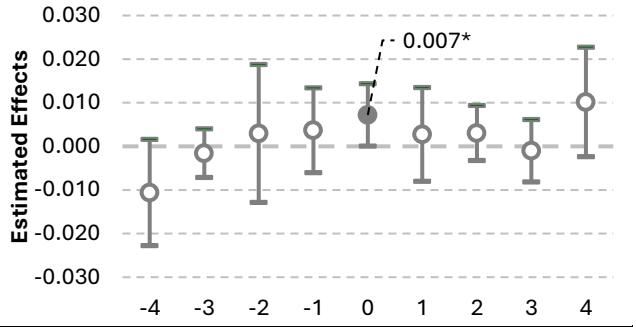


Figure 6B. Cost Issue, All Ages

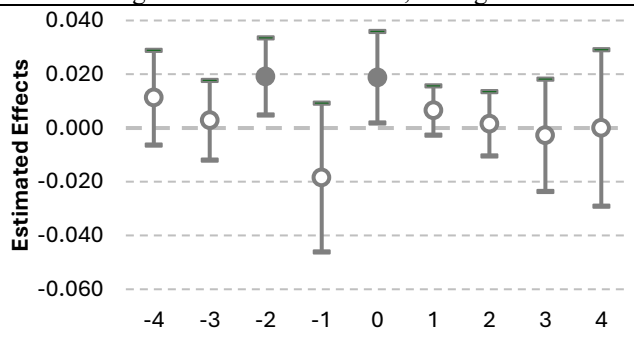


Figure 6C. Personal Doctor, Ages 25-64

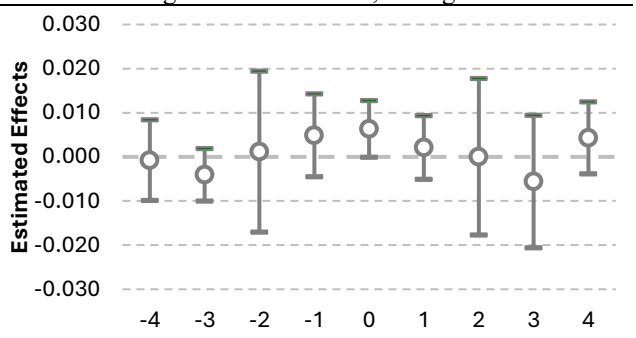


Figure 6D. Cost Issue, Ages 25-64

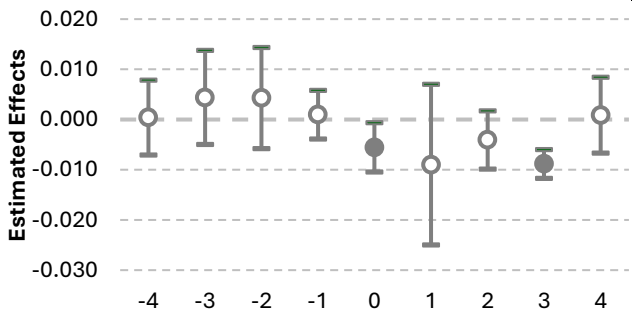


Figure 6E. Personal Doctor, Ages 65+

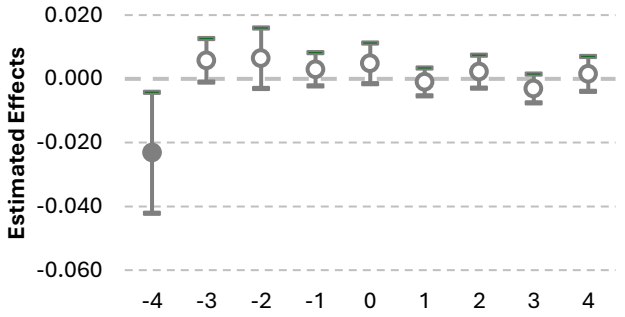


Figure 6F. Cost Issue, Ages 65+

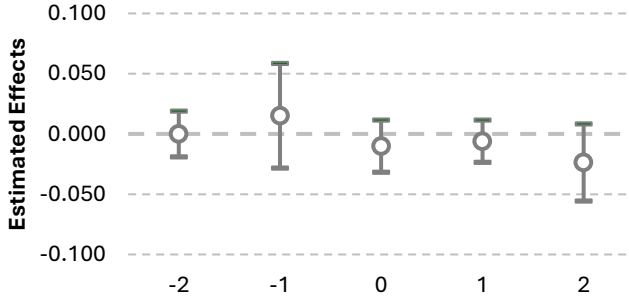


Figure 6G. 1+ Medical Visits

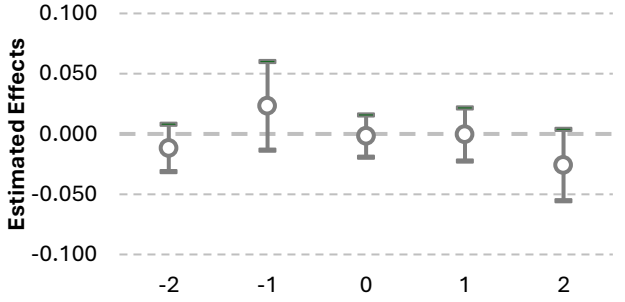


Figure 6H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures 6A-6F), N = 180 (15 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures 6G-6H), N = 84 (14 States × 6 years), using the states that adopted the universal reciprocity of physician licenses with residency requirements as the alternative treatment group. *** p<.001, ** p<.01, * p<.05.

Figure 7. Changes in Healthcare Access and Utilization: Falsification Test

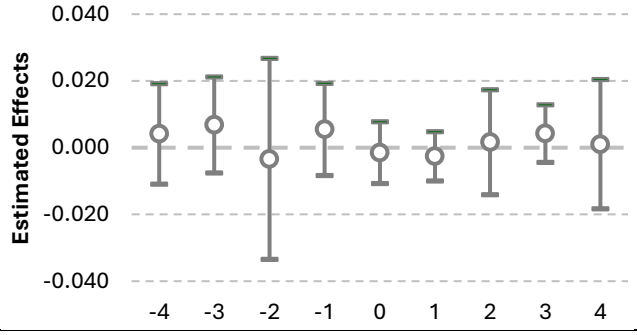


Figure 7A. Personal Doctor, All Ages

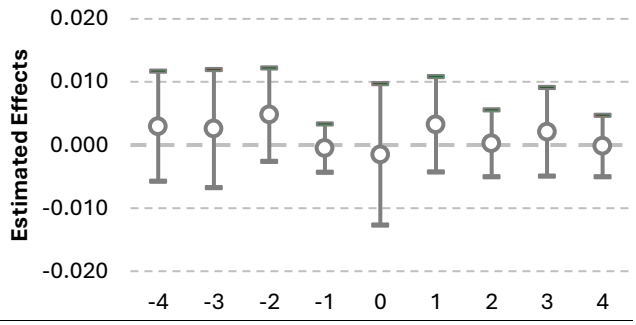


Figure 7B. Cost Issue, All Ages

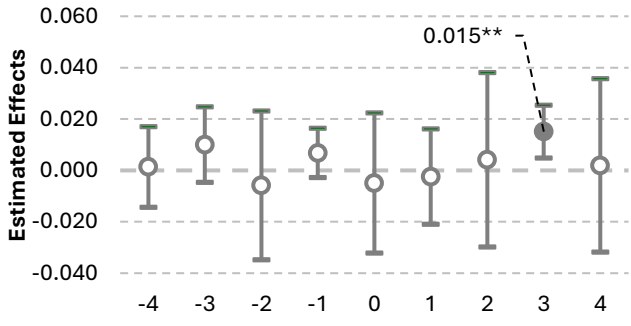


Figure 7C. Personal Doctor, Ages 25-64

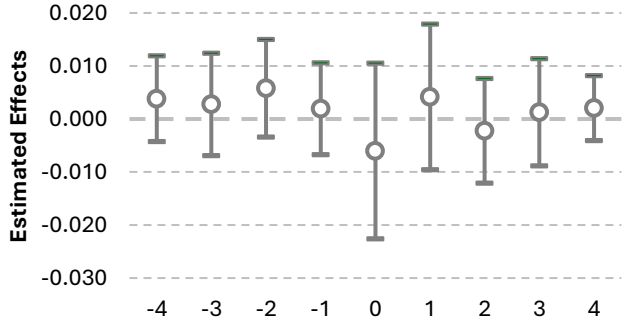


Figure 7D. Cost Issue, Ages 25-64

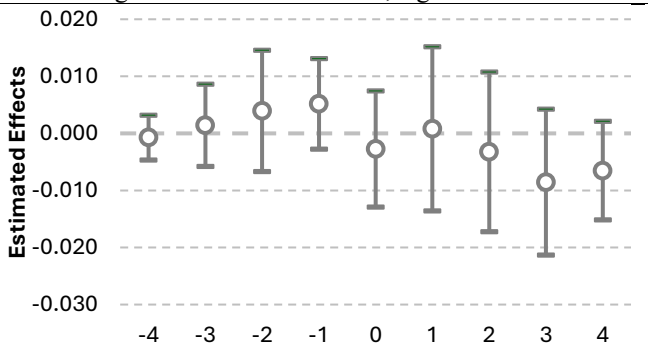


Figure 7E. Personal Doctor, Ages 65+

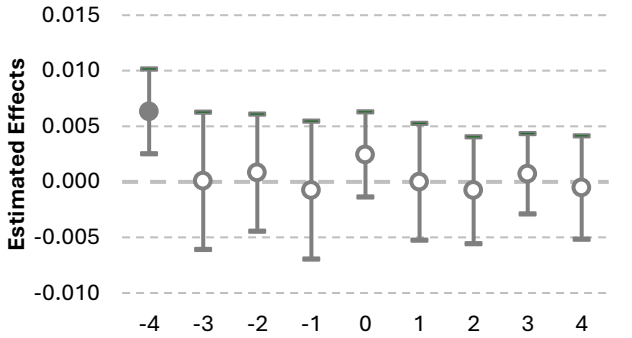


Figure 7F. Cost Issue, Ages 65+

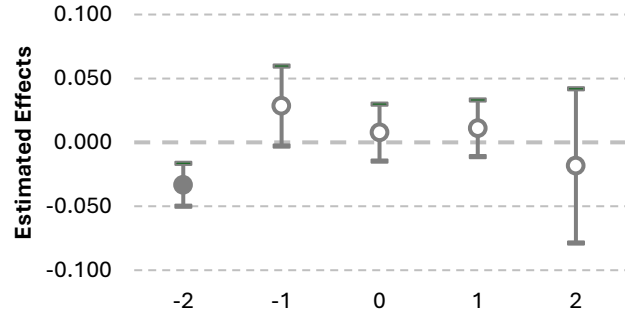


Figure 7G. 1+ Medical Visits

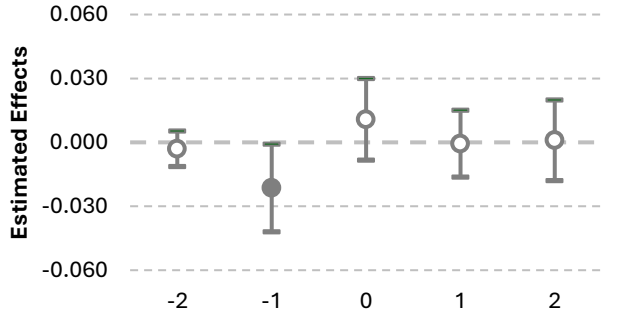


Figure 7H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures 7A-7F), N = 180 (15 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures 7G-7H), N = 84 (14 States × 6 years), using the states that adopted ULR but did not include physician licenses for universal reciprocity as the placebo treatment group. *** p<.001, ** p<.01, * p<.05.

Figure 8. Changes in Healthcare Access and Utilization: Excluding Medicaid/State-Specific Public Health Insurance Recipients

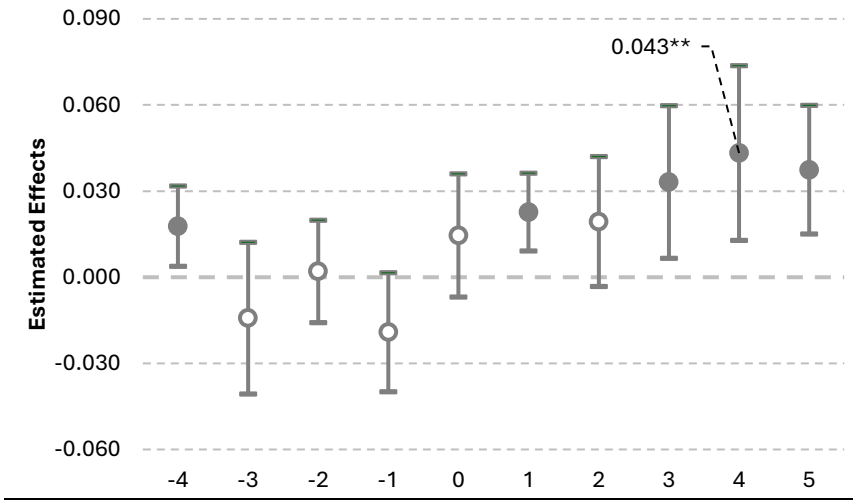


Figure 8A. Personal Doctor

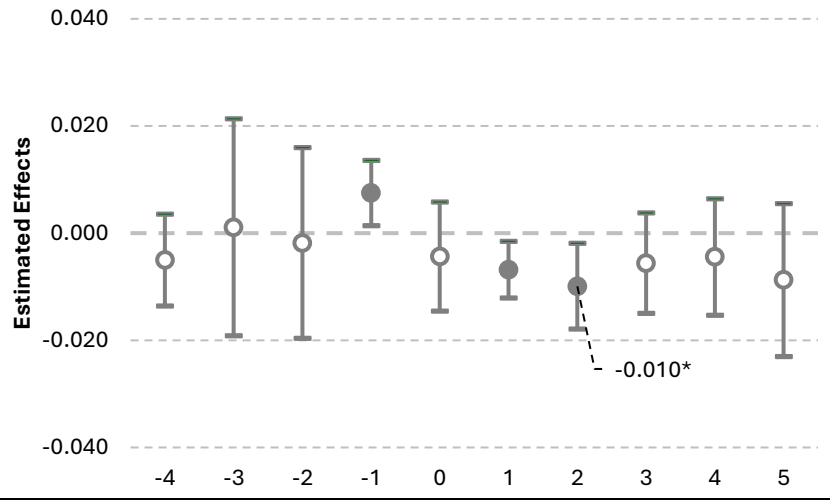


Figure 8B. Cost Issue

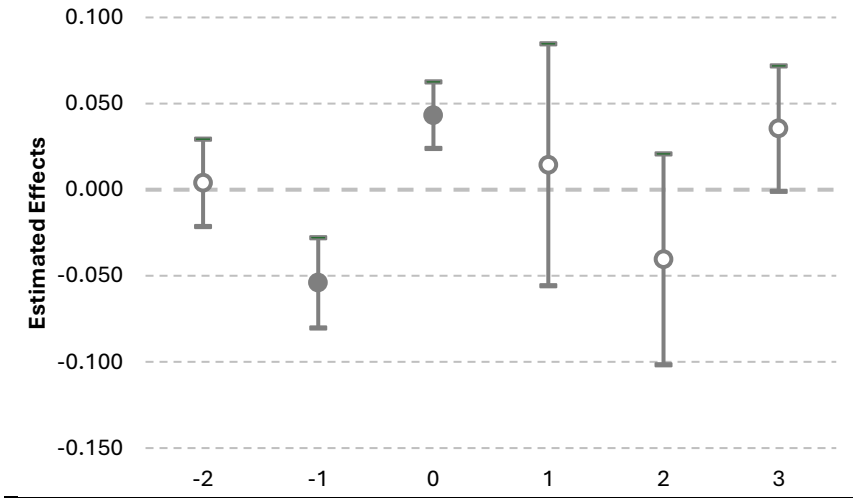


Figure 8C. 1+ Medical Visits

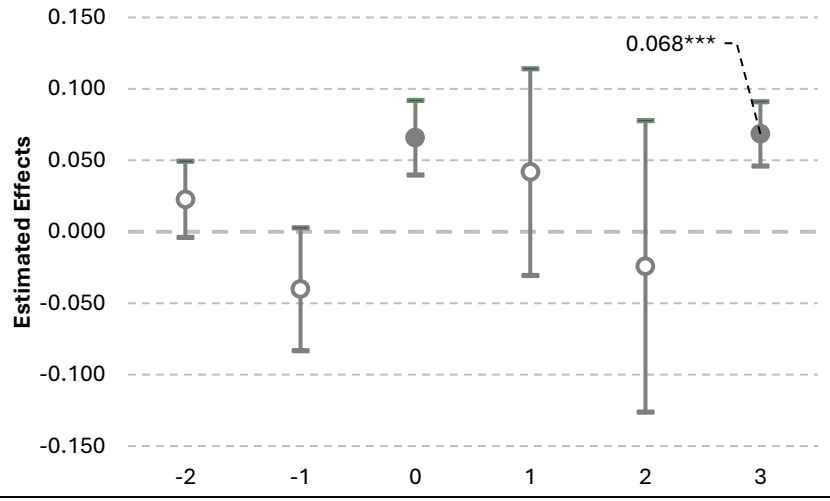


Figure 8D. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures 8A-8B), N = 216 (18 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures 8C-8D), N = 90 (15 States × 6 years). *** p<.001, ** p<.01, * p<.05.

Online Appendix of: Does Universal Occupational Licensing Recognition Improve Patient Access? Evidence from Physician Labor Supply and Healthcare Utilization

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Online Appendix A. Operationalization of Survey Questions

Outcome Variable	Question from the Survey	Response Choices	Operationalization
1. Behavioral Risk Factor Surveillance System (BRFSS)			
Personal Doctor	[BRFSS 2018–2020] "Do you have one person you think of as your personal doctor or health care provider?" [BRFSS 2021–2023] "Do you have one person (or group of doctors) that you think of as your personal health care provider?"	1 – Yes, only one 2 – More than one 3 – No 7 – Don't know / Not sure 9 – Refused	= "Yes" if Response = {1,2} = "No" if Response = {3}
Cost Issue	[BRFSS 2018–2023] "Was there a time in the past 12 months when you needed to see a doctor but could not because you could not afford it?"	1 – Yes 2 – No 7 – Don't know / Not sure 9 – Refused	= "Yes" if Response = {1} = "No" if Response = {2}
Routine Check	[BRFSS 2018–2023] "About how long has it been since you last visited a doctor for a routine checkup?"	1 – Within past year 2 – Within past 2 years 3 – Within past 5 4 – 5 or more years ago 7 – Don't know / Not Sure 8 – Never 9 – Refused	=" Yes" if Response = {1} = "No" if Response = {2,3,4,8}
2. Survey of Income and Program Participation (SIPP)			
1+ Medical Visits	How many times did ... see or talk to a doctor, nurse, or any other type of medical provider about his/her health?	Responses in frequencies (0 or higher)	= "Yes" if Response > 0 = "No" if Response = 0
1+ Doctor's Office Visits	How many of the visits or calls include contact with a physician?	Responses in frequencies (0 or higher)	= "Yes" if Response > 0 = "No" if Response = 0

Note: There was a change in the wording of the survey question for "Personal Doctor" in 2021; therefore, we provide both question texts in this table.

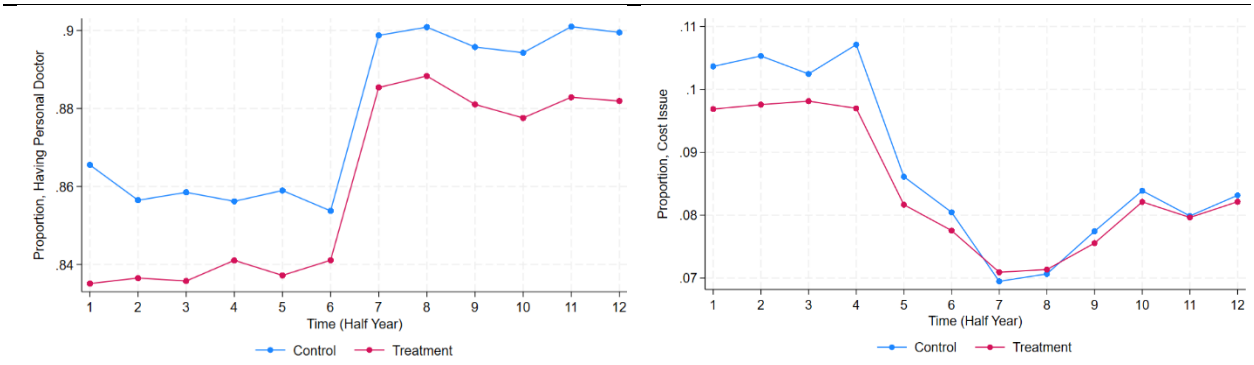
Online Appendix B. Comparison of Measures Between 2020 and 2021

Online Appendix B.1 Comparison: Second Half of 2020 and First Half of 2021

	Personal Doctor				Cost Issue			
	No ULR		ULR		No ULR		ULR	
Year	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2020	.848	.037	.849	.053	.081	.019	.074	.013
2021	.891	.033	.898	.033	.072	.018	.065	.016
Diff (2021-2020)	.043		.049		.009		.009	

Note: The above descriptive statistics show the proportion of respondents who have one or more personal doctors or healthcare providers in the second half of 2020 and the first half of 2021, separately by the ULR adoption status: the states that adopted the ULR are included in the group "ULR," and those that did not adopt the ULR are included in the group "No ULR."

Online Appendix B.2 Changes in Healthcare Utilization Measures Over Time



Personal Doctor, 2018–2023 | Cost Issue, 2018–2023

Note: The first treatment (i.e., adopting the ULR) was in Time 3 (first half of 2019), $N = 240$ (20 States × 12 time points). The wording for the question "having one or more personal doctors or healthcare providers" was changed in the BRFSS 2021, which led to the increase in the proportion of respondents with personal doctors or healthcare providers across all the states in the U.S. Yet, this increase was observed at a similar rate across all states, and therefore this can be controlled by the use of time fixed effects in staggered difference-in-difference methods. For more information about the survey question and changes in the responses, check SHADAC's blog: https://www.shadac.org/news/brfss-potential-break-series-usual-source-care

Online Appendix C. 150% Federal Poverty Level – Determining Respondents Not Being Affected by Medicaid Expansions

Online Appendix C.1 150% Federal Poverty Level, 2018–2023

Family Size	Year					
	2018	2019	2020	2021	2022	2023
1	$18,210	$18,735	$19,140	$19,320	$20,385	$21,870
2	$24,690	$25,365	$25,860	$26,130	$27,465	$29,580
3	$31,260	$32,000	$32,580	$32,940	$34,545	$37,290
4	$37,740	$38,625	$39,300	$39,750	$41,625	$45,000
5	$44,220	$45,225	$45,780	$39,750	$49,050	$52,710

Note: Family size is operationalized by adding total number of adults and total number of children in the household.

Online Appendix C.2 Operationalization of Respondents with the Federal Poverty Level > 150%

Because the BRFSS does not provide the continuous measures of annual household income, only categorical income measures, we identify the respondents whose household income exceeds 150% of the Federal Poverty Level (FPL) by using these categorical measures. The income levels above 150% in each year by family size are provided in Appendix C.1. Note that the BRFSS added three more income categories in 2021, three upper-level categories ($100,000 to $150,000, $150,000 to $200,000, and $200,000 or more).

The annual household income categories in the BRFSS 2018–2020 are (1) less than $10,000, (2) $10,000–$15,000, (3) $15,000–$20,000, (4) $20,000–$25,000 (5) $25,000–$35,000, (6) $35,000–$50,000, (7) $50,000–$75,000, and (8) $75,000 and more. The annual household income categories in the BRFSS 2021-2023 are (1) less than $10,000, (2) $10,000–$15,000, (3) $15,000–$20,000, (4) $20,000–$25,000, (5) $25,000–$35,000, (6) $35,000–$50,000, (7) $50,000–$75,000, and (8) $75,000–$100,000, (9) $100,000–$150,000, (10) $150,000–$200,000, and (11) $200,000 or more. For more information, check the BRFSS's codebook.

1. Year 2018

- Family Size = 1, 150% FPL = $18,210: if household income level > $20,000 (Category 4)
- Family Size = 2, 150% FPL = $24,690: if household income level > $25,000 (Category 5)
- Family Size = 3, 150% FPL = $31,260: if household income level > $35,000 (Category 6)
- Family Size = 4, 150% FPL = $37,740: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $44,220: if household income level > $50,000 (Category 7)

2. Year 2019

- Family Size = 1, 150% FPL = $18,735: if household income level > $20,000 (Category 4)
- Family Size = 2, 150% FPL = $25,365: if household income level > $35,000 (Category 6)
- Family Size = 3, 150% FPL = $32,000: if household income level > $35,000 (Category 6)
- Family Size = 4, 150% FPL = $38,625: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $45,225: if household income level > $50,000 (Category 7)

3. Year 2020

- Family Size = 1, 150% FPL = $19,140: if household income level > $20,000 (Category 4)
- Family Size = 2, 150% FPL = $25,860: if household income level > $35,000 (Category 6)
- Family Size = 3, 150% FPL = $32,580: if household income level > $35,000 (Category 6)
- Family Size = 4, 150% FPL = $39,300: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $45,780: if household income level > $50,000 (Category 7)

4. Year 2021

- Family Size = 1, 150% FPL = $19,320: if household income level > $20,000 (Category 4)
- Family Size = 2, 150% FPL = $26,130: if household income level > $35,000 (Category 6)
- Family Size = 3, 150% FPL = $32,940: if household income level > $35,000 (Category 6)
- Family Size = 4, 150% FPL = $39,750: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $39,750: if household income level > $50,000 (Category 7)

5. Year 2022

- Family Size = 1, 150% FPL = $20,385: if household income level > $25,000 (Category 5)
- Family Size = 2, 150% FPL = $27,465: if household income level > $35,000 (Category 6)
- Family Size = 3, 150% FPL = $34,545: if household income level > $35,000 (Category 6)
- Family Size = 4, 150% FPL = $41,625: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $49,050: if household income level > $50,000 (Category 7)

6. Year 2023

- Family Size = 1, 150% FPL = $21,870: if household income level > $25,000 (Category 5)
- Family Size = 2, 150% FPL = $29,580: if household income level > $35,000 (Category 6)
- Family Size = 3, 150% FPL = $37,290: if household income level > $50,000 (Category 7)
- Family Size = 4, 150% FPL = $45,000: if household income level > $50,000 (Category 7)
- Family Size = 5, 150% FPL = $52,710: if household income level > $75,000 (Category 8)

Online Appendix D. Analyses Including Intercurrent IMLC Adopters

Online Appendix D1. Descriptive Statistics

	Universal Recognition of Physician Licenses							
	No		Yes					
			Placebo Groups					
	Control Group (9 States)		Residency Required (3 States)		Physician Licenses Not Included (3 States)		True Treatment Group (5 States)	
	Prop/ Mean	SD	Prop /Mean	SD	Prop/ Mean	SD	Prop /Mean	SD
CMS Medicare Physician & Other Practitioners by Provider 2018 Proportion of Physicians In-migrated, Including Intercurrent IMLC Adopters								
From Other States	0.023	0.005	0.023	0.007	0.038	0.015	0.031	0.010
From IMLC States	0.013	0.005	0.013	0.004	0.024	0.008	0.019	0.009
From Non-IMLC States	0.010	0.004	0.010	0.005	0.014	0.008	0.012	0.006
CMS National Downloadable File, January/February 2018 Proportion of Physicians Conducting Out-of-State Practices, Including Intercurrent IMLC Adopters								
From Other States	0.023	0.005	0.023	0.007	0.038	0.015	0.031	0.010
From IMLC States	0.013	0.005	0.013	0.004	0.024	0.008	0.019	0.009
From Non-IMLC States	0.010	0.004	0.010	0.005	0.014	0.008	0.012	0.006

Note: IMLC – Interstate Medical Licensure Compact; CMS – Centers for Medicare & Medicaid Services. Prop – proportion; SD – standard deviation. The above descriptive statistics are from the CMS Medicare Physician & Other Practitioners by Provider 2018, CMS National Downloadable File January/February 2018. "Control group" states include Alabama, Illinois, Maine, Minnesota, Nebraska, Tennessee, Washington, West Virginia, and Wisconsin. "Residency required" states include Arizona, Kansas, and Mississippi. "Physician licenses not included" states include Colorado, Utah, and Wyoming. "True treatment group" states include Idaho, Iowa, Montana, New Hampshire, and South Dakota. Check Table 3 for more information about these groups and states.

Online Appendix D2. Changes in State-Level Labor Supply: Interstate Migration

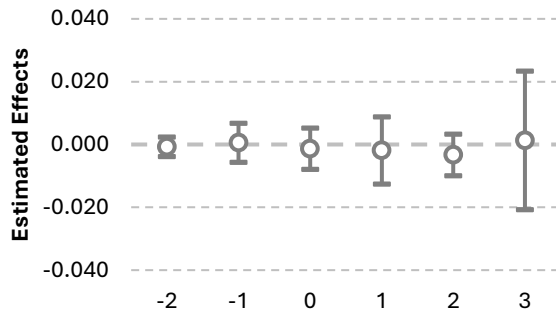


Figure D2A. Baseline, Overall

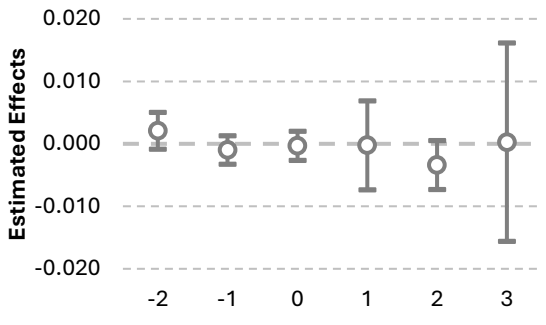


Figure D2B. Baseline, IMLC

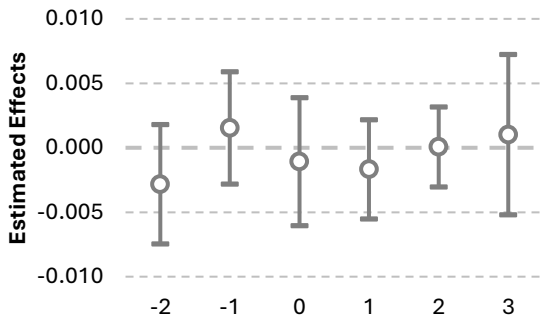


Figure D2C. Baseline, Non-IMLC

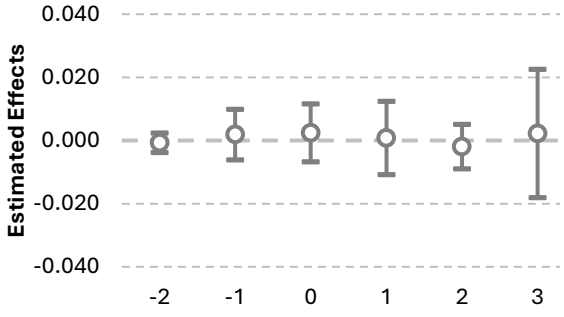


Figure D2D. + Alternative/Placebo Groups in Control Group, Overall

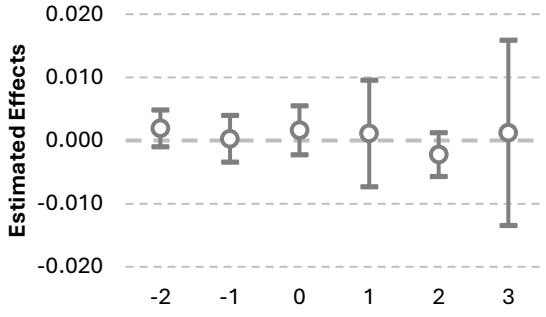


Figure D2E. + Alternative/Placebo Groups in Control Group, IMLC

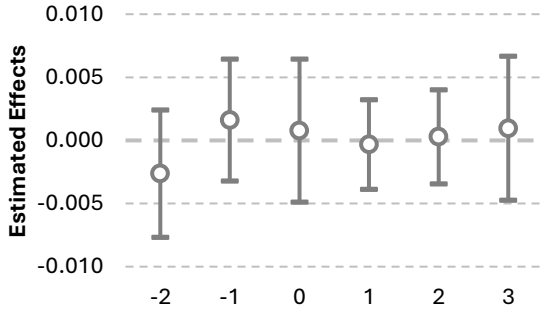


Figure D2F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Medicare Physician & Other Practitioners by Provider. N = 84 (14 States × 6 years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 120 (20 States × 6 years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Online Appendix D3. Changes in State-Level Labor Supply: Out-of-State Practices

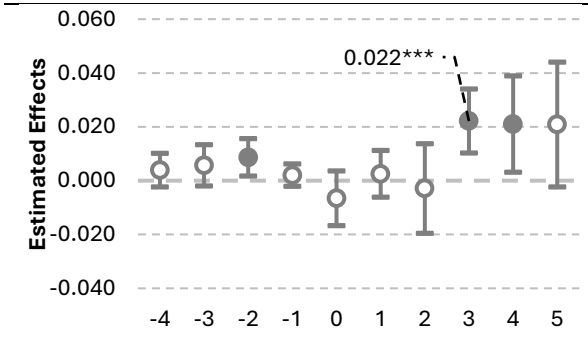


Figure D3A. Baseline, Overall

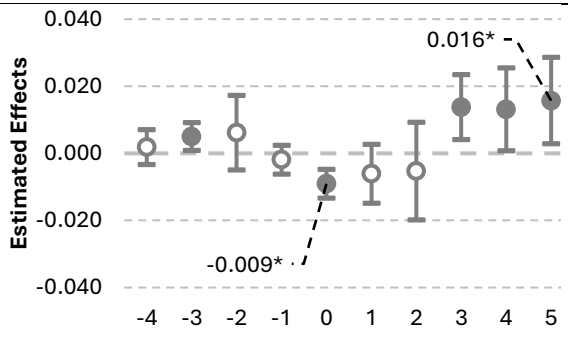


Figure D3B. Baseline, IMLC

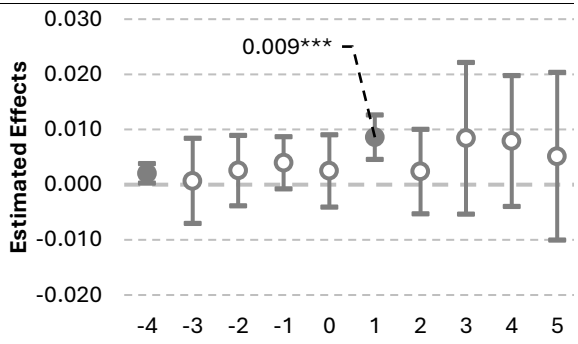


Figure D3C. Baseline, Non-IMLC

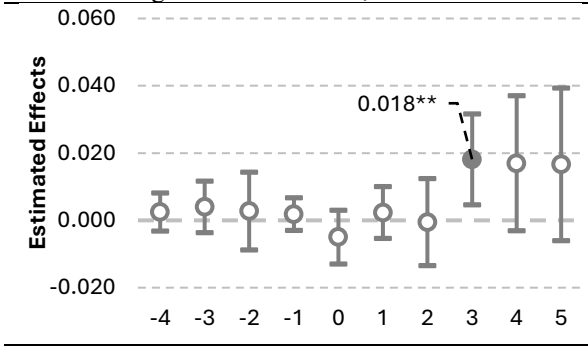


Figure D3D. + Alternative/Placebo Groups in Control Group, Overall

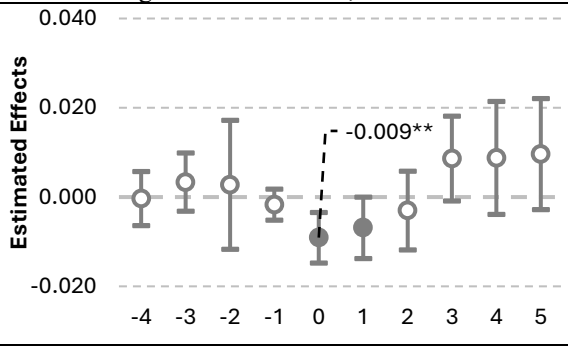


Figure D3E. + Alternative/Placebo Groups in Control Group, IMLC

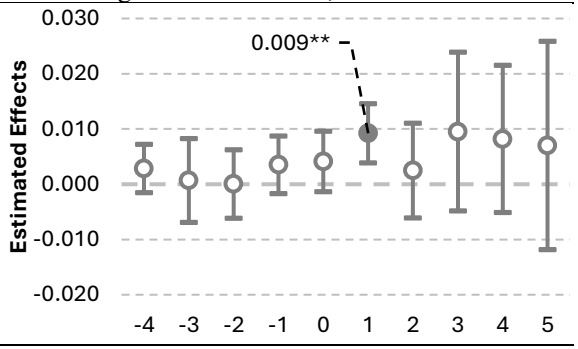


Figure D3F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 168 (14 States × 12 half-years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 240 (20 States × 12 half-years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Online Appendix D4. Changes in State-Level Labor Supply: Out-of-State Practices, Residency Requirements & Falsification Test

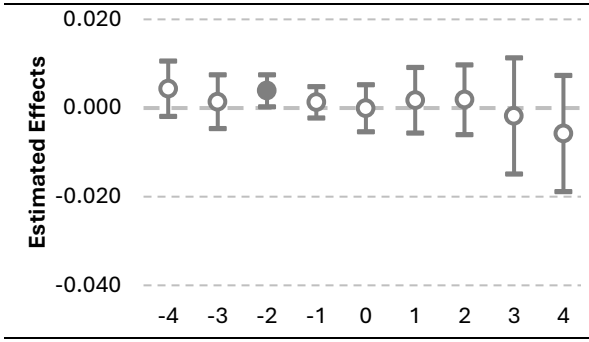


Figure D4A. Out-of-State Practices, Overall, Residency Requirement Alternative Treatment Group

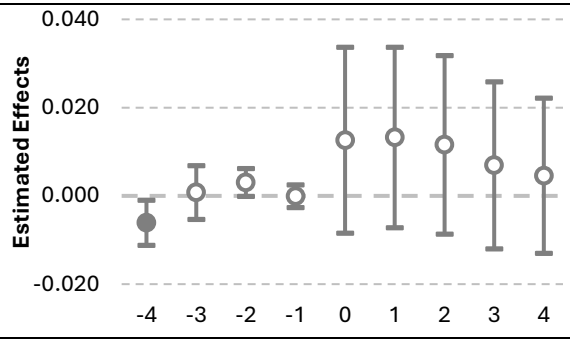


Figure D4B. Out-of-State Practices, IMLC, Residency Requirement Alternative Treatment Group

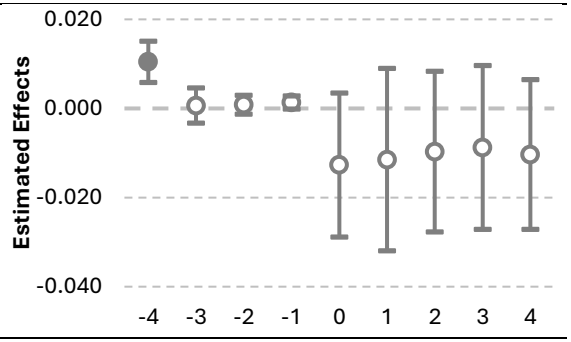


Figure D4C. Out-of-State Practices, Non-IMLC, Residency Requirement Alternative Treatment Group

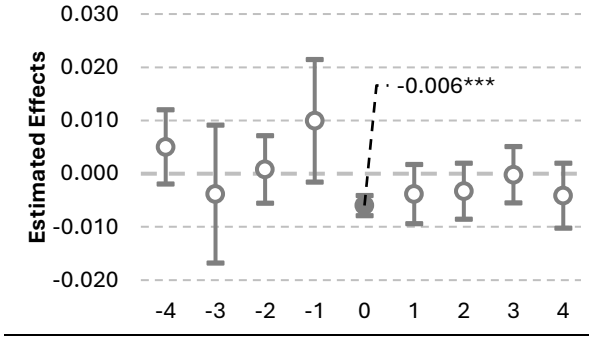


Figure D4D. Out-of-State Practices, Overall, Placebo Treatment Group

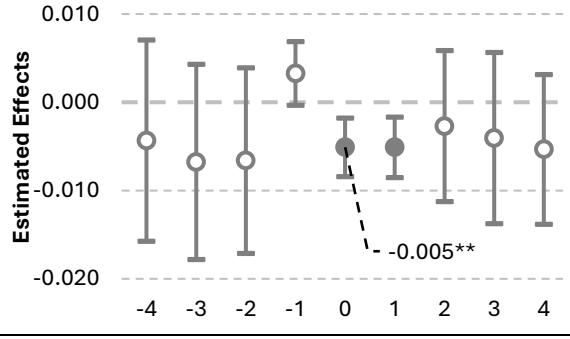


Figure D4E. Out-of-State Practices, IMLC, Placebo Treatment Group

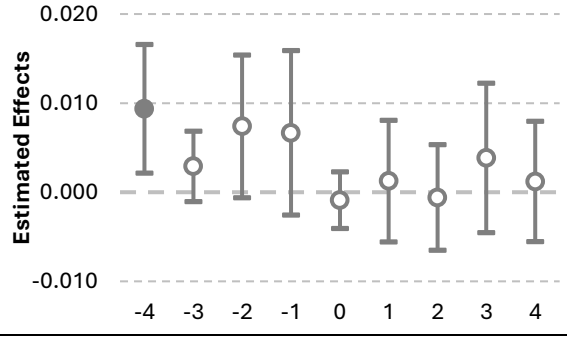


Figure D4F. Out-of-State Practices, Non-IMLC, Placebo Treatment Group

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 180 (15 States × 12 half-years) for the results in the top row, using the states that adopted the universal reciprocity of physician licenses with residency requirements as the alternative treatment group. N = 180 (15 States × 12 half-years) for the bottom row, using the states that adopted ULR but did not include physician licenses for universal reciprocity as the placebo treatment group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E. Analyses Controlled for Pandemic-Caused Demand Shocks

Online Appendix E1. Changes in State-Level Labor Supply: Interstate Migration

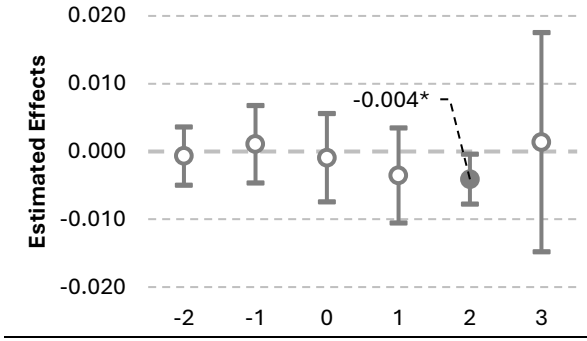


Figure E1A. Baseline, Overall

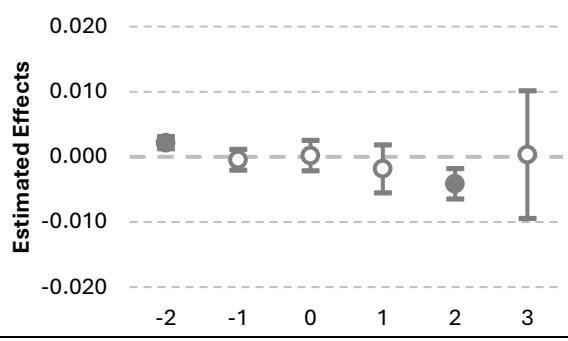


Figure E1B. Baseline, IMLC

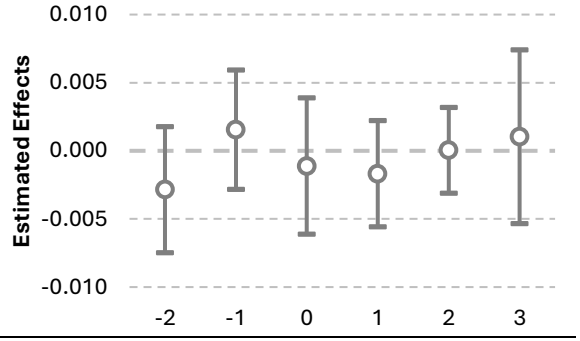


Figure E1C. Baseline, Non-IMLC

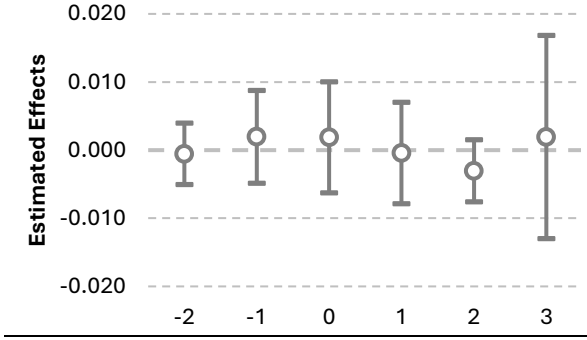


Figure E1D. + Alternative/Placebo Groups in Control Group, Overall

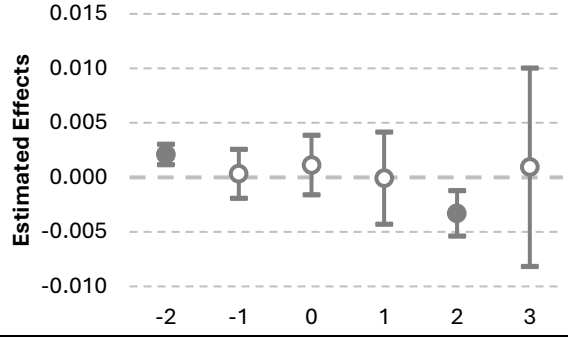


Figure E1E. + Alternative/Placebo Groups in Control Group, IMLC

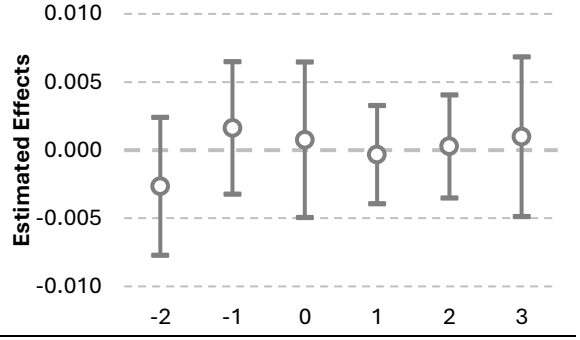


Figure E1F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Medicare Physician & Other Practitioners by Provider. N = 84 (14 States × 6 years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 120 (20 States × 6 years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E2. Changes in State-Level Labor Supply: Out-of-State Practices

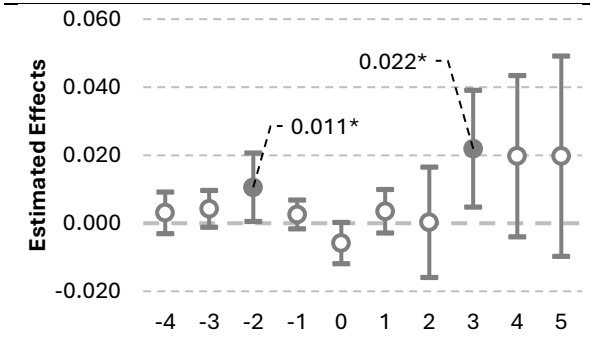


Figure E2A. Baseline, Overall

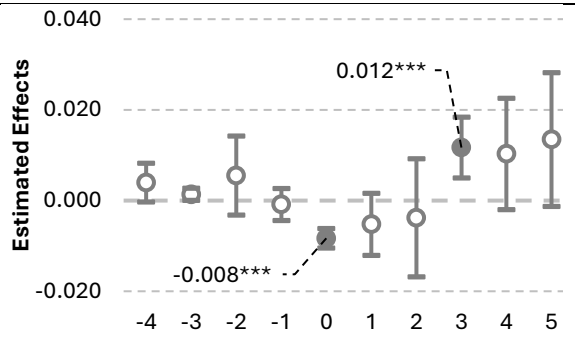


Figure E2B. Baseline, IMLC

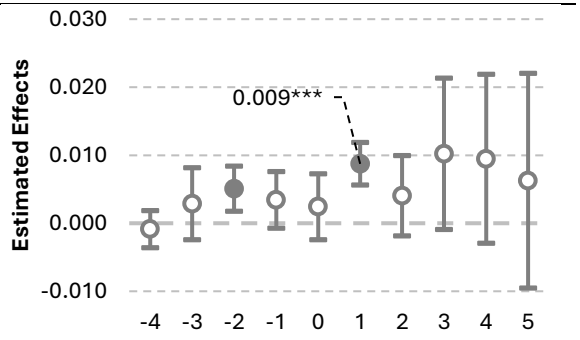


Figure E2C. Baseline, Non-IMLC

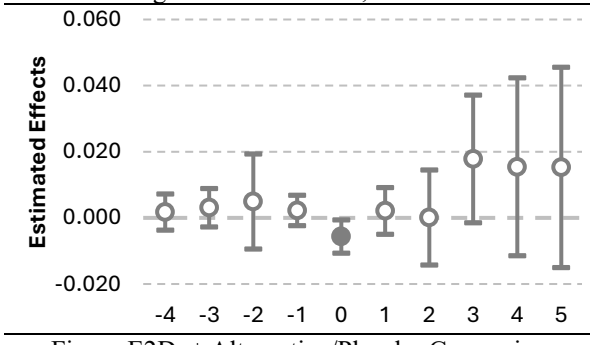


Figure E2D. + Alternative/Placebo Groups in Control Group, Overall

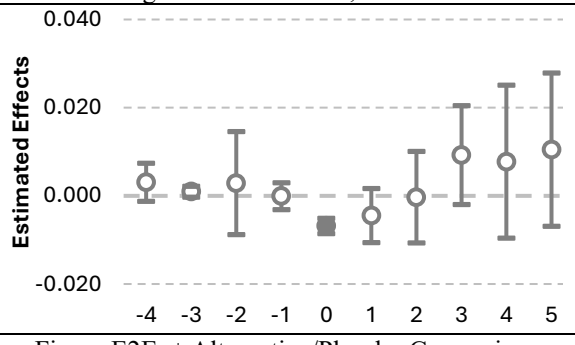


Figure E2E. + Alternative/Placebo Groups in Control Group, IMLC

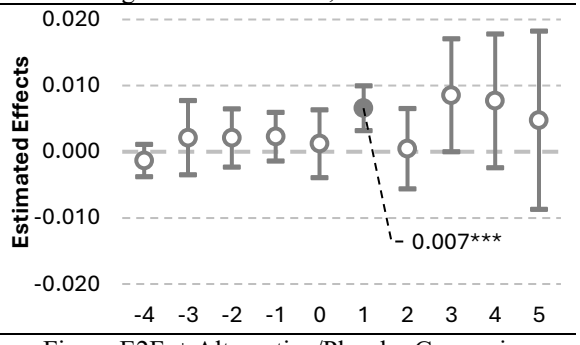


Figure E2F. + Alternative/Placebo Groups in Control Group, Non-IMLC

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 168 (14 States × 12 half-years) for the results in the top row, using the baseline control group: states that never adopted ULR until 2023. N = 240 (20 States × 12 half-years) for the bottom row, using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E3. Changes in State-Level Labor Supply: Out-of-State Practices, Residency Requirements & Falsification Test

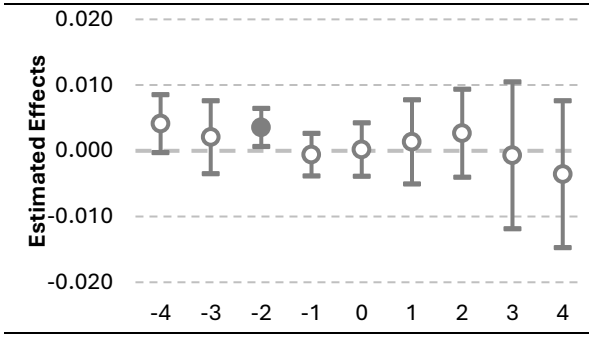


Figure E3A. Out-of-State Practices, Overall, Residency Requirement Alternative Treatment Group

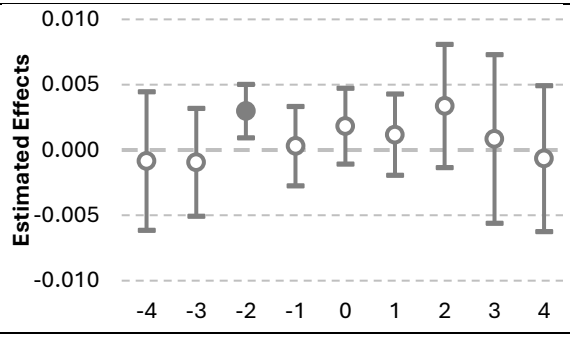


Figure E3B. Out-of-State Practices, IMLC, Residency Requirement Alternative Treatment Group

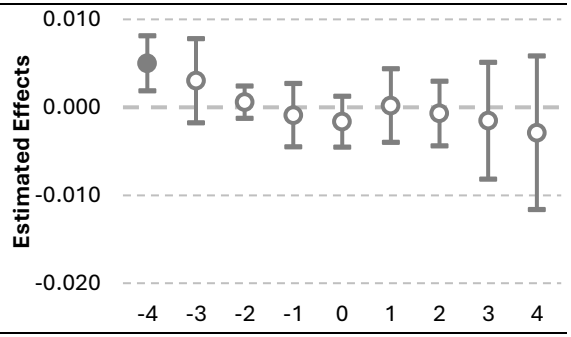


Figure E3C. Out-of-State Practices, Non-IMLC, Residency Requirement Alternative Treatment Group

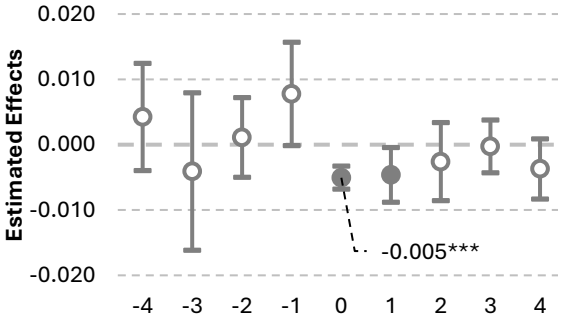


Figure E3D. Out-of-State Practices, Overall, Placebo Treatment Group

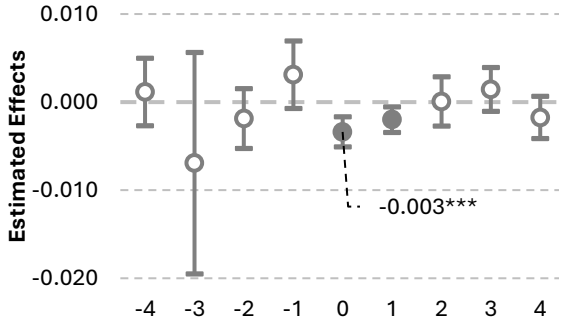


Figure E3E. Out-of-State Practices, IMLC, Placebo Treatment Group

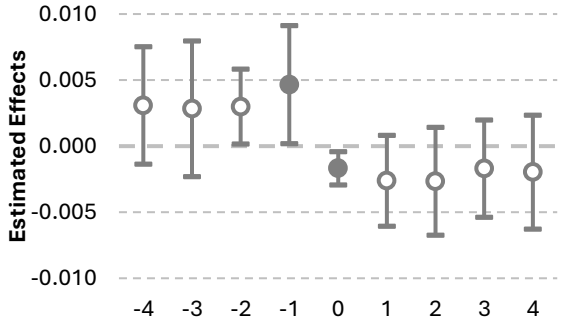


Figure E3F. Out-of-State Practices, Non-IMLC, Placebo Treatment Group

Note: The sub-figures above are obtained using Callaway-Sant'Anna staggered difference-in-differences, using the states that implemented the Interstate Medical Licensure Compact (IMLC) before 2018, using the CMS Doctors and Clinicians National Downloadable File. N = 180 (15 States × 12 half-years) for the results in the top row, using the states that adopted the universal reciprocity of physician licenses with residency requirements as the alternative treatment group. N = 180 (15 States × 12 half-years) for the bottom row, using the states that adopted ULR but did not include physician licenses for universal reciprocity as the placebo treatment group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E4. Changes in Healthcare Access and Utilization

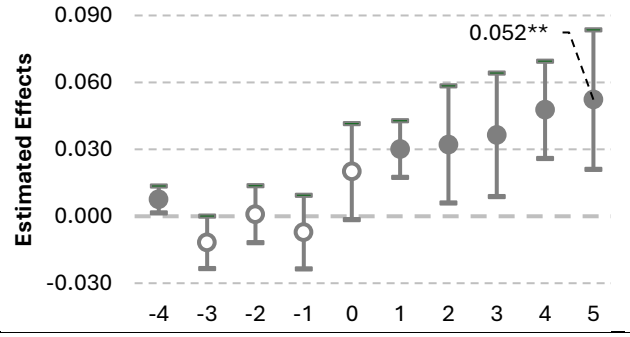


Figure E4A. Personal Doctor, All Ages

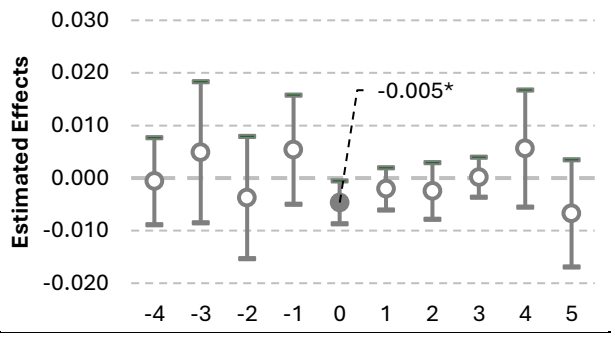


Figure E4B. Cost Issue, All Ages

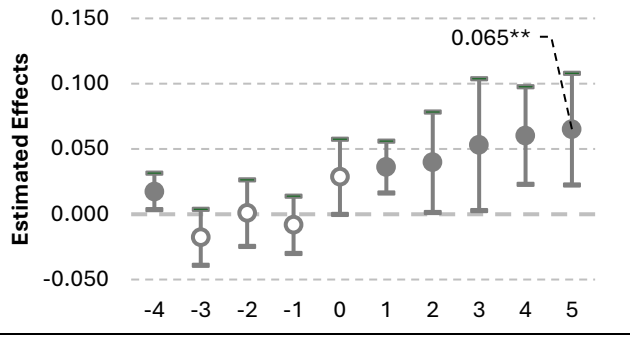


Figure E4C. Personal Doctor, Ages 25-64

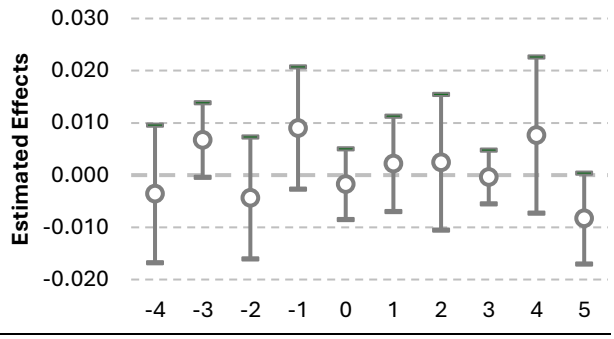


Figure E4D. Cost Issue, Ages 25-64

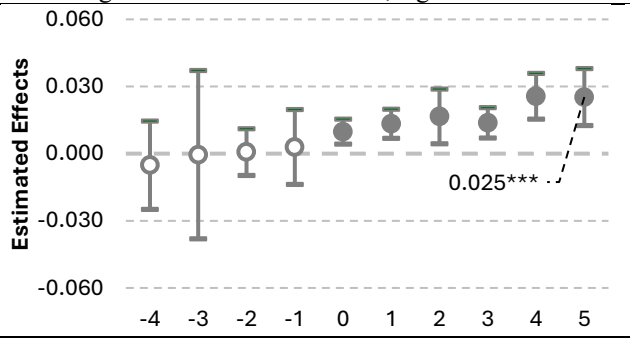


Figure E4E. Personal Doctor, Ages 65+

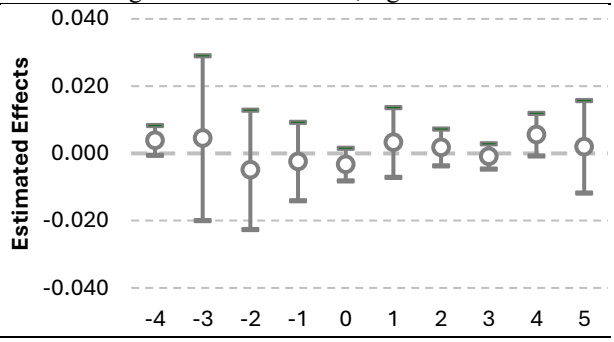


Figure E4F. Cost Issue, Ages 65+

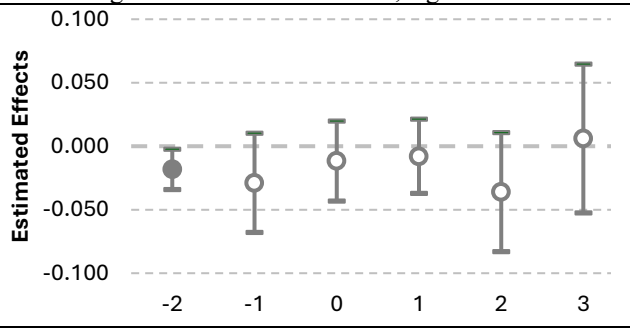


Figure E4G. 1+ Medical Visits

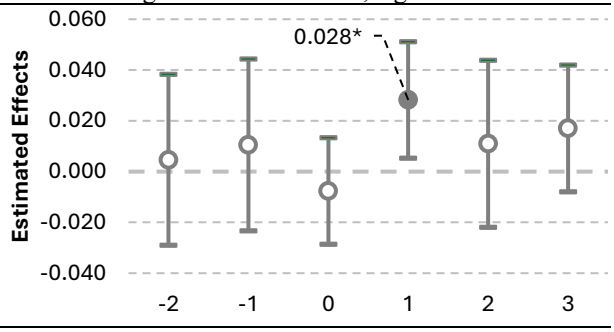


Figure E4H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures E4A-E4F), N = 168 (14 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures E4G-E4H), N = 72 (12 States × 6 years), using the baseline control group: states that never adopted ULR until 2023. *** p<.001, ** p<.01, * p<.05.

Online Appendix E5. Changes in Healthcare Access and Utilization, Alternative/Placebo Groups Added

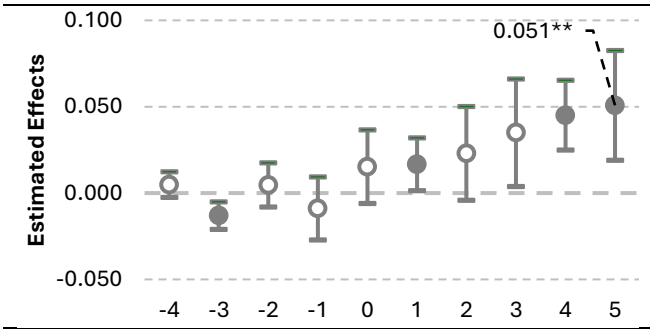


Figure E5A. Personal Doctor, All Ages

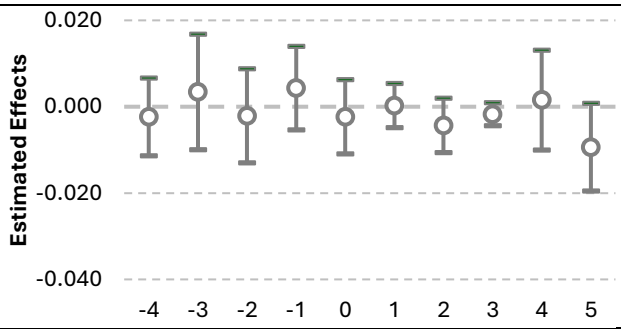


Figure E5B. Cost Issue, All Ages

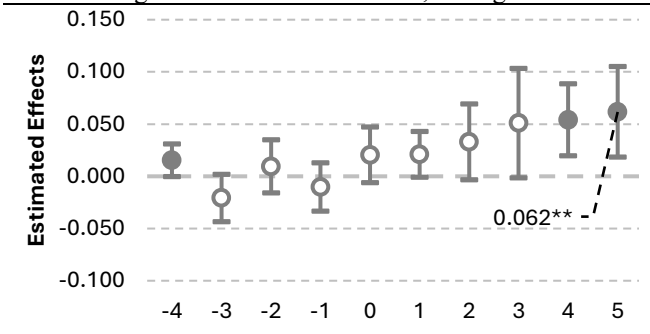


Figure E5C. Personal Doctor, Ages 25-64

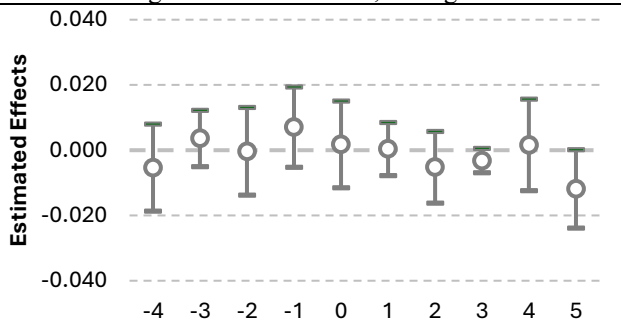


Figure E5D. Cost Issue, Ages 25-64

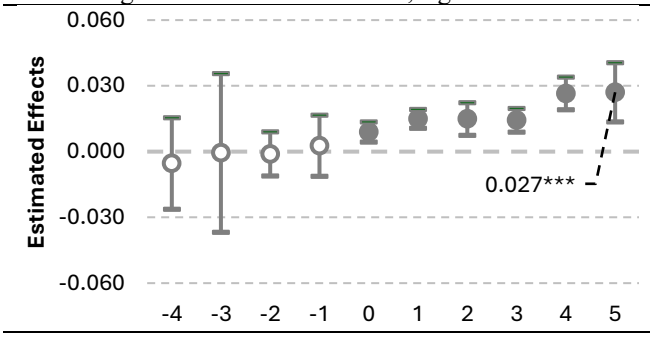


Figure E5E. Personal Doctor, Ages 65+

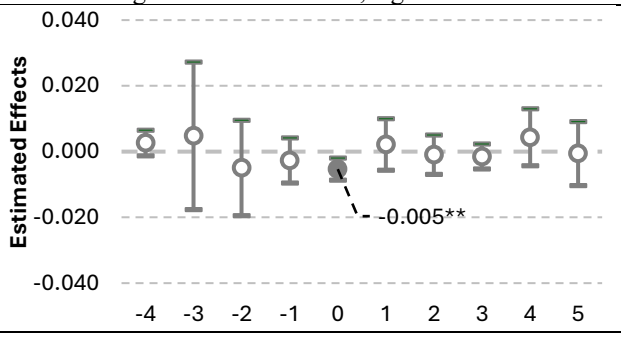


Figure E5F. Cost Issue, Ages 65+

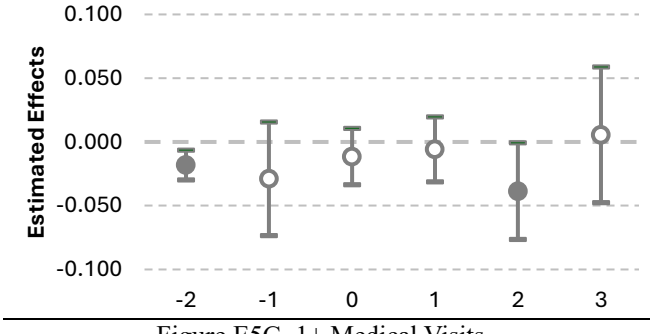


Figure E5G. 1+ Medical Visits

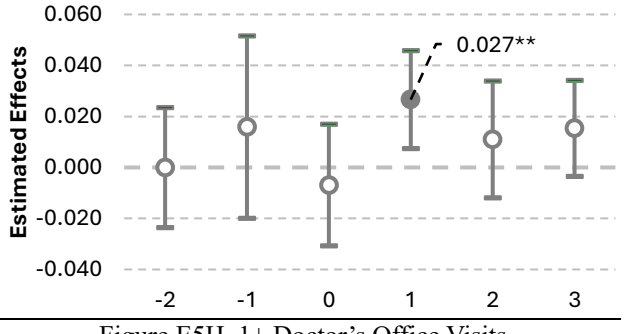


Figure E5H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures E5A-E5F), N = 240 (20 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures E5G-E5H), N = 102 (17 States × 6 years), using the baseline control group and alternative/placebo groups as the control group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E6. Changes in Healthcare Access and Utilization: Residency Requirements

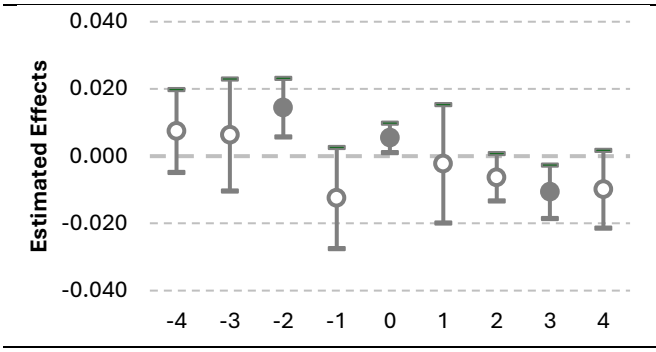


Figure E6A. Personal Doctor, All Ages

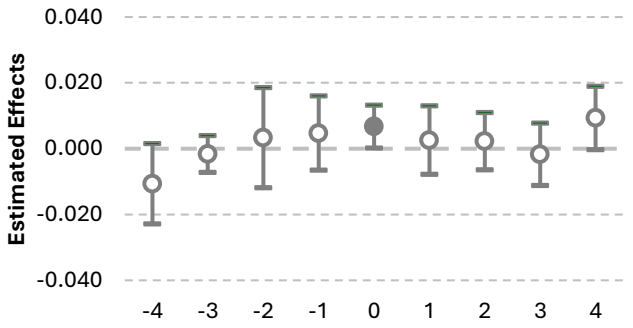


Figure E6B. Cost Issue, All Ages

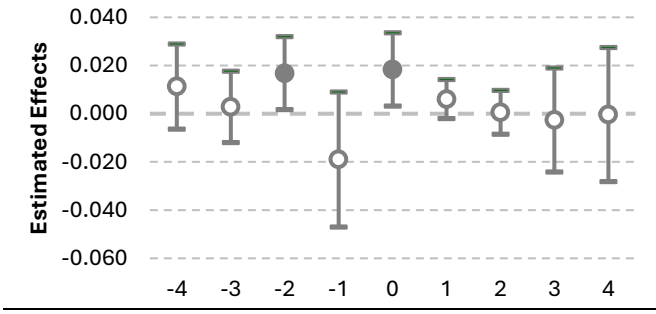


Figure E6C. Personal Doctor, Ages 25-64

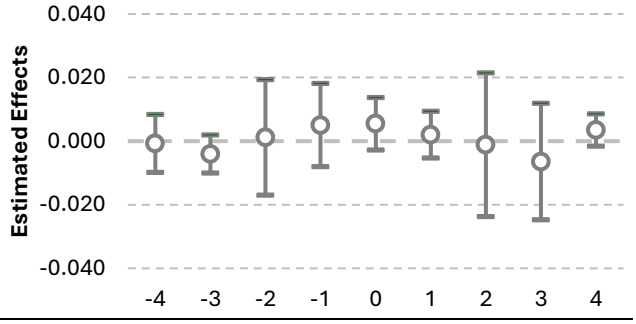


Figure E6D. Cost Issue, Ages 25-64

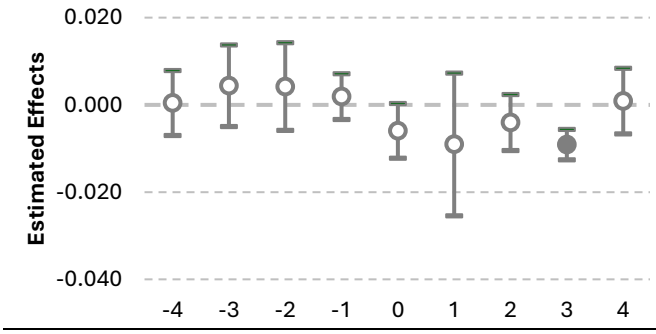


Figure E6E. Personal Doctor, Ages 65+

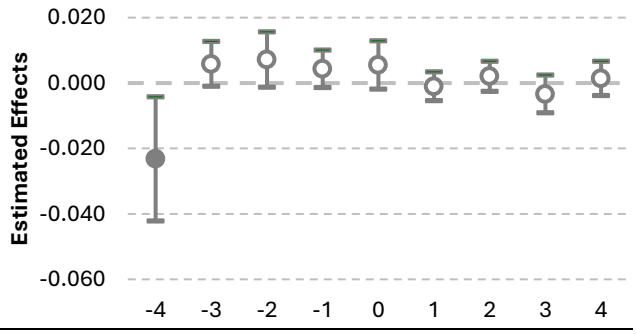


Figure E6F. Cost Issue, Ages 65+

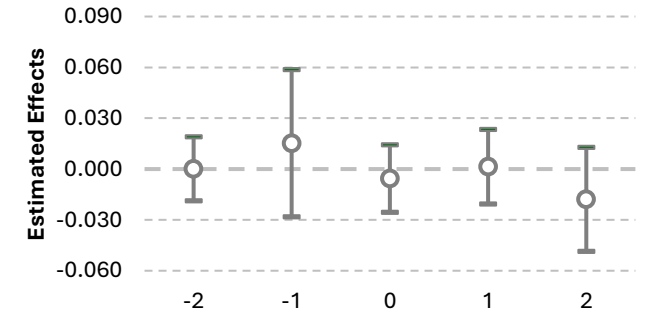


Figure E6G. 1+ Medical Visits

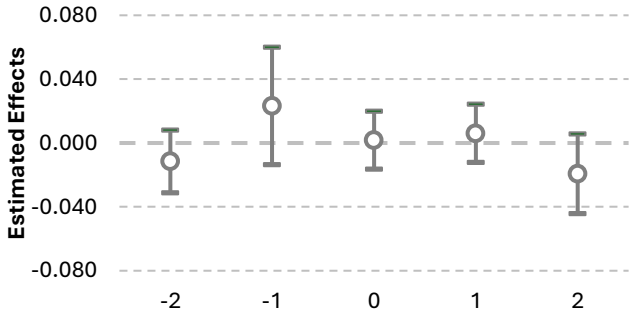


Figure E6H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures E6A-E6F), N = 180 (15 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures E6G-E6H), N = 84 (14 States × 6 years), using the states that adopted the universal reciprocity of physician licenses with residency requirements as the alternative treatment group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E7. Changes in Healthcare Access and Utilization: Falsification Test

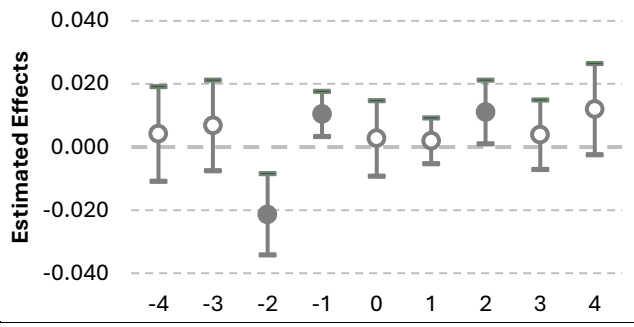


Figure E7A. Personal Doctor, All Ages

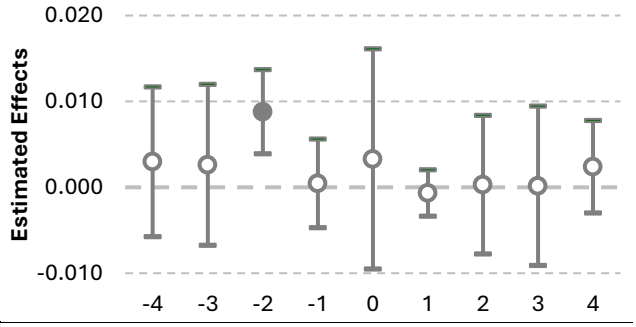


Figure E7B. Cost Issue, All Ages

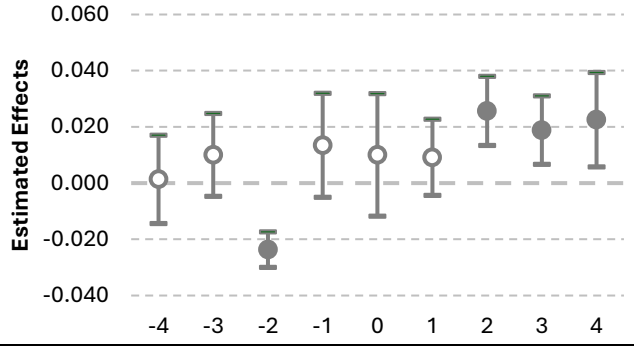


Figure E7C. Personal Doctor, Ages 25-64

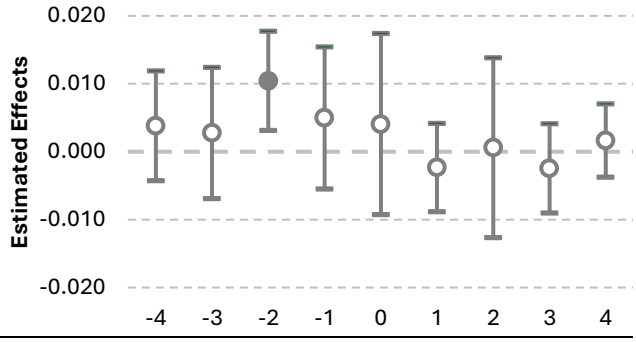


Figure E7D. Cost Issue, Ages 25-64

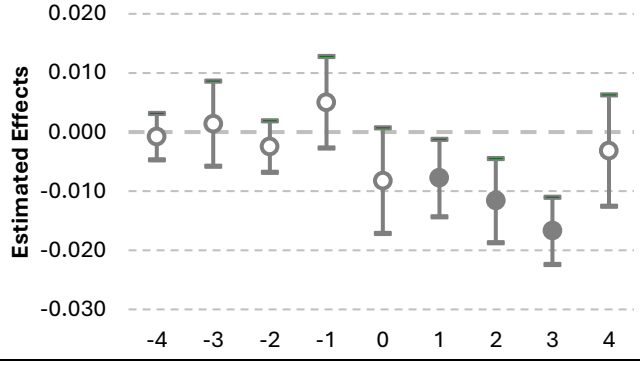


Figure E7E. Personal Doctor, Ages 65+

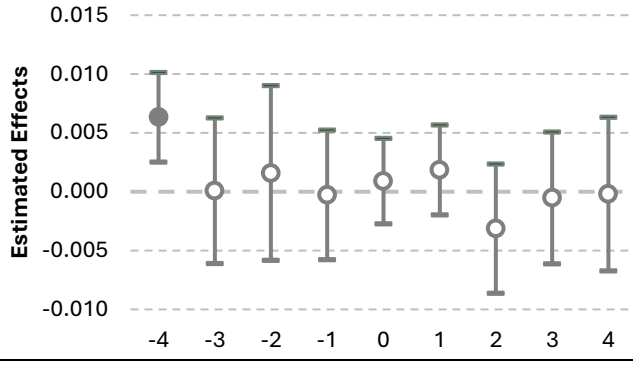


Figure E7F. Cost Issue, Ages 65+

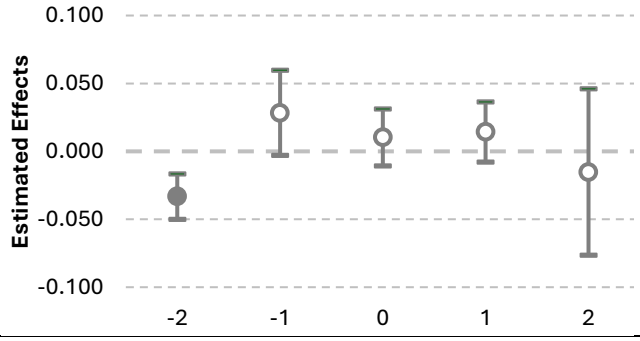


Figure E7G. 1+ Medical Visits

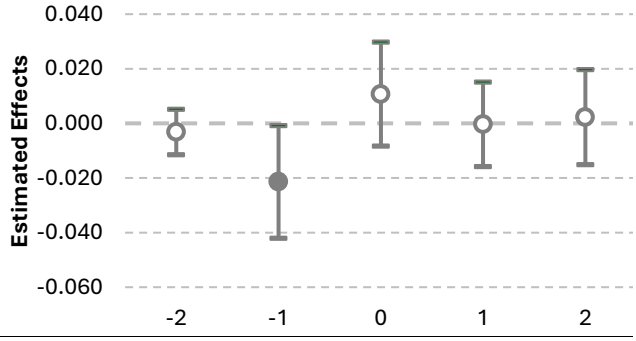


Figure E7H. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures E7A-E7F), N = 180 (15 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures E7G-E7H), N = 84 (14 States × 6 years), using the states that adopted ULR but did not include physician licenses for universal reciprocity as the placebo treatment group. *** p<.001, ** p<.01, * p<.05.

Online Appendix E8. Changes in Healthcare Access and Utilization: Excluding Medicaid/State-Specific Public Health Insurance Recipients

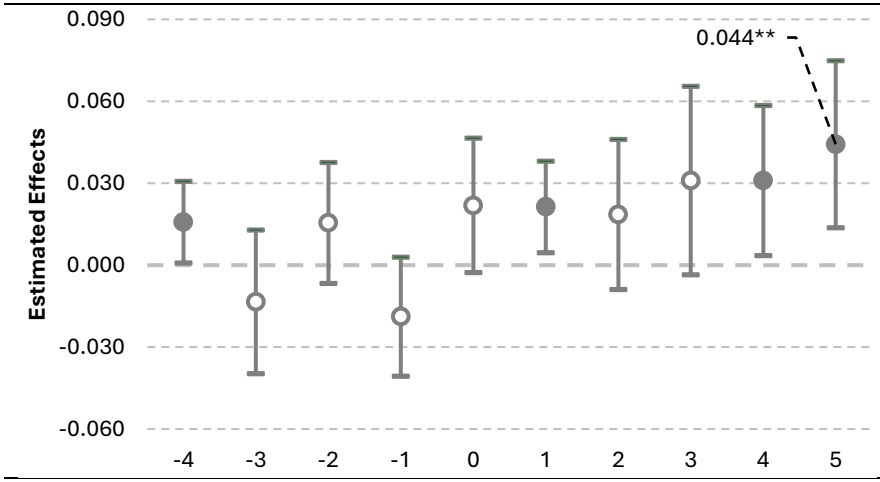


Figure E8A. Personal Doctor

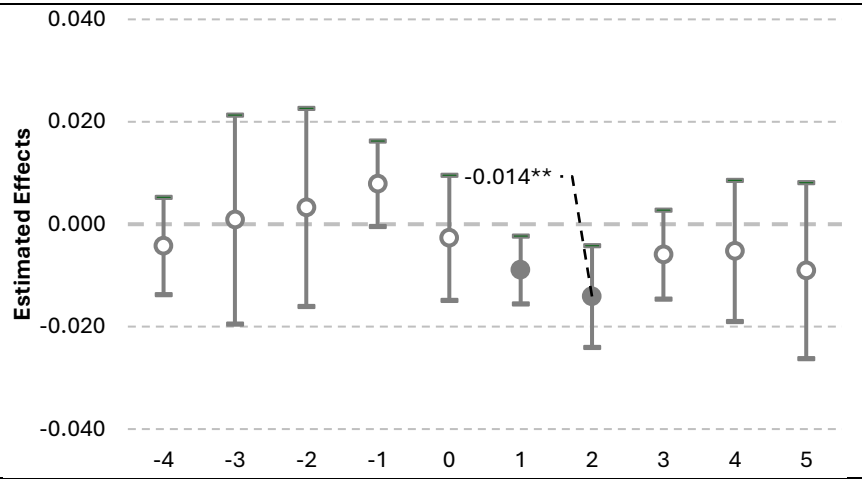


Figure E8B. Cost Issue

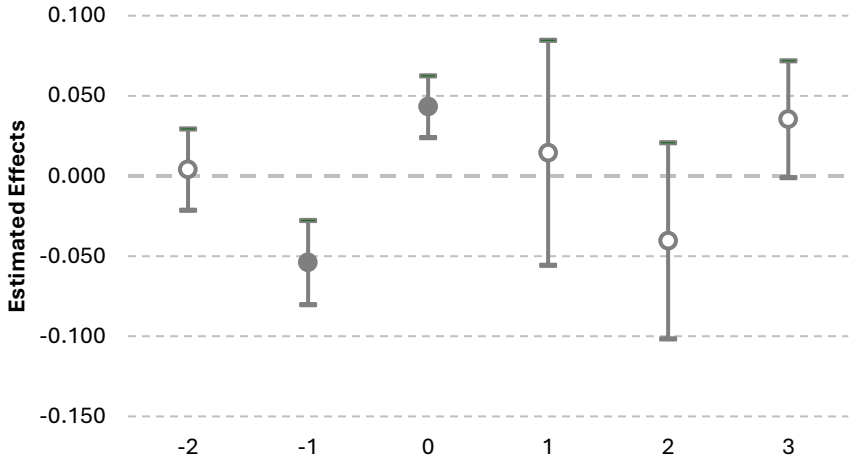


Figure E8C. 1+ Medical Visits

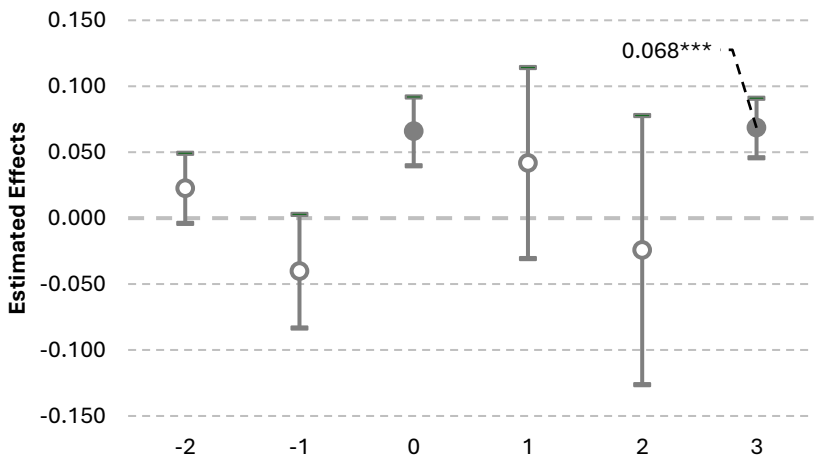


Figure E8D. 1+ Doctor's Office Visits

Note: The sub-figures are obtained using the states that implemented the Interstate Medical Licensure Compact before 2018 from the Behavioral Risk Factor Surveillance System (BRFSS) 2018-2023 (Figures E8A-E8B), N = 216 (18 States × 12 half-years), and Survey of Income and Program Participation (SIPP) 2019-2024 (Figures E8C-E8D), N = 90 (15 States × 6 years). *** p<.001, ** p<.01, * p<.05