

# Does Scope of Practice Affect Mobility of Nurse Practitioners Serving Medicare Beneficiaries?

## Abstract

The shortage of nurse practitioners in the United States has broadly decreased access, decreased quality, and increased care costs. In some states, policymakers are trying to address such shortages by expanding nurse practitioners' scope of practice or extending autonomy for nurses to order tests, prescribe medications, diagnose patients, and initiate and manage treatments. We exploit the state-level variations in the nurse practitioner's scope of practice laws to estimate the impact on the mobility decisions of the nurse who serve Medicare beneficiaries. We identify nurse's practice locations from 2013 to 2017 by gleaning their National Provider Identifiers from Part D Prescriber Public Use File data. We find that nurses in full-practice states are 0.41 percent less likely to move out of the state compared to nurses in restrictive-practice states. Also, nurses who move are 5.70 percent more likely to move to full-practice states than restrictive-practice states. Our estimates demonstrate nurses' preference for practicing in states with the full scope of practice.

**Keywords:** Scope of practice, nurse practitioners, regulation, mobility

**JEL Classification:** J44, I18, H75

# 1 Introduction

The shortage of nurse practitioners (NPs) in the United States has broadly limited access, reduced quality, and increased cost for an aging population in both metro and rural areas. The NP shortage is a key part of the more general and ever-increasing shortage of primary care. Accordingly, some states have expanded NPs' scope of practice (SOP). In these states, NPs can use all of their training and education in various primary care roles, such as ordering testing, prescribing medication, diagnosing patients, and initiating and maintaining patient treatment. However, little is known about whether these policy changes incentivize NPs to relocate to areas where they have a full SOP.

We estimate the impact of expanded NP SOP on the mobility decisions of NPs who serve Medicare beneficiaries enrolled in the Part D prescription-drug program. These expansions occurred at the state level. Therefore it is important for policy evaluation to know whether the legal differences in the job roles of NPs affect where they decide to both live and practice. We identify the location of practice decisions of individual NPs between 2014 and 2017 by gleaning their National Provider Identifiers (NPI) from the Part D Prescriber Public Use File data.

Using a regression framework, we then determine whether NPs in states with restricted or full SOP are more likely to move out of state. We find that NPs in full-SOP states are 0.41 percent less likely to relocate than nurses working in states with restrictive job autonomy requiring written or supervisory physician collaboration. Though this is insightful, we are also interested in learning where NPs are moving. This is essential information for policymakers and researchers because it indicates whether the policy differences are driving the location decisions of NPs.

Using our regression framework, we find that NPs who move are 5.70 percent more likely to relocate to full-SOP states than to other restrictive-SOP states. Thus, broadening SOP and allowing NPs to act independently and without complicated contracts with primary care physicians can attract NPs. Expanding SOP is an effective way to remedy primary care shortages.

Section 2 reviews the relevant literature. Section 3 describes our data sources, methodology, and research framework. Section 4 outlines our results. Section 5 discusses policy implications and concludes.

## 2 Literature

[Pigou \(1938\)](#) and [Stigler \(1971\)](#) lay competing theoretical foundations for studying the causes and consequences of regulation.<sup>1</sup> [Pigou \(1938\)](#) describes regulation as a policy tool that can address market failures, monopoly powers, and externalities, along with achieving other goals of benevolent policymakers, to engender socially superior outcomes. [Stigler \(1971\)](#), however, contradicts Pigou by describing regulation as an outcome of rent-seeking behavior that serves the interests of industry leaders, often at the expense of other groups such as workers, entrants, and other industries. Regulations give industry incumbents more market power, and the outcomes of regulation are socially inefficient.

The Association of Medical Colleges has consistently reported that the demand for physician care is outpacing medical school enrollments, and it projects the shortage of physicians will reach 100,000 by 2030 ([Mann, 2020](#)). With the increased demand for primary care and accompanying labor shortages, more NPs are acting as primary caregivers, particularly in states with full practice authority. Full practice authority, also known as the full scope of practice (SOP), means that with their occupational license, they can work to the extent that their education level and training ([Kandrack et al., 2019](#)). Figure 1 depicts the states with full or restrictive SOP as defined by the American Association of Nurse Practitioners ([American Association of Nurse Practitioners, 2018](#)).<sup>2</sup> Table 1 provides the AAPN definition for restricted, reduced, and full SOP for NPs ([American Association of Nurse Practitioners, 2018](#); [Klein, 2005](#)). In states with full SOP, NPs can order testing, prescribe medication and controlled substances, initiate diagnoses, and manage patients' treatment. Restricted- or reduced-SOP states erect barriers that restrict the scope of services NPs may provide, which can lead to additional problems in the health care market such as difficulty scheduling appointments, longer waiting periods for routine visits, higher health care costs, and higher administrative costs for some physician practices ([Fairman et al., 2011](#); [Pittman and Williams, 2012](#); [Traczynski and Udalova, 2018](#)). The AANP distinguishes SOP for restricted and reduced states by whether they require physician supervision or merely a written collaboration to conduct one or more elements of the

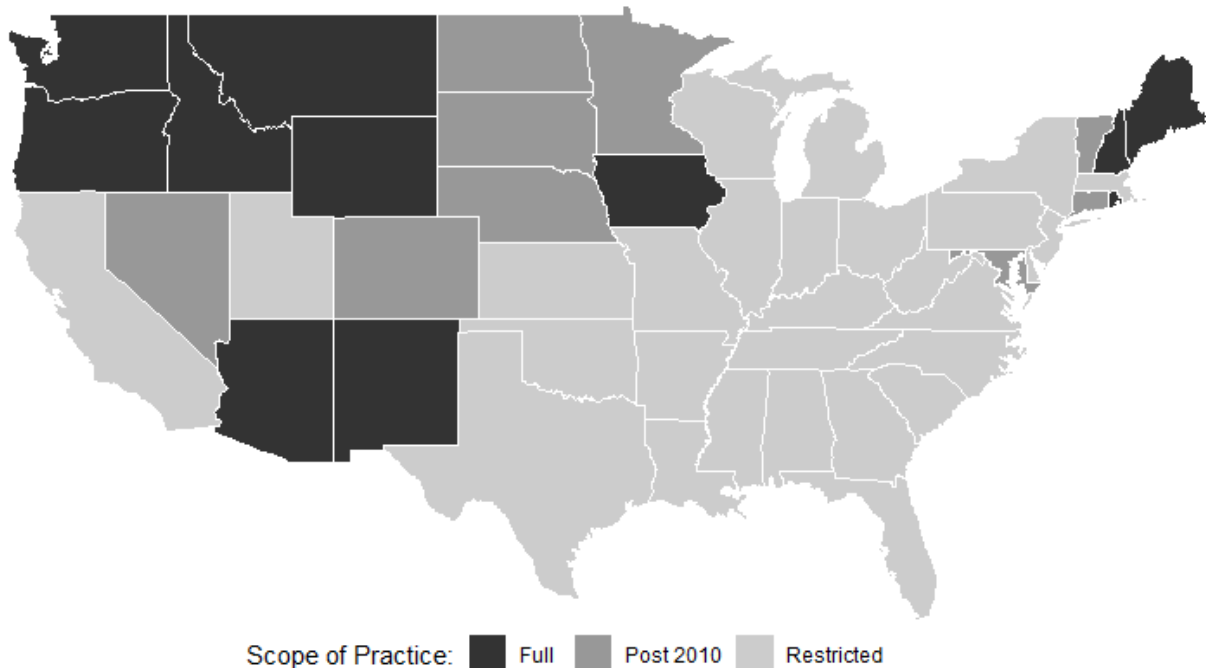
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<sup>1</sup>[Hall and Shakya \(2019\)](#) try to reconcile these two theories and demonstrate an inverted-U-shaped relation of regulation to industry growth. In contrast, [Scarcioffolo et al. \(2020\)](#) show that some regulations can be expressive without the significant effects in the industry.

<sup>2</sup>For ease of readability for readers, the state by state regimes shown in Figure 1 are repeated in Table A1 within the appendix.

NPs job, respectively ([American Association of Nurse Practitioners, 2018](#)).

**Figure 1:** Scope of Practice for Nurse Practitioners



*Notes:* Post2010 represents the states that expanded SOP after 2010. These states are Colorado (2010), Hawaii (2010), North Dakota (2011), Vermont (2011), Nevada (2013), Connecticut (2014), Minnesota (2014), Nebraska (2015), Maryland (2015), and South Dakota (2018). The years in parentheses are when the states became full SOP.

**Table 1:** Definitions of Scope-of-Practice Regimes

Restricted Practice	Reduced Practice	Full Practice
State laws regarding the practice and licensure of nurse practitioners (NPs) require supervision and delegation of team management by another health provider in order for an NP to engage in at least one element of NP practice.	State laws regarding the practice and licensure of NPs require collaboration or written practice agreements between an NP and another health provider in order for an NP to engage in at least one element of NP practice.	State laws regarding the practice and licensure of NPs allow all NPs to order testing, prescribe medications, prescribe controlled substances, diagnose, and initiate and manage treatment of patients.

NPs are considered advanced-practice clinicians, which means that similar to physician assistants and advanced practice registered nurses, they have postgraduate medical training, with either a degree of a master of science in nursing or doctor of nursing practice, but do not attend medical school or go through the same residency process as physicians. Both physicians and NPs can choose specializations in medicine, but while most physicians specialize in lucrative fields such as pediatrics, cardiology, or obstetrics, over 80 percent of NPs focus on general-practice medicine in the primary care setting ([American Association of Colleges of Nursing,](#)

2020). Congress’s Office of Technology Assessment first began assessing the quality of NP care in 1986 and at that time found that “NPs performed as well as physicians with respect to patient outcomes, proper diagnoses, management of ‘indicator’ medical conditions, frequency of patient hospitalization, and patient satisfaction” (U.S. Congress, Office of Technology Assistants, 1986).

Increased political spending by physician interest groups raises the probability that a state will maintain restrictive NP SOP regulations (McMichael, 2017). Even the American Medical Association argues strongly against expanding NP SOP, citing its concern that NPs operating without physician oversight will risk patient safety (Iglehart, 2013). However, various medical studies have found that NPs provide a level of care that is similar in quality to what physicians provide (Laurant et al., 2005; Lenz et al., 2004; Munding et al., 2000; Swan et al., 2015). Hughes et al. (2015) use Medicare-patient data to compare the performance of NPs and physician assistants to assess the hypothesis that NPs are sufficient for simple general care but unprepared for more complex medical needs. They find that NPs provide similar care to physicians in all but the rarest cases.

With recent labor-market shortages, the number of registered nurses who obtain graduate degrees and NP licenses has surged. In the early 1990s, NPs were granted the ability to bill Medicare at 85 percent of physician fees (Perloff et al., 2016). Areas with the least access to primary care, such as rural or impoverished counties, are better able to afford the wage rate of NPs relative to physicians’ wage rate, meaning that increased NP SOP provides important sources of primary care to underserved areas and reduces obesity and diabetes (Gaglioti et al., 2016; Grumbach et al., 2003; Lenz et al., 2004; Martin, 2000; Perry, 2009; Stange, 2014). Restricted SOP are also associated with reduced hours worked and self-employment for nurse practitioners that are subject to physician oversight requirements (Markowitz and Adams, 2020).

In response to these potential shortages, policymakers designed the Nurse Licensure Compact (NLC) to incorporate reciprocity between a set of states so that nurses could move freely without incurring additional years of training or experience to begin work. This idea is in line with studies such as Johnson and Kleiner (2020), which finds that licensure limits the interstate movement of workers because of additional costs between states (though they did not analyze NPs specifically within this study). As of September 2020, 34 states have joined this compact, with an additional six states currently have bills moving through the legal process that would

join the NLC. [DePasquale and Stange \(2016\)](#) analyzed this agreement and found that, despite being for the intention of improving the labor supply and mobility of nurses, it found that the adoption of the NLC within states did not reduce labor market frictions or promote mobility of nurse practitioners.

In response to studies of the NLC, we propose that nurses instead might be motivated by the SOP within a state, such as supervision and collaboration requirements, to engage in work. We attempt to determine if these mobility decisions are instead in response to workplace autonomy and independence. There have also been many benefits to SOP expansions. Reduced regulation of NPs is associated with lower prices for general medical visits for children but is not associated with a difference in infant mortality of malpractice ([Kleiner, 2016](#)). NP SOP expansions may also help states cut costs, as states with a higher ratio of primary care providers to patients spend less on Medicare and Medicaid ([Starfield et al., 2005](#); [Timmons, 2017](#)). Policy discussions regarding SOP expansions extend beyond NPs to include dental hygienists, midwives, and physician assistants. Using dental records of Air Force personnel over the years, [Kleiner and Kurdle \(2000\)](#) finds that stricter SOP regulations for dental hygienists raise the price of dental services and the income of dentists but do not lead to improved oral health. [Lanfelier et al. \(2016\)](#) finds improved dental health in areas with less restrictive SOP, as people in these areas used more dental care and were less likely to need teeth removal for decay or disease. This leads to the claim that SOP restrictions are preventing dental hygienists from using their full education and training, which is limiting access to oral health care for many underrepresented populations ([Manski et al., 2015](#)). Similar studies of midwifery find that states with full SOP for certified midwives see improvements in infant birth weight ([Markowitz et al., 2017](#)). Though we do not directly address cost, our paper seeks to complement this trend in the literature by analyzing the mobility trends of nurse practitioners under different SOP regimes, which is the intermediary driver of cost adjustments in these theoretical models.

## 3 Data and Methods

### 3.1 Data

We track the state-level mobility of NPs from 2013 to 2017 using National Provider Identifiers from the Part D Prescriber Public Use File. Our analysis only covers the subset of NPs who

serve beneficiaries enrolled in the Medicare Part D prescription-drug program (approximately two-thirds of all Medicare beneficiaries). Using the NPI numbers and we web scrape NP’s specialty from the NPES NPI Registry website<sup>3</sup> to record the NPs’ specialties.

From this database, we consider NPIs and their practice location. We merge NP’s practice state for the year  $t$  and  $t + 1$  on their NPI to identify who moved and who did not move. We can identify if NPs move or not by comparing their practice state for the year  $t$  and  $t + 1$ . For example, first, we merge the data from 2013 and 2014 and keep only the data on NPs whose data is available in both years. We compare each NP’s practice state from 2013 to 2014 to create the mobility indicator variable  $\text{Move}_{it+1}$ . If the state is the same in both years, then we infer that the NP did not move out of state; if it differs, we infer that the NP moved to a different state.

Second, we use the definitions of restricted, reduced, and full NP SOP in Table (1) to identify each state’s SOP. The definitions of the various levels of the scope of practice are determined by the American Association of Nurse Practitioners and are outlined in both Figure 1 and Table A1 (American Association of Nurse Practitioners, 2018). In our regressions, restricted-SOP states include states identified as either fully restricted or reduced practice as defined by the standard AANP definitions referenced in Table (1). We use the variables  $\text{Regime}_{it}$  and  $\text{Regime}_{it+1}$  to indicate the SOP regime for each year and succeeding year. Third, we repeat this second step for the paired years 2014–15, 2015–16, and 2016–17 to develop a repeated cross-sectional data.

### 3.2 Model

We consider NPs in two periods,  $t$  and  $t + 1$ . In period  $t$ , an NP, indexed as  $i$ , is in a restrictive-SOP state or a full-SOP state. The variable  $\text{Regime}_{it}$  can take the following values:

$$\text{Regime}_{it} = \begin{cases} 0 & \text{Restrictive-SOP state at time } t \\ 1 & \text{Full-SOP state at time } t \end{cases}$$

Each NP decides to move to a different state in the next period,  $t + 1$ , or remain in the same state, a decision reflected in the variable  $\text{Move}_{it+1}$ .

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<sup>3</sup><https://npiregistry.cms.hhs.gov/>

$$\text{Move}_{it+1} = \begin{cases} 0 & \text{if individual } i \text{ remained in the same state at time } t+1 \\ 1 & \text{if individual } i \text{ moved to different state at time } t+1 \end{cases}$$

In period  $t+1$ , an NP can be in the same state or a different state than previously while the SOP regime can change from or remain the same as the previous period. A state's SOP regime in the second period,  $\text{Regime}_{it+1}$ , takes one of the following values:

$$\text{Regime}_{it+1} = \begin{cases} 0 & \text{Restrictive SOP at time } t+1 \\ 1 & \text{Full SOP at time } t+1 \end{cases}$$

We assume that  $\text{Regime}_{it}$  can predict  $\text{Move}_{it+1}$  and  $\text{Move}_{it+1}$  can predict  $\text{Regime}_{it+1}$ :

$$\text{Regime}_{it} \longrightarrow \text{Move}_{it+1} \longrightarrow \text{Regime}_{it+1}$$

### 3.3 Effect of SOP Regime on the Mobility of NPs

We are interested in determining whether the SOP regime affects the mobility of NPs. If occupational licensing restricts the SOP of NPs, then NPs are more likely to move to a different state than if it does not. To estimate such quantity causally, we rely on a simple difference-in-difference regression framework in equation 1.

$$\text{Move}_{ist+1} = \alpha + \beta \text{Regime}_{st} + \gamma_s + \varsigma_t + \lambda_o + \varepsilon_{ist} \quad (1)$$

where NPs practicing within restricted SOP are the control group and NPs practicing within full SOP are the treatment group, and time indexed with  $t$  is the control period, and  $t+1$  is the treatment period.  $i$ ,  $s$ , and  $o$  index the individual NPs, their practicing states, and their specialty.  $\beta$  estimates the probability of moving in the next time period with respect to the SOP of the current time period.  $\gamma_s$ ,  $\varsigma_t$ , and  $\lambda_o$  are additive state, year, and NP's specialty fixed effects used to account for the unobserved heterogeneity associated with the state, year, and specialty, respectively.



### 3.4 Impact of NP Movement on Regime Selection

Equation (1) allows us to estimate the effect of SOP regime on NP mobility. But do NPs move to states that allow full SOP or to other states? To answer this, we can estimate the following regression:

$$\text{Regime}_{it+1} = \alpha + \delta \text{Move}_{it+1} + \gamma_s + \varsigma_t + \lambda_o + \varepsilon_{ist} \quad (2)$$

where  $i$ ,  $s$ , and  $o$  index the individual NPs, their practicing states, and their specialty.  $\delta$  estimates the probability of NPs mobility to states that allow full SOP compared to the state that has restricted SOP.  $\gamma_s$ ,  $\varsigma_t$ , and  $\lambda_o$  are additive state, year, and NP’s specialty fixed effects used to account for the unobserved heterogeneity associated with the state, year, and specialty, respectively.

## 4 Results

We begin our analysis with the time-series overview of NPs in Table (2). Column (2) provides total NPs for each year, and column (3) provides the number of NPs with a match in the following year. The records might not match for several reasons: NPs may have stopped practicing, retired, died, or changed their specialty from 2013 to 2014, and new NPs may have entered the market in 2014.

**Table 2:** Mobility of Nurse Practitioners Serving Medicare Beneficiaries

Year (1)	Total NPs (2)	Matched NPs (3)	Restricted (4)	Move (5)	F→F (6)	F→R (7)	R→F (8)	R→R (9)
2013	97,693	-	-	-	-	-	-	-
2014	109,105	90,406	76,572	1,518	130	154	318	916
2015	122,793	101,145	82,092	1,647	183	232	365	867
2016	137,777	113,999	90,265	1,538	179	233	326	800
2017	153,922	128,145	101,949	1,833	218	285	392	938

*Notes:* In columns (6) to (9), “F” indicates states that allow full scope of practice and “R” represents states with restrictive scope of practice.

Table (2), column (4) shows the numbers of matched nurses in restrictive-SOP states. Column (5) shows the numbers of matched NPs who moved from one year to the next. For example, out of 90,406 matched NPs, 76,572 were in restrictive-SOP states in 2014, and 1,518 moved to

different states from 2013 to 2014. Columns (6) to (9) show the details of NPs' mobility. For example, in column (6), out of 1,518 NPs in 2013, 130 moved from a full-SOP state to another full-SOP state. Column (7) shows that 154 NPs practiced in full-SOP states in 2013 and moved to restrictive-SOP states in 2014. Column (8) shows that 318 NPs in restrictive-SOP states in 2013 moved to full-SOP states in 2014. Finally, column (9) shows that 916 NPs in restrictive-SOP states in 2013 moved to other restrictive-SOP states in 2014.

#### 4.1 Impacts of SOP Regime on NP Mobility

**Table 3:** Effect of Scope-of-Practice Regime on the Mobility of Nurse Practitioners (2013–17)

	<i>Mobility of Nurse Practitioners, <math>Move_{it+1}</math></i>					
	(1)	(2)	(3)	(4)	(5)	(6)
$Regime_{it}$	0.0055*** (0.0005)	0.0055*** (0.0005)	0.0056*** (0.0005)	−0.0067*** (0.0020)	−0.0046** (0.0021)	−0.0040* (0.0022)
Constant	0.0140*** (0.0002)	0.0140*** (0.0002)				
Year FE	-	-	✓	-	✓	✓
State FE	-	-	-	✓	✓	✓
Specialty FE	-	-	-	-	-	✓
HC SE	-	✓	✓	✓	✓	✓
Cluster SE (NPI)	-	✓	✓	✓	✓	✓
Observations	433,695	433,695	433,695	433,695	433,695	382,786
R <sup>2</sup>	0.0003	0.0003	0.0005	0.0016	0.0017	0.0038
Adjusted R <sup>2</sup>	0.0003	0.0003	0.0004	0.0015	0.0016	0.0032

*Notes:* The 1%, 5%, and 10% levels of significance are given as \*\*\*, \*\*, and \* respectively.  $Regime_{it} = 0$  indicates that a state has restrictive scope of practice for nurse practitioners in period  $t$ .  $Move_{it+1} = 1$  indicates a nurse practitioner's decision to move to a different state in period  $t + 1$ . HC SE represents heteroskedasticity-consistent standard errors. Cluster SE (NPI) represents the standard errors are clustered at NPI-level.

Table 3, columns (1)-(6) provide six regression specifications of NPs' decision to move in the next period based on the SOP regime during the current period. The regression output in column (6) exhibits the results of the equation (1). Column (1) is a simple regression. Column (2) is a simple regression with heteroskedasticity-robust standard errors. Column (3) includes year fixed effects. All these estimates are positive, suggesting NPs who practice in full-SOP states are more likely to move than NPs in restrictive-SOP states. However, this does not account for underlying state-level differences. When we include state fixed effects in column

(4), both state and year fixed results in column (5), as well as state, year, and specialty fixed effects in column (6), the sign flips. These estimates suggest that NPs who practice in full-SOP states are 0.41 percent less likely to move than NPs in restrictive-SOP states.

## 4.2 Impact of NP Movement on Regime Selection

Next, we show the estimates of whether NPs are likely to move to states that allow full SOP or not. Table 4 follows the same structure as Table 3. The estimates in columns (1) to (3) show that NPs are about 11.8 percent more likely to move to states with full-SOP than other states. The estimates of columns (4), (5), and (6) suggest that NPs are 5.27, 5.33, and 5.70 percent more likely to move to states with full-SOP than restrictive-SOP states, even when controlling for specialty, state, and year fixed effects. This implies that nurse practitioners who are relocating are more likely to move to states that allow them to work at the full extent of their training and experience rather than to states with written collaboration or supervisory requirements with the physician.

**Table 4:** Mobility Choices of Nurse Practitioners (2013–17)

	<i>States Chosen by Nurse Practitioners, <math>Regime_{it+1}</math></i>					
	(1)	(2)	(3)	(4)	(5)	(6)
$Move_{it+1}$	0.1179*** (0.0050)	0.1179*** (0.0058)	0.1182*** (0.0058)	0.0527*** (0.0073)	0.0533*** (0.0073)	0.0570*** (0.0078)
Constant	0.2050*** (0.0006)	0.2050*** (0.0006)				
Year FE	-	-	✓	-	✓	✓
State FE	-	-	-	✓	✓	✓
Specialty FE	-	-	-	-	-	✓
HC SE	-	✓	✓	✓	✓	✓
Cluster SE (NPI)	-	✓	✓	✓	✓	✓
Observations	433,695	433,695	433,695	433,695	433,695	382,786
$R^2$	0.0013	0.0013	0.0016	0.9385	0.9392	0.9413
Adjusted $R^2$	0.0013	0.0013	0.0016	0.9385	0.9392	0.9413

*Notes:* The 1%, 5%, and 10% levels of significance are given as \*\*\*, \*\*, and \* respectively.  $Regime_{it+1} = 0$  indicates that a state has restrictive scope of practice for nurse practitioners in period  $t + 1$ .  $Move_{it+1} = 1$  indicates a nurse practitioner's decision to move to a different state in period  $t + 1$ . HC SE represents heteroskedasticity-consistent standard errors. Cluster SE (NPI) represents the standard errors are clustered at NPI-level.

## 5 Robustness Checks

Table 5 provides additional robustness checks. These additional checks are to address common questions that may arise in response to our primary methodology. Here we estimate equation 1 and 2 using three strategies. In columns (1) and (4), we drop the reduced practice states and only analyze the movement and regime selection of nurse practitioners within full practice states relative to those who are within states that require strict physician supervision for one or more job attributes. These states were considered restricted as opposed to reduced in the scope of practice within the original AANP definition referenced in Table 1. We find that when limiting to restrictive and full-SOP regimes, nurse practitioners from reduced-SOP states were still 0.3 percent less likely to move, though no longer significant, which is a similar magnitude to the most restrictive model, column (6) within Table 3. This same subset analysis found that nurse practitioners were 5.75 percent more likely to move to states with full-SOP, which is also similar to previous estimations.

**Table 5:** Mobility Choices of Nurse Practitioners (2013–17)

	Move <sub>it+1</sub>	Move <sub>it+1</sub>	Move <sub>it+1</sub>	Regime <sub>it+1</sub>	Regime <sub>it+1</sub>	Regime <sub>it+1</sub>
	(1)	(2)	(3)	(4)	(5)	(6)
Regime <sub>it</sub>	−0.0030 (0.0019)	−0.0022 (0.0018)	−0.0041** (0.0018)			
Move <sub>it+1</sub>				0.0575*** (0.0122)	0.0757*** (0.0134)	0.0802*** (0.0107)
Contiguous			0.9896*** (0.0003)			−0.0521*** (0.0154)
Sub-Sample	Restricted	Reduce	Contiguous	Restricted	Reduce	Contiguous
Year FE	✓	✓	✓	✓	✓	✓
State FE	✓	✓	✓	✓	✓	✓
Specialty FE	✓	✓	✓	✓	✓	✓
HC SE	✓	✓	✓	✓	✓	✓
Cluster SE (NPI)	✓	✓	✓	✓	✓	✓
Observations	242,629	217,665	379,252	242,629	379,252	379,252
R <sup>2</sup>	0.0040	0.0035	0.3713	0.9462	0.3713	0.9418
Adjusted R <sup>2</sup>	0.0031	0.0026	0.3709	0.9462	0.3709	0.9417

*Notes:* The 1%, 5%, and 10% levels of significance are given as \*\*\*, \*\*, and \* respectively. Regime<sub>it</sub> = 0 indicates that a state has restrictive scope of practice for nurse practitioners in period *t*. Move<sub>it+1</sub> = 1 indicates a nurse practitioner’s decision to move to a different state in period *t* + 1. Regime<sub>it+1</sub> = 0 represents states with restrictive scope of practice for nurse practitioners in period *t*. Move<sub>it+1</sub> = 1 indicates an NP’s decision to move to a different state in period *t* + 1. HC SE represents heteroskedasticity-consistent standard errors. The number of observations is 433,695.

Columns (2) and (5) repeat this methodology but remove nurse practitioners under strict supervisory requirements and instead compares full-SOP to reduced-SOP, which only requires a written collaboration with a physician for one or more job attributes. There is a slightly smaller negative and insignificant effect of the regime, signifying that nurses from the reduced scope of practice states are less likely to move. Nurse practitioners are also 7.57 percent more likely to move to full-SOP states when the sample is limited to this relationship. The changes in mobility and ultimate location decision is similar across nurse practitioners that originally reside in either reduced or restricted-SOP states.

Finally, to account for the fact that nurse practitioners may be more inclined more move to states that are adjacent to their own, Columns (3) and (6) include an indicator variable equal to 1 if the nurse practitioner moves to a contiguous state. When including this variable, nurse practitioners from restrictive-SOP states are 0.41 percent less likely to move and are 8.02 percent more likely to move to states with full-SOP regimes. These results are all consistent with the observations within our core methodology.

## 6 Conclusion

We analyzed how a state’s NP SOP regime influences NPs’ location decisions. Although a significant body of research has studied the effects of SOP on practitioner quality and wages, to our knowledge, little investigation has focused on the interstate movement of NPs in response to differences in their legal ability to work independently of physicians. Previous work found that reciprocity agreements were not underlying causes of nurse practitioner movement across states. We seek to further understand this relationship between nurse practitioners and mobility decisions by analyzing the scope of practice across states, which are the range of duties nurse practitioners are able to perform and if there is a requirement for supervision or written collaborative agreement with physicians. Our regression framework, coupled with Medicare Part D information on NPs serving Medicare beneficiaries, allowed us to track and analyze individual NPs between 2013 and 2017.

We found that NPs in states with laws allowing them to work to the full extent of their training without physician supervision are 0.41 percent less likely to move in a given year. NPs residing in restrictive-SOP states were also 5.33 percent more likely to relocate to states

that have full-SOP where nurse practitioners are allowed to perform all aspects of their job in alignment with education and experience without the necessity of physician supervision. These results imply that nurse practitioners prefer to live and work in places where they have more autonomy over their practice.

The United States faces a drastic shortage of primary care physicians that are only projected to increase over the next decade as physicians are likely to pursue more lucrative specializations. In part to address the shortage, some states have granted NPs full SOP, which allows NPs to work independently and use their education and training to their full extent. Our study found that states with increased SOP are enticing to NPs working in restrictive states.

Much of the current literature has found that NPs provide similar quality of primary care across various metrics in all but the rarest of cases. States faced with the primary care shortages that have not adopted full SOP for NPs would benefit from changing their policies by allowing NPs in their own state to work to the full extent of their ability and disincentivizing NPs from moving out of state and attracting NPs from restrictive states. This reform is crucial for impoverished and rural areas that cannot sustain the wages of primary care physicians.

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## A Appendix A

**Table A1:** State Regime

State	Scope of Practice	State	Scope of Practice
Alabama	Reduced	Missouri	Restricted
Alaska	Full	Montana	Full
Arizona	Full	Nebraska	Full
Arkansas	Reduced	Nevada	Full
California	Restricted	New Hampshire	Full
Colorado	Full	New Jersey	Reduced
Connecticut	Full	New Mexico	Full
Delaware	Reduced	New York	Reduced
District of Columbia	Full	North Carolina	Restricted
Florida	Restricted	North Dakota	Full
Georgia	Restricted	Ohio	Reduced
Hawaii	Full	Oklahoma	Restricted
Idaho	Full	Oregon	Full
Illinois	Reduced	Pennsylvania	Reduced
Indiana	Reduced	Rhode Island	Full
Iowa	Full	South Carolina	Restricted
Kansas	Reduced	South Dakota	Full
Kentucky	Reduced	Tennessee	Restricted
Louisiana	Reduced	Texas	Restricted
Maine	Full	Utah	Reduced
Maryland	Full	Vermont	Full
Massachusetts	Restricted	Virginia	Restricted
Michigan	Restricted	Washington	Full
Minnesota	Full	West Virginia	Reduced
Mississippi	Reduced	Wisconsin	Reduced
		Wyoming	Full

*Notes:* Nevada changed to full practice in 2013; Minnesota and Connecticut changed to full practice in 2014; Maryland and Nebraska changed to full practice in 2015; South Dakota changed to full practice in 2018