

# ONLINE APPENDIX A

**Figure A1: Event Study for Full NP SOP on Natural Log Total NP Job Postings**

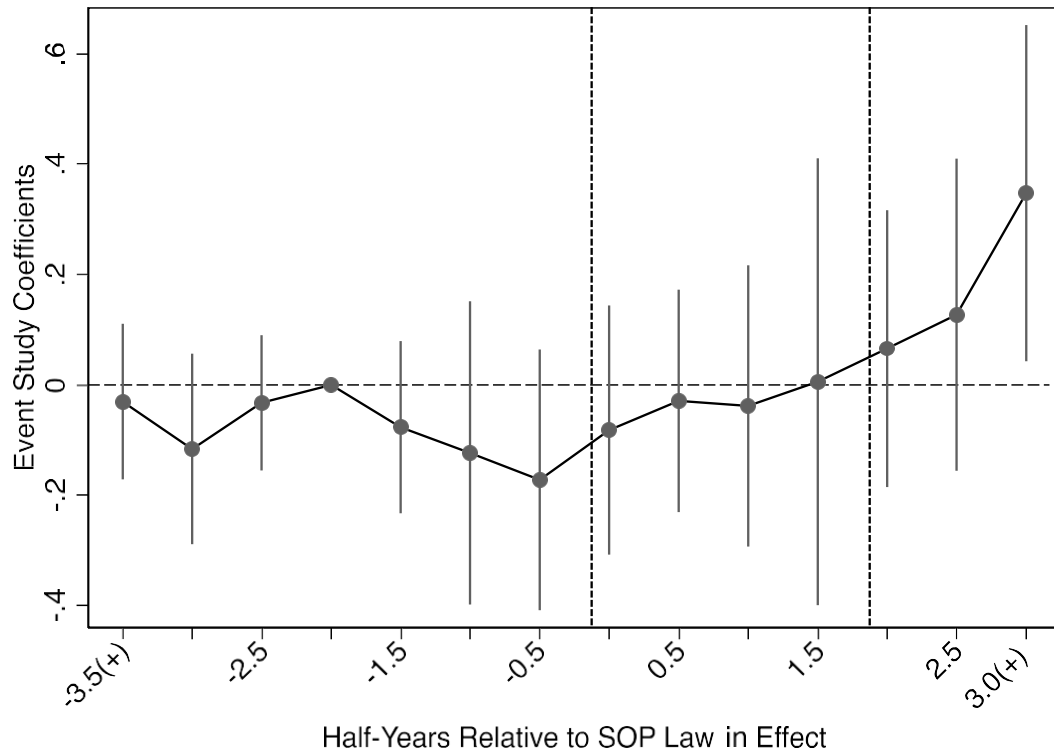
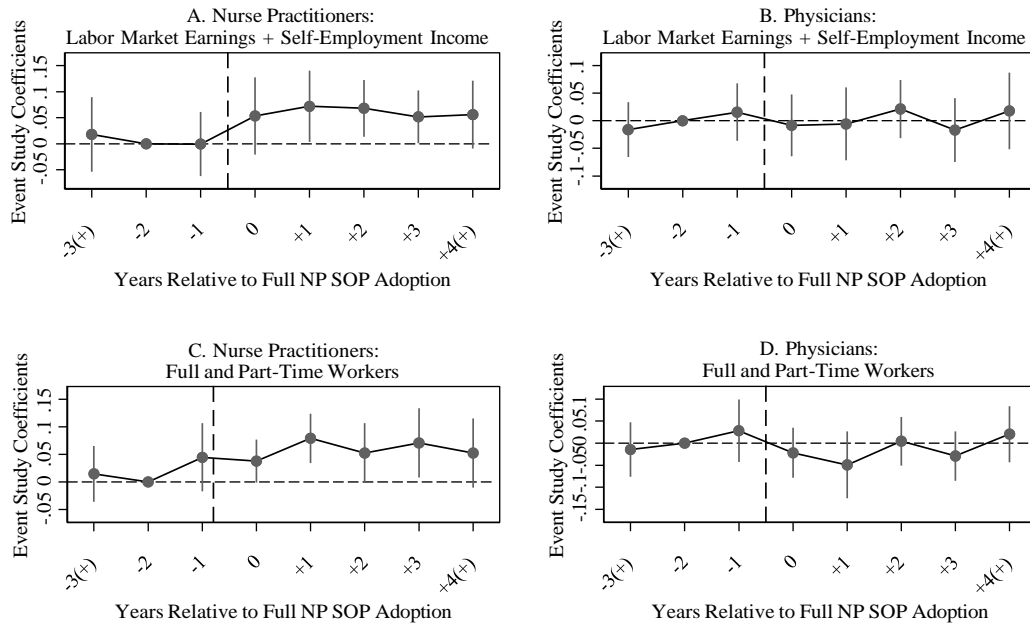
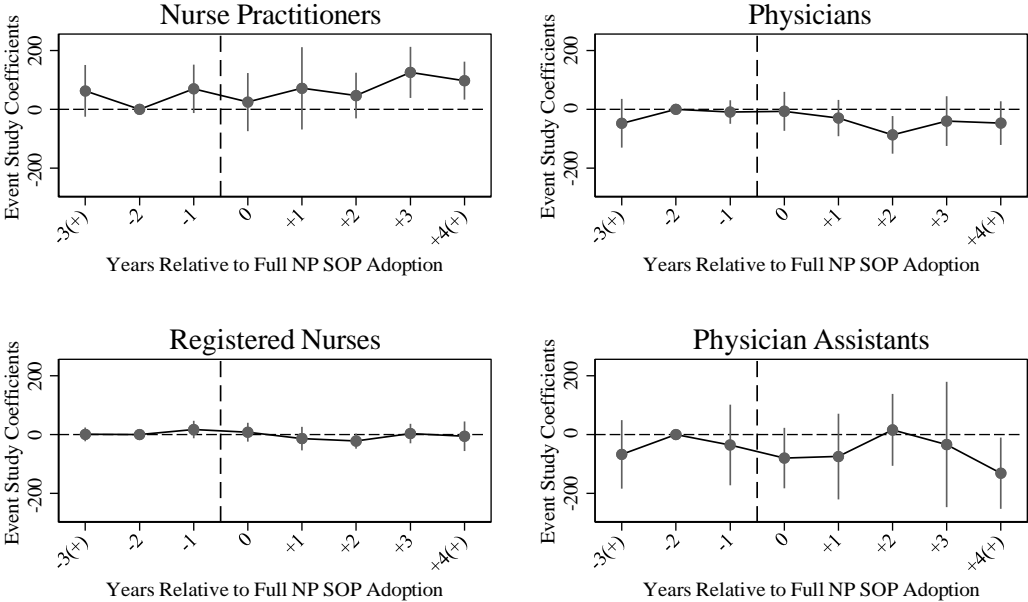


Figure A2: Effect of Full NP SOP Adoption on Earnings II



Notes: This figure plots the coefficients and 95 percent confidence intervals of the event study estimates showing the effect of Full NP SOP adoption on earnings for nurse practitioners and physicians. Panels A and B include self-employment income for full-time employed workers. Panels C and D include annual earnings for full and part-time workers. All coefficients are relative to the effect two years prior to adoption.

Figure A3: Effect of Full NP SOP Adoption on Annual Hours Worked



Notes: This figure plots the coefficients and 95 percent confidence intervals of the event study estimates showing the effect of Full NP SOP adoption on annual hours worked for different health care occupations in the ACS. All coefficients are relative to the effect two years prior to adoption.

**Table A1: BGT Skills Included in our Skill Groupings**

<b>General Care Skills</b>	<b>Healthcare Support (continued)</b>	<b>Office &amp; Business Support (continued)</b>	<b>Leadership (continued)</b>
Advanced Patient Care	Basic Living Activities Support	General Marketing	Program Management
Basic Patient Care	Blood Collection	General Networking	
General Medical Tests and Procedures	Exercise Training	General Sales	<b>Other Skills</b>
General Medicine	First Aid	General Sales Practices	Art and Illustration
Geriatrics	Healthcare Procedure and Regulation	General Shipping and Receiving	Biologics Industry Knowledge
Healthcare Procedure and Regulation	Medical Procedure and Regulation	Graphic and Visual Design Software	Biology
Injury Treatment	Medical Support	Health Information Management and Security	Broadcasting Industry Knowledge
Pediatrics	Mobility Assistance	Housekeeping	Chemical Analysis
Routine Examination Tests and Procedures	Nutrition and Diet	Human Resource Management and Planning	Chemistry
	Occupational Health and Safety	Labor Compliance	Child Care
<b>Specialized Care Skills</b>	Patient Education and Support	Management Information System (MIS)	Child Development
Allergies	Patient Physical Measurements	Market Analysis	Civil and Architectural Engineering
Anesthesiology	Physical Abilities	Marketing Management	Clinical Informatics
Cardiology	Physical Therapy	Marketing Strategy	Clinical Research
Cellular Biology	Public Health and Disease Prevention	Medical Billing and Coding	Construction Management
Dental Care	Rehab Therapy	Medical Documentation and Abstraction	Data Analysis
Dermatology	Rehabilitation	Medical Records	Drug Development
Ear, Nose, and Throat	Social Work	Microsoft Development Tools	Education Administration
Endocrinology		Microsoft Office and Productivity Tools	Environmental Work
Eye Care	<b>Office &amp; Business Support Skills</b>	Office Machines	Equipment Repair and Maintenance
Gastroenterology	Administrative Support	Operations Management	Food and Beverage Service
Genetics	Advanced Customer Service	Order Management	Foreign language skills
Infectious Diseases	Auditing	Patient Reception	Hazardous Waste Management
Nephrology	Basic Customer Service	PHP Web	Instructional and Curriculum Design
Neurology	Billing and Invoicing	Process Improvement	Laboratory Research
Neuroscience	Brand Management	Procurement	Law Enforcement and Criminal Justice
Nuclear Medicine	Budget Management	Product Development	Lean Manufacturing
Obstetrics and Gynecology (OB/GYN)	Business Communications	Project Management	Litigation
Oncology	Business Process and Analysis	Public Relations	Mathematics
Orthopedics	Business Solutions	Quality Assurance and Control	Medical Research
Pathology	Claims Processing	Recruitment	Molecular Biology
Pharmacy	Clinical Data Management	Regulation and Law Compliance	Music
Pulmonology	Compensation and Benefits	Sales Management	na
Radiology	Computer and Information Technology Industry Knowledge	Scheduling	Peer Review
Speech Language Pathology	Contract Management	Social Media	Physics
Surgery	Customer Relationship Management (CRM)	Software Development Principles	Research Methodology
Urology	Cybersecurity	Specialized Sales	Retail Industry Knowledge
	Data Management	System Design and Implementation	Robotics
<b>Emergency Care Skills</b>	Data Techniques	Web Development	Simulation
Emergency and Intensive Care	Database Administration		Social Services Industry Knowledge
Emergency Services	Dictation	<b>Leadership Skills</b>	Surveillance
	Employee Relations	Business Development	Talent Management
<b>Mental Healthcare Skills</b>	Enterprise Resource Planning (ERP)	Business Management	Teaching
Mental and Behavioral Health Specialties	Financial Advisement	Business Strategy	Technical Support
Mental Health Diseases and Disorders	Financial Management	Employee Training	Telecommunications
Mental Health Therapies	Financial Reporting	Leadership and Management	Training Programs
	Financial Risk Management	Office Management	Writing
<b>Healthcare Support Skills</b>	General Accounting	People Management	
Alternative Therapy	General Administrative and Clerical Tasks	Performance Management	

Notes: This figure excludes any BGT skill (called "skill clusters" in the BGT data) comprising less than 0.01 percent of all skills mentioned in the BGT postings, in terms of frequency. This (includes three "Specialized Care" skills together comprising 0.018 percent of skills mentioned), three "Healthcare Support" skills (together comprising 0.004 percent of all skills mentioned), (133 "Office and Business Support" skills together comprising 0.382 of all skills mentioned), and 246 "Other" skills (together comprising 0.301 percent of all skills mentioned). Thus, this table lists more than 99 percent of all skill mentioned in the BGT data, in terms of frequency of being mentioned. BGT Skills within skill groupings are organized alphabetically.

**Table A2: Full NP SOP on NP Job Postings  
Effects by HPSA Designation**

	<b>Full HPSA Counties</b>	<b>Other Counties</b>
	(1)	(2)
1 Year Pre	-0.11 (0.10)	-0.21 (0.19)
SOP Zero to Two Years Post	0.05 (0.12)	-0.12 (0.17)
SOP Two Plus Years Post	0.31 (0.14)	0.30 (0.17)
State FE	Yes	Yes
Yr-Qtr FE	Yes	Yes
N	1,089	1,156

Notes: See notes from Table 4.

**Table A3: Effects of Full NP SOP on Skill in BGT Job Postings for Primary Care Physicians  
BGT Data, 2011Q1 - 2019Q2**

	Skill Groupings									
	Number of BGT Skills	Number of Skill Groupings	General Care Skills	Specialized Care Skills	Emergency Care Skills	Mental Health Skills	Healthcare Support Skills	Office Support Skills	Leadership Skills	Other Skills
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 Year Pre	0.19 (0.18)	-0.06 (0.06)	-0.00 (0.02)	-0.02 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.01)	-0.01 (0.02)
SOP Zero to Two Years Post	-0.07 (0.14)	-0.09 (0.06)	-0.02 (0.01)	0.00 (0.02)	-0.00 (0.01)	-0.01 (0.01)	-0.02 (0.02)	-0.01 (0.01)	-0.01 (0.00)	-0.03 (0.03)
SOP Two Plus Years Post	0.01 (0.17)	-0.02 (0.08)	-0.00 (0.01)	-0.02 (0.01)	-0.01 (0.01)	-0.01 (0.02)	-0.02 (0.03)	-0.00 (0.02)	0.01 (0.01)	0.02 (0.04)
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yr-Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Mean	4.2	2.2	0.73	0.36	0.03	0.12	0.22	0.18	0.04	0.48
N	1,156	1,156	1,156	1,156	1,156	1,156	1,156	1,156	1,156	1,156

Notes: The outcome is either the average number of skills per job posting (columns 1 and 2) or the probability that a job posting includes a skill associated with a specific skill grouping (columns 3-10) – both computed at the state-quarter-year level. *SOP Zero to Two Years Post* is defined as the quarters associated with the year of adoption and one year after adoption. *SOP Two Plus Years Post* is defined as the quarters associated with two or more years after adoption. Always treated SOP states are excluded from the analyses. Sample means differ slightly from the means in Table 2 because these means are based on a straight average of state-quarter-year averages and the means use only the analytic sample. Standard errors are clustered at the state level.

**Table A4: Effects of Full NP SOP on Self-Employment  
ACS Data, 2010 - 2019**

	<b>Physicians</b>	<b>Nurse Practitioners</b>	<b>Licensed Practical Nurses</b>	<b>Physician Assistants</b>
	(1)	(2)	(3)	(4)
1 Year Pre	0.019 (0.016)	0.003 (0.002)	0.002 (0.005)	0.004 (0.011)
SOP Zero to Two Years Post	0.014 (0.009)	0.002 (0.001)	-0.003 (0.003)	0.008 (0.006)
SOP Two Plus Years Post	0.018 (0.013)	0.001 (0.001)	-0.004 (0.005)	0.013 (0.007)
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sample Mean	0.180	0.008	0.016	0.028
N	68,755	244,231	63,050	9,298

Notes: The outcome is an indicator for being self-employed. *SOP Zero to Two Years Post* is defined as the year of adoption or one year after adoption. *SOP Two Plus Years Post* is defined as two-years or more after adoption. Always treated SOP states are excluded from the analyses. Standard errors are clustered at the state level.

**Table A5: Robustness Estimates for NPs in BGT Analysis**

	<b>Preferred Specification</b>	<b>All States</b>	<b>Common Adoption Period</b>	<b>Exclude No ACA Exp. States</b>
	(1)	(2)	(3)	(4)
<b>Panel A: Effect on Natural Log of NP Job Postings</b>				
1 Year Pre	-0.104 (0.10)	-0.105 (0.10)	-0.009 (0.13)	-0.122 (0.11)
SOP Zero to Two Years Post	0.01 (0.11)	-0.033 (0.01)	0.10 (0.09)	-0.034 (0.12)
SOP Two Plus Years Post	0.27 (0.12)	0.20 (0.12)	0.30 (0.15)	0.21 (0.13)
N	1,156	1,734	1,054	816
<b>Panel B: Effect on Relative Number of Job Postings (RNs : NPs)</b>				
1 Year Pre	0.49 (0.77)	0.46 (0.74)	-0.60 (0.71)	0.56 (0.82)
SOP Zero to Two Years Post	0.11 (1.05)	0.25 (1.01)	-1.13 (0.67)	0.44 (1.18)
SOP Two Plus Years Post	-3.79 (1.15)	-3.34 (1.13)	-3.96 (1.28)	-3.20 (1.28)
N	1,156	1,734	1,054	816

Notes: See notes for Tables 4-5. Column (2) presents estimates that use always treated states as control states. Column (3) presents estimates when we limit our treatment sample to Full NP SOP adopting states over the two-year period (7/1/14 - 6/1/16) as the treated states. Column (4) presents estimates when we exclude states that did not expand Medicaid from the control sample. *SOP Zero to Two Years Post* is defined as the year of adoption or one year after adoption. *SOP Two Plus Years Post* is defined as two- years or more after adoption. Standard errors are clustered at the state level.



**Table A6: Robustness Estimates for NPs in ACS Data**

	Preferred Specification	No Earnings Restrictions	Include Hours Worked	All States	Common Adoption Period	Exclude No ACA Exp. States	No Sample Weights	Include Extra Covars
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Panel A: Effect on Natural Log of Earnings for NPs working Full-Time</b>								
1 Year Pre	0.00 (0.03)	0.00 (0.03)	-0.01 (0.03)	-0.01 (0.03)	-0.01 (0.04)	-0.01 (0.03)	0.00 (0.01)	0.00 (0.03)
SOP Zero to Two Years Post	0.06 (0.02)	0.05 (0.01)	0.05 (0.02)	0.05 (0.02)	0.05 (0.02)	0.05 (0.02)	0.03 (0.02)	0.06 (0.02)
SOP Two Plus Years Post	0.07 (0.03)	0.06 (0.03)	0.05 (0.03)	0.05 (0.03)	0.06 (0.03)	0.06 (0.03)	0.04 (0.03)	0.06 (0.03)
N	9,697	9,697	11,022	11,022	9,250	6,188	9,697	9,697
<b>Panel B: Effect on Self-Employment</b>								
1 Year Pre	0.00 (0.02)			0.00 (0.02)	0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)	0.00 (0.01)
SOP Zero to Two Years Post	0.01 (0.01)			0.02 (0.01)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
SOP Two Plus Years Post	0.02 (0.01)			0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
N	12,182			13,916	11,616	7,772	12,182	12,182
<b>Panel C: Effect on Relative Employment (RNs : NPs)</b>								
1 Year Pre	-1.91 (2.77)			-0.18 (2.82)	-2.69 (3.00)	-1.06 (2.82)	-2.18 (2.73)	-1.73 (2.81)
SOP Zero to Two Years Post	1.83 (2.55)			1.73 (2.63)	1.30 (2.68)	1.28 (3.09)	1.81 (2.49)	2.11 (2.69)
SOP Two Plus Years Post	-1.19 (2.65)			-1.20 (2.35)	-1.68 (2.87)	1.23 (1.42)	-1.55 (2.65)	-0.51 (3.01)
N	331			486	231	302	331	331

Notes: See notes for Tables 7-9. Column (2) presents estimates when we include topcoded and winsorized earnings levels. Column (3) presents estimates where we also include hours worked and hours squared as covariates. Column (4) presents estimates that use always treated states as control states. Column (5) presents estimates when we limit our treatment sample to Full NP SOP adopting states over the two-year period (7/1/14 - 6/1/16) as the treated states. Column (6) presents estimates when we exclude states that did not expand Medicaid from the control sample. Column (7) presents results when we do not use the sample weights as weights in our estimates. Column (8) presents estimates where we include the state-level unemployment rate and state-level share of individuals aged 65+. *SOP Zero to Two Years Post* is defined as the year of adoption or one year after adoption. *SOP Two Plus Years Post* is defined as two-years or more after adoption. Standard errors are clustered at the state level.

## **ONLINE APPENDIX B**

Suppose the labor market for NPs is monopsonistic with  $W_M = g(H_M) = \lambda H_M$ . Then, the profit maximization expression becomes:

$$\pi = p_Y f(H_H^p, H_M, H_L) - w_H H_H^p - \left( \lambda H_M + \frac{1}{\alpha} w_H \right) H_M - w_L H_L$$

and our three first order conditions are:

$$(1) \frac{\partial \pi}{\partial H_M} = p_Y f_{H_M} - 2\lambda H_M - \frac{w_H}{\alpha} = 0$$

$$(2) \frac{\partial \pi}{\partial H_H^p} = p_Y f_{H_H^p} - w_H = 0$$

$$(3) \frac{\partial \pi}{\partial H_L} = p_Y f_{H_L} - w_H = 0$$

From (2) above, we know  $w_H = f_{H_H^p}$ . We also know that  $W_M = \lambda H_M$ , by definition. Thus, we can plug these two expressions into (1) and rewrite it as:

$$W_M = \frac{1}{2} \left[ P_Y \left( f_{H_M} - \frac{f_{H_H}}{\alpha} \right) \right]$$

After full SOP adoption,  $\alpha \rightarrow \infty$  and this expression reduces to  $W_M = \frac{1}{2} (P_Y f_{H_M})$ . Thus, the increase in labor demand is  $\frac{P_Y f_{H_H}}{2\alpha}$  with full SOP adoption, which is exactly half of the increase compared to when the market is competitive, which was  $\frac{P_Y f_{H_H}}{\alpha}$ . Taken together, this analysis shows that monopsony would weaken the equilibrium response to changes in NP SOP.