

Medical Worker Migration and Origin-Country Human Capital: Evidence from U.S. Visa Policy

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Motivation

- Many developed countries face shortages of medical workers
 - Often recruit foreign-born nurses (Cortes and Pan, 2014)
- For migrant-origin, developing countries, recruitment may lead to scarcity, or “brain drain,” of health care professionals (Bhagwati and Hamada, 1974; Bhagwati and Rodriguez, 1975; Docquier et al., 2008)
 - Could contribute to poor health outcomes for local population
- Alternatively, emigration and high prospective returns abroad may lead to skill acquisition, or “brain gain” (Stark et al., 1997; Mountford, 1997; Beine et al., 2001)
- Despite theoretical prevalence of debate, little causal evidence exists

- What is the effect of demand for foreign-born health care workers on the stock of health care workers and educated labor in the country of origin?

- Exploit pair of plausibly exogenous policy changes
 - In 2000, U.S. dramatically expanded availability of visas for foreign nurses
 - In 2007, visas suddenly reduced to pre-2000 levels
- Altered migration prospects for nurses, especially from the Philippines
- Examine effect of international migration of nurses from the Philippines on both demand for and supply of education
- Event study methodology compares historically high versus low nurse migrant-origin provinces before and after the policy changes
 - Leverages migrant networks (Munshi, 2003; Theoharides, 2018)

Preview of Results

- Expansion and contraction of U.S. nursing visas first increased, then decreased migration of Filipino nurses
- Nursing enrollment increased after expansion, then decreased when visas reduced
 - Nursing graduates responded similarly but with 4-year lag
- Inverted U-shaped pattern of results challenging to attribute to differential province-specific trending
- Supply of nursing programs increased to allow for new enrollment
 - Response concentrated among private schools without previously existing nursing programs
 - Education response driven by provinces with greater supply elasticity of schooling

Preview of Results

- Increase in licensed nurses far exceeded number departing
 - 1 new nurse migrant → 9 newly licensed nurses
 - While more nurses pass the licensure exam overall, they pass at lower rates
- Brain drain or gain?
 - Increases due to individuals switching to nursing from other fields
 - Persisted to graduation at higher rate, increasing college grads overall
 - Overall increase in human capital stock in the Philippines

Contributions

- Provide first causal microeconomic estimates of effects of medical worker migration on origin-country human capital
 - Provides support for models of brain gain
 - Previous evidence of brain gain in low- and high-skilled settings (Batista et al., 2012; Beine et al, 2001; Chand and Clemens, 2019; Dinkelman and Mariotti, 2016; Docquier et al., 2008; Khanna and Morales, 2019; Shrestha, 2017; Theoharides, 2018)
- Focus on skill-specific migration where supply of postsecondary education may not readily respond
 - Measure supply-side effects of changes in nursing programs and changes in quality of nursing programs
 - Unique data allow for accurate estimates of skill prior to migration
- More broadly, provide empirical test of human capital theory given exogenous increase in returns to education

External Validity

- Key to our findings is that supply of schooling was able to accommodate increased demand
 - Such a response may not be possible in all contexts
 - Supply response due to existing institutions adding programs
 - For countries with established postsecondary system, adding programs may present fewer hurdles than opening entirely new institutions
- Low-to-middle income countries seeking to use migration as a development tool may experience increases in human capital stock and domestic supply of healthcare workers

Background on Filipino Nurse Migration

- Philippines is one of world's largest migrant-origin countries
- Filipino nurses make up largest group of foreign-born nurses
 - Rooted in colonial relationship with U.S.
 - United States is largest destination (74%)
 - Filipino nurses in U.S. earn over 13 times higher salaries plus legal status for family members
- Migrant networks are key determinant of nurse migration patterns (Choy, 2006)

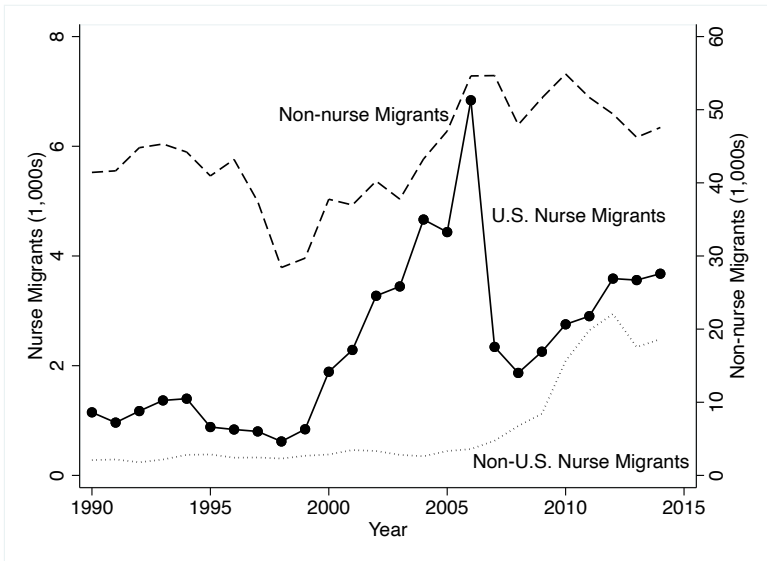
U.S. Recruitment of Nurses

- Most common channel for foreign nurses is through permanent employment based visas (EB-3)
- 140,000 EB-3 visas granted per year
 - Nurses experience shorter processing time due to shortages of U.S. nurses (Schedule A occupations)
 - Philippines cannot receive more than 7% of EB-3 visas granted
 - Demand for visas far exceeds supply

U.S. Recruitment of Nurses

- American Competitiveness in the 21st Century Act of 2000 loosened per country limits in visa allocation
 - Approximately 200,000 additional visas to Schedule A occupations
- In 2007, processing of Schedule A visas stopped
 - In 2006, 6,839 nurse visas processed from the Philippines
 - Fell to 2,342 in 2007

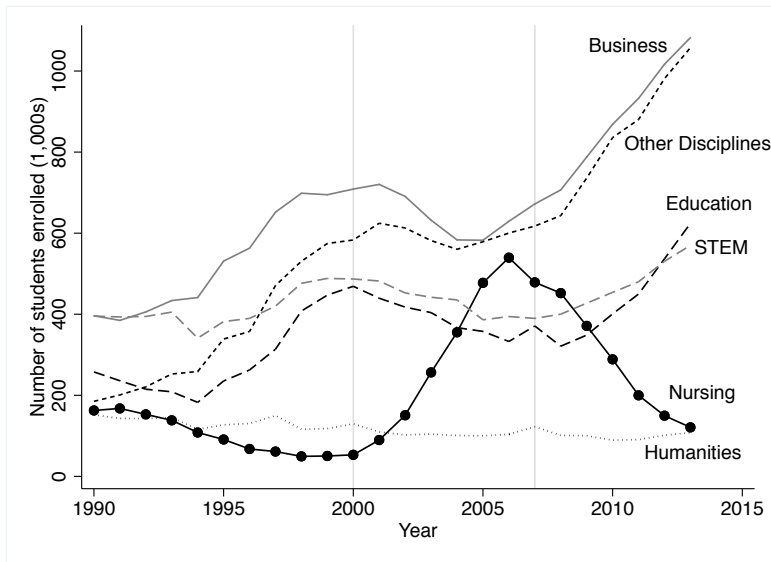
Departures of Nurse and Non-nurse Migrants



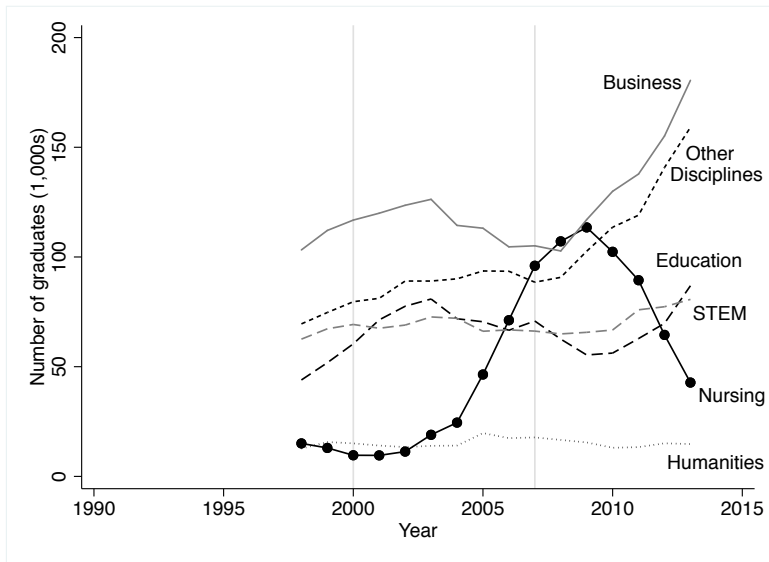
Brain Drain or Brain Gain?

- Philippines provides compelling example of where one might anticipate a shortage of domestically employed nurses
 - Government officials in the Philippines have described migration of nurses not as a “...brain drain, but more appropriately as a brain hemorrhage of our nurses.” (Galvez-Tan, 2003)
- Despite this fear, postsecondary enrollment and graduation data suggest opposite result

Enrollment in Postsecondary Education by Discipline



Graduations from Postsecondary Education by Discipline



- Commission for Filipinos Overseas (CFO): Administrative data on all permanent migrant departures from 1990 to 2013
 - Demographics, place of birth, country of destination, education, profession, etc.
 - Calculate province-level migration rates for nurses
- Commission on Higher Education (CHED): Institution-level postsecondary enrollment and graduation data from 1990 to 2013 disaggregated by program of study
 - Calculate enrollment, graduation rates and number of nursing programs in each province-year
- Philippine Nursing Licensure Exam (NLE): Number of examinees and number of passers by institution from 1990 to 2016
 - Aggregate to province-year-level examination and pass rates

Summary Statistics

	Full Sample	
	Mean	St. Dev.
	(1)	(2)
<i>Panel A. All Years</i>		
<i>Migrants Per 100,000</i>		
Total	75.03	93.83
U.S. Nurse	3.89	5.46
Non-Nurse	69.88	89.48
<i>Postsecondary Enrollment Rates (%)</i>		
Total	25.02	14.70
Nurse	1.80	3.14
Other	23.21	12.98
<i>Postsecondary Graduation Rates (%)</i>		
Total	4.43	2.41
Nurse	0.42	0.67
Other	4.01	2.08
<i>Number of Nursing Programs</i>		
Total	4.39	8.94
Public	0.64	1.15
Private	3.75	8.16
<i>Nursing Licensure Exam (%)</i>		
Examinees/Population	0.533	1.048
Passers/Population	0.235	0.439

Empirical Strategy

- Exploit plausibly exogenous and opposite-signed policy changes that occurred in 2000 and 2007 that expanded and restricted nurse migration to US
- National time series provide suggestive evidence of impacts of policy changes
- To isolate causal effect, exploit importance of migrant networks
- Compare high baseline nurse migration areas (treatment group) to low baseline nurse migration areas (control group) before and after the policy changes

$$Y_{pt} = \sum_{\tau \neq 1999} \beta_{\tau} High_{p,0} D_t^{\tau} + \alpha_p + \gamma_t + X_{p0} \gamma_t + \epsilon_{pt} \quad (1)$$

- Y_{pt} : outcome in province p year t
- $High_{p,0}$: binary variable equal to 1 if above median nurse migration at baseline
- D_t^{τ} : binary variable equal to one if year of observation t equals the specific year, τ , and 0 otherwise
- α_p and γ_t : province and year fixed effects
- $X_{p0} \gamma_t$: baseline controls interacted with year fixed effects
 - Baseline domestic nurses per capita x year fixed effects

Identifying Assumptions

- Identifying assumption: In absence of the policy changes, high nurse migration provinces would not have experienced differential changes in outcomes compared to low nurse migration provinces
- If this assumption holds, should not reject null hypothesis that β_τ 's prior to 2000 equal zero

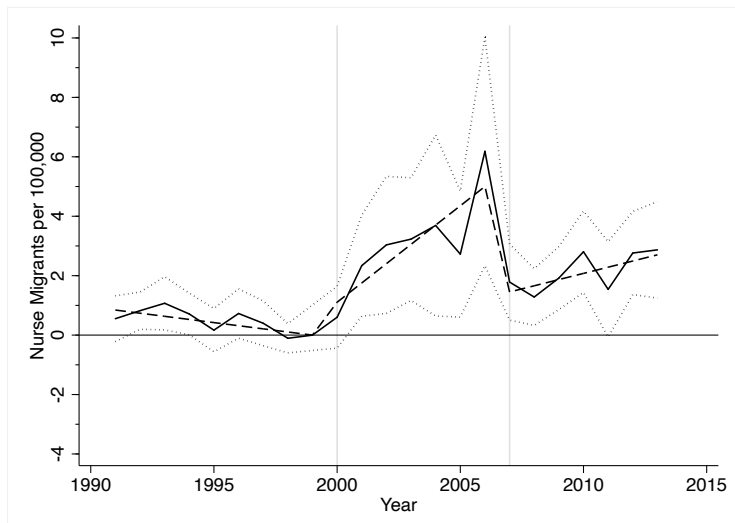
Threats to Validity

- Differential trending of outcomes by high and low nurse migration provinces
 - Baseline controls interacted with year fixed effects
 - No evidence of pre-trends
 - Dual policy changes yield inverted U-shaped pattern of results
 - Non-nursing disciplines decline in enrollment during expansion
- Cross province migration
 - Very low rates of migration for education from low to high migration provinces
 - Bounding exercises show such migration could explain only a trivial portion of effects

Threats to Validity

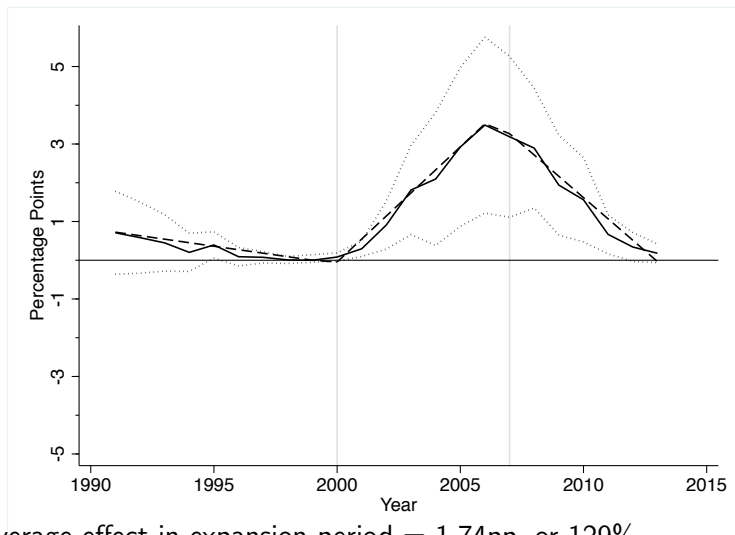
- Economic shocks or policy changes correlated with both nurse migration and outcome variable
 - No major changes to healthcare system or legislation occurred simultaneously
 - Domestic nurse controls help rule out domestic shocks and isolate effect of foreign demand shock
- Robustness checks:
 - Baseline non-nurse migration x year fixed effects
 - Without Manila
 - Additional baseline controls
 - Island x year fixed effects
 - Continuous Treatment
 - Borusyak et al. (2021) imputation estimator

Effect on Nurse Migration to U.S.



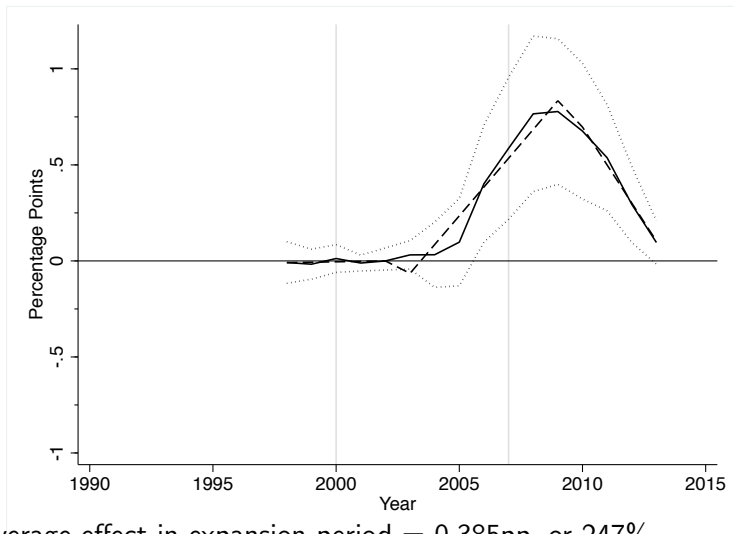
- Average effect in expansion period = 3.9 nurses per 100,000, or 126%
- Pre-period mean = 3.1 nurses per 100,000

Effect on Nursing Enrollment



- Average effect in expansion period = 1.74pp, or 129%
- Pre-period mean = 1.35pp

Effect on Nursing Graduation



- Average effect in expansion period = 0.385pp, or 247%
- Pre-period mean = 0.156pp

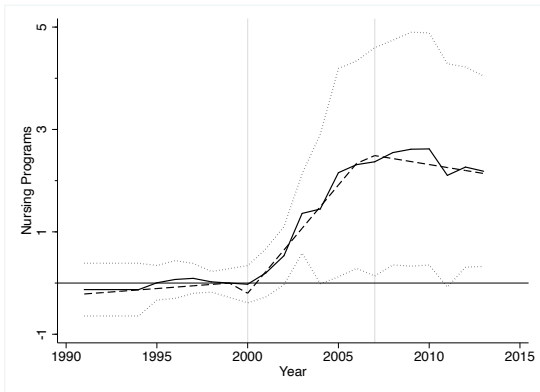
Magnitude of Effects

- Visa expansion led to 247% increase in graduates
 - Implies for each additional nurse migrant, 21 additional nursing graduates
- Huge effect, but recall aggregate response
 - 1,207 nurse migrants in 1999 to 7,323 in 2006
 - 11,313 nurse grads in 2002 and 113,484 in 2009
 - Also note that individuals switched programs
- Back of envelope calibration of standard utility function
 - Under reasonable levels of risk aversion, many individuals will shift to nursing despite low probability of migration

Supply of Schooling

- Common argument: even if returns to schooling could induce enrollment, supply constraints bind
 - Particularly likely for specialized occupations
- To test for this, examine effect of policy changes on number of nursing programs

Effect on Supply of Nursing Programs



- Average increase in expansion = 1.07 programs, relative to pre-period mean of 4.13
- Mostly driven by increases in private institutions
- Almost entirely from existing institutions adding programs, rather than new institutions

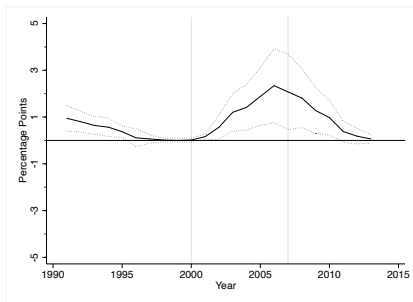
▶ Table

▶ Private

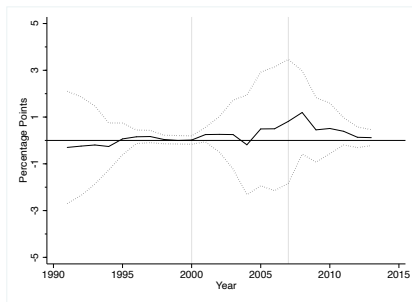
▶ Existing

Enrollment Effects by Postsecondary Supply Elasticity

More Elastic Supply

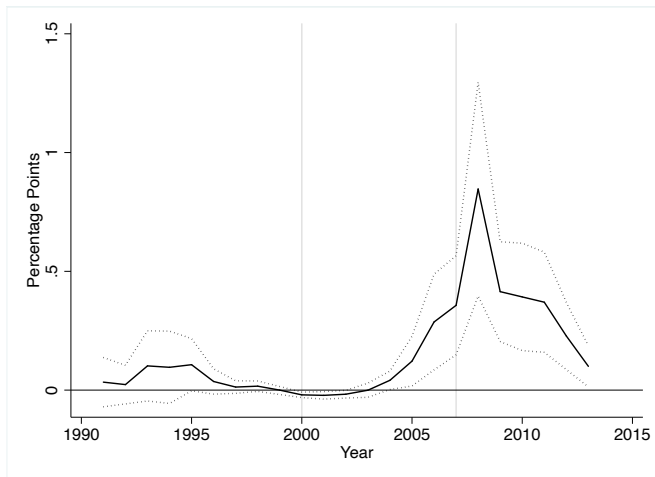


Less Elastic Supply



- Measure of supply elasticity:
 - Share of private institutions without nursing programs out of total private institutions
- Elastic schooling supply is key to brain gain effects found here

Effect on Nurse Licensure Pass Rates



- Nursing graduates must pass licensure exam in order to practice
- Average annual increase in pass rate of 0.17 pp (80%)
- Approximately 9 newly licensed nurses for each nurse migrant

Quality of the Marginal Nurse

- While the Philippines gained licensed nurses, not all new graduates passed exam
- Is marginal nurse less likely to pass?
 - Marginal nurse may be less-skilled either because new schools are less rigorous or students themselves are weaker
- Use data on examinee and pass rates from Philippine Nursing Licensure Exam (NLE)

Are those taking exam more or less likely to pass?

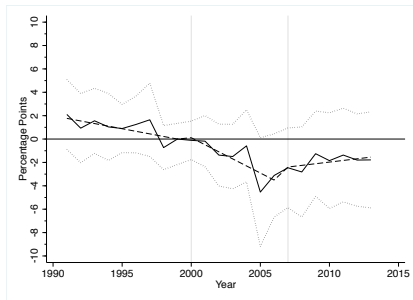
	Passers out of Population	Examinees out of Population	Pass Rate (Column 1/Column 2)	P-value, col 3=0.58 (Pre-period pass rate)
Year	(1)	(2)	(3)	(4)
Average Effect (2000-2013)	0.174*** (0.050)	0.453*** (0.124)	0.384	0.000

- Estimate basic DID with two outcomes:
 - ① Number of passers/population
 - ② Number of examinees/population
- Divide coefficient 1 by coefficient 2 to get implied pass rate: 38.4%
- Test against pre-period past rate of 58%
- Examinees pass at lower rate in high relative to low nurse provinces
- But, so many more people take exam in high nurse provinces that licensed nurses increased substantially
 - 9 nurses for every new migrant

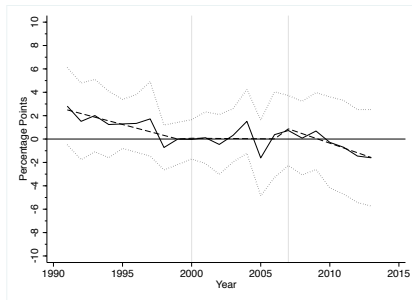
Effect on Non-Nursing Enrollment

- Did this policy change increase overall stock of college educated labor?

Non-Nursing Enrollment Rate

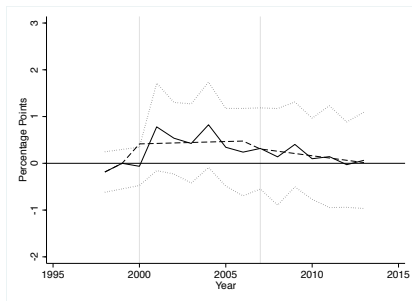


Total Enrollment Rate

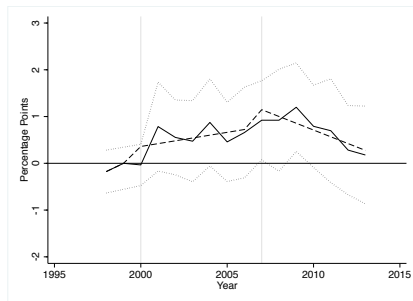


Effect on Non-Nursing Graduation

Non-Nursing Graduation Rate



Total Graduation Rate



- Post-expansion effects on total graduation jointly significant
- Those in nursing degrees more likely to persist to graduation
- 560 more graduates compared to 32 new nurse migrants
- Overall increase in stock of human capital

What happens to nursing graduates who do not get a visa?

- Very small share migrate as nurses to other destinations
 - Do not appear to be absorbed by temporary contracts
- Analysis of Census suggests a large increase in nurse employment in the Philippines
 - No major healthcare expansions during this time
 - Driven by RN HEALS program and “Professional Volunteer” nurses
- What about those that do not pass?
 - Universal Healthcare Implementers, Public Health Associates
 - Business Process Outsourcing (BPO)

- In terms of benefits, Philippines gained nurses, including in underserved areas
- Those who migrated experienced huge gains in wages and sent remittances
- In terms of costs, many nurses remained unemployed or in volunteer positions
 - Switched to nursing from other fields
 - Unclear if remaining in those fields would have greater development impacts
- Ultimately, our paper aims to provide well-identified estimate of partial equilibrium effects of demand for foreign nurses on education in the origin

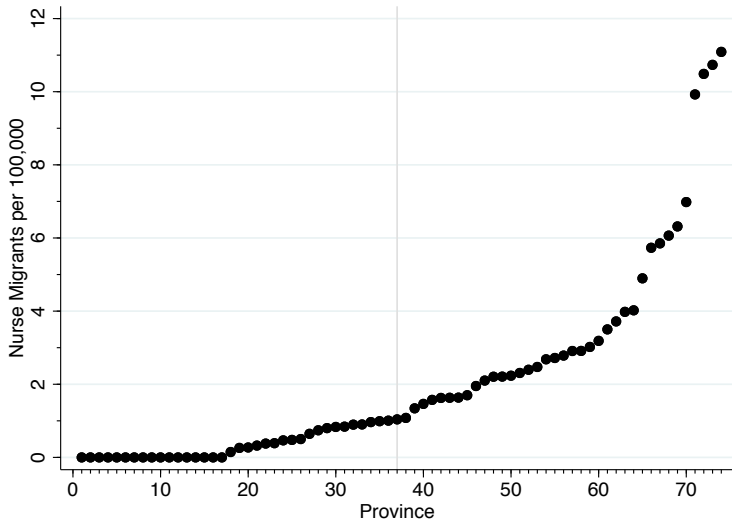
Conclusion

- Expanded migration opportunities did not deplete stock of nurses in the Philippines
- Overall, supply of nurses and total human capital stock increased
 - Caveat: Results may not translate to all settings, particularly where postsecondary infrastructure is unable to expand
- Our results provide useful evidence for low-to-middle income countries seeking to facilitate labor migration
- Brain gain can dominate brain drain in context of medical worker migration

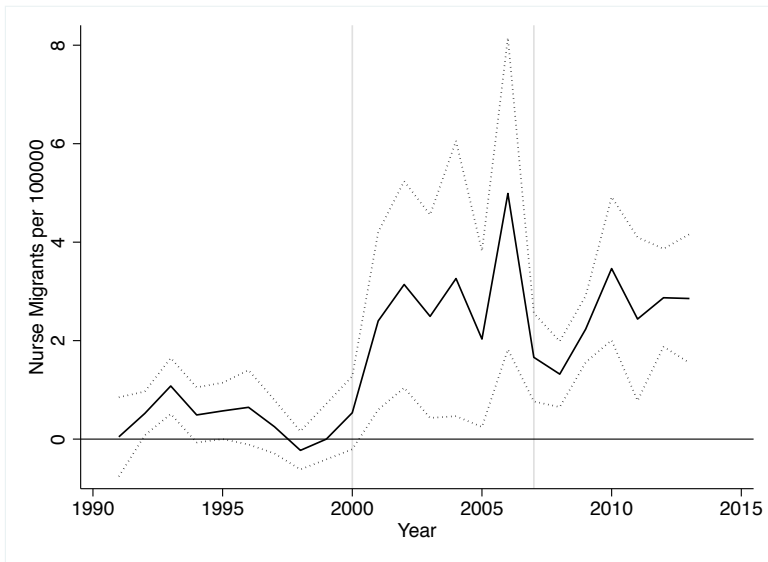
$$Y_{pt} = \beta_{post1} High_{p,0} 1(t \geq t_1) + \beta_{trend1} High_{p,0} 1(t > t_1)(t - t_1) \\ + \beta_{post2} High_{p,0} 1(t \geq t_2) + \beta_{trend2} High_{p,0} 1(t > t_2)(t - t_2) \quad (2) \\ + \beta_{trend} High_{p,0}(t - t_1) + \alpha_p + \gamma_t + X_{p0}\gamma_t + \epsilon_{pt}$$

- Y_{pt} : outcome in province p year t
- t_1 and t_2 represent years of expansion (2000) and contraction (2007), respectively
- β_{post1} and β_{post2} capture the immediate change in outcomes
- β_{trend1} and β_{trend2} capture delayed annual changes in outcomes

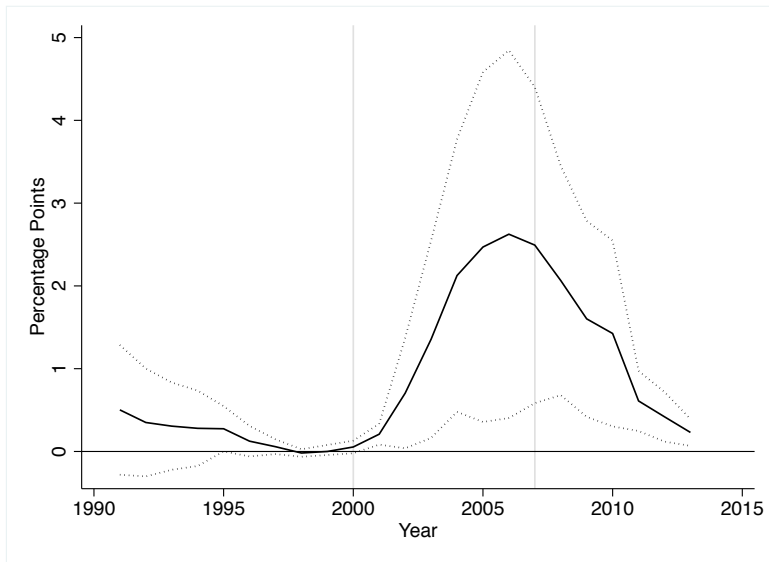
Baseline U.S. Nurse Migration Rates



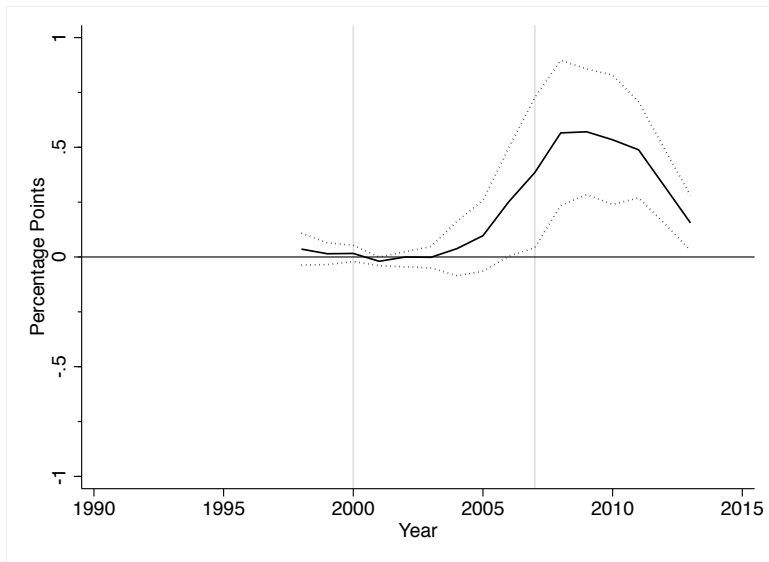
Continuous Treatment: U.S. Nurse Migration Rate



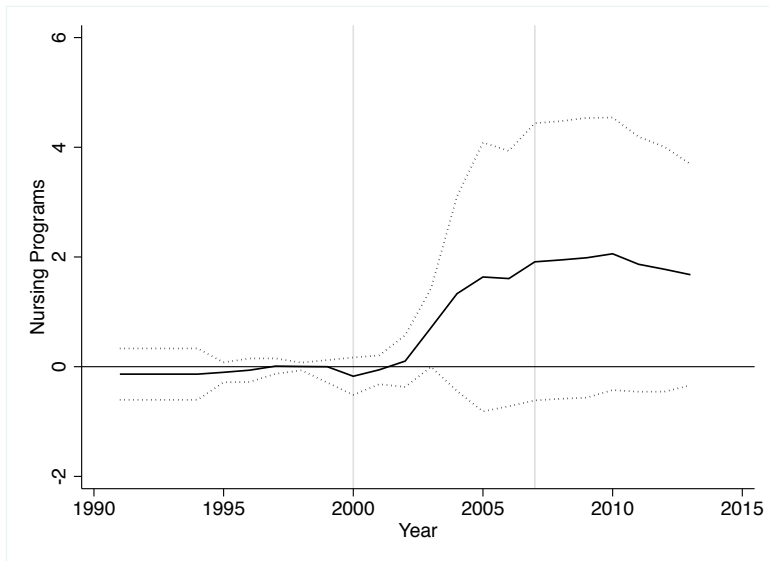
Continuous Treatment: Nursing Enrollment



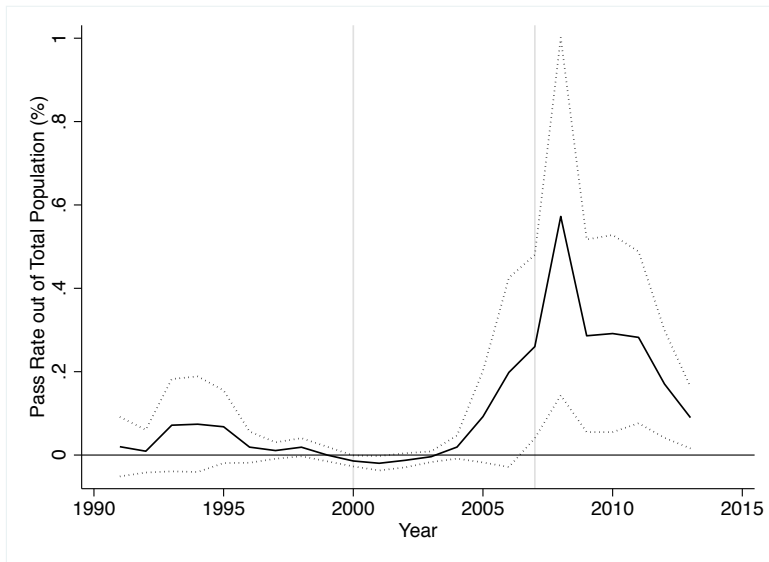
Continuous Treatment: U.S. Nurse Graduation



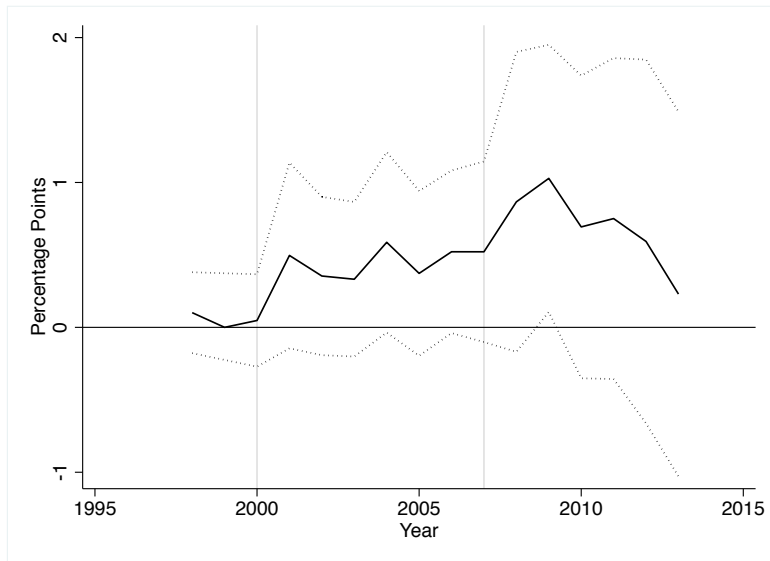
Continuous Treatment: Total Nursing Programs



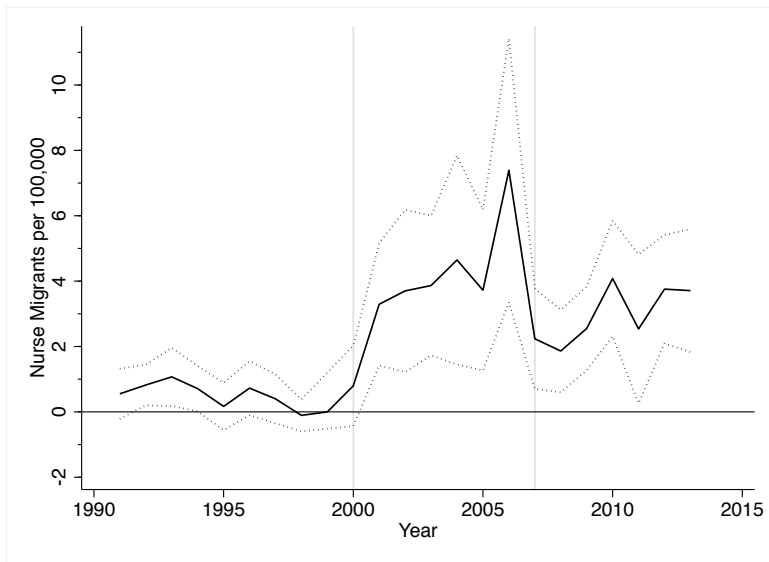
Continuous Treatment: Nursing Exam Pass Rate



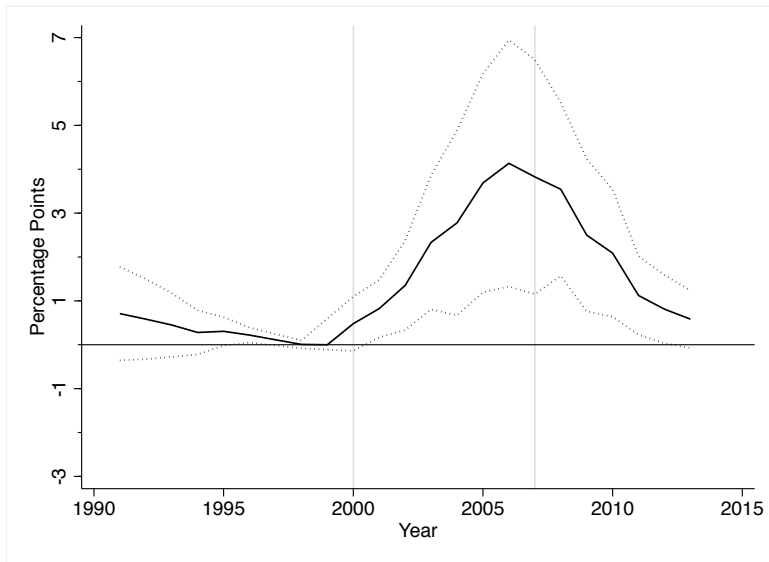
Continuous Treatment: Total Graduation Rate



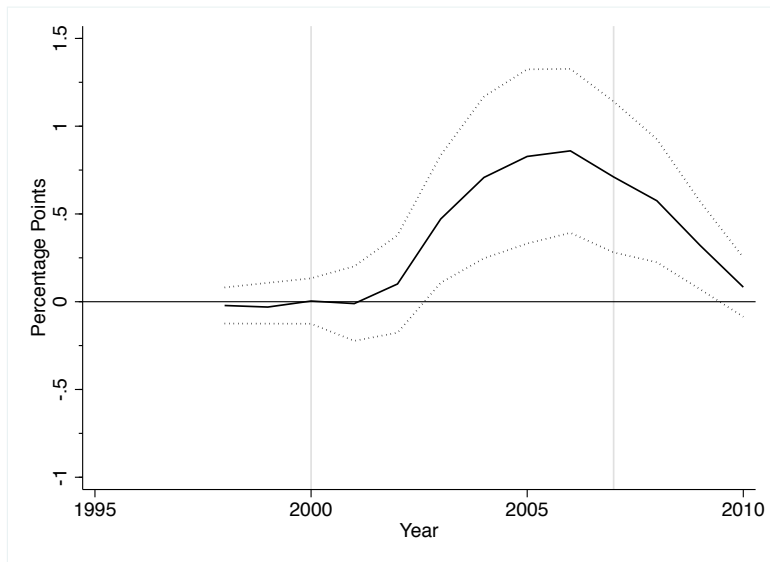
Borusyak et al. Imputation Estimator: U.S. Nurse Migration Rate



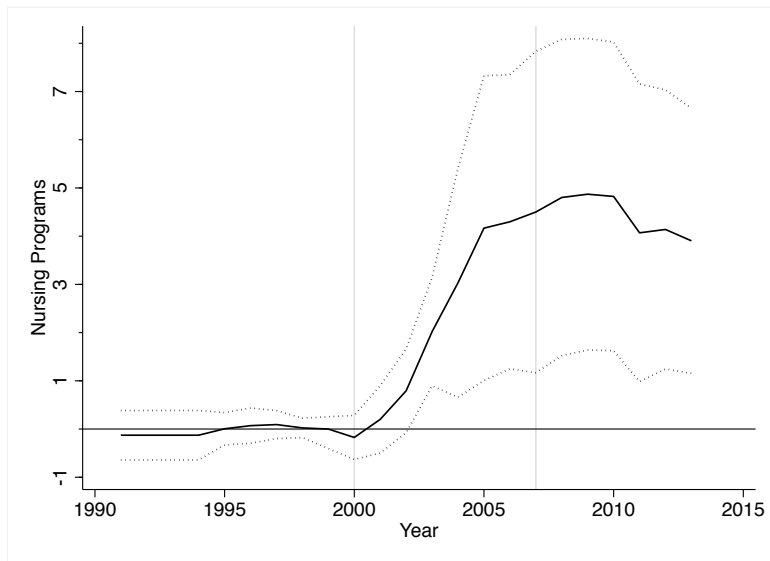
Borusyak et al. Imputation Estimator: Nursing Enrollment



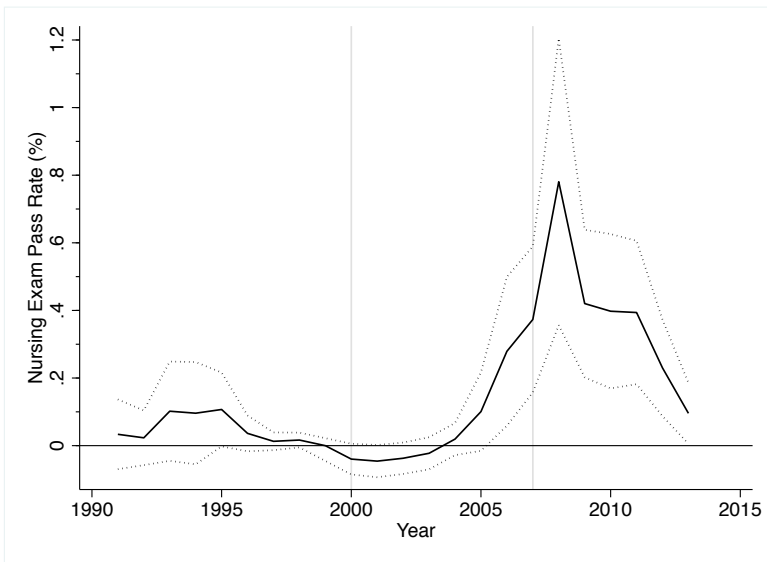
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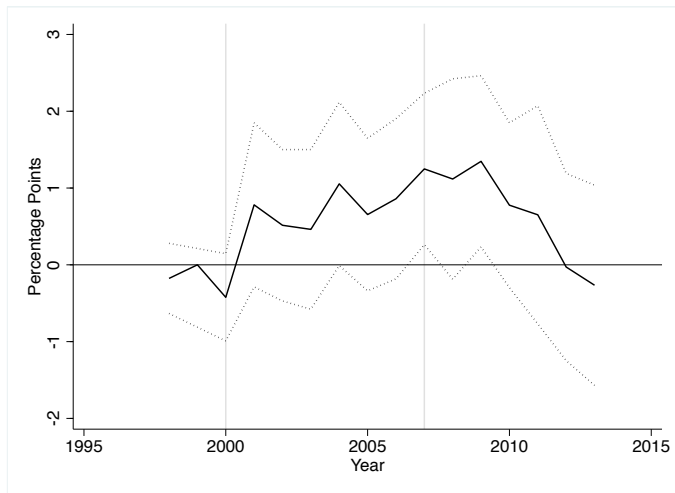
Borusyak et al. Imputation Estimator: Total Nursing Programs



Borusyak et al. Imputation Estimator: Nursing Exam Pass Rate



Borusyak et al. Imputation Estimator: Total Graduation Rate

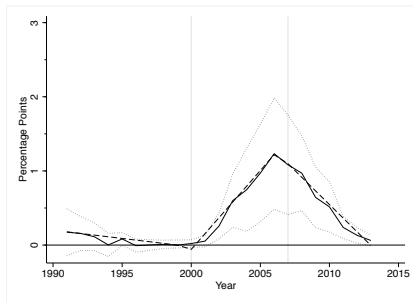


Borusyak et al. Imputation Estimator: Post Expansion Effects

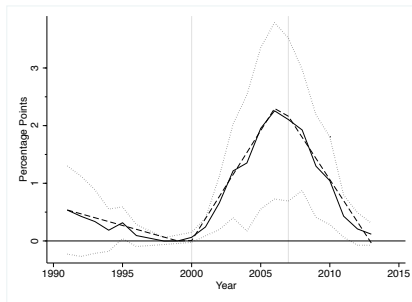
	U.S. Nurse Migrants Per 100,000 (1)	Nursing Enrollment Rate (2)	Nursing Graduation Rate (3)	Number of Nursing Programs (4)	Total Graduation Rate (5)
<i><u>Panel A. Main specification</u></i>					
Post Expansion x High	2.632** (1.030)	1.380*** (0.487)	0.387*** (0.114)	1.176** (0.552)	0.558** (0.278)
<i><u>Panel B. Borusyak et al. imputation estimator</u></i>					
Post Expansion x High	3.364*** (1.110)	1.522*** (0.478)	0.439*** (0.128)	2.176*** (0.741)	0.737 (0.472)

Nursing Enrollment Rates by Gender

Male Nursing Enrollment Rate



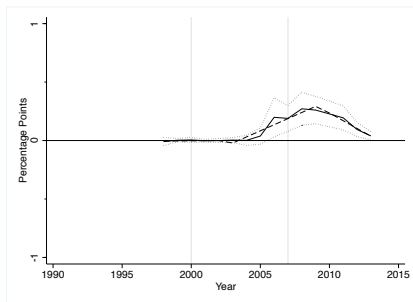
Female Nursing Enrollment Rate



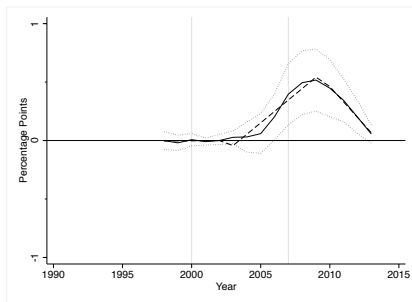
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Nursing Graduation Rates by Gender

Male Nursing Graduation Rate



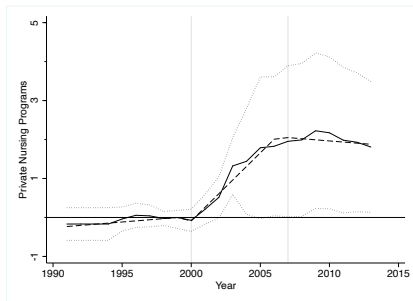
Female Nursing Graduation Rate



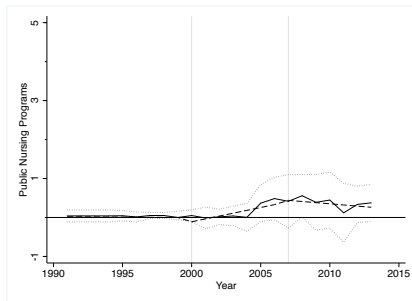
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Effect on Supply of Nursing Programs

Private Nursing Programs



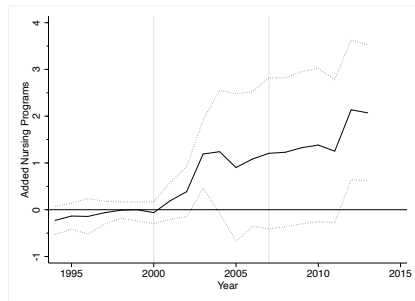
Public Nursing Programs



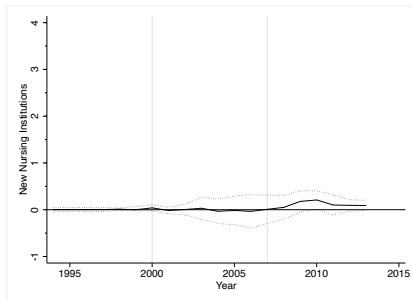
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Effect on Type of New Nursing Program

Nursing Programs Added to Existing Private Institutions



New Private Nursing Institutions



▶ Back

Robustness Checks

	U.S. Nurse Migrants Per 100,000	Nursing Enrollment Rate	Nursing Graduation Rate	Number of Nursing Programs	Total Graduation Rate
	(1)	(2)	(3)	(4)	(5)
<i><u>Panel A. Main specification</u></i>					
Post Expansion x High	2.632** (1.030)	1.380*** (0.487)	0.387*** (0.114)	1.176** (0.552)	0.558** (0.278)
Post Contraction x High	-0.977 (0.792)	-0.127 (0.159)	0.015 (0.070)	1.246* (0.628)	-0.305 (0.282)
<i><u>Panel B. Plus baseline non-nurse migration rate x year fixed effects</u></i>					
Post Expansion x High	2.722*** (1.005)	1.304*** (0.470)	0.365*** (0.108)	0.870 (0.577)	0.388 (0.252)
Post Contraction x High	-1.792** (0.798)	-0.200 (0.160)	-0.089 (0.072)	0.686 (0.641)	-0.598* (0.317)
<i><u>Panel C. Without Manila</u></i>					
Post Expansion x High	2.591** (1.051)	1.349*** (0.491)	0.380*** (0.116)	1.362*** (0.372)	0.555* (0.283)
Post Contraction x High	-0.968 (0.792)	-0.126 (0.158)	0.015 (0.070)	1.443*** (0.438)	-0.315 (0.278)
<i><u>Panel D. Plus additional controls x year fixed effects</u></i>					
Post Expansion x High	3.137** (1.411)	1.501** (0.691)	0.340** (0.161)	0.509 (0.801)	0.624* (0.344)
Post Contraction x High	-1.789* (1.061)	-0.110 (0.183)	0.030 (0.084)	0.346 (0.815)	-0.447 (0.293)

Robustness Checks

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Post Contraction x High	-0.977 (0.792)	-0.127 (0.159)	0.015 (0.070)	1.246* (0.628)	-0.305 (0.282)
<i><u>Panel E. Plus additional controls x year fixed effects, without Manila</u></i>					
Post Expansion x High	3.010** (1.405)	1.399** (0.675)	0.315* (0.160)	1.168*** (0.387)	0.609* (0.363)
Post Contraction x High	-1.798* (1.056)	-0.103 (0.177)	0.032 (0.086)	1.019** (0.419)	-0.493 (0.299)
<i><u>Panel F. Plus island x year fixed effects</u></i>					
Post Expansion x High	3.230*** (0.912)	1.488*** (0.426)	0.430*** (0.095)	0.892 (0.669)	0.252 (0.260)
Post Contraction x High	-1.449** (0.719)	-0.194 (0.162)	-0.018 (0.063)	0.789 (0.755)	-0.313 (0.273)
<i><u>Panel G. Continuous Treatment Measure: Baseline Nurse Migration Rate</u></i>					
Post Expansion x Baseline Nurse Migration Rate	2.318** (1.030)	1.157** (0.485)	0.263*** (0.088)	0.814 (0.651)	0.403** (0.197)
Post Contraction x Baseline Nurse Migration Rate	-0.287 (0.933)	-0.103 (0.141)	0.101 (0.080)	1.152* (0.675)	-0.041 (0.409)

Pooled Event Study Estimates

	U.S. Nurse Migrants Per 100,000 (1)	Nursing Enrollment Rate (2)	Nursing Graduation Rate (3)
Post Expansion x High	1.211* (0.646)	0.045 (0.133)	-0.067 (0.074)
Post Expansion x High x Trend	0.755*** (0.267)	0.685** (0.261)	0.148*** (0.043)
Post Contraction x High	-4.200** (1.760)	-0.850* (0.497)	-0.287*** (0.108)
Post Contraction x High x Trend	-0.441** (0.217)	-1.144*** (0.371)	-0.348*** (0.077)
Trend x High	-0.105*** (0.039)	-0.091 (0.073)	0.002 (0.014)
Observations	1702	1670	1169
Pre-period mean for high nurse provinces	3.068	1.348	0.156

Pooled Event Study Estimates

	Number of Nursing Programs (4)	Number of Private Nursing Programs (5)	Number of Public Nursing Programs (6)
Post Expansion x High	-0.226 (0.296)	-0.118 (0.255)	-0.109 (0.102)
Post Expansion x High x Trend	0.396** (0.187)	0.320* (0.172)	0.076* (0.045)
Post Contraction x High	-0.270 (0.251)	-0.307 (0.219)	0.037 (0.135)
Post Contraction x High x Trend	-0.481* (0.250)	-0.378* (0.219)	-0.103 (0.064)
Trend x High	0.027 (0.038)	0.029 (0.031)	-0.002 (0.011)
Observations	1702	1702	1702
Pre-period mean for high nurse provinces	4.126	3.685	0.441

DID Estimates

	<u>Enrollment Rate Outcomes</u>		<u>Graduation Rate Outcomes</u>	
	Non-Nurse	Total (Non-Nurse + Nurse)	Non-Nurse	Total (Non-Nurse + Nurse)
	(1)	(2)	(3)	(4)
Post Expansion x High	-2.589** (1.100)	-1.209 (1.125)	0.172 (0.296)	0.558** (0.278)
Post Contraction x High	-0.267 (1.060)	-0.395 (1.117)	-0.319 (0.263)	-0.305 (0.282)
Observations	1670	1670	1169	1169
Mean Dependent Variable	23.50	24.85	4.52	4.67