

# The International Migration of Healthcare Professionals and the Supply of Educated Individuals Left Behind<sup>1</sup>

Paolo Abarcar<sup>2</sup>  
Mathematica Policy Research

Caroline Theoharides<sup>3</sup>  
Amherst College

This draft: June 29, 2018

The migration of skilled professionals, particularly of healthcare workers, is often cited as a key concern for many developing countries because of its potential to deplete the number of skilled workers from the local economy. In contrast, the recruitment abroad of skilled migrants might increase the returns to education, leading to human capital formation. We estimate the effect of skilled migration on educational investment in the country of origin by exploiting the aggressive nurse recruitment policies and subsequent visa restrictions employed by the United States in the 2000s. Using a new administrative dataset combining the universe of permanent migrant departures from the Philippines with the universe of institution-level post-secondary enrollment and graduation, we show that enrollment and graduation in nursing programs increased in response to demand from abroad for nurses. For each new nurse that moved abroad, approximately two more individuals with nursing degrees graduated. The supply of nursing programs increased to accommodate this. New nurses appear to have switched from other degree types. Nurse migration had no impact on either infant or maternal mortality. JEL: O15, F22, J61

---

<sup>1</sup> We thank the Commission on Filipinos Overseas (CFO) and the Philippine Commission on Higher Education (CHED) for access to the data: Secretary Imelda Nicolas, Rodrigo V. Garcia, and Allan Dennis T. Pulma from the CFO; Gregorio Atienza, Aiza Dilidili, and Napoleon K. Juanillo from CHED were invaluable in compiling these databases. We are especially grateful to Dean Yang, Jeffrey Smith, Achyuta Adhvaryu, and Brian Jacob for their comments and helpful advice. We also thank conference participants at NEUDC 2017, the 2017 Barcelona Summer Forum Migration Workshop and 2017 Pac-Dev Conference, as well as seminar participants at the University of Michigan, the University of Connecticut, RPI, Clark University, and IFPRI for comments.

<sup>2</sup> 1100 1st Street NE, Washington, DC 20002. Email: pabarcar@mathematica-mpr.com.

<sup>3</sup> Converse Hall, Amherst, MA 01002. Email: ctheoharides@amherst.edu.

## I. Introduction

While international labor migration provides many benefits to developing countries (Clemens, 2011; Yang, 2008), many consider the migration of skilled professionals to be a chief concern. Policymakers worry that as receiving countries recruit workers from abroad, origin countries lose talent that their education systems paid to train. At the center of these concerns is the migration of healthcare professionals. As rich countries increasingly address workforce shortages by recruiting doctors and nurses from abroad, a popular view is that this hurts poor countries by causing a scarcity of healthcare professionals, leading to poor health outcomes in these places. The consequences are deemed so grave that in 2010, members of the WHO adopted a *Global Code of Practice in the International Recruitment of Health Personnel* discouraging active recruitment from developing countries (Clemens 2013). Destination countries have responded by banning recruitment from certain countries.

In this paper, we identify the effect of demand from the United States for international nurses on post-secondary enrollment and degree receipt in the Philippines by exploiting changes in U.S. migration policy. In 2000, the U.S. dramatically expanded the availability of visas for nurse migrants and their families, and then in 2007, suddenly imposed restrictions on the number of these visas. This altered the migration prospects of many Filipino nurses, who generally want to migrate to the U.S. but have limited options. We exploit the fact that not all geographic areas of the Philippines were affected equally by these changes. Due to the importance of migrant networks as a determinant of international migration (Munshi, 2003; Theoharides, 2018), the changes in demand for nurse migrants had a larger effect in provinces that historically specialized in sending nurses abroad. We therefore employ an event study methodology to explicitly measure the effect of the policy changes on enrollment and graduation by comparing

what happened in historically high versus low nurse migration provinces in the Philippines. Our key identifying assumption is that in the absence of the policy change, the educational investments in provinces with high relative to low nurse migration would not have changed differentially.

We utilize an original administrative dataset on all permanent migrant departures from the Philippines from 1990 to 2014 to calculate provincial-level nurse migration over time. We combine this with administrative data on post-secondary level enrollment and graduation as well as the supply of nursing programs in the Philippines over time. We find that post-secondary enrollment and graduation in nursing programs increased in response to greater opportunities to work abroad, during the period when visas were made easily available to nurses. The increase in graduations from nursing programs responded with a lag, consistent with the fact that investments in education take several years. The magnitude of the increase in nursing degrees was such that not all of the additional nurses migrated, and for each additional nurse that went abroad during the period of expansion, two new individuals graduated from nursing school. In response to reductions in the availability of visas for nurses, nursing enrollment and graduation declined. The supply of nursing programs expanded in order to accommodate the increase in demand for nursing education. Our results suggest that increased nurse migration from the Philippines did not deplete, and rather increased, the number of nurses in the Philippines, and fears of healthcare worker brain drain were unwarranted in this case.

We also examine the effects of the policy change on enrollment and graduation in other degree programs in order to determine whether the marginal nursing graduate did not previously obtain a college education. We find that new nursing graduates appear to switch from other fields

of study, primarily STEM and business fields. As such, the total number of college graduates remains constant throughout the sample period.

Finally, debates surrounding healthcare worker migration center largely on concerns for the health of individuals in the country of origin. We examine the effects of the policy changes on infant and maternal mortality and find no changes. This suggests that healthcare worker migration did not adversely affect key health outcomes. On the other hand, increases in nurses due to aspirational brain gain effects also did not positively benefit the health of Filipinos.

Our paper makes several contributions to both the academic and policy literatures on migration and development. First, our results are consistent with models of human capital formation where high prospective returns to skill in foreign countries lead to skill acquisition at home (Stark et al. 1997; Mountford 1997; Beine et al., 2001). Recent empirical work finds support for such models in countries like Nepal, Fiji, and Cape Verde. Shrestha (2016), for instance, argues that the recruitment of Nepalese men into the British Army raised educational attainment. Chand and Clemens (2008) exploit political shocks in Fiji to demonstrate that mass departures by Indo-Fijians subsequently led this group to invest more heavily into education. Batista et al. (2012) use household survey data in Cape Verde and determine that increases in the probability of future migration lead to higher rates of intermediate schooling completion. Our results contribute to the literature on brain drain by testing such models using a more skilled and prominent flow of migrants (healthcare workers) from the Philippines, one of the world's largest senders of migrants. Docquier and Marfouk (2006) point out that research examining such a flow is critical since the supply of post-secondary schooling may not respond as easily to the demand for education in a specialized but large occupation. Our results suggest that, at least in the context of the Philippines, such a supply response was possible.

Second, our results add to the broader academic literature on the effects of migration on origin countries. In particular, our results show that increases in demand for migrants lead to increases in educational investment, similar to the findings of Dinkelman and Mariotti (2016) in the context of low-skilled African migration and Theoharides (2016) in the context of temporary migration and secondary school enrollment. By examining the effects of nurse migration on post-secondary enrollment, we provide evidence for the brain drain and brain gain debate in the context of healthcare workers, the context in which it is most commonly debated.

Finally, in terms of policy, our results imply that, despite concerns of brain drain, the number of nurses in the Philippines increased as a result of greater migration. The results provide evidence against the usual refrain about the brain drain of healthcare professionals: that when these workers leave, their domestic numbers decrease, and it is difficult to replace them. We demonstrate why it might not be useful to assume that the stock of healthcare workers in migrant-sending countries is fixed. At least in this case, the supply of medical professionals responded to demand from employers abroad. Our findings lend support for well-designed partnerships between sending and receiving countries that can in principle facilitate both human capital accumulation and migration.

The remainder of the paper is outlined as follows. Section II discusses background on nurse migration from the Philippines and discusses changes in U.S. migration policy that led to increased demand for Filipino nurses. Section III presents the data. Section IV outlines the empirical strategy, while Section V presents the results. Section VI concludes.

## II. Background

### *A. The Philippines and Nurse Migration*

With over 11% of its population living abroad, the Philippines is one of the largest migrant-sending countries in the world. It is also the world's largest supplier of nurses. Filipino nurses make up the single largest group of foreign-born nurses serving in OECD countries (OECD, 2007). Around 3,000 to 8,000 nurses leave the country each year on permanent visas.

With such high rates of nurse migration, the Philippines is where one would likely expect to find a shortage of nurses. Indeed, Filipino policymakers expected as much when nurse migration suddenly picked up in the early 2000s. "Sadly, this is no longer brain drain, but more appropriately, brain hemorrhage of our nurses," remarked the former minister of health, Dr. Jaime Galvez-Tan. "Very soon, the Philippines will be bled dry of nurses." (Asia Times, 2003).

Despite this concern, however, data from the Philippine Commission on Higher Education (CHED) suggest an opposite outcome. In response to increased prospects of moving abroad, enrollment in nursing programs rose from 90,000 to over 400,000 from 2001 to 2006 (Figure 1a). At the same time, the number of nursing graduates grew from 9000 to 70,000 (Figure 1b). Hence, increased demand for nurses from abroad may not have caused a drain on human resources, but rather increased the supply college educated individuals remaining in the country.

While early theoretical work in economics tends to share a negative view of skilled migration,<sup>4</sup> recent models question the notion that skilled-worker movement necessarily leads to a "loss" in countries of origin. Stark et al. (1997) and Mountford (1997) provide models where a home country can end up with a higher stock of human capital even when high-skill members of its workforce migrate. These models highlight that (1) when there are substantially higher returns

---

<sup>4</sup> See for example Grubel and Scott (1966) or Bhagwati and Hamada (1974).

to human capital abroad than at home, (2) and migration requires investment in education, (3) but the probability of migrating is uncertain, then migration may induce workers to acquire education, even if not everyone eventually moves abroad. Thus, a net “gain” may occur if more end up investing in education than those who move away.

The Philippines is an excellent setting to test the relationship between the international migration of nurses and human capital formation. The setting fulfills conditions described by aforementioned “brain gain” models. First, there are huge returns for nurses to migrate abroad from the country. In 2006, for example, the mean annual salary for a professional nurse adjusting for purchasing power parity was equivalent to \$6,229 in the Philippines; in the same year, it was \$59,730 in the U.S.<sup>5</sup> For the migration episode we study, not only were the monetary benefits to migration large, but nurses were also provided the benefit of bringing family members with them and giving them legal status in the U.S. Second, nurse migration from the country requires significant investment in education. It takes a minimum of four years to obtain a nursing degree from the Philippines and this is generally a requirement to obtain a nursing license abroad (Engman 2010). In contrast, the minimum requirement for nurses in the U.S. to obtain licensure is a two year associates degree. Third, migration is highly uncertain. Especially in the period we consider, the number of visas made available for employers to sponsor workers was an important determinant. But it was practically difficult to predict how many people were in queue for these visas and if numerical quotas would be reached, as we describe next.

---

<sup>5</sup> Salary data are from the Bureau of Labor and Employment Statistics, Republic of the Philippines (2006) and the U.S. Bureau of Labor Statistics.

### *B. Nurse Migration to the U.S.*

The U.S. is the preferred destination of Filipino migrant nurses. Departures to the country are a major driver of the nurse migrant flow between 1990 and 2014 (Figure 2). During this period, 74% of migrant nurses went to the U.S. This corresponds to survey results from Van Eyck (2004), which reveal that more than four-fifths of Filipino nurses prefer a job in the U.S.

The most common channel for foreign nurses to enter the U.S. market is through employment-based visas (EB-3 visas). Opportunities to migrate under temporary work permits for nurses are generally limited (DHS 2008). Unlike temporary visas, employment-based visas allow individuals to permanently reside in the U.S. and to bring family members, who also obtain the same legal status. A worker must be sponsored by an employer for the visa but is not obligated to remain with the same employer. U.S. immigration law provides 140,000 employment-based visas annually to principals in addition to their spouses and children (Jasso et al. 2010). Visas for first and second preference workers (persons with extraordinary ability and professionals holding advanced degrees) are first processed, then a portion of the 140,000 is allocated to EB-3 visas. Nurses belong to this third preference category but typically enjoy a shorter processing time frame for their visas. The U.S. Department of Labor designates nurses as a “Schedule A” occupation, meaning that there is a shortage of U.S. workers who are able, willing, qualified, and available.

It is by no means, however, easy to migrate to the U.S. as a nurse from the Philippines. The most important barrier is that visas are usually unavailable. Immigration rules stipulate that individuals born in any given country may not be allocated more than 7 percent of the total number of immigrant visas per fiscal year. Since visa applications from the Philippines far exceed the 7 percent per-country limit each year, waiting times to get a visa span years. Those



wishing to migrate as a nurse must also pass a battery of tests (Aiken 2007). All nurses take the National Council Licensure Examination (NCLEX) to practice as a registered nurse in the U.S and must pass the local license examination in their home country. Applicants need to demonstrate that their education was at the postsecondary level. Foreign trained nurses must pass an English Proficiency Test (TOEFL).

Several changes in U.S. immigration policy affected nurse migration from the Philippines in the 2000s. The American Competitiveness in the 21<sup>st</sup> Century Act of 2000 (AC21) modified law to loosen per country limits in visa allocations. AC21 excused per country limits when part of the 140,000 employment-based visas would go unused. This immediately benefitted oversubscribed countries like China, Mexico, India, and the Philippines. The rule change cut down on waiting times and allowed visas to be issued immediately to individuals from these places. AC21 further recaptured 130,137 visas, which had gone unused in 1999 and 2000. These were made immediately available for employment-based visa applications (Jasso et al. 2010). In addition, the Real ID Act of 2005 made 50,000 unused visas from 2001-2004 available, allocating them to Schedule A occupations. The combination of these policies led to the rise of nurse migration from the Philippines from 2000 to 2006 in Figure 2. It was an exceptional period, where there were minimal wait times for a visa.

Then, in February 2007, processing for EB-3 visas suddenly went into “retrogression.” The U.S. Citizenship and Immigration Services (USCIS) defines “visa retrogression” as a situation where many more people apply for visas in a particular category than there are visas available. The 180,137 unused visa numbers previously made available had all been claimed. Processing of Schedule A visas stopped. As a result, in 2006, there were 5,290 employer-sponsored visas for nurses that were processed from the Philippines; in 2007, this dropped to 815

and has continued to be that low.<sup>6</sup> Other migration streams to the U.S. were unaffected by these changes. The period of easy migration of nurses to the U.S. suddenly came to an end.

We exploit these large and sudden changes in visa availability for nurses in our analysis to look at the effect of visa expansion and restriction on migration and education. We argue that the changes in the number of available visas were plausibly unexpected. Given that even immigration officers could not have predicted these abrupt changes (Jasso et al., 2010), it would been difficult for any individual in the Philippines to predict these changes. As the USCIS Ombudsman (2007) reported to Congress in an annual report: “Exactly how many employment-based green card applications does the agency have pending? USCIS still cannot answer that question today with certainty.”

### **III. Data**

We utilize a new and unique administrative data on all permanent migrant departures from the Philippines from 1990 to 2014. The data are from the Commission on Filipinos Overseas (CFO), a government agency responsible for registering emigrants and strengthening the ties of the diaspora with the homeland. All emigrants who plan to move abroad on a permanent immigrant visa are required to register with the CFO before leaving.

The CFO data contain rich information on every individual who has left for abroad on a permanent visa. The data include demographic information as well as information on place of birth, usual address, country of destination, education, course of study, and profession, among other things. To our knowledge, this is the first dataset of its kind, and as a result, we are able to accurately measure skilled migration and track the outflow of all nurses.

---

<sup>6</sup> The recent uptick in nurse migration from 2009 onwards in Figure 3 is due to Canada.

The use of origin-country administrative data to analyze high-skilled migration already represents an improvement in understanding the effect of skilled migration. Past studies typically rely on changes in the stock of educated individuals living abroad to estimate skilled migration from a country. Such calculations may overstate “brain drain” from a country if many individuals acquire education *after* they migrate. Ozden and Philipps (2015), for example, show that almost half of African-born doctors were trained outside of their birth country. Our administrative data allows us to accurately measure the number of skilled professionals leaving each Philippine province annually.

We calculate province-level migration rates for nurses and the rest of the migrant population using the CFO dataset. To do this, we aggregate departures in each province-year and divide by the working aged (18-60) population in each province. We define nurses as those who have obtained a nursing degree or whose usual work is as a professional nurse. Panel 1 of Table 1 presents summary statistics. The average province-level migration rate is 0.075% while the nurse migration rate is 0.005% of the working aged population.

We obtained administrative data on post-secondary enrollment, graduation, and number of nursing programs from 1990 to 2013 from the Commission on Higher Education (CHED). The data include school-level information on the number of enrollees and graduates in an academic year, as well as numbers disaggregated by program of study. Thus, to complement our data on migration, we have information on all enrollments and graduations in the various disciplines around the country.

We aggregate numbers at the province-level and calculate rates of enrollment and graduation for nurses and other disciplines by dividing by the college-aged population (18-21) in each province. We also calculate the number of nursing programs in each province. Panels B and

C in Table 1 present summary statistics. The average province-level enrollment rate is 21.6%, while the rate of enrollment in nursing programs represent 1.5% of the college-aged population. The average total and nurse graduation rates in an academic year are 3.6% and 0.36% of the province population, respectively.

Finally, in order to measure infant and maternal mortality, we obtained province-year level data on births, infant deaths, and maternal deaths. We calculate the infant and maternal mortality rates by dividing infant deaths and maternal deaths by the number of live births, and multiplying by 1,000. The average infant mortality rate is 15.6 infants per 1,000 live births, while the average maternal mortality rate is approximately 1 death per 1,000 live births.

#### **IV. Empirical Strategy**

To identify the causal effect of nurse migration on human capital accumulation, we exploit the exogenous policy changes that occurred in 2000 and 2007 that expanded and restricted nurse migration to the U.S. respectively. As described earlier, the policy changes were sudden, and severely expanded and then limited the option of many Filipino nurses and their families to migrate to the U.S. Our strategy is based on the idea that provinces that usually have a larger flow of nurse migrants to the U.S. should be disproportionally affected by the rule change compared to provinces that usually have a smaller flow of nurse migrants, after accounting for year- and province-specific fixed differences. This is due to the importance of historical flows and migrant networks as determinants of international migration (Munshi 2003; Theoharides 2018).

We identify a province as a high migration province if it had an above median nurse migration rate to the U.S. in a base year, 1990. Table 2 lists the top 20 provinces using this

measure. Note that the inclusion of several provinces in this list is unsurprising, given the history of Filipino migration to the U.S. Ilocos Sur, Ilocos Norte, La Union, Pangasinan are places where mass emigration of Filipinos to the U.S. first took place as a result of recruitment from Hawaiian sugar plantations in the early 1900s. Zambales, Pampanga, and Tarlac are where the U.S. established military bases at the end of World War II. These places are traditional migrant sending provinces to the U.S.<sup>7</sup>

We estimate an event study model that incorporates both the visa expansion and visa contraction. Formally, we estimate the following equation:

$$Y_{pt} = \sum_{\tau \neq 1999} \beta_{\tau} High_{p,1990} D_t^{\tau} + \alpha_p + \gamma_t + X_{p0}\gamma_t + \varepsilon_{pt} \quad (1)$$

where  $Y_{pt}$  is some measure of nurse migration or education in province  $p$ , year  $t$ .  $High_{p,1990}$  is equal to 1 for provinces with above median nurse migration in 1990.  $D_t^{\tau}$  is a binary variable equal to one if the year of observation  $t$  equals the specific year,  $\tau$ , and zero otherwise. We omit the interaction term in 1999 (the year prior to the visa expansion) in order to identify the model.<sup>8</sup> The  $\beta_{\tau}$  thus capture the precise timing of differential changes in outcomes for high nurse migration provinces relative to the omitted year, 1999. The  $\beta_{\tau}$  after 2000 provide the effect of visa expansion, while the  $\beta_{\tau}$  after 2007 provide the effect of visa restriction. Province fixed effects,  $\alpha_p$ , and year fixed effects,  $\gamma_t$ , account for province-specific and year-specific omitted variables, respectively.  $X_{p0}\gamma_t$  are pre-policy baseline controls for province characteristics that are

---

<sup>7</sup> For a full discussion of the history of these areas with respect to the U.S, see Scalabrini Migration Center (2011).

<sup>8</sup> We choose 1999 as the omitted year since the policy occurs partway through 2000, and thus there may be effects of the policy change beginning in 2000.

interacted with dummy variables for each year.<sup>9</sup> Standard errors are clustered at the province level. 74 provinces are included in the analysis and are defined to use consistent geographic boundaries over time.<sup>10</sup>

We also estimate a pooled event study model that allows for a simpler, aggregated interpretation following the expansion and contraction of visas. Formally, we estimate:

$$\begin{aligned}
 Y_{pt} = & \beta^{postexp} High_{p,1990} 1(t > t_{1999}^*) + \beta^{trendexp} High_{p,1990} 1(t > t_{1999}^*)(t - t_{1999}^*) \\
 & + \beta^{postcon} High_{p,1990} 1(t > t_{2006}^*) + \beta^{trendcon} High_{p,1990} 1(t > t_{2006}^*)(t - t_{2006}^*) \\
 & + \beta^{trend} High_{p,1990} (t - t_{1999}^*) + \alpha_p + \gamma_t + X_{p0}\gamma_t + \varepsilon_{pt}
 \end{aligned}
 \tag{2}$$

where  $t_{1999}^*$  and  $t_{2006}^*$  represent the year immediately prior to the expansion and contraction of visas, respectively. The coefficients  $\beta^{postexp}$  and  $\beta^{postcon}$  represent the immediate change in outcome in high relative to low nurse migration provinces following each policy change.

$\beta^{trendexp}$  and  $\beta^{trendcon}$  capture delayed event effects and can be interpreted as annual changes in outcomes after the policy change in high relative to low nurse migration provinces, compared to before the policy change.  $\beta^{trend}$  estimates the changes in outcome variables in high relative to low nurse migration provinces prior to the policy change in 2000. It provides a falsification exercise, since  $\beta^{trend} \neq 0$  would suggest that there is differential trending in high versus low nurse provinces prior to the policy change. All other variables are defined as in equation 1.

Comparisons of the results from equation 1 and equation 2 suggest that the pooled specification in equation 2 accurately captures the dynamics. The key identifying assumption for

---

<sup>9</sup> These include baseline values for the average female employment rate, the average male employment rate, the average age in the province, and the fraction female.

<sup>10</sup> The four districts of metro Manila are treated as one province.

both models is that, in the absence of policy changes, areas with high nurse migration to the U.S. in the base year should not have experienced different trends in outcomes in 2000 and later compared to low nurse migration provinces. The  $\beta_\tau$  prior to 2000 in equation 1 provide evidence on whether this assumption holds. Prior to 2000, it should be true that high migration provinces were not experiencing differential trends in outcomes relative to low migration areas, for the equation to estimate the causal effect of visa expansion and restriction.  $\beta^{trend}$  provides evidence of this for equation 2.

## V. Results

### *A. Nurse Migration and Education*

To determine the effect of nurse migration on post-secondary schooling outcomes, we exploit two policy changes that first expanded visa availability for nurses to the U.S. and then dramatically restricted these visas. To establish the first stage of the policy, we first estimate the effect of the policies on the migration rate of nurses to the U.S. If there is not an effect on U.S. nurse migration, we would not expect nursing enrollment and graduation to change in response to the policies. Figure 3 presents two different plots of estimates: the solid line represents the  $\beta_\tau$ 's in the flexible event study (equation 1), with 95 percent confidence intervals shown by dotted lines. The dashed line shows the results of the pooled event study (equation 2). The policy changes in 2000 and 2007 are indicated by two vertical light grey lines.

Following the policy change in 2000, nurse migration started to increase in high migration provinces relative to other provinces. Consequently, in 2007, the nurse migration rate suddenly dropped, corresponding to when visas were restricted. These results are consistent with the story that changes in migration policy did affect the provinces specializing in sending

migrant nurses to the U.S.<sup>11</sup> We report the coefficients from the pooled specification in Column 1 of Table 3. In 2000, nurse migration jumped by 0.002 percentage points in high relative to low nurse migration provinces, effectively doubling nurse migration from the pre-policy nurse migration sample mean of 0.002%. Following the initial jump, nurse migration increased by 0.001 percentage points each year in high relative to low nursing provinces until 2007, for a total increase of 0.008 percentage points. In 2007, nurse migration dropped by 0.005 percentage points, and continued to fall slightly in the period after 2007. Appendix Table 1 shows the point estimates for each  $\beta_t$  estimated using Equation 1.

There is a slight downward trend in nurse migration in high relative to low nurse migration provinces prior to the 2000 policy change. The first three years of the pre-period are statistically significantly different from zero in the event study model, but the pre-trend is of the opposite sign relative to the effects following the visa expansion. It is also statistically significant in the simpler version, though the magnitude is quite small and substantially smaller than the point estimates after 2000. The pre-trend also has the opposite sign of the effects after 2000, suggesting that the increased nurse migration in 2000 is not driven by differential trending of high and low nurse migration provinces in the pre-period.

Overall, nurse migration from the Philippines increased in response to U.S. visa expansions. However, as a result of these opportunities abroad, individuals in the Philippines may enrolled in nursing education at a higher rate in the hopes of taking advantage of these high wage opportunities. To examine this, we turn next to the effects on nursing school enrollment. The enrollment rate is an aggregate measure, and includes enrollment in all four years of college. We find that enrollment rates in nursing in high relative to low nurse migration provinces

---

<sup>11</sup> The larger standard errors in the post period are due to a substantial increase in variance in the outcome variables after 2000.



responded positively, and then negatively, following the policy shocks in 2000 and 2007, respectively. In Figure 4a, we present estimates of  $\beta_\tau$  for enrollment in nursing. We cannot reject the null hypothesis that the  $\beta_\tau$  prior to 2000 are equal to zero, implying that high migration provinces were not already experiencing a trend in enrollment. However, estimates of  $\beta_\tau$  start becoming positive in 2000. The effect peaks in 2006 then starts to decrease gradually to zero after, at the onset of visa restrictions in February 2007. The trends estimated in the pooled event study follow the more flexible estimates. Table 3 shows that overall, nursing enrollment increased by 0.7 percentage points per year following the policy change in 2000. This persisted for 7 years, leading to an aggregate increase of 4.9 percentage points. This is about a 734% increase in nursing enrollment, relative to the pre-period enrollment rate of 0.667%, a huge effect, though not surprising given the aggregate enrollment numbers shown in Figure 1. The contraction of visas in 2007 led to an immediate drop in nurse enrollment of 0.996 percentage points. Enrollment continued to decline by 1.15 percentage points per year through 2013, until the increase in enrollment in high relative to low provinces disappeared. Similar to the flexible event study, there is no evidence of a pre-trend.

While enrollment increased dramatically, these students will not contribute to the supply of nurses in the Philippines if they do not persist to graduation. The corresponding event study analysis for graduation rates are presented in Figure 4b and reflect the pattern of effects found for enrollment. We find that there were large increases in nurse graduation after U.S. demand for nurses increased, but that the effect manifests approximately four years after visas were made available, consistent with the time it takes to finish post-secondary school. Nurse graduations decreased after 2007, again with a 4 year lag. Because the graduation data are only available for 1998 onward, we are only able to test for a pre-trend in 1998 and 1999. There is no evidence of

differential trending in high relative to low nurse provinces in the pre-period for either the pooled or flexible event study models.

We next consider if the additional nursing graduates compensate for the nurses that migrate abroad. In the period from 2001 to 2007, the estimated effect on the nurse graduation rate was 0.067 percentage points per year. Given a sample mean of the nursing graduation rate of 0.106 prior to the visa expansion, the visa expansion led to a 63% increase in nurse graduations in each year following the policy change. The average province had 189 nurses per year prior to the expansion, so this leads to an increase of 119.6 new nursing graduates in each year. With an average of 52.6 nursing departures per province per year in 2001 to 2007, this suggests that for each additional nurse that goes abroad, there are 2.27 additional nursing graduates. Thus, despite more nurses going abroad, the expanded opportunities to migrate abroad led to increases in the number of nurses remaining in the Philippines.

While the potential for brain gain has long been touted as a possibility, one concern is that even if individuals aspire to obtain more education due to the increased return to human capital, they may be unable to since the supply of schooling may not respond for such a specialized occupation (Docquier and Marfouk, 2006). Our results indicate that such brain gain effects are indeed possible, and we now document the supply response of nursing programs in the Philippines.

Using the data from CHED, we calculate the number of nursing programs in each province-year, and estimate both models. The number of nursing programs increased dramatically in high relative to low nursing provinces following the 2000 visa expansion. From Figure 5 and Table 3, we can see that the increase occurred gradually, with about a 0.5 program increase per year through 2007, for a 3.5 program increase in total over this period. Given a

sample mean in the pre-period of 2.5 programs, this more than doubled the number of nursing programs in high relative to low nurse migration provinces. The effects appear to be driven by increases in nursing programs in private institutions rather than public (Figure 6). Again, there is not a statistically significant pre-trend in either model.

Thus, it appears that the supply of nursing programs, particularly private programs, was nimble enough to respond to increased demand due to opportunities abroad. As a result, while more nurses depart from the Philippines in response to this policy change, the Philippines ends up with an overall increase in the number of nurses at home, suggesting that in this case, brain gain effects dominate potential brain drain.

#### *B. Other Educational Responses*

A natural question is whether this policy change increased the overall stock of college educated labor in the Philippines by inducing more individuals to attend college, or if it simply altered the choice of degree type for students who would already have enrolled in the absence of the change. To examine this, we look at non-nursing enrollment and graduation (Figure 7 and Table 4). We find suggestive evidence that increases in enrollment in nursing were due to individuals switching from other degree types. While our estimates of  $\beta_\tau$  for other enrollment are not statistically different from zero, the u-shaped nature of our estimates suggests that other enrollment followed an opposite pattern to nurse enrollment. The results for total enrollment further emphasize this, and are generally flat. These results suggest that rather than enrolling new students in nursing education, the increases in nursing enrollment were due to shifts in students entering nursing from other degree types.

We explore the degree type that individuals switch to nursing from following the policy change. We examine four categories, excluding nursing: STEM fields, business, education, and humanities/other. Figures 8 and 9 show the results. While there is suggestive evidence of declines in all four categories, there is a statistically significant decline in STEM enrollment. Turning to the pooled event study estimates, there are statistically significant declines in both STEM and business enrollment. Thus, it appears that individuals are switching from STEM and business majors to nursing in response to the policy change.

In terms of graduation, we do not find a statistically significant effect on graduation in other types of degrees. Given the positive effects on nursing, this suggests that there could be an increase in post-secondary graduation overall in high relative to low nursing provinces. However, while the pooled event study results shown in Table 4 suggest that total graduation may have increased slightly in 2007 as a result of the increases in nurse graduation, the results are not statistically significant. Thus, we can conclude that the visa expansion and contraction did not reduce the number of college graduates in the Philippines, and the overall level of graduates appears overall to have stayed the same.

### *C. Effects on Infant and Maternal Mortality*

One of the major concerns in the debate surrounding the migration of health care workers is that their departure will lead to adverse health outcomes in the country of origin. While in Section V.A we showed that there were approximately two nursing graduates for each additional nurse that went abroad, suggesting that health outcomes should not have declined due to the absence of nurses, we next test this explicitly. To do this, we examine the effects of the two policy changes on infant and maternal mortality.

The results are shown in Figure 10 and Table 5. There is no effect on either infant or maternal mortality using either the flexible event study or the pooled event study. The results do not appear to be driven by pre-trends. It appears that the migration of health care workers did not lead to declines in health in the Philippines, as measured by infant and maternal mortality. Further, despite an increase in the number of nurses in the Philippines, there was also not an improvement in these health outcomes. We hypothesize that this is because these new nurses were not necessarily located in the communities that most needed them, however understanding why increases in the number of nurses through brain gain did not lead to improved health outcomes should be the subject of future research.

#### *D. Robustness Checks*

We conduct a number of robustness checks on each of our main outcome variables in Table 6. Column 2 replaces baseline controls times year dummies with province-specific linear time trends. The inclusion of province-specific linear time trends removes concerns that differences in provinces at baseline could lead to differential trending in variables related to the outcome variable. A similar pattern emerges as in the main results: the visa expansion increased US nurse migration, nursing enrollment and graduation, and number of nursing programs. While there is now a statistically significant pre-trend for some of these outcomes, it has the opposite sign and is much smaller in magnitude than Post 2000 x Trend, suggesting that it would bias us against finding these results.

In Column 3, we show that the results are robust to the inclusion of population weights, though they are less precisely estimated. The results on the number of nursing programs goes

away. This suggests that the results for nursing programs are driven by smaller provinces increasing the supply of schooling, rather than more urban areas like Manila or Cebu.

In Column 4, we exclude Metro Manila, the capital province, to ensure that such a large province is not driving the results. A similar pattern as in Column 1 emerges. Finally, in Columns 5 and 6, we include no controls (Column 5) and the controls interacted with a linear trend rather than year dummies (Column 6). The results are quite robust, though there is now a statistically significant pre-trend on enrollment and graduation. The pre-trend is much smaller than the main estimates in magnitude and also of the opposite sign, suggesting that this is not biasing our results.

Our empirical strategy essentially designates provinces with high baseline nursing migration rates as the treatment group and provinces with low baseline nursing migration rates as the control group. Another concern is that provinces with low nurse migration at baseline may have high rates of other types of migration. If a policy change occurred in either 2000 or 2007 that altered demand for these other types of migrants, this could lead to bias in our estimates. For instance, suppose that in 2000, demand for engineers increased and engineers typically migrate from low nursing migration provinces. As a result of this expansion in demand for engineers, other post-secondary enrollment may increase in response. Thus, any changes in other post-secondary enrollment in high nursing provinces could simply be a result of comparing this to a control group where other enrollment was increasing.

To test this, we plot a scatterplot of the migration rate excluding US nurse migration at baseline versus US nurse migration at baseline in Figure 11. The aforementioned concern would be a problem if high nursing migration provinces had low other migration, and low nursing migration provinces had high other migration. Figure 11 shows that this is not the case.

Provinces that sent a large number of nurses at baseline also sent larger shares of other migrants. The correlation between these two migration rates is 0.84 (p-value 0.00). Thus, the negative effect on other enrollment does not appear to be driven by contamination of the control group. We create a similar figure for nurse migrants to the second largest destination, Canada. There is again a positive correlation between the baseline migration rates (0.62, p-value=0.00), suggesting that shocks to migration in Canada do not appear to lead to bias.

## **VI. Conclusion**

The migration of skilled professionals, particularly of healthcare workers, is often cited as a key concern for many developing countries due to its potential to deplete the number of skilled workers from the local economy. In contrast, the demand for these skilled migrants may lead to human capital formation by increasing the returns to education. We estimate the causal effect of skilled migration on educational investment in the country of origin by exploiting the aggressive nurse recruitment policies and subsequent visa restrictions employed by the United States in the 2000s. We show that enrollment in nursing programs in the Philippines accommodated the large and sudden demand for nurses from the U.S. The increase in nursing enrollment and graduation during the period was much larger than the increase in nurse migration, and for each additional nurse that went abroad, two more individuals graduated from nursing school.

Our results suggest that demand for healthcare professionals did not deplete the stock of healthcare workers in the Philippines. As a caveat, the effects we find may not necessarily apply in other contexts and settings. The Philippines is somewhat unique because of its history as a migrant-sending country to the U.S. Nevertheless, we show that common assumptions about skilled migration need not apply in a setting where there is a huge volume of departures and

people largely expect a “drain.” The supply of nurses responded and accommodated demand from abroad. Part of the reason many individuals were able to obtain nursing education during the period was because schools were rapidly able to accommodate increased demand from students to become nurses.

Our results provide support for well-designed partnerships regarding healthcare workers between receiving and sending countries. The cost of training nurses in migrant-sending countries is often a small fraction of the cost of training nurses at receiving countries, whereas nursing services are worth much more in receiving countries, at least in terms of pay (Clemens 2015). Further, Cortes and Pan (2015) document that foreign educated nurses, particularly Filipino nurses, in the United States have higher levels of skill than their native counterparts. A well-designed partnership can, at least in principle, present a win-win situation by allowing receiving countries to subsidize training for workers in sending countries while facilitating the migration of skilled workers.



## References

- Aiken, Linda. 2007. "US Nurse Labor Market Dynamics are Key to Global Nurse Sufficiency." *Health Services Research*, 42(3): 1299-1320.
- Asia Times. 2003. "Nurse Exodus Plagues Philippines." May 17, 2003 [Available at: [http://www.atimes.com/atimes/Southeast\\_Asia/EE17Ae04.html](http://www.atimes.com/atimes/Southeast_Asia/EE17Ae04.html), Accessed March 12, 2016].
- Batista, Catia, Aitor Lacuesta, and Pedro C. Vicente. 2012. "Testing the 'Brain Gain' Hypothesis: Micro Evidence from Cape Verde." *Journal of Development Economics*, 97(1): 32-45.
- Beine, Michel, Frederic Docquier, and Hillel Rapoport. 2001. "Brain Drain and Economic Growth: Theory and Evidence." *Journal of Development Economics*, 64(1): 275-289.
- Bhagwati, Jagdish, and Koichi Hamada. 1974. "The Brain Drain, International Integration of Markets for Professionals and Unemployment: a Theoretical Analysis," *Journal of Development Economics*, 1: 19-42.
- Bureau of Labor and Employment Statistics, Republic of the Philippines. 2006. *2006 Yearbook of Labor Statistics* Manila, Philippines.
- Chand, Satish, and Michael Clemens. 2008. "Skilled Emigration and Skill Creation: A quasi-experiment." Center for Global Development Working Paper 152.
- Clemens, Michael. 2013. "What do we Know About Skilled Migration and Development?" Policy Brief.
- Clemens, Michael. 2015. "Global Skill Partnerships: A Proposal for Technical Training in a Mobile World." *IZA Journal of Labor Policy*, 4(1): 1-18.
- Cortes, Patricia, and Jessica Pan. 2015. "The Relative Quality of Foreign Nurses in the U.S." *Journal of Human Resources*, 37: C164-180.
- Department of Homeland Security (DHS). 2008. "Improving the Processing of "Schedule A" Nurse Visas", U.S. Department of Homeland Security, [https://www.dhs.gov/xlibrary/assets/cisomb\\_recommendation\\_36.pdf](https://www.dhs.gov/xlibrary/assets/cisomb_recommendation_36.pdf) (Accessed October 12, 2017)
- Dinkelman, Taryn and Martine Mariotti. 2016. "The Long Run Effect of Labor Migration on Human Capital Formation in Communities of Origin," *American Economic Journal: Applied Economics*, 8(4): 1-35.
- Docquier, Frederic, and Abdeslam Marfouk. 2006. "International Migration by Educational Attainment (1990-2000)—Release 1.1" in *International Migration, Remittances and Development*, ed. Caglar Özden and Maurice Schiff. Palgrave Macmillan: New York.

Engman, Michael. 2010. "A Tale of Three Markets: How Government Policy Creates Winners and Losers in the Philippine Health Sector." Working Paper.

Gruber, Herbert and Anthony Scott. 1966. "The International Flow of Human Capital." *The American Economic Review*, 56: 268–274.

Jasso, Guillermina, Vivek Wadhwa, Gary Gereffi, Ben Rissing, and Richard Freeman. 2010. *International Migration Review*, 44(2): 477–498.

Mountford, Andrew. 1997. "Can a Brain Drain be Good for Growth in the Source Economy?" *Journal of Development Economics*, 53: 287–303.

Munshi, Kaivan. 2003. "Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market." *Quarterly Journal of Economics*, 118(2): 549–599.

Organization for Economic Cooperation and Development (OECD). 2007. "Immigrant Health Workers in OECD Countries in the Broader Context of Highly Skilled Migration." *International Migration Outlook*, SOPEMI 2007 Edition. OECD Publishing: Paris.

Özden, Caglar, and David Phillips. 2015. "What really is Brain Drain? Location of Birth, Education, and Migration Dynamics of African Doctors." KNOMAD Working Paper 4.

Scalabrini Migration Center. 2011. *Minding the Gaps: Migration, Development and Governance in the Philippines*. Manila, Philippines.

Shrestha, Slesh A. 2016. "No Man Left Behind: Effects of Emigration Prospects on Educational and Labor Outcomes of Non-migrants." *Economic Journal*.

Stark, Oded, Christian Helmenstein, and Alexia Prskawetz. 1997. "A Brain Gain with a Brain Drain," *Economic Letters*, 55: 227–234.

Theoharides, Caroline. 2016. "Manila to Malaysia, Quezon to Qatar: International Migration and the Effects on Origin-Country Human Capital." *Journal of Human Resources*, forthcoming.

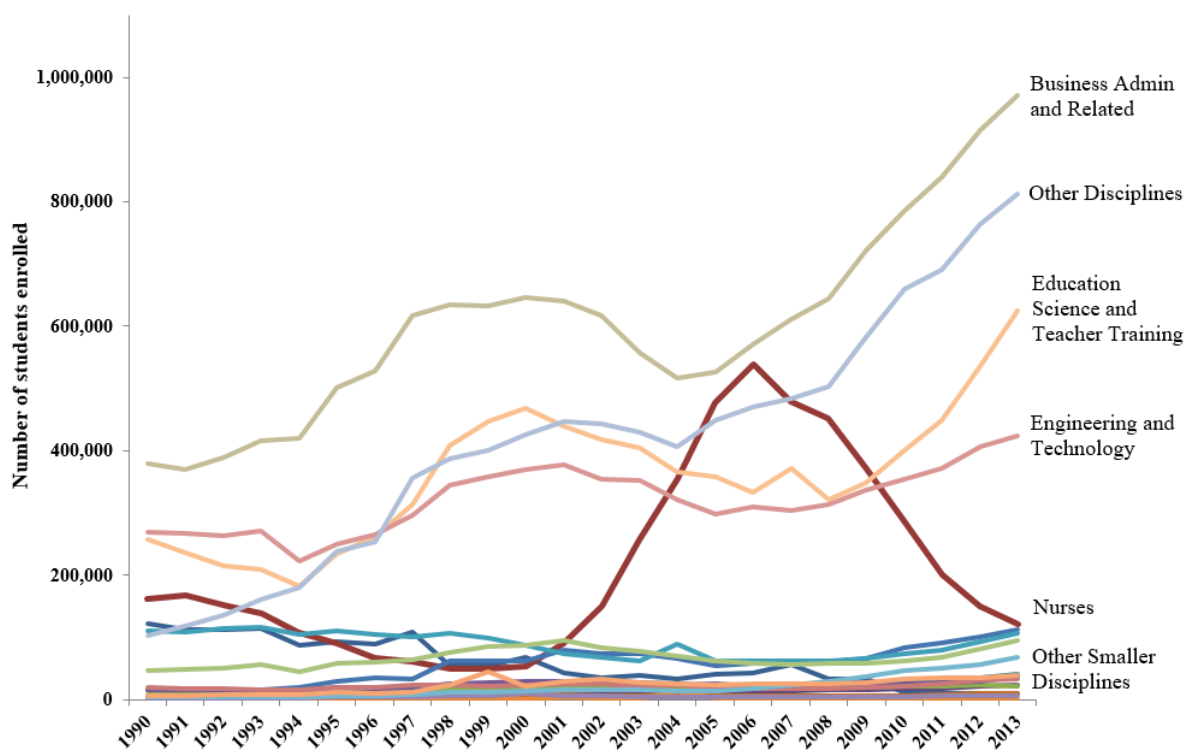
United States Citizenship and Immigration Services (USCIS) Ombudsman. 2007. *Annual Report to Congress June 2007*.

U.S. Bureau of Labor Statistics. "Occupational Employment Statistics" <https://www.bls.gov/oes/data.htm> (Accessed on October 12, 2017)

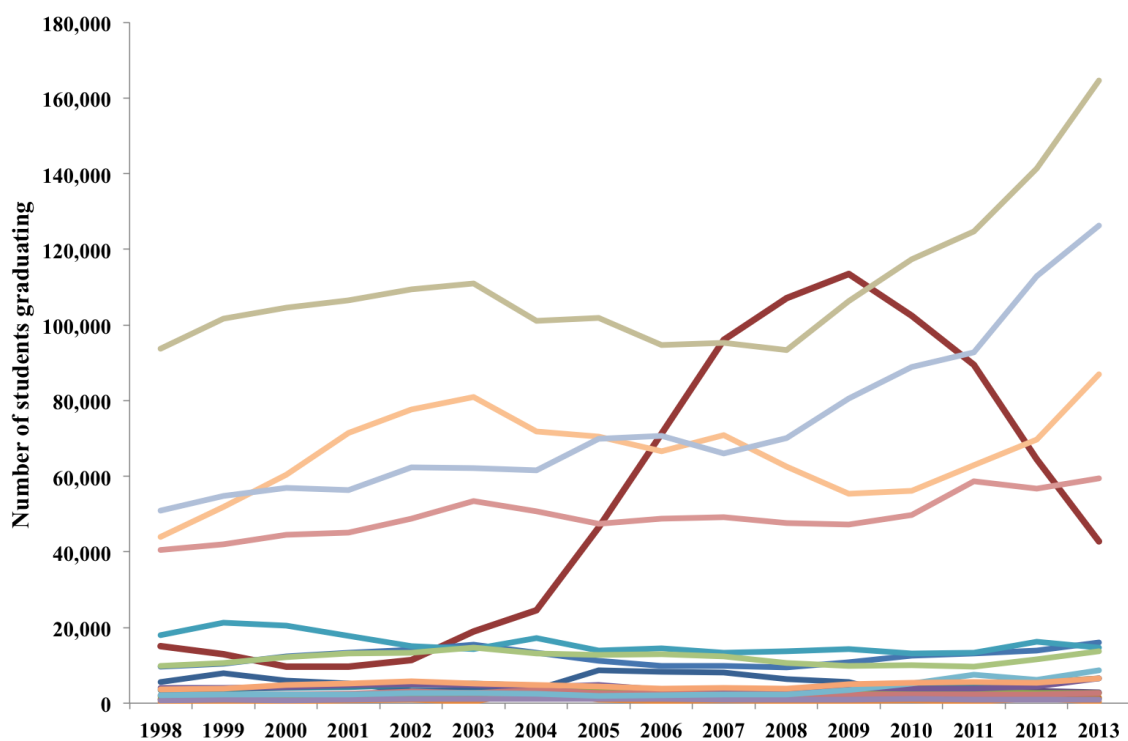
Van Eyck, Kim. 2004. "Women and International Migration in the Health Sector." Final Report of Public Services International's Participatory Action Research 2003.

Figure 1: Enrollment and Graduation in Post-Secondary Education by Discipline (1990-2013)

(a) Enrollment

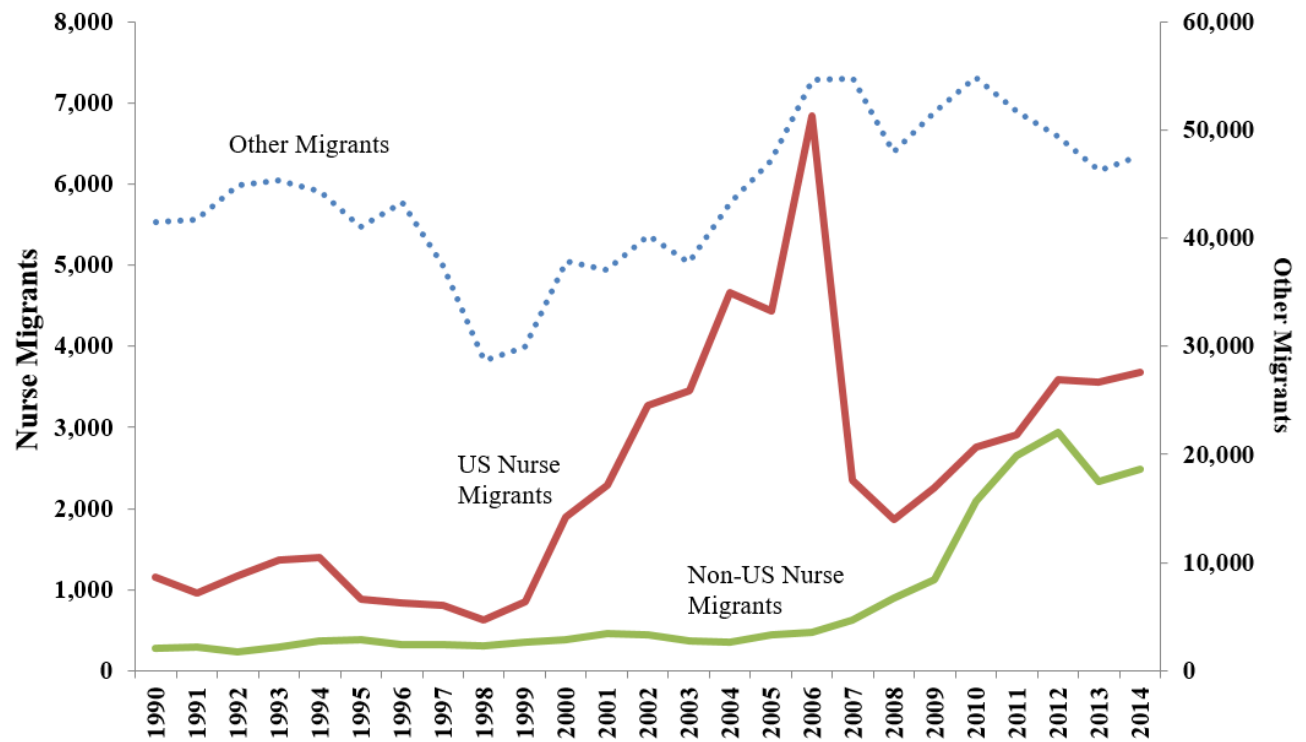


(b) Graduation



Notes: Enrollment includes aggregate enrollment across all four years of post-secondary education. Source: CHED and authors' calculations.

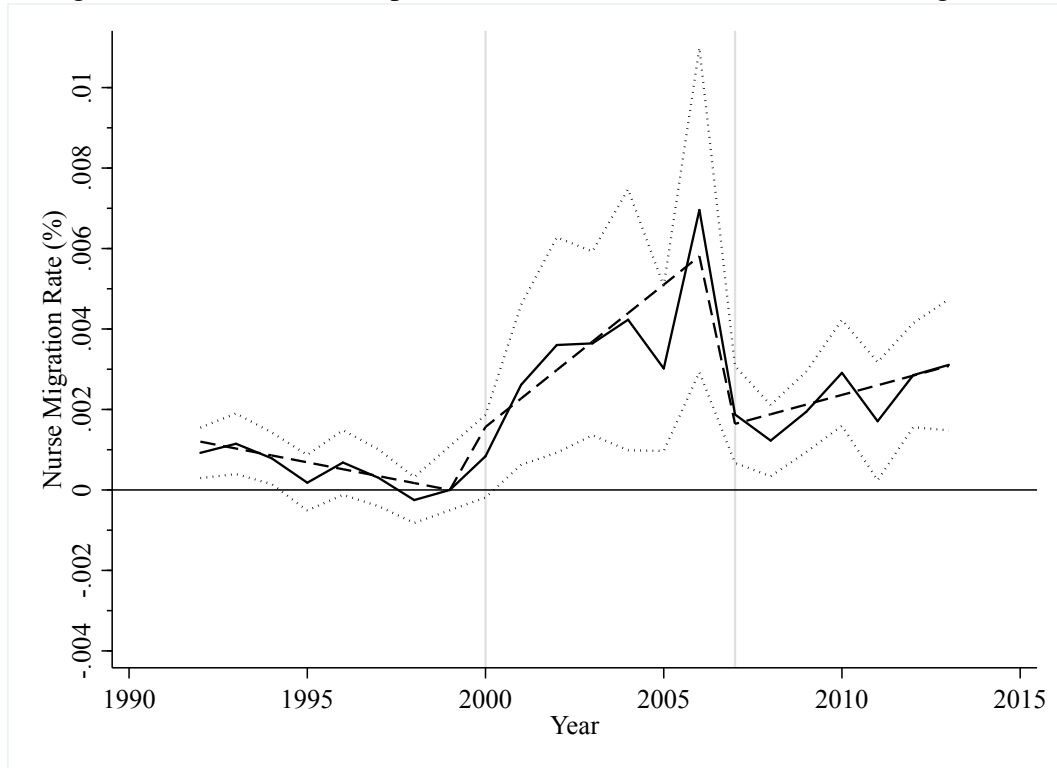
Figure 2: Number of Departures of Nurse and Other Migrants (1990-2014)



Notes: The red and green lines show the total for nurse migrants to U.S. and non-U.S. countries (left vertical axis) while the blue dotted line shows the total for other migrants (right vertical axis).

Source: CFO and authors' calculations.

Figure 3: Effect of Visa Expansion and Contraction on U.S. Nurse Migration



Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators. Province-level baseline controls include: male employment rate (aged 25-64), female employment rate (aged 25-64), share female, and average age in the province. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007.

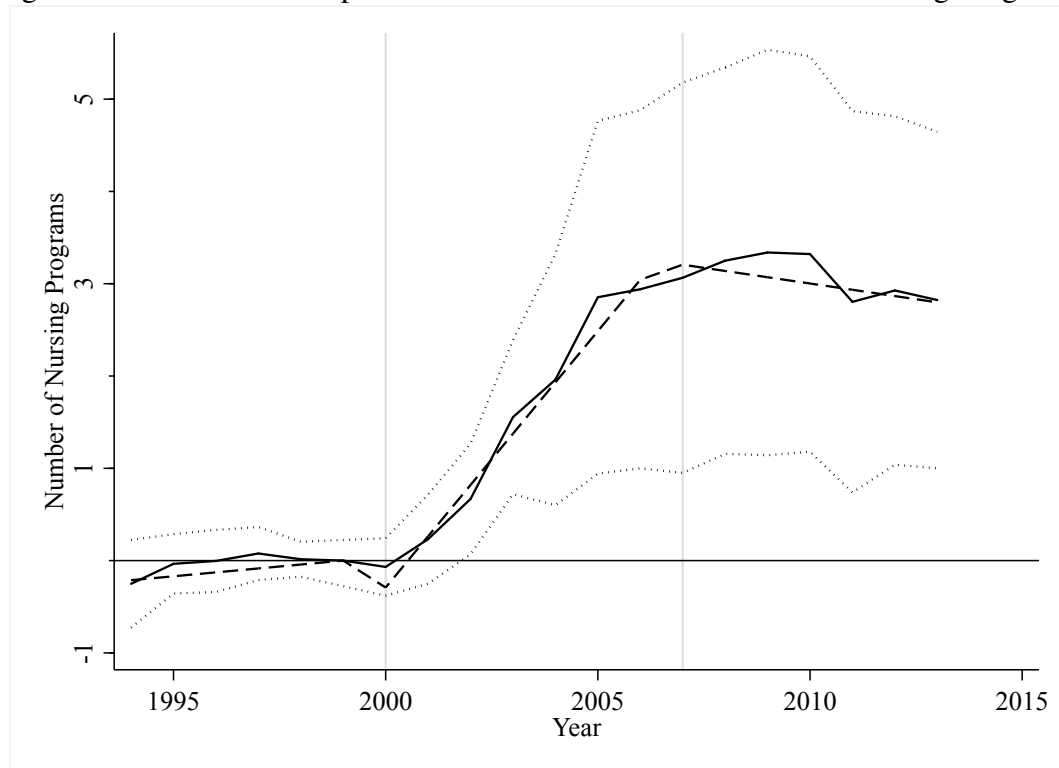
Source: CHED, CFO and authors' calculations.

Figure 4: Effect of Visa Expansion and Contraction on Post-Secondary Nursing Enrollment and Graduation Rates



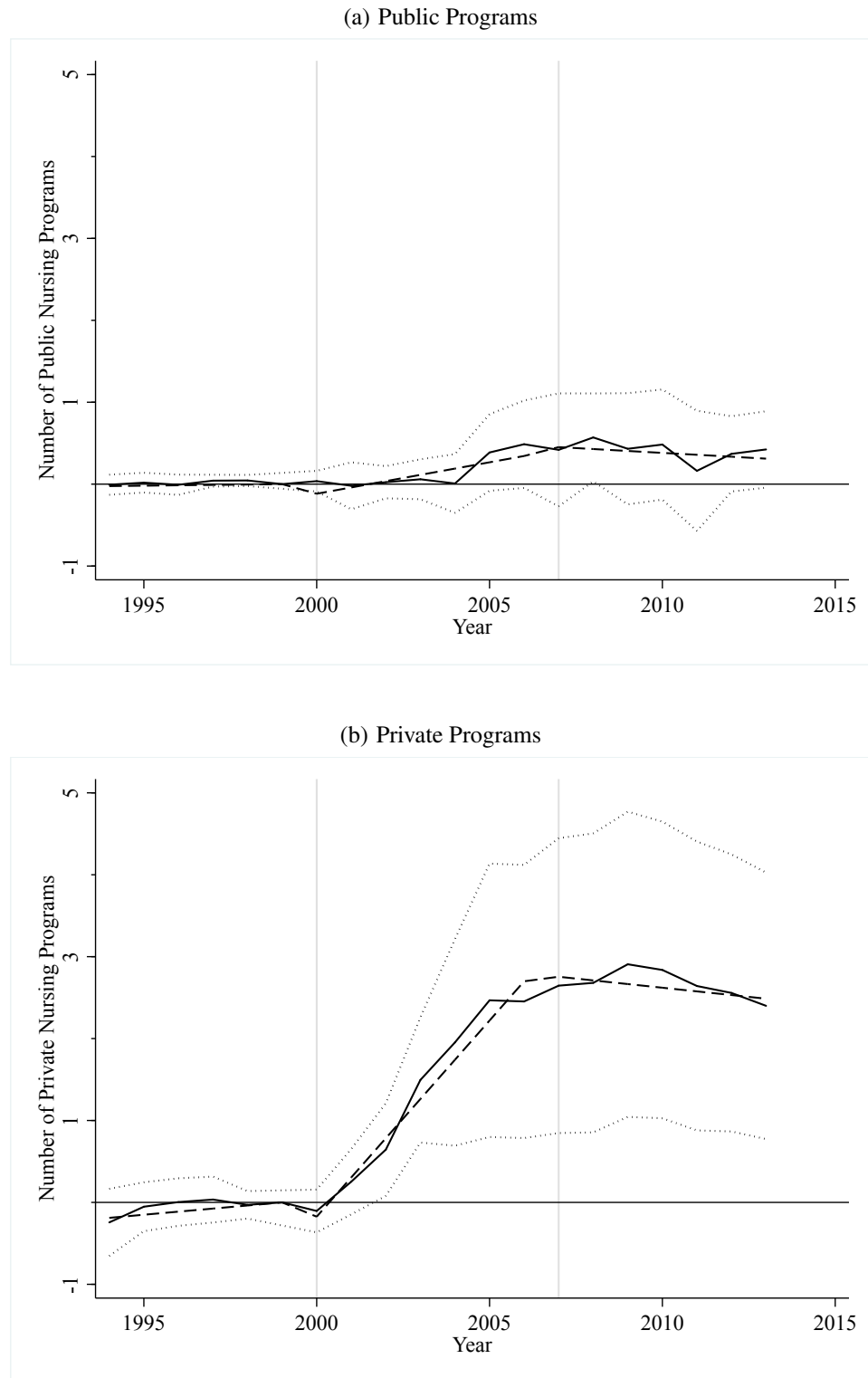
Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007. Source: CHED, CFO, Census, and authors' calculations.

Figure 5: Effect of Visa Expansion and Contraction on Number of Nursing Programs



Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators. Province-level baseline controls include: male employment rate (aged 25-64), female employment rate (aged 25-64), share female, and average age in the province. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007. Source: CHED, CFO and authors' calculations.

Figure 6: Effect of Visa Expansion and Contraction on Number of Nurse Programs: Public Versus Private



Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007.

Source: CHED, CFO and authors' calculations.

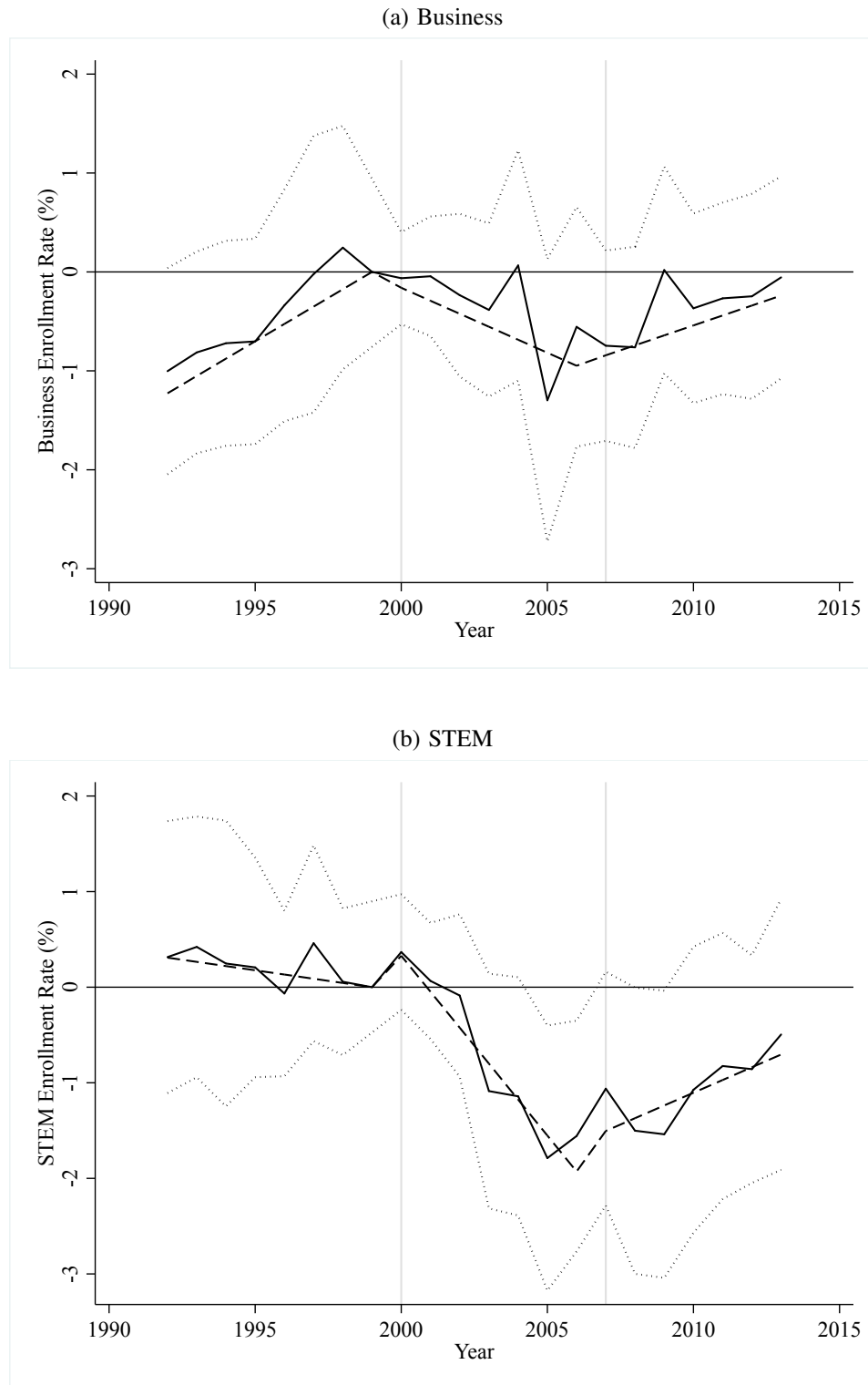


Figure 7: Effect of Visa Expansion and Contraction on Other Post-Secondary Enrollment and Graduation Rates



Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007. Source: CHED, CFO and authors' calculations.

Figure 8: Effect of Visa Expansion and Contraction By Discipline



Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines.

Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007.

Source: CHED, CFO and authors' calculations.

Figure 9: Effect of Visa Expansion and Contraction By Discipline

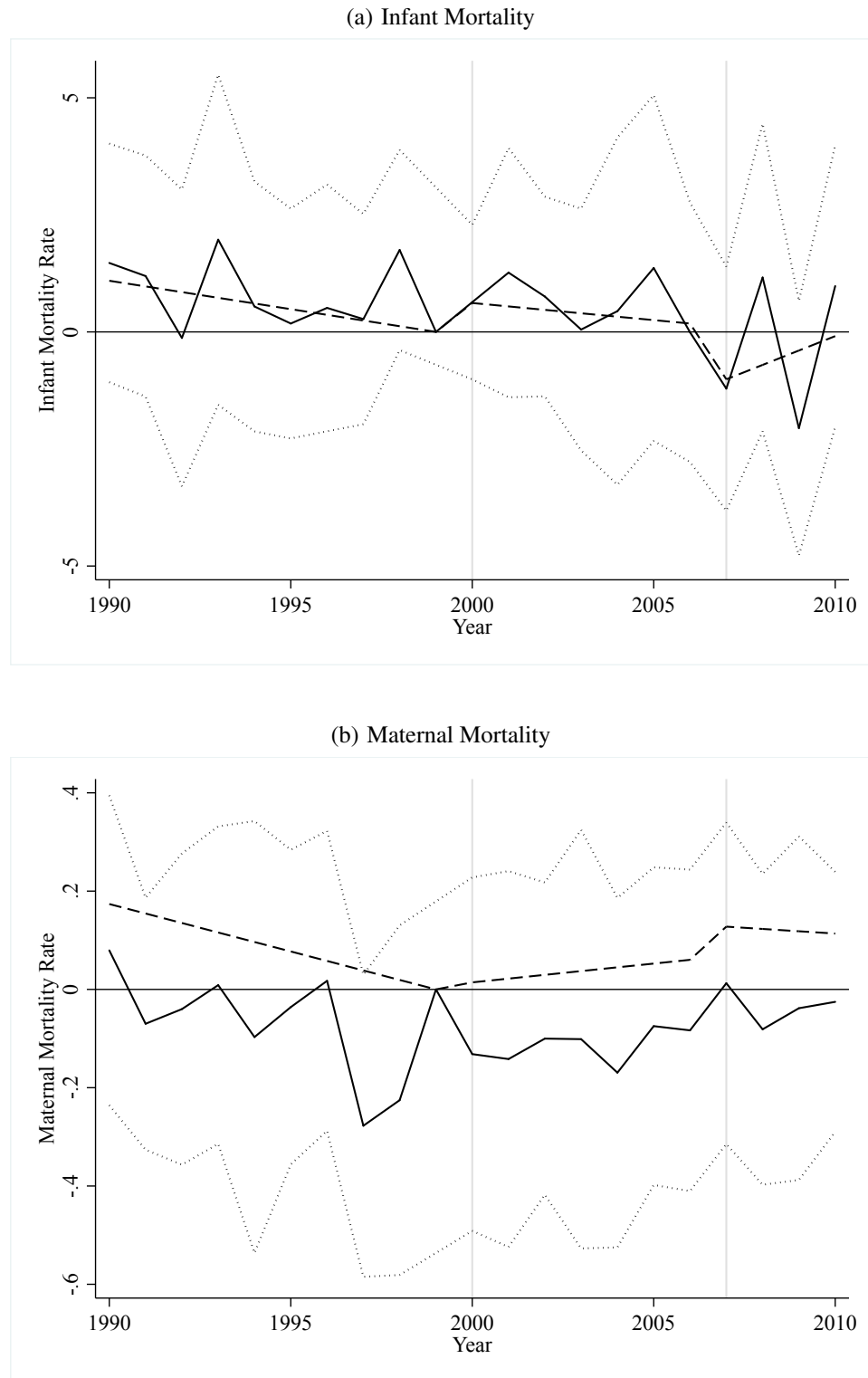


Notes: The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines.

Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007.

Source: CHED, CFO and authors' calculations.

Figure 10: Effect of Visa Expansion and Contraction On Infant and Maternal Mortality

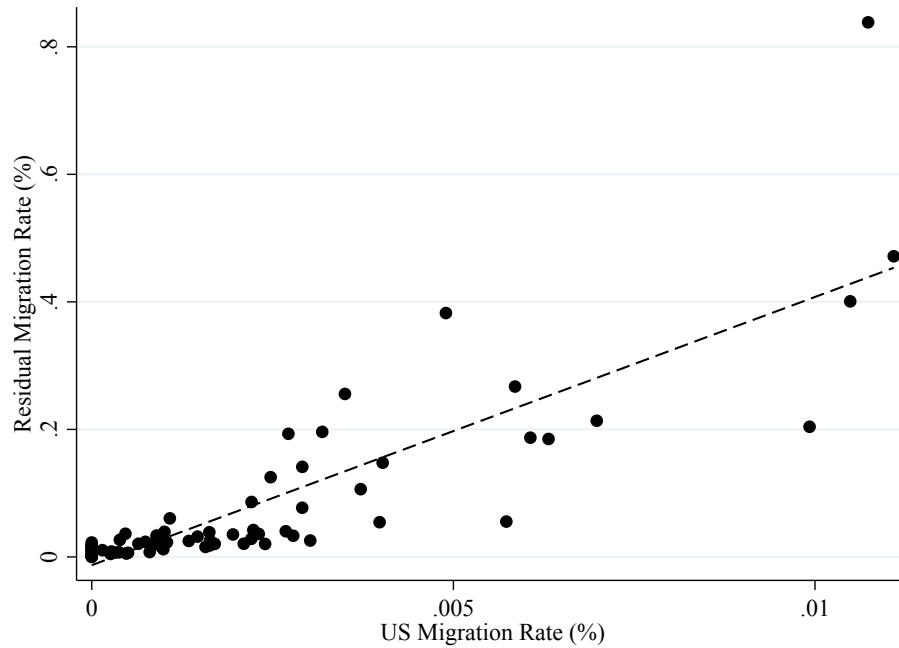


Notes: Infant and maternal mortality are measured as the number of deaths per thousand live births. The graph shows coefficients from event study regressions. The solid line shows coefficients from the event study model (equation 1). The interaction with the dummy variable for the year 1999 is omitted to identify the model. 95% confidence intervals are shown by dotted lines. Dashed lines show the pooled model (equation 2). All specifications include province and year fixed effects, and baseline controls interacted with year indicators as listed in Figure 4. The estimation sample includes 74 provinces. Standard errors are clustered by province. The light grey lines represent visa expansion from AC21 in 2000 and the restriction on nursing visas in 2007.

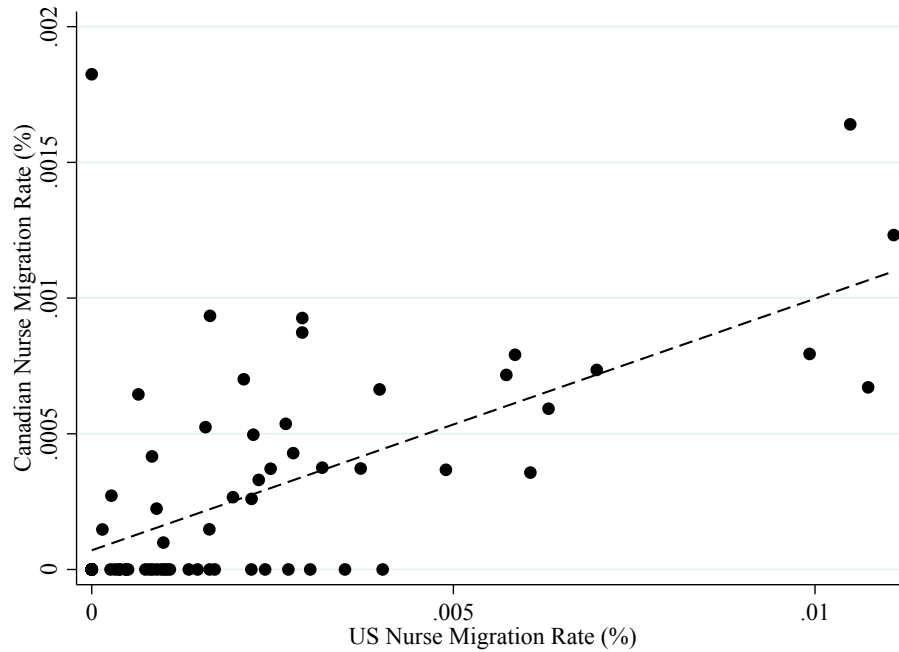
Source: CHED, CFO and authors' calculations.

Figure 11: Identification Check

(a) Province-Level Baseline U.S. Nurse Migration Rate and Other Migration Rate



(b) Province-Level Baseline U.S. and Canadian Nurse Migration Rates



Notes: Figure a plots the U.S. nurse migration rate on the left Y-axis and the residual migration rate on the right Y-axis. The residual migration rate is defined as the migration rate of all migrants except for nurses that migrate to the U.S. Figure b plots the U.S. nurse migration rate and the Canadian nurse migration rate. The dotted lines represent best fit lines. The base year is 1990.  
Source: CFO and authors' calculations.

Table 1. Summary Statistics

	Mean	Std. Dev.	Min	Max
<i>Panel A. Migration Rate (%)</i>				
Total Migration Rate	0.0750	0.0922	0.0000	1.2277
Nurse Migration Rate	0.0053	0.0069	0.0000	0.0672
Other Migration Rate	0.0698	0.0877	0.0000	1.2200
<i>Panel B. Post-Secondary Enrollment Rates (%)</i>				
Total Enrollment	21.6054	12.5959	0.0000	103.5853
Total Nurse	1.5355	2.6986	0.0000	36.6294
Female Nurse	1.1397	1.9077	0.0000	25.1639
Male Nurse	0.4480	0.8506	0.0000	11.4655
Total Other	20.0699	11.1472	0.0000	93.2836
Female Other	11.1024	5.8840	0.0834	52.9972
Male Other	9.0248	5.3709	0.0070	40.2864
<i>Panel C. Post-Secondary Graduation Rates (%)</i>				
Total	3.6331	2.2834	0.0000	33.1846
Total Nurse	0.3302	0.5459	0.0000	5.5975
Female Nurse	0.2597	0.4046	0.0000	3.9064
Male Nurse	0.1028	0.1842	0.0000	1.7917
Total Other	3.3029	2.0335	0.0000	33.1846
Female Other	1.9993	1.1990	0.0000	21.5797
Male Other	1.4769	0.9089	0.0000	11.6049
<i>Panel D. Number of Nursing Programs</i>				
Total	4.7041	9.3883	0.0000	101.0000
Public	4.0081	8.5594	0.0000	93.0000
Private	0.6959	1.2021	0.0000	9.0000
<i>Panel E. Infant and Maternal Mortality Rates (per 1,000 live births)</i>				
Infant Mortality Rate	15.157	7.502	0.904	70.793
Maternal Mortality Rate	1.138	0.722	0.060	8.859

*Notes:* The sample period is from 1992 to 2013. The unit of observation is the province-year. Data from 74 Philippine provinces are used based on 1990 geographic boundaries. Values are expressed as percentages. Enrollment and graduation rates are calculated using the population 18-21 as the denominator, while the migration rate uses the working aged population (18-60) as the denominator. N=1,628 Results by gender omit the year 1997 since data by gender were not collected during that year. Graduation rates are only available from 1998-2013. Number of programs is available in 1994-2013. Mortality data are from 1990-2010.

*Source:* CHED, CFO, and authors' calculations.

**Table 2. List of Top 20 Nurse Migration Provinces to the USA**

		Nurse Migration Rate to the U.S. in 1990 (% of province population aged 18-60)
1.	Ilocos Norte	0.01109
2.	Zambales	0.01073
3.	Metro Manila	0.01049
4.	Benguet	0.00815
5.	Ilocos Sur	0.00698
6.	Pangasinan	0.00632
7.	La Union	0.00607
8.	Cavite	0.00585
9.	Iloilo	0.00573
10.	Pampanga	0.00490
11.	Tarlac	0.00402
12.	Nueva Vizcaya	0.00398
13.	Cebu	0.00372
14.	Bataan	0.00350
15.	Rizal	0.00319
16.	Aurora	0.00302
17.	Laguna	0.00291
18.	Nueva Ecija	0.00291
19.	Bohol	0.00279
20.	Aklan	0.00268

*Source:* CFO and authors' calculations.

Table 3. Pooled Event Study Estimates of Effects of Demand for Nurse Migrants on Nursing Education Outcomes

	US Nurse Migration			Number of Nurse	Number of Private	Number of Public
	Rate	Nurse Enrollment Rate	Nurse Graduation Rate	Programs	Nursing Programs	Nursing Programs
	(1)	(2)	(3)	(4)	(5)	(6)
Post 2000 x High	0.0017** (0.0009)	0.036 (0.104)	-0.055 (0.036)	-0.334 (0.261)	-0.212 (0.228)	-0.122 (0.098)
Post 2000 x Trend	0.0009*** (0.0003)	0.700** (0.269)	0.067* (0.037)	0.513*** (0.173)	0.441*** (0.155)	0.072 (0.045)
Post 2007 x High	-0.0049*** (0.0018)	-0.996* (0.565)	0.497*** (0.127)	-0.392 (0.238)	-0.424** (0.207)	0.031 (0.134)
Post 2007 x Trend	-0.0005** (0.0002)	-1.153*** (0.397)	-0.145*** (0.051)	-0.624*** (0.228)	-0.524*** (0.194)	-0.100 (0.063)
Trend	-0.0002*** (0.0000)	-0.089 (0.058)	-0.014 (0.019)	0.043 (0.043)	0.038 (0.036)	0.005 (0.013)
N	1628	1596	1169	1480	1480	1480
R2	0.811	0.761	0.753	0.911	0.912	0.717
Mean Dependent Variable	0.002	0.667	0.106	2.588	2.313	0.275

*Notes:* Table reports estimates of the pooled event study model (equation 2). The sample period is from 1992-2013 in Columns 1 and 2, 1998-2013 in Column 2, and 1994-2013 in Columns 4-6. Province and year fixed effects, as well as baseline controls interacted with year dummies as outlined in Figure 3, are included in all specifications unless otherwise indicated. Robust standard errors are clustered at the province level. Post 2000 is a dummy variable equal to 1 in the year 2000 and after and 0 otherwise. Post 2007 is a dummy variable equal to 1 in the year 2007 and after and 0 otherwise. High is an indicator variable for a high nurse migration province to the U.S. in the base year 1990. \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, Census, and authors' calculations.



Table 4. Pooled Event Study Estimates of Effects of Demand for Nurse Migrants on Other Education Outcomes

*Panel A. Enrollment Rate Outcomes*

	Non-Nurse (1)	Total (Non-Nurse plus Nurse) (2)	Education (3)	STEM (4)	Business (5)	Humanities and Other (6)
Post 2000 x High	-0.047 (0.898)	-0.011 (0.886)	-0.076 (0.652)	0.373 (0.495)	-0.335 (0.305)	-0.008 (0.328)
Post 2000 x High x Trend	-0.513 (0.460)	0.187 (0.288)	0.268 (0.174)	-0.332* (0.192)	-0.307** (0.151)	-0.143 (0.137)
Post 2007 x High	1.556* (0.877)	0.560 (0.810)	0.494 (0.508)	0.801* (0.404)	0.237 (0.302)	0.024 (0.325)
Post 2007 x High x Trend	0.754* (0.407)	-0.399 (0.246)	-0.221 (0.161)	0.509*** (0.161)	0.232 (0.141)	0.234* (0.125)
Trend x High	-0.095 (0.233)	-0.184 (0.229)	-0.217** (0.108)	-0.044 (0.126)	0.175** (0.084)	-0.009 (0.073)
N	1596	1596	1596	1596	1596	1596
R2	0.912	0.935	0.768	0.877	0.881	0.802
Mean Dependent Variable	17.157	17.824	4.119	4.298	5.168	3.572

*Panel B. Graduation Rate Outcomes*

	Non-Nurse (1)	Total (Non-Nurse plus Nurse) (2)	Education (3)	STEM (4)	Business (5)	Humanities and Other (6)
Post 2000 x High	0.230 (0.324)	0.174 (0.323)	0.142 (0.113)	0.314** (0.125)	0.252** (0.113)	0.029 (0.096)
Post 2000 x High x Trend	-0.206 (0.201)	-0.139 (0.209)	0.080* (0.042)	0.042 (0.060)	0.021 (0.048)	0.038 (0.035)
Post 2007 x High	-0.180 (0.197)	0.317 (0.226)	0.045 (0.066)	-0.065 (0.094)	-0.070 (0.067)	-0.084 (0.085)
Post 2007 x High x Trend	0.011 (0.107)	-0.134 (0.095)	0.008 (0.032)	0.016 (0.039)	-0.025 (0.054)	0.013 (0.033)
Trend x High	0.183 (0.190)	0.169 (0.199)	-0.080*** (0.030)	-0.061 (0.047)	-0.022 (0.028)	-0.041 (0.026)
N	1169	1169	1388	1388	1388	1388
R2	0.804	0.845	0.700	0.745	0.764	0.542
Mean Dependent Variable	3.122	3.229	0.572	0.664	0.878	0.568

*Notes:* Table reports estimates of the pooled event study model (equation 2). The sample period is from 1992-2013 in Panel A and 1998-2013 in Panel B. Province and year fixed effects, as well as baseline controls interacted with year dummies as outlined in Figure 3, are included in all specifications unless otherwise indicated. Robust standard errors are clustered at the province level. Post 2000 is a dummy variable equal to 1 in the year 2000 and after and 0 otherwise. Post 2007 is a dummy variable equal to 1 in the year 2007 and after and 0 otherwise. High is an indicator variable for a high nurse migration province to the U.S. in the base year 1990. \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, Census, and authors' calculations.

Table 5. Pooled Event Study Estimates of Effects of Demand for Nurse Migrants on Health Outcomes

	Infant Mortality Rate	Maternal Mortality Rate
	(1)	(2)
Post 2000 x High	0.7385 (0.6449)	0.0336 (0.1284)
Post 2000 x High x Trend	0.0483 (0.2068)	0.0270 (0.0315)
Post 2007 x High	-1.1178 (1.5302)	0.0598 (0.1600)
Post 2007 x High x Trend	0.3803 (0.4561)	-0.0124 (0.0490)
Trend x High	-0.1214 (0.1267)	-0.0193 (0.0133)
N	1547	1487
R2	0.831	0.698
Mean Dependent Variable	15.157	1.138

*Notes:* Table reports estimates of the pooled event study model (equation 2). The sample period is from 1990-2010. Province and year fixed effects, as well as baseline controls interacted with year dummies as outlined in Figure 3, are included in all specifications unless otherwise indicated. Robust standard errors are clustered at the province level. Post 2000 is a dummy variable equal to 1 in the year 2000 and after and 0 otherwise. Post 2007 is a dummy variable equal to 1 in the year 2007 and after and 0 otherwise. High is an indicator variable for a high nurse migration province to the U.S. in the base year 1990. \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, PSA, Census, and authors' calculations.

Table 6. Robustness Checks for Pooled Event Study Results

*Panel A. US Nurse Migration*

	Main specification	Province- Specific Linear Time Trends	Population Weights	Without Manila	No Controls	Controls x Trend
	(1)	(2)	(3)	(4)	(5)	(6)
Post 2000 x High	0.0017** (0.0009)	0.0023*** (0.0007)	0.0010 (0.0006)	0.0017** (0.0009)	0.0023*** (0.0007)	0.0023*** (0.0007)
Post 2000 x High x Trend	0.0009*** (0.0003)	0.0011*** (0.0002)	0.0004* (0.0002)	0.0009*** (0.0003)	0.0011*** (0.0002)	0.0011*** (0.0002)
Post 2007 x High	-0.0049*** (0.0018)	-0.0060*** (0.0016)	-0.0020 (0.0018)	-0.0049*** (0.0018)	-0.0060*** (0.0016)	-0.0060*** (0.0016)
Post 2007 x High x Trend	-0.0005** (0.0002)	-0.0005*** (0.0002)	-0.0001 (0.0002)	-0.0005** (0.0002)	-0.0005*** (0.0002)	-0.0005*** (0.0002)
Trend x High	-0.0002*** (0.0000)	-0.0002*** (0.0001)	-0.0001** (0.0000)	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0003*** (0.0001)

*Panel B. Nurse Enrollment Rate*

Post 2000 x High	0.036 (0.104)	0.079 (0.085)	0.018 (0.136)	0.036 (0.104)	0.092 (0.084)	0.091 (0.085)
Post 2000 x High x Trend	0.700** (0.269)	0.746*** (0.212)	0.417* (0.215)	0.698** (0.270)	0.746*** (0.207)	0.745*** (0.207)
Post 2007 x High	-0.996* (0.565)	-0.865* (0.457)	-0.341 (0.453)	-0.990* (0.569)	-0.865* (0.447)	-0.867* (0.448)
Post 2007 x High x Trend	-1.153*** (0.397)	-1.175*** (0.315)	-0.755** (0.303)	-1.152*** (0.399)	-1.173*** (0.308)	-1.173*** (0.308)
Trend x High	-0.089 (0.058)	-0.090 (0.056)	-0.051 (0.062)	-0.088 (0.059)	-0.129*** (0.043)	-0.126*** (0.043)

*Panel C. Nurse Graduation Rate*

Post 2000 x High	-0.055 (0.036)	-0.072** (0.031)	-0.048 (0.045)	-0.055 (0.036)	-0.073** (0.030)	-0.075** (0.030)
Post 2000 x High x Trend	0.067* (0.037)	0.087*** (0.029)	0.020 (0.037)	0.067* (0.037)	0.087*** (0.028)	0.088*** (0.029)
Post 2007 x High	0.497*** (0.127)	0.502*** (0.121)	0.427*** (0.113)	0.497*** (0.127)	0.504*** (0.117)	0.503*** (0.117)
Post 2007 x High x Trend	-0.145*** (0.051)	-0.161*** (0.042)	-0.110* (0.060)	-0.145*** (0.051)	-0.161*** (0.041)	-0.161*** (0.041)
Trend x High	-0.014 (0.019)	-0.035* (0.021)	0.011 (0.018)	-0.014 (0.019)	-0.024* (0.014)	-0.027** (0.014)

*Panel D. Number of Nursing Programs*

Post 2000 x High	-0.334 (0.261)	-0.707* (0.389)	0.941 (0.745)	-0.298 (0.201)	-0.707* (0.379)	-0.707* (0.380)
Post 2000 x High x Trend	0.513*** (0.173)	0.737** (0.280)	-0.272 (0.500)	0.488*** (0.124)	0.737*** (0.273)	0.737*** (0.273)
Post 2007 x High	-0.392 (0.238)	-0.519 (0.352)	0.450 (0.695)	-0.365* (0.209)	-0.519 (0.343)	-0.519 (0.343)
Post 2007 x High x Trend	-0.624*** (0.228)	-0.944** (0.370)	0.543 (0.667)	-0.590*** (0.156)	-0.944** (0.360)	-0.944** (0.361)
Trend x High	0.043 (0.043)	-0.247*** (0.088)	-0.144 (0.110)	0.038 (0.038)	0.070 (0.053)	-0.014 (0.095)

*Notes:* Table reports estimates of the parametric event study model (equation 1). The sample period is from 1992-2013 in Panels A and B, 1998-2013 in Panel C, and 1994-2013 in Panel D. Province and year fixed effects, as well as baseline controls interacted with year dummies as outlined in Figure 4, are included in all specifications unless otherwise indicated. Robust standard errors are clustered at the province level. Post 2000 is a dummy variable equal to 1 in the year 2000 and after and 0 otherwise. Post 2007 is a dummy variable equal to 1 in the year 2007 and after and 0 otherwise. High is an indicator variable for high nurse migration province to the U.S. in the base year 1990. \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, Census, and authors' calculations.

Appendix Table 1. Non-Parametric Results: US Nurse Migration Rate and Enrollment Rate

	US Nurse Migration	Nurse Enrollment	Other Enrollment	Total Enrollment
	(1)	(2)	(3)	(4)
<i>Pre-Visa Expansion</i>				
High Migration Province x 1992	0.001*** (0.000)	0.623 (0.399)	0.464 (1.520)	1.087 (1.565)
High Migration Province x 1993	0.001*** (0.000)	0.483 (0.316)	1.007 (1.397)	1.490 (1.453)
High Migration Province x 1994	0.001** (0.000)	0.220 (0.215)	0.499 (1.559)	0.719 (1.532)
High Migration Province x 1995	0.000 (0.000)	0.427** (0.169)	0.490 (1.046)	0.917 (1.008)
High Migration Province x 1996	0.001 (0.000)	0.074 (0.118)	0.956 (1.090)	1.030 (1.106)
High Migration Province x 1997	0.000 (0.000)	0.102* (0.061)	1.548 (1.392)	1.650 (1.419)
High Migration Province x 1998	-0.000 (0.000)	0.012 (0.040)	-0.581 (0.780)	-0.569 (0.795)
<i>Post-Visa Expansion</i>				
High Migration Province x 2000	0.001 (0.001)	0.087 (0.053)	-0.113 (0.651)	-0.027 (0.670)
High Migration Province x 2001	0.003** (0.001)	0.303*** (0.079)	-0.323 (0.929)	-0.021 (0.935)
High Migration Province x 2002	0.004** (0.001)	0.944** (0.363)	-1.465 (1.230)	-0.521 (1.105)
High Migration Province x 2003	0.004*** (0.001)	1.846*** (0.678)	-1.754 (1.452)	0.092 (1.031)
High Migration Province x 2004	0.004** (0.002)	2.262** (0.982)	-1.158 (1.642)	1.103 (1.161)
High Migration Province x 2005	0.003*** (0.001)	3.042** (1.163)	-4.261** (2.041)	-1.218 (1.317)
High Migration Province x 2006	0.007*** (0.002)	3.532*** (1.235)	-3.274* (1.729)	0.258 (1.473)
<i>Post-Visa Restriction</i>				
High Migration Province x 2007	0.002*** (0.001)	3.194*** (1.112)	-2.748 (1.738)	0.446 (1.315)
High Migration Province x 2008	0.001*** (0.000)	2.815*** (0.809)	-2.982 (1.889)	-0.168 (1.408)
High Migration Province x 2009	0.002*** (0.001)	1.953*** (0.687)	-1.739 (1.863)	0.214 (1.504)
High Migration Province x 2010	0.003*** (0.001)	1.604** (0.628)	-2.190 (1.938)	-0.586 (1.667)
High Migration Province x 2011	0.002** (0.001)	0.663*** (0.248)	-1.755 (1.859)	-1.092 (1.793)
High Migration Province x 2012	0.003*** (0.001)	0.361* (0.193)	-1.977 (1.750)	-1.617 (1.718)
High Migration Province x 2013	0.003*** (0.001)	0.199* (0.118)	-2.051 (1.911)	-1.852 (1.890)

*Notes:* The sample period is from 1992-2013. Province and year fixed effects are included in all specifications, as well as baseline controls interacted with year indicators as described in Figure 4. Robust standard errors are clustered at the province level. High Migration Province is equal to 1 if the province had above median nurse migration in the base year (1990). \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, and authors' calculations.

Appendix Table 2. Non-Parametric Results: Graduation Rates

	Nurse Graduation	Other Graduation	Total Graduation
	(1)	(2)	(3)
<i>Pre-Visa Expansion</i>			
High Migration Province x 1998	0.014 (0.019)	-0.183 (0.191)	-0.169 (0.200)
<i>Post-Visa Expansion</i>			
High Migration Province x 2000	0.002 (0.025)	0.027 (0.202)	0.028 (0.208)
High Migration Province x 2001	-0.000 (0.029)	0.673* (0.395)	0.673* (0.402)
High Migration Province x 2002	0.007 (0.035)	0.495 (0.323)	0.502 (0.335)
High Migration Province x 2003	0.040 (0.036)	0.306 (0.372)	0.347 (0.380)
High Migration Province x 2004	0.064 (0.073)	0.596 (0.403)	0.660 (0.401)
High Migration Province x 2005	0.125 (0.098)	0.215 (0.365)	0.340 (0.363)
High Migration Province x 2006	0.398*** (0.132)	0.090 (0.423)	0.488 (0.418)
<i>Post-Visa Restriction</i>			
High Migration Province x 2007	0.592*** (0.183)	0.109 (0.416)	0.700* (0.371)
High Migration Province x 2008	0.733*** (0.193)	-0.059 (0.491)	0.674 (0.472)
High Migration Province x 2009	0.749*** (0.179)	0.212 (0.429)	0.961** (0.409)
High Migration Province x 2010	0.652*** (0.174)	-0.004 (0.396)	0.647* (0.375)
High Migration Province x 2011	0.519*** (0.127)	0.036 (0.471)	0.555 (0.465)
High Migration Province x 2012	0.305*** (0.097)	-0.054 (0.383)	0.251 (0.397)
High Migration Province x 2013	0.106** (0.048)	0.054 (0.424)	0.160 (0.428)

*Notes:* The sample period is from 1998-2013. Province and year fixed effects are included in all specifications, as well as baseline controls interacted with year indicators as described in Figure 4. Robust standard errors are clustered at the province level. High Migration Province is equal to 1 if the province had above median nurse migration in the base year (1990). \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, and authors' calculations.

Appendix Table 3. Non-Parametric Results: Number of Nursing Programs

	Nursing Programs	Private Nursing Programs	Public Nursing Programs
	(1)	(2)	(3)
<i>Pre-Visa Expansion</i>			
High Migration Province x 1994	-0.252 (0.243)	-0.244 (0.209)	-0.007 (0.063)
High Migration Province x 1995	-0.035 (0.164)	-0.053 (0.152)	0.018 (0.062)
High Migration Province x 1996	-0.004 (0.172)	0.004 (0.148)	-0.008 (0.063)
High Migration Province x 1997	0.077 (0.146)	0.035 (0.143)	0.042 (0.037)
High Migration Province x 1998	0.015 (0.097)	-0.030 (0.086)	0.045 (0.035)
<i>Post-Visa Expansion</i>			
High Migration Province x 2000	-0.069 (0.159)	-0.105 (0.133)	0.036 (0.064)
High Migration Province x 2001	0.233 (0.246)	0.253 (0.204)	-0.020 (0.146)
High Migration Province x 2002	0.668** (0.306)	0.645** (0.289)	0.023 (0.100)
High Migration Province x 2003	1.554*** (0.426)	1.495*** (0.390)	0.059 (0.124)
High Migration Province x 2004	1.961*** (0.694)	1.953*** (0.644)	0.007 (0.183)
High Migration Province x 2005	2.853*** (0.975)	2.467*** (0.851)	0.386 (0.238)
High Migration Province x 2006	2.940*** (0.990)	2.453*** (0.851)	0.487* (0.272)
<i>Post-Visa Restriction</i>			
High Migration Province x 2007	3.065*** (1.079)	2.646*** (0.918)	0.418 (0.352)
High Migration Province x 2008	3.250*** (1.068)	2.680*** (0.931)	0.570** (0.274)
High Migration Province x 2009	3.338*** (1.121)	2.907*** (0.951)	0.431 (0.346)
High Migration Province x 2010	3.321*** (1.093)	2.838*** (0.924)	0.483 (0.343)
High Migration Province x 2011	2.804*** (1.054)	2.642*** (0.900)	0.162 (0.374)
High Migration Province x 2012	2.927*** (0.964)	2.557*** (0.863)	0.370 (0.234)
High Migration Province x 2013	2.823*** (0.930)	2.400*** (0.830)	0.423* (0.238)

*Notes:* The sample period is from 1994-2013. Province and year fixed effects are included in all specifications, as well as baseline controls interacted with year indicators as described in Figure 4. Robust standard errors are clustered at the province level. High Migration Province is equal to 1 if the province had above median nurse migration in the base year (1990). \*\*\* indicates significance at the 1% level. \*\* indicates significance at the 5% level \* indicates significance at the 10% level.

*Sources:* CFO, CHED, and authors' calculations.