Regulating High-Skilled Immigration:
The Market for Medical Residents

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JEL codes: I18; J08; J18; J44

Acknowledgments
I am grateful to the Center for Health Workforce Studies at the School of Public Health, State University of New York, Albany for providing data for the study. I also thank the NY Department of Health for providing valuable hospital data. Michael R. Richards provided important input on an earlier version of this paper. I also wish to thank seminar and conference participants from the Southeast Health Economics Study Group, Atlanta Federal Reserve, American Society of Health Economists, Association for Public Policy Analysis & Management, the University of Illinois-Chicago, Indiana University, and Johns Hopkins University as well as Scott Barkowski, Susan Gerber, Robert Kaestner, Melissa McInerney, and Coady Wing for providing valuable feedback on earlier versions of this paper. Thanks to Gloria Bazzoli and Teresa Waters for providing Medicare Cost Report data. All views and remaining errors belong solely to the author.

Keywords: labor demand, physician supply, medical education, H-1B visa, healthcare workforce

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Abstract

The effect of high-skill immigration remains central to many US industries and policy debates. Beginning in 2009, the federal government heightened enforcement of existing laws and increased employer fees for the cost of obtaining H-1B visas. The change can be viewed as a de facto tax on immigrant labor. I estimate the extent to which high-skill non-citizen workers, in the form of international medical school graduates seeking residency training in US teaching hospitals, are displaced by US citizens who received their medical school training abroad. Changes in immigration policy can have important effects in this labor market with implications for the larger health care system. I find that demand for medical residents among teaching hospitals based on immigration status is highly responsive to increased regulatory cost. A lower bound labor demand elasticity is –2.5.

1. Introduction

While much policy attention is focused on the consequences of low-skilled labor immigration, many immigrants are high-skilled. There is growing interest in the effects of high-skilled immigrants on US labor markets. Some recent studies show that an influx of highly educated immigrants can suppress wages and crowd out natives seeking similar occupations or educational opportunities (Borjas 2006, Borjas and Doran 2012, Bound et al. 2015, Orrenius and Zavodny 2015); however, other research has shown improvements in innovation and productivity through worker complementarities (Kerr 2013, Kerr and Lincoln 2010, Mithas and Lucas 2010, Peri 2012, Saxenian 2002). A parallel relevant literature examines higher education markets and how international enrollment at universities affects enrollment of domestic students (Shih 2017, Stuen, Mobarak, and Maskus 2012). A key component of the debate revolves around the degree to which immigrant labor substitutes for domestic labor.

In this paper I examine a symmetric question. Specifically, I examine the extent to which high-skill non-citizen workers, in the form of international medical school graduates seeking residency training in US teaching hospitals, are displaced by US citizens who received their medical school training from international medical schools. Teaching hospitals recruit and train medical school graduates (both domestic and international) before they can be licensed as physicians in the US. Thus, teaching hospitals are responsible for producing the next generation of practicing physicians through residency programs. Beginning in 2009, heightened enforcement of existing laws and increased fees for employers increased the cost of obtaining H-1B visas. My research uses the stronger regulatory environment around H-1B visa applicants to study the demand response of physician employers and subsequent spillovers to the larger health care system.

The US health care system accounts for approximately $3 trillion in annual spending and represents nearly a fifth of all economic activity within the country (Center for Medicare & Medicaid Services 2014). To help satisfy the demand for medical services, immigrant clinicians, especially physicians and nurses, are recruited and relied upon to supplement the native supply of health care personnel. Currently, more than a quarter of all US physicians received their medical education outside the US (Boulet et al. 2009, Eckhert 2010, Gozu, Kern, and Wright 2009) and as many as 15% of all registered nurses are foreign born (Chen et al. 2013). Changes in immigration policies may have consequences to the flow of foreign-trained clinicians to the US labor market. If so, the change in immigration may affect the labor market opportunities of domestic health care professionals and possibly cause unintended downstream consequences for the provision of medical services to consumers.

My results show a sharp substitution by teaching hospitals in favor of foreign-trained US citizen applicants in place of foreign-trained non-citizen applicants seeking H-1B visas. I then show that the compositional shift in physician labor leads to fewer new physicians choosing to work in under-served areas. I did not find evidence that hospital quality outcomes and intensity of service were affected, which at least partly validates my finding of a high apparent degree of substitution between foreign medical school trained non-citizens and foreign medical school trained citizens. My research more generally highlights the choices teaching hospitals confront given the evolving immigration policy environment and financial circumstances as well as potential implications for other health policy objectives such as improving provider access. This is especially important within a setting where hospitals are directly benefiting from publicly subsidized high-skilled labor.

The paper is structured as follows. In the next section I provide background on graduate medical education and details of the regulatory enforcement change and its impact on hospital decision making. I then provide a simple styled model for evaluating the regulatory change and the potential broader spillovers in the health care sector. The next section describes my data and estimation strategy. I then present my results and conclude.

2. Background

2.1. US Residency Market and International Medical Graduates

For individuals wishing to practice medicine in the US, a necessary step is completing an accredited physician residency program in the US. US-based residency training applies for both US medical graduates (USMGs) and international medical graduates (IMGs), who received a medical degree, and potentially other clinical experience, in another country. Residency slots are allocated each year via the National Residency Match Program, a doubly-binding matching algorithm (Roth 1999). Residents then accept low, administratively fixed wages in exchange for medical training, specialization, and higher future incomes (Agarwal 2015).

The US federal government is the primary sponsor of residency educational programs. The Medicare program spends $9.5 billion annually to financially support more than 100,000 residency positions across the country (Iglehart 2013). Medicaid programs are responsible for an additional $2-3 billion in support (Henderson 2010). The total expenditures are comprised of "direct" and "indirect" payments to teaching hospitals. Direct payments cover residents' salaries and training expenses, while indirect payments compensate the hospital for all other related activities (e.g., using more medical services, more technology, or delivering more indigent care) (Scheffler 2008).

Both the number of USMGs (approximately 20,000 annually from 141 medical schools) and the number of residency positions is politically determined, as opposed to responding to market forces (Iglehart 2013). Moreover, the number of residency training slots generally exceeds the number of graduating USMGs by as much as 30% in any given year (Chen and Boufford 2005, Eckhert 2010).[1] Because leaving a slot unfilled not only leaves money on the table and is also viewed as negative signal of a program's leadership, IMGs are frequently used to fill the gap. Indeed, each year the number of IMGs certified far exceeds the number of potentially available residency positions (Boulet et al. 2009). For example, more than 12,000 IMGs have been applying for residency slot in recent years, with roughly half successfully obtaining one (Iglehart 2013, Jolly et al. 2011).

IMGs are a heterogeneous group composed of three subtypes: J1 visa holders, H-1B visa holders, and US citizens. [2] The third group (USIMGs) received their medical degree abroad (71% from a Caribbean institution in 2006),[3] but aim to reintegrate into the US health care system. As USIMGs are US citizens, immigration considerations are not relevant. Between 1992 and 2006 the annual number of USIMGs applying for residency positions increased 300%, with roughly 2800 applications in 2006 (Boulet et al. 2009). By 2013, there exists an almost even split

[1] Iglehart (2013) notes that annual medical education spending growth through the federal channel has generally been less than 1%, mostly due to the Balanced Budget Act of 1997, which capped support. This has likely exacerbated the imbalance between physician supply and demand during recent years, especially as the population ages and is experiencing greater health needs.

[2] The J1 visa pathway is another (non-H-1B) source of labor. However, the J1 pathway may be an inferior option from the applicant's perspective, even if training hospitals are indifferent. J1 visa holders require a waiver to avoid a mandatory 2-year return to their home country post-training in order to directly seek employment in the US. These waivers have also become fewer and more difficult to acquire in recent years (Richards, Chou, and Lo Sasso 2009). Residents with J1 status are additionally subject to annual reviews and renewals by the ECFMG (ECFMG 2015). For these reasons, applicant demand for J1 visas may be weaker, especially with the uncertain prospect of remaining in the US to work – making it a poor substitute for the H-1B channel. With limited or no increase in the supply of J1 applicants, hospitals trying to eschew the tougher H-1B regulatory environment would be left with USIMGs as the potential source of physician resident labor.

[3] See Boulet et al. (2009) for this and related descriptive statistics for the USIMG population.

between USIMGs and non-US IMGs among the roughly 6,000 residency positions claimed by IMGs (Iglehart 2013). Importantly, prior research demonstrates the value of disaggregating IMGs into the corresponding subtypes since one type may substitute for another and compositional changes can impact physician availability (Richards, Chou, and Lo Sasso 2009).

The majority of IMGs that enter into residency training remain to practice in the US. While a quarter of US physicians received their medical school training abroad, that share could soon reach a third or more (Boulet et al. 2009, Guey-Chi Chen et al. 2010). IMGs are also commonly viewed as a source of labor to benefit underserved areas (Cohen 2006, Gozu, Kern, and Wright 2009, Howard et al. 2006, Steinbrook 2009). For example, many US public health advocates and policymakers are often concerned about the supply of clinicians in rural areas (Brooks et al. 2002, Gamm and Hutchison 2003, Gamm et al. 2002, Newhouse 1990, Pepper, Sandefer, and Gray 2010, Rabinowitz et al. 2001, Ricketts 2000, 2005) and feel existing rural providers are overburdened with excess demand (Colwill and Cultice 2003). Consequently, IMGs are often suggested as a means of alleviating rural physician shortages (Baer et al. 1998, Rabinowitz et al. 2012, Thompson et al. 2009). IMGs are thus a potential means of satisfying other social policy objectives.

2.2. Regulatory Changes

The American Recovery and Reinvestment Act (ARRA) of 2009 included a variety of elements that constrained H-1B hiring (Peri and Sparber 2011). The United States Citizenship and Immigration Services (USCIS) agency announced new and higher fees starting in 2010 along with plans for stronger enforcement of existing H-1B regulations. Specifically, USCIS started the Administrative Site Visit and Verification Program in July 2009 as an added measure to verify information in visa petitions. This resulted in greater documentation demands on employers, unannounced worksite audit reviews, and even criminal proceedings.[4] As these announcements were being made, the Department of Labor (DOL) simultaneously increased its worksite investigation staff by 30% and presented plans for 20,000 worksite visits in 2010 alone.[5] One of the penalties to noncompliance with DOL and USCIS policy is the risk of being cut off from sponsoring any H-1B visa applications in the future. Given the heavy dependency of some residency programs on IMGs, such a penalty could shut down residency programs and severely impair care provision at hospitals.

Evidence suggests that compliance with existing regulations prior to the new policies was limited at best for many US employers, including hospitals. A USCIS study released in the fall of 2008 demonstrated that 20% of H-1B applications were found to be fraudulent, with the prevalence of violations highest in more recent years. Among the identified problems included misrepresented educational degrees and forged letters of experience (USCIS 2008). These findings provided further impetus for an aggressive regulatory stance, and importantly, the health care industry was not immune. Of the 13 occupational categories used in the 2008 report, the "medicine and health" classification ranked fifth in terms of its H-1B application violation rate (USCIS 2008).

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[4] USCIS Policy Memorandum (PM-602-0009) "Implementing of Provisions of Public Law 111-230 Instituting Increased Fees for Certain H-1B and L1 Petitions and Applications, October 7th 2010; USCIS New Release, "After Public Comment, US Citizenship and Immigration Services Announces Final Rule Adjusting Fees for Immigration Benefits, September 23 2010. Vision System Group Inc. received a criminal indictment in 2009 for H-1B application fraud, which served as a severe warning to employers across the US. A USCIS description of the case can be found here: http://www.uscis.gov/archive/archive-news/11-arrested-indicted-multi-state-operation-targeting-visa-and-mail-fraud.

[5] The new labor secretary at the time, Hilda Solis, was quoted as saying, "There is a new sheriff in town", which led business and legal advisers to caution employers about the regulatory shift underway and stress the importance of full compliance with existing law (Fialkowski 2010).

A specific source of pre-2010 infraction committed by some employers was shirking on the hospital's duty to cover required fees to obtain H-1B visas for residents. While many of the administrative fees were waived for these not-for-profit, education-affiliated institutions, the legal fees were not.[6] During the more lax regulatory period, however, some teaching hospitals did not always ensure that these costs (roughly $3,000-5,000 per application) were actually borne by the hospital as opposed to the applicant or another third party.[7] To compound immigration issues for hospitals, USCIS began to challenge their fee exemption status during this time, and the DOL started to deny permanent labor certification applications for some would-be IMG residents (Klasko 2009). Taken together, these factors aimed to make H-1B hiring costlier in the late 2000s.

3. Model

3.1. Salient Features of the Labor Market for Residency Positions

The market for medical residents has several unique features that distinguish it from typical labor markets. As previously noted, the supply of resident training slots is fixed in the short-run by professional governing bodies. Additionally, the wages attached to each slot are administratively set at roughly $50,000 per year (Chandra, Khullar, and Wilensky 2014).[8] For simplicity I consider three distinct labor pools in a stylized representation: USMGs, non-citizen IMGs, and USIMGs. Again, for simplicity I will think of non-citizen IMGs as those seeking an H-1B visa; I refer to them as HIMGs.

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[6] Not-for-profit hospitals are also exempt from the annual H-1B caps imposed by law, so there is no quantity restriction for their H-1B use. They are still required to pay legal fees for H-1B processing.

[7] These details were provided via private communications with some residency directors in New York State.

[8] Adjustments for local cost of living differences are allowed but are not very large. Thus, the wages for residents of the same training cohort only vary within a fairly narrow bandwidth.

Like any firm, the equilibrium choice of foreign- or US-trained applicants depends on the relative quality, denoted by MP (marginal product) and costs of each:

$$\frac{MP_{USMG}}{C_{USMG}} = \frac{MP_{HIMG}}{C_{HIMG}} = \frac{MP_{USIMG}}{C_{USIMG}}$$

The firm will select applicants according to this simple equilibrium condition. The costs of applicants consist of wages, which are the same across applicant types, and administrative costs including the H-1B fees, which given the regulatory change have now increased for the HIMG group. Hospitals would then tend to increase USMG and USIMG recruitment (though for some hospitals the USMGs may not be an option).[9] For example, in the 2017 residency match, 94.3% of USMGs matched to residency positions while 52.4% of non-citizen IMGs matched and 54.8% of US citizen IMGs matched (NRMP 2017).

The tighter enforcement policies of H-1B visa applications introduces a *de facto* tax on HIMGs, leading to a change in the relative cost of the different labor inputs. The extent of the change in the quantity of HIMGs accepted depends on the availability of substitute medical graduates labor supply pool. As is standard in a tax incidence model, in a labor market without wage rigidities and a cap on residency slots, teaching hospitals would simply pass the tax onto H-1B sponsored residents in the form of lower wages (or, equivalently, having the applicant bear the additional costs). Thus even with wage rigidities and a cap on total residents, as long as H-1B applicants have a sufficiently inelastic labor supply curve (which makes sense given the high value of US residency training), the quantity of H-1B residents would be largely unchanged—but only if the HIMGs could bear the cost of the fees. However, mandating that the incidence of H-1B costs must be borne by the employer implies a movement along the demand curve in

[9] An alternative and more realistic version of the styled model might assume that residency programs attempt to first fill slots with USMGs and sequentially proceed to fill the remaining slots with HIMGs or USIMGs.

accordance with the additional cost and some resulting decrease in the quantity of HIMGs demanded along with a co-occurring increase in demand for USIMGs.

Non-US citizen IMGs migrating to the US are often the top performers in their foreign schools (Gozu, Kern, and Wright 2009), in contrast with USIMGs who generally failed to gain acceptance into a US-based medical school. Moreover, prior to arriving in the US, many HIMGs already have extensive clinical experience in their home country (perhaps even completing a residency equivalent) and often needed to excel within self-taught, low-tech environments in order to migrate (McDonald, Zeger, and Kolars 2007). HIMGs have tended to outperform USIMGs on general medical licensing exams, specialty exams administered during residency, and other clinical aptitudes (Boulet et al. 2009, Boulet et al. 2006, Garibaldi et al. 2002, Norcini, Anderson, and McKinley 2006, Norcini et al. 2010). This suggests that average H-1B human capital may be greater than USIMGs at baseline, and some already voice concerns about the sufficiency of USIMGs educational preparation (Boulet et al. 2009, Eckhert 2010). The extent of any willingness of teaching hospitals to substitute USIMGs in place of HIMGs characterizes the perceived quality tradeoff between HIMGs and USIMGs and remains an empirical question.

3.2. Potential Spillover Effects

My model and prior stylized facts about the roles of IMGs in the US health care workforce suggest that training hospitals' short-run objectives may be misaligned with long-run social policy aims. Presumably, the public funding for residency programs is intended to produce the best possible cohort of new physicians. In which case, training hospitals receiving subsidies should apply them to the most qualified candidates. However, the regulatory factors associated with H-1B applicants are likely to distort teaching hospitals' private quality-cost tradeoff as exemplified by a willingness to substitute USIMGs for HIMGs.

Recall, the residency market does not clear due to excess supply of applicants given the cap on subsidized residency slots; the match process relies on preference rankings so that the last "matched" resident should be at least as desirable to the hospital as any remaining applicants in the pool. However, in the presence of a differential tax, individual hospitals' valuation of quality differences across applicant types (i.e., H-1B IMGs vis-à-vis USIMGs) would be weighed against the new burdens of hiring an H-1B resident physician. If the quality benefit is perceived to be less than the costs, broadly defined, a substitution will be made, leading a hospital to move further down its applicant ranking than it otherwise would. A hospital would not change its behavior after the regulatory shift if it either put a premium on cohort quality or the incremental costs were viewed as trivial.

Downstream consequences of any changes in resident mix are relevant if H-1B residents and USIMG residents choose to work in different markets post-training. Much of the previously cited medical literature suggests that IMGs help bolster physician supply in shortage areas. A qualitative study of IMGs indicates that many IMGs expressed a sense of limited geographic choice in terms of eventual practice opportunities within the US (Guey-Chi Chen et al. 2010); other research similarly demonstrates clustering of IMGs in certain markets (Polsky et al. 2002). Location choices may reflect lower demand for IMG services in more popular markets or weaker geographic preferences among IMG physicians. In either case, IMG availability for underserved areas is important given concerns regarding the allocation of providers in the US and available health resources for vulnerable populations. If H-1B visa holders and USIMGs act differently when it comes to practice location choice, then training hospital behavior will be at odds with other health policy objectives.

4. Empirical Strategy

4.1. Data

I rely on a unique dataset from the Center for Health Workforce Studies at the State University of New York at Albany, which tracks the residency, fellowship, and first job characteristics among all training physicians in New York State. The survey is administered at the time of training completion (i.e., the final year of residency or fellowship) via the local residency program directors and staff. These data thus provide a detailed snapshot of each cohort of physician trainees as well as the experiences of new medical labor market entrants. The survey spans 1998 to 2014, with an overall response rate of 62% (Armstrong, Chung, and Forte 2014), which is on par with or better than many other physician tracking surveys.[10] To focus on the enforcement change that began in 2010, I restrict to the years 2007–2014. While the data only encompass a single state, New York trains the plurality of physicians nationally (AAMC Center for Workforce Studies 2013). New York also receives the largest share of residency applications from IMGs and is their most popular training destination (ECFMG 2015). Thus, New York State is a highly relevant market to study the behavior of teaching hospitals and newly trained physicians.

I also obtain hospital-level data collected by the New York Department of Health that are part of the Statewide Planning and Research Cooperative System (SPARCS). SPARCS data capture hospital discharges within the State of New York and allow me to investigate any

[10] The survey was not given in 2004 and 2006 during this time window due to budgetary restrictions.

changes in care quality outcomes after teaching hospitals faced stricter immigration policy enforcement. The key hospital-level outcomes that potentially relate to care management are average length of stay and total charges per admission. Poor care coordination, excessive testing, and/or treatment errors can increase either measure, and I capture this information from 2006 through 2014.

4.2. Identification Strategy

Because the survey is conducted when residents complete their training, I can leverage the differential length of residency programs to create groups of physicians that were exposed to the enforcement change and those who were not. The duration of residency training is either 3, 4, or 5 years depending on specialty. Thus to identify the effect of the increased enforcement policy beginning in 2010, I observe the changes among physicians completing 3-year residency programs (emergency medicine, family medicine, internal medicine, and pediatrics) in 2013 and 2014, who "matched" with their program in early 2010 and early 2011 respectively, relative to physicians in the same specialty who began training prior to 2010. Because market conditions may affect the outcomes of graduates in 2013 and 2014, I use graduates from 5 (or more)-year programs (all surgical fields) to represent the untreated control group.[11] Importantly, the 2013 and 2014 graduating cohorts from residency programs requiring 5 or more years to complete would have been selected by training hospitals *before* the greater enforcement of H-1B immigration rules; specifically 2008 and 2009, respectively. I can then use difference-in-differences (DD) to explore any change in demand for H-1B residents and accompanying

[11] Of note, I only include graduates of emergency medicine programs that indicate a 3-year length of training, as opposed to 4-year (emergency medicine programs have two varieties in this regard), and I also exclude ophthalmology from the 5+ year surgical residency group because it is a 4-year surgical program.

substitution toward alternative resident labor. Note that a necessary compromise in the approach is the need to compare residents from different residency cohorts. A potential concern with this approach is that the presence of cohort-by-year effects that could be confounded with the timing of the enforcement change. Descriptive results presented below suggest that there are no notable trends in HIMG or USIMG use over the period. It should also be noted that the use of IMGs in the relatively more competitive 5+ year residency programs is significantly lower than in 3-year residency programs, but identification requires that the parallel trends assumption not be violated.

4.2.1. Substitution of IMG Types. To examine potential substitution, I first construct four indicator variables for training physician type: USMGs, USIMGs, H-visa IMGs, and J-visa IMGs. I do so with survey provided information on location of medical school (i.e., domestic versus international) and citizenship status.[12] I then restrict to graduates of 3-year and 5-year residency programs to represent the treatment and control groups and estimate the following regression model to test for enforcement effects:

$$Y_i = \alpha + \beta\ 3YearRes_i + \varphi\ Post_i + \delta\ 3YearRes_i{*}Post_i + \theta X_i + \tau + \varepsilon_i \qquad (1)$$

There are four outcome variables in total. Each outcome reflects a separate regression for each of the four immigration groups. I include indicators for completing a 3-year residency program and for residents finishing their training in 2013 and 2014 from either residency program group (the *Post* variable). The parameter δ captures my DD estimate of interest. The model also controls for demographic characteristics belonging to a given cohort: age, gender, race/ethnicity, medical degree type (MD or DO), and amount of educational debt, and a linear time trend.

[12] International medical schools are those existing outside of the US and Canada; only a small number of respondents report receiving a Canadian medical education in a given year.

4.2.2. Non-Training Labor Market Outcomes. To investigate spillover effects from compositional shifts in residency cohorts, I focus my attention on residency graduates entering direct patient care positions. I specifically examine their attractiveness to prospective employers and, for those with a job, their propensity to enter less popular markets, Health Professional Shortage Areas (HPSAs) and more rural locations.[13] For the former, I have a binary outcome equal to one for those reporting zero job offers at the time of survey completion. While an imperfect, proxy measure of a trainee's competitiveness in the labor market, the measure can at least capture if the search for an acceptable position has been lengthened, plausibly due to weaker demand from employers. Regarding practice geography, HPSAs and more rural markets are often considered in need of more providers and more accessible medical services, so the proportion of graduates choosing to work in these locations matters potentially for population health. I in turn construct a binary variable equal to one when the respondent has taken a job in a HPSA. Similarly, I make another binary variable that takes the value of one if the respondent reports taking a job in a "rural" or "small city (<50,000 population)" market.[14]

Paralleling my primary analyses, I examine trends for no job offers and entry into these practice locations for two separate groups: USMGs and IMGs. Importantly, the IMG group includes both USIMGs and non-citizen IMGs. The difference-in-differences estimator thus compares the effect of the regulatory change on the IMG composite group relative to the

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[13] HPSAs are an official designation based on census information that is constructed and monitored by the Health Resources and Services Administration within the US Department of Health and Human Services.

[14] Along with "No" responses, I code "don't know" responses to the HPSA survey question as a zero as well since I my interested in those deliberately going to practice in such a market. There are five geographic categorizations possible: inner city, other area within a major city, suburban, and the two I use to capture less urban markets. Note, "rural" by itself is a very rare response in data, making corresponding trends volatile and hard to interpret.

unaffected USMG group. The first equation restricts the analytic sample to those within 3-year programs and entering the clinical workforce:

$$Y_i = \alpha + \beta\, IMG_i + \varphi\, Post_i + \delta\, IMG_i * Post_i + \theta X_i + \tau + \varepsilon_i \qquad (2)$$

The outcome variables are each of three variables described above, and the execution and subsequent interpretation of Equation 2 closely follows my primary DD regressions.

I can also leverage the graduates of 5-year programs to implement a triple difference model placebo test in this setting. The triple-differences (DDD) model has a third indicator variable equal to one for graduates of the longer residency programs (i.e., those unexposed to the regulatory shift). If my prior model (Equation 2) is appropriately capturing an effect attributable to the regulatory change, then I should see no corresponding effect among this untreated group. Otherwise, any observed changes in the post-training outcomes are more likely to be specific to that labor market year as opposed to any residency compositional changes. To operationalize the DDD placebo test, I estimate the following specification:

$$Y_i = \alpha + \beta\, IMG_i + \varphi\, Post_i + \gamma\, 5YearRes_i + \delta\, IMG_i * Post_i + \lambda_1\, IMG_i * 5YearRes_i +$$
$$\lambda_1\, Post_i * 5YearRes_i + \lambda_1\, IMG_i * Post_i * 5YearRes_i + \theta X_i + \tau + \varepsilon_i \qquad (3)$$

For all of my primary and secondary analyses, I use case-wise deletion for observations lacking full information on model-included variables. I use robust standard errors throughout.

4.2.3. Health, Quality, and Efficiency Outcomes. To examine hospital-level outcomes, I first classify hospitals as either teaching or non-teaching institutions by mapping the New York State discharge data facility information to a list of all institutions with residency programs in NY. I identify 77 unique teaching hospitals in total belonging to the hospital discharge data.[15] I

[15] Some very specialized (and irrelevant for my purposes) teaching programs were not included, so 77 is not the universe of training facilities.

then flag teaching hospitals that rely on a very high fraction of IMGs to staff their residency positions (at least 85% of residents being foreign educated). I identify dependence on IMG residents by taking a 3-year average from the 2010, 2011, and 2012 resident exit survey waves (years chosen to represent the period prior to the enforcement change). Twenty-one unique hospitals satisfy the high-reliance on IMGs criterion. I subsequently link this IMG penetration information to the discharge data for the corresponding facilities. For each hospital quality outcome, I distinguish between three types of hospitals: 1) all non-teaching hospitals 2) all teaching hospitals 3) teaching hospitals with a heavy reliance on IMGs at baseline.

5. Results

5.1. Changing Composition of Residency Cohorts

Figure 1 restricts to H-1B and USIMG residents within 3-year programs and reveals my first key finding. 22% of the 2007–2012 cohorts are made up of USIMGs, with approximately 18–19% of these same cohorts relying on H-visa physicians. However, for the 2013 and 2014 cohorts (those participating in the residency match in 2010 and 2011), I see sharp trend changes. Once heightened regulation is introduced, only about 14% of a cohort belongs to the H-visa group; conversely, the USIMG portion climbs to 26% and higher. The 4–5 percentage point increase for USIMGs essentially offsets the 4–5 percentage point decline in H-1B residents, suggesting a nearly one-for-one exchange. The observed change roughly translates to a 25% fall in demand for H-visa residents when compared to their steady-state levels. Appendix Figure 1 shows no similar patterns for the USMG or J-1 subtypes. Both groups make up fairly stable contributions to 3-year residency cohorts and do not demonstrate compelling trend breaks after the regulatory shift.

Figures 2 and 3 place the trends from Figure 1 alongside their respective control group counterparts, the 5+ year residency graduates. As is evident from both figures, H-1B and USIMGs are less prevalent among surgical fields—around 10% of a given cohort or less—and the trajectories are nearly flat. For the purposes of my empirical strategy, the most important feature of the control groups is a pre-treatment trend paralleling the corresponding 3-year programs. Given the data displays in Figures 2 and 3, this DD identification assumption seems appropriate within my research setting.[16] Of note, I also do not see any apparent movements in the control groups' trends in later cohorts, indicating a differential experience for those exposed to the regulatory change.

Before presenting my regression results, I summarize compositional features of the two types of residency programs in Table 1. Graduates from the longer duration programs are slightly older and much more likely to fill their available positions with USMGs.[17] The surgical residencies (second column) are also less likely to be female and more likely to be white, on average. They tend to carry more educational debt as well. Table 2 presents my main regression results for H-visa and USIMGs, respectively. Column 1 statistically tests the differences seen in the prior figures. Columns 2 and 3 then include other covariates and a linear time trend. In the first column, I can see that residents in 3-year programs are 14-percentage points more likely to hold an H-1B, but this differential shrinks by 4-percentage points after stronger regulatory enforcement is introduced. Adding covariates in columns 2 and 3 does not meaningfully alter the pattern of results or precision in the estimates. A parallel set of findings in the subsequent three

[16] Formal tests of pre-2013 outcome trends cannot reject that they are in fact parallel. The coefficients are very small (reflecting the largely flat trends seen in Figures 2 and 3) and statistically insignificant.

[17] There is a residual 10-15% of cohorts within the residency program groups that could not be cleanly allocated to the IMG and USMG designations listed in Table 1. Thus, they do not sum to 100%. The residual group is composed of visa-holders completing medical school in the US (vanishingly small minority) and those reporting their citizenship status as "permanent resident" or "other".

columns focuses on USIMGs. The clear difference is the opposite sign for the DD estimate, which is consistent with training hospitals substituting more USIMGs in place of H-1Bs. Controlling for other compositional characteristics and a linear time trend also does not change the effects. Table 3 performs identical exercises for J1 IMGs and USMGs. The DD estimates are uniformly small across all specifications. Consistent with the prior figures, the shift in hospital recruitment behavior appears concentrated within the H-1B and USIMG applicant pools.

5.2. Job Search and Location Spillovers

While my first contribution is empirically demonstrating training hospitals' substitution for different residents within a setting of stricter immigration law enforcement, I can leverage other features of my data to explore consequences. Table 4 presents regression results for the fraction of jobseekers without any offers at the time the survey was completed.[18] Not many new physicians experience this outcome in a given year (2–6%). IMGs experience a longer job search among cohorts exposed to the regulatory shift and hence contain a greater share of USIMGs than prior years. The regression estimates for HPSA practice entry (columns 3 and 4) reveal a strong negative effect for these same IMG cohorts. The greater likelihood for IMGs (relative to USMGs) to select these locations is reduced by more than a third when compared to the pre-period average difference. The findings are also largely insensitive to covariate inclusion. Identical models for less urban practice entry (columns 5 and 6) offer qualitatively similar results, though precision is lost with the addition of other covariates. Using the longer duration residency programs (i.e., those lasting at least 5 years) for triple-difference placebo tests

[18] When formally testing the pre-period trends across IMGs and USMGs, parallel trends can only be rejected at the 5% level for the outcome capturing zero job offers at the time of the residency survey, which is not surprising given the data patterns evident in Figure 5.

(Appendix Tables 1 and 2) helps support my inferences, though I maintain the caveat that IMGs in surgical programs represent a small trainee subgroup.

Figure 4 disaggregates the IMG group into its subcomponents to descriptively examine each of my three labor market outcomes by resident type. It is clear in Figure 4 that USIMGs are generally more likely to have a longer job search and far less likely to accept a position within an underserved area (i.e., shortage area or less urban location) when compared to their H-1B counterparts. The descriptive patterns are consistent with what I empirically observe in my primary and secondary analyses. Teaching hospitals' substitution of resident labor in response to the new regulatory environment lead to substantive differences in practice location patterns across the different IMG types as well as changes in job search patterns (Table 4). The increased delay in securing a position may be a function of perceived lower quality (driven by the USIMG influx) by prospective employers as well as searching in more competitive markets (e.g., urban areas with desirable living amenities).

5.3. New York Hospital Performance and Quality Measures

Table 5 shows event history regressions using New York State hospital discharge data for average inpatient length of stay and total charges. The first two columns compare trends between teaching hospitals and non-teaching hospitals. The second two columns show results for teaching hospitals with a high (above median) reliance on IMGs based on my resident survey and non-teaching hospitals. For length of stay I observe generally shorter stays for teaching hospitals after the regulatory change, though the differences rarely achieve statistical significance. Average total charges assigned to hospital admissions are increasing for teaching hospitals throughout the period; however, the levels were diverging prior to the regulatory change. When I compare high-

IMG teaching hospitals to non-teaching hospitals I do not observe statistically different spending levels.

In non-tabulated results [available upon request] I examine four in-hospital mortality measures between teaching hospitals, the subset of teaching hospitals most reliant on IMGs, and non-teaching hospitals.[19] I do not observe statistically different mortality rates for heart attack, heart failure, hip fracture, or pneumonia coincident with the regulatory change. Overall, I do not see any compelling evidence that hospitals' performance and quality demonstrably weakened after bringing more USIMGs into their residency programs, at least in the short-run.

5.4. Alternative Interpretations

One concern with the analysis is that the timing of the regulatory change coincides roughly with the Great Recession. If financial pressures induced hospitals to eliminate H-1B expenses, there is potential concern that by comparing a 2010 entering cohort to one that started in 2008 might reflect differential economic conditions. However, it is important to note that the substantive financial shock to hospitals occurred primarily in 2008, given that the recession officially began in December 2007 and ended in June 2009 (Bazzoli et al. 2014). Data on hospital total margin (defined as net income from all sources divided by total revenues) from the CMS Healthcare Cost Report Information System bear this out: Appendix Table 3 indicates that New York hospitals as a group experienced negative total margins in 2008 which then recovered in 2009 and 2010. Moreover, Figure 1 provided little evidence of changes the mix of IMGs prior

[19] Using SPARCS Inpatient Quality Indicators (IQI) data, which are available from 2009 through 2013, I measure in-hospital mortality rates (per 1,000 discharges) for acute myocardial infarction, heart failure, hip fracture, and pneumonia admissions. These medical problems are relatively common in most hospitals and pertain to clinical fields where IMGs are likely to occupy related residency positions (e.g., internal medicine), and hence could be sensitive to a fall in average resident quality. I merge the SPARCS data with data elements constructed from the resident exit survey data.

to the incoming residency cohort of 2010 (who graduated in 2013) when the effects of the recession would have been greatest. Thus, I do not believe the Great Recession represents a confounding influence on my findings.

A related concern is that the broader world economy might have influenced or disrupted the supply of non-citizen IMGs applying for US residency positions at the same time as the regulatory change. Evidence on non-citizen applications for residency slots through the Educational Commission for Foreign Medical Graduates points to a pre-existing (pre-2010) downward trend in applications from Indian IMGs and a slightly earlier increasing trend of applications from US citizens.[20] The timing of the changes does not appear to be correlated with the recession.

6. Conclusion

I show that regulatory changes targeting H-1B-visa-seeking immigrants can influence the composition of new physician cohorts. The imposition of greater visa-related costs leads teaching hospitals to substitute US-citizen IMGs for H-visa-seeking IMGs. The result suggests that hospitals, and hence the broader physician labor market, are sensitive to the prevailing immigration law and enforcement efforts. The effect size is not small as training hospitals reduced non-citizen IMGs by 25% in my data. While establishing the elasticity of demand for non-citizen international medical graduates is difficult because of the need to quantify the cost of the regulatory enforcement change, I can proffer a back of the envelope calculation. The number most frequently cited by residency program heads was the $3000-$5000 cost associated with H-1B processing and legal costs. Relative to the annual residency salary of roughly $50,000, the

[20] See https://www.ecfmg.org/resources/Top5CitizenshipCountries1993-2017.pdf (accessed 7/31/18).

fees amount to at most a 10% increase in costs. Thus a lower bound labor demand elasticity estimate is –2.5. However, given that the fees are only assessed once over the course of a 3-year residency, the elasticity could be three times larger in absolute value. Either way, my results are consistent with a strong willingness to substitute US citizen IMGs for non-citizen IMGs.

My findings also suggest that enforcement changes with respect to H-1B visas for high-skilled professionals, in this case physicians, can have downstream consequences. First, an H-1B applicant excluded from a US residency program potentially experiences a long-run earnings decrease. Source countries may perceive some benefit from this—for example, the so-called brain-drain when high-skilled individuals migrate abroad (Desai et al. 2009)—but from the perspective of the individual, there is a clear welfare loss, particularly given that most residency applicants would likely be willing to pay H-1B fees that must be borne by the hospital. USIMGs clearly gain from the present regulatory shift in terms of training placement, without investment in additional human capital or other job market signals. Regarding spillover effects on the health care system, I found some evidence that clinician distribution was negatively affected, at least insofar as substituted physicians were less like to work in underserved areas.

At the same time, I do not find evidence that NY teaching hospitals suffer worse outcomes on broad and highly visible care quality metrics after making the labor substitution. This suggests that whatever desired resident attributes residency programs tradeoff when selecting against H-1B physicians are not the same attributes that strongly shape markers of hospital performance. It also further reinforces the rational response of hospitals to a more costly immigration policy climate. Teaching hospitals can rely less on the targeted H-1B workers to reduce their exposure to costly compliance and risks of regulatory sanction without damaging their reputation among consumers and payers.

Beyond resident quality, my results suggest a potentially unintended effect of greater regulatory enforcement on new physician location decisions. The subsequent decline of IMGs accepting jobs in medically underserved and rural markets is consistent with H-1B and USIMG residents having different preferences over their future practice locations. Indeed, research has shown the role of IMGs in staffing community health centers and other safety net practices (Rosenblatt et al. 2006). Additionally, several existing policy initiatives try to incentivize current and recent US medical school graduates to accept jobs in areas with scarce providers, with mixed success (GAO 2017). It is possible that a more efficient means to that end would be greater accommodation of foreign physicians, at least according to my data.

On the broader question of the degree to which immigrants substitute for US citizens in a high-skill profession such as medicine, my results imply a quite high degree of apparent interchangeability. However, questions of interest regarding wage implications from greater high-skill immigration in medicine may be less relevant given the overall cap on the number of residency training slots. Yet the zero-sum nature of the residency market has potentially longer run (though clearly more normative implications) regarding whether US citizens versus non-citizens are “entitled” to residency slots. Such questions are beyond the scope of this work.

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Figure 1: Compositional Changes in Cohorts among Three-Year Residency Programs, 2007 – 2014

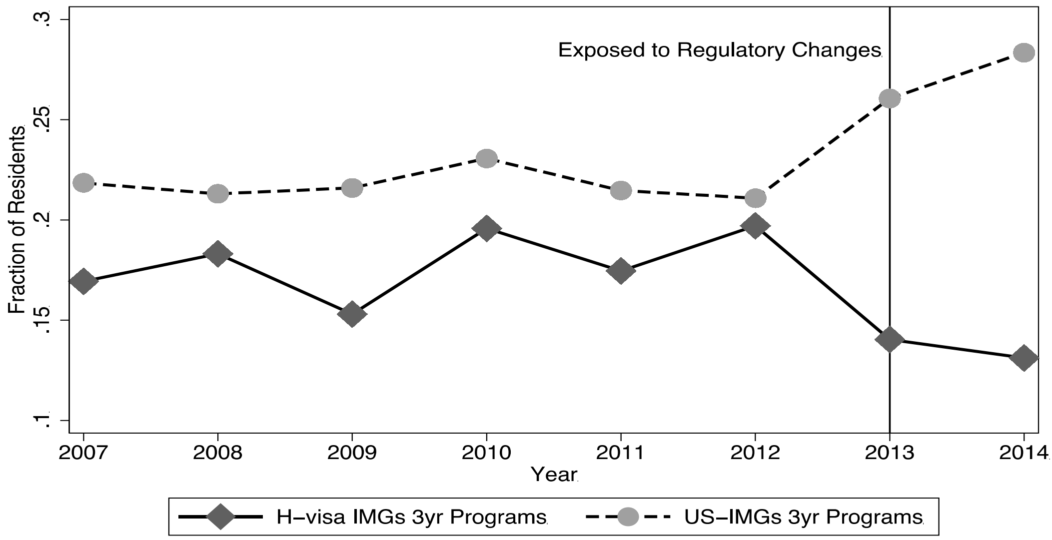
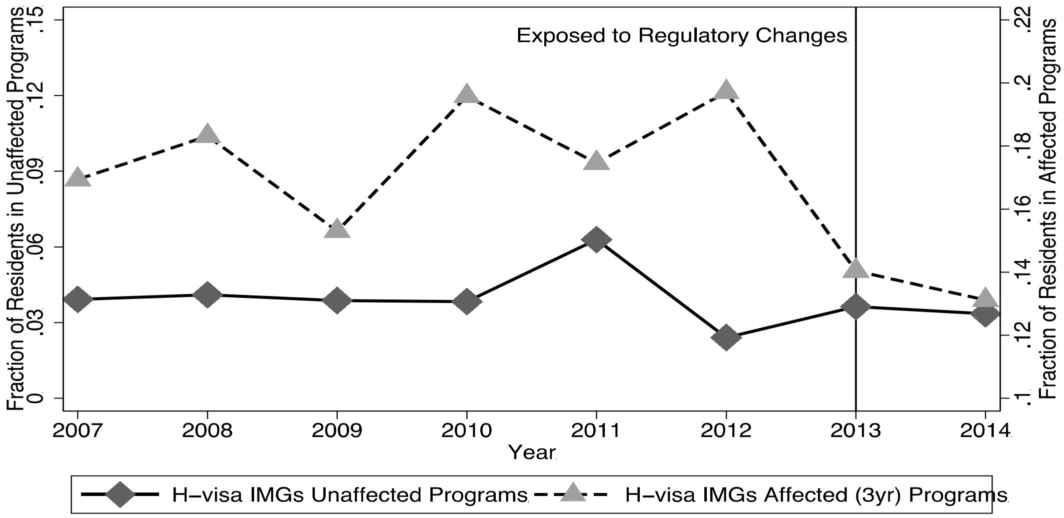


Figure 2: Use of H-visa Residents Among Treated and Untreated Residency Programs



Note: Unaffected programs are residencies that require at least 5 years to complete

Figure 3: Use of USIMGs Among Treated and Untreated Residency Programs

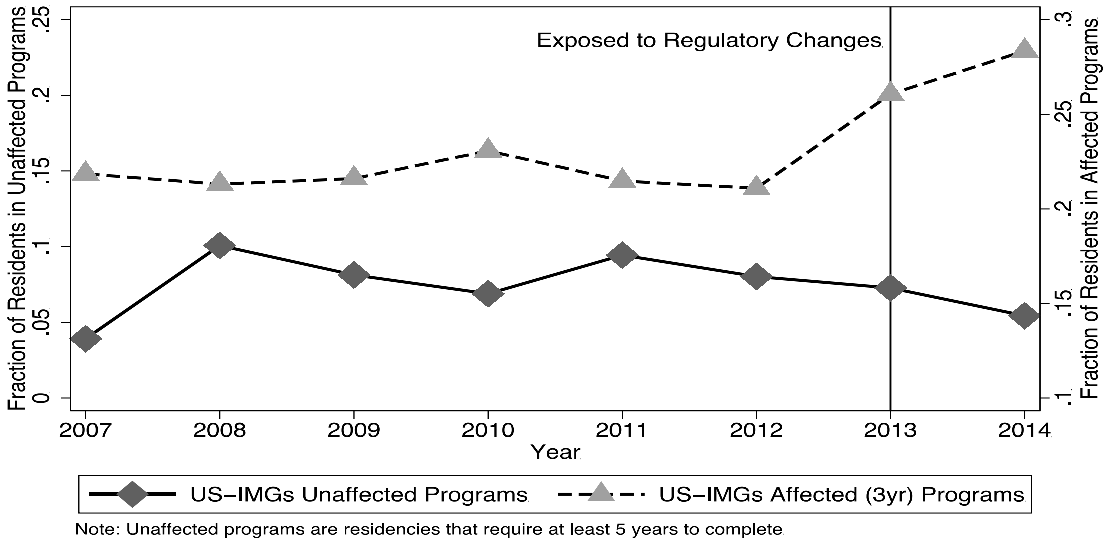


TABLE 1:
Demographic Summary Characteristics of Residents by Program Length (2007 – 2014)

	Duration of Residency Training	
	3-Year Programs	5 or More-Year Programs
Age	32.5	33.3
	(%)	(%)
H-visa IMGs	16.9	4.0
J-visa IMGs	9.8	4.4
US-IMGs	23.1	7.6
USMGs	34.0	77.6
Female	50.2	23.0
Asian	40.5	23.4
Black	8.1	4.8
Hispanic	8.7	6.0
Other Race	11.5	7.7
MD	92.8	95.0
Under $100K in Educ. Debt	66.3	45.1

Source: SUNY residency exit survey from 2007 through 2014, not excluding observations with incomplete information
IMGs: respondents reporting attending medical school outside of the US and Canada
3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics
5 or More-Year programs include: all surgical fields except for ophthalmology

TABLE 2:
Effect of Regulatory Changes on Treatment versus Control Residency Cohorts

	Difference-in-Differences Analyses					
	Outcome: H-visa IMG			Outcome: USIMG		
	(1)	(2)	(3)	(1)	(2)	(3)
3-Year x Post	-0.037***	-0.045***	-0.045***	0.071***	0.074***	0.075***
	(0.013)	(0.014)	(0.014)	(0.017)	(0.018)	(0.018)
3-Year Program	0.138***	0.093***	0.093***	0.138***	0.181***	0.181***
	(0.007)	(0.007)	(0.007)	(0.009)	(0.010)	(0.010)
Post Regulation	-0.006	0.010	0.0002	-0.016	-0.019	-0.029*
	(0.010)	(0.010)	(0.014)	(0.013)	(0.014)	(0.018)
Covariates		Yes	Yes		Yes	Yes
Linear Time Trend			Yes			Yes
Observations	10,342	9205	9205	10,342	9205	9205

*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information
Sample restricted to respondents within 3 or 5+ year programs: 3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics
5 or More-Year programs include: all surgical fields except for ophthalmology and were not exposed to the policy treatment
Post Regulation variable equal to ‘1’ for 2013 and 2014 residency cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

TABLE 3:
Effect of Regulatory Changes on Treatment and Control Residency Cohorts

	Difference-in-Differences Analyses					
	Outcome: J-visa IMG			Outcome: USMG		
	(1)	(2)	(3)	(1)	(2)	(3)
3-Year x Post	0.001	0.002	0.002	0.018	0.018	0.017
	(0.014)	(0.014)	(0.014)	(0.026)	(0.023)	(0.023)
3-Year Program	0.053***	0.026***	0.026***	-0.440***	-0.368***	-0.367***
	(0.006)	(0.007)	(0.007)	(0.012)	(0.013)	(0.013)
Post Regulation	0.016	0.019*	-0.025	-0.017	-0.048**	0.005
	(0.012)	(0.011)	(0.013)	(0.023)	(0.021)	(0.023)
Covariates		Yes	Yes		Yes	Yes
Linear Time Trend			Yes			Yes
Observations	10,342	9205	9205	10,342	9205	9205

*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information
Sample restricted to respondents within 3 or 5+ year programs: 3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics
5 or More-Year programs include: all surgical fields except for ophthalmology and were not exposed to the policy treatment
Post Regulation variable equal to ‘1’ for 2013 and 2014 residency cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

TABLE 4:
Effect of Regulatory Changes on Labor Demand from Physician Employers and Labor Supply to Underserved Areas

	Difference-in-Differences Analyses (3-Year Programs Only)					
	No Job Offers		HPSA Practice Entry		Less Urban Practice Entry	
	(1)	(2)	(3)	(4)	(5)	(6)
IMG x Post	0.039***	0.040***	-0.084***	-0.073**	-0.071**	-0.048
	(0.014)	(0.015)	(0.032)	(0.033)	(0.034)	(0.036)
IMG	-0.013*	-0.012	0.191***	0.182***	0.143***	0.115***
	(0.008)	(0.009)	(0.017)	(0.019)	(0.018)	(0.020)
Post Regulation	-0.025***	-0.022**	0.001	-0.004	-0.008	-0.012
	(0.009)	(0.009)	(0.021)	(0.021)	(0.023)	(0.024)
Covariates	No	Yes	No	Yes	No	Yes
Observations	3538	3165	3238	2897	3254	2911

*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information, and all included observations report are graduating from 3-year programs and entering non-training direct patient care positions in US markets

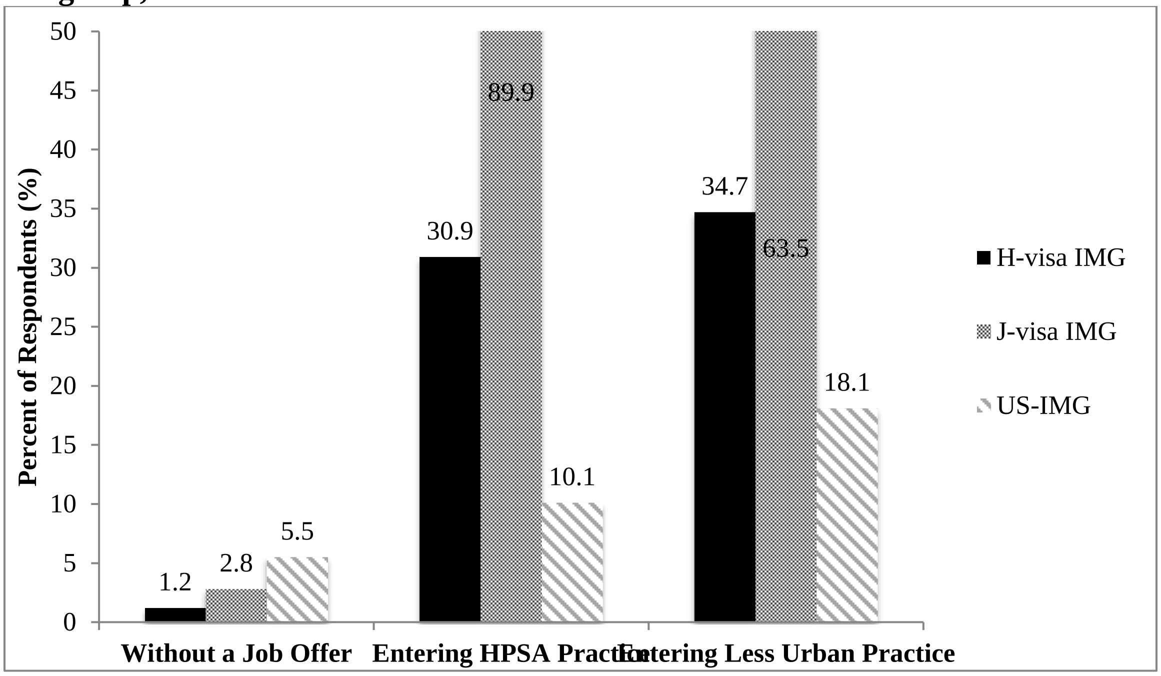
3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics

Post Regulation variable equal to '1' for 2013 and 2014 residency cohorts

'No Job Offers' outcome reflects respondents who are entering the labor market (i.e., searching) but have not yet received any formal offers for a non-training clinical position

Covariates include: age, gender, ethnicity, degree type, and educational debt

Figure 4: Summary Measures of Physician Labor Market Outcomes by IMG Subgroup, 2007 – 2014



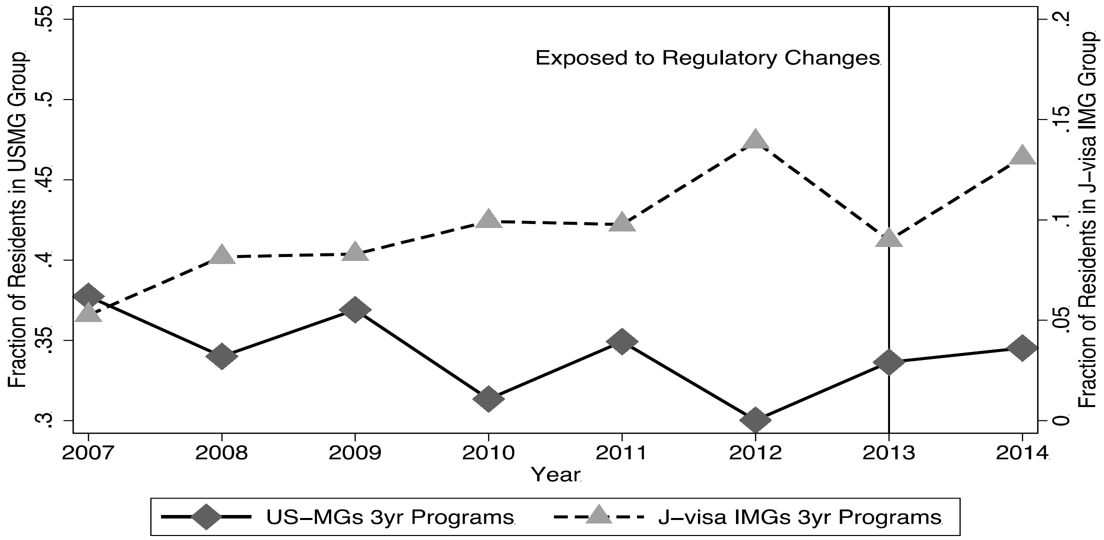
Note: Samples restricted to those completing 3-year residency programs and planning to enter a non-training direct patient care position within US markets. The practice setting measures for J-visa IMGs are not fully reflected by the truncated bars; instead, they are captured by the numerical values present within the respective bar

TABLE 5:
Changes in NY Hospital-Level Average LOS and Average Total Charges Per Inpatient Admission Before and After H-Visa Regulatory Shift

	Treated Group: All Teaching Hospitals		*Restricted Treated Group: Teaching Hospitals with High IMG Trainee Reliance*	
	LOS	**Total Charges**	**LOS**	**Total Charges**
	(1)	(2)	(3)	(4)
Teaching x 2007	0.072	820	0.003	307
	(0.101)	(561)	(0.106)	(566)
Teaching x 2008	0.097	1412**	0.033	237
	(0.115)	(684)	(0.125)	(671)
Teaching x 2009	0.098	1737**	-0.002	-120
	(0.102)	(883)	(0.123)	(825)
Regulatory Shift				
Teaching x 2010	-0.130	1749*	-0.272**	-451
	(0.104)	(985)	(0.133)	(934)
Teaching x 2011	-0.034	2307*	-0.178	-356
	(0.107)	(1228)	(0.136)	(1050)
Teaching x 2012	0.083	3144**	-0.097	-374
	(0.105)	(1561)	(0.138)	(1208)
Teaching x 2013	-0.039	4955***	-0.192	972
	(0.112)	(1721)	(0.141)	(1288)
Teaching x 2014	-0.136	5468***	-0.221	1896
	(0.113)	(1918)	(0.144)	(1676)
Hospital FE	Yes	Yes	Yes	Yes
Unique Hospitals	243	243	196	196
Observations	2040	2040	1617	1617

*** P value at 0.01 ** P value at 0.05 * P value at 0.10, standard errors clustered at the hospital level
"High IMG Trainee Reliance" is composed of NY teaching hospitals with above the median percent of residents classified as an IMG according to the matched SUNY data. Discharge information is from the NY SPARCS inpatient discharge data.

Appendix Figure 1: Compositional Trends among US Medical Graduates and J-visa IMGs, 2007 – 2014



Appendix Table 1:
Placebo Tests with Triple Interactions

	Outcome: No Job Offers			
	Diff-in-Diff (3-Year Programs Only)		With Triple-Diff Placebo Test (3-Year and 5-Year Programs)	
	(1)	(2)	(3)	(4)
IMG x Post	0.039***	0.040***	0.039***	0.041***
	(0.014)	(0.015)	(0.014)	(0.015)
IMG	-0.013*	-0.012	-0.013*	-0.013
	(0.008)	(0.009)	(0.008)	(0.009)
Post Regulation	-0.025***	-0.022**	-0.025***	-0.022**
	(0.009)	(0.009)	(0.009)	(0.009)
DDD Estimate				
IMG x Post x 5-Year	--	--	0.047	0.014
	--	--	(0.077)	(0.019)
Covariates	No	Yes	No	Yes
Observations	3538	3165	4108	3687

*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information, and all included observations report entering non-training direct patient care positions in US markets
In columns 1 and 2, sample restricted to respondents within 3-year programs. 5+ year programs added in columns 3 and 4 to provide a placebo DDD test (output from sub-interactions suppressed)
3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics
5 or More-Year programs include: all surgical fields except for ophthalmology and were not exposed to the policy treatment
Post Regulation variable equal to ‘1’ for 2013 and 2014 residency cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

Appendix Table 2:
Placebo Tests with Triple Interactions

PANEL A				
	Outcome: HPSA Practice Entry			
	Diff-in-Diff (3-Year Programs Only)		With Triple-Diff Placebo Test (3-Year and 5-Year Programs)	
	(1)	(2)	(3)	(4)
IMG x Post	-0.084***	-0.073**	-0.084***	-0.073**
	(0.032)	(0.033)	(0.032)	(0.033)
IMG	0.191***	0.182***	0.191***	0.185***
	(0.017)	(0.019)	(0.017)	(0.019)
Post Regulation	0.001	-0.004	0.001	-0.004
	(0.021)	(0.021)	(0.021)	(0.021)
DDD Estimate				
IMG x Post x 5-	--	--	-0.057	0.008
Year	--	--	(0.158)	(0.159)
Covariates	No	Yes	No	Yes
Observations	3238	2897	3791	3404

PANEL B				
	Outcome: Less Urban Practice Entry			
	Diff-in-Diff (3-Year Programs Only)		With Triple-Diff Placebo Test (3-Year and 5-Year Programs)	
	(1)	(2)	(3)	(4)
IMG x Post	-0.071**	-0.048	-0.071**	-0.049
	(0.034)	(0.036)	(0.034)	(0.036)
IMG	0.143***	0.115***	0.143***	0.121***
	(0.018)	(0.020)	(0.018)	(0.020)
Post Regulation	-0.008	-0.012	-0.008	-0.012
	(0.023)	(0.024)	(0.023)	(0.024)
DDD Estimate				
IMG x Post x 5-	--	--	0.208	0.127
Year	--	--	(0.155)	(0.150)
Covariates	No	Yes	No	Yes
Observations	3254	2911	3811	3420

*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information, and all included observations report entering non-training direct patient care positions in US markets
In columns 1 and 2, sample restricted to respondents within 3-year programs. 5+ year programs added in columns 3 and 4 to provide a placebo DDD test (output from sub-interactions suppressed)
3-Year programs include: emergency medicine, family medicine, internal medicine, and pediatrics
5 or More-Year programs include: all surgical fields except for ophthalmology and were not exposed to the policy treatment
Post Regulation variable equal to ‘1’ for 2013 and 2014 residency cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

Appendix Table 3
Total Margin for New York State Hospitals Over Time

Year	Total Margin (SD)	N
2006	2.03	138
	(5.07)	
2007	1.35	136
	(5.41)	
2008	-2.28	134
	(7.67)	
2009	3.23	135
	(5.65)	
2010	2.35	136
	(5.02)	
2011	0.74	134
	(6.76)	

Data from CMS Healthcare Cost Report Information System. I used the definition of total margins in OptumInsight. Almanac of Hospital Financial and Operating Indicators 2012: A Comprehensive Benchmark of the Nation’s Hospitals. Salt Lake City (UT): OptumInsight; 2011.