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Regulating High-Skilled Immigration and the Market for Medical Residents

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Abstract

A US industry heavily relying on high-skilled immigrants is health care, where a large swathe of the US physician workforce received their medical education abroad. Consequently, broad policies that affect immigration flows can significantly influence this specific labor market, with potential consequences for the larger health care system. Using a difference-in-differences research design, we show that more aggressive regulation changes US teaching hospitals' demand for certain types of medical residents based on immigration status. The subsequent shift in residency cohort composition also has negative spillovers for the quality and allocation of these physicians post-training.

I. Introduction

The availability and flows of immigrant labor can have profound effects on local and national economies. The United States (US), in particular, has long been accustomed to foreign workers, and many argue its global reach for labor has led to financial and productivity gains (Peri 2012, Saxenian 2002). At the same time, the economic implications from changes in foreign labor supply help shape the attitudes of legislators, firms, and voters toward immigration (Facchini et al. 2008, Facchini, Mayda, and Mishra 2011, Facchini and Steinhardt 2011, Llavador and Solano-García 2011, Mayda 2006, Mayda and Rodrik 2005, Scheve and Slaughter 2001). The resulting mix of attitudes can generate conflicting preferences, with accompanying immigration policy volatility and uncertainty. Any subsequent changes to existing policies can then widen or shrink the path to US-based employment for those residing outside its borders.

While much of the contemporary political discourse and research has focused on the consequences of low-skilled labor immigration, high-skilled immigration is also occurring and carries its own effects on labor markets and the larger economy. Some recent studies show that an influx of highly educated foreigners 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). But this is balanced by other research revealing improvements in innovation as well as productivity through worker complementarities (Kerr 2013, Kerr and Lincoln 2010, Mithas and Lucas 2010, Stuen, Mushfiq Mobarak, and Maskus 2012). Irrespective of the prevailing views on high-skilled immigration, specific programs exist that are tailored to this segment of the workforce. One such program is the H1B visa pathway, which has been a topic of

regular debate for decades but received heightened attention following the recent economic downturn. As the US government tried to stem the fallout from the 2008 – 2009 financial crisis, a less favorable attitude toward H1B use simultaneously emerged. Prospective employers soon faced new costs for H1B hiring as well as stricter enforcement of prior regulations. While the policymakers' intentions are easily inferred, it remains unknown if and how these administrative changes impacted actual labor markets. Moreover, since specialization among high-skilled workers is likely, it seems plausible that the ramifications from a greater regulatory burden could be industry-specific, which suggests value in narrower labor studies.

One US industry of interest due to its size and prevalence of foreign educated workers is health care. The US health care system is home to 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 such 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 elsewhere (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). The ability to draw labor from abroad helps US medical markets to better equilibrate supply and demand, and the migrating workers benefit from returns on their educational investments well beyond what is typically feasible in their home countries. Yet, restrictive immigration policies may directly or indirectly alter the flow of non-native clinicians to the US labor market. Doing so could then have implications for the supply and composition of US health care

professionals and possibly downstream consequences for the provision of medical services to consumers.

Within this study, we use the arrival of a stronger regulatory environment around foreign workers to study the demand response of physician employers and subsequent spillovers to the larger health care system. Our setting focuses on US teaching hospitals and their use of medical resident labor. Teaching hospitals recruit and clinically train medical school graduates (both domestic and international) before they can be licensed as independent practitioners within the US. In this way, these hospitals are responsible for producing the next generation of physicians via their residency programs, and a change to their private incentives for doing so may be at odds with other social objectives.[1] Section 2 describes the US physician residency landscape and the related shifts in immigration policy occurring immediately after the recent financial crisis. Within Section 3, we diagram the potential effects of these targeted regulations within a labor market characterized by extreme wage rigidity and alternative labor sources. Our subsequent empirics demonstrate a sharp change in teaching hospitals' labor preferences during this time, with a substitution away from H1B applicants in favor of US citizens receiving their medical education abroad. We then show that this compositional shift in physician labor is not without social costs. Both intuition and empirical observation imply that health care quality and equitable provider allocation can suffer after the labor market distortion. Our work in turn highlights the influence – and perhaps unintended consequences – broad immigration rules can have on unique labor markets. The findings

[1] Note, "teaching hospitals" are not limited to those attached to a university. For example, in 2007, there were over 1,000 teaching hospitals in the US – far more than the number of medical schools (less than 150). See the AAMC fact briefing: https://www.aamc.org/download/82452/data/keyfactsaboutth.pdf

are also relevant to discussions around evolving US immigration policy and health care delivery.

II. Background

We benefit from a setting where key aspects of immigration law and enforcement interact with long-standing institutional features of medical training. We can then explore physician employers' sensitivity to the regulatory burden tied to different residency recruits.

A. US Residency Market and International Medical Graduates

1. Supply and Demand for Residents

For those wishing to eventually practice in the US, a necessary step is generally completing an accredited physician residency program on US soil. This is true 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). Trainees then accept lower, administratively set wages in exchange for greater medical expertise, specialization, and higher future incomes (Agarwal 2015).

The US federal government is the primary sponsor of these clinical education opportunities. The Medicare program, alone, doles out an annual $9.5 billion 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; however, their contributions are less consistent over time (Henderson 2010). State

governments also deliver some supplemental funding to their local training hospitals, but their financial contributions are orders of magnitude smaller (Iglehart 2013). The total expenditures are composed of "direct" and "indirect" payments to teaching hospitals. The former covers physician residents' salaries and training expenses, while the latter aims to 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 (~20,000 from 141 medical schools) and the number of Graduate Medical Education (GME) residency positions is politically determined, as opposed to responding to market forces (Iglehart 2013). These two numbers are also out of balance so that the demand for residency staffing generally exceeds available USMGs by as much as 30% (Chen and Boufford 2005, Eckhert 2010).[2] The insufficient number of USMGs creates opportunities for IMGs to fill the gap. Prior to competing for an available position, IMGs must first have their medical background reviewed and approved (i.e., certified) via the Educational Commission for Foreign Medical Graduates (ECFMG). Each year the ratio of certificates to available GME residency positions is not 1:1, with excess certificates being disbursed (Boulet et al. 2009). This generates regular competition among IMGs for scarce training slots – e.g., more than 12,000 IMGs have been applying for US GME programs in recent years, with roughly half successfully obtaining a residency position (Iglehart 2013, Jolly et al. 2011).[3]

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[2] Iglehart (2013) notes that annual GME spending growth through the federal channel has generally been less than 1%, mostly due to the Balanced Budget Act of 1997, which capped GME 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.

[3] Also note that neither USIMGs nor non-USIMGs are able to claim all of the GME positions they would like (i.e., both have significant residual populations that are excluded from US GME year-on-year).

IMGs are also a heterogeneous group that is primarily composed of three subtypes: J1 visa holders, H1B visa holders, and US citizens. The latter group (USIMGs) received their medical degree abroad (71% from a Caribbean institution in 2006 – see Boulet et al. 2009) but aim to reintegrate into the US health care system as GME trainees. USIMGs also circumvent all immigration hurdles due to their existing US citizenship, and between 1992 and 2006, the annual number of USIMGs applying for ECFMG certification increased 300%, with roughly 2800 applications in 2006 alone (Boulet et al. 2009). By 2013, there exists an almost even split between USIMGs and non-USIMGs among the roughly 6000 GME 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 distribution (Richards, Chou, and Lo Sasso 2009).

2. Role of IMGs in the US Health Care Workforce

The majority of IMGs that enter into GME training remain in the US to then contribute to the overall stock of physicians. Over 25% of all practicing US physicians belong to this group, with expectations that their 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 (i.e., provider shortage) 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, Weeks and Wallace 2008). Consequently, IMGs are often put forth as one avenue toward alleviating rural physician shortages (Baer et al. 1998, Rabinowitz et al. 2012, Thompson et al. 2009). In these ways, making IMGs available to markets with greater unmet health care needs can satisfy other ongoing social policy objectives.

B. Regulatory Environment After the Financial Crisis

In order to mitigate the negative effects of the recent economic downturn, US policymakers turned to a bundle of initiatives to prop up credit and labor markets. The domestic employment rate, in particular, became a focal concern, which was reflected in new legislation as well as regulatory activity. The American Recovery and Reinvestment Act of 2009 included various stipulations that further constrained H1B hiring (Peri and Sparber 2011),[4] and the United States Citizenship and Immigration Services (USCIS) agency announced new and higher fees starting in 2010 [5] along with plans for stronger enforcement of existing H1B regulations – leading to greater petition filing demands on employers (e.g., more documentation),[6] worksite audit reviews,[7] and even criminal proceedings.[8] As these announcements were being made, the Department of Labor (DOL) simultaneously increased its worksite investigation staff by 30% and laid out plans for 20,000 worksite visits for the 2010 year alone. The new labor secretary at the

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4 A description of the legal issues can be found at: http://www.ssbb.com/index.php/publications/entry/213

5 USCIS Policy Memorandum (PM-602-0009) "Implementing of Provisions of Public Law 111-230 Instituting Increased Fees for Certain H1B 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.

6 A description of the legal issues can be found at: http://www.xielaw.com/immigration-articles/h1b-immigration-articles/urgent-issues-about-h1b-extensionrenewal.html

7 A description of the legal issues can be found at: http://www.meyner.com/Business-Immigration/H-1B-Audits-I-9-Compliance.shtml

8 Vision System Group Inc. received a criminal indictment in 2009 for H1B 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

time, Hilda Solis, was even 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).

But compliance was no small matter for many US employers. A USCIS study released in the fall of 2008 demonstrated that 20% of H1B applications were found to be fraudulent, with the prevalence of violations highest in more recent years. One common violation was passing H1B filing and legal fees onto applicants, which was strictly prohibited in existing regulations. Other identified problems included misrepresented educational degrees and forged letters of experience (USCIS 2008).[9] 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 H1B application violation rate (USCIS 2008). A specific source of pre-2010 rule breaking committed by some was shirking on the hospital's duty to cover required fees for H1B trainees. While many of the administrative fees were waived for these not-for-profit, education-affiliated institutions, the legal fees were not.[10] During the more lax regulatory period, however, teaching hospitals did not always ensure that these costs were actually born by the hospital as opposed to the applicant or another third party.[11] This could save the institution up to a few thousand dollars per H1B resident but also place the hospital firmly out of step with regulatory code. To compound immigration issues for hospitals,

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[9] A description and legal warning can also be found here: http://www.meyner.com/Business-Immigration/H-1B-Audits-I-9-Compliance.shtml

[10] Not-for-profit hospitals are also exempt from the annual H1B caps imposed by law, so there is no quantity restriction for their H1B use. They are still required to pay legal fees for H1B processing.

[11] These details were provided via private communications with some GME directors in the State of New York.

USCIS even began to challenge their fee exemption status during this time, and the Department of Labor (DOL) started to deny permanent labor certification applications for some would-be IMG residents (Klasko 2009). Each of these developments added uncertainty and compliance costs for teaching hospitals recruiting resident labor from abroad.

Beyond shifting a greater burden onto H1B employers, the supply of residency applicants also seemed to be affected by the invigorated regulators. In the 2008 report, 46% of all reviewed cases belonged to India-born employment seekers, with a 25% violation rate among this pool of H1B candidates (USCIS 2008). Shortly after the report's release, USCIS began to question the legitimacy of some academic credentials for foreign physicians practicing in the US – despite having already passed ECFMG inspection. Physicians trained within Indian medical schools were a particular target of these new USCIS inquiries (Klasko 2009). The ECFMG appeared to take notice and injected greater stringency into its certification reviews. While the number of applicants to the ECFMG had been virtually constant since the mid-2000s, with steady proportions from US and non-US citizens, the number of certificates issued to Indian citizens in 2009, 2010, and 2011 were 15%, 31%, and 37% *lower* than the previous steady-state levels, respectively.[12] This was a stark change for the most well-represented country in the IMG applicant pool, by far, and juxtaposed to a noticeable climb in the number of ECFMG certificates distributed to USIMGs (ECFMG 2015).

Taken together, a number of factors aimed to make H1B hires less attractive and less available in the wake of the US financial crisis. Teaching hospitals likely faced new

[12] From the early 2000s through 2008, the number of ECFMG certificates distributed to applicants from India was nearly constant. See the ECFMG 2014 Annual Report.

costs related to H1B processing, especially if they had been previously noncompliant with established rules, and prospective non-US IMGs likely found it more difficult to clear the administrative hurdles (e.g., ECFMG certification) to even be eligible for residency market participation.

III. Conceptual Framework

Below, we describe a simple framework for demonstrating the implications of new H1B recruitment costs and changes for residency markets, with specific attention to how different IMG groups could be affected. We then consider the downstream consequences of altering the mix of IMGs in residency training programs.

A. Immigration Regulations Distorting the Residency Market

The market for medical residents has a number of 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 – around $50,000 per year in pre-tax salary (Chandra, Khullar, and Wilensky 2014).[13] With fixed and publicly financed wages, hospitals have a private incentive to maximize the quality of an incoming residency cohort. Quality can be a summary measure of a number of attributes, such as existing medical knowledge, ability to learn, non-cognitive skills (e.g., responsibility and cooperation), prior clinical experiences, and other relevant characteristics. To accomplish this goal, hospitals draw from two labor pools (i.e., USMGs and IMGs), with the latter group composed of J1 visa holders, H1B visa holders, and USIMGS. Teaching hospitals then try to attract the

[13] 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.

highest quality candidates to fill their fixed number of residency positions. Their preferences and resulting mix of residents should be driven by the quality objective and only constrained by the quantity of applicants received from each labor pool and degree of competition with other residency programs.

The tighter regulations around H1B visa applications described in Section 2B potentially create new costs of compliance (i.e., documentation and reporting) and perhaps new fees for teaching hospitals – at least for those shirking on their application payment responsibilities (i.e., H1B legal fees). We can conceptualize the added regulatory burden as a *de facto* tax on one component of the IMG labor pool, with the full incidence falling on the employer. The relative attractiveness of the available labor inputs are then altered since accepting an H1B resident is now more costly due to prevailing regulations – costs not found among any other applicant type. Either the hospital must accept these costs or risk being sanctioned by the regulating agencies. The only way for a teaching hospital to avoid the tax *and* the risk of penalty with certainty is to substitute away from H1B applicants toward other sources of labor. Additionally, and irrespective of hospitals' concerns over immigration law compliance, the regulatory shift may have changed the supply of IMG applicants to prospective training hospitals. The ECFMG data previously mentioned suggest that many would-be applicants, especially from India, could no longer obtain certification – barring them from the US residency market. As the ECFMG process is not directly tied to clinical skill or applicant appeal, it is possible that desirable H1B candidates were excluded from the market because of administrative technicalities, which would then weaken the average competitiveness of this particular labor source.

In Figures 1A and 1B, we provide a stylized demonstration of teaching hospitals' labor choices in this setting. We first assume that residency programs exhaust the supply of available USMG candidates – making their contribution to filling residency slots independent of immigration issues. The remaining alternative (non-H1B) sources of labor are J1 visa holders and USIMGs. However, the J1 pathway may be an inferior option from the applicant's perspective. J1 visa holders require a waiver to avoid a mandatory 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 H1B channel. With limited or no increase in the supply of J1 applicants, hospitals trying to eschew the tougher H1B regulatory environment would be left with USIMGs as the potential source of physician resident labor. To illustrate this, we first consider the total expense of hiring a new trainee prior to the regulatory shift to include: recruitment costs (administrative requirements as well as efforts to attract desirable candidates) and the lump sum needed to cover the mandated salary – which is drawn from existing GME subsidy funds. The hospital's demand for H1B residents likely slopes downward – given that IMG resident substitutes exist in the market. With excess labor available in any given recruitment year (i.e., more IMG applicants than open slots), the supply curve for either IMG type (H1B or USIMG) is effectively a horizontal line whereby a teaching hospital can hire as much labor as it wants at the prevailing factor price (i.e., the total costs W in Figures 1A and

1B). Once tighter H1B regulations are in place, the costs to the hospital could shift upward for these applicants (W^* in Figure 1A) leading to a reduction in H1B labor as teaching hospitals move up their demand curve (L^* in Figure 1A). Alternatively, and possibly concurrently (depending on a given hospital's prior conditions), an arbitrarily shrunken pool of H1B candidates due to changes within the ECFMG process could weaken demand for this labor source – shifting down the demand curve to *D'* in Figure 1A. Lower overall demand would again move the optimal quantity of H1B labor to L^* (Figure 1A) and hence leave fewer H1B applicants receiving residency slots during the period of stricter regulation. However, it is not in teaching hospitals' interests to leave these positions vacant. Instead, we would expect a counterbalancing increase in the demand for their closest substitutes, USIMG residents. Teaching hospitals' demand for USIMGs shifts outward (*D'* in Figure 1B), and the larger number of USIMGs should perfectly offset the reductions in H1B residents. The hospital's allotted slots would then be filled, and its aggregate trainee costs (direct expenses and regulatory burden) would be minimized.

In sum, the tougher regulatory environment has the potential to distort the residency labor market in several ways. The marginal H1B acceptance could subsequently require greater legal compliance effort, new fees for previously non-compliant hospitals, and higher risk of regulatory audit. The pool of H1B candidates may have also been artificially shrunk due to heavier regulation. Each of these consequences from US immigration law favors USIMGs at the expense of H1Bs.

B. Potential Social Welfare Implications

Our conceptual framework 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 publicly funded GME infrastructure is intended to produce the best possible cohort of new physicians year-on-year. In which case, training hospitals receiving GME subsidies should apply them to the most qualified candidates. The purpose of GME would be partly undermined if hospitals tradeoff applicant quality to avoid regulatory burdens. In fact, the willingness of teaching hospitals to substitute USIMGs for H1Bs characterizes their private quality-cost tradeoff. Recall, the residency market does not clear due to excess applicants, and 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 market distortion, this assumption may no longer hold. Individual hospitals' valuation of quality differences across applicant types (i.e., H1B IMGs vis-à-vis USIMGs) would be weighed against the new burdens of hiring an H1B 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 farther down its applicant ranking than it otherwise would. A hospital would only opt for the same mix of residents as the steady-state (i.e., prior to the regulatory shift) labor bundle if it puts a premium on cohort quality that is larger than the increased costs and hassles associated with the prevailing immigration laws.

Similarly, the mere preservation of total new physicians (i.e., replacing H1B residents with USIMG residents) is insufficient if these two types of residents would not choose to work in the same markets post-training. Much of the previously cited medical

literature claims that IMGs help bolster physician supply in shortage areas. And during a qualitative study of IMGs, many of these physicians 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). These location choices may reflect less demand for IMG services in more popular markets and/or weaker geographic preferences among this physician group. In either case, their availability for underserved areas is highly relevant for perennial concerns over the allocation of providers in the US and available health resources for vulnerable populations. If H-visa holders and USIMGs act differently when it comes to selecting post-GME practice locations, then training hospital behavior will again be at odds with other health policy objectives.

IV. Empirical Strategy

A. Diff-in-Diff Identification

Our data, described next, allow us to observe the cohorts of residents completing their GME training – along with their compositional characteristics. We can then leverage the set length of residency programs to create "treatment" and "control" groups for a difference-in-differences (DD) analysis. For a given specialty, the duration of the training is fixed and uniform across programs due to the GME accreditation process. We consider the 2010 residency market to be the first exposed cohort and then allocate graduates from 3-year programs in 2013 and 2014 (emergency medicine, family medicine, internal medicine, and pediatrics) to the treatment group (i.e., those who would have been seeking residency positions at the time of the regulatory shift) and graduates from 5 (or more)-

year programs (all surgical fields) to the control group.[14] Importantly, the 2013 and 2014 graduate cohorts from residency programs requiring 5 or more years to complete would have been selected by training hospitals *before* the greater enforcement of H1B immigration rules – making them unexposed. We can then implement our DD strategy to explore any change in demand for H1B residents and accompanying substitution toward alternative resident labor.

B. Data

1. Primary Analyses

We 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 the state of New York. The survey is focused on GME and is administered at the time of training completion (i.e., the final year of residency or fellowship for a given specialty) via the local residency program directors and staff. This annual and cross-sectional data then provide a detailed snapshot of each cohort of physician trainees as well as the experiences of new (non-training) 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.[15] For this study, we restrict to the 2007 – 2014 available years of data. While the data only encompass a single state, New York is also the lead driver of GME production within the US – about 15% of all training physicians (residents and fellows) within accredited GME programs in a given year. In fact, the sheer number of

[14] Of note, we 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 we also exclude ophthalmology from the 5+ year surgical residency group because it is a 4-year surgical program.

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

GME participants in New York nearly matches the next two highest training states (California and Pennsylvania) combined (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). For these reasons, this is a highly relevant GME market to study the behavior of teaching hospitals and newly trained physicians.

To execute our primary analyses, we first construct four indicator variables for training physician type: USMGs, USIMGs, H-visa IMGs, and J-visa IMGs. We do so with survey provided information on location of medical school (i.e., domestic versus international) and citizenship status.[16] We then restrict to graduates of our classified 3-year and 5-year residency programs to produce our needed treatment and control groups belonging to the DD analysis. After generating the relevant trend lines for our key GME groups, we implement a straightforward regression model to statistically test for regulation effects:

$$Y_i = \alpha + \beta(3\text{-}YearRes)_i + \varphi(Post)_i + \delta(3\text{-}Year \times Post)_i + \varepsilon_i \quad (1)$$

There are four Y variables in total. Each outcome reflects one of the four immigration groups (i.e., the DD model is estimated for each group separately). We then have indicators for completing a 3-year residency program and for those finishing their training in 2013 and 2014 from either residency program group (i.e., the *Post* variable). The delta parameter belongs to the interaction of these two variables, which captures our DD estimate of interest. Equation 1 is also our preferred model as it directly maps to the

[16] International medical schools are those existing outside of the US and Canada – typical of the related medical literature, and only a handful of respondents report receiving a Canadian medical education in a given year.

displayed trends as well as the DD empirical setup. However, we also estimate two alternative specifications as robustness checks:

$$Y_i = \alpha + \beta(3\text{-}YearRes)_i + \varphi(Post)_i + \delta(3\text{-}Year \times Post)_i + \theta X_i + \varepsilon_i \quad (2)$$

$$Y_i = \alpha + \beta(3\text{-}YearRes)_i + \varphi(Post)_i + \delta(3\text{-}Year \times Post)_i + \theta X_i + \tau + \varepsilon_i \quad (3)$$

Equation 2 incorporates additional demographic characteristics belonging to a given cohort: age, gender, race/ethnicity, medical degree type (MD or DO), and amount of educational debt. Equation 3 then adds a linear time trend to the right-hand side.

2. Secondary Analyses

As described in our conceptual framework, it is important to consider the social welfare implications from any compositional shifts in GME cohorts. To this end, we focus our attention on residency graduates entering non-training direct patient care positions (i.e., taking clinical jobs and formally joining the existing US health care workforce). We 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.[17] For the former, we 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 physician employers. Regarding practice geography, HPSAs and more rural markets are often considered in need of greater provider supply and more accessible medical services, so the proportion of graduates agreeing to work in these locations matters for population health and other health policy

[17] 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.

aims. We in turn construct a binary variable equal to one when the respondent affirms she has taken a job based within a HPSA. Similarly, we make another binary variable that takes the value of one if the respondent reports that her new job will be within a "rural" or "small city (<50,000 population)" market.[18]

Paralleling our primary analyses, we then construct trend lines for no job offers and entry into these practice locations for two separate groups: USMGs and IMGs. Importantly, the latter group is the composite IMG type, which is a part of every cohort by construction (via excess GME capacity) – and we make no further restrictions on the subcomponents belonging to the IMG group in a given year. With this setup, we then have proper treatment and control groups relative to the regulatory change (i.e., it can affect the IMG composite group but should not influence the USMGs) to then estimate another reduced-form DD model. The first equation restricts the analytic sample to those within 3-year programs and entering the clinical workforce:

$$Y_i = \alpha + \beta(IMG)_i + \varphi(Post)_i + \delta(IMG \times Post)_i + \varepsilon_i \quad (4)$$

The outcome variables are each of three variables described above, and the execution and subsequent interpretation of Equation 4 closely follows our primary DD regressions.

We also leverage our graduates of 5-year programs to implement a placebo test in this setting. The third "D" in this analytic setup is an admittedly small group (i.e., IMGs are quite rare among the highly competitive surgical fields), but we still pursue and report these estimates for completeness. The triple-differences (DDD) model has a third indicator variable equal to one for graduates of the longer residency programs (i.e., those

[18] Along with "No" responses, we code "don't know" responses to the HPSA survey question as a zero as well since we our 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 we 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.

unexposed to the regulatory shift). If our prior model (Equation 4) is appropriately capturing an effect attributable to regulatory behavior, then we 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 GME compositional changes. To operationalize the DDD placebo test, we estimate the following specification:

$$Y_i = \alpha + \beta(IMG)_i + \varphi(Post)_i + \gamma(5\text{-}YearRes)_i + \delta(IMG \times Post)_i + \lambda_1(IMG \times 5\text{-}Year)_i + \lambda_2(Post \times 5\text{-}Year)_i + \lambda_3(IMG \times Post \times 5\text{-}Year)_i + \varepsilon_i \quad (5)$$

We also re-estimate Equations 4 and 5 with the same demographic variables found in our primary analyses as another robustness check. For all of our primary and secondary analyses, we use case-wise deletion for observations lacking full information on model-included variables. We also rely on Huber-White robust standard errors since all of our outcome variables are binary.

We finish our empirical work with the GME data by descriptively displaying the rates of our three post-training outcomes for each of our three IMG subtypes. The rates are pooled across all years and can further elucidate if changes in cohort composition (primary analyses) underpin any observed changes in IMG labor market outcomes (secondary analyses).

V. Results

A. Changing Composition of Residency Cohorts

Figure 2 restricts to H1B and USIMG residents within 3-year programs and reveals our 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), we see sharp trend changes. Once heightened regulation is introduced, only about 14% of a cohort belongs to the H-visa group – meanwhile 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 H1B 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 3 and 4 place the trends from Figure 2 alongside their respective control group counterparts (i.e., the 5+ year residencies). As evident from both figures, H1B and USIMGs play smaller roles among these surgical fields – around 10% of a given cohort or less – and the trajectories are nearly flat. Appendix Figure 2 displays the control group trends in isolation for easier viewing. For the purposes of our 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 3 and 4, this DD identification assumption seems appropriate within our research setting. Of note, we also do not see any apparent movements in the control groups' trends in later cohorts – indicating a differential experience for those actually exposed to the regulatory change.

Before formally testing these changes within our DD framework, we summarize some other compositional features of these 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.[19] 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. Moving to Table 2, we have our core DD results modeled 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 as robustness checks. In the first column, we can see that residents in 3-year programs are 14-percentage points more likely to hold an H1B, but this differential shrinks by 4-percentage points after stronger regulatory enforcement is introduced. The DD estimate is also statistically significant with a t-statistic of 2.85. 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 belongs to the subsequent three columns focused on USIMGs. The clear difference is the opposite sign for the DD estimate, which confirms training hospitals' substitution for more USIMGs in place of H1Bs. Controlling for other compositional characteristics and a linear time trend also does not change our inferences. Table 3 performs identical exercises for J1 IMGs and USMGs. The DD estimates are uniformly small and imprecise across all specifications. Consistent with the prior figures, the shift in hospital recruitment behavior appears concentrated within the H1B and USIMG applicant pools.

B. Post-Training Labor Market Outcomes

While our first contribution is empirically demonstrating training hospitals' change in taste for different residents within a setting of stricter immigration law enforcement, we

[19] 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".

can leverage other features of our unique data to explore policy and welfare relevant consequences.

Figure 5 shows the fraction of jobseekers without any offers at the time the survey was completed. Not many trainees experience this outcome in a given year (2 – 6%), and prior to the 2013 cohort, IMGs are no more likely than USMGs to still be searching – and actually less likely in the more proximate years. However, IMGs experience a strong reversal of fortune after 2013, with elevated rates of jobless trainees at a time when the rate for USMGs has actually fallen. Moving to our practice location outcomes, Figure 6 plots the entry rate of USMGs versus IMGs into post-GME clinical positions within underserved areas. One trend is for HPSA practices, while the other is for less urban practice settings (i.e., rural and small city). Over our study period, USMGs, from 3-year programs, generally oscillate between 15 – 20% of graduates accepting jobs in these areas, with stable rates over time. Conversely, IMGs often enter these physician labor markets at double the USMG rate prior to 2013, but for the exposed cohorts, IMG rates drop to below 30%. Their decline represents a 17% reduction (or more) when compared to the pre-regulation levels.

Table 4 presents formal analyses of the changes witnessed in Figures 5 and 6. Columns 1 and 2 confirm the pattern seen in Figure 5. 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 DD 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 DDD placebo tests (Appendix Tables 1 and 2) helps support our inferences – though we maintain the caveat that IMGs in surgical programs represent a small trainee subgroup.

Figure 7 disaggregates the IMG group into its subcomponents to descriptively examine each of our three labor market outcomes by resident type. It is clear in Figure 7 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., HPSA or less urban location) when compared to their H1B counterparts. The descriptive patters are consistent with what we empirically observe in our primary and secondary analyses and suggest that teaching hospitals' substitution of resident labor in response to the new regulatory environment is not without consequence.

VI. Discussion and Conclusions

Although teaching hospitals are exempt from some H1B rules and mandates, we show that other regulatory changes targeting H-visa workers can significantly influence the composition of new physician cohorts. Imposing greater costs on teaching hospitals and/or disrupting the pool of GME applicants lowers their demand for H-visa residents by 25% in our data. Training hospitals consequently rely on greater quantities of USIMG labor to compensate for their reduction in H1B physicians, and the behavior we

empirically document implies that these institutions – and hence this particular labor market – are strongly sensitive to the prevailing immigration law and enforcement level.

Our findings also suggest that distorting the residency labor markets through more stringent regulation can have downstream consequences. First, an H1B applicant excluded from US GME is having her long-run earnings potential artificially suppressed. Source countries may perceive some benefit from this – e.g., other work indicates they suffer fiscal losses when their high-skilled migrate abroad (Desai et al. 2009) – but from the perspective of the individual, this is welfare reducing. USIMGs clearly gain from the present regulatory shift in terms of training placement, without investment in additional human capital or other quality signals. Future USIMGs may prefer that the GME distortion be sustained, but there is little reason to believe that this is the socially optimal strategy. As for the overarching system, both clinician quality and distribution seem to be negatively impacted by the labor adjustment. For example, we observe some evidence that the greater influx of USIMGs makes the IMG composite group less attractive to post-training physician employers – plausibly due to lower perceived skill. The result is not necessarily surprising since non-USIMGs migrating to the US are often the top performers in their foreign schools (Gozu, Kern, and Wright 2009) – in contrast with USIMGS where many, if not all, failed to matriculate into any of the 141 US-based schools. Moreover, prior to arriving in the US, many non-USIMGs have undergone extensive clinical work within their home country (perhaps even completing a residency equivalent) and often needed to excel within self-taught environments in order to migrate (McDonald, Zeger, and Kolars 2007). Non-USIMGs have also outperformed USIMGs on general medical licensing exams (i.e., the USMLE Step 1 and Step 2 CK), specialty

exams administered during residency (Boulet et al. 2009, Boulet et al. 2006, Garibaldi et al. 2002, Norcini, Anderson, and McKinley 2006, Norcini et al. 2010), and other clinical aptitudes (Norcini et al. 2010). Taken together, average H1B human capital may be greater than USIMGs at baseline, and some already voice concerns about the sufficiency of USIMGs pre-GME educational exposure (Boulet et al. 2009, Eckhert 2010).

Beyond resident quality, our data facilitate a direct estimate of the regulatory burden's effect on new physician entry into underserved areas. The subsequent decline of IMGs accepting jobs in these markets is consistent with H1B and USIMG residents having different preferences over their future practice locations. Changes in IMG compositional mix among affected cohorts can then alter the eventual allocation of newly trained physicians. This, in turn, can challenge physician employers from these markets if they face less affinity toward these jobs among prospective recruits – perhaps forcing them to offer more expensive pay packages (a drain on scarce resources) or endure persistent physician vacancies. Research has shown the role IMGs in staffing community health centers and other safety net practices in these same locations (Rosenblatt et al. 2006); thus, our results shed light on an unintended consequence of tougher immigration rules.

In a recent paper, Mithas and Lucas (2010) encourage skepticism toward calls for more restrictive immigration laws as a means to protect foreign professionals. Norcini and colleagues (2010) similarly remark that policies shaping the pool of non-USIMGs may have underappreciated importance, especially if IMGs drawn from this group are relatively better skilled. Our empirical work directly speaks to the sentiment from each of these authors and demonstrates specific negative spillovers from broad immigration laws.

Distorting the residency labor market can misalign training hospital incentives with the objectives of the overarching health care system (i.e., maximizing GME cohort quality and improving provider access). In this way, altering training hospitals' short-run interests can generate long-run social costs.

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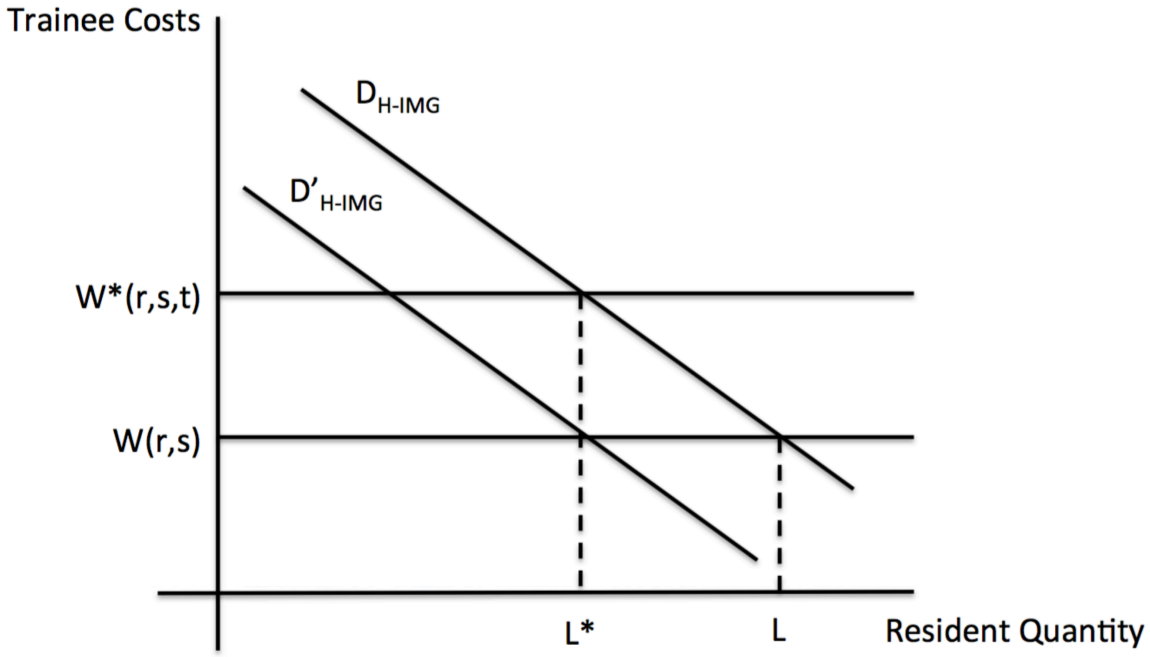
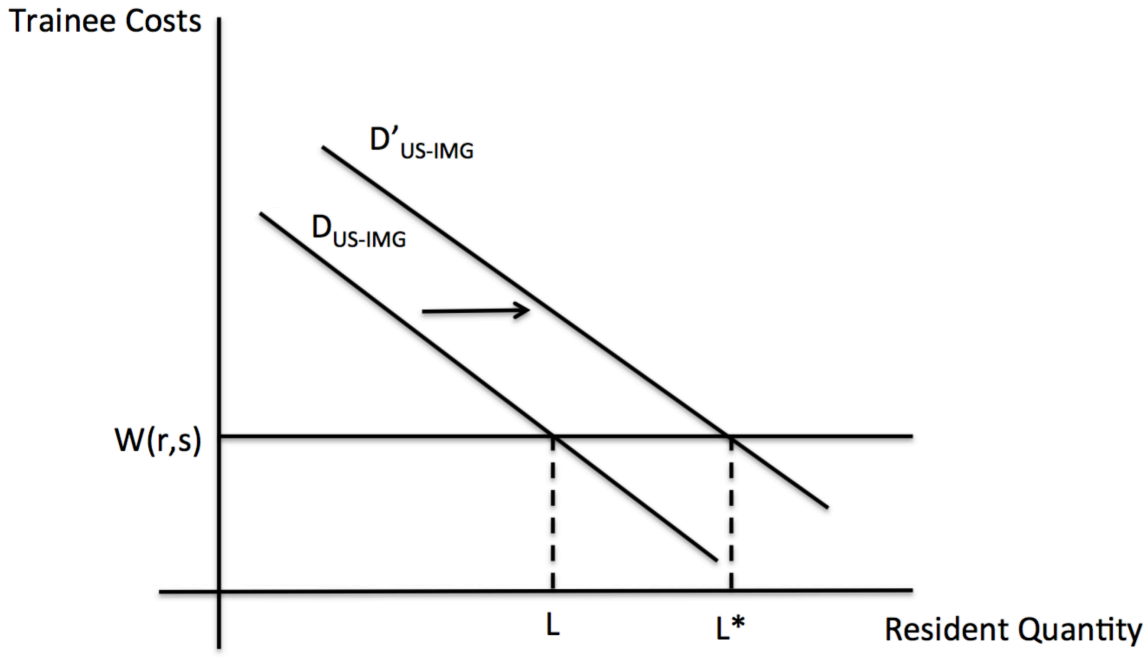
TABLES AND FIGURES

Figure 1A: Demand for H-visa Residents Before and After the Regulatory Change



Note: The total cost of a trainee (W) includes: recruitment costs (r), amount of subsidies devoted to trainee pay (s), and after the regulation change (W*) the implicit tax on H1B recruits (t)

Figure 1B: Demand for USIMG Residents Before and After the Regulatory Change



Note: The total cost of a trainee (W) includes: recruitment costs (r) and amount of subsidies devoted to trainee pay (s). The regulatory shift labor demand curve (D') is shifted out

Figure 2: Compositional Changes in Cohorts among Three-Year Residency Programs, 2007 – 2014

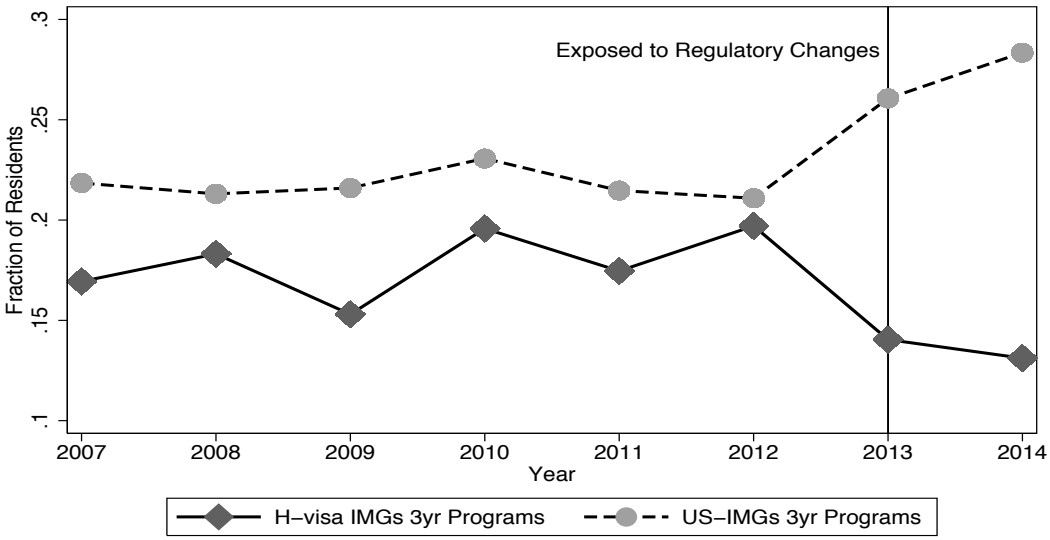
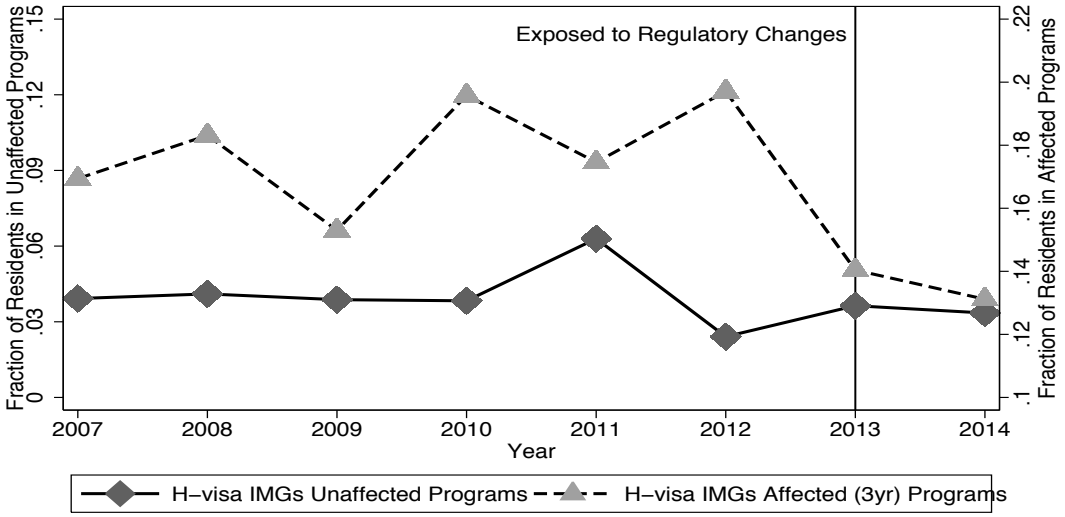
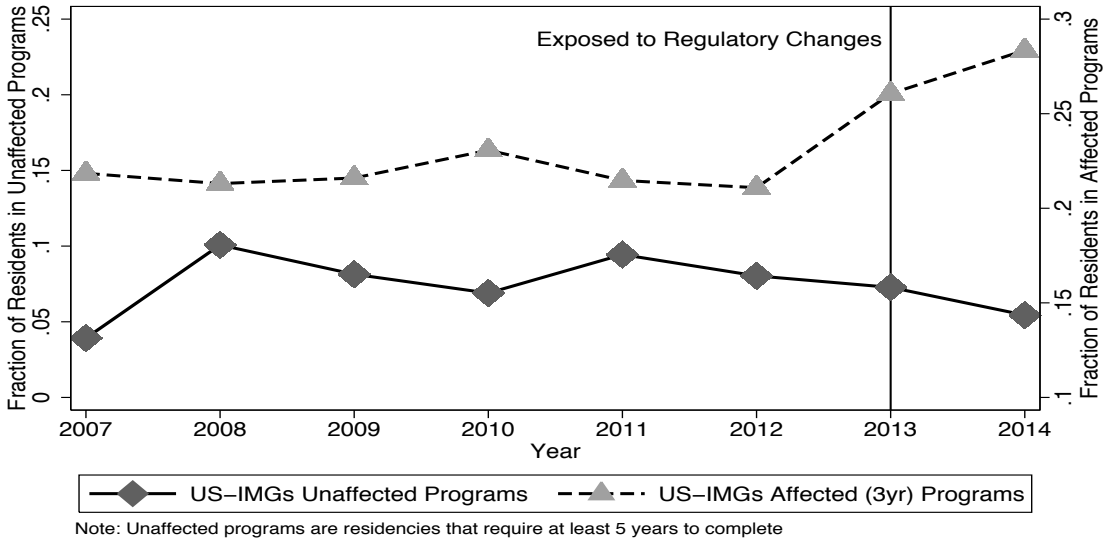


Figure 3: Use of H-visa Residents Among Treated and Untreated Residency Programs



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

Figure 4: Use of USIMGs Among Treated and Untreated Residency Programs



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

TABLE 1:
Demographic Summary Characteristics of GME 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 GME 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 GME Cohorts

	Difference-in-Differences Analyses					
	Outcome: H-visa IMG			Outcome: USIMG		
	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
Covariates		Yes	Yes		Yes	Yes
Linear Time Trend			Yes			Yes
Observations	10,342	9205	9205	10,342	9205	9205

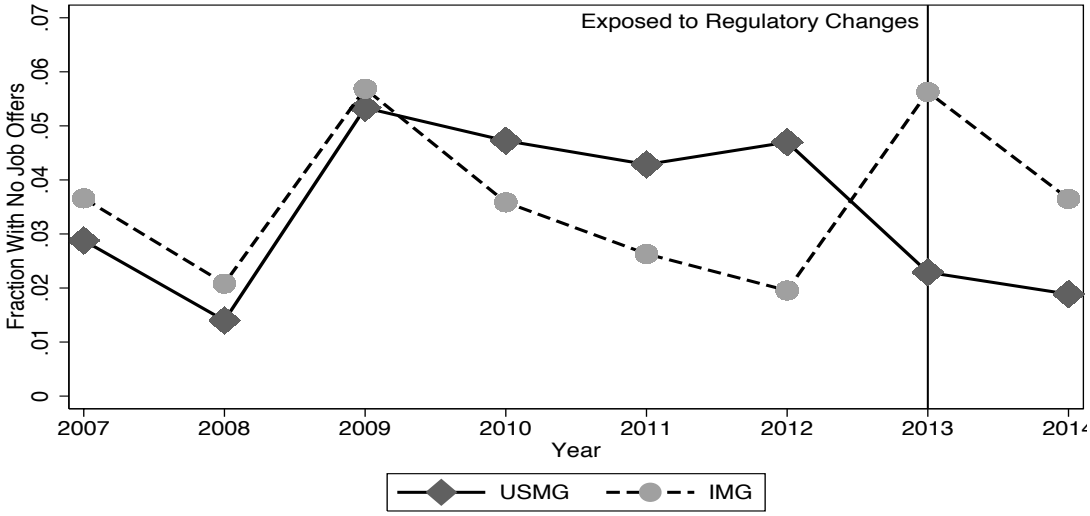
*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information
Sample restricted to respondents within 3 or 5+ year programs: 3-Year programs include: emergency medicine, family medicine, internal medicine, 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 GME cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

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

	Difference-in-Differences Analyses					
	Outcome: J-visa IMG			Outcome: USMG		
	(1)	(2)	(3)	(1)	(2)	(3)
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)
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)
Covariates		Yes	Yes		Yes	Yes
Linear Time Trend			Yes			Yes
Observations	10,342	9205	9205	10,342	9205	9205

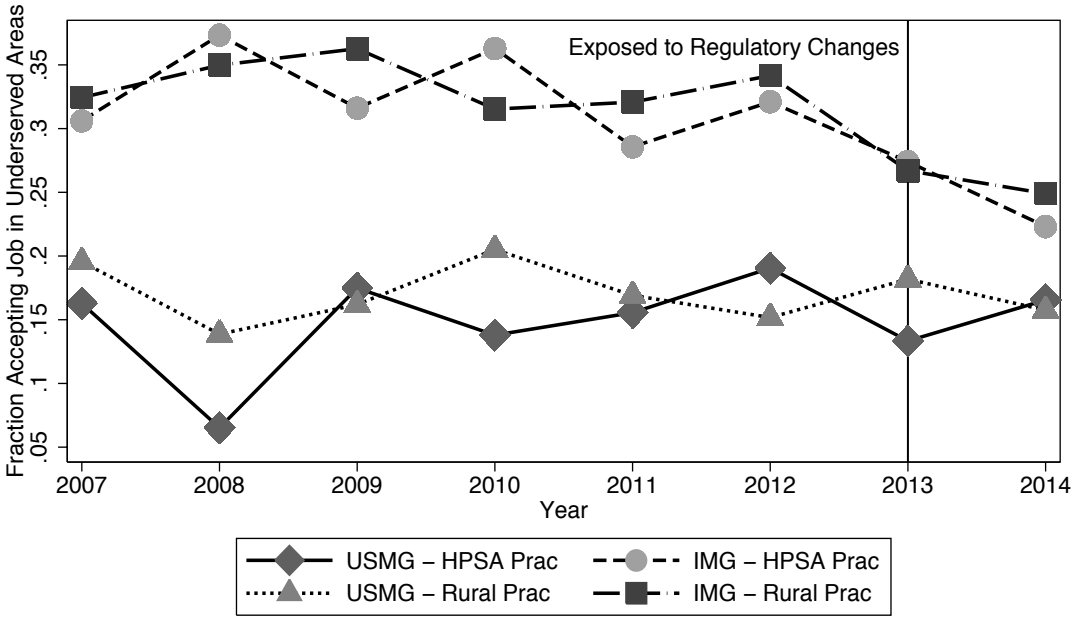
*** P value at 0.01 ** P value at 0.05 * P value at 0.10 Huber-White standard errors throughout, case wise deletion for observations with missing information
Sample restricted to respondents within 3 or 5+ year programs: 3-Year programs include: emergency medicine, family medicine, internal medicine, 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 GME cohorts
Covariates include: age, gender, ethnicity, degree type, and educational debt

Figure 5: USMG and IMG Trends for Receiving Zero Job Offers by the Time of the Workforce Survey among 3-Year Residency Programs, 2007 – 2014



Note: Sample restricted to those entering direct patient care in a non–training position and completing a 3–year program

Figure 6: USMG and IMG Trends in Accepting Jobs in HPSA and Less Urban Areas among 3-Year Residency Programs, 2007 – 2014



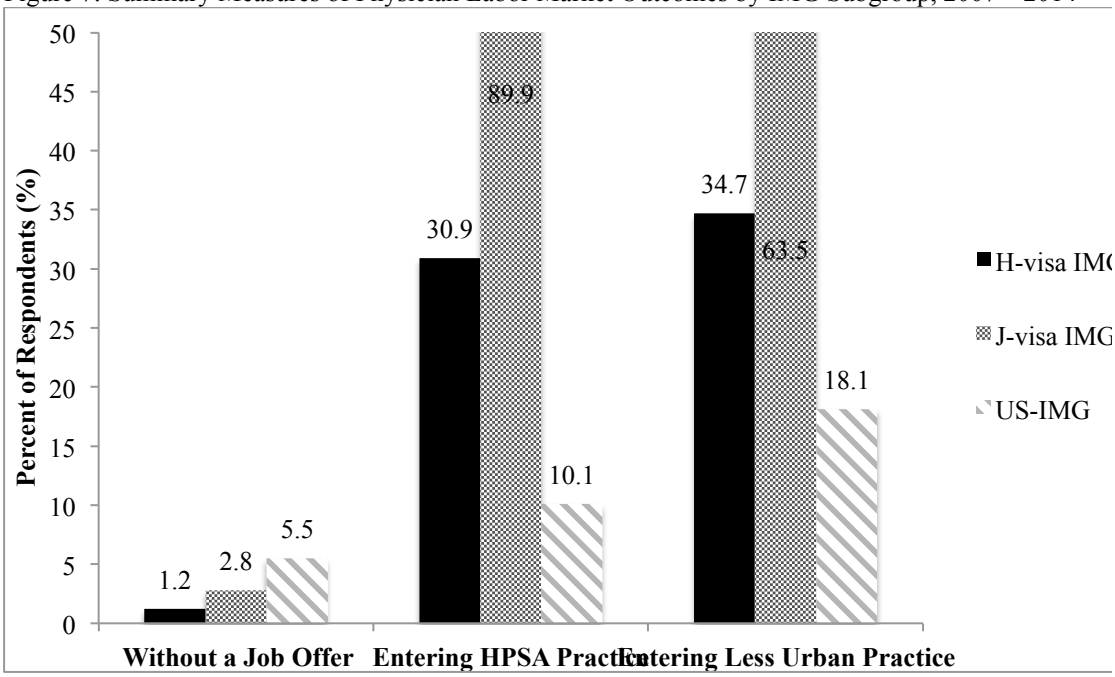
Note: Sample restricted to those entering direct patient care in a non–training position and completing a 3–year program

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	-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)
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)
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 GME 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

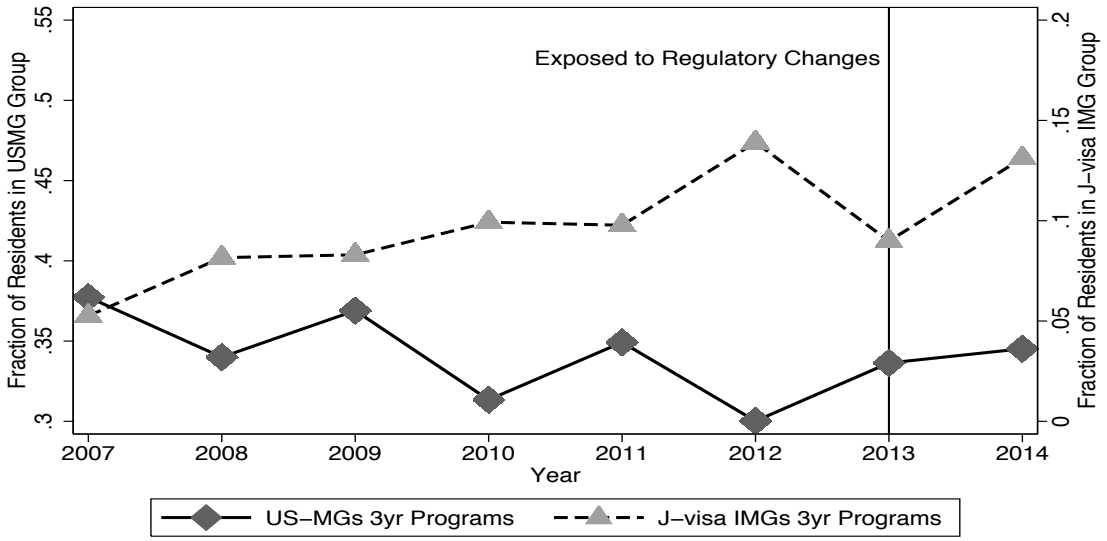
Figure 7: Summary Measures of Physician Labor Market Outcomes by IMG Subgroup, 2007 – 2014



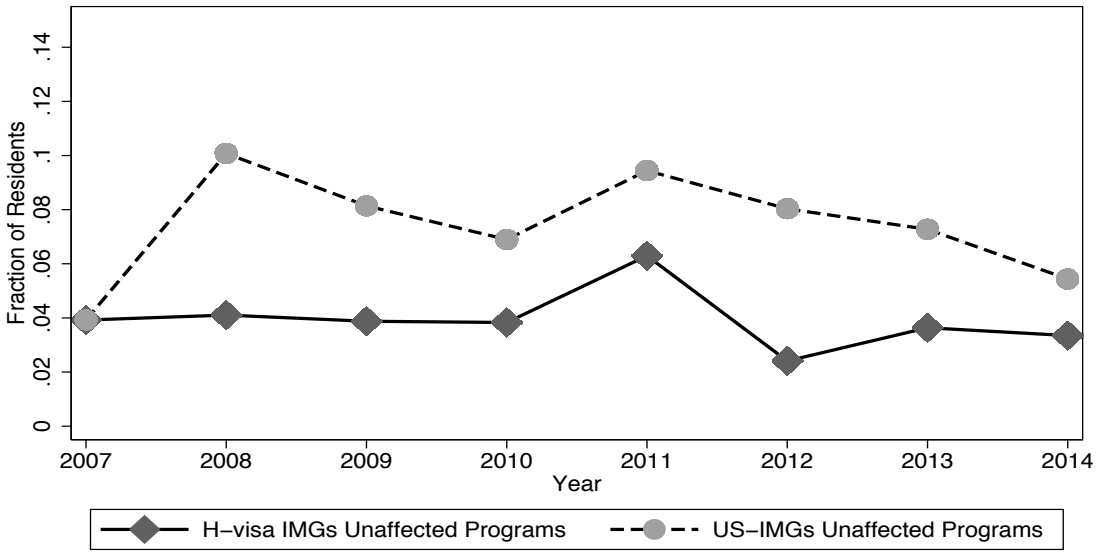
Note: Samples restricted to those completing 3-year residency programs and planning to enter a non-training direct patient care position within US markets. The practice setting measures for J-visa IMGs ar not fully reflected by the truncated bars; instead, they are captured by the numerical values present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

APPENDIX TABLES AND FIGURES

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



Appendix Figure 2: Compositional Trends in H-visa and USIMG Residents within Programs Lasting at least 5 Years



Note: Graphic includes residency programs that require at least 5 years to complete

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	-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)
IMG x Post	0.039***	0.040***	0.039***	0.041***
	(0.014)	(0.015)	(0.014)	(0.015)
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 GME 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	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)
IMG x Post	-0.084***	-0.073**	-0.084***	-0.073**
	(0.032)	(0.033)	(0.032)	(0.033)
DDD Estimate				
IMG x Post x 5-Year	--	--	-0.057	0.008
	--	--	(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	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)
IMG x Post	-0.071**	-0.048	-0.071**	-0.049
	(0.034)	(0.036)	(0.034)	(0.036)
DDD Estimate				
IMG x Post x 5-Year	--	--	0.208	0.127
	--	--	(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 GME cohorts

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