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# Settling for Academia?

## H-1B Visas and the Career Choices of International Students in the United States

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**Catalina Amuedo-Dorantes**  
**Delia Furtado**

### ABSTRACT

*The yearly cap on H-1B visas became binding for the first time in 2004, making it harder for college-educated foreigners to work in the United States. However, academic institutions are exempt from the cap, and citizens of five countries (Canada, Mexico, Chile, Singapore, and Australia) have access to alternative work visas. We exploit these exemptions to gauge how immigrant career choices have been affected by the binding visa cap. Among other impacts, the binding cap raises international students' likelihood of employment in academia, even outside of their field of study, a result consistent with the notion of "settling" for academia.*

### I. Introduction

Proponents of more open immigration policy often cite the ability of immigrants to address shortages of workers in specific fields. For example, the relationship between workers in STEM fields (science, technology, engineering, and mathematics) and both innovation and economic growth have led some policymakers to propose "stapling" green cards to the diplomas of noncitizens who earn advanced degrees in STEM fields from U.S. universities (Thibodeau 2016). Others have advocated special work visas for healthcare professionals to address the growing healthcare


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*Catalina Amuedo-Dorantes is a professor of economics at San Diego State University (camuedod@mail.sdsu.edu). Delia Furtado is an associate professor of economics at the University of Connecticut (Delia.Furtado@uconn.edu). The authors thank conference participants at the PAA meeting in Seattle, the SOLE meeting in Montreal, the Eastern Economics Association meeting in Washington, DC, the WEA meeting in San Diego, and the European Economics Association Annual Congress in Lisbon as well as seminar participants at the Brookings Institute, Marquette University, the Office of the Comptroller of the Currency, and the University of Wisconsin–Milwaukee. The data used in this article are publicly available at <https://ncesdata.nsf.gov/datadownload/>, and the authors are willing to assist (camuedod@mail.sdsu.edu).*

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needs of an aging population.<sup>1</sup> Critics of occupation- or industry-specific visas worry that these policies would create perverse incentives in both the labor and educational markets. This paper examines how the newly binding H-1B visa cap for employment in the private sector affected career choices of international students in the United States given that those employed in academia and several other industries were exempt from the cap.

The H-1B visa was established within the 1990 Immigration and Nationality Act to allow U.S. employers to temporarily hire foreign-born workers in specialty, high-skill occupations. The work authorization is limited to the sponsoring employer and lasts for three years, with the possibility of a three-year renewal and the sponsorship of permanent residency (that is, a green card). The number of H-1B visas, which had been initially capped at 65,000 per year, was temporarily increased to 115,000 in 1999 and 2000 and further to 195,000 in 2001, 2002, and 2003. However, the legislation granting these temporary increases expired in 2004, so the visa cap for bachelor's degrees was reinstated to 65,000. Despite that the H-1B Visa Reform Act of 2004 made available an additional 20,000 visas for applicants with U.S. postgraduate degrees, starting in 2005, it suddenly became significantly harder for foreigners to secure legal employment in the United States, at least in the for-profit private sector (Ruiz 2017).

Since the passage of the American Competitiveness in the 21st Century Act of 2000 (AC21), however, several types of employers have been exempt from the cap. Specifically, institutions of higher education, nonprofit entities affiliated with institutions of higher education and nonprofit or U.S. governmental research organizations can apply for as many H-1B visas as they need for their workers without worrying about the cap. Although the exemptions are focused on research-oriented institutions, all employees of these institutions are exempt from the cap, regardless of whether research is a main part of their jobs. For example, an IT person working at a nonprofit research organization would be exempt from the cap, while a research scientist working at a private sector firm would not.

We aim to determine whether immigrants who would have otherwise worked in the private sector started pursuing careers in the cap-exempt sectors, predominantly colleges and universities, as a result of the change in visa policy.<sup>2</sup> To answer this question, we use a control group of immigrants who were not bound by the lower visa cap. Specifically, free trade agreements allowed citizens from five countries (Canada, Mexico, Chile, Singapore, and Australia) to apply for close H-1B visa substitutes (Kato and Sparber 2013; Shih 2016). We thus examine whether international students graduating during or after 2004 became more likely to pursue an academic career if they were from a country without an H-1B substitute visa relative to their counterparts from one of the five countries with other work visas available.

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1. The H-1A visa category, established through the 1989 Immigration Nursing Relief Act to allow for temporary employment of foreign-born nurses, expired in 1995. The H-1C visa program, established through the Nursing Relief for Disadvantaged Areas Act of 1999, was directed toward nurses in hospitals located in designated "health professional shortage areas" serving a minimum share of Medicaid and Medicare patients. This program expired in 2009.

2. Because we are not able to identify all of the cap-exempt institutions in our data, we will examine the impact of the policy on the likelihood of working in institutions of higher education and any affiliated research institutes. More than 80 percent of the cap-exempt H-1B applications are for academic institutions (Sparber 2015). For the remainder of the paper, we will generally use the term "academia" to refer to cap-exempt careers and the term "private sector" to refer to all other careers.

A prolific literature has provided either direct or indirect evidence of significant reductions in the number of high-skilled immigrants working in the United States when the visas became scarce (for example, Ghosh, Mayda, and Ortega 2014; Peri, Shih, and Sparber 2015a,b). The bulk of that literature focuses on the impact of visa scarcity on U.S. firms and native-born workers' outcomes, but several papers examine the effects on H-1B holders themselves. For example, Clemens (2013) shows that Indian programmers who come to the United States after winning the H-1B lottery earn wages six times higher than comparable workers who lose the lottery and stay in India. More recently, Sparber (2015) shows that wages on H-1B applications from the private sector (bound by the cap) increase after the yearly cap is reached relative to wages on H-1B applications from academic institutions (unbound by the cap). He interprets this result as evidence that workers with an H-1B visa in the private sector are able to negotiate higher wages (at a different firm) once the competition has subdued.<sup>3</sup>

We build on this literature by examining how visa scarcity affects whether college-educated immigrants who first came to the United States on a student visa pursue careers in academia or the private sector. Understanding how the binding H-1B visa cap impacts the employment choices of immigrants is a first step in learning about its further impacts on natives. Learning how immigrants react to the more restrictive work visa policy can also inform us about the effectiveness of this type of policy in steering labor towards specific sectors and needs. Given the crucial role played by academia in higher education and innovation, it is essential to understand how a binding H-1B visa cap alters immigrants' career choices and, in turn, the sector's labor composition.

Using several years of data from the National Survey of College Graduates (NSCG), a representative dataset of the U.S. college-educated population, we find that a post-2003 graduation is associated with a 7.1 percentage point higher likelihood of working in academic institutions for the foreign-born from countries impacted by the visa cap relative to those from countries with alternative visas. This finding, which is driven by students with a B.A. or professional degree and by STEM students, is robust to various changes to the composition of the control and treatment countries, as well as to other changes to the sample and model specification. We also provide evidence supporting our identification assumptions.

We then explore the mechanisms through which H-1B visa caps might be impacting the careers of international students in the United States. It is possible that international students wanting to pursue a career in the private sector simply return to their home countries, or move to a third country, if scarce H-1B visas make it difficult to remain in the United States after graduation. Given that return migration decisions of those planning academic careers would not be (directly) affected by reductions of the visa cap, the resulting selective out-migration would generate an increase in the proportion of immigrants relying on H-1Bs in academia among foreign-born graduates remaining in the United States. Because we only have data on those residing in the United States at the time of the survey, we cannot gauge the degree to which our findings are due to this type of selective return migration. However, we provide suggestive evidence that the latter is not likely the main driver of our results. To that end, instead of considering the impact of

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3. Cap-exempt H-1B holders need to apply for a new H-1B visa (subject to the cap) to switch to the private sector. Private sector H-1B holders must also apply for a new H-1B visa to switch jobs within the private sector, but they are not subject to the cap a second time.

the visa policy change on the *likelihood* of pursuing careers in academia, we examine how the reduction in the visa cap impacted the *number* of graduates employed in academia and in the private sector, separately. If our results were mostly driven by selective return migration, we would expect to see fewer international students from countries impacted by the change in the visa policy working in the private sector, but no significant change in the number employed in the academic sector. Instead, we find evidence of an increase in the number of foreign-born graduates employed in academia, but no significant change in the number working in the private sector.

We then offer evidence of alternative mechanisms driving our findings. First, we consider whether students who would have otherwise prepared for a career in the private sector tailor their studies for a career in academia by pursuing postgraduate studies. Limiting our sample to international students who completed their B.A. degrees in the United States, we find no evidence of students from H-1B visa-bound countries becoming relatively more likely to pursue a postgraduate degree when visas became scarce. Second, we explore whether graduates from countries without H-1B substitutes have become more likely to settle for job offers within academia following the reinstatement of the lower visa cap. We find that immigrants from countries impacted by the visa cap working in academia became more likely to work in a field outside of their expertise if they graduated after the policy change. This relationship is not observed among workers in the private sector, suggesting that foreign-born students unable to secure employment in the private sector after the reinstatement of the lower visa cap may have accepted job offers in unrelated fields within academia.

The remainder of the paper proceeds as follows. Section II provides a brief background of the literature. A description of our data is presented in Section III. Section IV follows with an explanation of our baseline model and identification strategy, whereas Section V presents our baseline results as well as robustness and identification checks. Tests for heterogeneous effects are discussed in Section VI, and Section VII follows with an examination of the mechanisms through which visa caps impact career decisions. Section VIII summarizes our findings and concludes.

## II. Relevant Literatures

The present study builds on two related literatures and their employed methodologies. The first explores the impact of graduating during a recession on economic outcomes (Altonji, Kahn, and Speer 2016; Kahn 2010; Oreopoulos, von Wachter, and Heisz 2012). As discussed in Oreopoulos et al. (2012), Canadians who graduate from college during a recession start their careers at lower paying jobs. Although their earnings recover, mostly because they move to better paying firms, earnings losses last an average of ten years and can even be permanent for certain groups.<sup>4</sup> The variation in attractiveness of different career choices across graduation

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4. Using panel data on students in the United States, Kahn (2010) finds that graduating in a recession can have permanent impacts. In an analysis of more recent data, Altonji, Kahn, and Speer (2016) again find persistent wage impacts of graduating during a recession, with larger earnings losses for those graduating during the Great Recession than would have been predicted from earlier economic downturns.

years also has implications for the relative quality of workers in different fields depending on when they were hired. For example, teachers starting their careers during recessions are better at raising student test scores (Nagler, Piopiunik, and West 2015).

In our paper, instead of examining the responsiveness of career trajectories to economic conditions at the time of graduation, we explore international students' responsiveness to H-1B visa scarcity at the time of graduation. Because we do not observe entire employment histories, we can only measure the impact of visa scarcity at graduation on employment at the time of the survey. However, given that graduating in recessions has been found to have long run implications, it is not unreasonable to expect that graduating when visas are scarce has an effect, not only on students observed immediately after graduation, but also on those observed years later.

The second group of studies upon which our analysis builds exploits the fact that immigrants from five countries have had alternative visas to the H-1B allowing them to work in the United States (Kato and Sparber 2013; Shih 2016). The North American Free Trade Agreement, enacted in 1994, created the TN (Trade NAFTA) visa for professionals from Canada and Mexico. Although the approved list of occupations is more restrictive than that of the H-1B, each occupation is associated with college degree holders. There is no limit to the number of TN visas that can be issued. Furthermore, two free trade agreements signed by President Bush on September 3, 2003 created the H-1B1 program by setting aside up to 5,400 of the annual H-1B visas for citizens of Singapore and up to 1,400 for Chileans. These visas are subtracted from the overall H-1B visa cap, but unused H-1B1 visas are made available, as H-1B visas, to citizens of other countries. Finally, a bill signed on May 11, 2005 established 10,500 annual E-3 visas for Australian professionals. The caps on E-3 and H-1B1 visas have never been reached.

These alternate visas are not perfect substitutes for the H-1B. Most importantly, they are meant to be used for temporary stays. That said, they do allow foreign nationals to work in the United States, and they can be renewed indefinitely. Shih (2016) shows how quickly immigrants from Canada, Mexico, Chile, and Singapore became more likely to use the substitute visas when the cap on the H-1B became binding. Despite falls in the number of H-1B visas issued to Australians starting in 2001, the total number of work visas (H-1B plus E3) issued to Australians spiked after 2005 when the E3 was introduced (Shih 2016).

Exploiting this variation by country of origin, Kato and Sparber (2013) show that the quality of students, as measured by SAT scores, pursuing an undergraduate degree in the United States decreased in response to binding H-1B caps. They interpret this as evidence that the opportunity to work in the United States is a main motivation for high ability students' decisions to study in the country. When visas become scarce, these high ability students become less likely to pursue U.S. bachelor's degrees, whereas low ability students, who may not have ever intended to work in the United States, are less affected. In a related analysis using a similar identification strategy, Shih (2016) shows that the H-1B visa cap cut decreased the number of students pursuing degrees in the United States. We contribute to this literature by examining whether international students from countries without substitute visas who graduated after the policy change became more likely to pursue careers in academia relative to those originating in countries with access to alternative work visas.

Our findings complement those from a growing literature exploiting the same visa-cap variation to examine the impacts of high-skilled immigrants on innovation and

productivity. Using state panel data, Hunt and Gauthier-Loiselle (2010) show that increases in the share of foreign-born college graduates lead to increases in the number of patents per capita. In a similar vein, Kerr and Lincoln (2010) find that H-1B admissions are associated with more patents by people with Indian and Chinese last names, without meaningful decreases in the number of patents by natives. Lastly, exploiting variation in H-1B visa caps in conjunction with the distribution of STEM workers across U.S. cities before the start of the H-1B program, Peri, Shih, and Sparber (2015a) find that H-1B driven increases in STEM workers are associated with higher wages for native workers, especially high-skilled natives. Their finding suggests that high-skilled foreign-born workers, at least those in STEM fields where innovation is central, complement high-skilled natives in production. Consistent with this assessment, Kerr, Kerr, and Lincoln (2015b) find that firms hiring more skilled foreign workers also hire more native workers.

These overall conclusions, however, are controversial. Comparing H-1B lottery winners and losers in fiscal years 2007 and 2008, Doran, Gelber, and Isen (2014) find no evidence of differences in patenting within eight years of the lottery. They find that lottery-winning firms pay lower wages and earn higher profits than lottery-losing firms.<sup>5</sup> However, Peri, Shih, and Sparber (2015b) find that wages of native computer science workers were either unchanged or harmed in cities where many H-1B applications were denied. We contribute to this literature on the effects of H-1B cap restrictions by considering their impacts on the career choices of those requiring the visa as opposed to the impacts on native workers and firms.

### III. Data and Descriptive Statistics

We rely on data from the 2003, 2010, and 2013 National Survey of College Graduates (NSCG). The NSCG provides coverage of the nation's college-educated population as of the survey reference date, and it includes information on demographics, educational attainment, degree field, and sector of employment, among other characteristics. Our sample consists of immigrants who first came to the United States for more than six months on a student visa,<sup>6</sup> graduated in or after 1993, were living and working in the United States at the time of the survey, and had nonmissing information on our variables of interest. Although studying in the United States is not a prerequisite for receiving an H-1B visa, we focus on international students because we can identify a year that they might specifically be looking for a job in the United States.

Table 1A provides some basic employment and demographic characteristics of foreign-born college graduates in our sample according to whether they are from countries bound by the H-1B visa cap. While similar in age, foreign-born college graduates from countries bound by the cap are more likely to be male, black, and Asian than their counterparts from unbound countries. A significantly higher share has completed a master's or a Ph.D. than foreigners from nations unbound by the visa cap. They are also more likely to have graduated between 1998 and 2007, but less likely to have graduated

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5. Using an identification strategy similar to the one in Kerr and Lincoln (2010), Ghosh, Mayda, and Ortega (2014) show that H-1B visa restrictions are associated with losses in average labor productivity and with reductions in firm size and profits in a subset of firms that conduct R&D and are heavy users of H-1B workers.

6. Of the H-1B visas awarded in 2012, 35 percent were transferring from a student visa (Ruiz 2013).

**Table 1**  
*Summary Statistics*

	Bound by H-1B Visa Cap ( <i>HIB</i> = 1)		Not Bound by H-1B Visa Cap ( <i>HIB</i> = 0)	
	Mean	SD	Mean	SD
<b>Panel A: Full Sample</b>				
Employment in the academic sector	0.233	0.423	0.203	0.402
Age	37.577	7.975	38.613	8.798
Male	0.642	0.479	0.445	0.497
Married	0.724	0.447	0.711	0.454
White	0.236	0.424	0.545	0.498
Black	0.083	0.275	0.004	0.064
Asian	0.601	0.49	0.091	0.287
Hispanic	0.075	0.264	0.286	0.452
B.A. degree	0.221	0.415	0.401	0.491
M.A. degree	0.505	0.5	0.375	0.485
Ph.D. degree	0.234	0.424	0.149	0.357
Professional degree	0.04	0.196	0.075	0.264
Father with college degree	0.316	0.465	0.303	0.46
Father with more than college	0.248	0.432	0.248	0.432
Mother with college degree	0.224	0.417	0.165	0.371
Mother with more than college	0.142	0.349	0.135	0.342
Year of graduation: <1997 (highest degree)	0.259	0.438	0.363	0.481
Year of graduation: 1998–2002 (highest degree)	0.26	0.439	0.242	0.429
Year of graduation: 2003–2007 (highest degree)	0.279	0.449	0.138	0.345
Year of graduation: 2008–2013 (highest degree)	0.201	0.401	0.258	0.438
New England	0.06	0.238	0.066	0.249
Middle Atlantic	0.179	0.383	0.192	0.394
East North Central	0.128	0.334	0.109	0.312
West North Central	0.037	0.19	0.029	0.167
South Atlantic	0.199	0.399	0.161	0.368
East South Central	0.027	0.161	0.006	0.075
West South Central	0.092	0.288	0.113	0.317
Mountain	0.037	0.19	0.124	0.33
Pacific	0.241	0.428	0.2	0.4
Field: Computer and mathematical sciences	0.148	0.356	0.028	0.164

(continued)

**Table 1** (continued)

	Bound by H-1B Visa Cap ( <i>HIB</i> = 1)		Not Bound by H-1B Visa Cap ( <i>HIB</i> = 0)	
	Mean	SD	Mean	SD
Field: Biological, agricultural, and environmental life sciences	0.1	0.3	0.098	0.297
Field: Physical and related sciences	0.054	0.226	0.044	0.204
Field: Social and related sciences	0.064	0.244	0.086	0.281
Field: Engineering	0.205	0.404	0.079	0.27
Field: Science and engineering related fields	0.118	0.323	0.161	0.368
Field: Nonscience and engineering related fields	0.31	0.463	0.505	0.5
Survey year: 2003	0.171	0.377	0.204	0.403
Survey year: 2010	0.375	0.484	0.344	0.475
Survey year: 2013	0.454	0.498	0.452	0.498
Observations	9,090		536	

	Foreign-Born from Countries Needing H-1B		Foreign-Born from Countries with Substitute Visas	
	Mean	SD	Mean	SD
Employment in the academic sector	0.171	0.377	0.192	0.394
Age	40.177	7.13	39.88	7.307
Male	0.651	0.477	0.517	0.5
Married	0.82	0.384	0.767	0.423
White	0.247	0.431	0.592	0.492
Black	0.064	0.245	0.003	0.052
Asian	0.604	0.489	0.114	0.319
Hispanic	0.079	0.269	0.287	0.453
B.A. degree	0.229	0.42	0.356	0.479
M.A. degree	0.461	0.499	0.392	0.489
Ph.D. degree	0.258	0.438	0.151	0.359
Professional degree	0.052	0.221	0.101	0.302
Father with college degree	0.309	0.462	0.23	0.422
Father with more than college	0.247	0.431	0.295	0.457
Mother with college degree	0.221	0.415	0.137	0.344
Mother with more than college	0.137	0.344	0.181	0.386

**Panel B: Sample Graduating before Policy Change**

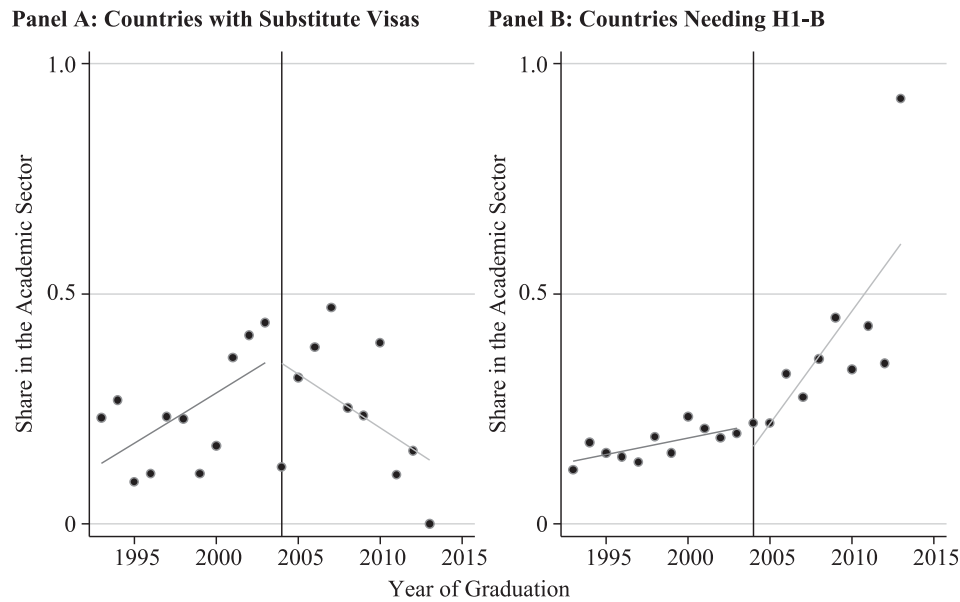
(continued)



**Table 1** (continued)

	Foreign-Born from Countries Needing H-1B		Foreign-Born from Countries with Substitute Visas	
	Mean	SD	Mean	SD
Year of graduation: <1997 (highest degree)	0.455	0.498	0.581	0.494
Year of graduation: 1998–2002 (highest degree)	0.456	0.498	0.389	0.488
Year of graduation: 2003–2007 (highest degree)	0.089	0.285	0.03	0.171
Year of graduation: 2008–2013 (highest degree)	0	0	0	0
New England	0.058	0.234	0.092	0.289
Middle Atlantic	0.186	0.389	0.236	0.425
East North Central	0.131	0.337	0.147	0.355
West North Central	0.033	0.178	0.036	0.186
South Atlantic	0.199	0.399	0.118	0.324
East South Central	0.022	0.147	0.007	0.084
West South Central	0.091	0.288	0.093	0.291
Mountain	0.034	0.181	0.03	0.171
Pacific	0.247	0.431	0.241	0.428
Field: Computer and mathematical sciences	0.157	0.364	0.024	0.154
Field: Biological, agricultural, and environmental life sciences	0.1	0.3	0.129	0.336
Field: Physical and related sciences	0.056	0.23	0.031	0.175
Field: Social and related sciences	0.067	0.25	0.091	0.288
Field: Engineering	0.189	0.392	0.081	0.274
Field: Science and engineering related fields	0.126	0.332	0.208	0.406
Field: Nonscience and engineering related fields	0.305	0.46	0.435	0.497
Survey year: 2003	0.3	0.458	0.327	0.47
Survey year: 2010	0.349	0.477	0.354	0.479
Survey year: 2013	0.351	0.477	0.319	0.467
Observations	5,391		337	

Notes: Sample includes foreign-born college graduates age 16–64 who were living in the United States at the time of the survey (2003, 2010, or 2013) but first arrived on a student visa. Panel A: Other sample restrictions include a 1993 or later graduation year and nonmissing information on all of the variables in the model. Observations not bound by the H-1B cap ( $H1B = 1$ ) either graduated before 2004 or graduated on or after 2004 but are from countries with access to substitute visas (Canada, Mexico, Chile, Singapore in all years; Australia starting in 2005). Observations bound by the cap ( $H1B = 0$ ) graduated on or after 2004 and are from a country without an available substitute visa. Panel B was constructed using observations with graduation years before 2004. Immigrants from all other countries must rely on the H-1B.



**Figure 1**

*Share of Foreign-Born in the Academic Sector by Year of Graduation and Country of Origin*

Notes: See notes for Table 1 for a description of our sample. Each dot on the graphs shows the share of our sample employed in the academic sector by graduation year. The vertical lines show the year of the H-1B visa cut. Also on the graphs are prediction lines obtained from running linear regressions of the share in academia on year of graduation, separately before and after the visa cut. The number of observations used to construct the shares graduating after 2010 was lower than in previous years because these observations come only from the 2013 survey. There are very few observations in our sample graduating in 2013, so the outlier in the figure on the right will not influence our regression estimates.

before 1998 or after 2007. We do not see large differences in the region of residence of foreign-born students depending on whether they are from countries with substitute visas. However, those from countries with substitute visas are substantially more likely to major in nonscience and nonengineering fields. Most importantly, a somewhat higher share of foreign-born college graduates from countries bound by the H-1B visa cap are employed in the academic sector (23 percent as opposed to 20 percent), which we define as working at a two- or four-year college or university, a medical school, or a university research institute.

Some of these differences may be a result of the policy change. To address this issue, Table 1B presents the same descriptive statistics using a sample of immigrants who graduated before the policy change. Just as in Table 1A, foreign-born college graduates from countries bound by the cap are more likely to be male, black and Asian, but notably, they are less likely to be employed in academia.

Before turning to the formal regression analysis, we begin our examination of the H-1B visa cap cut with a graphical approach. Figure 1 displays the mean share of foreign-born college graduates employed in the academic sector from countries bound and unbound by the H-1B visa, by year of graduation. The two shares trended similarly prior to the reinstatement of the lower H-1B visa cap, but they display very distinct trends thereafter.

**Table 2**  
*Differences-in-Differences in the Share Employed in the Academic Sector*

	Foreign-Born from Countries Needing H-1B			Foreign-Born from Countries with Substitute Visas			Difference in Difference	N		
	Pre-2004	2004 or After	Difference	Pre-2004	2004 or After	Difference				
Share employed in academic sector	0.171 [0.377]	0.316 [0.465]	0.145*** (0.027)	9,090	0.192 [0.394]	0.220 [0.415]	0.028 (0.052)	536	0.117*** (0.054)	9,626

Notes: See notes for Table 1 for a description of our baseline sample. Immigrants with access to substitute visas are those from Canada, Mexico, Singapore, and Australia. Even though Australians did not have access to an alternative visa for one of the years during which the visa cap was binding (2004), we put them in the control group for the purposes of this table. Standard deviations are in brackets, and standard errors, clustered at the country of origin level, are in parentheses. \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

In a similar vein, Table 2 gives the shares employed in academia before and after the visa cap cut among both foreign nationals from countries bound by the H-1B visa cap and from nations that are not. While the share of college graduates from countries bound by the H-1B visa cap rose by 14.5 percentage points following the policy change, the share from other nations going into academia remained unchanged. As a result, after the cap cut, college graduates needing the H-1B visa became 11.7 percentage points more likely to work in the academic sector relative to graduates from the five countries with substitute visas. This represents a 68 percent increase given that, prior to the policy change, 17.1 percent of foreign-born workers from countries bound by the H-1B visa worked in the academic sector.

#### IV. Methodology

While revealing, Figure 1 and the results in Table 2 fail to properly account for a wide range of factors potentially responsible for the relationships in the data. As such, we proceed to examine the impact of the policy more rigorously by estimating the following benchmark model:

$$(1) \quad Y_{i,c,g,t} = \alpha + \beta HIB_{c,g} + X_{i,c,g,t} \gamma + \delta_c + \delta_g + \delta_t + \varepsilon_{i,c,g,t}.$$

where  $Y_{i,c,g,t}$  equals one if person  $i$  from country  $c$  who graduated in year  $g$  is employed in the academic sector in year  $t$ , and zero otherwise.<sup>7</sup> While we would like to observe the sector of employment right after the student obtained her/his highest degree, such information is not available in our data set. It is possible that some students who were initially constrained by the visa cap started working in academia only to switch to the private sector later on in their careers. We note, however, that even the first students affected by the policy who were surveyed in the most recent survey year are observed less than ten years after graduation.

Our variable of interest,  $HIB$ , measures exposure to the restrictive H-1B visa policy. It equals zero for all individuals graduating before 2004. For those graduating in or after 2004, it equals zero for Canadians, Chileans, Mexicans, and Singaporeans since they had access to alternative visas. Because Australians only gained access to the alternative visa in 2005, the variable equals one for Australians graduating in 2004, but changes back to zero for those graduating starting in 2005. For all other immigrants graduating in

7. As discussed previously, employees of government and nonprofit *research* institutions are also exempt from the visa cap. While we can determine whether a worker is employed by a government or nonprofit organization and whether that specific worker is engaged in research, we do not know whether the organization is primarily research-based, and it is the organization's research activities that determine cap exemption. For our baseline empirical analysis, we chose to be conservative and assumed that all government and nonprofit employees were bound by the visa. Nevertheless, in Table A.1 in Online Appendix A, we display our findings using alternative definitions of the cap-exempt category. Since about 20 percent of all federal government workers in our full NSCG sample (including natives) are engaged in research (authors' calculations), we start by showing results when we classify federal government workers as cap-exempt. Next, we include state government workers in the cap-exempt category; 13 percent of those workers work in research (authors' calculations). Finally, we return to our baseline classification of cap-exempt employees but add to this all government (federal, state, and local) and nonprofit employees who list basic or applied research as a primary or secondary activity in their principal jobs. All estimates remain similar across these various classifications.

or after 2004, the *H1B* variable takes on a value of one since they are dependent on the scarce H-1B visa. The main coefficient of interest,  $\beta$ , measures how the binding H-1B visa cap has impacted the likelihood of obtaining a job in the academic sector among international students relying on the H-1B relative to students with substitute visas available.

The vector  $X$  accounts for a number of individual level characteristics likely affecting employment choices, such as age, age-squared, gender, field of expertise, marital status, parental education, and highest educational degree. All models include fixed effects to capture idiosyncratic labor market characteristics by foreigners' country of origin ( $\delta_c$ ) and graduation year ( $\delta_g$ ). We also incorporate year of the survey fixed effects to control for economy-wide changes in the labor market over time ( $\delta_t$ ). Because we use several NSCG surveys, we are able to identify the impacts of graduation year and survey year separately. Finally, our most complete specification also includes field-specific trends. With this full set of fixed effects, we account for differences in labor market opportunities by country of origin, for poor labor market opportunities faced by students graduating in certain downturn years, and for contemporaneous macroeconomic shocks, respectively (Altonji, Kahn, and Speer 2016; Kahn 2010; Oreopoulos, von Wachter, and Heisz 2012; Böhm and Watzinger 2015). Additionally, we account for time-varying characteristics of various fields of study, such as variability in funding. Standard errors are clustered at the country of origin level.<sup>8</sup>

## V. Did the H-1B Cap Cut Alter the Employment Choices of International Students?

### A. Main Findings

Table 3 presents some results using a number of model specifications that progressively add controls. In the first column, we include basic individual-level controls, such as age, race, ethnicity, and marital status, which raise the difference-in-difference estimate from Table 2 by approximately 21 percent. Subsequently, we add controls for the respondent's highest degree and for parental education in Column 2, which bring back down our prior estimate by 10 percent. Further incorporating region of residence fixed effects in Column 3 does not have a substantial impact. However, adding field of degree fixed effects reduces our estimated coefficient by about 12 percent. This could be partially due to students responding to the visa scarcity by majoring in fields that are more employable in the academic sector. To be most conservative, in the last column, we show results from a model that includes field-specific time trends. This model controls for any unobserved time-varying field characteristics that could potentially be driving employment choices, such as field-specific federal grants or state support to universities and research projects. Doing so further reduces the estimate by 6 percent. Overall, the results from the most complete model specification suggest that the H-1B visa cap cut

8. We also considered double clustering standard errors on country of origin and graduation year (Cameron, Gelbach, and Miller 2011). Although our baseline results prove robust to the use of double clustering, we cluster standard errors solely at the country of origin level because of the small number of year of graduation clusters.

**Table 3**  
*Effect of Visa Cap Cut on Employment in the Academic Sector*  
*(Dependent Variable: Employment in the Academic Sector)*

Model Specification	(1)	(2)	(3)	(4)	(5)
Bound by H-1B visa cap	0.142* (0.073)	0.108** (0.053)	0.102** (0.045)	0.090** (0.038)	0.071** (0.030)
Age	-0.034 (0.023)	-0.064*** (0.021)	-0.057*** (0.018)	-0.056*** (0.017)	-0.055*** (0.017)
Age-squared	0.000 (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Male	0.001 (0.023)	-0.025 (0.019)	-0.026 (0.017)	-0.016 (0.014)	-0.017 (0.014)
Black	0.007 (0.075)	0.070 (0.070)	0.047 (0.070)	0.051 (0.071)	0.047 (0.073)
Asian	0.015 (0.078)	0.022 (0.068)	0.015 (0.067)	0.009 (0.064)	-0.001 (0.060)
Hispanic	-0.068 (0.112)	-0.049 (0.083)	-0.049 (0.087)	-0.063 (0.082)	-0.058 (0.078)
Married	-0.053** (0.022)	-0.070*** (0.016)	-0.069*** (0.013)	-0.066*** (0.014)	-0.067*** (0.013)
M.A. degree		0.037 (0.034)	0.034 (0.034)	0.047 (0.031)	0.049 (0.032)
Ph.D. degree		0.377*** (0.053)	0.366*** (0.052)	0.325*** (0.050)	0.331*** (0.048)
Professional degree		0.156*** (0.041)	0.141*** (0.036)	0.140*** (0.031)	0.147*** (0.034)
Father with college degree		-0.034 (0.023)	-0.032 (0.021)	-0.026 (0.022)	-0.022 (0.022)
Father with more than college		0.009 (0.019)	0.008 (0.017)	0.005 (0.016)	0.004 (0.016)
Mother with college degree		-0.007 (0.021)	-0.007 (0.018)	-0.001 (0.016)	-0.005 (0.017)
Mother with more than college		-0.028 (0.036)	-0.022 (0.036)	-0.017 (0.035)	-0.018 (0.036)
Graduation year FE	Y	Y	Y	Y	Y
Country of origin FE	Y	Y	Y	Y	Y
Survey year FE	Y	Y	Y	Y	Y

(continued)

**Table 3** (continued)

Model Specification	(1)	(2)	(3)	(4)	(5)
Region of residence FE	N	N	Y	Y	Y
Field of expertise FE	N	N	N	Y	Y
Field of expertise-time trend	N	N	N	N	Y
Dependent variable mean			0.231		
Observations	9,626	9,626	9,626	9,626	9,626
R-squared	0.164	0.257	0.283	0.300	0.306

Notes: See notes for Table 1 for a description of our baseline sample. The sample size is slightly larger in Column 1 because it includes observations with missing data on parental education. Regressions include a constant term. Standard errors, reported in parentheses, are clustered on country of origin. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

raised the academic employment likelihood of foreign-born graduates relying on the H-1B visas by 7.1 percentage points or 31 percent, relative to those from the five countries with H-1B substitutes.<sup>9,10</sup>

As for the estimated coefficients on our control variables, we find that older graduates have a lower employment likelihood in the academic sector, although this inverse relationship reverses after age 27.5. Married immigrants appear less likely to be employed in academia compared to immigrants who are divorced, widowed, or never married. In contrast, graduates with a Ph.D. or professional degree are 33 percentage points and 15 percentage points, respectively, more likely to work in the academic sector than their reference group with only a bachelor's degree. Not surprisingly, the impact is large in the case of graduates with a doctoral degree, since they are more likely to train for careers in academia.

### ***B. Econometric Challenges***

A potential criticism of our identification strategy is that unobserved factors, unrelated to the lower H-1B cap, might have increased the propensity of international students from countries without substitute work visas to work in academia when compared to their counterparts from countries with access to alternative work visas. In this section,

9. In Table A.2 in Online Appendix A, we further explore whether the visa cap cut pushed people into employment in colleges and universities or university research institutes, since both are cap-exempt. As displayed by the estimates therein, the employment impacts were concentrated among colleges and universities.

10. We also experimented with estimating the policy impact using propensity score matching (PSM) methods. In Panels A and C of Table A.3 in Online Appendix A, we report average treatment effects (ATEs) using various PSM algorithms and two different sets of matching controls that fulfill the balancing prerequisite. In Panels B and D, we report the results from estimating our baseline differences in differences models using propensity score weights. Overall, the treatment effects in Panels A and C are close to the estimates in Panels B and D, and all results seem largely consistent with those shown in Table 3.

we perform a number of identification checks focused on assessing whether our findings might be interpreted as causal effects of the policy change.

*1. Tests of robustness to changes in sample composition and policy timing*

One of the most notable challenges when performing policy evaluation among the foreign-born is addressing changes in sample composition driven by factors other than the policy in question. We first consider the possibility that country of origin-specific factors unrelated to the visa policy change altered the pool of foreign-born graduates wishing to remain in the United States postgraduation. To that end, we examine whether adding home country economic conditions at the time of graduation to our model significantly alters our estimated impact of the policy change. Based on the estimated impact from Specification 1 in Panel A of Table 4, which controls for home countries' per capita GDP growth rates in the year of graduation, that is not the case.<sup>11</sup>

Next, we explore if our results are driven by foreign-born graduates from a selective number of H-1B visa-bound countries that have experienced significant economic changes during the period under consideration. For instance, China and India are the two countries of origin receiving the most H-1B visas. Two-thirds of all recipients of new H-1B visas in 2012 were from India (Kerr, Kerr, and Lincoln 2015a), and about 8 percent were from China (U.S. Citizenship and Immigration Services 2013). The two countries were also undergoing rapid economic changes during this time period. If international students who would have otherwise chosen to work in the private sector in the United States became increasingly likely to return to these countries after graduation in recent years, the estimated impact of the lower visa cap might have little to do with the change in visa policy. Likewise, Bulgaria and Romania joined the European Union in 2007. As a result, many of their nationals might have sought private-sector employment in Europe, as opposed to the United States, independently of the new visa policy change. To assess if our estimates are driven by foreigners from those nations, we experiment with dropping them from the sample. In Columns 2–4 of Panel A in Table 4, our estimated coefficients of interest remain statistically significant and are not much different from the estimate in the most complete specification in Table 3, despite the substantially smaller sample sizes.

Another potential concern with our identification strategy is that the foreign-born in our control group (those from Canada, Mexico, Chile, Australia, and Singapore) might have experienced some shock, unrelated to H-1B visa policy, but contemporaneous to the visa policy change, making them more likely to opt for nonacademic jobs. To address that possibility, we first expand our control sample to include Puerto Ricans and natives from other U.S. territories since, despite having a distinct mother tongue and culture while growing up as foreign-born graduates, they do not face the employment restrictions examined herein. As can be seen in Column 1 of Panel B in Table 4, we find that the reinstatement of the lower H-1B visa cap raised the likelihood of academic employment of foreign-born graduates relying on the H-1B visas, relative to the expanded control group, to approximately 11 percentage points.

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11. Annual percentage growth rates of GDP by year were downloaded from the World Development Indicators databank and were created using World Bank national accounts data and OECD National Accounts data files. The data we use was last updated on February 17, 2016.



**Table 4**  
*Robustness Checks (Dependent Variable: Employment in the Academic Sector)*

Model Specification	(1)	(2)	(3)	(4)
<b>Panel A: Home Country Economic Conditions and Changes in the Treatment Group</b>				
Bound by H-1B visa cap	0.075** (0.032)	0.060** (0.027)	0.073** (0.031)	0.069** (0.030)
Exclusions/additions	Adding per capita GDP growth rate	No China	No India	No China, India, Bulgaria, or Romania
Dependent variable mean	0.298	0.212	0.239	0.220
Observations	8,724	7,558	7,508	5,338
R-squared	0.304	0.325	0.326	0.356
		(1)		(2)
<b>Panel B: Changes in the Control Group</b>				
Bound by H-1B visa cap		0.113** (0.026)		0.124*** (0.030)
Exclusions/additions		Adding U.S. territories to control group		Only natives, born in U.S. 50 states, in control group
Dependent variable mean		0.185		0.086
Observations		11,520		98,726
R-squared		0.303		0.120
<b>Panel C: Assessing the Role of Specific Fields or Policy Timing</b>				
Bound by H-1B visa cap		0.087*** (0.022)		0.058** (0.026)
Exclusions/additions		No computer science		Policy implementation moved to 2003
Dependent variable mean		0.236		0.231
Observations		8,087		9,626
R-squared		0.315		0.306

Notes: See notes for Table 1 for a description of our baseline sample. All regressions include a constant and the full set of controls shown in the most complete specification of Table 3, including graduation year, country of origin, survey year, region of residence, and field of expertise fixed effects, as well as field of expertise trends. In Panel A, Column 1 adds home country per capita GDP growth rate in the year of graduation to the list of controls. The sample size is smaller in this column because of missing data on this additional control variable. Standard errors are clustered at the country of origin level. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Although it is comforting that our findings are robust to expanding the control group, we may still be concerned that the alternative visas available to nationals from the five substitute visa countries are, in fact, temporary work visas. Thus, many of the post-2004 graduates from those five countries may have initially worked in the private sector but subsequently returned home, making it more difficult for us to find impacts in our data.<sup>12</sup> To address this concern, along with other issues related to the possibility of selective return migration by foreign-born graduates in our control group, we drop these countries from the sample and include only natives of the 50 U.S. states in the control group. Column 2 of Panel B in Table 4 suggests that the lower H-1B visa cap raised the likelihood of academic employment of foreign-born graduates relying on the H-1B visas by approximately 12 percentage points.

In Panel C of Table 4, we consider additional changes to our sample composition and policy definition. First, we explore whether the findings are driven by the graduates in a dominant field, as would be the case with computer science. In fiscal year 2010, about one-half of all H-1B recipients were in computer-related occupations (Wasem 2012; Kerr, Kerr, and Lincoln 2015a). By 2012, the number had risen to more than 70 percent (Kerr, Kerr, and Lincoln 2015a). If all of our results are driven by computer science–related occupations, we might be concerned that country of origin specific demand shocks for computer scientists in home countries or within the U.S. academic sector are driving our main result in Table 3. According to the estimate in Column 1 of Panel C in Table 4, which does not differ very much from our baseline estimate, this does not appear to be the case.

Finally, we experiment with altering the year in which the lower visa cap was reinstated. The Department of Homeland Security (DHS) fiscal year starts in October of the prior calendar year. Graduates often apply for Optional Practical Training (OPT), which during the time period under consideration lasted one year. Therefore, we examine the robustness of our results to adding 2003 graduates to our list of students affected by the 2004 visa cap cut. Doing so lowers the estimated impact from seven to six percentage points (Column 2 in Panel C of Table 4), but the two estimates are not statistically different from each other.

## 2. Identification tests

In policy assessments, one might be concerned about the endogeneity of the policy making it difficult to estimate causal impacts of the policy change (for further discussion, see Romer and Romer 2010). This seems unlikely in our context for several reasons. First, for two of the five alternative visa countries, the alternative visas were established *before* the academic exemption to the H-1B cap went into effect. Second, all five of the alternative visas, enacted in different years, were just small parts of larger trade agreements. Finally, as highlighted in Kerr, Lincoln, and Mishra (2014), the 2004 cap cut was not a result of a new policy; rather, it was a reinstatement of the original cap after temporary increases in the cap expired.

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12. We checked if our estimated impacts die out with time since graduation. While we do not find evidence of this, we must note that we only observe individuals affected by the policy for up to nine years after graduation. Results are available from the authors.

Even though it seems unlikely that the 2004 visa cap reinstatement occurred *in response* to a change in the tendency of certain immigrants to pursue careers in academia, there could have been differential trends in the propensity of pursuing careers in the academic sector among nationals of countries exempt and nonexempt from the H-1B visa cap that were not picked up in Figure 1. To investigate whether that was the case, we start by constructing new indicators for those graduating during the years preceding the implementation of the H-1B visa cap (that is, in 2000, 2001, 2002, and 2003) and originating from a never-exempt country, that is, from any country besides Canada, Mexico, Chile, Singapore, and Australia. We then include the placebo terms, along with the true policy indicator, in a model similar to Equation 1. If international students from countries without substitute visas were increasingly pursuing careers in the academic sector before the H-1B cap cut, we would expect the placebo terms to have positive and statistically significant estimated coefficients. The results of this test are documented in Panel A of Table 5. The estimated coefficients on the placebo terms are not statistically different from zero, signaling that the impact of the visa cap in Table 3 is not the result of a preexisting differential trend. Furthermore, despite the inclusion of the placebo terms, the true policy term continues to be statistically significant and similar in magnitude to the final estimate in Table 3.

To offer reassurance that the results are not driven by a longer trend prior to the implementation of the visa cap, we restrict our sample to those graduating before the policy implementation, namely 1993 through 2003. Then, we create a time trend for the period under consideration, and interact it with our eligibility indicator (that is, originating from a never-exempt country). Panel B in Table 5 displays the results from this exercise. Consistent with the parallel trends assumption, we find no evidence of a preexisting trend driving our results. The estimated coefficient on the interaction term is not statistically different from zero.<sup>13</sup>

Lastly, as another way to check whether some other factor unrelated to the visa policy change induced immigrants from nonexempt countries to pursue careers in colleges and universities, we follow Sparber (2015) in limiting our sample to those who work for exempt employers; in our data, these are colleges, universities, and university-affiliated research institutes. If factors other than the policy change were making employment in colleges and universities increasingly attractive to foreign-born graduates requiring an H-1B visa, they should exhibit a higher propensity to work in college campuses relative to university research institutes after the policy change. In contrast, if the H-1B policy is driving our baseline results, there is no particular reason to expect differential likelihoods of pursuing careers in colleges or universities relative to university research institutes since both job categories are exempt from the cap. Panel C of Table 5 shows the results from estimating a model similar to our baseline model but using a sample of workers employed in a job that is not subject to the H-1B visa cap. The dependent variable is equal to one for those employed in a university research institute, and it equals zero for those employed in a college or university. The estimated coefficient on our variable of interest is not statistically significant from zero, a result that could be partially due to our smaller sample size. However, the practically zero point estimate of our

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13. In Online Appendix B, we also address identification concerns related to the potentially nonrandom designation of countries as nations with H-1B visa substitutes.

420 **Table 5**  
*Falsification Tests*

Panel A	Full Sample (Dependent Variable: Employment in the Academic Sector)
Bound by H-1B visa cap	0.059* (0.033)
1 year prior to bound by H-1B visa cap	-0.158 (0.134)
2 years prior to bound by H-1B visa cap	-0.061 (0.047)
3 years prior to bound by H-1B visa cap	-0.068 (0.123)
4 years prior to bound by H-1B visa cap	0.034 (0.068)
Dependent variable mean	0.231
Observations	9,626
<i>R</i> -squared	0.307
Panel B	Prepolicy Period Sample (Dependent Variable: Employment in the Academic Sector)
Time trend*Treated country	-0.006 (0.007)
Time trend	-0.020 (0.036)
Dependent variable mean	0.173
Observations	5,728
<i>R</i> -squared	0.278
Panel C	Cap-Exempt Job Sample (Dependent Variable: Employment in a University Research Institute)
Bound by H-1B visa cap	-0.001 (0.033)
Dependent variable mean	0.177
Observations	2,910
<i>R</i> -squared	0.149

Notes: See notes for Table 1 for a description of our baseline sample. All regressions include a constant and the full set of controls shown in the most complete specification of Table 3, including graduation year, country of origin, survey year, region of residence, and field of expertise fixed effects, as well as field of expertise trends. In Panel A, the variable, “1 Year Prior to Bound by H-1B cap” takes a value of one for immigrants without access to substitute visas who graduated in 2003 (the year before the policy change). The variable “2 Years Prior to Bound by H-1B visa” takes a value of one for immigrants without access to substitute visas who graduated in 2002, and so on. In Panel B, only individuals graduating prior to 2004 are included in the sample. Individuals from treated countries are those from any country except Canada, Mexico, Chile, Singapore, and Australia. In Panel C, only individuals in a cap-exempt job (either a college or university or a university research institute) are included in the sample. Standard errors, reported in parentheses, are clustered on country of origin. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

coefficient of interest provides suggestive evidence that the observed impacts are unlikely driven by unrelated factors making employment in colleges and universities more attractive to migrants from countries without H-1B substitutes.

### 3. Ruling out U.S.-based demand-side explanations

Finally, an alternative threat to identification is the existence of unobserved U.S.-based labor demand factors pulling foreign-born graduates bound by the visa cap to the academic sector or pulling those from countries with substitute visas to the private sector after 2004. If colleges and universities developed a preference for foreign-born graduates from countries bound by the visa cap for reasons unrelated to the policy change, they should be willing to pay them higher wages than they pay their counterparts from countries with a substitute visa. Similarly, if private sector firms developed a preference for immigrants from countries with substitute visas for reasons unrelated to the policy change, they should be willing to pay them higher wages than they pay their H-1B visa-bound counterparts.

To assess whether any of those predictions materialized, we estimate a model similar to Equation 1 but using the log of yearly wage payments as the dependent variable.<sup>14</sup> The model is estimated separately for the academic and private sectors. Results in Column 1 of Table 6 show that the reinstatement of the lower visa cap did not significantly change the relative wage of immigrants without substitute visas in the academic sector. While inconsistent with a U.S. labor demand shock specific to immigrants requiring an H-1B visa in the academic sector, this result is what we would expect from the H-1B cap cut. Since the H-1B cap is not binding in the academic sector, there is no reason for colleges and universities to treat applicants from H-1B dependent countries and their counterparts from countries with substitute visas any differently.

Furthermore, we find no evidence of relative wage reductions for immigrants without H-1B substitutes in the private sector after 2004. Rather, according to the results in the second column of Table 6, the cutback in H-1B visas was associated with a statistically significant 31 percent *increase* in the yearly earnings (in 2013 dollars) of foreign-born workers from countries bound by the H-1B visa cap relative to those with substitute visas. Once more, these results are expected and consistent with the reinstatement of a lower H-1B visa cap. Given how difficult it became for private sector firms to acquire H-1B visas, these firms might have only considered applying for the scarce visas for exceptionally well-qualified job applicants, that is, those commanding higher wages.<sup>15</sup>

14. Note that because of the inclusion of graduation year and year of the survey fixed effects in the model, we are not identifying any equilibrium wage impacts of cap-induced labor supply shocks. The latter would impact all workers regardless of their need for scarce visas. Instead, we consider whether, after the policy change, workers requiring the scarce visas had different wages than workers with H-1B substitutes. These estimates should not be viewed as causal effects of the policy change on people's wages but rather as indicative of both the types of workers that were able to secure employment in each sector after the visa cap cut and how well they were compensated.

15. These results not only serve to provide further evidence that our baseline results reflect causal impacts of the cap cut, but they also help to gauge if H-1B workers are paid below market wages as a means to offset their potentially higher hiring cost. As a first step in applying for an H-1B visa, employers must attest on the Labor Condition Application (LCA) that they will pay a wage not lower than the higher of: (i) the wages paid to all other employees with similar experience and qualifications in the specific firm or (ii) the prevailing wage level

**Table 6**  
*Changes in Relative Annual Pay and Skill Level Following the H-1B Visa Cap Cut by Sector*

	Dependent Variable			
	Log (Annual Pay)		Possession of a Postgraduate Degree	
	Academic	Private	Academic	Private
Bound by H-1B visa cap	0.100 (0.072)	0.321** (0.139)	0.017 (0.170)	0.319** (0.106)
Dependent variable mean	10.51	11.12	0.841	0.744
Observations	2,903	6,688	2,910	6,716
R-squared	0.693	0.525	0.438	0.392

Notes: See notes for Table 1 for a description of our baseline sample. The annual pay specifications include a constant and the full set of controls shown in the most complete specification of Table 3, including graduation year, country of origin, survey year, region of residence, and field of expertise fixed effects, as well as field of expertise trends. In addition, they include controls for job tenure, job tenure-squared, number of weeks worked per year, and hours typically worked per week. The sample size is slightly smaller in the annual pay specifications because some individuals in the sample report zero earnings, and they were dropped from the sample. The specification modeling the possession of a postgraduate degree includes a constant and all baseline controls, except for the educational attainment variables. Standard errors, reported in parentheses, are clustered on country of origin. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

For further support to the notion that private sector firms became more selective when hiring candidates requiring an H-1B, we examine whether the educational distribution of workers changed with the lower visa cap. As shown in the last two columns of Table 6, foreign-born graduates relying on H-1B visas and working in the private sector became significantly more likely to have a postgraduate degree after the cap became binding. No such change occurred within academia. This finding further supports the notion that private sector firms became more selective when hiring candidates requiring an H-1B visa as the visas became scarcer.

## VI. Heterogeneous Impacts

It is of interest to learn if the lower H-1B visa cap has heterogeneous impacts among foreign-born graduates depending on their education and field of expertise. Specifically, we are interested in whether the effect of the lower visa cap differs with the type of degree held (that is, B.A., M.A., Ph.D., or professional degree) or with the field of specialization being a Science Technology Engineering and Mathematics (STEM) field.

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for the occupational classification. Our earnings results suggest that firms are abiding by their attestations on the LCAs—that is, they do not seem to respond to H-1B restrictions by paying H-1B workers less relative to other workers. Instead, they appear to be restricting their H-1B hires to the most highly qualified candidates and paying them wages reflective of their higher productivity.

**Table 7**  
*Heterogeneous Impacts (Dependent Variable: Employment in the Academic Sector)*

By Educational Attainment		By STEM vs. Non-STEM Degree	
Bound by H-1B visa cap*B.A.	0.163*** (0.045)	Bound by H-1B visa cap*STEM	0.059** (0.028)
Bound by H-1B visa cap*M.A.	0.049 (0.031)	Bound by H-1B visa cap	0.048 (0.039)
Bound by H-1B visa cap*Professional degree	0.322*** (0.082)	STEM	0.027 (0.023)
Bound by H-1B visa cap	0.005 (0.038)		
B.A.	-0.392*** (0.042)		
M.A.	-0.300*** (0.037)		
Professional degree	-0.277*** (0.051)		
Dependent variable mean	0.231		0.231
Observations	9,626		9,626
R-squared	0.312		0.301

Notes: See notes for Table 1 for a description of our baseline sample. All regressions with educational attainment interactions include a constant and the full set of controls shown in the most complete specification of Table 3, including graduation year, country of origin, survey year, region of residence, and field of expertise fixed effects as well as field of expertise trends. The omitted category in the educational attainment specification is a PhD. The regression with STEM interactions includes all baseline control variables and fixed effects but omits the field-specific trends. Standard errors, reported in parentheses, are clustered on country of origin. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

Table 7 displays the estimated impacts of the lower H-1B visa cap on the likelihood of holding a job in academia for the aforementioned subgroups. The policy change particularly raises the propensity to hold an academic job of foreign-born graduates with either a B.A. or a professional degree, when compared to Ph.D. holders. These results suggest that doctorate degree holders pursue careers in academia regardless of H-1B visa policy. On the other hand, those with only a B.A. may specifically pursue careers at colleges and universities in response to the visa policy change. For example, IT professionals and investment consultants with a B.A. may have intended to pursue careers in the private sector but, because of the reduction in the number of visas, instead start pursuing careers in the academic sector.

In Column 2 of Table 7, we use interaction terms to assess whether foreign-born graduates relying on H-1B visas and in STEM fields have an especially high tendency to pursue careers in academia as the visas become scarce. Prior research has shown that

half of long-run U.S. productivity growth can be attributed to scientists and engineers (Greenwood, Hercowitz and Krusell 1997), suggesting that a possible intention of the academic exemption from the H-1B cap was to retain the brightest minds in STEM fields. According to the estimates in Table 7, the reinstatement of the lower H-1B visa cap increased the likelihood of holding academic jobs among graduates in STEM fields by close to six percentage points relative to those in non-STEM fields. Regardless of whether this was the original intent of the exemption, we can conclude that the policy successfully contributed to the retention within academia of the foreign-born in STEM fields.

## VII. Mechanisms

To conclude, we look at the mechanisms through which H-1B visa caps may have influenced the career trajectories of international students in the United States. One potential mechanism driving our results is that the foreign-born interested in pursuing careers in the private sector simply returned to their home countries when unable to receive H-1B visas in the private sector. This alone would imply that the foreign born who remain in the United States became more likely to be employed in academia. To gauge the extent of selective return migration, we would need longitudinal data tracking graduates over time, even as they return to their home countries. While we lack that type of data, we can examine the extent to which our results parallel a significant increase in the number of foreign-born graduates choosing the academic sector or a decrease in the number in the private sector.

To this end, we first collapse our data into cells based on country of origin and graduation year. We compute weighted counts of graduates working in the private and academic sectors, separately, as well as weighted means of the regressors in our main model specification (Specification 5 in Table 3). Subsequently, using the aforementioned data, we run a regression of the logarithm of the number of graduates in each sector on our key policy dummy, the means of our controls, as well as country of origin and year of graduation fixed effects.

Table 8 shows the results from this exercise. If return migration in response to fewer available H-1B visas were the main explanation for our baseline results, we might expect a postpolicy decrease in the number of people requiring the H-1B in the private sector, relative to the number of people with substitute visas, and no corresponding change in the academic sector. As it turns out, the change in the visa cap did not significantly alter the relative volume of graduates without access to H-1B substitutes working in the private sector, while it raised the relative number in the academic sector by a statistically significant 62 percent, a value very similar to what we estimated using the simple differences in differences model shown in Table 2. In sum, the increase in the greater *likelihood* of foreign graduates bound by the visa cap being employed in the academic sector after the policy change paralleled an also statistically significant and large increase in the *number* of those graduates opting for academia (relative to the number from countries with substitute visas), without significantly changing the relative number of those graduates going into the private sector.

We view these results as suggestive. If, for example, the number of students from countries dependent on the H-1B had significantly increased after 2004 for whatever



**Table 8**  
*Effect of Visa Cap Cut on the Number Employed in the Academic and Nonacademic Sectors*

	Log of Number Employed in	
	Academic	Private
Bound by H-1B visa cap	0.619*** (0.172)	0.308 (0.206)
Dependent variable mean	5.580	6.095
Observations	847	1,242
R-squared	0.832	0.817

Notes: See notes for Table 1 for a description of our baseline sample. Each observation in this specification is a cell constructed based on country of origin and year of graduation. The number of observations in the two columns do not match because there are more country of origin–year of graduation combinations with zero people employed in the academic sector than with zero employed in the nonacademic sector, and zeros are dropped given our log specification. Controls in these regressions include a constant, cell means of the full set of controls shown in the most complete specification of Table 3, and the share of people in each cell in each region of residence and each field of expertise. All specifications include country of origin and year of graduation fixed effects. Regressions are weighted by the number of individuals in each cell. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

reason, there might have been room for selective return migration in conjunction with significant increases in the number of these students going into academia. This seems unlikely, however, given Shih's (2016) findings that the number of international students coming to study in the United States from countries dependent on the H-1B actually decreased after 2004.

Hence, we turn to alternative explanations. Perhaps international students, mindful of the difficulty of securing a work visa, tailor their educations to prepare themselves for careers in academia when it becomes more difficult to work in the private sector. After all, Ryoo and Rosen (2004) show that students' decisions to pursue engineering careers are very sensitive to career prospects in the engineering field. To explore this possibility, we keep a sample of international students who completed a bachelor's degree in the United States. We then examine whether those affected by the visa cap (because they are from countries without H-1B alternatives and they completed their bachelor's degree after the cap became binding) are relatively more likely to pursue a postgraduate degree (master's, doctoral, or professional degrees).

The first column of Table 9 shows that students in this sample did not become significantly more likely to pursue a postgraduate degree because of the lower visa cap. In fact, they became less likely to pursue a higher degree. This result is consistent with Kato and Sparber's (2013) finding that H-1B scarcity is associated with declines in the quality of students (as measured by SAT scores) pursuing undergraduate degrees in the United States. If after the policy change, international undergraduate students from countries without substitute visas are less academically inclined, they might be less likely to pursue graduate degrees. Another potential explanation of these results is that graduate

**Table 9**  
*Channels through which Visa Caps May Impact Career Paths*

	Dependent Variable		
	Possessing or Currently Pursuing a Postgraduate Degree	Working outside Their Degree	
		Foreign-Born with a U.S. B.A.	Academic Sector
Bound by H-1B visa cap	-0.217 (0.149)	0.055*** (0.019)	-0.073 (0.062)
Dependent variable mean	0.575	0.041	0.100
Observations	2,080	2,910	6,716
R-squared	0.481	0.132	0.286

Notes: See notes for Table 1 for a description of our baseline sample. The first column includes only observations who earned their bachelor's degree in the United States, and the "Bound by H-1B visa cap" is based on the year of B.A. graduation. The dependent variable takes a value of one if the student possesses or is currently pursuing a postgraduate degree and zero otherwise. This specification includes a constant and all of the controls shown in the most complete specification of Table 3, except for the education controls. It also includes B.A. graduation year fixed effects and field of B.A. degree fixed effects and trends. The last two columns revert to our baseline sample and specification. They include the full set of controls shown in the most complete specification of Table 3 including graduation year (for highest degree), country of origin, survey year, region of residence, and field of expertise (for highest degree) fixed effects as well as field of expertise trends. The dependent variable in these columns takes a value of one if the person's principal job is either "somewhat related" or "not related" to his or her highest degree. Standard errors, reported in parentheses, are clustered on country of origin. Asterisks denote statistical significance as follows: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

study in the United States is costly, as measured by direct tuition fees and foregone income. This investment might only make sense if students are reasonably confident that they will be able to recoup these costs via higher future U.S. wages. When H-1B visas become scarce, students dependent on these visas may find it less optimal to make the investment, potentially in the private sector.

Finally, we examine the possibility that, faced with scarce visa opportunities, immigrants who might otherwise pursue careers within the private sector opt instead for jobs within academia where visas are unrestricted. The NSCG asks respondents whether they are working in a field outside the one in which they earned their highest degree.<sup>16</sup> Therefore, we can assess if, following the reinstatement of the visa caps, immigrants requiring the H-1B and working in academia became more likely to be working in a field outside of their degree than their counterparts in the private sector.

16. The question in the survey is "To what extent was your work on your principal job related to your highest degree? Was it a) closely related, b) somewhat related, or c) not related?" Our variable for working in a field outside one's degree takes a value of one for respondents who answered "somewhat related" or "not related." Other papers have used this variable to assess job mismatches (for example, Robst 2007; Bender and Heywood 2011).

One of the theoretical explanations for job mismatches with most empirical support is *assignment theory*, which posits that the matching process between worker and occupation depends on both demand and supply factors (Sattinger 1993). Of particular interest to us is the notion that workers trained for specific jobs or occupations may end up working in different fields if there are not enough jobs in their areas of expertise. From a labor demand perspective, Wolbers (2003) shows that mismatches increase during recessions. From a labor supply perspective, students typically have information on wages in occupations related to their major while pursuing their studies (Betts 1996), but may find jobs in other fields more attractive after learning about working conditions, job locations, and work–family balance issues postgraduation (Montt 2017). In the case of international students, the added uncertainty regarding future U.S. immigration policy, as well as how employers might respond to it, can contribute to the mismatches. Assignment theory would predict that international students with a preference for remaining in the United States, yet facing a shortage of private sector employers willing to sponsor them, may “settle” for academic jobs even in unrelated fields. If they are sufficiently well qualified in other dimensions, academic employers will hire them despite the mismatched fields.

To test this prediction, we separate our sample by sector and then examine the impact of the H-1B cap decrease on the likelihood of working out of field. The last columns of Table 9 show that immigrants impacted by the visa restrictions were no more likely to work outside of their field than those who were not impacted if they managed to acquire jobs in the private sector. In contrast, within academia, immigrants affected by the visa cap became more likely to work outside of their field. This is especially remarkable considering the fact that mismatches are more common in the private sector (Wolbers 2003; see also the means of the dependent variables in Table 9). While consistent with our “settling for academia” hypothesis, an alternative explanation of our results is that academic institutions became less selective when making job offers to applicants requiring an H-1B visa. However, that seems unlikely given our previous findings of no change in the relative wages or educational attainment of immigrants requiring the H-1B after the policy change in the academic sector (Table 6). A more likely explanation of our results is that high ability job seekers relying on the H-1B visas became more likely to accept job offers within academia for jobs that were not perfect fits for their level of expertise.

## VIII. Summary and Conclusions

Using several years of data from the National Survey of College Graduates, we examine whether immigrants from countries without H-1B substitute visas are more likely to work in academic institutions if they graduated after the H-1B visa cap was lowered in 2004, relative to those from countries with H-1B substitutes. We find that, indeed, they are more likely to work in academic institutions. These results are robust to changes in the composition of the control and treatment groups, as well as to changes in our control variables. They also survive a number of identification checks addressing common threats of difference-in-difference analyses.

We also investigate the mechanisms through which H-1B cap reductions increase the likelihood that the foreign-born pursue careers in academia, at least among those who remain in the United States. We do not find evidence consistent with selective return

migration as a main driver of our results. We also do not find evidence of foreign-born graduates requiring the H-1B flocking into postgraduate programs in order to improve their employment chances in academia. However, we find suggestive evidence that some of the immigrants employed in the academic sector following the reinstatement of the H-1B visa caps might have, otherwise, preferred to work in the private sector. As the visas became more scarce, immigrants without available substitutes for the H-1B visa became more likely to work in a field outside of their degree if they worked in academia, but not if they worked in the private sector.

Overall, our analysis can inform policymakers about the various impacts of more restrictive immigration policy pertaining to high-skill immigrants. The intention of the higher education exemption from the H-1B visa cap might have been to retain (foreign) talent in the U.S. academic sector. We examine whether the binding H-1B cap, in conjunction with the academic exemption, changes the intended career paths of the foreign-born. Learning about how immigrants respond to this type of policy is crucial in understanding its role in steering labor toward specific sectors. To the extent that the policies target immigrant labor, any discussion regarding their potential impacts on natives inevitably requires an understanding of how they impact immigrants in the first place. If, additionally, we consider the role of academia as a pillar of higher education and innovation, further attention to how changes in the H-1B visa policy affect its composition (and that of the private sector) is well warranted.

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