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▶ **The Value of H-1B Status in Times of Scarcity**

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The Value of H-1B Status in Times of Scarcity*

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Abstract

For-profit firms are limited in their ability to hire new, foreign-born, highly-educated workers after quotas on H-1B work permits are met each year, though they are able to hire existing H-1B workers. Universities and other non-profit research institutions do not face the same restrictions. Using difference-in-difference methodology, this paper estimates the marginal value of an accepted H-1B job offer – in the form of wages – at for-profit firms after quotas have been met. Lower-bound estimates suggest a 1% wage premium with the largest differences occurring in the first month after meeting the quota. At least some of these effects are attributable to wage increases within narrowly-defined groups of workers during years in which available H-1B permits are quickly exhausted. These results provide indirect evidence that H-1B workers are imperfectly substitutable with other labor sources.

Key Words: Skilled Workers, H-1B Work Permit, Immigration, Difference-in-Difference.

JEL Codes: J61, F22

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1 Introduction

The H-1B program allows U.S. employers to temporarily hire foreign-born workers in specialty occupations that require highly specialized knowledge. The program is controversial among economists, policy-makers, and the public. On the one hand, it might allow U.S. firms to engage in economic activity that would be impossible to pursue through domestic labor alone. Moreover, H-1B workers tend to work in Science, Technology, Engineering, and Mathematics (STEM) fields that are responsible for much of the country's technological and productivity growth. On the other hand, some worry that foreign workers are perfectly substitutable with native-born Americans and therefore reduce domestic wage and employment opportunities. Other critics argue that the program represents a form of indentured servitude that limits the mobility of foreign workers once they have arrived in the U.S. This paper provides a unique but indirect approach to add insight into these unresolved issues. Namely, it performs difference-in-difference estimation of the value of H-1B status to for-profit firms. Regressions find that H-1B workers command a wage premium when permits have been exhausted – an effect unlikely to exist in a world in which such workers are both perfectly substitutable with other labor sources and immobile across employers.

H-1B permits are awarded to individuals for up to a three year period and are renewable to a total of six years. Current policy allows a maximum of 65,000 new H-1B issuances per year, plus an additional 20,000 for individuals with advanced degrees from U.S. universities. However, perspective employees of colleges, universities, and other non-profit research institutions (henceforth “non-profit” firms) are exempt from H-1B quotas. Existing H-1B workers at “for-profit” firms who wish to change employers and have time remaining on their work permits are also exempt.¹ Program design therefore creates a market that segments individuals who possess otherwise-similar education, skills, ethnic heritage, and other characteristics. Highly-educated foreign-born workers seeking to enter the U.S. labor market through employment at non-profit institutions can be hired at any time. Similar workers seeking employment at for-profit firms can do so only if permits are still available.

The filing period for new for-profit H-1B permits fluctuates according to demand, implying that permit scarcity is particularly acute in some years. Quotas pertain to fiscal years (which begin on October 1), but

¹In this non-profit / for-profit dichotomy, employees of non-profit firms that do not conduct research are bound by H-1B restrictions, and are therefore classified as for-profit.

an individual can apply for an H-1B permit up to six months in advance (April 1). Table 1 illustrates that for 2005, all available H-1B permits were exhausted by the beginning of the fiscal year. The filing period was even shorter in subsequent years. The shortage was so severe in fiscal years 2008 and 2009 that the number of applications exceeded the number of available permits during the first week of the filing period, and all permits were distributed by random lottery. This trend in increasing popularity stopped in fiscal year 2010 when the recession had sufficiently reduced labor demand so that H-1B caps were not met until months after the fiscal year had started.

The popularity of H-1B permits evident from 2006-2009, coupled with the design of the H-1B program, provides a natural experiment for identifying the value of H-1B status to for-profit firms in times of policy-induced scarcity. Non-profit research organizations are relatively free to hire college-educated foreign workers throughout the year. For-profit firms, however, cannot hire new H-1B workers after the quota has been exhausted. This paper exploits this differential treatment of individuals and firms and performs difference-in-difference estimation of the effect of restrictive H-1B policy on the wages offered to H-1B workers.

Data comes from H-1B applications during fiscal years 2006-2009 acquired through a Freedom of Information Act (FOIA) request. Filled H-1B job offers (i) on date (t) serve as the unit of observation. Offers from for-profit firms serve as the treatment group; offers from non-profit research firms are the control. The treatment occurs after the date on which the quota has been filled. After this “last date of receipt,” for-profit firms wanting to hire H-1B workers can only hire those who have been previously subject to the quota, such as current H-1B employees at other for-profit firms who have not exhausted their six-year limit.

Baseline results find that H-1B wage offers from for-profit firms increase by 1% or more after the date of last receipt relative to offers from non-profit firms. The largest increases occur within the first month after the quota is exhausted. Much of this effect could be driven by compositional forces and selection issues since inexperienced (and low wage-earning) workers cannot be hired by for-profit firms throughout the year. To reduce the influence of compositional forces, regressions then turn to an examination of effects within narrow classes of workers. Much of this analysis is conducted for specific years since mechanisms driving wage effects might vary across years due to differing levels of H-1B scarcity. Fiscal year 2007 is particularly informative since scarcity was acute in that year, but there are enough observations both before and after the last date

of receipt to produce identifying variation. The analysis finds that for-profit firms increase wage offers as the date of last receipt approaches, perhaps in an attempt to secure a guaranteed labor force before work permits are exhausted. This premium persists after the last date of receipt.

As noted, direct estimation of the value of H-1B status to for-profit firms indirectly contributes to two larger debates in the economics literature: First, it provides suggestive evidence on the substitutability between H-1B workers and similar workers in the American economy. If skilled workers are readily available domestically, then the unavailability of new H-1B workers should exert little pressure on wages paid to existing H-1B workers. That some effect does exist suggests that a ready supply of alternatives is not available. Second, the paper provides insight about the value of added market power attained by H-1B workers after quotas have been exhausted. If H-1B workers are imperfectly substitutable inputs into production, then policy-induced increased scarcity should increase their rate of return – an effect consistent with the results. The next section provides a more detailed discussion of these phenomena and the related literature before describing the data and performing the empirical estimation.

2 Motivation

There is much debate about the effects of highly-educated foreign-born workers on American labor markets and the economy. In a simplified textbook supply and demand setting, an increase in the supply of laborers possessing a particular set of skills (college-educated immigrants, for example), should decrease the wage paid to similar workers in the short run (college-educated native-born labor, for example). Indeed, this is what Borjas(2003, 2013) argues when he finds that influxes of foreign-labor into the U.S. have substantially reduced wages paid to native-born workers with similar education and experience levels. In contrast, work by Ottaviano and Peri (2008, 2012) and Peri and Sparber (2009, 2011) argues that labor markets are more nuanced. Immigrants and natives are imperfectly substitutable within education groups because they supply differentiated skills. This helps protect groups from labor market competition and wage losses.²

One area in which highly-educated workers might be distinct in the labor market is in their ability to generate long-run productivity gains and economic growth. For example, Jones (2002) argues that scientists,

²See Borjas, Grogger, and Hanson (2008, 2011) for studies challenging this conclusion.

engineers, and research and development activity are essential in creating growth-promoting technological spillovers. If true, then the consequences of highly-educated foreign-born labor inflows are not governed solely by potential skill-complementarities; such inflows also expand a scarce resource with positive externalities.³ Whether this occurs is another source of contention. Evidence that immigrants generate productivity gains can be found in Hunt and Gauthier-Loiselle (2010), Kerr and Lincoln (2010), Peri, Shih, and Sparber (2015a, 2015b), and Moser, Voena, and Waldinger (2014). Evidence for nonexistent or negative effects can be found in Borjas (2009), Borjas and Doran (2012), and Doran, Gelber, and Isen (2014).

Typical approaches to assessing labor substitutability or the macroeconomic consequences of immigration might directly estimate how an increase in the foreign-born share of the labor force affects native-born workers' skills, wages, or productivity. Alternatively, they might measure how the relative supply of native and foreign labor affects relative wages. Scholars' methodological choices have led to differing conclusions and have fueled much of the academic debate. No one methodology is immune to criticism. Spatial analyses performed across regions (Card (2009), Peri, Shih, and Sparber (2015b)) are subject to omitted variables and reverse causality concerns even when they employ instrumental variable strategies and thorough robustness checks. National-level analyses that group workers into education and experience cells (Borjas (2003, 2013), Ottaviano and Peri (2012)) are sensitive to decisions on how those cells are constructed, result in a small number of observations, and require assumed parameter values to infer general equilibrium results. A promising new line of research is exploiting variation caused by H-1B lotteries (Doran, Gelber, and Isen (2014), Peri, Shih, and Sparber (2015a)), but this approach must respond to challenges regarding sample size, coverage, and randomness.

Lack of consensus on this important issue necessitates further analysis. Thus, this paper adopts yet a fourth approach to examining labor substitutability. U.S. policy has created a natural experiment facilitating difference-in-difference assessment of how caps on the supply of a distinct type of worker (highly-educated, foreign-born, H-1B speciality workers) affect the wage paid to that type of worker. This is clearly not a direct test of the substitutability between H-1B workers and other groups: If the decrease in supply of H-1B workers is large enough to affect the market supply of highly-educated workers, then wages paid to all highly-

³Note that a resource (e.g., skilled workers) can be "scarce" without implying that a "shortage" of that resource exists.

educated workers should rise. Furthermore, one cannot definitively conclude anything about elasticities of substitution without evidence on relative wages. Nonetheless, three aspects of the methodology do suggest that the approach can be informative on this issue. First, the difference-in-difference estimation in this paper does incorporate a comparison between for-profit H-1B job offers with otherwise similar non-profit offers. If H-1B caps raise the wages for all highly-educated workers, those gains will be absorbed by fixed effects in this exercise. Second, for-profit firms can hire other college-educated foreign-born workers throughout the year. For example, all firms can hire foreign-born graduates of U.S. universities through the OPT program, and firms with a presence in multiple countries can hire foreign workers with L status. Third, much debate outside the economics literature has contested whether a “shortage” of skilled workers exists in the domestic economy. If Matloff (2003), Hira (2007), and Miano (2008) are right in arguing that no shortage exists and native-born skilled labor is underemployed, then these workers could substitute for H-1B workers. Altogether, it is unlikely that the wage paid to H-1B workers would rise in response to the exhaustion of available H-1B permits if such workers are perfectly substitutable with available, highly-educated, native and foreign-born alternatives. That is, if such alternatives are in ample supply, one would expect little incentive to raise the wage paid to H-1B workers after permits are exhausted.

A second area of concern regarding the H-1B program is that there are at least four reasons to believe that it might limit the market power of highly-educated foreign-born workers even though an existing H-1B employee can legally change employers. One friction is that firms might be deterred from hiring H-1B workers due to fees that could cost employers more than \$2000 in 2007.⁴ A second limitation noted on the U.S. Citizenship and Immigration Services (USCIS) website is that “there is no automatic 10-day or other grace period for terminated employees holding H-1B status, so once the individual is no longer in a lawful nonimmigrant status, he/she usually must depart from the United States.”⁵ Thus, workers face huge risks from potential unemployment spells. Third, the H-1B program allows firms to sponsor their employees for permanent residency (a green card), and a worker might not want to jeopardize this possibility by exploring new employment opportunities. Finally, the permit is temporary in nature, thereby decreasing the time

⁴Fee schedules are available in I-129 instructions and G-1055 forms. Revised forms for July 30, 2007 require a minimum \$320 filing fee plus additional funds that vary depending upon a firm’s type, usage of the H-1B program, and possible fraud prevention fee. Depew, Norlander, and Sorensen (2013) note that in 2013 fees rose to between \$2000 and \$5225 and that “the forms required have an estimated paperwork burden of 3 hours and 45 minutes.” The Labor Condition Application (LCA) is a related form required to hire an H-1B worker. However, there are no filing fees with this form.

⁵See USCIS (2010).

available to look for new work. All of these characteristics combine to reduce mobility and have led critics to call the H-1B program a form of “indentured servitude” (Hira 2010, Matloff 2013). Such market power would allow firms to systematically underpay H-1B workers and undercut the wages for similarly-skilled native-born workers. It is therefore worth examining power in markets for foreign labor (including the H-1B program). Again, mixed evidence on this issue exists.

Recent work by Mukhopadhyay and Oxborrow (2012) estimates that green card holders earn a massive 25% wage premium over foreign-born temporary workers. One might surmise that this is a result of vastly underpaying immobile temporary workers (see such arguments in Center for Immigration Studies Backgrounders by Miano 2007 or Matloff 2008, for example). However, alternative analyses suggest that H-1B workers are reasonably mobile and well-paid. In terms of mobility, Depew, Norlander, and Sorensen (2013) find that “during periods of full employment, inter-firm mobility [of Indian Information Technology H-1B workers] is comparable to other estimates in the literature obtained from presumably more mobile workers in other labor markets, suggesting that competitive market forces provide some check against firms dramatically underpaying these workers.” In terms of wages, Lofstrom and Hayes (2011) find that although H-1B workers earn 3.1% to 11.6% less than U.S.-born workers within Science, Technology, Engineering, and Mathematics (STEM) fields, the regularity reverses itself when controlling for age, educational attainment, and fixed effects for occupation and industry. Conditional on these factors, new H-1B workers in Information Technology earn a 6.7% wage premium, and the premium nearly doubles to 11.7% for H-1B renewals.

This paper does not provide a direct test of H-1B mobility, but it can inform the issue. If H-1B workers are imperfectly substitutable inputs into production, then the last receipt date of the H-1B filing period represents a major shift in market power away from for-profit firms (who are no longer legally permitted to hire new H-1B workers) toward existing H-1B workers (who can move to any firm willing to complete the necessary legal documents and pay the filing fees). If this shift in market power is large, then the last receipt date should be associated with large wage gains. If wage gains are small, it might indicate that firms never had market power, or that the shift in power is trivial (perhaps due to the existence of H-1B alternatives).

As noted, this paper does not provide a direct test of substitutability between native and foreign-born labor, nor does it provide a direct test of firms’ market power and labor mobility under the H-1B program.

Instead, it directly tests whether jobs filled by H-1B workers at for-profit firms after the last date of receipt for new H-1B applicants offer higher wages. In doing so, it provides suggestive evidence on related substitutability and mobility questions using a method previously unemployed to explore those questions.

3 Data and Methodology

Foreign-born specialty workers seeking H-1B status for new or continuing employment must submit an I-129 petition to USCIS. We have complete data on 920,728 I-129 forms approved for fiscal years 2006-2009 – years in which H-1B limits were reached early in the filing period. These paper refers to these forms as filled job offers, and they serve as the unit of analysis. Fiscal years begin on October 1, and H-1B petitions can be filed as early as April 1. We assume that all petitions filed in April through March are for the fiscal year that begins in the intervening October. The model estimated for filled job offers i at date t is:

$$\begin{aligned} \ln(wage_{i,t}) = & \alpha + \beta_1 \cdot Forprofit_{i,t} \cdot PastLastDate_{i,t} & (1) \\ & + \beta_2 \cdot Forprofit_{i,t} + \beta_3 \cdot PastLastDate_{i,t} \\ & + \gamma \cdot X_{i,t} + \varepsilon_{i,t} \end{aligned}$$

The key parameter of interest, β_1 , identifies whether the treatment group of employers (for-profit firms) offered higher wages after the last date of receipt when compared to the control group (non-profit firms). The variable *PastLastDate* earns a value of zero if the I-129 form has a recorded submission date between April 1 and the date of last receipt (inclusive) for the 65,000 general H-1B permits displayed in Table 1. It receives a value of one for all other dates. One important exception is that for fiscal year 2009, more than 45,000 applications for new H-1B permits list April 14, 2008 as the submission date (by far the most commonly recorded date). This was the date on which a lottery was conducted to distribute new work permits to applications filed in the first week of April. Given the anomaly in the data, we assume that USCIS recorded April 14 as the submission date for all new applications in that year, and adjust the last date of receipt and *PastLastDate* variable accordingly.

The variable X includes a number of controls including an assortment of fixed effects. At a minimum, all

regressions control for the month and year of application, type of application⁶ (e.g., whether it is for a new H-1B permit, a change of employer, an extension of stay, etc.), and quadratic trends specific to non-profit and for-profit firms. All regressions are estimated with robust standard errors.

One underlying assumption in (1) is that a permit quota applied to for-profit firms would generate effects similar to a permit quota applied to non-profit firms. Since H-1B caps do not apply to non-profit firms, this narrow assumption cannot be validated. More broadly, however, the model assumes that market forces affect wages paid by non-profit and for-profit firms alike. Past work and alternative data can provide insight on this assumption. Anecdotal support is available in 2010-2012 American Community Survey (ACS) data: academic fields of study that earn high wages in for-profit firms (e.g., engineering, mathematics and computer science, economics) also earn high wages in non-profit firms. A simple bivariate regression across degree fields reveals an elasticity of 0.79 between wages paid at non-profit and for-profit firms that is significantly different from both zero and one.⁷ This correlation is obviously not causal, but it is consistent with non-profit responsiveness to market forces and the existence of competition between the for-profit and non-profit sectors over scarce labor resources. More robust support is available in the literature on academic labor markets. Ellison (2010), Hamermesh and Pfann (2011), and Hilmer, Hilmer, and Ransom (2012) are among recent authors who have found that academic wages are affected by the quantity and/or quality of publications (among other factors), while Katz (1973) provided an early study documenting wage variation across academic departments. Importantly, job offers from academic institutions comprise more than 80% of the non-profit observations in the H-1B sample. Although it is not certain that quotas would affect for-profit and non-profit H-1B wages similarly, it is reassuring to know that academic wages reflect returns to skills and are influenced by market pressures.

Table 2 provides important summary statistics of the available H-1B data. Real wages (2010 dollars, top panel) are higher for both for-profit and non-profit firms after the date of last receipt, but the magnitude is much greater for for-profit firms. The summary statistics suggest a real wage increase of about \$11,000. The number of H-1B petitions filed follows a similar pattern. Far more are filed for for-profit firm employment,

⁶The Appendix contains a more complete discussion of application type (the basis of classification in an I-129 petition). Applications for new employment comprise nearly 40% sample. Another 34% of the applications are for continuation of previously approved employment with the same employer. Applications to change employer are the next largest group at 10% of the sample.

⁷See the appendix for further detail.

and a greater number are filed after the last date of receipt. This is true both of H-1B filings overall (middle panel), and for individuals filing to change employers (bottom panel).

Figure 1 displays trends in average log-wages paid before and after the last day of receipt from 2006-2009. Four regularities are worth noting. First, average wages paid by for-profit firms are much higher than wages in non-profit firms. Second, wages demonstrate a steady increase for both firm types, but average wages in for-profit firms experience a marked jump after the week in which the last date of receipt occurred. Non-profit firms experience no such jump, again suggesting that difference-in-difference estimation will uncover positive coefficients. Third, wages experience a one-time decline during the week of the last date of receipt. This is true for both firm types. This suggests that there may be some measurement error in the data, with some for-profit firms being categorized as non-profit. Fourth, the graph might conflate effects driven by wage increases within narrowly-defined demographic groups and compositional changes that might arise due to selection into for-profit employment after the date of last receipt and/or differences in H-1B application phenomena across years. For example, the week of the last date of receipt is the only week for which the treatment does not occur for two years in the dataset. These issues will require further examination in the empirical exercise.

4 Results

4.1 Main Results

Table 3 provides baseline results for regressions of the natural log of an accepted job offer's wage on firm type (for-profit versus non-profit), whether the I-129 petition was filed after the last date of receipt, and the interaction between the two (the key difference-in-difference variable of interest). Robust standard errors are in parenthesis. Column (1) is the most basic specification and includes controls for the month and year of application, type of application, and quadratic trends specific to firm type. It finds that H-1B wage offers increase 3.9% for for-profit firms after the last date of receipt. Application type coefficients reveal that new H-1B workers (the reference group) earn among the lowest wages. This is not surprising given that such workers have the least amount of experience working in the U.S. Those applying to continue employment

with their current employer and/or change employers receive a 16.8%-18.5% wage premium.

Column (2) adds indicators for educational attainment plus a quadratic age term. The estimate decreases to 1.3%. Wages peak at age 45. Workers with an advanced degree from a U.S. institution receive a 1.9% wage premium compared to those with comparable Masters, Professional, or Doctorate degrees from other countries. One surprise is that workers with less than a bachelor's degree earn higher wages than workers who have one (the reference group). However, only 0.2% of the sample has a high school degree or less education, and an additional 0.5% of the sample has some college experience but no bachelor's degree. The H-1B program is reserved for workers in specialty occupations, and H-1B workers with little educational attainment might be of extraordinary ability. Furthermore, H-1B workers with less than a bachelor's degree have a higher propensity to be in (high paying) managerial positions. Column (3) adds indicators for broad occupation group that will absorb some, but not all, of this variation. It also includes controls for country of birth and metropolitan area of residence. The main coefficient remains virtually the same at 1.2%. The sign on the coefficient for workers with some college experience reverses. The premium to advanced US degree holders more than triples to 6.6%.

Columns (4)-(6) add further richness by replacing the simple pre/post date of last receipt indicator with measures for the effects occurring within one, two, and three or more months after the last date of receipt.⁸ In the presence of demographic control variables, the largest effects consistently occur during the month following the last date of receipt. One possible explanation is that firms rush to hire existing H-1B workers and agree to pay high wages to attract them immediately after learning that new H-1B workers are no longer available. This explanation would be consistent with the notion that H-1B workers are imperfectly substitutable with alternative workers.

The remainder of the analysis conducts various robustness checks in an attempt to understand if the baseline results indicate wage gains for H-1B workers after the last date of receipt, or instead arise solely due to compositional or spurious forces. Unless otherwise noted, all subsequent specifications include a complete set of controls that are analogous to Columns (3) and (6).

⁸More specifically, the effects are separated between those that occur within 30 days, between 31 and 60 days, and more than 60 days after the the date of last receipt.

4.2 Placebo Analysis

The first robustness exercise employs a series of alternative models and placebo checks to test whether the results legitimately arise from differences in for-profit firm behavior after the last date of receipt or are instead coming from some other factor. Consider Table 4. The first regression notes that the last date of receipt occurred immediately (during the first week of the filing period) in April 2007 and 2008. This raises some concern that the last date of receipt is simply proxying for events that occur after April 1. To examine this, the regression in Column (1) redefines the treatment variable as whether the observation occurred after April 1. This approach is limited by the fact that less than 1% of observations are filed on April 1 (and hence earn a value of zero). Nonetheless, it is encouraging that results are insignificant and the magnitudes of the coefficients are small.

Column (2) explores whether the same mechanism was at work in the years immediately before and after years in which the quota was quickly reached. There is no reason to necessarily expect a null result, but if firms are unhindered in hiring H-1B workers over a longer time horizon, one might expect the effects of the last date of receipt to be much smaller. Indeed, that is what Column (2) finds. Although the coefficient is positive and significant, it is not driven by increased wages immediately following the last date of receipt. Instead, they occur much later in the application cycle when it is possible that firms attempt to offer high wages to existing H-1B workers before the following year's round of new H-1B applications begins.

Column (3) assesses whether the effects are driven by for-profit firms or are instead motivated by something intrinsic to universities that occurs around the last date of receipt. To do so, we remove all for-profit firms and pretend that non-university non-private research institutions are the treated group (13% of the remaining sample). Coefficient magnitudes are small and insignificantly different from zero, helping to confirm that the main results are driven by the treatment's effect on for-profit firms.

4.3 Robustness and Challenges

Table 5 assesses whether the effects identified in baseline regressions continue to hold under a number of alternative selection criteria. Column (1) recognizes that five countries (Australia, Canada, Chile, Mexico, and Singapore) have country-specific H-1B alternatives due to various trade agreements. Thus, for-profit

firms wishing to hire workers from these countries have more certainty in their ability to do so, and such individuals do not receive the same treatment that citizens of other countries do.⁹ Column (1) removes people born in those countries and finds that the results are consistent with those in baseline specifications.

Columns (2) and (3) explore the role of Indian-born individuals since they comprise roughly half of new H-1B issuances to for-profit firms each year. The results are robust to the exclusion of Indians, and it is reassuring that this one group is not driving the results. However, the coefficients are negative and significant when focusing on Indians exclusively. This might be driven by limited data variation. Only 6% of the India sample consists of job offers from non-profit firms.

Columns (4) and (5) explore the role of computer-related workers since they comprise roughly two-thirds of new H-1B issuances to for-profit firms each year. The results are robust to the exclusion of computer-related work. However, the coefficients are insignificant (and negative) when focusing on computer workers exclusively. Again, limited data variation might be a concern – only 1% of the computer-related sample consists of non-profit firms.

Finally, Columns (6) and (7) explore heterogeneity across firm size by removing, respectively, for-profit firms with 1000 or fewer H-1Bs (annually) and those with more than 1000 H-1B workers. The results remain highly significant. Altogether, the results in Table 5 are not uniformly positive, but they largely help to establish the robustness of baseline results: for-profit firms increase wage offers after the last date of receipt. Exceptions to this regularity appear in Table 5 but are limited to samples in which comparatively few job offers at non-profit institutions occur.

4.4 Exploration of Compositional Effects

The results of Tables 3 and 5 are indicative of average wage increases at for-profit firms after the date of last receipt. Those effects could be driven by a combination of two forces. On the one hand, they might reflect the increased value and/or bargaining power of existing H-1B workers after for-profit firms are legally prohibited (with limited exception) from hiring new H-1B workers. This effect would be consistent with the interpretation that such workers are imperfectly substitutable with alternative labor sources, and that

⁹Canadians and Mexicans qualify for TN status. Australians qualify for the E-3 work permit. Citizens of Singapore and Chile receive preferential H-1B treatment until the quota has been met.

government-induced scarcity raises their compensation. On the other hand, the effects might be purely compositional in nature. For-profit firms cannot hire new H-1B workers after the date of last receipt. Even though regressions include indicators to control for this type of worker, they might fail to completely account for selection biases that lead to wage gains at for-profit firms. Results driven by compositional forces are interesting in the sense that they would signal that firms cannot hire the workers with the lowest marginal product of labor (i.e., those with the least amount of U.S. experience). They also provide insight into the return to experience in the U.S. Nonetheless, there is a greater interest in whether scarcity increases H-1B value for non-compositional reasons.

Table 6 begins to examine whether wage gains exist after attempting to remove possible compositional effects. Recall that Figure 1 demonstrated that wage offers are particularly low for both for-profit and non-profit firms during the week of the last day of receipt. Column (1) explores the robustness of the main results by removing observations that occur during this week. One limitation of this approach is that it reduces the power of the model since fiscal years 2008 and 2009 exhibit no variation in the treatment variable (there are no observations prior to the date of last receipt in those years). The basic difference-in-difference model no longer estimates a significant coefficient. However, the positive effect remains in the first month following the last receipt date, which largely complements baseline results but at a smaller magnitude.

The remaining columns recognize that for-profit firms are able to hire new H-1B workers after the last date of receipt under two conditions: The worker must have an advanced degree from a U.S. institution, and the extra 20,000 permit quota for these individuals must not have been met. It was appropriate to include such individuals in the baseline model since they help to influence the market wage, but it is also important to explore their role in driving the results.

Column (2) includes an interaction term controlling for new H-1B applications received after the last date of receipt in order to separate effects arising from the increased value of H-1B status after the last receipt date and those driven by compositional forces. These observations are predominately at non-profit institutions, though – as noted above – some are employees at for-profit institutions who have advanced degrees from U.S. universities. Results are quite comparable to those from baseline regressions. Wage offers from for-profit firms increase by 1.3% after the last date of receipt, with the largest effects occurring within

the first month after that date. Column (3) instead examines the role of workers with advanced U.S. degrees by removing them from the regressions. The results are again robust and quite similar to those from baseline specifications.

The final three columns of Table 6 provide a great amount of insight into the various forces driving baseline results. Rather than examine the role of the last date of receipt in the wage determination of all job offers, Columns (4) through (6) include only the narrowly-defined and more homogenous group of workers who earned an advanced degree in the U.S. and are applying for new H-1B work permits. We also separate columns by year of observation to assess whether the effects might vary over time.

Column (4) examines fiscal year 2006. This is the least binding year in the sample in the sense that new perspective employees had over four months in which to apply for an H-1B permit. Workers with advanced U.S. degrees had more than twice as long to do so. The results indicate that the last date of receipt had no statistically significant effect on wage offers to new H-1B workers with advanced U.S. degrees at for-profit institutions. The sample is small and precision is lower than in other regressions, but point estimates are very close to zero. This result is informative: In 2006, when H-1B permit scarcity was not particularly acute – the value of H-1B status appears to have been fairly static throughout the filing period.

Column (5) indicates that fiscal year 2007 was quite different. The filing period for new H-1Bs lasted only 56 days, and the period for new H-1Bs with advanced US degrees lasted just 61 days longer. The heightened scarcity of work permits seems to have added wage pressure and increased wage offers to new H-1B workers with advanced U.S. degrees by 5.6%. The largest effects appear to happen immediately, though point estimates are imprecise (the p-value is 0.19).¹⁰

Fiscal year 2008 presents new challenges in that there are no observed values prior to the week in which the last date of receipt occurs, nor are there observed for-profit new H-1B workers with advanced U.S. degrees observed beyond the first month following the last date of receipt. Regressions in Column (6) effectively use the date of last receipt as the only comparison period for the treated group, and the treatment period is short. The mechanics governing wages again appear to be quite different for this year as the coefficient of interest becomes negative, significant, and sizable. It is possible that firms sensed the increased scarcity of

¹⁰The number of observations is surprisingly low given that 20,000 new H-1B visas should be available for new for-profit workers with advanced U.S. degrees. 15,472 of the observations are for-profit employees. Remaining workers might be misclassified into other application types.

H-1B permits and began offering premiums to workers who could be hired with certainty in the first week of April. Note that the model cannot be estimated for fiscal year 2009 since all new for-profit work permits were exhausted on the last receipt date.

4.5 Event Studies and Triple Difference Estimation

The results of Table 6 encourage more detailed exploration of the effects from the last receipt date for fiscal years 2006 and 2007. Equation (2) provides a year-specific event study model.

$$\begin{aligned} \ln(\text{wage}_{i,t}) = & \alpha + \sum_{n \neq 0} \beta_1^n \cdot \delta_{i,t}^n \cdot \text{Forprofit}_{i,t} & (2) \\ & + \beta_2 \cdot \text{Forprofit}_{i,t} + \sum_{n \neq 0} \beta_3^n \cdot \delta_{i,t}^n \beta_3 \\ & + \gamma \cdot X_{i,t} + \varepsilon_{i,t} \end{aligned}$$

The model in (2) is similar to (1). It includes the full set of control variables and robust standard errors as in previous regressions. Like Columns (4) and (5) of Table 6, regressions are performed separately for years 2006 and 2007 and include only new H-1B applications from individuals with advanced U.S. degrees. The major difference is that the model now allows the difference-in-difference coefficient of interest (β_1^n) to vary across weeks (n) preceding and following the date of last receipt. The variable $\delta_{i,t}^n$ is simply an indicator variable for the week. The week of the date of last receipt ($n = 0$) is the reference period.

Coefficient estimates and 90% confidence intervals for the five weeks before and after the date of last receipt are displayed in Figure 2. The top panel illustrates the results for 2006. The wage paid to new H-1B workers with advanced U.S. degrees at for-profit firms remains fairly constant over this period. Consistent with results in Table 6, the scarcity of H-1B permits might not have been acute enough in 2006 to generate wage consequences (or changes in market power) around the date of last receipt.

Results from 2007 tell a different story. Wages remain relatively constant two to five weeks prior to the last receipt date. As that date approached, however, wages started to rise and earn a premium. Workers with offers two weeks past the last receipt date earned 10% more than those hired on the last receipt date,

and 20% more than workers hired two weeks prior to that date. This helps inform two of the results from Table 6. First, the results confirm the Column (5) outcome that a premium existed after the last receipt date in 2007. Second, the model illustrates that when the availability of H-1B permits is heavily restricted, wage premiums might rise before the last receipt date as firms try to secure employees before permits are exhausted. This adds context to the negative coefficient found for fiscal year 2008 in Column (6). The heightened scarcity of that year may have encouraged firms to offer high wages to workers during the first week of the H-1B filing period.

With the awareness that the level of H-1B scarcity in a particular year might affect the mechanisms driving wage premia near the last receipt date, equation (3) turns to triple-difference estimation that exploits the differences in behavior between 2006 and 2007:

$$\begin{aligned}
\ln(\text{wage}_{i,t}) = & \alpha + \beta_0^{\text{WeekOf}} \cdot \delta_{i,t}^{2007, \text{WeekOf}} \cdot \text{Forprofit}_{i,t} & (3) \\
& + \beta_0^{\text{WeekAfter}} \cdot \delta_{i,t}^{2007, \text{WeekAfter}} \cdot \text{Forprofit}_{i,t} \\
& + \beta_1^{\text{WeekOf}} \cdot \text{Forprofit}_{i,t} + \beta_1^{\text{WeekAfter}} \cdot \text{Forprofit}_{i,t} \\
& + \beta_2^{\text{WeekOf}} \cdot \text{WeekOf}_{i,t} + \beta_2^{\text{WeekAfter}} \cdot \text{WeekAfter}_{i,t} \\
& + \beta_3^{\text{WeekOf}} \cdot \delta_{i,t}^{2007, \text{WeekOf}} + \beta_3^{\text{WeekAfter}} \cdot \delta_{i,t}^{2007, \text{WeekAfter}} \\
& + \beta_4 \cdot \delta_{i,t}^{2007} \cdot \text{Forprofit}_{i,t} + \beta_5 \cdot \text{Forprofit}_{i,t} \\
& + \gamma \cdot X_{i,t} + \varepsilon_{i,t}
\end{aligned}$$

Though there are many additional parameters in model (3), just two simple innovations warrant special attention. First, rather than compare the wages past the last date of receipt to those on or before that date, the model instead chooses weeks leading up to the date of last receipt as the reference period, and includes separate estimates for effects occurring during the week of and the week after the last date of receipt. This recognizes the regularities (discovered above) that wages appear to rise in anticipation of reaching the H-1B cap. Second, there are two main triple-difference coefficients of interest, β_0^{WeekOf} and $\beta_0^{\text{WeekAfter}}$. These terms do not simply identify whether the date of last receipt causes for-profit firms to offer higher wages

relative to non-profit firms. Instead, they identify whether that premium was higher in 2007 (a year of acute H-1B scarcity) than in 2006 (when H-1B constraints were less binding).

Table 7 presents the results. Regressions are again performed within specific H-1B application type. Column (1) continues the focus on new H-1B workers with advanced degrees from U.S. institutions. The results are consistent with Figure 2. The for-profit premium during the week of the last date of receipt was 10.2% higher in 2007 than in 2006. After that date, the premium was 7.9% higher. This suggests that acute H-1B scarcity changes the value of an H-1B work permit for new H-1B workers with advanced degrees from U.S. universities. This evidence is consistent with an interpretation that H-1B workers are imperfectly substitutable with alternative labor sources, that work permit scarcity gives H-1B workers more market power, and that baseline results are not driven simply by compositional forces.

Columns (2)-(5) examine triple difference effects for other groups of workers that can be hired at all points during the year. Each specification excludes workers with advanced U.S. degrees. Column (2) drops all new H-1B applicants. Column (3) includes only those workers applying to continue employment with their current employer (i.e., those who are effectively renewing their existing permit). Column (4) includes workers who are changing employers. Column (5) includes individuals who have previously been subject to the H-1B cap, left the country, and are applying to return to U.S. employment. Three of these four cases find evidence for an increase in the wage premium in 2007 during the week of the last date of receipt or beyond.

The triple difference regressions are not flawless. One concern is that sample sizes can be small. For example, there are only 218 non-profit employees in the Column (5) sample of workers returning to the U.S. (they are evenly divided into the three periods of interest). Another concern is that the model is largely identified by comparing variation in 2007 to that in 2006. It would be better to include 2008 and 2009 in the sample, but those years contain no observations for periods leading up to the date of last receipt and do not provide necessary identifying variation. In any case, the results of the event study and triple difference exercises suggest that the baseline estimates of Table 3 do not solely arise from compositional forces. H-1B scarcity changes the value of work permits within narrowly-defined groups of workers. This effect is unlikely to exist if H-1B workers are perfectly substitutable with other labor sources and/or lacked market power.

5 Conclusions

Caps on the number of new H-1B workers that for-profit firms are allowed to hire were reached before the start of the fiscal year every year between fiscal years 2006 through 2009. That scarcity could change the value of an average H-1B work permit for a variety of reasons. Wages will rise if (1) Limits are severe enough to induce a leftward shift the market labor supply curve; (2) The least-skilled, least-experienced, and least-paid workers are selected out of the population; (3) H-1B workers are imperfectly substitutable with alternative workers with otherwise similar characteristics; (4) Or, not only are H-1B workers imperfectly substitutable, but scarcity also leads to a shift in bargaining power away from firms and toward H-1B workers.

This paper exploited a natural experiment to conduct a variety of difference-in-difference tests examining the value of H-1B status after available permits for new workers have been exhausted. Job offers from for-profit firms serve as the primary treatment group; job offers from non-profit firms that are exempt from H-1B limits serve as the primary control group. Baseline regressions and robustness checks find that wages associated with job offers from for-profit firms rise by over 1% relative to non-profit firms after USCIS stops accepting new H-1B applications. The largest wage differential occurs within the first month following this date of last receipt.

Subsequent analysis examined wage effects within narrowly-defined demographic groups and for specific years. These exercises helped to demonstrate that the mechanisms governing wage premia differ by year. This might be attributable to different levels of work permit scarcity across time. In years of particularly acute scarcity, the premia appears to rise on or just before the date of last receipt as firms increase wages to ensure a successful hire without being restrained by H-1B quota. The regressions also confirmed that wage premia exist within specific types of H-1B applicants including new applicants with advanced degrees from U.S. institutions, pre-existing H-1B workers, those continuing employment with their current employer, and former H-1B workers returning to the U.S. It is unlikely that compositional forces are driving the entire effect identified in baseline regressions.

The results provide new insights into issues that remain controversial in the economics literature. Most notably, previous work exploring the substitutability between foreign and native-born labor has failed to come to a consensus on the issue. Disparities in results exist, in part, due to the methodologies used to

estimate effects. Unlike prior studies, this paper uses a natural experiment caused by U.S. policy to perform a difference-in-difference comparison of wage offers between two highly similar groups of workers – foreign-born specialty workers at for-profit versus non-profit firms. Though this is not a direct test of the elasticity of substitution between types of workers, the results are consistent with an interpretation that H-1B labor is imperfectly substitutable with other sources of labor, including both native and foreign-born college-educated workers available through other work programs. The results are also consistent with increased market power for such individuals, which helps to assuage concerns about potential labor exploitation and indentured servitude.

References

- George J. Borjas (2003). "The Labor Demand Curve Is Downward Sloping: Reexamining The Impact Of Immigration On The Labor Market," *The Quarterly Journal of Economics*, MIT Press, Vol. 118(4), pp. 1335-1374.
- Borjas, George J (2009), "Immigration in High-Skill Labor Markets: The Impact of Foreign Students on the Earnings of Doctorates," in *Science and Engineering Careers in the United States: An Analysis of Markets and Employment*. NBER, pp. 131-161.
- Borjas, George J (2013), "Immigration and the American Worker: A Review of the Academic Literature", Center for Immigration Studies, April 2013.
- Borjas, George J and Kirk Doran (2012), "The Collapse of the Soviet Union and the Productivity of American Mathematicians", *Quarterly Journal of Economics*, 127(3): 1143–1203.
- Borjas, George J, Jeffrey Grogger, and Gordon H. Hanson (2008). "Imperfect Substitution between Immigrants and Natives: A Reappraisal," NBER Working Papers 13887
- Borjas, George J, Jeffrey Grogger, and Gordon H. Hanson (2011). "Substitution Between Immigrants, Natives, and Skill Groups," NBER Working Paper 17461
- Card, David (2009). "Immigration and Inequality." *American Economic Review*, Vol. 99(2): 1-21.
- Depew, Briggs, Peter Norlander, and Todd A. Sorensen (2013). "Flight of the H-1B: Inter-Firm Mobility and Return Migration Patterns for Skilled Guest Workers," IZA Discussion Paper 7456.
- Doran, Kirk, Alexander Gelber, and Adam Isen (2014). "The Effect of High-Skilled Immigration on Patenting and Employment: Evidence from H-1B Visa Lotteries." NBER Working Paper 20668.
- Ellison, Glenn (2010), "How Does the Market use Citation Data? The Hirsch Index in Economics." NBER Working Paper 16419.
- Hamermesh, Daniel S. and Gerard A. Pfann (2011). "Reputation and Earnings: The Roles of Quality and Quantity in Academe." *Economic Inquiry*, Vol. 50(1): 1-16.

Hilmer, Christiana E., Michael J. Hilmer, and Michael R. Ransom (2012), "Fame and the Fortune of Academic Economists: How the Market Rewards Influential Research in Economics." IZA Discussion Paper 6960.

Hira, Ron (2007). "Outsourcing America's Technology and Knowledge Jobs: High-Skill Guest Worker Visas are Currently Hurting Rather than Helping Keep Jobs at Home," Briefing Paper 187, Economic Policy Institute.

Hira, Ron (2010). "The H-1B and L-1 Visa Programs: Out of Control," Briefing Paper 280, Economic Policy Institute.

Hunt, Jennifer and Marjolaine Gauthier-Loiselle (2010). "How Much Does Immigration Boost Innovation?", *American Economic Journal: Macroeconomics*: 31–56.

Jones, Charles I (2002). "Sources of US Economic Growth in a World of Ideas", *The American Economic Review*, Vol. 92(1): 220–239.

Katz, David A. (1973). "Faculty Salaries, Promotions and Productivity at a Large University." *The American Economic Review*, Vol. 63(3): 469–477.

Kerr, William R and William F Lincoln (2010). "The supply side of innovation: H-1B visa reforms and US ethnic invention", *Journal of Labor Economics*, 28: 473–508.

Lofstrom, Magnus and Joseph J Hayes (2011). "H-1Bs: How do They Stack up to US Born Workers?", IZA Discussion Paper No. 6259.

Matloff, Norman (2003) "On the Need for Reform of the H-1B Nonimmigrant Work Visa in Computer-Related Occupations." *University of Michigan Journal of Law Reform*, Vol. 36(4), pp. 815–914.

Matloff, Norman (2008), "H-1Bs: Still Not the Best and the Brightest," Center for Immigration Studies Backgrounder, May 2008. http://cis.org/h1bs_not_best.html

Matloff, Norman (2013) "Immigration and the Tech Industry: As a Labour Shortage Remedy, for Innovation, or for Cost Savings?" *Migration Letters*, Vol. 10 (2), pp. 211–228.

- Miano, John (2007). "Low salaries for low skills wages and skill levels for H-1B computer workers, 2005," Center for Immigration Studies Backgrounder, April 2007. <http://www.cis.org/articles/2007/back407.html>
- Miano, John (2008). "H-1B Visa Numbers: No Relationship to Economic Need," Center for Immigration Studies Backgrounder, June 2008. <http://cis.org/H1bVisaNumbers>
- Moser, Petra, Alessandra Voena, and Fabian Waldinger, (2014). "German-Jewish Emigres and U.S. Invention," NBER Working Papers 19962.
- Mukhopadhyay, Sandar and David Oxborrow (2012). "The Value of an Employment-Based Green Card," *Demography*, Vol. 49 (1), pp. 219-237.
- Ottaviano, Gianmarco I. P. and Giovanni Peri (2008). "Immigration and National Wages: Clarifying the Theory and the Empirics," NBER Working Papers 14188
- Ottaviano, Gianmarco I. P. and Giovanni Peri (2012). "Rethinking The Effect Of Immigration On Wages," *Journal of the European Economic Association*, European Economic Association, Vol. 10(1), pp. 152-197.
- Peri, Giovanni, Kevin Shih, and Chad Sparber (2015a). "Foreign and Native Skilled Workers: What Can We Learn from H-1B Lotteries", NBER Working Papers 21175
- Peri, Giovanni, Kevin Shih, and Chad Sparber (2015b). "STEM Workers, H-1B Visas, and Productivity in US Cities" (with Giovanni Peri and Kevin Shih), *Journal of Labor Economics*, Vol. 33 (No. S1, US High-Skilled Immigration in the Global Economy): S225-S255, July 2015
- Peri, Giovanni and Chad Sparber (2009). "Task Specialization, Immigration, and Wages", *American Economic Journal: Applied Economics*, 1(3): 135–169.
- Peri, Giovanni and Chad Sparber (2011). "Highly-Educated Immigrants and Native Occupational Choice", *Industrial Relations*, 50(3).
- Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek (2015). *Integrated Public Use Microdata Series: Version 6.0* [Machine-readable database]. Minneapolis: University of Minnesota, 2015.

USCIS (2010). “Practical Immigration Consequences for Foreign Workers in a Slowing Economy,” <http://www.uscis.gov/tools/ombudsman-liaison/practical-immigration-consequences-foreign-workers-slowng-economy> March 15, 2010.

A Appendix

A.1 Wage Correlations across Academic Fields of Study

The 2010-2012 ACS¹¹ provides data on variables that facilitate the comparison of average (log) wages paid to for-profit and non-profit workers by primary academic field of study. Individuals included are native-born civilian employees, age 18-65, who do not reside in group quarters, and who have obtained a bachelor's degree or more education and are not currently enrolled in school. The sample is further restricted to individuals working for private for-profit or non-profit organizations. Figure A1 displays a simple bivariate scatterplot of average wages paid by field of study. STEM degrees are marked with an X; non-STEM degrees are marked with an O.¹² A line of best fit across all fields of study reveals that a 1% increase in the wage paid to for-profit workers is associated with a 0.79% increase in wages paid to non-profit employees with the same field of study. The coefficient is significantly different from both zero and one.

A.2 H-1B Classification

Instructions for I-129 petitions for H-1B status include a section on “Basis for Classification.” Applicants are given six options from which this paper begins to construct the seven application type indicator variables:

- **New employment.** The beneficiary is outside the U.S. and holds no classification; is set to begin employment for a new U.S. employer in a different nonimmigrant classification than he/she currently holds; or will work for the same employer but in a different nonimmigrant classification.
- **Continuation of previously approved employment without change with the same employer.** The beneficiary is applying to continue employment in the same nonimmigrant classification currently held and there has been no change to employment.
- **Change in previously approved employment.** The beneficiary is notifying USCIS of non-material changes to the previously approved employment such as a change in job title without a material change in job duties.

¹¹Ruggles et al. (2015).

¹²Economics is the highest-earning non-STEM degree in the for-profit sector; actuarial science (a business degree) is the highest-earning non-STEM degree in the non-profit sector.

- **New concurrent employment.** The beneficiary will begin new employment with an additional employer in the same nonimmigrant classification currently held while the beneficiary will continue working for his/her current employer.
- **Change of employer.** The beneficiary will begin employment with a new employer in the same nonimmigrant classification currently held.
- **Amended petition.** The beneficiary is notifying USCIS of a material change in the terms or conditions of employment or training or the beneficiary's eligibility as specified in the original approved petition.

The analysis in this paper adds a seventh application type for "Returning H-1B workers." These are beneficiaries who (1) were previously granted status as an H-1B nonimmigrant in the past 6 years; (2) are applying from abroad to reclaim the remaining portion of the six years; or (3) are seeking a 7th year extension and the beneficiary's previous H-1B petitioner/employer was not a cap-exempt organization; and (4) are applying for new employment.

Appendix Table A1 lists the number of observations by application type. Petitions for new employment and continuation of employment account for over 70% of the sample. Those changing employers and returning to the U.S. account for an additional 18%. Remaining categories are relatively rare.

Table 1: Final Receipt Date by Fiscal Year

Fiscal Year	General		Advanced US Degree	
	Final Receipt Date	Days in Filing Period	Final Receipt Date	Days in Filing Period
2005	October 1, 2004	184	Not Reached	548
2006	August 10, 2005	132	January 17, 2006	292
2007	May 26, 2006	56	July 26, 2006	117
2008	April 3, 2007	3	April 30, 2007	30
2009	April 7, 2008	7	April 7, 2008	7
2010	December 21, 2009	265	July 9, 2009	100

Table 2: Descriptive Difference-in-Difference Estimates

<u>Average Wages</u>			
	For Profit	Non Profit	Difference
Pre-Last Receipt	66,906	57,984	8,922
Post-Last Receipt	80,621	60,516	20,105
Difference	13,715	2,532	11,183
<u>Number of Observations: Overall</u>			
	For Profit	Non Profit	Difference
Pre-Last Receipt	310,027	31,164	278,863
Post-Last Receipt	446,210	132,367	313,843
Difference	136,183	101,203	34,980
<u>Number of Observations: Change of Employer</u>			
	For Profit	Non Profit	Difference
Pre-Last Receipt	15,143	2,121	13,022
Post-Last Receipt	105,099	12,174	92,925
Difference	89,956	10,053	79,903

Table 3: Baseline Results

	Dependent Variable: ln(Wage)					
	(1)	(2)	(3)	(4)	(5)	(6)
Post Last Day * For-Profit	0.039*** (0.004)	0.013*** (0.004)	0.012*** (0.004)			
1 Month Post Last Day * For-Profit				0.036*** (0.005)	0.020*** (0.005)	0.023*** (0.005)
2 Months Post Last Day * For-Profit				0.021*** (0.005)	0.009* (0.005)	0.014*** (0.005)
3+ Months Post Last Day * For-Profit				0.045*** (0.004)	0.010** (0.004)	0.006* (0.004)
For-Profit Firm	0.127** (0.055)	0.201*** (0.053)	0.171*** (0.052)	0.117** (0.055)	0.179*** (0.053)	0.153*** (0.052)
Post Last Day of Receipt	0.009** (0.004)	0.007** (0.004)	0.008** (0.004)			
1 Month Post Last Day				0.009** (0.005)	-0.001 (0.004)	-0.003 (0.004)
2 Months Post Last Day				0.026*** (0.005)	0.014*** (0.005)	0.012** (0.005)
3+ Months Post Last Day				0.010** (0.004)	0.025*** (0.004)	0.024*** (0.004)
Continuation of Employment	0.168*** (0.001)	0.130*** (0.001)	0.121*** (0.001)	0.167*** (0.001)	0.129*** (0.001)	0.120*** (0.001)
Change in Approved Employment	0.211*** (0.002)	0.175*** (0.002)	0.150*** (0.002)	0.210*** (0.002)	0.174*** (0.002)	0.150*** (0.002)
Concurrent Employment	-0.043*** (0.012)	-0.179*** (0.012)	-0.161*** (0.012)	-0.043*** (0.012)	-0.180*** (0.012)	-0.162*** (0.012)
Change of Employer	0.185*** (0.002)	0.162*** (0.001)	0.156*** (0.001)	0.184*** (0.002)	0.161*** (0.001)	0.156*** (0.001)
Amended Petition	0.170*** (0.003)	0.145*** (0.003)	0.118*** (0.003)	0.169*** (0.003)	0.144*** (0.003)	0.117*** (0.003)
Returning H-1B	0.179*** (0.002)	0.151*** (0.002)	0.139*** (0.002)	0.178*** (0.002)	0.150*** (0.002)	0.139*** (0.002)
No Diploma		0.150*** (0.035)	0.131*** (0.035)		0.150*** (0.035)	0.131*** (0.035)
High School		0.122*** (0.017)	0.125*** (0.018)		0.122*** (0.017)	0.125*** (0.018)
Some College		0.031*** (0.007)	-0.018*** (0.006)		0.031*** (0.007)	-0.018*** (0.006)
Masters		0.050*** (0.001)	0.021*** (0.001)		0.050*** (0.001)	0.021*** (0.001)
Professional		0.460*** (0.003)	0.340*** (0.003)		0.460*** (0.003)	0.340*** (0.004)
Doctorate		0.199*** (0.002)	0.186*** (0.002)		0.199*** (0.002)	0.186*** (0.002)
Advanced US Degree		0.019*** (0.001)	0.066*** (0.001)		0.019*** (0.001)	0.067*** (0.001)
Age		0.038*** (0.001)	0.046*** (0.001)		0.038*** (0.001)	0.046*** (0.001)
Age^2		-0.0004*** (0.0000)	-0.0005*** (0.0000)		-0.0004*** (0.0000)	-0.0005*** (0.0000)
Constant	11.898*** (0.143)	10.594*** (0.140)	10.632*** (0.131)	11.963*** (0.145)	10.797*** (0.141)	10.787*** (0.132)
Observations	919,768	880,656	841,093	919,768	880,656	841,093
R-squared	0.129	0.207	0.336	0.129	0.207	0.336

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All models include indicators for month, year, and H-1B filing status, plus quadratic trends specific to for-profit and non-profit firms. Columns (3) and (6) also include indicators for birthplace, occupation, and metropolitan area.

Table 4: Placebo Tests

	Dependent Variable: $\ln(\text{Wage})$		
	(1)	(2)	(3)
<i>Placebo Checks:</i>	<i>Define April 1 as Last Day of Receipt</i>	<i>2005 and 2010 Fiscal Years</i>	<i>Define Private Research as For-Profit</i>
Post Last Day * For-Profit	0.013 (0.024)	0.019*** (0.004)	0.010 (0.012)
1 Month Post Last Day * For-Profit	0.007 (0.024)	0.009 (0.008)	0.008 (0.016)
2 Months Post Last Day * For-Profit	0.031 (0.024)	0.011 (0.007)	0.017 (0.017)
3+ Months Post Last Day * For-Profit	0.010 (0.024)	0.025*** (0.004)	0.009 (0.012)
Observations	841,093	391,766	80,758

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

All models include indicators for month, year, H-1B filing status, birthplace, occupation, US Advanced Degree, and metropolitan area, plus quadratic trends specific to for-profit and non-profit firms.

Table 5: Robustness Checks of Main Specification

	Dependent Variable: ln(Wage)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	<i>Exclude: Five Countries with H-1B Substitutes</i>	<i>Exclude: India</i>	<i>Indians</i>	<i>Exclude: Computer Occupations</i>	<i>Computer Occupations</i>	<i>Exclude: For-Profit Firms with 1000 or Fewer H- 1Bs</i>	<i>Exclude: For-Profit Firms with More than 1000 H- 1Bs</i>
Post Last Day * For-Profit	0.014*** (0.004)	0.015*** (0.004)	-0.063*** (0.009)	0.010** (0.004)	-0.014 (0.016)	0.027*** (0.004)	0.015*** (0.004)
1 Month Post Last Day * For-Profit	0.025*** (0.005)	0.018*** (0.005)	-0.019* (0.011)	0.022*** (0.005)	-0.008 (0.023)	0.029*** (0.005)	0.028*** (0.005)
2 Months Post Last Day * For-Profit	0.015*** (0.005)	0.010* (0.006)	-0.023** (0.011)	0.014*** (0.005)	-0.007 (0.020)	0.025*** (0.005)	0.018*** (0.005)
3+ Months Post Last Day * For-Profit	0.010** (0.004)	0.014*** (0.004)	-0.092*** (0.010)	0.004 (0.004)	-0.017 (0.016)	0.025*** (0.004)	0.009** (0.004)
Observations	787,589	418,266	422,827	443,936	397,157	264,235	719,887

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All models include indicators for month, year, H-1B filing status, birthplace, occupation, US Advanced Degree, and metropolitan area, plus quadratic trends specific to for-profit and non-profit firms.

Table 6: Exploration of Compositional Effects

	Dependent Variable: $\ln(\text{Wage})$					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Regressions Include Only:</i>	<i>Exclude: Week of Last Receipt</i>	<i>Include New H-1B interaction with Post Last Date</i>	<i>Exclude: Advanced US Degree Applications</i>	<i>New H-1Bs with Advanced US Degrees in FY 2006</i>	<i>New H-1Bs with Advanced US Degrees in FY 2007</i>	<i>New H-1Bs with Advanced US Degrees in FY 2008</i>
Post Last Day * For-Profit	0.004 (0.004)	0.013*** (0.004)	0.011** (0.005)	-0.006 (0.022)	0.056** (0.028)	-0.122*** (0.034)
1 Month Post Last Day * For-Profit	0.015*** (0.005)	0.023*** (0.005)	0.033*** (0.006)	0.001 (0.023)	0.038 (0.029)	-0.129*** (0.035)
2 Months Post Last Day * For-Profit	0.006 (0.005)	0.015*** (0.005)	0.028*** (0.006)	-0.009 (0.027)	-0.017 (0.043)	.
3+ Months Post Last Day * For-Profit	-0.003 (0.004)	0.008** (0.004)	-0.004 (0.005)	0.039 (0.037)	-0.097 (0.068)	.
Observations	693,503	841,093	581,639	31,321	21,197	21,359

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All models include indicators for month, year, H-1B filing status, birthplace, occupation, US Advanced Degree, and metropolitan area, plus quadratic trends specific to for-profit and non-profit firms.

Table 7: Triple Difference Estimates

	Dependent Variable: ln(Wage)				
	(1)	(2)	(3)	(4)	(5)
	New Workers with Advanced US Degrees	Pre-Existing H-1Bs	Continuation of Employment	Change of Employer	Returning to US
Week of Last Receipt * For Profit * 2007	0.102** (0.042)	0.095*** (0.032)	0.092** (0.037)	0.016 (0.083)	0.213* (0.126)
Weeks after Last Receipt * For Profit * 2007	0.079*** (0.026)	0.016 (0.018)	0.027 (0.021)	0.004 (0.047)	0.154** (0.071)
Week of Last Receipt * For Profit	-0.022 (0.032)	-0.045** (0.023)	-0.038 (0.028)	-0.033 (0.049)	-0.092 (0.090)
Weeks after Last Receipt * For Profit	0.001 (0.021)	-0.040*** (0.015)	-0.047*** (0.018)	-0.039 (0.036)	-0.119** (0.060)
Observations	52,518	197,042	119,383	38,872	21,046
R-squared	0.303	0.314	0.337	0.324	0.324

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All models include indicators for month, year, H-1B filing status, birthplace, occupation, US Advanced Degree, and metropolitan area, plus quadratic trends specific to for-profit and non-profit firms. See main text for the full set of difference-in-different controls.

Figure 1: Trends in Average $\ln(\text{Wage})$ Before and After the Last Date of Receipt, Fiscal Years 2006-2009

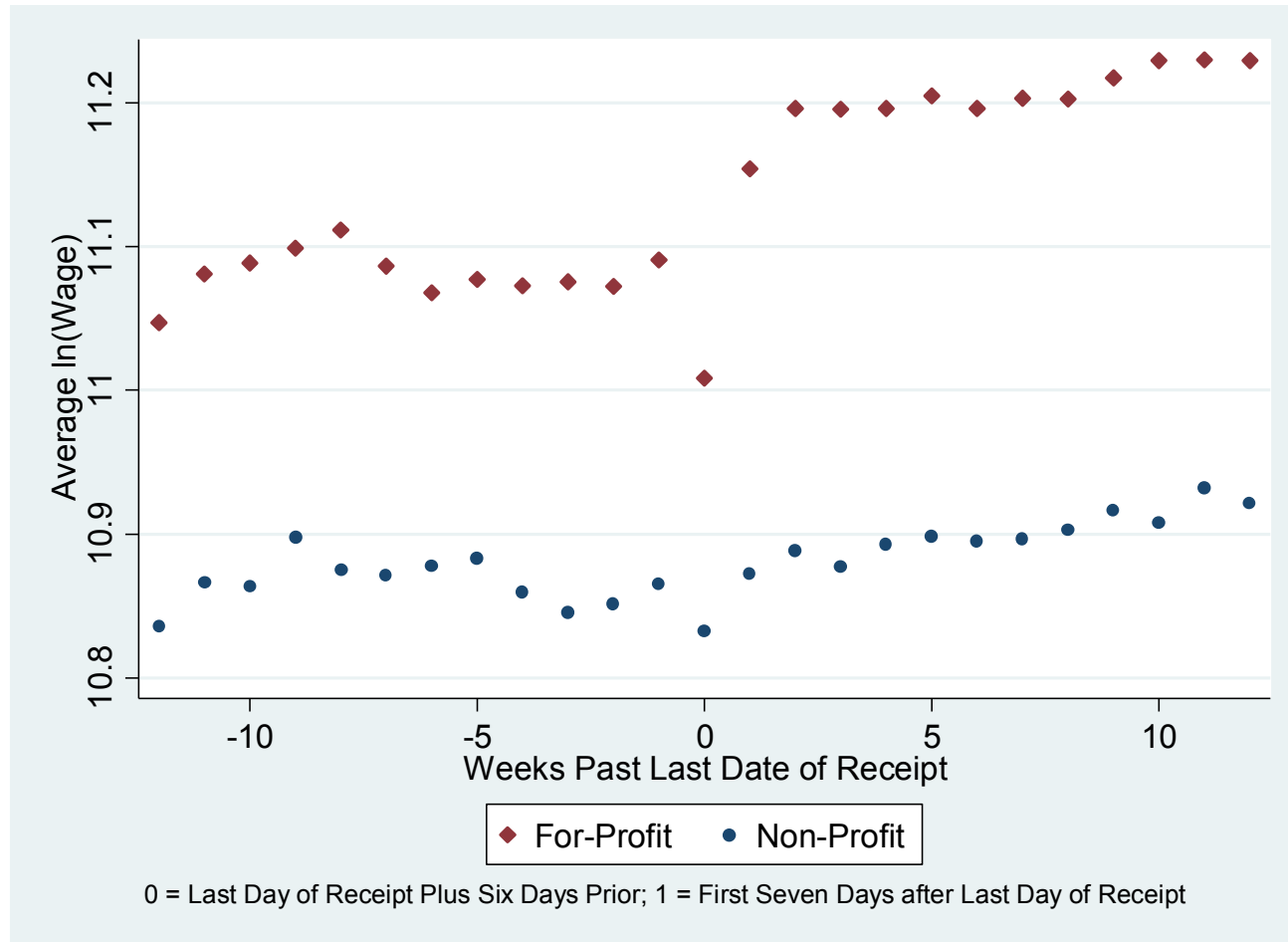
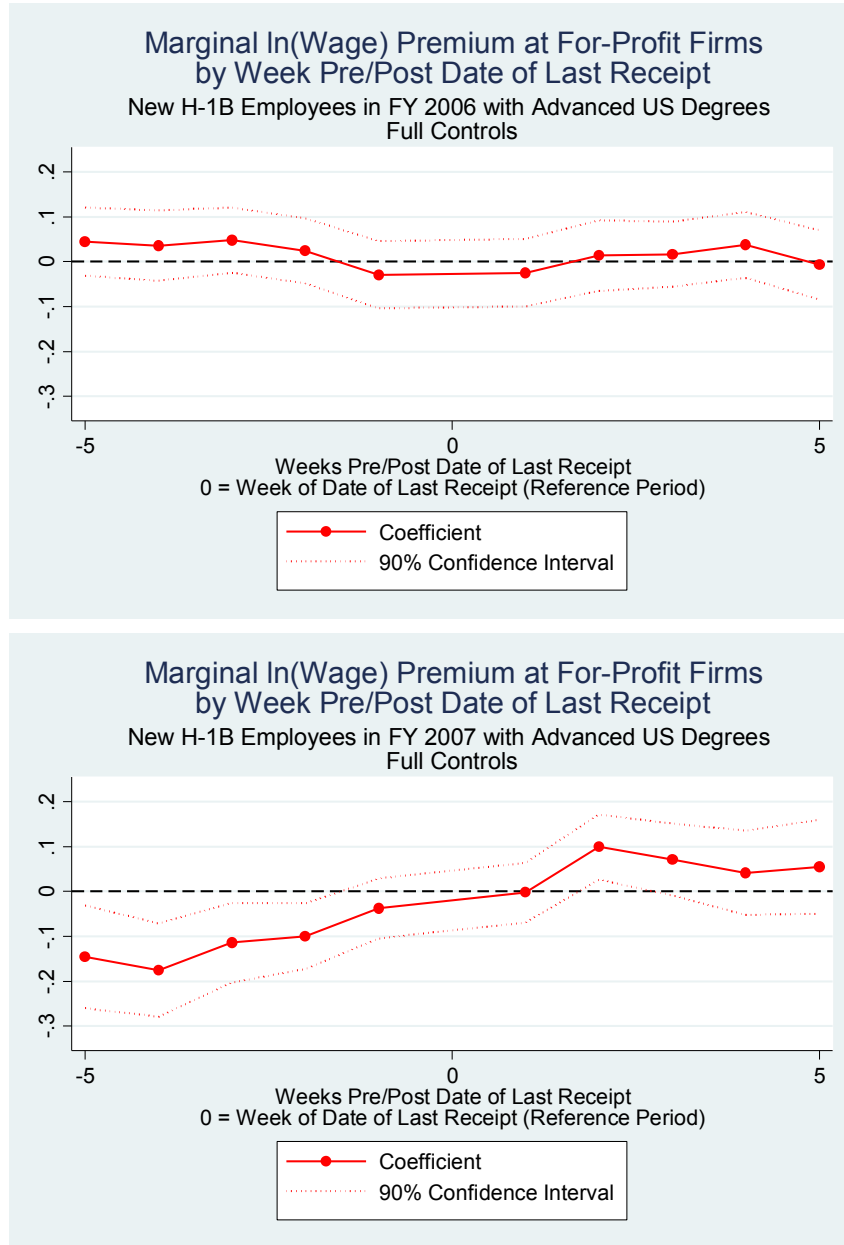


Figure 2: Coefficient on For-Profit Firms before and after the Last Date of Receipt



Models include indicators for month, year, week, H-1B filing status, birthplace, occupation, US Advanced Degree, and metropolitan area, plus quadratic trends specific to for-profit and non-profit firms.

Appendix Table A1: Number of Observations by Application Type

Application Type	Observations	Percent
New Employment	854,002	39.87
Continuation of Employment	718,212	33.53
Change in Previously Approved Employment	129,327	6.04
New Concurrent Employment	9,563	0.45
Change of Employer	217,340	10.15
Amended Petition	39,336	1.84
Returning H-1B Worker	174,127	8.13

Appendix Figure A1: Wages by Field of Study and Employer Type

