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ABSTRACT

Low-Wage Jobs, Foreign-Born Workers, and Firm Performance*

How do migrant workers impact firm performance? We exploit an unexpected change in firms' likelihood of securing low-wage workers through the U.S. H-2B visa program to address this question. Using comprehensive administrative data, we find that access to H-2B workers raises firms' annual revenues and survival likelihood without crowding out other forms of employment. We do not find evidence of negative spillover effects on competitor firms. Our results support the notion that guest worker programs can mitigate labor shortages while limiting harm to incumbent workers.

JEL Classification: J23, F22, J61

Keywords: guest workers, migrants, employment, firm dynamics, H-2B visa

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1 Introduction

Firms increasingly report difficulties finding workers, particularly in sectors that employ low-wage workers.[1] In 2018, roughly 25% of E.U. firms in the construction and service sectors reported that labor shortages limited their production, compared to less than 5% in 2010 (European Commission, 2022). In the U.S., job opening rates in the construction and the food and accommodation sectors more than doubled over the same period. In light of these developments, calls for increasing (temporary) immigration have become commonplace.[2] Yet, we still have a limited understanding of how guest workers impact firm performance, particularly when labor markets are tight.

The U.S. H-2B visa program offers a unique opportunity to address this question. It is the primary channel available to U.S. firms seeking to secure guest workers for non-agricultural jobs that do not require a college degree. As such, it matches workers who usually make less than $15 per hour with large firms in locally traded sectors. Because the program has the potential to displace especially vulnerable native workers, the H-2B visa has been the subject of a contentious policy debate that mirrors the larger discussion surrounding U.S. immigration. On the one hand, users of the program argue that having access to foreign-born labor is vital to their survival based on the shortage of U.S. workers willing to perform the jobs they offer. On the other hand, opponents of the H-2B visa program argue that firms primarily use the H-2B program to save on labor costs.[3]

This paper uses a unique suite of administrative data to study how the H-2B visa program impacts firm performance. We compile a data set that links administrative data on 1) firm initial requests for H-2B workers from the Department of Labor (DoL), 2) firm-level counts of eventual H-2B visa approvals from the United States Customs and Immigration Services (USCIS), and 3) administrative data on firm-level outcomes from the U.S. Census Bureau. Our final data set includes the near-universe of H-2B applicant firms. It allows us to observe information on their quarterly payroll, quarterly employment, and annual revenues over the period spanning from 2015 through 2021.

[1] See, e.g., Kosakow and Waddell (2022) for a recent survey of employers that makes this point.

[2] See, e.g., Gordon H. Hanson and Matthew J. Slaughter, "America Needs More Immigration to Defeat Inflation" in *Foreign Affairs*; Vanessa Yurkevich, "America needs immigrants to solve its labor shortage" from CNN; Justin Gest, "How Immigrants Tame Inflation" from the *Wall Street Journal*.

[3] See, for example for congressional testimony by a large, Michigan hotel owner in favor of the H-2B program (https://www.visalawyerblog.com/Musser080416H2B%20testimony.pdf) and this account of the strains the 2018 H-2B visa shortage placed on Maryland crab houses (https://www.voanews.com/a/no-immigrant-workers-no-crab-meat/4397864.html). Several popular press accounts also highlight the importance of immigrant workers to firms in lower-wage sectors. See, e.g., Miriam Jordan and Santiago Pérez, "Small Businesses Lament There Are Too Few Mexicans in U.S., Not Too Many" in the *Wall Street Journal* and Jeff Barker, "Visas for crab processors is a 'one-year remedy'" in the *Washington Post*. For a summary of arguments made by H-2B detractors, see Daniel Costa, "Claims of labor shortages in H-2B industries don't hold up to scrutiny".

The primary challenge in assessing the impact of access to H-2B workers is that firms participating in the H-2B program are likely selected along unobserved dimensions. To identify the effect of access to H-2B workers on firm performance, we exploit the unprecedented spike in Temporary Labor Certification (TLC) applications for H-2B workers that occurred on January 1, 2018, in the midst of a historically tight labor market for low-wage workers. This spike forced the DoL to change its processing procedures ex-post, generating quasi-random variation in firms' access to H-2B workers during the second half of fiscal year 2018 (calendar Q2 and Q3 of 2018).

Specifically, firms that applied to the DoL before 7:00 am EST on January 1, 2018 (early-applicants) were much more likely to have their applications processed in time to hire H-2B workers than firms that applied later on January 1, 2018 (late-applicants). On average, early applicants gained access to approximately eight additional H-2B workers in 2018 when compared to late-applicants. Yet, because this cutoff was not predictable ex-ante, early-applicants and late-applicants were on parallel trends before 2018, prompting us to use a difference-in-differences approach to identify how access to H-2B worker impacts firm outcomes.[4,5]

Using this identifying variation, we start by exploring the canonical question of whether hiring foreign-born workers through the H-2B program crowds out other forms of employment at the firm level. We find that employment increased significantly at early-applicant firms during the H-2B hiring period of calendar Q2 and Q3 in 2018, roughly one-for-one with H-2B hires.[6] In the fourth quarter, when most H-2B workers were no longer employed, estimates reverted back to zero. Given that these estimates likely include the H-2B workers themselves, we find limited scope for crowd-out of other workers.[7] Further, we do not find evidence that firms used the H-2B program to cut down on labor costs. These results are consistent with the notion that firms mostly hire H-2B workers to tackle seasonal labor shortages.

Second, we assess the impact of access to H-2B workers on key measures of firm performance. We find that firms able to hire H-2B workers experienced revenue gains, with an implied elasticity of 0.14. Furthermore, firms with access to H-2B workers exhibited a higher likelihood of staying in operation, as measured by an indicator for having a positive annual payroll. Specifically, early-applicant firms were 2.1 and 4.2

[4]The 7:00 am EST "cutoff" may bring to mind a regression discontinuity design, i.e., Pinoti (2017). Unfortunately, we observe very few firms around the threshold, which leads to small sample problems. Instead, we adopt a difference-in-differences approach that allows us to use the entire data set, while providing evidence that the parallel trends and the no anticipation assumptions hold in our setting.

[5]There are a small number of firms who sent in applications both before and after 7:00 am EST (for different sets of workers). Therefore, as we further explain in Section 4, our treatment is technically continuous. However, given that this group is small, we discuss our treatment in binary terms here to facilitate exposition.

[6]As H-2B workers are subject to federal income taxes, they are counted in the data as employees.

[7]Since we do not observe firm workforce composition by nativity, we cannot explore whether any extant crowd-out affects foreign-born or natives.

percentage points more likely to remain active in 2018 and 2021, respectively. These large extensive margin effects suggest that, among H-2B participant firms, profitability and viability may hinge on the ability to hire foreign-born workers.

Third, we address whether early applicants' access to H-2B workers generated negative spillovers for their competitors. We fail to detect evidence that either late applicants or non-H-2B participating firms in the same market (county and 6-digit industry) fared worse on a broad range of measures. In doing so, we generate novel evidence on the viability of scaling up the H-2B visa program.

Finally, we show that firms in stricter immigration enforcement environments particularly benefit from access to H-2B workers, suggesting scope for substitution between H-2B workers and unauthorized immigrants. As such, our findings highlight the notion that immigration policies impact both undocumented *and* legal workers employed in low-wage positions.

Our study contributes to the existing literature on the impact of migrant workers on labor markets. Previous literature on contemporary temporary migration schemes has mostly studied non-U.S. settings, with mixed results regarding the well-being of migrants and incumbent workers (e.g., Naidu et al., 2016; Mobarak et al., 2023; Muñoz, 2023). Meanwhile, most studies evaluating the impact of "low-skill" U.S. immigration focus on worker-level outcomes or market-level outcomes derived from worker-level data (e.g., Borjas, 2003; Clemens et al., 2018; Abramitzky et al., 2022; East et al., 2023). In contrast, most of the research using firm-level data focuses on the hiring of "high-skilled" immigrant workers, mainly through the H-1B program (e.g., Kerr and Lincoln, 2010; Peri, 2012; Kerr et al., 2015; Peri et al., 2015; Doran et al., 2022; Glennon, 2024; Brinatti and Guo, 2023; Mahajan et al., 2024; Signorelli, forth.) or on market-level immigration shocks (e.g., Dustmann and Glitz, 2015; Dustmann et al., 2017; Mitaritonna et al., 2017; Ayromloo et al., 2020; Orefice and Peri, 2020; Beerli et al., 2021; Brinatti and Morales, 2021; Amior and Stuhler, 2023; Mahajan, 2024). A singular exception is Clemens and Lewis (2024), who examine the effect of the 2021 and 2022 H-2B visa lotteries using a survey of participant firms. They provide evidence that winning the H-2B lottery leads to a significant expansion in production, revenues, investment, and employment. They also rule out substantive native displacement.

Our work complements and extends these findings in important ways. First, the panel structure data allows us to evaluate the impacts of H-2B hiring on medium run firm survival. In this sense, our results highlight the essential role of H-2B workers for a group of large, productive firms. The comprehensive nature of our data also allow us to rule out large spillover effects on competitor firms, including those who did not participate in the H-2B program. Meanwhile, our findings on payroll provide

additional evidence that guest workers earning low wages do not necessarily harm incumbent workers' labor market prospects.

Second, we qualitatively confirm some of the primary findings in Clemens and Lewis (2024)—such as the increase in firm revenues and the relative lack of employment crowd-out—using the full set of potential H-2B users, a different year, and a different methodological approach. This is particularly important given that the the H-2B hiring restrictions generated by the 2018 application spike were unanticipated, whereas the H-2B hiring restrictions embodied by the 2021 and 2022 lotteries were fully anticipated.[8] As such, the similarity of findings across these studies further buttresses the case that H-2B workers are essential to the operation of H-2B users. They also stand in contrast to equivocal results surrounding the firm-level effects of hiring college-educated, foreign-born workers through the H-1B visa program (Kerr et al., 2015; Doran et al., 2022; Mahajan et al., 2024).

The rest of this paper proceeds as follows. Section 2 describes relevant details of the H-2B visa program. Section 4 describes our identification strategy. Section 3 describes the H-2B data, the administrative firm-level data, and the matching of these two data sources. Section 5 provides evidence consistent with our identification strategy, while Section 6 presents our main findings. Section 7 examines spillovers, robustness, and heterogeneity. Section 8 concludes the paper.

2 Institutional Setting and Labor Market Context

2.1 Overview of the H-2B Visa Program

The H-2B visa program has its roots in the World War II era, when the War Food Administration recruited guest workers from various Central and South American countries through the Bracero program. As time passed, the Bracero program underwent several changes until the 1986 Immigration Reform and Control Act divided it into two separate visa programs: H-2A for agricultural workers and H-2B for non-agricultural workers.

The H-2B visa program serves as a means for U.S. employers to hire foreign-born individuals to fulfill temporary and full-time non-agricultural positions within a specified area(s) of intended employment.[9] Jobs offered through this program typically

[8]The Department of Labor (DoL) began holding lotteries to determine which Temporary Labor Certification (TLC) applications were processed first starting in 2020. As a result, firms knew before applying that their application was subjected to a lottery. This lottery system might impact the type of firms that apply, potentially influencing the strategic decisions of businesses seeking to hire foreign labor. See for example, "With Jobs to Fill, Businesses Play the Visa Lottery" from *The New York Times*.

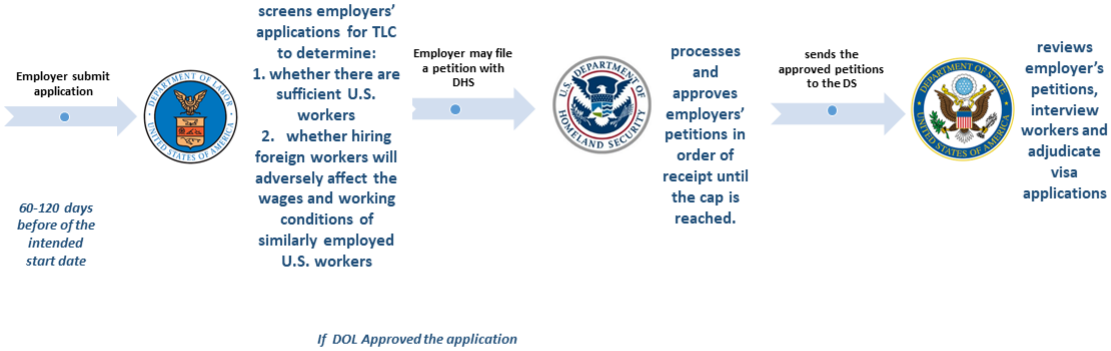
[9]H-2B visas belong to the category of nonimmigrant visas granted to foreign nationals who seek temporary entry into the United States. Alongside H-2B visas, there are several other nonimmigrant visas

have a duration of up to nine months and require a minimum of 35 hours of work per week.[10] The H-2B program admits a total of 66,000 workers annually, and this number is equally divided between the two halves of the fiscal year.[11]

2.2 Employing an H-2B Visa Worker

Employers seeking to hire foreign-born workers under the H-2B visa program must navigate a multi-step process involving three U.S. Departments: the Department of Labor (DoL), U.S. Citizenship and Immigration Services (USCIS), and the Department of State (DoS). Therefore, many H-2B program users contract out the application process to immigration attorneys. For example, our calculations indicate that 92% of initial H-2B applications to the DoL were submitted by attorneys in 2018. Hired attorneys file applications electronically or send the required documents by mail.

Figure 1: H-2B Visa Program Application Process



Source: Authors' analysis of DoL, DHS, and DoS regulations and guidance.

Initially, employers must obtain a Temporary Labor Certification (TLC) from the DoL, which requires registration 120 to 150 days before the intended job start date. TLC applications for the same occupation and worksite are consolidated into a single form, and most firms submit one consolidated form with multiple applications. To secure

permitting foreign nationals to work in the U.S. for a specific time and purposes. These include H-1B visas, designed for college-educated workers in specialty occupations, H-2A visas for agricultural laborers, B-1 visas catering to business travelers, B-2 visas for tourists, and J visas for exchange visitors like certain teachers and students. Of these, only the J visa has the potential to be a substitute for an H-2B visa, based on education requirements and occupational constraints. However, the J visa has primarily been used by firms in the hospitality and leisure sector, whereas H-2B users have increasingly become concentrated in Landscaping.

[10] While nine months is the maximum, most firms that demand H-2B workers starting in the second half of a fiscal year use a shorter period. For example, 71% of applications for H-2B workers to the DoL in 2018 indicated an end date before December 12, 2018, when Q4 employment is measured in our Census firm data.

[11] A fiscal year in the U.S. starts October, 1 and ends September, 30 in the following year. Consequently, the first half of a fiscal year is from October, 1 until March, 30. The second half of a fiscal year starts April 1 and ends September, 30.

the certification, applicant firms need to demonstrate the lack of native workers willing, qualified, and able to perform the job, as well as show that hiring an H-2B worker will not adversely affect the wages and conditions of local employees. Additionally, before submitting their applications, companies need to determine the prevailing wage rate for the position. This information is obtained from the National Prevailing Wage Center and involves comparing the pay of non-H-2B workers in the same occupation and geographic area.[12] The H-2B worker's pay must be higher than both the prevailing wage rate and the applicable Federal, State, or local minimum wage.[13] Part of the TLC requirements also includes extensive advertising of the position, contacting former workers and union representatives, and utilizing other suggested channels by the certifying officer. This has to be done 75 to 90 days before the job start date, and the firm is required to accept all qualified U.S. applicants up to 21 days before the job start date.

Due to existing deadlines, the DoL experiences a spike in applications at the beginning of each year for seasonal workers for the spring and summer—the second half of a given fiscal year—when most temporary workers are needed. The earliest a firm can apply for a 2nd Half Fiscal Year (2HFY) worker is January 1, and the earliest this worker can start employment is April 1. Our identification strategy is based on the unexpected change in the processing of firms' H-2B worker requests sent before vs. after 7:00 am on January 1, 2018 based on an unusually large spike in TLC applications that year (see Section 2.4 for details).

Following DoL's approval of their TLC applications, firms can submit official petitions for H-2B workers to the USCIS in an i129 form. The USCIS determines whether there is still room under the statutory cap for the workers requested and then charges a base of $460 for processing an application. Most firms select a premium service, which costs an additional $1,500, but guarantees faster processing, i.e., within 15 days.[14] USCIS usually processes applications sequentially, in the order they were received. However, if USCIS estimates that the cap will be exceeded based on the number of petitions received within five business days after the application start date, it conducts a lottery to allocate the H-2B visas randomly. The USCIS analyzes full firm petitions instead of worker solicitations. This means that firms' petitions are either fully approved or denied. Therefore, firms have no incentive to apply for more workers than needed.

Following USCIS approval, firms can start the hiring process. Each prospective employee has to apply for an H-2B visa at their corresponding U.S. embassies, and the

[12] Information on the determinants of the prevailing wage rate is given here https://www.dol.gov/agencies/eta/foreign-labor/wages.

[13] See, for example, the Fact Sheet on H-2B wage requirements, available under https://www.dol.gov/agencies/whd/fact-sheets/78c-h2b-wage-requirements.

[14] See the USCIS fee schedule https://www.uscis.gov/sites/default/files/document/forms/g-1055.pdf. The premium service does not, however, modify the firm's position in the TLC submission queue or give priority to the processing of requests submitted later in the day.

DoS charges employers an additional $190 per worker for visa processing. The DoS screens the applications and can still refuse to issue some visas. To our knowledge, the only public information on the rate of conversion from a USCIS approval to a DoS approval comes from a DHS report to Congress in 2016.[15] Table B1 shows Department of State H-2B cap-subject visa issuances and USCIS H-2B, cap-subject visa approvals for the years available from this report, along with data on DoS denials in years when available. Issuances by the DoS are generally well below USCIS approvals, with conversion rates ranging form 57.0% to 88.1%. In practice, this means that a firm hires fewer H-2B workers than it receives approvals for from the USCIS, mostly because of DoS denials.[16] We use 78%—the average conversion rate across years—as our benchmark for the rate at which USCIS H-2B approvals convert into DoS H-2B issuances ("hires").

2.3 The Post-Recession, Pre-Pandemic Labor Market

Demand for H-2B workers has steadily increased since the recovery from the Great Recession. Figure 2 shows the initial number of applications for H-2B workers (roughly, demand) and the final number of visas issued (supply) from 2010 through 2019.

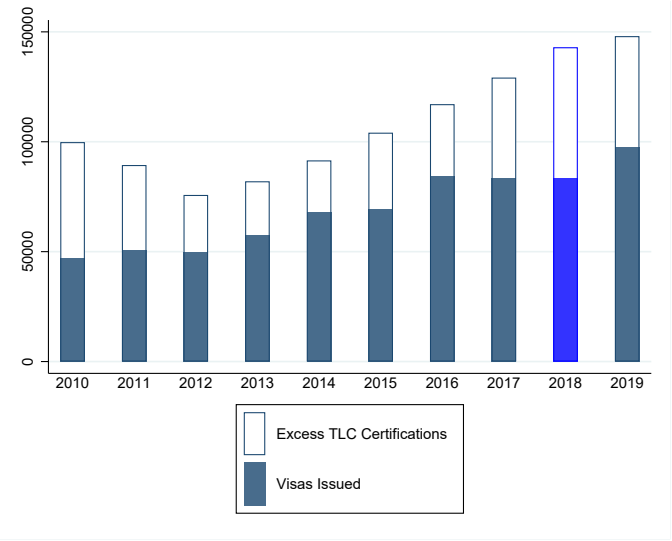
Two features emerge from Figure 2. First, the demand for H2B-workers always exceeded the number of visas available over the period under consideration. Second, the figure shows a clear increase in the demand for H-2B workers over time. Excess demand mirrors the increase in total demand, given statutory constraints. For example, in 2018, around 80,000 visas were issued, but almost 150,000 applications were received, implying that almost 50% of the initial demand was not met.

The increasing demand for H-2B workers may have been driven by firms' inability to address their labor needs through other channels, connecting our work to studies of firm performance during labor shortages (e.g., Le Barbanchon et al., 2023). In the left panel of Figure 3, we plot the unemployment rate for workers with and without a college degree from 2000 to 2019. The start year of our analysis—2015—is marked by a vertical line in each figure. Non-college workers have generally faced higher unemployment rates and have been harder hit by recessions (shown by the gray-shadowed areas). Since the end of the Great Recession, however, the non-college unemployment

[15] See H-2B Usage and Recommendations: https://www.dhs.gov/sites/default/files/publications/U.S.%20Citizenship%20and%20Immigration%20Services%20-%20H-2B%20Usage%20and%20Recommendations.pdf.

[16] The DoS states that: "While the vast majority of visa applications are approved, U.S. law sets out many standards under which a visa application may be denied. An application may be denied because the consular officer does not have all of the information required to determine if the applicant is eligible to receive a visa, because the applicant does not qualify for the visa category for which he or she applied, or because the information reviewed indicates the applicant falls within the scope of one of the inadmissibility or ineligibility grounds of the law. An applicant's current and/or past actions, such as drug or criminal activities, as examples, may make the applicant ineligible for a visa."

Figure 2: Supply and Demand of H-2B Visa Workers



Sources: DoL Office of Foreign Labor Certification Performance Data (total LCA applications) and Department of State (visas issued). Figure B1 plots issuances (blue) divided by total (issuances plus excess) for reference.

rate has witnessed a remarkable decline, falling from 12% at the beginning of 2010 to roughly 4% at the beginning of 2019. In comparison, the unemployment rate of workers with a college degree fell from 4% to 3% over the same period.

Figure 3: Labor Market Indicators

Notes: Thick dashed lines connect values in April of each year. Thinner lines represent non-seasonally-adjusted, monthly values. Gray bars represent National Bureau of Economic Research (NBER) recessions. Vertical black line indicates start of this paper's study period: January 2015.
Sources: Authors calculations from BLS Current Population Survey (CPS) microdata, via IPUMS-CPS (Ruggles et al., 2022) (left) and Bureau of Labor Statistics (BLS) Job Openings and Labor Turnover Survey (JOLTS) (right).

The drop in the unemployment rate of non-college workers was accompanied by a strong increase in job openings in industries generally associated with low- and medium-wage jobs, such as food and accommodation and construction. Using data from the Bureau of Labor Statistics Job Openings and Labor Turnover Survey (JOLTS),

the right panel of Figure 3 plots job opening rates in low- and medium-wage industries over time. Job openings grew steadily from the end of the Great Recession until the end of our sample period. Kosakow and Waddell (2022) show that low-wage workers' expectations of wage growth were higher than those of high-wage workers, even in the pre-pandemic labor market. In sum, we believe that the increased demand for H-2B workers during our study period is a consequence of the increase in demand for workers in low-wage industries.

2.4 The 2018 TLC Application Spike

Before 2018, the DoL processed applications based on the day they were filed, irrespective of the time of day. This procedure gave firms submitting their TLC applications on the same day a roughly equal chance to proceed to the next stage—i129 submission to the USCIS—on time. Further, while demand for H-2B workers had been steadily rising prior to 2018, the H-2B FY 2nd Half cap was not reached until mid-to-late March in 2015, 2016, and 2017. Hence, firms applying on January 1st would have almost certainly received certification in time to submit an i129 petition to the USCIS.

However, on January 1, 2018, the DoL received around 4,500 consolidated forms with more than 81,000 TLC applications for positions with an April 1 start date, exceeding the semi-annual visa allotment by almost 250%.[17] As described in Section 2.3, this spike occurred amid a tight U.S. labor market, specifically for low-wage workers. It was also the first time enough TLC applications to fill the H-2B cap were received on the first possible application date. For comparison, the DoL received TLC applications for 26,673 positions on January 1, 2017 and less than 10,000 positions on January 1, 2016. Following the surge in applications, the DoL announced modifications to the adjudication process on January 17, 2018. Certified applications would be released on February 20, 2018 based on the exact day *and* time—down to the millisecond—that they were received. Anecdotal evidence,[18] along with direct evidence we provide in Section 6, suggests that firms did not anticipate this change to DoL procedures.[19]

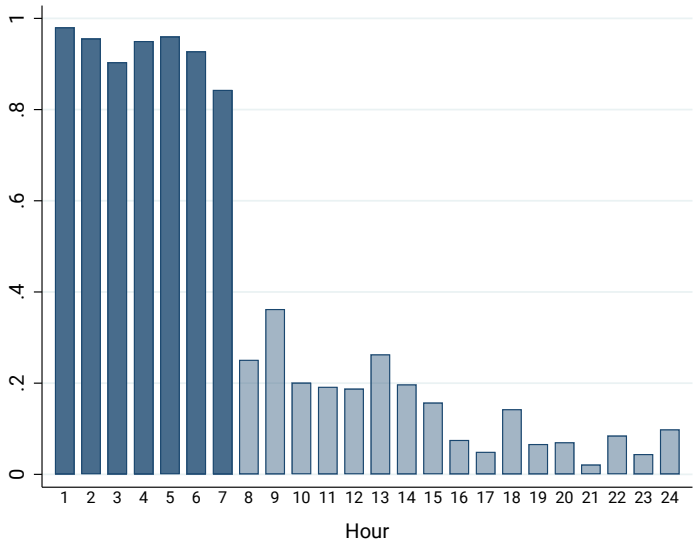
After the January 17th DoL announcement of changes to its TLC application processing, approved TLC applications started to be released on February 20, 2018. Within five business days, the USCIS had already received 47,700 i129 applications for H-2B workers, well exceeding the 33,000 cap. The USCIS conducted its first-ever lottery for

[17] See the January 23 announcement in the Federal Register, 83 FR 3189.
[18] See, for example, https://nickarnosti.com/blog/h2bvisas/.
[19] Figure B2 shows that the location of applicant firms did not significantly change from January 1, 2017 to January 1, 2018.

i129 petitions for H-2B visas on February 28, 2018. In addition, the USCIS announced that further petitions would be denied.[20]

Given that approved TLC applications are required for i129 petitions, the change to the DoL processing generated variation in firms' ability to send their i129 petitions to USCIS in time to *participate* in the USCIS lottery. As a comparison, in FY2017, 98.5% of TLC applications received on January 1 were processed in time for firms to send their certified i129 applications before the cap was reached. In FY2018, that figure dropped to 71.4%.

Figure 4: Proportion of 2HFY 2018 TLC Applications Processed before February 27, by Hour of Day Received on January 1



Source: DoL Office of Foreign Labor Certification Performance Data.
Notes: Figure B3 shows there is not a discrete change in the number of applications sent in by hour of the day on January 1—that is, no discrete change in the denominator of the proportion plotted here.

Figure 4 shows that the decline in on-time processing over the course of applications received on January 1 was not linear. Applications submitted before 7:00am were substantially more likely to be processed before February 27 relative to those received later in the day. Specifically, 96% of TLC applications received before 7:00am were processed before February 27, giving early applicants a chance to proceed to the second step in the H-2B worker procurement process. Meanwhile, only 19% of TLC applications received after 7:00am on January 1 were processed before February 27. Thus, the majority of firms who sent in applications after 7:00am were excluded from the original tranche of 33,000 2HFY H-2B workers.[21] As detailed in Section 4, the basis of our identification strategy is to compare firms that applied for H-2B workers before

[20] See the USCIS announcement on the allocation procedure, USCIS Completes Random Selection Process for H-2B Visa Cap for Second Half of FY 2018.

[21] Figure 4 makes it clear that there were some instances in which "first-come, first-served" was not exactly followed. DoL has not released any information indicating why 4% of applications sent in before 7:00am

7:00am on January 1, 2018 to those that applied for workers after 7:00am on January 1, 2018.

A second tranche of 15,000 "supplemental" visas was announced on May 25, 2018. The process of allocating those visas was the same as for the initial visa allotment. As petitions once more exceeded the new allotment, USCIS conducted a second lottery for these supplemental visas. The lottery results were announced June 11. Some firms who were originally unable to get 2HFY 2018 H-2B workers—either because their TLC applications were processed too late to participate in the first lottery, or because they lost the first lottery—had a second chance to do so. As we show in Section 6, this appears to have helped some firms that applied for TLC certifications after 7:00am on January 1, 2018 eventually hire H-2B workers, but it did not fully close the gap in H-2B hiring between pre- and post-7am applicants.

3 Data

3.1 Data Compilation and Matching

To examine how access to H-2B workers impacts firms, we combine administrative data on H-2B visa applications from the Department of labor and firm-level panel data compiled by the U.S. Census Bureau.

We first gather data on firms' H-2B TLC applications from the Office of Foreign Labor Certification at the DoL.[22] These records include the universe of H-2B TLC Applications and the certification determinations from the Department's Office of Foreign Labor Certification, Employment, and Training Administration. For each submission, we have information on the employer name, address, state, ZIP code, the number of requested workers, the number of certified requests, and the date the application was submitted. Crucially, for FY 2018, the data includes the millisecond on January 1 at which applications were received.

We also obtain data on i129 petitions from the USCIS.[23] The USCIS data is available for FY 2015 onward and contains information on employer name, address, state, and ZIP code, along with the number of approved i129 petitions for each employer.

To explore the impact of access to H-2B workers on firm-level outcomes, we use access to the 2021 version of the Longitudinal Business Database (LBD) (Chow et al.,

were not processed before February 27 and 19% of applications sent in after 7:00am were. We were not able to predict the incidence of either type of nonconforming case using our data. Additionally, we do not find evidence of application timing spillovers on firms in the same market, further limiting the evidence for strategic behavior.

[22] This data is publicly available from the Department of Labor Performance Data website.

[23] This data is available from the USCIS H-2B Employer Data Hub.

2021), granted to us by the U.S. Census Bureau. The LBD is an establishment-level panel data set constructed from administrative tax records for each U.S. non-farm, employee-hiring, private-sector establishment. Establishments are assigned unique, consistent identifiers that can be linked over time to create a true panel. It contains establishment-level information on calendar Q1 employment and annual payroll for all employers. Critically, it also contains establishment-level quarterly employment and payroll for single-establishment firms. Given that 2HFY H-2B visa workers are employed in calendar Q2 and Q3, this level of granularity helps us examine employer-level outcomes during the specific H-2B hiring period we study. Quarterly employment is measured on March 12, June 12, September 12, and December 12. Following convention, we recode missing values of employment and payroll to 0 when firms are inactive to balance our panel.

The timing of measurement—in conjunction with the provision of the supplemental tranche of H-2B visas in the second half of FY 2018—impacts how we interpret our employment results. Given that the supplemental visa lottery results were announced on June 11, it is highly unlikely that H-2B workers on supplemental visas were on firm payrolls by June 12, but highly likely that they were on payrolls by September 12. Thus, when estimating how many total employees are hired per H-2B approval, we only consider the initial tranche of H-2B approvals for calendar Q2. In contrast, both initial and supplemental tranche H-2B approvals are taken into consideration in calendar Q3.

The unique firm identifiers in the LBD allow us to link establishments to their parent firms. We thus collapse establishment-level variables to the firm level using these identifiers. A majority of firms are matched to annual revenues from the Census Bureau's BRFIRM_REV data set starting in 1997 (see Haltiwanger et al., 2019). Revenue data are only currently available through 2018.

Given that the H-2B data and the Census firm data contain the employer name, state, city, and ZIP code, we can link them using a fuzzy matching procedure. We match 92.8% of January 1, 2018, consolidated TLC forms and 93.2% of TLC worker applications to a source firm in the U.S. Census Bureau data, resulting in a sample of roughly 3,300 firms that sent in TLC applications to the DoL on January 1, 2018.[24] Appendix A provides a more detailed description of the matching process.

To check that imperfections in our match do not generate bias in our results, we estimate bivariate, consolidated TLC form-level regressions where the outcome is an indicator for whether a given January 1, 2018 application was matched to the Census data and the independent variable is an indicator of whether a given form was turned in before 7:00 am. As we would hope, Table 1 shows that we cannot reject the null

[24] All firm counts are rounded following Census Bureau requirements.

hypothesis that the match probability of any given application is uncorrelated with the timing of its submission.

Table 1: Match Checks

	𝟙{Matched}	
	(1)	(2)
𝟙{Sent in Before 7am}	-0.009	-0.017
	(0.008)	(0.011)
Frequency Weights		✓
Observations	4,411	79,326
Dependent Variable Mean (Match Rate)	0.928	0.932

Notes: Unit of observation is a consolidated TLC form when frequency weights are not used. Unit of observation is an individual TLC application with frequency weights are used (the frequency weights are the number of applications on a given consolidated form).

3.2 Characteristics of H-2B Firms and Jobs in the Research Sample

Table B2 in the Appendix presents the top five industries and occupations reported on TLC applications for H-2B workers on January 1, 2018. Landscaping is the dominant industry for 2HFY H-2B users, accounting for 52.6% of all TLC applications sent in on January 1, 2018 alone. Correspondingly, Landscaping and Groundskeeping are the dominant occupations for H-2B workers. The other key industry is Hotels and Motels (except casinos), which corresponds closely with the Maids and Housekeeping occupation. Generally, the occupations reported in Table B2 are associated with low-wage, manual work.

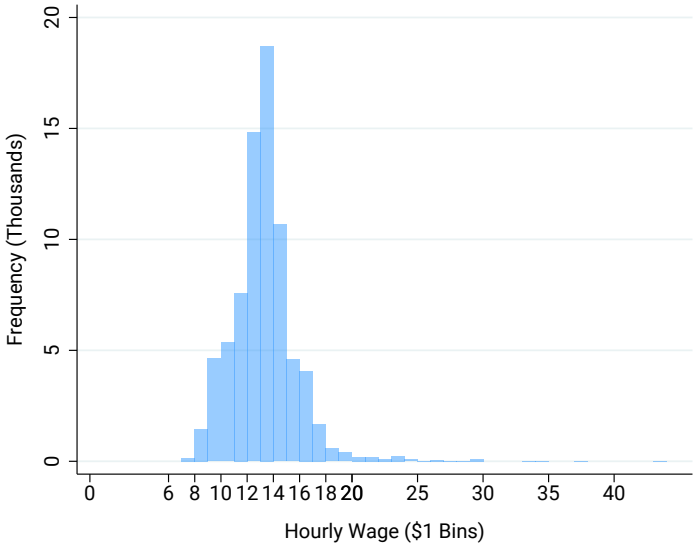
This notion is confirmed by the hourly wages associated with each request, which are reported in the DoL TLC application data and visualized in Figure 5. Hourly wages are tightly and roughly symmetrically distributed around a mean of $13.24 per hour.[25] About 80% of TLC applications feature hourly wages below $15 per hour, and more than 99% feature hourly wages below $22 per hour. Therefore, following the definition in Rose and Shem-Tov (2023), the vast majority of H-2B postings are for low-wage jobs.[26] As described in Section 2.2, H-2B employees are to be paid based on "prevailing wages" determined by the BLS, so reported wages in Figure 5 are generally in line with wages of peer workers in similar occupations and geographies.

Table 2 provides some context for our sample by comparing the firms in the data set to those in the U.S. economy. Firms applying for H-2B workers tend to be larger across several dimensions. For instance, the median firm in our sample grossed $2.1 million in revenues, compared to $1 million in the case of the median U.S. firm.

[25] Standard deviation: $2.44; Median: $13.29

[26] Rose and Shem-Tov (2023) consider full-time jobs with an hourly rate of $15 or less as low-wage jobs.

Figure 5: Distribution of Hourly Wages Reported on Certified Jan. 1, 2018 TLCs



Notes: In limited cases ($\approx 1\%$) in which wages are reported on a weekly basis, they are divided by expected weekly hours—which are also reported in TLC applications—to generate an hourly wage. Wages are in nominal terms, to be paid in calendar Q2 and Q3 of 2018.
Source: DoL Office of Foreign Labor Certification Performance Data.

In terms of employment, the median H-2B employer in our sample is approximately three times as large as the average U.S. employer. These characteristics are consistent with Mahajan (2024), who finds that H-2B users are concentrated toward the top of the labor productivity distribution. Thus, despite their concentration in a few sectors, these firms have the potential to play a significant role in their local economies.

Table 2: 2017 Firm-Level Summary Statistics

		Research Sample (H-2B Firms)			U.S. Economy	
Variable	Universe	Mean	Std. Dev.	Median[§]	Mean	Median
Revenues ($1,000)	All Private Sector	6,634	54,516	2,101	6,232[†]	[500,1,000)[†]
Employment	All Private Sector	34.6	69.0	17.8	21.44[†]	[1,5)[†]
2HFY Employment	Single-Unit Only	41.7	79.0	22.27	10.21[††]	[3,9][††]
Payroll ($1,000)	All Private Sector	1,404	2,665	713.7	1,121[†]	$\approx$ 211[†††]

Notes: Source for all statistics in "Research Sample" is the Longitudinal Business Database and associated linked data sets from the U.S. Census Bureau. Employment refers to mean employment across all four quarters for single-unit firms and Q1 employment for multi-unit firms in the research sample. 2HFY Employment refers to mean employment across the second and third quarters in a calendar year (the second half of the fiscal year) for single-unit firms. Monetary values are in 2017 USD, deflated by the GDP Implicit Price Deflator series. Medians for "U.S. Economy" are reported as ranges due to the ranges reported in publicly-available data. For example, the Statistics of the U.S. Businesses data set reports firm counts by revenue bins. From those counts, one can infer that the median firm is in the [500,100) revenue bin. We follow a similar procedure for employment, 2HFY employment, and payroll.
[§] For the research sample, reported medians are means taken between the 40th and 60th percentile in accordance with Census Bureau requirements.
[†] Source: Statistics of U.S. Businesses, Census Bureau—firm counts by revenue bins.
[††] Source: Business Dynamics Statistics—Single-Unit (BDS-SU), Census Bureau—firm counts by employment bins.
[†††] Source: Statistics of U.S. Businesses, Census Bureau—mean payroll among firms with $500-1,000 thousand in revenues.

4 Identification Strategy

Our identification strategy relies on the unexpected change in the ability to hire workers through the H-2B visa program, stemming from the January 1, 2018 TLC application spike. Based on the pattern shown in Figure 4, we define our exposure variable of interest as *Prop Apps Before 7am*$_j$: the proportion of a firm j's January 1, 2018 TLC applications sent in before 7:00 am. Table 3 displays some basic summary statistics of *Prop Apps Before 7am*$_j$.

Table 3: *Prop Apps Before 7am*$_j$ Summary Statistics

		Proportion of firms with *Prop Apps Before 7am*$_j$		
Firm count	Mean	Equal to 0	Between 0 and 1	Equal to 1
3,612	0.721	0.278	0.004	0.718

Notes: In order to avoid excessive disclosure avoidance review burden on the Census Bureau, we report these summary statistics directly from publicly-available DoL data before matching them to the Census Bureau data. We define a firm based on name, address, and location in publicly-available records from the DoL. Where appropriate and easily identified, we combine multi-unit firms across locations.

While the importance of submitting applications before 7:00 am was not possible to foresee, there are still reasons to believe that firms applying before and after this cutoff might have differed. For example, lawyers submitting TLC applications on firm owners' behalf may prioritize certain clients. To address this concern, we estimate the following model specification:

$$g_{jt}^{y} = \sum_{\tau \neq b} \beta_\tau \left[\text{Prop Apps Before 7am}_j \times \mathbb{1}\{t = \tau\}\right] + \Gamma X_{jt} + \alpha_t + \varepsilon_{jt}, \tag{1}$$

where, for continuous variables y, g_{jt}^{y} is the Davis-Haltiwanger-Schuh (DHS) growth rate between period t and some base period b:

$$g_{jt}^{y} \equiv \frac{(y_{jt} - y_{jb})}{(y_{jt} + y_{jb})/2} \approx \log(y_{jt}) - \log(y_{jb}). \tag{2}$$

When outcomes are available at a quarterly frequency (i.e., for employment and payroll of single-unit firms), t indexes a quarter and $b = 2017Q2$ (the start of the 2HFY 2017 hiring season), and when outcomes are available at an annual frequency, t either indexes a fiscal or calendar year and $b = 2017$.

Using DHS growth rates allows us to closely approximate an event study with logged outcomes and firm fixed effects while still accommodating 0-valued outcomes.[27] Further, it allows us to do so in a way that is consistent with prior literature on firm dynamics (Davis et al., 1998; Tornqvist et al., 1985). As such, our identifying assumption is that the outcomes of early-applicant firms—those who submitted their TLC applications before 7:00 am on January 1, 2018—would have trended similarly to those of later-applicant firms had it not been for the fact that the early-applicants had access to the original tranche of H-2B workers in the second half of FY 2018.[28] Estimates of $\beta_\tau, \tau < b$ help assess the plausibility of this assumption.

When we include X_{jt}, this assumption becomes conditional on industry-by-year fixed effects, state-by-year fixed effects, an indicator for prior usage of the H-2B visa program interacted with year fixed effects, and two sets of size-quartile-by-year fixed effects. Here, industry refers to a 6-digit NAICS code, controlling for industry-wide labor demand shocks at a detailed level. Our state-by-year fixed effects capture geographic labor market trends, state-level policies, and other state-level characteristics. In the case of multi-unit firms, state refers to the state where a firm has the highest payroll.[29] Prior usage of the H-2B visa program is defined based on whether the firm had sent in TLC requests to the DoL in any year between 2015 and 2017. The first size control is based on average employment of the firm in 2017. The second size control is

[27] We prefer logs or a log-like transformation both because we prefer the resulting percentage interpretation and because it improves the precision of the estimated impacts. Note that the standard event study in logged outcomes would be

$$\log(y_{jt}) = \sum_{\tau \neq b} \beta_\tau \left[(\text{Prop Apps Before 7am})_j \times \mathbb{1}\{t = \tau\} \right] + \Gamma X_{jt} + \alpha_j + \alpha_t + \varepsilon_{jt}.$$

Since all of our control variables X_{jt} are time-invariant, pre-treatment controls interacted with time-fixed effects, this is equivalent to estimating

$$\log(y_{jt}) - \log(y_{jb}) = \sum_{\tau \neq b} \beta_\tau \left[(\text{Prop Apps Before 7am})_j \times \mathbb{1}\{t = \tau\} \right] + \Gamma X_{jt} + \alpha_t + \varepsilon_{jt},$$

where the firm fixed effect, α_j, has been differenced out. Logged 0s present a problem in our analysis due to the found impacts on firm survival. Therefore, we follow the firm dynamics literature in utilizing the close approximation from Equation (2). We view this as a modified version of the "normalizing the outcome" approach advocated for in Chen and Roth (2023), but one that is more tailored to our application. We probe robustness to other functional forms and other approaches for dealing with 0-valued outcomes in Section 7.1.

[28] This is a slight abuse of language since *Prop Apps Before 7am*$_j$ is continuous, but it nonetheless conveys the intuition behind our identification. Furthermore, *Prop Apps Before 7am*$_j$ is either 0 or 1 in most cases, as seen in Table 3. This is because firms pool worker requests in the same occupation and worksite onto one application form, and the vast majority of firms only request workers in one occupation-worksite pairing.

[29] In particular, state-by-year fixed effects address differences in time zone. Firms located in states on Pacific Standard Time could have sent their TLC applications in at 9:00 pm on December 31, 2017 as opposed to waiting to midnight to send them in as their counterparts in states on Eastern Standard Time. In practice, we do not find evidence of a significant correlation between the firm's time zone and $(\text{Prop Apps Before 7am})_j$.

based on the number of TLC requests the firm sent in on January 1, 2018. Therefore, our size quartile indicators capture both firm size and reliance on the H-2B program.

5 Supporting Evidence for Identifying Assumptions

We start our analysis by presenting a series of results that are consistent with three critical checks: 1) firms were not trending differently in their usage of the H-2B program before 2018, 2) firms were ex-ante unaware of the importance of sending their H-2B applications into the DoL by 7:00 am on January 1, 2018, and 3) nonetheless, sending applications in before 7:00 am generated a substantive increase in the number of H-2B workers a firm procured in 2018. These results are presented in Figure 6 and explained further below.

First, we note that if firms had anticipated the application spike, one would expect those with higher demand for H-2B workers to have submitted their applications earlier. In addition, expecting increased competition for a limited number of visas, one would expect these firms to send in higher-quality applications with a higher likelihood of being certified. To assess any possible anticipation, we estimate a placebo regression using TLC applications as a measure of demand in Equation (1). To proxy application quality, we use the final number of TLC certifications by the DoL.[30] Panels A and B of Figure 6 presents the estimated coefficients $\hat{\beta}_\tau$.

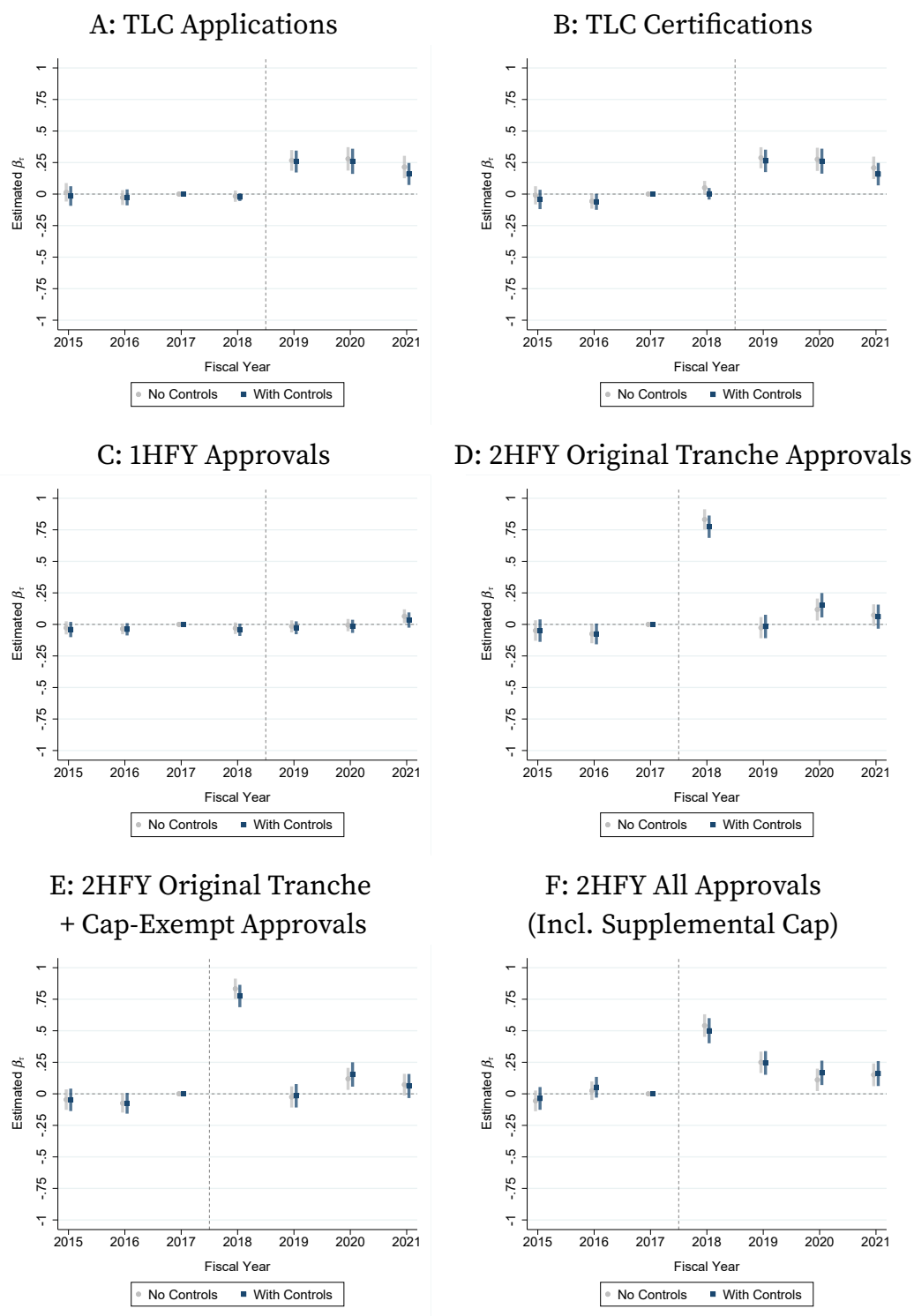
Panel A of Figure 6 does not present evidence of a difference in TLC application growth between early- and late-applicants *through* 2018. Our estimates in 2018 are small and precise and virtually unchanged when we include any control variables.[31] We also obtain similar results when using our proxy for application quality in Panel B of Figure 6. In sum, both the number and likely quality of applications were not trending differently for early and late applicants through January 1, 2018, suggesting they were unaware of the changes in processing that the DoL would announce ex-post, on January 17, 2018.

We next establish that TLC application submission before 7:00 am on January 1, 2018, was a strong predictor for the number of H-2B worker petitions approved by USCIS for the 2nd half of the fiscal year (2HFY). To do so, we use the data on i129 petitions from the USCIS, which distinguishes between FY 1st Half (1HFY), original tranche 2HFY, and supplemental 2HFY visa petitions, along with whether petitions are for initial employment or continuing workers.

[30] Recall that, conditional on application quality, early-applicants are no less likely to be certified than late applicants; rather, they are more likely to be certified *on time*.

[31] Given that the application size-bin-by-year fixed effects are based on the number of January 1, 2018 TLC applications, one may worry that we are conditioning on the outcome in Panel A of Figure 6. This finding does not depend on the inclusion (blue circles) or exclusion of controls (gray circles).

Figure 6: The Effect of Applying Before 7am on H-2B-Related Outcomes



Notes: See Equation (1) and Section 4 for details of specification. Spikes around coefficient estimates represent 95% confidence intervals generated from standard errors that are clustered at the firm level. Each specification was estimated on 3,300 firms that applied to the Department of Labor for a TLC certification on January 1, 2018. Specifications with controls include industry-by-year fixed effects, state-by-year fixed effects, application-size-by-year fixed effects, and employment-size-by-year fixed effects. Outcomes are DHS growth rates between a given year and 2017. The vertical dashed line separates placebo tests from study period effects. For outcomes TLC Applications, TLC Certifications, and first-half fiscal year (1HFY) Approvals, placebo tests extend through 2018 because these outcomes should not have been affected by the DoL's change to processing rules. Meanwhile, the change to processing rules should have an effect on second-half fiscal year (2HFY) H-2B approvals in 2018.

Panel C of Figure 6 starts with an additional placebo test by using *first-half* fiscal year H-2B approvals as the outcome. FY 2018 1st half approvals were already determined by January 1, 2018, and thus should not have been affected by the January 1, 2018 application spike. Once again, we find no evidence of 1st half of H-2B approvals trending differently across early and late applications *through* 2018.

Panels D, E, and F then present a precise test of the "first stage:" the effect of *Prop Apps Before 7am*$_j$ on firms' ability to receive approvals for 2HFY i129 petitions for initial employment in 2018. Panel D plots the coefficients $\hat{\beta}_\tau$ from estimating Equation (1) using growth in approved petitions subject to the original fiscal year 2HFY cap as the outcome (2HFY Original Tranche). These are the visa approvals directly affected by the rationing caused by the January 1, 2018 application spike. Panel E adds continuing (cap-exempt) employment visas (2HFY Original Tranche + Cap-Exempt). Finally, Panel F adds approved i129 petitions subject to the 2HFY supplemental cap (2HFY All).

Two apparent features of Panel D further support the validity of our research design. First, we do not find evidence of H-2B usage trending any differently for earlier applicants when compared to later applicants before 2018. Second, we estimate a substantive increase in H-2B visa approvals in the second half of FY 2018 for early applicants. The results indicate that original tranche visa approvals grew 75 percentage points more at early relative to late applicants.[32] These results indicate that the timing of applications unexpectedly influenced the outcomes in the 2018 2HFY H-2B procurement process, leading to unforeseen advantages. Given that continuing visas were not subject to the cap, Panel E represents our best measure of the set of workers that were likely available to firms by April 1, 2018. Since continuing visas were exceedingly rare in 2018, the results plotted in Panels D and E are nearly identical.

Finally, in Panel F of Figure 6, we estimate Equation (1) including the supplemental visas in the outcome variable. The results suggest that the supplemental visas may have enabled late applicants to regain some capacity to hire H-2B workers. When we account for the supplemental tranche of visas, the effect of applying for TLCs before 7:00 am on January 1 on receiving *any* H-2B visa approvals for the second half of FY 2018 is about 64% as big as the effect on receiving H-2B visa approvals from the original tranche. Nevertheless, even with the additional supplemental visas, firms applying after 7:00 am were left with substantially fewer opportunities to hire H-2B visa workers relative to early applicants.[33] Given that workers on supplemental H-2B visas were only available after mid-June, $\hat{\beta}_{2018}$ in Panel F reflects differential employment of H-2B workers later in the hiring season (mostly calendar Q3).

[32] In Section 6.1, we show that this translates to approximately 8 additional original tranche H-2B workers.
[33] In Section 6.1, we show that this translates to approximately 5.7 additional total H-2B workers.

$\hat{\beta}_\tau, \tau \geq 2019$ in Panel F also indicates that early-applicant firms were more likely to be approved by USCIS to hire H-2B workers in subsequent years (2019, 2020, and 2021). This pattern may indicate that firms who were successful in procuring H-2B workers in 2018, despite the unanticipated change to procedures, were buoyed to continue participating in the H-2B visa program.

6 Main Results

We next turn to our main results using outcomes from the U.S. Census Bureau's administrative, firm-level data. We begin by examining quarterly employment and payroll before moving on to annual measures of firm performance, including revenues and operational status.

6.1 Employment and Payroll

Event Study Results

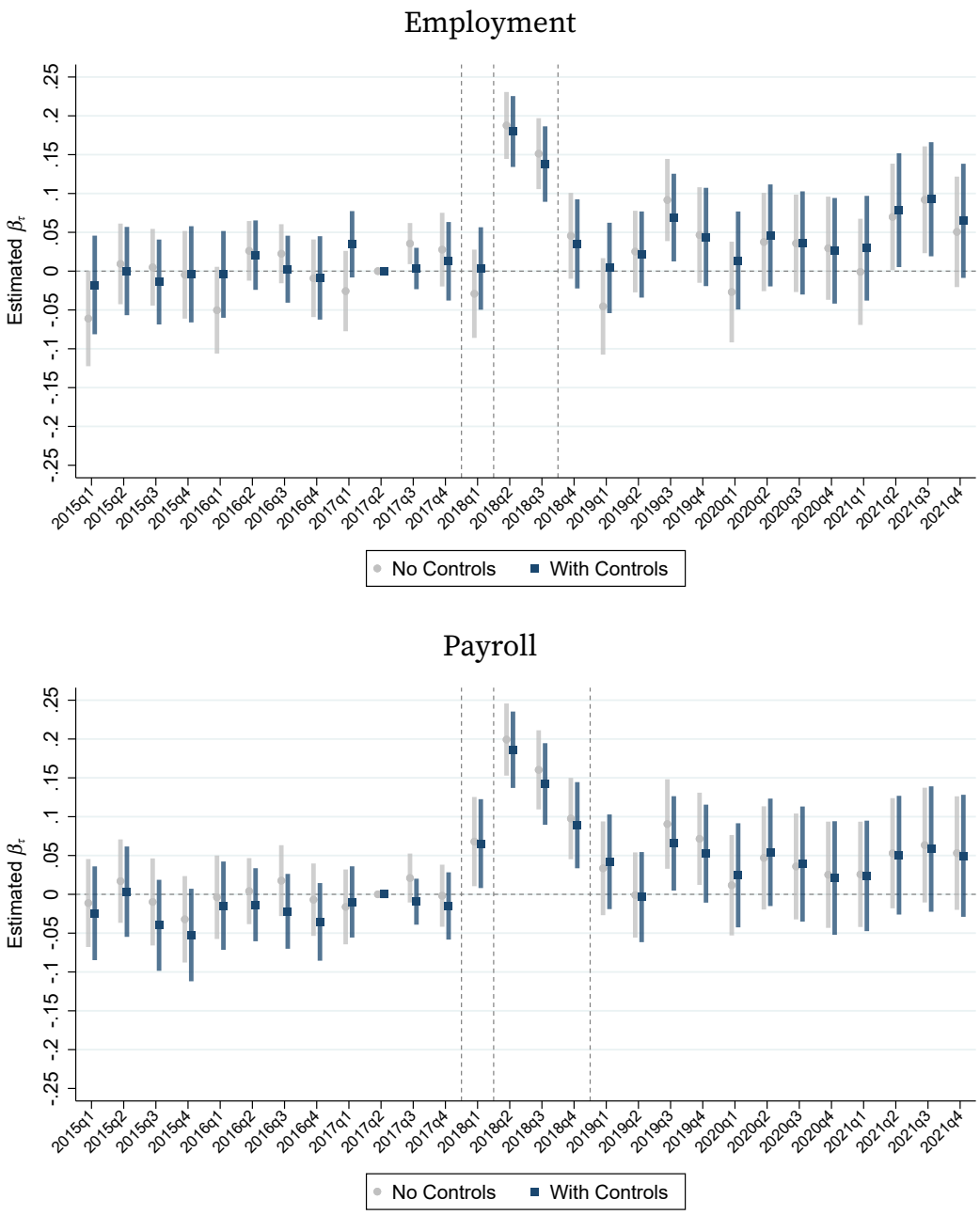
Figure 7 plots the results of estimating Equation (1) using quarterly employment (top) and quarterly payroll (bottom) as outcomes. These outcomes are only available at a quarterly frequency for single-unit firms (91% of our sample). Critically, the granular timing allows us to specifically pick up responses during the 2HFY 2018 H-2B hiring period.[34] The interpretation of our results relies on the fact that H-2B workers are subject to federal income taxes; therefore, our employment and payroll outcomes include H-2B workers.

We divide our plots into four distinct phases: 1) pre-2018Q1, 2) 2018Q1, 3) the 2018 H-2B hiring period, and 4) after the 2018 H-2B hiring period. First, coefficients before 2018Q1 represent pure tests of parallel pre-trends, as early- and late- applicants were unaware of the processing changes that were to occur in January of 2018. Across both outcomes, we find no evidence of early- and late-applicants trending differently in the pre-treatment period.

The next phase of our event study is an in-between period: the first quarter of 2018 (2018Q1). At that time, firms had not yet hired their 2HFY H-2B visa workers. However, they were both aware of the DoL's change in processing procedures by mid-January and aware of whether or not they would receive their requested 2HFY H-2B workers on time by the end of February. Thus, there is scope for anticipatory changes in firm behavior in 2018Q1. We do not find evidence that early applicants employed additional workers on March 12, 2018 (the date of the 2018Q1 employment count) relative to late

[34] Employment counts are only available for March 12 of a given year for multi-unit firms.

Figure 7: The Effect of Applying Before 7am on Employment and Payroll



Notes: See Equation (1) and Section 4 for details of specification. Spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each outcome is the DHS growth rate between a given quarter and 2017Q2, where inactive firms are given values of 0. Employment results reflect 2,900 single-unit firms and payroll results reflect 3,000 single-unit firms for whom the respective outcome is measured at a quarterly frequency at least once during the study period and who applied to the Department of Labor for a TLC certification on January 1, 2018. Specifications with controls include industry-by-year fixed effects, state-by-year fixed effects, application-size-by-year fixed effects, and employment-size-by-year fixed effects. Outcomes are DHS growth rates between a given year and 2017. First vertical dashed line separates placebo tests (in periods prior to calendar year 2018) from study period effects. The second vertical line brackets an anticipation period—2018Q1—in which firms heard about and knew the results of the DoL change in processing but could not yet hire 2HFY H-2B workers. The third vertical line brackets the H-2B hiring period—Q2–2018Q3 for employment but 2018Q2–2018Q4 for payroll because a vast majority of H-2B workers were hired into 2018Q4 but with an end date before December 12, 2018 (when employment for 2018Q4 was measured).

applicants. However, it appears that they did slightly increase their total 2018Q1 payroll in anticipation of having their 2HFY H-2B workers ready to start on time.

The next, most critical, phase of our event study focuses on the 2018 H-2B hiring period. Given that most H-2B workers were employed for part of the fourth quarter of 2018 (2018Q4) but completed their employment before December 12, 2018 (the date when Q4 employment is measured), we define the H-2B hiring period as the second and third quarters of 2018 (2018Q2–2018Q3) when considering employment, and the second through fourth quarters of 2018 (2018Q2-2018Q4) when considering payroll. We find that early applicants experience significant increases in both employment and payroll during the H-2B hiring period. Compared to late applicants, early applicants experience an 18 percentage point higher growth in employment and a 19 percentage point higher growth in payroll between the second quarter of 2017 (2017Q2) and the second quarter of 2018 (2018Q2). Estimated effects diminish somewhat as the H-2B hiring period progresses, likely due to the issuance of supplemental visas to late applicants.

Finally, we find at-most-suggestive evidence that employment and payroll counts remain elevated at early-applicant firms beyond the 2018 2HFY H-2B hiring period. Point estimates suggest that early applicants may have continued to enjoy longer-term benefits from their expansion capabilities during the 2018 2HFY H-2B hiring season, potentially due to higher survival rates (see Section 6.2). However, since we cannot rule out null effects, a plausible alternate interpretation is that late applicants found alternative means to procure workers in subsequent years, despite being less likely to utilize the H-2B program.

Magnitudes: IV Results

The positive coefficients in Figure 7 indicate that H-2B hiring does not fully crowd out the usage of other labor inputs during the 2018 H-2B hiring period. However, these coefficients are in percentage point change terms. In this section, we employ an instrumental variables (IV) approach to more directly assess the extent to which the hiring of foreign-born workers crowds out other forms of employment in this setting.

Specifically, we estimate:

$$\frac{\Delta y_{j,2018}}{\text{Applications}_j} = \beta^{IV}\left(\frac{\Delta\text{Approvals}_{j,2018}}{\text{Applications}_j}\right) + \Gamma X_j + \varepsilon_j, \tag{3}$$

where *Prop Apps Before 7am*$_j$ is used as an instrument for $\left(\frac{\Delta Approvals_{j,2018}}{Applications_j}\right)$, Δ represents a one-year change (for example, 2018Q2 employment minus 2017Q2 employment), and *Applications*$_j$ represents the number of worker requests firm j filed with the DoL on

January 1, 2018. For 2018Q2 outcomes, $\Delta Approvals_{j,2018}$ is the 2017–2018 change in USCIS approvals for 2HFY H-2B visa workers under the original tranche and through cap-exempt means, as these approvals could have resulted in hires by June 12, 2018. For 2018Q3 outcomes, $\Delta Approvals_{j,2018}$ is the 2017–2018 change in USCIS approvals for *all* 2HFY H-2B visa workers, since workers under the supplemental visa cap of 2018 were likely employed for most of 2018Q3 (including on September 12, 2018).[35]

$Applications_j$ provides a common denominator across the instrumental variable, exposure variable, and outcome variable.[36] Our first-stage coefficients, therefore, represent the increase in approvals per pre-7am request, and β^{IV} represents the increase in the outcome per approval. Perhaps most importantly, when the outcome is the employee count, β^{IV} represents the number of additional workers hired at the firm in a given quarter per H-2B approval, and $\beta^{IV} = 0$ would indicate one-for-one crowd-out of other employees at the firm.

Table 4 presents our IV results. Columns (1) and (2) show the first-stage estimates for calendar Q2 and Q3 of 2018, respectively. Column (1) indicates that each application sent in before 7 am on January 1, 2018, resulted in 0.369 additional USCIS approvals for initial tranche or continuing H-2B visas, representing workers likely available by April 1, contingent on DoS visa issuance ("Initial"). Column (2) shows that each application sent in before 7 am on January 1, 2018, resulted in 0.262 additional approvals for initial tranche, continuing, or supplemental USCIS H-2B visas—workers likely available throughout calendar Q3, contingent on DoS visa issuance ("All"). The relatively low conversion rates from DoL to USCIS approval likely result from two factors: 1) the fees associated with i129 form submissions to the USCIS, and 2) even among those who submitted DoL TLC applications before 7:00 am, on-time processing did not guarantee approval.[37] Nonetheless, given the mean of $Applications_j$ is approximately 22, these first stage effects are sizable, corresponding to 8 additional H-2B approvals in 2018Q2 and 5.7 additional H-2B approvals in 2018Q3.

Column (3) shows the IV estimates for the effect of an initial H-2B approval on employment in 2018Q2. Each i129 approval resulted in 0.74 additional employees in 2018Q2. We consider this estimate to be a lower bound on the number of additional employees per H-2B *hire*. Given that approximately 78% of H-2B i129 approvals resulted in an actual hire in the years leading up to 2018, our estimates suggest an increase of around 0.95 employees per H-2B hire.[38] As such, it would take 20 H-2B hires to crowd

[35] Recall from Section 3 that workers on supplemental H-2B visas had not started working for employers by June 12, 2018, when Q2 employment was measured for 2018.

[36] Recall that $Prop\ Apps\ Before\ 7am_j$ is simply the number of applications that were in before 7:00 am on January 1, 2018 divided by $Applications_j$, the total number of applications sent in by firm j on January 1, 2018.

[37] Recall that the USCIS held multiple lotteries to determine which petitions it would process in 2018.

[38] See our discussion in Section 2.2 and Table B1.

out one non-H-2B worker.[39] Given the standard errors in Column (3) and the uncertainty surrounding our approval-to-hire conversion rate, a more appropriate conclusion is that there is limited firm-level crowd-out or crowd-in as a result of H-2B hiring, but we can strongly rule out one-for-one crowd-out.

We can conduct a similar exercise for Q3 employment, using *all* 2HFY 2018 H-2B visa approvals as the first stage outcome. According to the estimate in Column (4), each 2HFY H-2B visa approval leads to 0.80 additional employees per approval in Q3. Using our benchmark 78% H-2B approval-to-hire conversion rate, this estimate suggests an increase of 1.02 employees per H-2B hire in Q3. This effect is very close to the estimated impact for Q2, indicating that the impact of H-2B hiring on total firm employment was relatively stable workforce over this period.

Table 4: IV Results—Additional Employees and Payroll per H-2B Approval

	2HFY Approvals		Employment		Payroll (2009$)	
	Initial	All	Q2	Q3	Q2	Q3
	(1)	(2)	(3)	(4)	(5)	(6)
Prop Apps Before 7a$_j$	0.369***	0.262***				
	(0.023)	(0.025)				
Approvals$_j$			0.737***	0.796***	5,453***	6,157***
			(0.125)	(0.192)	(860)	(1,355)
Observations	3,000	3,000	2,900	2,900	3,000	3,000
Estimation	OLS (1st Stage)	OLS (1st Stage)	2SLS	2SLS	2SLS	2SLS
Approvals$_j$ Type	—	—	Initial	All	Initial	All
First Stage F Statistic	—	—	240.8	107.7	257.4	109.8

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. See Equation (3) for details of specification. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. In Columns (1) and (2), the outcome variable is the 2017-2018 change in 2HFY H-2B approvals divided by January 1, 2018 DoL worker requests. "Initial" refers to approvals that would have been initially available, by Q2 of 2018: initial tranche 2HFY and cap-exempt H-2B visa approvals. "All" adds supplemental cap 2HFY visas. In Columns (3) and (4), the outcome is the year-over-year 2017-2018 change in employment for a given quarter (e.g., 2018Q2 minus 2017Q2 employment in Column (3)), divided by January 1, 2018 DoL worker requests. In Columns (5) and (6), the outcome is similar to the year-over-year 2017-2018 change in payroll for a given quarter, divided by January 1, 2018 DoL worker requests. Only single-unit firms that had at least one non-missing payroll observation during the study period are included in these calculations. All specifications include firm fixed effects, state-by-year fixed effects, industry-by-year fixed effects, and size-quintile-by-year fixed effects. Columns (5) and (6) are in 2009 USD, deflated by the GDP Implicit Price Deflator series.

Beyond crowd-out, critics of the H-2B visa program have long been concerned about its impact on the wages of incumbent workers. In addressing this concern, it is worth noting that the percent change in payroll is either in parity with or larger than the percent change in employment counts, as shown in Figure 7. This suggests that firms do not reduce worker pay when they have access to the H-2B program. However, changes in average pay can mask variations in within-firm pay dispersion. This

[39] Unfortunately, we cannot differentiate between foreign-born and native workers in our employment data. However, we note that results from the H-1B visa program (Doran et al., 2022; Mahajan et al., 2024) and Clemens and Lewis (2024) indicate that any extant crowd out may impact other foreign-born workers more than native workers.

could occur, for example, if firms try to save on labor costs by hiring H-2B workers while increasing the compensation of incumbents. Alternatively, it could occur if H-2B workers are paid more than other employees and firms compensate for the cost difference by lowering incumbent workers' wages. To fully understand these dynamics, a closer examination of within-firm pay structures is necessary.

While we lack individual compensation data, we can examine if changes in payroll align with the increase in H-2B employment. According to Columns (5) and (6) of Table 4, firm payroll increased by 5,453 USD (in 2009 dollars) per approval in 2018Q2 and by 6,157 USD (in 2009 dollars) per approval in 2018Q3. Using the 78% approval-to-hire conversion rate, these figures translate to 6,992 USD (in 2009 dollars) per H-2B hire in Q2 and 7,894 USD (in 2009 dollars) per H-2B hire in Q3. Meanwhile, the average weekly wage rate for an H-2B worker is approximately $450. Given that a fiscal quarter has 13 weeks, a full-time H-2B worker should earn roughly 5,800 USD in 2018 dollars, or 4,990 USD in 2009 dollars per quarter. Thus, our results do not support the notion that firms use the H-2B visa program to undercut wages. Instead, we find some suggestive evidence of positive spillovers on non-H-2B workers.

Our findings in this section are broadly in line with those from Clemens and Lewis (2024), who do not find any significant changes in the hiring of U.S. workers by firms participating in the H-2B program. Indeed, Clemens and Lewis (2024) find a statistically imprecise amount of crowd in of other employment. Our results on employment counts on the 12th of the last month of each quarter do not indicate significant crowd out or crowd in. However, our payroll results suggest either pay raises among incumbent workers or the crowd-in of new employees who are not necessarily present on June 12 or September 12. We also note that the survey sample in Clemens and Lewis (2024) appears positively selected on productivity relative to our sample. While imprecise, heterogeneity results in our Section 7.3 indicate that our employment results are larger at such firms, which could further explain the slight difference in point estimates across the two papers.

In sum, our results on employment and payroll indicate that the scope for crowd-out of existing employment is rather limited. Instead, they support the notion that firms use the H-2B program to address temporary labor needs, with minimal impacts on other employment.

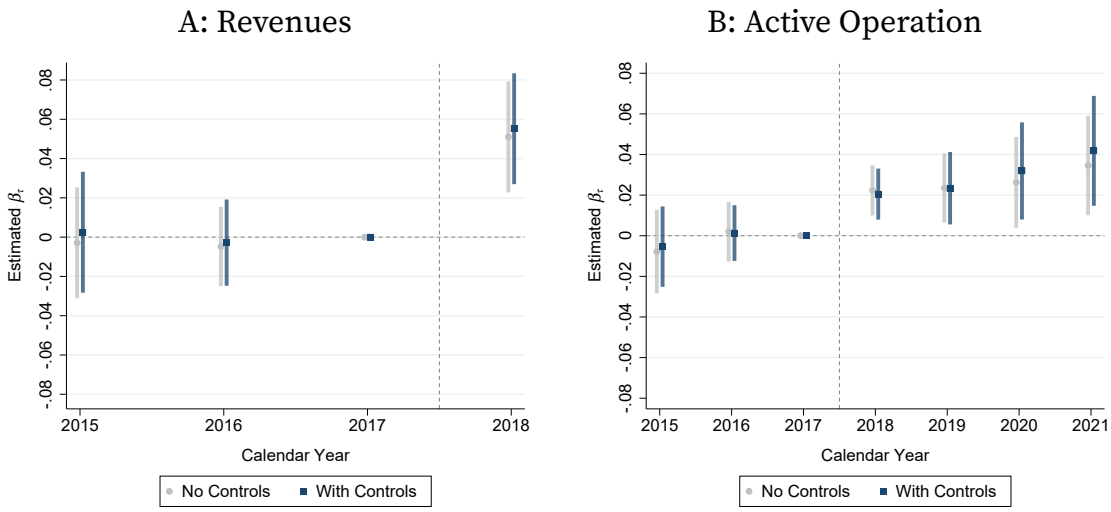
6.2 Firm Performance

We next investigate the impact of H-2B hiring on firm performance, as captured by revenues and firm survival.

Revenues

We first turn to the impact of H-2B hiring on firms' annual revenues.[40] If firms rely on the H-2B program to address hiring constraints, lifting such constraints should result in higher revenues (Clemens and Lewis, 2024).

Figure 8: The Effect of Applying Before 7am on Firm Performance



Notes: See Equation (1) (Panel A) and Equation (4) (Panel B) along with Section 4 for details of specification. Spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Panel A estimated on 2,400 firms that applied to the Department of Labor for a TLC certification on January 1, 2018 with observed annual revenues in a given year, and observations weighted by inverse probability weights designed to make revenue sample consistent with the universe of private sector firms. Revenues are deflated by the GDP Implicit Price Deflator series. Panel B is estimated on a fully balanced panel of 3,300 firms that applied to the Department of Labor for a TLC certification in January 1, 2018. Across both panels, specifications with controls include industry-by-year fixed effects state-by-year fixed effects, and size-quintile-by-year fixed effects.

Panel A of Figure 8 reveals that early applicants experience more than 5 percentage point higher revenue growth rates compared to late applicants in 2018. This translates to a revenue elasticity with respect to H-2B approvals of 0.11 and an elasticity with respect to H-2B hires of approximately 0.14.[41] This finding is also broadly in line with the results in Clemens and Lewis (2024), who document production expansion among firms winning the 2021 and 2022 H-2B lotteries, with a revenue elasticity of around 0.2. Additionally, in a wide swath of theoretical models featuring imperfect competition in the product market (e.g., Dixit and Stiglitz, 1977), revenue increases imply output price decreases. Thus, our results support the notion that expanding the H-2B program may lower prices.

[40] Recall that annual revenues are available for a subset of firms, but that this subset *does* include multi-establishment firms, unlike our quarterly payroll and employment results.

[41] The scaling for approvals comes from dividing $\hat{\beta}_{2018}$ in Panel A of Figure 8 by $\hat{\beta}_{2018}$ from Panel F of Figure 6. Applying our 78% approval-to-hire conversion rate, we arrive at a revenue elasticity with respect to H-2B hires of 0.14. Note that the underlying samples differ between the numerator and denominator in these calculations, as the revenue results include multi-unit firms.

Firm Survival

Firms applying for H-2B workers regularly state that access to this temporary source of labor is vital to their survival. Yet, to our knowledge, prior analyses have not directly assessed this claim. To do so, we estimate Equation (4):

$$\text{Active}_{jt} = \sum_{\tau \neq 2017} \beta_\tau \left[\text{Prop Apps Before 7am}_j \times \mathbb{1}\{t = \tau\}\right] + \Gamma X_{jt} + \alpha_j + \alpha_t + \varepsilon_{jt}, \quad (4)$$

where Active_{jt} is a binary indicator for whether or not a firm j has positive annual payroll in year t. Equation (4) is estimated on a fully balanced panel—we set Active_{jt} equal to zero before entry and Active_{jt} equal to one upon exit.

Panel B of Figure 8 presents the results from estimating Equation (4). The likelihood of remaining active is 2.05 percentage points higher among early applicants in 2018, an impact that rises to 4.18 percentage points by 2021. One potential explanation is that firms interpreted the 2018 application spike as an indication of future difficulties in obtaining H-2B workers. Consequently, firms that had relied on this workforce for survival no longer anticipated long-term profitability.

Our results support the notion that low-wage migrant workers are essential to survival among a subset of firms. To put them in perspective, when assessing the impact of import shocks from low-wage countries on U.S. firms, Bernard et al. (2006) estimate that a one standard deviation increase in import competition from low-wage countries decreases firm survival in the same industry by 2.2 percentage points over a five year period. Thus, our results imply that the inability of firms to hire H-2B workers for one half of a fiscal year has a similar impact on firm survival as longer-term import competition from low-wage countries.

7 Robustness, Spillovers, and Heterogeneity

In this section, we assess the robustness of our results to changes to outcome functional forms and estimation methods. We then evaluate whether effects on H-2B applicant firms spill over into the broader market. Finally, we also probe whether there are heterogeneous responses based on the immigration enforcement environment or the initial productivity of firms. In all cases, we focus on variations of the following baseline model, which reproduces our key results from Section 6:

$$g^y_{j,2018} = \alpha + \beta \left[\text{Prop Apps Before 7am}_j\right] + \Gamma X_j + \varepsilon_j. \quad (5)$$

In Equation (5), y represents either 2HFY employment (which we define as the mean of Q2 and Q3 employment), total 2HFY payroll (Q2 payroll plus Q3 payroll), or annual

revenues, and $g^{y}_{j,2018}$ then represents the corresponding DHS growth rate in y between 2017 and 2018. Note that in the case of annual revenues, β in Equation (5) exactly corresponds to the event study coefficient β_{2018} in Equation (1) (plotted in Panel A of Figure 8).

In addition, given that the extensive margin effects of January 1, 2018 application timing last through 2021, we utilize the following baseline model to assess robustness, heterogeneity, and spillover effects on firm survival:

$$\text{Active}_{jt} - \text{Active}_{j,2017} = \alpha + \beta \left[\text{Prop Apps Before 7a}_j\right] + \Gamma X_j + \varepsilon_{jt} \tag{6}$$

for $t \in \{2018, 2019, 2020, 2021\}$, where β summarizes the effects across post-treatment years.[42]

7.1 Robustness

We gauge the robustness of our results along several dimensions. First, we confirm that results are robust to the exclusion of control variables X_j. Second, for continuous outcomes, we change the functional form of the growth rate to the change in logs while accounting for zeros by explicitly valuing extensive margin effects, as suggested in Chen and Roth (2023). Specifically, we replace $\log(0)$ with a value of -2, implying that moving from 0 to 1 in any of our continuous outcomes represents a 200% growth rate—as it would be when using DHS growth rates. We also estimate an analogous Poisson Pseudo Maximum Likelihood (PPML) specification to Equation (5), which accommodates percent change interpretations in 0-valued outcomes in a different way and targeting a different estimand.[43] Finally, in the case of revenues, we probe the robustness of our findings to the estimation of Equation (5) without probability weights.

Beyond assessing the robustness of our parameter estimates to different functional forms and controls, we also evaluate their robustness to potential violations of the parallel trends assumption using the "Relative Magnitudes" approach from Rambachan and Roth (2023). In their framework, a parameter $\bar{M}$ specifies how large post-treatment violations of parallel trends can be relative to pre-treatment violations. Rambachan and Roth (2023) provide methods to compute confidence intervals under violations as large as this $\bar{M}$. To report results from this approach concisely, we estimate

[42] Indeed, $\hat{\beta}$ from Equation (6) and $\frac{1}{4}(\hat{\beta}_{2018} + \hat{\beta}_{2019} + \hat{\beta}_{2020} + \hat{\beta}_{2021})$ from Equation (4) (Panel B of Figure 8) are equal up to four decimal points (0.0294).

[43] Specifically, for continuous and potentially 0-valued outcomes y_{jt}, we estimate

$$y_{jt} = \exp\left(\beta \left[\text{Prop Apps Before 7a}_j \times \mathbb{1}\{t = 2018\}\right] + \Gamma X_{jt} + \alpha_j + \alpha_t + \varepsilon_{jt}\right), t \in \{2017, 2018\}.$$

We report estimates of $e^{\beta} - 1$ along with associated standard errors, computed via the Delta Method.

event studies using Equations (1) and (4), and—following the recommendation in Rambachan and Roth (2023)—report $\bar{M}^{min}$, the "breakdown value" of $\bar{M}$. That is, $\bar{M}^{min}$ is the smallest value of $\bar{M}$ such that the confidence interval around our parameter of interest contains 0. For our continuous outcomes, our parameter of interest from these event studies is β_{2018}. A larger value of $\bar{M}^{min}$ indicates a higher degree of robustness to violations in parallel trends. For our active operation event study, our parameters of interest are both β_{2018} and $\mathbb{E}[\beta_t] = \frac{1}{4}(\beta_{2018} + \beta_{2019} + \beta_{2020} + \beta_{2021})$, given the shape of the event study in Panel B of Figure 8.

Table 5 presents the results of these checks. In each panel, Column (2) corresponds to our preferred specification. Panel A shows that the finding of higher revenues among early applicants is robust across functional forms, control sets, and the usage of probability weights designed to make the revenue sample consistent with the universe of private sector firms. We also demonstrate that, under the Relative Magnitudes approach of Rambachan and Roth (2023), parallel trends violations would need to be 1.6 times as large as those observed in the pre-period for our confidence interval to include 0. Therefore, we believe our rejection of the null hypothesis of no revenue effects to be credible. Panels B and C show similar robustness and stability for our employment and payroll results. We omit Column (5) since no weights were necessary for these outcomes. In these panels, the parallel trend violations required to include 0 in our confidence interval are exceedingly unlikely, reinforcing the credibility of our findings.

Finally, Panel D just reports results from Equation (6), since neither changes to functional form nor weighting are necessary. As previewed in Panel B of Figure 8, our results on whether a firm remains in active operation are robust to the exclusion of pre-determined control variables. However, an important note of caution is that our estimates on firm survival are somewhat more sensitive to potential violations of parallel trends, as indicated by lower breakdown values $\bar{M}^{min}$.

7.2 Do Effects on H-2B Firms Spill Over to Other Firms?

A key question both in terms of internal validity and aggregate implications of our results is whether or not the effects in Section 6 spill over onto competing firms. Our comprehensive panel of U.S. establishments enables us to assess this question. To do so, we separate firms into three groups:

1. Those who "participated" by applying to the DoL for an H-2B worker on January 1, 2018 ($Participant_j$)

Table 5: Robustness and Stability of Key Results

A: Revenues	(1)	(2)	(3)	(4)	(5)
Prop Apps Before 7a$_j$	0.051***	0.055***	0.052**	0.037*	0.050***
	(0.014)	(0.014)	(0.020)	(0.020)	(0.013)
Firms	2,400	2,400	2,400	2,400	2,400
Outcome Funct. Form	DHS Growth	DHS Growth	$\Delta \log$	Levels	DHS Growth
Estimation	OLS	OLS	OLS	PPML w/Firm FE	OLS
Controls		✓	✓	✓	✓
Rev. Sample Weights	✓	✓	✓	✓	
$\bar{M}^{min}$, $H_0 : \beta_{2018} = 0$		1.60			
B: 2HFY Employment	(1)	(2)	(3)	(4)	
Prop Apps Before 7a$_j$	0.142***	0.149***	0.204***	0.102***	
	(0.021)	(0.022)	(0.036)	(0.017)	
Firms	2,900	2,900	2,900	2,900	
Outcome Funct. Form	DHS Growth	DHS Growth	$\Delta \log$	Levels	
Estimation	OLS	OLS	OLS	PPML w/Firm FE	
Controls		✓	✓	✓	
$\bar{M}^{min}$, $H_0 : \beta_{2018} = 0$		2.52			
C: 2HFY Payroll	(1)	(2)	(3)	(4)	
Prop Apps Before 7a$_j$	0.161***	0.163***	0.258***	0.118***	
	(0.022)	(0.024)	(0.058)	(0.017)	
Firms	3,000	3,000	3,000	3,000	
Year t	2017–2018	2017–2018	2017–2018	2017–2018	
Outcome Funct. Form	DHS Growth	DHS Growth	$\Delta \log$	Levels	
Estimation	OLS	OLS	OLS	PPML w/Firm FE	
Controls		✓	✓	✓	
$\bar{M}^{min}$, $H_0 : \beta_{2018} = 0$		3.16			
D: Active Operation	(1)	(2)			
Prop Apps Before 7a$_j$	0.027***	0.029***			
	(0.008)	(0.009)			
Firms	3,300	3,300			
Outcome Funct. Form	$y_t - y_{2017}$	$y_t - y_{2017}$			
Estimation	OLS	OLS			
Controls		✓			
$\bar{M}^{min}$, $H_0 : \beta_{2018} = 0$		0.70			
$\bar{M}^{min}$, $H_0 : \mathbb{E}[\beta_t] = 0$		0.41			

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. See Equation (5) (Panels A, B, and C) and Equation (6) (Panel D) along with Section 7.1 for details of the specification. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification.

2. Any non-participant firm that was active in 2017 in a market with at least one participant (*In-Market Non-Participant*$_j$)

3. All other firms in the U.S. economy that were active as of 2017.

In our analysis, a market is defined by industry-by-county.[44] For a given firm, we also define:

$$\text{Competitor Prop Apps Before 7am}_j \equiv \sum_{j' \in m(j), j' \neq j} s_{j'} \times \text{Prop Apps Before 7am}_{j'},$$

where $s_{j'}$ is the share of January 1, 2018 applications for all firms other than j in market $m(j)$ that are accounted for by j'. This is a measure of whether a firm's competitors were able to send in their applications for H-2B workers to the DoL on time on January 1, 2018. For this exercise, both *Prop Apps Before 7a*$_j$ and *Competitor Prop Apps Before 7a*$_j$ are set equal to 0 if a firm is a non-participant or if a firm is not in a market with any other participants, respectively.

We then estimate the following modified versions of Equation (5) and (6) on the full set of firms in the U.S. economy as of 2017:

$$\begin{aligned} g^{y}_{j,2018} = \alpha &+ \zeta_0 \text{Participant}_j \\ &+ \beta \left(\text{Participant}_j \times \text{Prop Apps Before 7am}_j\right) \\ &+ \phi \left(\text{Participant}_j \times \text{Competitor Prop Apps Before 7am}_j\right) \\ &+ \delta \left(\text{Participant}_j \times \text{Prop Apps Before 7a}_j \times \text{Competitor Prop Apps Before 7am}_j\right) \\ &+ \zeta_1 (\text{In-Market Non-Participant}_j) \\ &+ \theta \left(\text{In-Market Non-Participant}_j \times \text{Competitor Prop Apps Before 7am}_j\right) \\ &+ \Gamma X_j + \varepsilon_j, \end{aligned} \tag{7}$$

$$\begin{aligned} \text{Active}_{jt} - \text{Active}_{j,2017} = \alpha &+ \zeta_0 \text{Participant}_j \\ &+ \beta \left(\text{Participant}_j \times \text{Prop Apps Before 7am}_j\right) \\ &+ \phi \left(\text{Participant}_j \times \text{Competitor Prop Apps Before 7a}_j\right) \\ &+ \delta \left(\text{Participant}_j \times \text{Prop Apps Before 7am}_j \times \text{Competitor Prop Apps Before 7a}_j\right) \\ &+ \zeta_1 (\text{In-Market Non-Participant}_j) \\ &+ \theta \left(\text{In-Market Non-Participant}_j \times \text{Competitor Prop Apps Before 7am}_j\right) \\ &+ \Gamma X_j + \varepsilon_j. \end{aligned} \tag{8}$$

[44] Industry is a 6-digit NAICS code. Multi-unit firms are assigned an industry and location based on where they incur the highest wage bill.

In these specifications, ζ_0 and ζ_1 are (non-causal) parameters that reflect selection into H-2B program participation and county-industries in which there are H-2B participants, respectively. The other parameters, meanwhile, are causal estimates of the effects of the H-2B program and how it spills over onto non-users. β is the "direct effect" of early application timing on January 1, 2018, for participants who did not face competition from other firms that also applied early. ϕ is the "participant spillover effect" that January 1, 2018 applicants faced when they applied after 7:00 am but in-market competitors applied before 7:00 am. δ represents how much of the direct effect is siphoned away when in-market competitors also applied early ("siphon effect").[45] Finally, θ represents the "non-participant spillover effect" onto in-market firms that did not attempt to participate in H-2B hiring in the second half of FY2018. The rest of the firms in the U.S. economy operating as of 2017 are the implicit left-out group.

Table 6: Assessing Spillovers

	2HFY Employment	2HFY Payroll	Annual Revenues	Active Operation
	(1)	(2)	(3)	(4)
β: Direct Effect	0.161***	0.209***	0.056**	0.021**
	(0.031)	(0.035)	(0.024)	(0.009)
ϕ: Participant Spillover Effect	0.037	0.087*	0.030	-0.017
	(0.046)	(0.048)	(0.033)	(0.012)
δ: Siphon Effect	-0.040	-0.095*	-0.013	0.011
	(0.054)	(0.057)	(0.036)	(0.015)
θ : Non-Participant Spillover Effect	0.002	0.003	-0.002	0.004
	(0.005)	(0.007)	(0.005)	(0.004)
ζ_0 : Selection into Participation	0.021	0.024	-0.018	0.116***
	(0.026)	(0.029)	(0.022)	(0.008)
ζ_1 : Selection into H-2B Markets	0.005	0.005	0.005	0.004
	(0.005)	(0.005)	(0.004)	(0.003)
Firms	6,198,000	6,521,000	3,746,000	6,721,000
County-Industries (Markets)	712,000	725,000	535,000	744,000
Specification	(7)	(7)	(7)	(8)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. See Equation (7) (Columns 1, 2, and 3) and Equation (8) (Column 4) along with Section 7.2 for details of specification. Standard errors, clustered at the market (industry by county) level, in parentheses. Each column represents a different specification.

Several implications emerge from Table 6, which present the estimates from Equations (7) and (8). First, the estimates of β largely align with those in Column (2) of Table 5, supporting the notion that early applicants who did not face competition from other early applicants benefited from access to H-2B workers in 2HFY 2018.

[45] Given the small number of firms that use the H-2B visa program, one may be concerned that δ cannot be separately identified from β—that is, that there are not enough markets that have more than one participant. However, according to our calculations, there are approximately 2,420 markets in which there is at least one participant, and approximately 25% of those markets have more than one participant.

While standard errors do not permit definitive conclusions, our point estimates of spillover effects largely indicate that early applicants' gains did not come at the cost of other firms. Estimates of ϕ provide initial evidence that the benefits enjoyed by early applicants did not negatively impact late applicants through business-stealing effects. Estimates of δ indicate that the advantages accruing to early applicants were largely unaffected by competition from other in-market early applicants.

Finally, and perhaps most importantly, given that H-2B users are few but integral to local markets, estimates of θ suggest that non-participant firms in markets with H-2B access did not perform worse than non-participant firms in markets where H-2B applications were submitted late. Here, effect and standard error sizes allow us to rule out that any negative effects on non-participant firms are on the same order of magnitude as positive effects on early applicants.

In sum, the above estimates suggest that labor shortages were large enough that H-2B visas could have been made available to late applicants without generating large, adverse effects on local markets.

7.3 Heterogeneity

Access to H-2B workers may have differential impacts across firms and markets on various dimensions. To learn about heterogeneous effects, we consider the following modified versions of Equation (5) and Equation (6):

$$\begin{aligned} g^{y}_{j,2018} =& \alpha + \beta \left(\text{Prop Apps Before 7a}\right)_j + \phi Z_j \\ &+ \delta \left[\left(\text{Prop Apps Before 7a}\right)_j \times Z_j\right] + \Gamma X_j + \varepsilon_j, \end{aligned} \tag{9}$$

$$\begin{aligned} \text{Active}_{jt} - \text{Active}_{j,2017} =& \alpha + \beta \left(\text{Prop Apps Before 7a}\right)_j + \phi Z_j \\ &+ \delta \left[\left(\text{Prop Apps Before 7a}\right)_j \times Z_j\right] + \Gamma X_j + \varepsilon_j. \end{aligned} \tag{10}$$

Here, Z_j represents one of two key stratifying variables: whether or not a firm is operating in a state with a universal e-Verify mandate and initial firm productivity, as measured by log revenues per worker in 2017 (standardized across firms for ease of interpretation). Table 7 presents results. Estimated coefficients from specifications without Z_j are also presented for comparison.[46]

[46] In a previous version of this manuscript, we did not find strong evidence for heterogeneous effects on our outcomes by firm size or age. Updated versions of these analyses are available upon request.

7.3.1 Heterogeneity by Immigration Enforcement Environment

Given that the H-2B program aims to increase employers' access to foreign workers to address temporary labor needs in low-wage jobs, its usage may vary with interior immigration enforcement policies that restrict firms' access to unauthorized workers. Unauthorized workers, who often occupy low-wage jobs, may have much in common with foreign-born low-wage workers hired through the H-2B program (Passel and Cohn, 2009). Consequently, firms located in states with stricter interior immigration enforcement policies may be more prone to turn to the H-2B program to meet their labor needs.

To assess how the policy environment may have impacted firms' response to the H-2B program, we focus on the effect of employment-based immigration enforcement, as exemplified by employment verification (E-Verify) mandates. E-Verify mandates require firms to verify the work eligibility of prospective employees using an internet-based program that matches information from the I-9 form against data from the Department of Homeland Security (DHS) and the Social Security Administration (SSA) databases. Universal E-Verify mandates, which require all public and private employers to use E-Verify, have been adopted by several states, including Alabama, Arizona, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Utah. These mandates are designed to ensure that employers hire only individuals authorized to work in the United States, thereby reducing the employment of unauthorized workers.[47] We set Z_j in Equation (9) equal to one when firm j's state of main operation, $s(j)$—defined as the state in which the firm employed the most workers—has a universal E-Verify mandate in place. Otherwise, it is set equal to zero.

Results from this heterogeneous analysis are displayed in Column (2) of Table 7. Overall, we find that effects are more pronounced in states with E-Verify mandates, although estimates are sometimes imprecise. There is suggestive evidence that the impact of access to H-2B workers on employment is larger in states with universal E-Verify mandates, and stronger evidence that the impact of H-2B workers on firm survival is larger in these states. Combined, these results suggest that H-2B workers and unauthorized workers may function as substitutes in production, aligning with the broader literature on the interaction between enforcement policy and legal channels of U.S. migration (Orrenius and Zavodny, 2020; Amuedo-Dorantes et al., 2021). Amid intensified immigration enforcement, firms may increasingly rely on alternatives like the H-2B program to meet their labor demands.

[47] East et al. (2023) find that Secure Communities—a police-based immigration enforcement program implemented by local or state-level police—significantly impacted local labor markets. However, Secure Communities was in place in all localities by 2014, before our study period. As such, we lack the variation to examine the interaction between the H-2B program and Secure Communities.

Table 7: Heterogeneity

A: Revenues	(1)	(2)	(3)
Prop Apps Before 7a$_j$	0.055***	0.053***	0.057***
	(0.014)	(0.015)	(0.014)
Prop Apps Before 7a$_j$		0.016	
×E-Verify$_{s(j)}$		(0.056)	
Std. Log 2017 Rev. pw$_j$			-0.040
			(0.040)
Prop Apps Before 7a$_j$			0.018
×Std. Log 2017 Rev. pw$_j$			(0.037)
B: 2HFY Employment	(1)	(2)	(3)
Prop Apps Before 7a$_j$	0.149****	0.132***	0.150***
	(0.022)	(0.015)	(0.014)
Prop Apps Before 7a$_j$		0.133*	
×E-Verify$_{s(j)}$		(0.071)	
Std. Log 2017 Rev. pw$_j$			0.002
			(0.030)
Prop Apps Before 7a$_j$			0.043
×Std. Log 2017 Rev. pw$_j$			(0.034)
C: 2HFY Payroll	(1)	(2)	(3)
Prop Apps Before 7a$_j$	0.163***	0.149***	0.165***
	(0.024)	(0.025)	(0.024)
Prop Apps Before 7a$_j$		0.108	
×E-Verify$_{s(j)}$		(0.084)	
Std. Log 2017 Rev. pw$_j$			-0.027
			(0.033)
Prop Apps Before 7a$_j$			0.030
×Std. Log 2017 Rev. pw$_j$			(0.035)
D: Active Operation	(1)	(2)	(3)
Prop Apps Before 7a$_j$	0.029***	0.021**	0.030***
	(0.009)	(0.009)	(0.009)
Prop Apps Before 7a$_j$		0.061**	
×E-Verify$_{s(j)}$		(0.028)	
Std. Log 2017 Rev. pw$_j$			-0.007
			(0.010)
Prop Apps Before 7a$_j$			0.008
×Std. Log 2017 Rev. pw$_j$			(0.011)

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. See Equation (9) (Panels A, B, and C) and Equation (10) (Panel D) along with Section 7.3 for details of specification. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification.

7.3.2 Heterogeneity by Firm Productivity

We next examine how our findings vary based on our proxy of firm productivity—standardized 2017 log revenues per worker. Because this stratifying variable is standardized, the δ coefficients in Equations (9) and (10) measure how much the treatment effect captured by β increases when initial firm productivity is one standard deviation above the mean.

Based on the results displayed in Columns (3) of Table 7, access to H-2B workers appears to have a statistically imprecise, albeit always more positive, impact on initially more productive firms. Because H-2B firms are already positively selected in terms of productivity, differences across H-2B firms may not be large enough to detect differential effects.

8 Conclusions

The impact that foreign-born workers who are willing to work in low-wage jobs have on the economy has been the center of numerous policy debates in advanced economies. Recently, these discussions have intensified due to labor shortages in sectors that employ low-wage workers and large migratory flows of displaced individuals into the U.S. and E.U. Despite these fervent debates, there is little well-identified evidence on how low-wage, foreign-born workers impact the firms that hire them. Ultimately, the aggregation of these firm-level effects largely determines the overall impact of low-wage, foreign-born workers on the economy as a whole.

In this context, the H-2B visa program plays a critical role for a subset of U.S. firms, providing a channel to address their temporary labor needs. We exploit an unanticipated change in the processing of H-2B worker requests in 2018 that affected firms' ability to hire low-wage, foreign-born workers on a temporary basis. Using detailed data from nearly all firms applying for the H-2B program, we find limited evidence that access to H-2B workers crowds out other forms of employment. Additionally, firms gaining access to H-2B workers appear to experience increases in annual revenues and survival likelihood, suggesting that the program may help firms address labor shortages.

Finally, we do not find evidence that the benefits of hiring H-2B workers generate negative spillovers for firms' competitors, while we do find evidence that these benefits are magnified in states with stricter immigration enforcement environments. Thus, while it remains an open question whether these results are specific to the H-2B visa program or applicable to "low-skill" U.S. immigration more broadly, our findings imply that expanding the H-2B visa program specifically may deter usage of unau-

thorized labor without generating unintended, adverse effects in general equilibrium. More broadly, our findings are consistent with previous studies documenting relatively muted impacts of large inflows of potential low-wage workers on existing U.S. employment and wages (e.g., Card, 1990; Kugler and Yuksel, 2008; Allen et al., 2018; Monras, 2020; Peri et al., 2022).

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A Matching Procedure

This procedure is necessitated by a lack of common firm identifiers across the H-2B and Census data. The key variables contained in the H-2B data are: employer name, employer state, and employer city, and employer ZIP code. We include i129 petitions an TLC applications as separate observations so that they can both be linked to a common firm identifier in the Census data. Using pre-processing commands described in Wasi and Flaaen (2015) along with some additional corrections of common mistakes, we clean the names of employers. We then collapse the dataset to the name-state-city-ZIP level.

On the Census side, we link the LBD to the CBPBR using unique, within-year establishment identifiers. The CBPBR also contains name, state, city, and ZIP information for employers. Notably, it includes two name fields and both mailing and physical address for the establishment. Because visa applications are filled out by employers, they may use either the physical or mailing address on their form. We therefore reshape the LBD-CBPBR dataset to have a unique observation for each employer's address. We perform the same pre-processing commands and collapse to the `lbdnum`-name-state-city-ZIP level. `lbdnum` is the longitudinal, unique, establishment-level identifier that enables all of the analyses in this paper.

The match proceeds in 6 steps, looping over states (implicitly requiring a match on state), using the `reclink2` command (Wasi and Flaaen, 2015):

1. Exact matching on all four variables.
2. Exact match on ZIP, fuzzy match on employer name1 and city, with more emphasis on name
3. Exact match on ZIP, fuzzy match on employer name1 and city, with slightly less emphasis on the name and a higher match score requirement
4. Fuzzy match on ZIP, employer name1, and city, with an even higher match score requirement.
5. Repeat Steps 2.-4. with employer name2

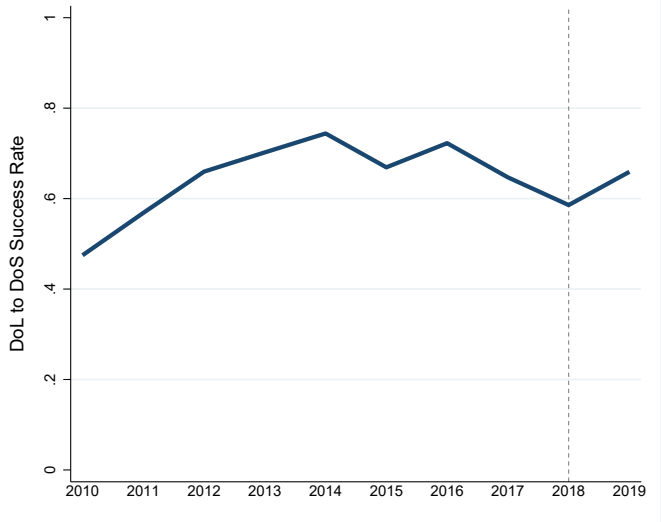
B Supplemental Figures and Tables

Table B1: Conversion Rate of USCIS Approvals to DoS Visa Issuances

Fiscal Year	DoS Issuances	USCIS Approvals	DoS Denials	Implied Conversion Rate (%)
2007	134,807	179,819	—	75.0
2008	95,036	107,920	—	88.1
2009	45,273	79,371	—	57.0
2010	47,987	70,341	—	68.2
2011	51,514	70,339	—	73.2
2012	50,554	64,588	—	78.3
2013	58,053	70,963	9,981	81.8
2014	68,424	79,258	10,533	86.3
2015	69,984	82,254	9,188	85.1
Total	621,632	804,853		77.2
Mean				78.0

Sources: Department of Homeland Security, Department of State.

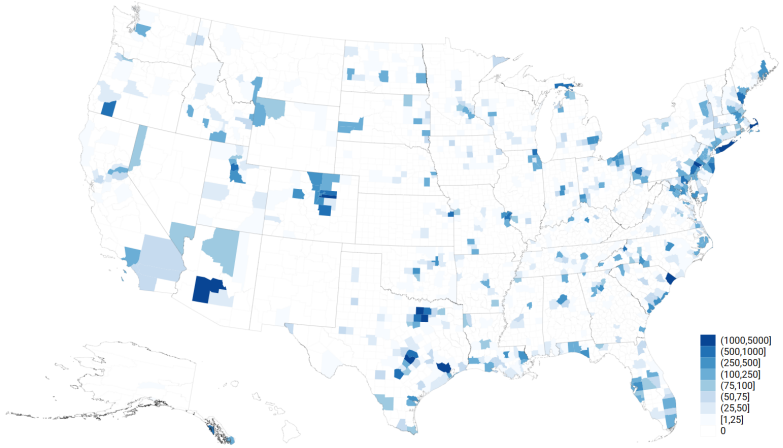
Figure B1: DoS Visas Issued per H-2B DoL Application



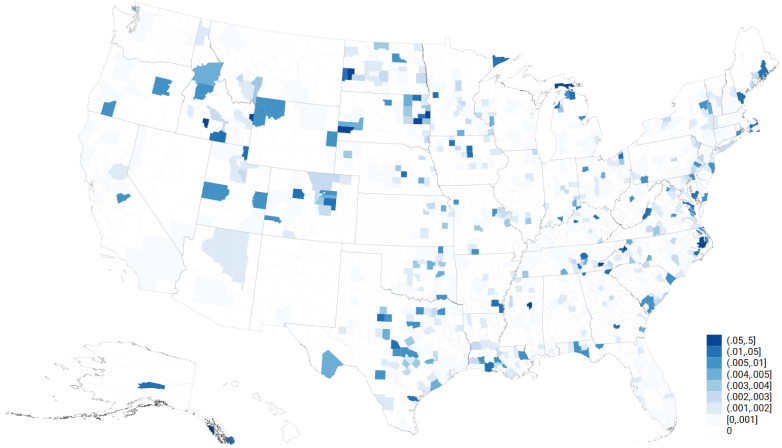
Sources: DoL Office of Foreign Labor Certification Performance Data (total LCA applications) and Department of State (visas issued). Figure 2 plots issuances and total LCA applications separately.

Figure B2: Geographic Distribution of TLC Applications

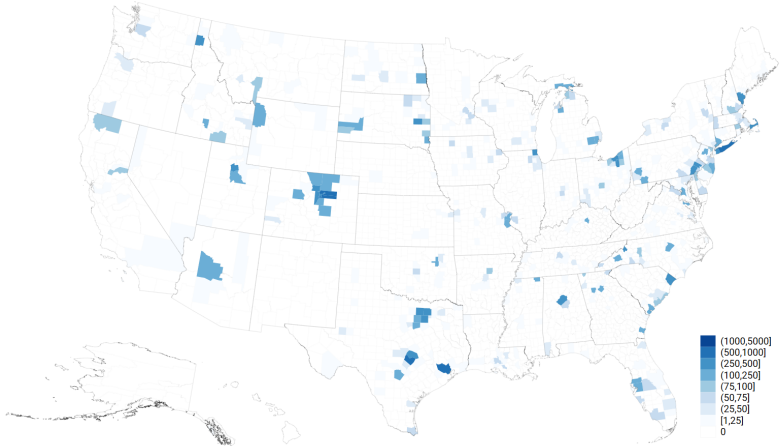
A: January 1, 2018 Application Count



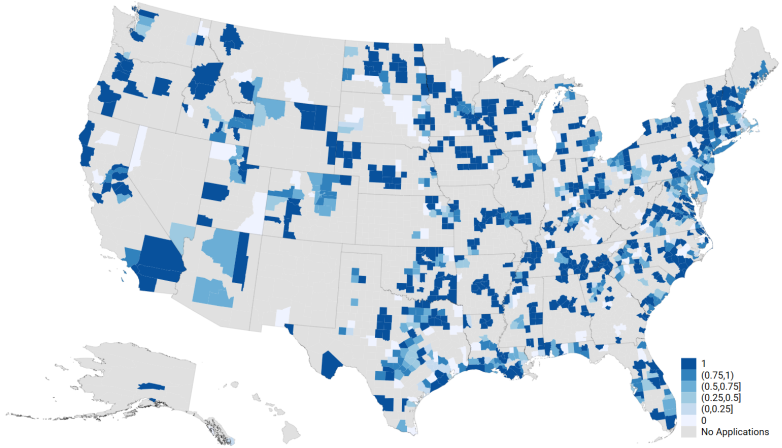
B: January 1, 2018 Application Count per Worker



C: January 1, 2017 Application Count

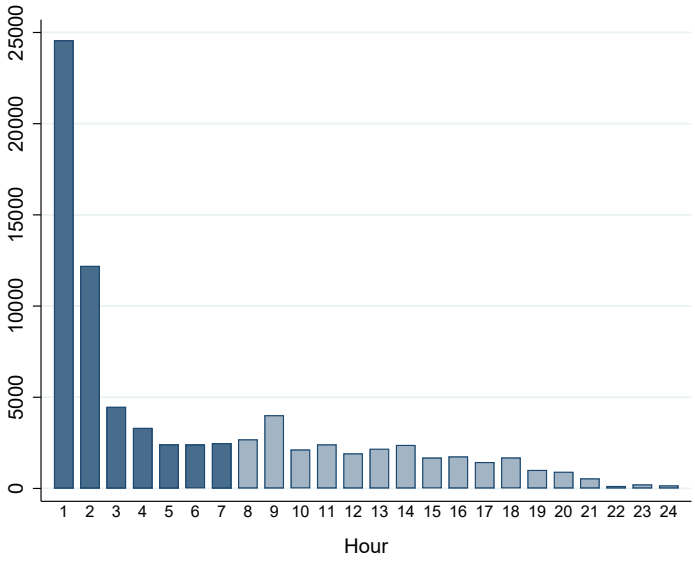


D: Proportion of January 1, 2018 Applications Before 7am



Source: Department of Labor Office of Foreign Labor Certification Performance Data and Business Dynamics Statistics (denominator of Panel B is BDS employment in 2018).

Figure B3: 2HFY 2018 TLC Applications by Hour of Day Received on January 1



Source: DoL Office of Foreign Labor Certification Performance Data.
Notes: This figure plots the denominator of Figure 4.

Table B2: Jan. 1 2018 Applicants' Top Five Industries and Occupations

A: Industry (NAICS)		Percent of	
		Applications	Firms
1.	Landscaping Services (561730)	52.6%	54.4%
2.	Hotels & Motels (721110)	9.4%	6.7%
3.	"Other" Amusement & Recreation (713990)	3.0%	3.1%
4.	Fresh & Frozen Seafood Processing (311712)	2.8%	2.6%
5.	Poured Concrete Foundation & Structure Contractors (238110)	2.5%	2.4%
B: Occupation (SOC)		Percent of	
		Applications	Firms
1.	Landscaping & Groundskeeping (37-3011)	55.5%	61.0%
2.	Maids & Housekeeping (37-2012)	6.6%	6.5%
3.	Construction Laborers (47-2061)	3.5%	4.4%
4.	Amusement & Recreation Attendants (39-3091)	3.4%	2.2%
5.	Meat, Poultry, and Fish Cutters & Trimmers (51-3022)	2.2%	2.0%

Notes: Calculated using publicly-available DoL Office of Foreign Labor Certification Performance Data. As in Table 3, firms are defined based on employer name and location and aggregated across locations where they are clearly multi-unit. If a firm applies for workers in multiple industries or occupations, we assign it the industry of occupation with the highest number of applications.