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

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Abstract

We examine how migrant workers impact firm performance using administrative data from the United States. Exploiting an unexpected change in firms' likelihood of securing low-wage workers through the H-2B visa program, we find limited crowd-out of other forms of employment and no impact on average pay at the firm. Yet, access to H-2B workers raises firms' annual revenues and survival likelihood. Our results are consistent with the notion that guest worker programs can help address labor shortages without inflicting large losses on incumbent workers.

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

JEL Codes: J23, F22, J61

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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 EU firms in the construction and service sectors reported that labor shortages limit their production, compared to less than 5% in 2010 (European Commission, 2022). In the US, job opening rates in the construction and the food and accommodation sectors more than doubled over the same time 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 hiring performance, particularly when labor markets are tight.

The US H-2B visa program offers a unique opportunity to address this question. It is the primary channel through which US firms secure guest workers for non-agricultural jobs that do not require a college degree. It therefore tends to match workers who make less than $15 per hour with large, locally important firms.[3] Because it risks displacing especially vulnerable native workers, the H-2B visa program has been the subject of a contentious policy discussion that mirrors the larger debate surrounding US immigration. On the one hand, users of the program argue that having access to foreign-born labor is vital to their survival, pointing out that they face a shortage of US 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.[4]

In this paper, we use 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 US 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 2019.

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[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] That these workers are therefore at the lower end of the hourly wage distribution is the sense in which we use the term "low-wage" in this paper. See Section 4.1 for more on H-2B employers and the wages they offer.

[4] 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. 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 US, 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 how access to H-2B workers impacts firms is that firms participating in the H-2B program are likely selected along various 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. This spike forced the DoL to change its processing procedures ex-post, generating quasi-random variation in firms' access to H-2B workers 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 participate in on-time H-2B hiring than firms that applied later on January 1, 2018 (late-applicants). On average, early-applicants gained access to approximately eight additional H-2B workers relative to late-applicants. Yet, because this cutoff was not predictable ex-ante, early-applicants and late-applicants were on parallel trends prior to 2018, prompting us to use a difference-in-differences approach to identify how access to low-wage, foreign-born workers impacted firm outcomes in 2018 and 2019.[5,6]

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, by roughly 0.63 employees per H-2B approval and 0.81 employees per actual H-2B hire. In the fourth quarter, when most H-2B workers were no longer employed, estimates revert back to zero. Given that these estimates likely include the H-2B workers themselves, we find limited scope for crowd-out of other workers ($0.81 - 1 = -0.19$ other workers per H-2B hire).[7] These results are consistent with the notion that firms are mostly hiring H-2B workers to tackle seasonal labor shortages.

Second, we assess whether firms are using the H-2B program to cut down on labor costs, as argued by some of the program's opponents. Using information on quarterly payroll, we fail to find any evidence that H-2B workers reduce average (per worker) or total payroll costs among hiring firms. Instead, we find payroll increases that imply small, positive spillover effects on the non-H-2B wage bill. We do not find any effects on longer-term payroll increases in 2019.

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[5]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.

[6]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 3, our treatment is technically continuous. However, given that this group is small, we discuss our treatment in binary terms here to facilitate exposition.

[7]As H-2B workers are subject to federal income taxes, they are counted in the data as employees. Since we do not observe firm workforce composition by nativity in our data, we cannot explore whether the crowd-out affects foreign-born or natives.

Third, we assess the impact of access to H-2B workers on key measures of firm performance. We find that access to H-2B workers significantly increases firm revenues, with early-applicants netting an additional $9.5 thousand in revenues relative to early-applicants in 2018. Furthermore, we find that firms with access to H-2B workers exhibit a higher likelihood of staying active as an employer, as measured by an indicator for having a positive annual payroll. Specifically, early-applicant firms had a 1.6 percentage point higher likelihood of being active in 2018 and a 3 percentage point higher likelihood in 2019. These large extensive margin effects indicate that, among H-2B participant firms, profitability and viability may hinge on the ability to hire foreign-born workers.

Heterogeneity analyses reveal that firms with higher initial revenues per worker and in stricter immigration enforcement environments benefit more from access to H-2B workers, indicating that higher productivity firms in more constrained hiring environments may be most reliant on the program. Lastly, we do not find strong evidence of H-2B participant firms in markets with more early-applicants faring differently from H-2B participant firms in markets with fewer early-applicants, indicating limited potential for contamination in our estimates from cross-firm spillovers.

Our study contributes to the existing literature on the impact of immigration on labor markets. Most studies evaluating the impact of "low-skill" immigration focus on worker-level outcomes or market-level outcomes derived from worker-level data (e.g., Borjas, 2003; Dustmann et al., 2017; 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; Pekkala Kerr et al., 2015; Peri et al., 2015; Doran et al., 2022; Brinatti et al., 2023) or on market-level immigration shocks (e.g., Dustmann and Glitz, 2015; Mitaritonna et al., 2017; Ayromloo et al., 2020; Orefice and Peri, 2020; Beerli et al., 2021; Brinatti and Morales, 2021; Mahajan, 2022). A singular exception is Clemens and Lewis (2022), who examine the effect of the 2021 H-2B visa lottery using a survey of participant firms.[8] 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, we confirm some of the primary findings in Clemens and Lewis (2022)—particularly the increase in firm revenues and 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 2018 change to DoL processing that we exploit was unanticipated by firms, whereas the 2021 lottery studied in Clemens and Lewis (2022) was

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[8]The DoL began holding lotteries that determined which TLC applications were processed first starting in 2020. These lotteries were implemented due to the application spike we study in 2018 and a subsequent application spike that took place in 2019.

fully anticipated. The similar results, then, further buttress the case that H-2B workers are essential to the operation of H-2B users.

Second, the use of comprehensive, administrative firm-level data allows us to add important dimensions to our understanding of the impact of foreign-born workers on firms. For example, our results on firm survival speak directly to the essentiality of H-2B workers to a set of large, locally important firms. Our results on payroll provide direct evidence that guest workers who earn low wages do not necessarily price incumbent workers out of jobs. Instead, we find evidence of a temporary pay spillover to non-H-2B workers. In this regard, our results are in contrast to recent findings on the impact of H-*1*B visa workers on firms in Doran et al. (2022). They find that these college-educated, migrant workers significantly crowd out other workers and decrease average earnings at the firm. The differences across these studies underscore the distinct nature and impact of foreign-born employment in different parts of the wage distribution and foreground the notion that recent labor shortages may be particularly acute in lower-paying sectors.

The rest of this paper proceeds as follows. Section 2 describes relevant details of the H-2B visa program. Section 3 describes our identification strategy. Section 4 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 heterogeneous responses and presents a test for spillover effects across firms. 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.[9] 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 US employers to hire foreign-born individuals to fulfill temporary and full-time non-agricultural positions within a specified area(s) of intended employment.[10] Jobs offered through this program typically have a

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[9]For a brief review of the program, please visit: https://guides.loc.gov/latinx-civil-rights/bracero-program.

[10]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 permitting foreign nationals to work in the US 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

duration of up to nine months and require a minimum of 35 hours of work per week.[11] 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.[12]

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
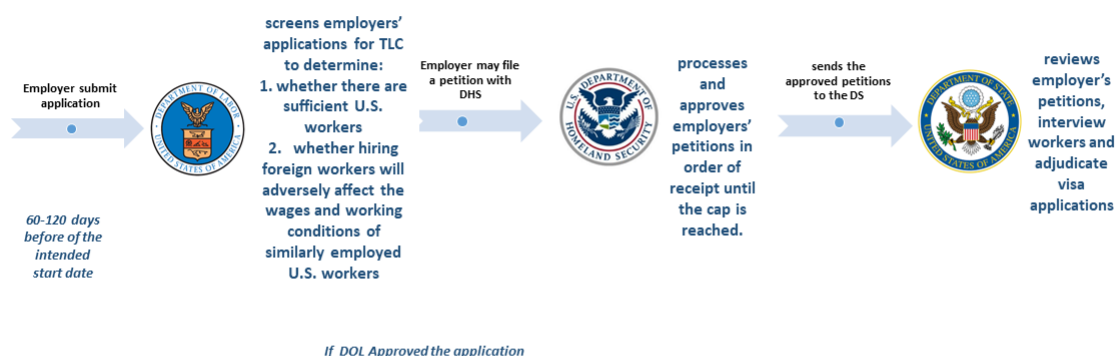
Source: Authors' analysis of DOL, DHS, and State regulations and guidance

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.[13] To secure the certification, they 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. Before submitting their applications, companies need to determine the prevailing wage rate for the position. This

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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.

[11]While nine months is the maximum, most firms that demand H-2B workers in the second half of a fiscal year only do so during what we observe as calendar Q2 and Q3 of a given year. 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.

[12]A fiscal year in the US 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.

[13]TLC applications for the same occupation and worksite are consolidated into a single form.

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.[14] The H-2B worker's pay must be higher than both the prevailing wage rate and the applicable Federal, State, or local minimum wage.[15] 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 US 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 in 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 an unusual spike in TLC applications that occurred on January 1, 2018 (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.[16] 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.[17]

Following USCIS approval, firms can start the hiring process. Each prospective employee has to apply for an H-2B visa at their corresponding US embassies, and the 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.[18] 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.[19] Issuances by

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

[15]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.

[16]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 enable late-submitting firms priority over firms that submitted their applications earlier.

[17]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.

[18]Link here: H-2B Usage and Recommendations.

[19]DoS visa denial data available here: DoS Non-Immigrant Visa Statistics.

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. 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.[20]

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.

Figure 2: Supply and Demand of H-2B Visa Workers
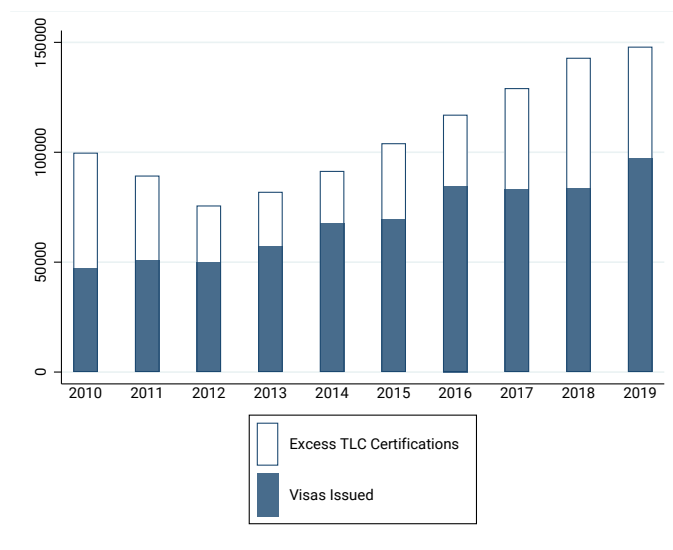
The increasing demand for H-2B workers may have been driven by firms' inability to address their labor needs through other channels. In the left panel of Figure 3, we plot the unemployment rate for workers with and without a college degree from 2000 to 2019. The years 2015 through 2019—the period for which we have data available—is marked

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[20]This brackets the period after the Great Recession and before the COVID-19 pandemic. We do not consider the COVID years due to their extraordinary nature. After a drop in demand for H-2B workers during the pandemic, demand for H-2B workers has picked up again in the post-pandemic period. In 2022, requests for H-2B workers were substantially higher than they were even in 2019.

by two vertical lines 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 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.

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 firm expectations of wage growth among low-wage workers 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 symbolic of the increase in demand for workers in low-wage industries.

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 lines bracket this paper's study period: January 2015 through December 2019.
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) and .

2.4 The 2018 TLC Application Spike

Prior to 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

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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 TLC applications for more than 81,000 positions with an April 1 start date, exceeding the semi-annual visa allotment by almost 250%.[21] This was the first time that enough TLC applications to fill the H-2B cap were received on the first possible application date. For comparison, the DoL received 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.[22] Anecdotal evidence,[23] along with direct evidence we provide in Section 6, suggests that firms did not anticipate this change to DoL procedures.

After the January 17 announcement on changes to its procedures, the DoL started to process and release approved TLC applications, i.e., on February 20, 2018. Within five business days, the USCIS had already received 2,700 i129 applications for a total of 47,000 workers, well-exceeding the 33,000 cap. USCIS conducted its first ever lottery for i129 petitions for H-2B visas on February 28, 2018. In addition, USCIS announced that further petitions would be denied.[24]

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 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%. Applications filed one hour later on January 1, 2018 were processed 0.6 days later and resulted in a 6 percentage point drop in the probability of receiving a TLC approval in time to participate in the lottery.[25]

Figure 4 shows that the decline in on-time processing over the course of applications received on January 1 was not linear. Applications submitted prior to 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

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[21]See the January 23 announcement in the Federal Register, 83 FR 3189.

[22]DoL announced it would permanently switch to this new form of sequential processing in June 2018.

[23]See, for example, https://nickarnosti.com/blog/h2bvisas/.

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

[25]Authors' calculations from DoL Office of Foreign Labor Certification data, described in Section 4.

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.

Figure 4: Proportion of 2HFY 2018 TLC Applications Processed before February 27, by Hour of Day Received on January 1
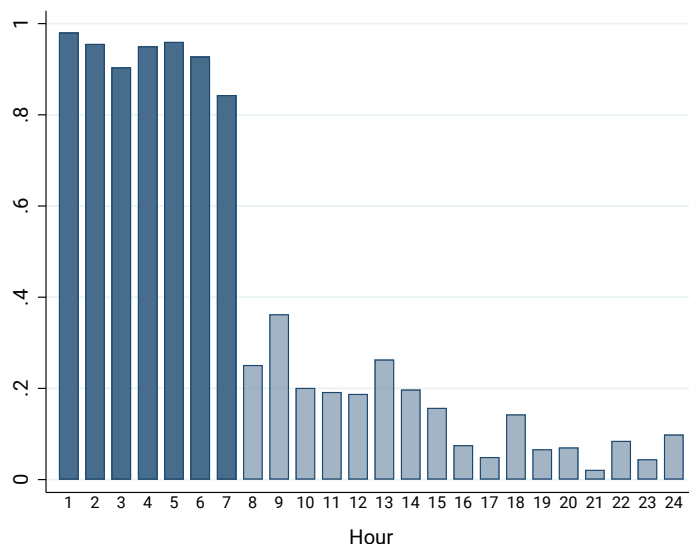
Source: DoL Office of Foreign Labor Certification Performance Data.

A second tranche of 15,000 "supplemental" visas was announced on May 25, 2018. The final rule was effective from May 31 through the end of the fiscal year. 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 2nd Half FY2018 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.

3   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. Applications Before 7am)$_j$: the proportion of a firm j's January 1, 2018 TLC applications sent in before 7:00am.

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While the criticality of getting applications in before 7:00am 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:

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

where firm fixed effects, α_j, control for unobserved, time-invariant characteristics that correlate with firm application timing and subsequent firm performance. As such, our identifying assumption is that the outcomes of early-applicant firms submitting their TLC applications before 7:00am 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.[26] Estimates of β_{2015} and β_{2016} 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, and 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.[27] In the case of multi-unit firms, state refers to the state in which a firm has the largest number of employees. Size is defined by the number of TLC applications the firm sent in on January 1, 2018. Therefore, size quartile indicators capture both firm size and reliance on the H-2B program.

Unless otherwise specified, outcome variables are divided by a common denominator: 2017 employment.[28] This helps remove skewness from our outcome variables while retaining the ability to compare coefficient estimates on a one-for-one basis (Roth and Chen, 2022).

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[26] This is a slight abuse of language since (Prop. Applications Before 7am)$_j$ is continuous, but it nonetheless conveys the intuition behind our identification. Furthermore, (Prop. Applications Before 7am)$_j$ is either 0 or 1 in the vast majority of cases. This is because firms pool applications for workers in the same occupation and worksite onto one request form, and the vast majority of firms only request workers in one occupation and one worksite.

[27] Of particular note is time zone, given that firms located in states on Pacific Standard Time could have sent their TLC applications in at 9:00pm on December 31, 2017 and therefore may have had an advantage over firms in states on Eastern Standard Time, who had to wait until midnight. In practice, we do not see evidence for such an advantage: we find no correlation between time zone and (Prop. Applications Before 7am)$_j$.

[28] For single-unit firms, 2017 employment is taken as the average across all four calendar quarters. For multi-unit firms, 2017 employment is measured only in calendar Q1.

4 Data

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 US Census Bureau.

We first gather data on firms' H-2B TLC applications from the Office of Foreign Labor Certification at the DoL.[29] 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, which allows us to construct (Prop. Applications Before 7 am)$_j$.

We also obtain data on i129 petitions from the USCIS.[30] 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 gauge the impact of access to H-2B workers on firm-level outcomes, we use the revised 2019 version of the Longitudinal Business Database (LBD) (Chow et al., 2021) granted to us by the US Census Bureau. The LBD is an establishment-level panel data set constructed from administrative tax records for each US 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 for calendar Q1, Q2, Q3, and Q4, respectively.

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.

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[29]This data is publicly available from the Department of Labor Performance Data website.
[30]This data is available from the USCIS H-2B Employer Data Hub.

The unique firm identifiers in the LBD allows 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 available through 2018.

Given that the H-2B data and the firm-level data (LBD) contain the employer name, state, city and ZIP code, we are able to link them using a fuzzy matching procedure.[31] We match 90.2% of January 1, 2018, TLC applications to a source firm in the US Census Bureau data, resulting in a sample of roughly 3,200 firms that sent in TLC applications to the DoL on January 1, 2018.[32] For most of the analyses, we focus on the subset of firms that were active in 2017 and 2018, but we then separately analyze the extensive margin outcome of whether or not a firm is actively operating in the full 3,200 firm sample.

4.1 Characteristics of H-2B Firms and Workers in the Research Sample

Table B2 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 is the dominant occupation 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, visualized in Figure 5. Reported hourly wages are tightly and roughly symmetrically distributed around a mean of $13.24 2018 per hour.[33] About 80% of TLC applications feature hourly wages below $15 per hour, and more than 99% feature hourly wages below $22 per hour. Based on the data, H-2B visa workers generally make less than 60% of the median wage and salary US worker on a weekly basis.[34]

A common characteristic of the H-2B industries is that they either sell directly to local customers or primarily provide inputs to firms that sell locally. Thus, the geography of applications is informative of the location of the impact of the H-2B visa program. Figure 6 shows that this impact is likely to be geographically dispersed.

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[31]See Appendix A for a description of the process.

[32]All firm counts are rounded in accordance with Census Bureau requirements.

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

[34]We multiplied weekly hours (also reported on TLC applications) with hourly wages to arrive at a weekly wage, which we then compared to the median weekly wages for all workers aged 16+ from the Bureau of Labor Statistics "Weekly and hourly earnings data from the Current Population Survey" release for 2018 Q2.

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

Figure 6: Geographic Distribution of January 1, 2018 TLC Applications
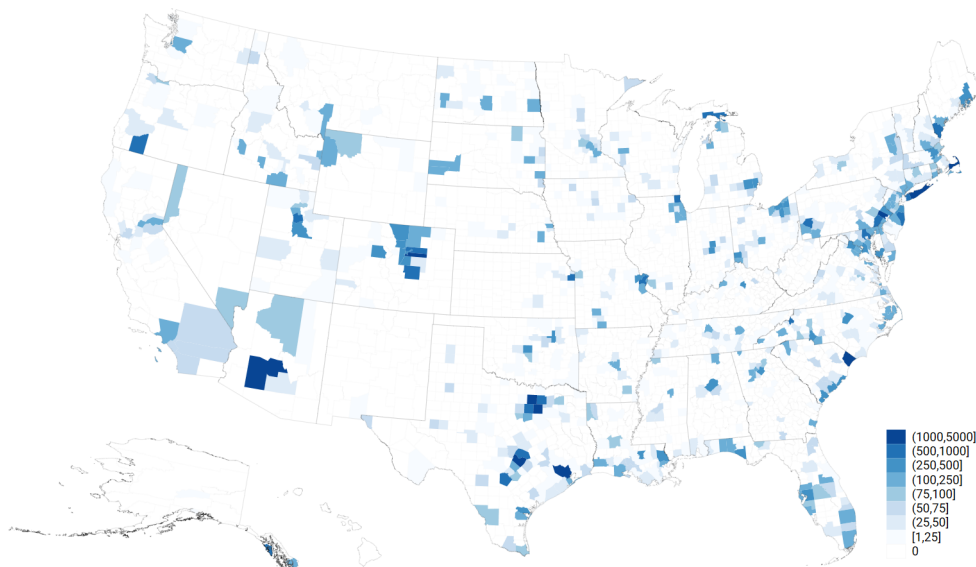
Finally, Table 1 provides some context for our sample by comparing the firms in the dataset to others in the US economy. Firms applying for H-2B workers tend to be larger across several dimensions. For instance, the median firm in our sample grossed $2.1 million in revenues, compared to $1 million in the case of the median US firm. In

terms of employment, the median H-2B employer in our sample is approximately three times as large as the average US employer. These characteristics are consistent with Mahajan (2022), 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 1: 2017 Firm-Level Summary Statistics

| Variable | Universe | Research Sample (H-2B Firms) | | | US Economy | |
		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[†]	≈ 211[†††]

Notes: Source for all statistics in "Research Sample" is the Longitudinal Business Database and associated linked data sets from the US 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.

[§] For the research sample, reported medians are means taken between the 40th and 60th percentile in accordance with Census Bureau requirements.

[†] Source: Statistics of US 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 US Businesses, Census Bureau—mean payroll among firms with $500-1,000 thousand in revenues.

5 Application Timing and H-2B Outcomes

5.1 Additional Support for Identification Assumptions

We start by presenting evidence that firms were unaware of the importance of sending their applications to the DoL by 7:00am on January 1, 2018. 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 the limited number of provided 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.[35] Figure 7 presents the estimated coefficients $\hat{\beta}_\tau$.

The left panel of Figure 7 does not present evidence of a difference in the number of TLC applications between early- and late-applicants *through* 2018. Our estimates in 2018 are small and not statistically different from zero at conventional significance levels.

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

The results are virtually unchanged when we do not include any control variables.[36] We also obtain similar results when using our proxy for application quality in the right panel of Figure 7.

In sum, both the number and likely quality of applications were not significantly different for early- and late-applicants on January 1, 2018, suggesting they were unaware of the changes in processing that DoL would announce ex-post, on January 17, 2018.

Figure 7: Placebo Tests
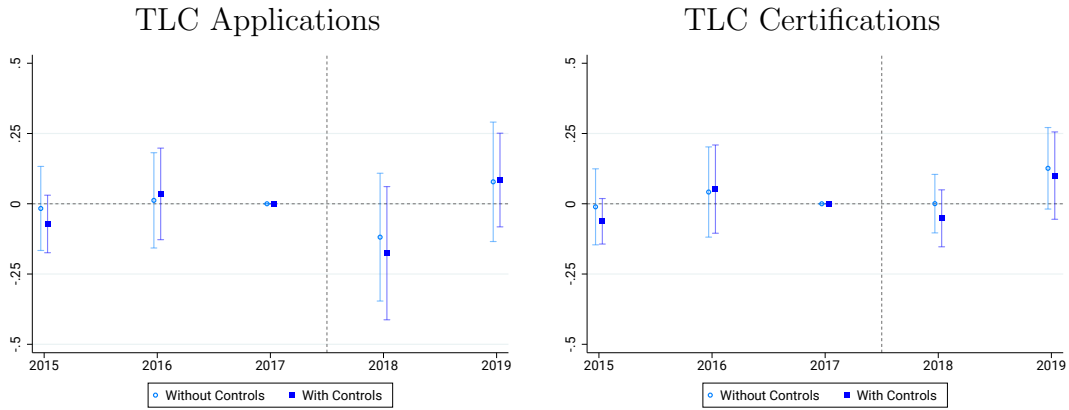
TLC Applications   TLC Certifications

Notes: See Equation (1) and Section 3 for details of specification. Capped spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each specification estimated on 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome numerators count the total number of TLC applications filed by a firm (left panel) and total number of TLC applications that were certified for a firm in a given fiscal year (right panel). All outcomes are divided by 2017 employment at the firm.

5.2   Effect of Application Timing on Eventual H-2B Visa Approvals

We next establish that TLC application submission prior to 7:00am on January 1, 2018 was a strong predictor for the likelihood of getting an H-2B worker petition approved by USCIS for the 2nd half of the fiscal year. To do so, we use the data on i129 petitions from the USCIS, which distinguishes between FY 1st Half, original tranche 2HFY, and supplemental 2HFY visa petitions, along with whether petitions are for initial employment or continuing workers. This enables us to conduct a precise test of the "first stage:" the effect of (Prop. Applications Before 7am)$_j$ on firms' ability to receive approvals for *original tranche*, 2HFY i129 petitions for initial employment in 2018.

Figure 8 plots the coefficients $\hat{\beta}_\tau$ from estimating Equation (1) using USCIS visa petition approvals as the outcome. The left panel uses approved i129 petitions subject to the original fiscal year 2HFY cap (Original Tranche 2HFY). In the right panel, we

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[36]Given that the 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 the "TLC Applications" panel of Figure 7. This finding does not change with the exclusion of controls (light blue circles).

also include approved i129 petitions subject to the 2HFY supplemental cap and approved 2HFY i129 petitions for continuing employment (All 2HFY).[37]

Figure 8: The Effect of Application Timing on H-2B Approvals
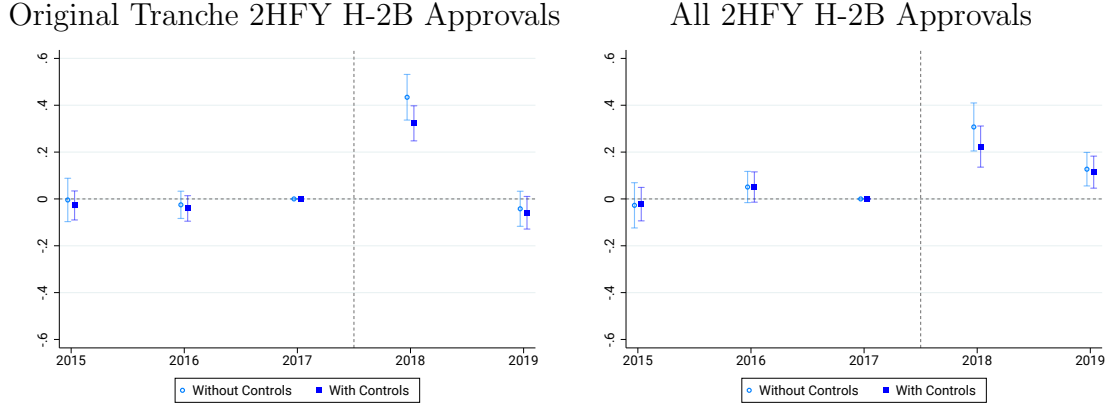
Original Tranche 2HFY H-2B Approvals   All 2HFY H-2B Approvals

Notes: See Equation (1) and Section 3 for details of specification. Capped spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each specification estimated on 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects, and size-by-year fixed effects. The outcome numerator in the left panel counts the total number of initial USCIS H-2B approvals for work in the second half of a fiscal year for a given firm. Outcome numerator in left panel counts the total number of initial USCIS H-2B approvals for a given firm. The outcome numerator in right panel counts *all* USCIS H-2B approvals for work in the second half of a fiscal year for a given firm: initial, continuing, and supplemental. All outcomes are divided by 2017 employment at the firm.

Two apparent features of the left panel of Figure 8 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 prior to 2018. Second, we estimate a substantive increase in H-2B visa approvals in the second half of FY 2018 for early applicants. The results in the left panel imply that early applicants obtained 11.2 additional H-2B original tranche visa approvals for the second half of FY 2018.[38] These results support the notion that application timing created unexpected luck in the 2HFY H-2B procurement process in 2018.

In the right panel of Figure 8, we re-run the event study including the supplemental visas in the outcome variable. The results indicate that the supplemental visas may have helped late-applicants recoup some of their ability to hire H-2B workers. When we account for the supplemental tranche of visas, the effect of applying for TLCs prior to 7:00am on January 1 on receiving *any* H-2B visa approvals for the second half of FY 2018 is about 70% 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 7:00am were left with approximately 7.7 fewer H-2B visa approvals relative to early-applicants.[39]

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[37]Continuing employment visas are not cap subject but were exceedingly rare in 2018 and therefore do not play a role in these results.

[38]Multiplying the 2018 coefficient estimate by the mean of 2017 firm employment.

[39]This time multiplying the i2018 coefficient in the right panel with the mean of 2017 firm employment.

6 Results

6.1 Does H-2B Hiring Crowd Out Other Employment?

We start with the canonical question of whether the hiring of foreign-born workers crowds out other forms of employment by looking directly at how access to H-2B workers affect firms' total employment counts. This assessment hinges crucially on the fact that H-2B workers are subject to federal income taxes and, therefore, enumerated in the firm-level employment counts. As we observe all workers subject to federal income taxes in our data, each H-2B hire should add one employee to the firm during the hiring period corresponding to calendars Q2 and Q3 in 2018 in the absence of crowd out. Conversely, if there is crowd out (crowd in), we would expect firm's employment to increase by less than one (more than one).

In Figure 9, we plot the results of estimating Equation (1) with quarterly employment as outcome. Being eligible to use the H-2B program has no impact on Q1 employment, as shown in the first upper panel in the figure. As Q1 employment is a count of employees at the firm on March 12 and 2HFY H-2B workers cannot start work before April 1, the null effect is reassuring, as it serves as an additional placebo check for anticipatory effects.

In calendar Q2, when firms are eligible to employ H-2B workers, we find a substantive increase in employment (upper right panel of Figure 9). Dividing the coefficient by the corresponding original tranche i129 approval estimates in the left panel of Figure 8 yields an estimate of 0.64 employees per H-2B *approval*.[40] We view this estimate as a lower bound on the number of additional employees per H-2B *hire*. Since roughly 78% of approved H-2B petitions result in an actual hire, our estimates suggest an increase of around 0.82 employees per H-2B hire.[41] This effect is slightly less than a one-to-one increase in employment per H-2B hire, suggesting extant but limited crowd-out of other workers.

These findings are in line with those from Clemens and Lewis (2022), who do not find any significant changes in the hiring of US workers by firms participating in the H-2B program, so long as the small crowd-out suggested above is of *other* (non-H-2B) temporary, foreign-born workers. Our results contrast strongly with those in Doran et al. (2022), who can not reject full crowd-out of other employees in response to *H-1B* hiring. Given that H-1B workers are required to have college degrees and earn substantially more than H-2B workers, we highlight the possibility that the hiring of foreign-born workers

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[40]Recall from Section 4 that workers on supplemental H-2B visas had not started working for employers by June 12, 2018 when Q2 employment was measured for 2018.

[41]See our discussion in Section 2.2.

may have substantively different implications for incumbent workers based on where they stand in the wage distribution.

We can conduct a similar exercise for Q3 employment, but using *all* 2HFY H-2B visa approvals as the denominator to account for the supplemental visas made available and likely realized before September 12, 2018. As above, we estimate that each 2HFY H-2B visa approval leads to 0.62 additional employees per approval in Q3. Using our benchmark 78% H-2B approval-to-hire conversation rate, this suggests an increase of 0.80 in Q3 employees per H-2B hire. This effect is very close to the estimated impact for Q2, suggesting firms kept a relatively stable workforce over the period.

Finally, the impact of H-2B hiring does not extend to Q4 employment (lower right panel of Figure 9). The estimated coefficient is close to zero and not statistically different from zero. This result implies firms eligible to hire through the program did not significantly alter the size of their workforce in the long run. In fact, the estimated employment impacts after 2018Q3 are all close to zero. In sum, the employment results suggest that access to the H-2B program helped firms address temporary labor needs.

Figure 9: The Effect of Application Timing on Employment Counts, by Quarter
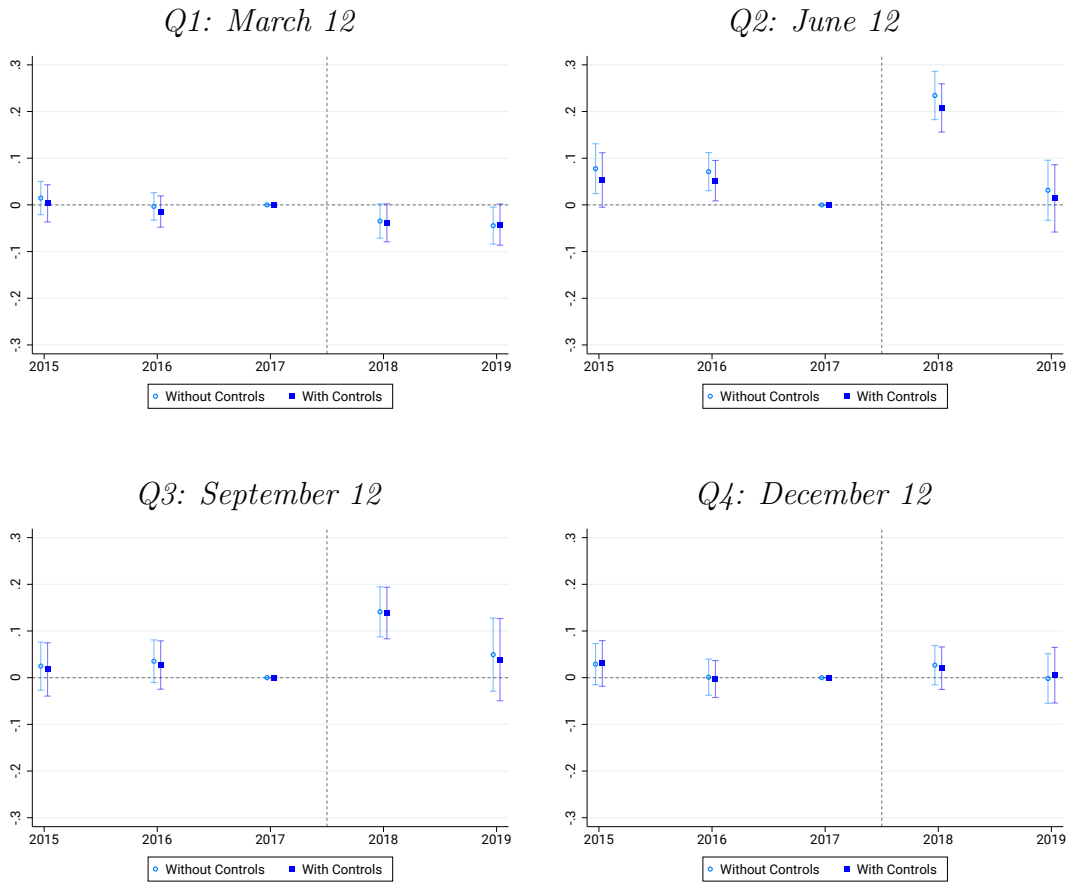
Notes: See Equation (1) and Section 3 for details of specification. Each specification estimated on 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome numerators are quarterly employment counts, measured on the indicated dates. All outcomes are divided by 2017 employment at the firm.

6.2 Effects on Payrolls and Average Pay

Critics of the H-2B visa program have long been concerned about how its impact on incumbent workers' wages. To assess the validity of such concerns, Figure 10 plots the estimated coefficients from Equation (1) using 2HFY payroll per worker as the outcome.[42] The results do not support the notion that firms lower worker pay when given access to the H-2B program. We also do not find evidence of payroll per worker trending any differently prior to 2018 for early- vs. late-applicants.

Figure 10: The Effect of Application Timing on Pay per Worker

Notes: See Equation (1) and Section 3 for details of specification. Capped spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each specification estimated on 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome in left panel is the log of total Q2 and Q3 payroll divided by mean Q2 and Q3 employment. All monetary variables are in real 2009 USD, deflated by the GDP Implicit Price Deflator series.

One possibility, however, is that effects on average pay mask changes to within-firm pay dispersion. This could occur if, for example, firms save on labor costs using H-2B workers while raising the compensation of higher-paid incumbent workers. Unfortunately, we cannot assess if that is the case because we do not have data on individual compensation. However, we can gauge if changes in payroll appear consistent with the one-to-one increase in H-2B employment, roughly matching the required compensation for an H-2B worker.

Figure 11 plots the impact of early application on quarterly payrolls. As with the employment results, we do not find evidence of a significant impact in Q1, when 2HFY H-2B workers were not yet on firm payrolls (upper left panel). In contrast, accompanying the increase in firms' employment documented above, early-applicants' payrolls rise by $1,439 in Q2 $1,332 in Q3 in 2018.

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[42]The denominator is the mean of Q2 and Q3 employment.

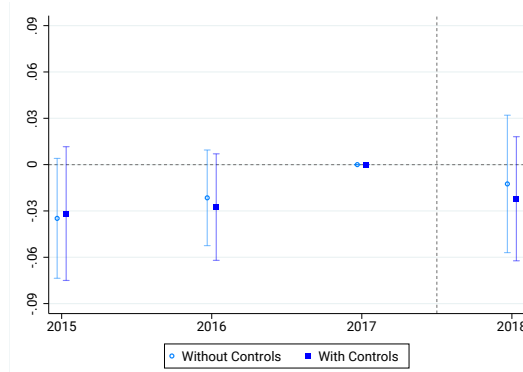**Figure 11:** The Effect of Application Timing on Payroll, by Quarter
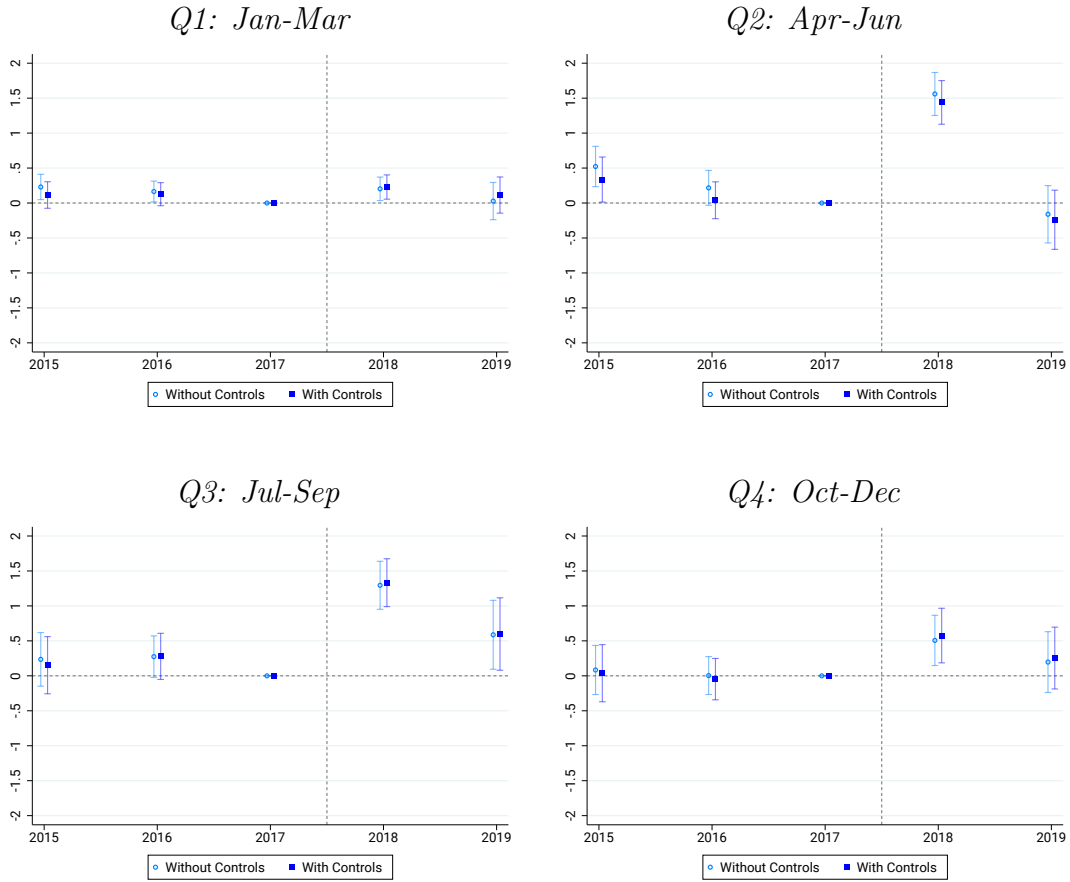
Notes: See Equation (1) and Section 3 for details of specification. Each specification estimated on 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome numerators are quarterly payroll, in thousands of real 2009 USD, deflated by the GDP Implicit Price Deflator series. All outcomes are divided by 2017 employment at the firm.

Using the same conversion rates as we do above, these figures translate to $4,458 per H-2B approval in Q2 and $5,960 per H-2B approval in Q3, and $5,715 per H-2B hire in Q2 and $7,631 per H-2B hire in Q3. Meanwhile, the average weekly wage rate for an H-2B worker is around $450. Given that a fiscal quarter has 13 weeks, a full-time H-2B worker should earn roughly $5,800 per quarter. Thus, our results are not supportive of the notion that firms use the H-2B visa program to undercut wages. Instead, we find evidence for positive spillovers on non-H-2B workers in Q3.

The small but statistically significant payroll increases seen among early applicant firms in Q4 of 2018 may also be the result of spillovers, given that employment effects have abated by Q4 in Figure 9. However, they may also be the result of the fact that payroll is measured for the whole quarter, whereas employment is only measured on December 12. While the majority (71%) of 2HFY H-2B applications indicate an end date before December 12, a majority also indicate an end date after October 1 (98%).

In sum, the results on employment and payroll indicate that the scope for crowd-out of existing employment is rather limited. Instead, they support the notion of firms' usage of the H-2B program to address temporary labor needs, with limited impacts on other employment and the potential for positive pay spillovers to non-H-2B workers. However, we caution that 1) these are estimates of firm impacts on the intensive margin, among operating firms, that do not incorporate firms that ceased operation; and 2) the estimated 78% conversion rate from H-2B approval to H-2B hire is taken from USCIS reports for FY 2007–2015 and is an approximation of the FY 2018 conversion rate. We separately examine extensive margin impacts in Section 6.3.

6.3 Does H-2B Hiring Affect Firm Performance?

Thus far, we have not found any evidence of access to H-2B workers crowding out other forms of employment or lowering workers' pay. Next, we investigate the impact that H-2B hiring might have on firm performance by focusing on revenues and firm survival.

Revenues

We first turn to the impact of H-2B hiring on firms' annual revenues.[43] If firms rely on the H-2B program to address hiring constraints, lifting that constraint should result in higher revenues.

Figure 12: The Effect of Application Timing on Annual Revenues
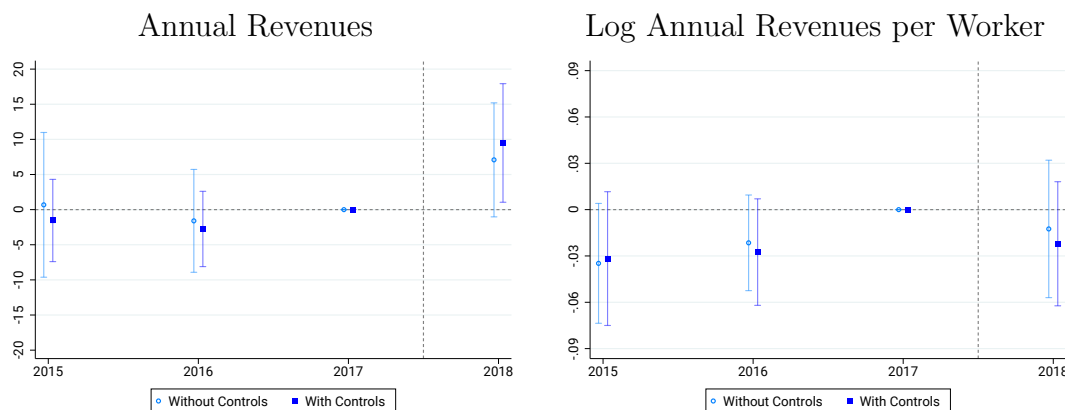
Notes: See Equation (1) and Section 3 for details of specification. Capped spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each specification estimated on 2,400 firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with observed, positive annual revenues in 2017 and 2018. Observations weighted by inverse probability weights designed to make revenue sample consistent with the universe of private sector firms. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome in left panel is annual revenues divided by 2017 mean employment. Outcome in right panel is the log of annual revenues divided by mean quarterly employment in a given year. Numerator is in thousands of real 2009 USD, deflated by the GDP Implicit Price Deflator series.

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

The left panel in Figure 12 reveals that this is the case. Early applicants earn an additional \$9.5 thousand in revenues in 2018 relative to late applicants, which roughly translates to an additional \$42 thousand in revenues per H-2B approval and \$54 thousand per H-2B hire.[44] This finding is also in line with the results in Clemens and Lewis (2022), who document a production expansion among firms winning the H-2B lottery. We also note that in a wide swath of theoretical models that feature imperfect competition in the product market (e.g., Dixit and Stiglitz, 1977), revenue increases also imply output price decreases. In the context of such models, our results lend some credence to the view that an expansion of the H-2B program may help lower price levels.

We do not find evidence of increases in per worker annual revenues (right panel of Figure 12). In conjunction with our results on payroll per worker, this suggests firms do not extract additional rents from hiring temporary H-2B workers.[45]

Firm Survival

Firms applying for H-2B workers often state that access to these temporary labor is vital to their survival. We use an indicator for whether or not a firm reports positive annual payroll to assess such claims. Our estimates from Equation (1) using this indicator as an outcome are presented in Figure 13.

Figure 13: The Effect of Application Timing on Firm Activity ($\mathbb{1}[\text{Ann. Payroll} > 0]$)
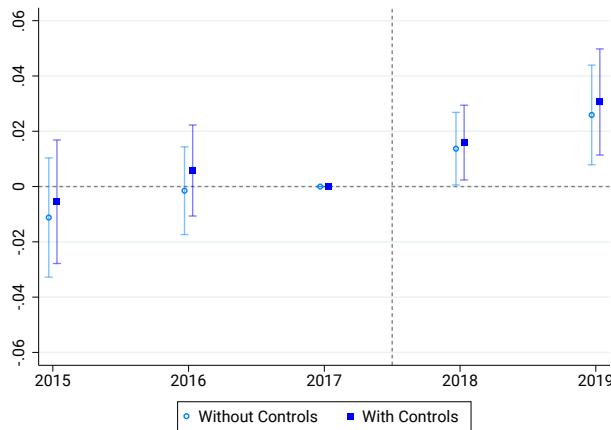
Notes: See Equation (1) and Section 3 for details of specification. Capped spikes around coefficient estimates represent 95% confidence intervals, generated from standard errors that are clustered at the firm level. Each specification estimated on 3,200 firms that applied to the Department of Labor for a TLC certification on January 1. Specifications with controls include industry-by-year fixed effects state-by-year fixed effects and size-by-year fixed effects. Outcome is an indicator of whether a firm had positive payroll in a given year.

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[44]The scaling for approvals comes from dividing $\hat{\beta}_{2018}$ in the left panel of Figure 12 by $\hat{\beta}_{2018}$ from the right panel of Figure 8. However, we note that the underlying samples are different in the two figures.

[45]One would ideally observe profits to evaluate rent-sharing. Profits are, however, not available in our data. In line with our interpretation, Clemens and Lewis (2022) find that being eligible for using the H-2B program does not change a firm's profit rate.

The likelihood of remaining active is 1.59 percentage points higher among early applicants in 2018, and this effect rises to 3.06 percentage points by 2019. One potential explanation could be that firms (correctly) saw the 2018 application spike as a harbinger for increased difficulty in obtaining H-2B workers in the future, so that those that had previously relied on this workforce for survival no longer forecast 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 and within the next five years by 2.2 percentage points. Thus, our estimates indicate that the inability of firms to hire H-2B workers in the very short term has a similar impact on firm survival as facing longer-run import competition from low-wage countries.

7 Heterogeneity and Spillovers Analysis

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 model specification:

$$
\begin{aligned}
\Delta y_j =& \beta \left(\text{Prop. Applications Before 7 am} \right)_j + \gamma Z_j \\
& + \delta \left[\left(\text{Prop. Applications Before 7 am} \right)_j \times Z_j \right] + \Gamma X_j + \varepsilon_j.
\end{aligned} \tag{2}
$$

and focus on three outcomes meant to summarize the main findings from Section 6 — namely, the 2017-2018 change in 2HFY employment (mean calendar Q2 and Q3 employment), the 2017-2018 change in annual revenues, and the 2017-2019 change in the activity indicator.[46] Z_j represents one of the stratifying variables described in the subsections below. Estimated coefficients from specifications without Z_j are also presented for comparison.

7.1 Heterogeneity by Firm Productivity Measures

We first examine how our findings vary based on two proxies of firm productivity in the base period—namely, the firm's 2017 standardized log revenues and its 2017 standardized log revenues per worker. Because these stratifying variables are standardized, δ measures

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[46]Without the terms for Z_j and $\left[\left(\text{Prop. Applications Before 7 am} \right)_j \times Z_j \right]$, the estimated coefficient indicated by β exactly corresponds to the β_{2018} coefficient from Equation (1) when 2HFY employment and revenues are the outcomes. It also corresponds to the β_{2019} coefficient from Equation (1) when the firm activity indicator is the outcome.

how much the treatment effect captured by β changes when productivity levels rise by one standard deviation above the mean.

Based on the results displayed in Table 2, we do not find evidence of access to H-2B workers having a greater impact on the employment or revenues of initially larger firms. Nevertheless, relative to smaller firms, larger early-applicant firms exhibit a higher survival likelihood a year later. Specifically, a one standard deviation increase in firms' initial revenues raises the likelihood of survival of early applicants by 5 percentage points.

Table 2: Heterogeneous Effects by Initial Firm Size

Outcome:	2HFY Employment		Annual Revenues		Activity Indicator	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Applications Before 7 am$_j$	0.173***	0.172***	9.49**	9.596**	0.031***	0.030***
	(0.024)	(0.0241)	(4.31)	(4.454)	(0.010)	(0.0099)
Std. Log 2017 Revenues$_j$		-0.006		-4.54		-0.002
		(0.030)		(3.04)		(0.010)
Prop. Applications Before 7 am$_j$		-0.023		4.90		0.020*
$\times$ Std. Log 2017 Revenues$_j$		(0.034)		(3.47)		(0.011)
Firms	2,800		2,400		3,200	
Change Taken Over	2017-2018		2017-2018		2017-2019	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 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 employment divided by 2017 mean employment. Columns (1) and (2) are estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. In Columns (3) and (4), the outcome variable is the 2017-2018 change in annual revenues divided by 2017 mean employment. Columns (3) and (4) are estimated on the set of 2,400 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive annual revenues in 2017 and 2018. In Columns (5) and (6), the outcome variable measures the 2017-2019 change in an indicator for whether or not a firm has positive payroll. Columns (5) and (6) are estimated on the set of 3,200 firms that applied to the Department of Labor for a TLC certification on January 1, 2018. All specifications include firm fixed effects, state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

Access to H-2B workers appears to have a stronger impact on initially more productive firms as well. Based on the results in Column (2) of Table 3, a one standard deviation increase above the mean in firms' initial revenues per worker increases the employment impacts of access to H-2B workers. This impact also translates into higher annual revenues (i.e., Column (4) with $p = 0.11$) and a higher likelihood of firm survival through 2019 (see Column (6)).

Overall, the results in Tables 2 and 3 are suggestive of larger and more productive firms benefiting the most from the H-2B program, especially with regards to firm survival throughout 2019. This finding is in line with prior studies showing how lower-wage immigrant workers may prove critical to business survival among higher-productivity and larger businesses (Mahajan, 2022; Ayromloo et al., 2020).

Table 3: Heterogeneous Effects by Initial Firm Labor Productivity

Outcome:	2HFY Employment		Annual Revenues		Activity Indicator	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Applications Before 7 am$_j$	0.173***	0.173***	9.49**	10.80**	0.031***	0.031***
	(0.024)	(0.0242)	(4.31)	(4.96)	(0.010)	(0.010)
Std. Log 2017 Rev. pw$_j$		0.046*		-23.80		-0.015
		(0.025)		(14.96)		(0.012)
Prop. Applications Before 7 am$_j$		0.099**		23.95		0.023*
$\times$ Std. Log 2017 Rev. pw$_j$		(0.041)		(15.15)		(0.013)
Firms	2,800		2,400		3,200	
Change Taken Over	2017-2018		2017-2018		2017-2019	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 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 employment divided by 2017 mean employment. Columns (1) and (2) are estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. In Columns (3) and (4), the outcome variable is the 2017-2018 change in annual revenues divided by 2017 mean employment. Columns (3) and (4) are estimated on the set of 2,400 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive annual revenues in 2017 and 2018. In Columns (5) and (6), the outcome variable measures the 2017-2019 change in an indicator for whether or not a firm has positive payroll. Columns (5) and (6) are estimated on the set of 3,200 firms that applied to the Department of Labor for a TLC certification on January 1, 2018. All specifications include firm fixed effects, state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

7.2 Heterogeneity by Immigration Enforcement Environment

Given that the purpose of the H-2B program is to increase employers' access to foreign workers to address temporary labor needs, its usage may vary with interior immigration enforcement policies that restrict firm access to unauthorized workers. Because unauthorized workers are more likely to be less educated and occupy low-wage jobs, they may have much in common with foreign-born low-wage workers hired through the H-2B program (Passel and Cohn, 2009). Firms exposed to greater interior immigration enforcement measures may have been more prone to turn to the H-2B program in order to meet 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 check the work eligibility of prospective employees using an internet-based program that compares information entered by an employer from the I-9 form against information from the Department of Homeland (DHS) and Social Security Administration (SSA) databases. Universal mandates—which require all public and private employers to

use E-Verify—have been adopted by Alabama, Arizona, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Utah.[47]

For this analysis, we set Z_j in Equation (2) 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 Table 4. Overall, the findings underscore the relevance of increased access to H-2B workers on firm survival, and show that these effects are magnified in E-Verify states. This result suggests that H-2B and unauthorized immigrant workers may be substitutes in production and speaks to the broader litera-ture on the interaction between enforcement policy and legal channels of U.S. migration (Orrenius and Zavodny, 2020; Amuedo-Dorantes et al., 2021). While we also find a pos-itive effect at the intensive margin, we lack the precision to conclude if it is statistically significant.

Table 4: Heterogeneous Effects by Firm Exposure to E-Verify Mandates

Outcome:	2HFY Employment		Annual Revenues		Activity Indicator	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Applications Before 7 am$_j$	0.173***	0.161***	9.49**	5.31**	0.031***	0.022**
	(0.024)	(0.026)	(4.31)	(2.64)	(0.010)	(0.010)
Prop. Applications Before 7 am$_j$ $\times$ E-Verify$_{s(j)}$		0.095		33.17		0.065**
		(0.087)		(27.65)		(0.033)
Firms	2,800		2,400		3,200	
Change Taken Over	2017-2018		2017-2018		2017-2019	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 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 employment divided by 2017 mean employment. Columns (1) and (2) are estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. In Columns (3) and (4), the outcome variable is the 2017-2018 change in annual revenues divided by 2017 mean employment. Columns (3) and (4) are estimated on the set of 2,400 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive annual revenues in 2017 and 2018. In Columns (5) and (6), the outcome variable measures the 2017-2019 change in an indicator for whether or not a firm has positive payroll. Columns (5) and (6) are estimated on the set of 3,200 firms that applied to the Department of Labor for a TLC certification on January 1, 2018. All specifications include firm fixed effects, state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects. State-by-year fixed effects absorb main effect of E-Verify$_{s(j)}$.

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[47]Prior studies have gauged how alternative immigration enforcement programs. Of particular note, 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, prior to our study period. As such, we lack the much needed policy variation to examine the interaction between the H-2B program and Secure Communities.

7.3 Testing for Spillovers

Finally, we use Equation (2) to gauge if violations of the no-spillover assumption implicit in our analysis could be biasing our findings. To that end, we construct a "market-level" on-time application rate and contrast it with the firm-level on-time application rate that we have been using thus far. The market level rate is defined as:

$$
\text{Prop. Applications Before 7 am}_{m(j)} \equiv \\
\frac{\sum_{j' \neq j, \in m(j)} \text{Jan. 1, 2018 TLC Applications Filed Before 7:00am}_{j'}}{\sum_{j' \neq j, j' \in m(j)} \text{Total Jan. 1, 2018 TLC Applications}_{j'}},
$$

to capture the proportion of January 1, 2018 TLC applications filed by firms, other than firm j in j's market, before 7:00am. Firm j's market, $m(j)$, is defined by the cross of firm j's commuting zone of primary operation (based on employment) and 4-digit NAICS industry.

We then use the Prop. Applications Before 7 am$_{m(j)}$ as the vector Z_j in Equation (2). In this case, γ can be interpreted as a measure of the spillover effect on firms that were excluded from the original tranche of 2HFY H-2B visas in 2018, but faced competition from firms that were not. δ can be interpreted as the portion of the treatment effect that is siphoned away by competitors' access to H-2B workers.

Table 5 presents the results of this exercise. Generally, our estimates of γ and δ in Equation (2) are not statistically significant, but point estimates are large. For example, in Column (4), we cannot reject the null hypothesis that market-level on-time application rates have no effect on either on-time or late applicants' revenues, but we also cannot reject the null hypothesis that all of a firm's revenue gains from on-time applications are siphoned away if all of their within-market competitors also applied on time. Thus, despite the lack of statistical significance presented in Table 5, we hesitate to draw strong conclusions about the existence of spillover effects. We do, however, note that the relative stability of our $\hat{\beta}$ estimates—across models in which we do and do not include Prop. Applications Before 7 am$_{m(j)}$—suggest that spillover effects are not generating substantial bias in our main results.

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 growing labor shortages in sectors that typically employ low-wage workers. Despite these fervent debates, there is little well-identified evidence on how low-wage, foreign-born workers impact the firms that hire

Table 5: Testing for Spillovers

Outcome:	2HFY Employment		Annual Revenues		Activity Indicator	
	(1)	(2)	(3)	(4)	(5)	(6)
Prop. Applications Before 7 am$_j$	0.173***	0.125***	9.49**	11.37**	0.031***	0.036**
	(0.024)	(0.026)	(4.31)	(5.72)	(0.010)	(0.015)
Prop. Applications Before 7 am$_{m(j)}$		-0.061		11.11		0.009
		(0.055)		(9.44)		(0.022)
Prop. Applications Before 7 am$_j$ $\times$ Prop. Applications Before 7 am$_{m(j)}$		0.088		-9.18		-0.011
		(0.059)		(7.96)		(0.023)
Firms	2,800		2,400		3,200	
Change Taken Over	2017-2018		2017-2018		2017-2019	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. 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 employment divided by 2017 mean employment. Columns (1) and (2) are estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive payroll and employment in Q2 and Q3 of 2017 and 2018. In Columns (3) and (4), the outcome variable is the 2017-2018 change in annual revenues divided by 2017 mean employment. Columns (3) and (4) are estimated on the set of 2,400 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and with positive annual revenues in 2017 and 2018. In Columns (5) and (6), the outcome variable measures the 2017-2019 change in an indicator for whether or not a firm has positive payroll. Columns (5) and (6) are estimated on the set of 3,200 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018. All specifications include firm fixed effects, state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

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 US firms, offering them a channel through which to address their temporary labor needs. Yet, the program has been criticized as a potential means for firms to cut down on labor costs at the expense of native workers. Despite such claims, surprisingly little is known about the program's impact on workers and firms.

We exploited 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 the near-universe of firms applying for the H-2B program, we find limited evidence of access to H-2B workers crowding out other forms of employment or adversely changing average pay per worker. Additionally, firms gaining access to H-2B workers appear to experience an increase in annual revenues and survival likelihood, suggesting the program may be helping firms address labor shortages.

In sum, our results point to the relevance of the H-2B program, in particular, and foreign-born workers, more generally, in alleviating firm-level hiring constraints. In addition, they challenge prevailing beliefs about the impact of low-wage, temporary migrants on employment and earnings, providing a different perspective on how access to temporary foreign labor affects workers and firms.

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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 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: Geographic Distribution of January 1, 2018 TLC Applications (per-worker basis)
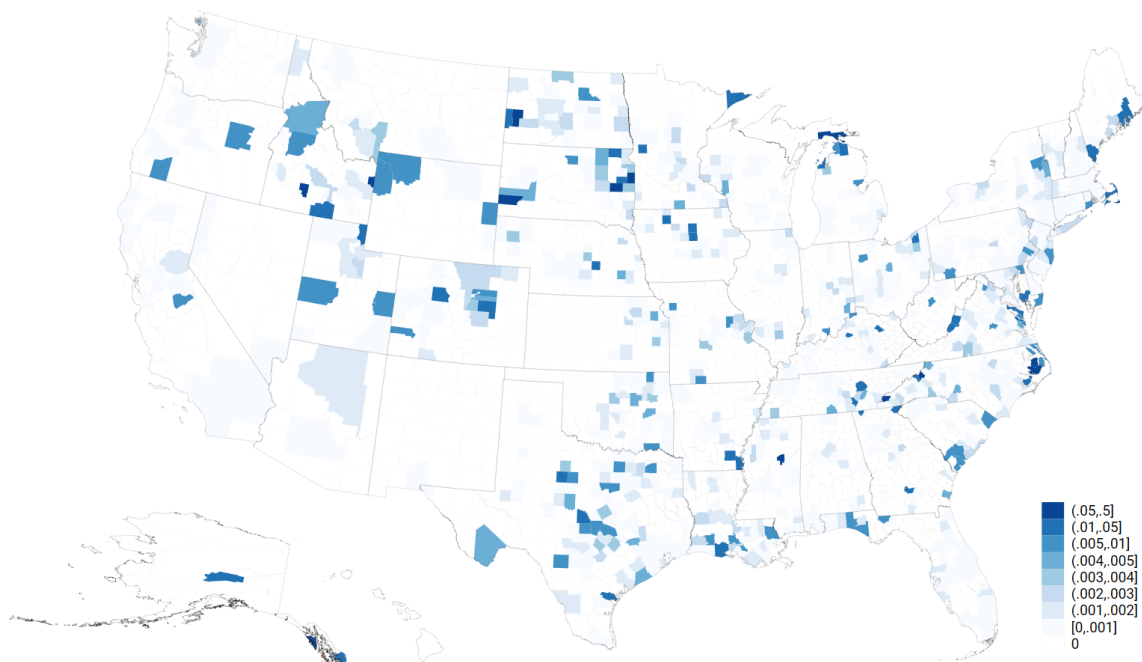
Notes: Numbers correspond to the ratio of TLC applications to 2018 Q1 employment in a given county. Figure 6 plots raw totals of TLC applications per county.
Source: Department of Labor Office of Foreign Labor Certification Performance Data (numerator), Business Dynamics Statistics (denominator).

Table B2: Top Five Industries and Occupations Listed on Jan 1., 2018 TLC Applications

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

Source: Department of Labor Office of Foreign Labor Certification Performance Data

Table B3: Estimation Results from Equation (1)—DoL Placebo Tests

	DoL Requests	DoL Requests	DoL Certifications	DoL Certifications
$\hat{\beta}_{2015}$	-0.0167	-0.0719	-0.0109	-0.0624
	(0.0763)	(0.0522)	(0.0690)	(0.0413)
$\hat{\beta}_{2016}$	0.0121	0.0351	0.0418	0.0521
	(0.0865)	(0.0831)	(0.0819)	(0.0801)
$\hat{\beta}_{2018}$	-0.1188	-0.1759	0.0004	-0.0518
	(0.1160)	(0.1209)	(0.0531)	(0.0517)
$\hat{\beta}_{2019}$	0.0781	0.0844	0.1262*	0.1002
	(0.1084)	(0.0850)	(0.0740)	(0.0793)
Controls		✓		✓
p-value: $\beta_{2015} = \beta_{2016} = 0$	0.9108	0.2604	0.7224	0.1562

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. Outcome variables, which label each outcome, are divided by 2017 mean employment. Each specification is estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and who had positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

Table B4: Estimation Results from Equation (1)—USCIS i129 Approvals ("First Stage")

	All Approvals	All Approvals	Original Tranche	Original Tranche
$\hat{\beta}_{2015}$	-0.0273	-0.0223	-0.0044	-0.0279
	(0.0493)	(0.0364)	(0.0472)	(0.0316)
$\hat{\beta}_{2016}$	0.0509	0.0508	-0.0252	-0.0406
	(0.0340)	(0.0330)	(0.0297)	(0.0278)
$\hat{\beta}_{2018}$	0.3073***	0.2235***	0.4341***	0.3228***
	(0.0523)	(0.0448)	(0.0497)	(0.0382)
$\hat{\beta}_{2019}$	0.1270***	0.1143***	-0.0421	-0.0591*
	(0.0365)	(0.0349)	(0.0382)	(0.0355)
Controls		✓		✓
p-value: $\beta_{2015} = \beta_{2016} = 0$	0.0211	0.0524	0.5449	0.3339

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. Outcome variables, which title each column, are divided by 2017 mean employment. Each specification is estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and who had positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

Table B5: Estimation Results from Equation (1)—Quarterly Employment

	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4
$\hat{\beta}_{2015}$	0.0146	0.0033	0.0776***	0.0533*	0.0248	0.0176	0.0290	0.0305
	(0.0182)	(0.0203)	(0.0272)	(0.0298)	(0.0263)	(0.0291)	(0.0225)	(0.0250)
$\hat{\beta}_{2016}$	-0.0033	-0.0142	0.0713***	0.0518**	0.0353	0.0271	0.0010	-0.0029
	(0.0150)	(0.0171)	(0.0208)	(0.0221)	(0.0233)	(0.0264)	(0.0197)	(0.0202)
$\hat{\beta}_{2018}$	-0.0347*	-0.0386*	0.2344***	0.2077***	0.1411***	0.1386***	0.0268	0.0203
	(0.0187)	(0.0207)	(0.0264)	(0.0264)	(0.0274)	(0.0282)	(0.0215)	(0.0232)
$\hat{\beta}_{2019}$	-0.0445**	-0.0423*	0.0313	0.0139	0.0493	0.0386	-0.0017	0.0053
	(0.0202)	(0.0225)	(0.0328)	(0.0368)	(0.0399)	(0.0450)	(0.0271)	(0.0304)
Controls		✓		✓		✓		✓
p-value: $\beta_{2015} = \beta_{2016} = 0$	0.5606	0.5567	0.0021	0.0608	0.3163	0.5918	0.2571	0.2494

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. Outcome variables (employment in the quarter indicated by a given column title) are divided by 2017 mean employment. Each specification is estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and who had positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

Table B6: Estimation Results from Equation (1)—Quarterly Payroll

	Q1	Q1	Q2	Q2	Q3	Q3	Q4	Q4
$\hat{\beta}_{2015}$	0.2297**	0.1149	0.5224***	0.3357**	0.2356	0.1518	0.0837	0.0373
	(0.0924)	(0.0969)	(0.1469)	(0.1644)	(0.1956)	(0.2086)	(0.1793)	(0.2085)
$\hat{\beta}_{2016}$	0.1646**	0.1263	0.2170*	0.0398	0.2748*	0.2785*	0.0037	-0.0471
	(0.0760)	(0.0841)	(0.1271)	(0.1346)	(0.1513)	(0.1682)	(0.1384)	(0.1509)
$\hat{\beta}_{2018}$	0.2031**	0.2287***	1.560***	1.439***	1.295***	1.332***	0.5068***	0.5758***
	(0.0859)	(0.0886)	(0.1570)	(0.1592)	(0.1753)	(0.1747)	(0.1834)	(0.1992)
$\hat{\beta}_{2019}$	0.0276	0.1140	-0.1608	-0.2394	0.5871**	0.5977**	0.1963	0.2543
	(0.1358)	(0.1320)	(0.2093)	(0.2160)	(0.2516)	(0.2644)	(0.2219)	(0.2255)
Controls		✓		✓		✓		✓
p-value: $\beta_{2015} = \beta_{2016} = 0$	0.0333	0.3042	0.0012	0.0413	0.1875	0.2511	0.8567	0.8583

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. Outcome variables (payroll in the quarter indicated by a given column title) are divided by 2017 mean employment. Each specification is estimated on the set of 2,800 single-unit firms that applied to the Department of Labor for a TLC certification on January 1, 2018 and who had positive payroll and employment in Q2 and Q3 of 2017 and 2018. Specifications with controls include state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.

Table B7: Estimation Results from Equation (1)—Additional Outcomes

	2HFY log Pay p.w.	2HFY log Pay p.w.	Revenues	Revenues	log Rev. p.w.	log Rev. p.w.	Active	Active
$\hat{\beta}_{2015}$	-0.0129	-0.0194	0.6808	-1.546	-0.0348*	-0.0317	-0.0112	-0.0055
	(0.0118)	(0.0132)	(5.255)	(2.986)	(0.0198)	(0.0221)	(0.0110)	(0.0114)
$\hat{\beta}_{2016}$	-0.0153	-0.0181*	-1.600	-2.753	-0.0215	-0.0275	-0.0015	0.0058
	(0.0102)	(0.0109)	(3.735)	(2.733)	(0.0158)	(0.0176)	(0.0081)	(0.0084)
$\hat{\beta}_{2018}$	0.0154	0.0127	7.084*	9.488**	-0.0125	-0.0221	0.0137**	0.0159**
	(0.0098)	(0.0108)	(4.140)	(4.306)	(0.0227)	(0.0205)	(0.0067)	(0.0069)
$\hat{\beta}_{2019}$	-0.0034	-0.0031	—	—	—	—	0.0259***	0.0306***
	(0.0109)	(0.0123)	—	—	—	—	(0.0092)	(0.0098)
Firms	2,800	2,800	2,400	2,400	2,400	2,400	3,200	3,200
Controls		✓		✓		✓		✓
p-value: $\beta_{2015} = \beta_{2016} = 0$	0.3081	0.2031	0.8648	0.5950	0.2011	0.2418	0.4808	0.3410

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors, clustered at the firm level, in parentheses. Each column represents a different specification. Outcome variables title each column. The tevenues outcome is divided by 2017 mean employment. Specifications with controls include state-by-year fixed effects, industry-by-year fixed effects and size-quintile-by-year fixed effects.