Mexican Migration Flows and Agricultural Labor Markets in the U.S.

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Abstract

Using information on undocumented migratory flows for every Mexican municipality and U.S. county pair throughout the 2006–2019 period, this paper estimates the effect that variations in Mexican migration flows have on U.S. agricultural labor-market outcomes. We instrument for migration-driven changes in local labor supply using a shift-share variable that combines Mexican municipality-level violence levels with preexisting migration network patterns. Decadal long-difference estimates show that, in the long run, higher migration inflows raise both wages and employment in agriculture. Employment adjusts almost entirely along the contract-labor margin as hiring through farm labor contractors expands, while the number of directly-hired crop workers is unchanged. We find no evidence that producers respond to slower inflows by substituting toward H-2A guest workers. Regarding the mechanisms driving these results, we find that counties receiving exogenously larger inflows have more farms, devote more acreage to horticulture and vegetables and less to field crops, spend less on machinery, and have higher average farmland values.

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1 Introduction

Relative to population size, immigrant workers play an outsized role in several industries of the U.S. economy. In particular, Mexican-born migrants comprise almost 70% of hired agricultural workers in the country (Hernandez and Gabbard, 2019). However, migration from Mexico to the United States has steadily declined over the past twenty years, and the U.S. farm labor supply has been contracting for more than a decade. The prevalence of labor shortages in the agricultural industry is increasing (Zahniser et al., 2018), and the scarcity of available workers has intensified in the last few years (Peri and Zaiour, 2022). A 2019 survey found that 56% of farms in California reported being unable to meet their full labor demand over the previous five years. Common responses to the shortage included raising of wages, adopting labor-saving technologies, and reducing or delaying various cultivation practices.[1] As summarized by Martin (2020), farm employers must face lower migration flows through some combination of satisfying, stretching, substituting, or supplementing the available workforce. While conceptually any of these strategies seems a viable response to dwindling migration inflows, empirical evidence on the way in which agricultural producers have been adapting to these secular changes in labor availability remains scarce. Quantifying the relative importance of these adjustment margins, and understanding whether the agricultural sector accommodates variation in migration through changes in factor proportions or through changes in production practices is necessary for the design of both agricultural and migratory policy.

This paper estimates the causal effect of migration inflows on local labor market outcomes in the U.S. agricultural industry. Estimating how changes in worker arrivals affect local labor markets in agriculture is challenging given that a large fraction of the migrant agricultural workforce is undocumented, and reliable data on this type of migratory flows at a sufficiently disaggregated geographical level has usually been unavailable or lacking in representativity. We overcome this obstacle by using administrative records on the consular identification cards (*Matrículas Consulares de Alta Seguridad*) issued by the Mexican government to individuals residing in the U.S. Because the card confers no immigration status and offers little additional benefit to migrants who already hold legal status, its recipients are predominantly undocumented (Massey et al., 2010), and the records have been shown to track independent measures of Mexican presumably undocumented migration closely at both origin and destination (Tiburcio and Camarena, 2023). Each record identifies the cardholder's municipality of origin and current U.S. county of residence, which allows us to measure the

[1] California Farm Bureau Federation. 2019. "Still Searching for Solutions: Adapting to Farm Worker Scarcity Survey".

yearly flow of new arrivals between each of roughly 2,400 Mexican municipalities and every U.S. county throughout the 2006–2019 period.

Because both the intensity of migration flows and their destination is not random, we instrument for migration flows of Mexican workers into U.S. counties by using a shift-share design that combines the sudden and spatially heterogeneous increase in violence across Mexican municipalities beginning in 2008 with preexisting migration networks, defined by the distribution of U.S. destinations chosen by migrants leaving each municipality during 2006 and 2007. Violence-driven migration flows in origin municipalities are plausibly orthogonal to labor demand conditions in destination counties, while location choices are well predicted by the share of migrants from the same municipality already established in each potential destination before violence levels rose. Based on this identification strategy, and combining migration flows data with county-level information on agricultural wages, employment, and cultivation practices, we are able to quantify how variations in the supply of migrant workers shape employers' hiring and production decisions in agriculture.

Long-difference estimates for the period 2008–2019 show that U.S. counties receiving exogenously larger migrant inflows during this time experienced both higher wage growth and higher employment growth in agriculture. An increase of one standard deviation in annual migration inflows (0.13 pp) raises average weekly wages by about 3.2% for directly hired crop workers and by a comparable 3.4% for workers employed through labor contractors. Total agricultural employment rises by 0.35 workers per 100 residents, with most of the increase occurring in contract labor, while the number of directly hired crop workers is essentially unchanged. We also find no evidence that farms compensate for lower undocumented migration by substituting toward H-2A visa temporary workers.

Our results suggest that migration changes the organization and composition of agricultural production, not simply the quantity of labor available to a fixed set of producers. The joint increase in both employment and wages suggests that larger migrant inflows also shift labor demand outward. Newly arrived workers may complement incumbent ones and allow for greater specialization in tasks (Ottaviano and Peri, 2012; Peri and Sparber, 2009). Because agricultural goods are tradable and their prices are set in national markets, an increase in local labor supply may also be accommodated through an expansion in output rather than through lower wages (Burstein et al., 2020). Finally, arriving workers may raise labor demand in other local industries that also employ migrant labor (Charlton and Castillo, 2022), so that competition for workers across sectors sustains agricultural wages.

We explore these potential mechanisms and investigate how long-run variations in migration rates change production decisions by comparing county-level changes in agricultural practices as measured in the Census of Agriculture. Counties receiving larger

inflows shifted the composition of their production toward more labor-intensive activities with increased acreage devoted to vegetables and horticulture and decreased acreage devoted to field crops. These counties also operate a larger number of farms, and report lower expenditures on machinery, consistent with evidence that greater labor scarcity drives the adoption of labor-saving technologies (Hornbeck and Naidu, 2014; Clemens et al., 2018). Finally, higher migration inflows raise average farmland values, which we interpret as evidence that a more abundant supply of agricultural labor raises the productivity of land. Puzzlingly, we find total incomes reported by producers fall.

This paper contributes to the literature on how local economies adjust to immigration-induced changes in labor supply. A growing body of work emphasizes that these effects need not be captured by movements along a fixed labor-demand curve, as firms can adjust production techniques, factor intensities, scale, entry and exit, and the composition of output in response to changes in the availability of immigrant labor (Lewis, 2011; Dustmann and Glitz, 2015; Mahajan, 2024). We provide evidence on these adjustment mechanisms in U.S. agriculture, a tradable sector in which producers can respond to changes in labor availability by altering crop choice, capital intensity, scale, and the organization of hiring. Our results show that migration-induced increases in agricultural labor supply are accompanied by higher employment and wages as local agricultural production expands and reorganizes and shifts toward more labor-intensive crops and spends less on machinery.

Second, we contribute to the literature on immigrant labor and U.S. agriculture. Previous work has documented the secular decline in the supply of Mexican farm workers and studied how agricultural production responds to changes in immigrant labor availability (Charlton and Taylor, 2016; Lafortune et al., 2015; San, 2023; Ifft and Jodlowski, 2022; Rutledge and Mérel, 2023). Relative to this literature, we study the modern U.S. agricultural sector using direct origin-to-destination measures of predominantly undocumented Mexican migration and trace a broad set of employer responses within a common empirical design. In particular, we identify the organization of hiring as an important margin of adjustment as the increase in agricultural employment generated by larger migrant inflows occurs almost entirely through farm labor contractors, while directly hired crop employment is essentially unchanged. This result highlights labor intermediation as a mechanism through which farms accommodate changes in the availability of migrant workers. At the same time, we do not find evidence that reductions in undocumented migration are offset by greater reliance on the H-2A visa program, suggesting that labor contracting and formal guest-worker recruitment are not interchangeable responses to migrant labor scarcity over our sample period.

Finally, our analysis complements recent work exploiting the rise in drug-related violence in Mexico and historical migration networks to estimate the consequences of undocumented

Mexican migration for U.S. local labor markets (Borgschulte et al., 2025). We study one of the sectors most dependent on Mexican migrant labor and uncover the employer-side adjustments underlying the equilibrium response. Taken together, our findings show that changes in migrant labor supply alters how firms obtain labor, what they produce, and the technologies and other factors of production they employ.

The rest of the paper is organized as follows. In Section 2 we describe the general trends on migratory flows from Mexico and agricultural labor, present the data and describe the samples and variables used for analysis. In Section 3 we motivate the use of our shift-share instrument, and discuss our empirical methodology. Section 4 reports our empirical results, and Section 5 concludes.

2 Data and Background

2.1 Mexican migration and agricultural labor: National-level trends

Our findings coincide with national-level trends showing that, while both the total number of workers and the share of Mexican-born workers hired in agriculture have remained stable during the 2000–2020 period, there has been a substantial drop in immigration flows arriving to the U.S. from Mexico. The sustained decline in worker arrivals from Mexico has been large enough that, at least since 2014, the net flow of migrants from Mexico to the U.S. is roughly zero and might even be slightly negative (Gonzalez-Barrera, 2015). By contrast, as Figure 1 illustrates, the number of temporary H-2A workers being requested by U.S. farmers in order to fill vacant positions increased from under 87,000 yearly workers in 2008, to more than 250,000 in 2019. Taken together, these trends suggest that—against the backdrop of falling permanent immigrant arrivals–U.S. agricultural producers are increasingly relying on H-2A guest workers as a source of labor.

2.2 Migratory flows: the *Matriculas Consulares de Alta Seguridad* data

We measure the yearly inflow of Mexican workers arriving to each U.S. county using information from the *Matrículas Consulares de Alta Seguridad* (MCAS) program maintained by the Mexican government. The MCAS dataset records all *Matrículas Consulares* identification cards issued by Mexican consulates to Mexican-born individuals living in the U.S., and registers both the municipality of origin and the current U.S. county of residence of each cardholder. MCAS are issued to all qualifying Mexican citizens regardless of

immigration status or age. While holding a MCAS card does not confer any U.S. immigration status to the person to whom it is issued, many states and local governments allow the document to be used as proof of identity, and so it permits the cardholder to access a services that include opening a bank account, being assigned an Individual Tax Identfication Number (ITIN), or obtaining a driver's license. Since obtaining the MCAS does not entail any additional benefit to authorized migrants, it is generally assumed that MCAS are a measure of unauthorized migration inflows to the U.S. (Massey et al., 2010). Comparing the joint distribution of these inflows both at origin and destination with alternative surveys, Caballero et al. (2018) confirm that MCAS records are in fact a representative and high-quality information source on Mexican migratory flows.

We take yearly MCAS issued for the first time as our main measure of Mexican migration flows to the U.S. from Mexico. Given that MCAS must be renewed every five years it is important, when trying to measure yearly migrant inflows, to separate renewals from first-issuances. The right panel of Figure 1 shows the close correspondence between the observed number of MCAS issued for the first time and the number of newly-arrived Mexican migrants to the U.S. as recorded in the *American Community Survey* (ACS), and is consistent with the documented decline in migration inflows throughout this period (Passel and Cohn, 2018). Figure A1 in Appendix A further shows the correspondence between ACS and MCAS data for the four states in the country with highest immigration rates. A detailed analysis of the validity of MCAS data as a measure of migration flows across time can be found in Tiburcio and Camarena (2023). The spatial distribution of municipality-level outflows, and county-level inflows of migrants is shown in Figure 2.

2.3 Mexican migration networks

The MCAS records allow us to build a measure of the strength of migratory networks between each Mexican municipality of origin and destination U.S. county pair. A large literature (see for example Munshi (2003, 2014)) shows that preexisting migrant community networks at destination are a fundamental determinant of the location choice of future migrants. To compute this network measure we use the first two years in our data (i.e. 2006 and 2007) and calculate the share of migrants going to each U.S. county out of the total number of migrants leaving each Mexican municipality during this two-year period. As documented by Tian et al. (2022), we find large differences in the historical destination patterns across different Mexican municipalities, even within the same state. We leverage this spatial variation in the settlement patterns of different origin communities to build the shares of our shift-share instrument for migration inflows. Figure A2 in Appendix A illustrates the differences in

migration networks for a pair of nearby municipalities.

2.4 Violence in Mexico

Starting in 2008, Mexico has suffered an unprecedented and drastic increase in violence levels across large parts of its territory. As shown in Figure 3, national homicide rates increased by 300% in 12 years, from 8.6 homicides per 100,000 population in 2007 to 34.4 homicides per 100,000 population in 2019 . While most violence in Mexico is closely related to the illicit drug market supply to the U.S. and the governmental stance on the war on drugs, the specific causes of the sudden surge in homicide rates remain a source of debate (Castillo et al., 2020; Guerrero-Gutiérrez, 2011; Dell, 2015; Williams, 2012). Regardless of their cause, these rapid increases in violence levels across the country have been shown to have negative impacts on labor-market outcomes (Velásquez, 2020), capital accumulation (Brown and Velásquez, 2017), and migration decisions (Orozco-Aleman and Gonzalez-Lozano, 2018).

We use yearly municipal-level data on violent homicide rates from INEGI, Mexico's national statistical agency. As Figure 3 shows, the growth in violence levels has been heterogeneous across space, with some states suffering a more-than-tenfold increase in murder rates while others showing no increase at all throughout the period. Combining this data with the MCAS information described above, in Section 3 we document the existence of a strong positive correlation between yearly municipal violence levels and migrant outflows to the U.S.

The spatial variation in the increase in violence across the 2008–2019 period acts as the 'shift' component of our shift-share instrument. By combining this component with municipal-county network shares we are able to aggregate destination origin shocks into a yearly destination-level measure of migrant-supply shocks.

2.5 US agricultural wages and employment

To measure labor market outcomes we use county-industry-year data on wages and employment from the *Quarterly Census of Employment and Wages* (QCEW), maintained by the U.S. Bureau of Labor Statistics and covering more than 95% OF U.S. jobs. The QCEW reports a quarterly count of establishments, employment levels, and the total wage bill at the 6-digit NAICS level for every county in the United States, built from the Quarterly Contribution Reports that employers subject to state and federal unemployment insurance laws file with each state.

Within agriculture we work with two main sub-industry classifications describing how farm labor is organized. NAICS 111 (crop production) captures workers hired directly

by farm operators, while NAICS 115 (support activities for agriculture and forestry) captures workers engaged indirectly, predominantly through farm labor contractors and other intermediaries. Figure A3 in Appendix A shows national-level trends of employment and wages for these sub-industries. Direct hiring accounts for roughly 60% of QCEW crop-agriculture employment and indirect hiring for the remaining 40%, a division that has been broadly stable over our sample period. Measured on an employment-weighted basis, contract workers earned less than directly hired workers throughout most of the period, though the gap has narrowed substantially: average weekly earnings in NAICS 115 were $489 against $526 in NAICS 111 in 2008, and $625 against $639 by 2019.

We also measure H-2A employment separately using individual request records published by the Department of Labor, as H-2A guest workers are not included in the QCEW.[2] To obtain yearly county-level counts we aggregate the total unique number of workers certified on each intended worksite according to the stated job start date on each application.[3] Figure 1 shows yearly trends in national H-2A request levels, and Figure A4 in Appendix A shows the change in their distribution across space. H-2A requests are concentrated in the southern states—Louisiana, Florida, North Carolina—as well as in California, Colorado and Washington. Since 2008, the number of certified H-2A seasonal workers has more than doubled from under 100,000 workers to nearly 250,000 workers in 2018.

Since these three components are mutually exclusive and jointly span both the direct and intermediated margins of hiring, we define total agricultural employment in county c and year t as their sum: $L_{c,t} = L_{c,t}^{111} + L_{c,t}^{115} + L_{c,t}^{H2A}$.

Estimation sample. To protect respondent confidentiality the QCEW suppresses county-industry-quarter cells in which the number of establishments is small enough to make individual employers identifiable. The published data are therefore an unbalanced panel in which agricultural employment and wages are missing for many county-years. To maintain a consistent set of counties throughout the main analysis, our baseline estimation sample consists of the 503 counties reporting non-missing employment *and* wages in both NAICS 111 and NAICS 115 in both 2008 and 2019, so that every long-difference regression is estimated on a common, balanced set of counties across all outcomes and margins of hiring. This set of counties covers 77% of observed NAICS 111 employment and 89% of NAICS 115 employment in 2008. Coverage of H-2A employment is lower, at 44% in 2008 and 56% in 2019, since guest-worker programs are used in some counties whose QCEW cells are suppressed. We report all

[2] https://www.dol.gov/agencies/eta/foreign-labor/performance

[3] In some years intended worksites are specified either as cities or zip codes. We harmonize all locations at the U.S. county level using the crosswalks provided by the Missouri Census Data Center https://mcdc.missouri.edu/applications/geocorr2018.html.

main results for alternative estimation samples (the unrestricted panel, and samples balanced on the yearly rather than the long-difference dimension) in Appendix A.

To understand the mechanisms driving our results we additionally use data from the 2007 and 2017 versions of the Census of Agriculture (COA) to measure the effect of migration on agricultural practices. The Census of Agriculture, carried out every 5 years, is a complete count of all farms and ranches in the country and the people who operate them. It collects information on land use and ownership, operator characteristics, production practices, income and expenditures.

3 Methodology

3.1 Instrumental variable motivation

Assessing whether changes in migration rates have an effect on wages or employment rates is challenging due to the fact that observed wages and employment are equilibrium outcomes that are endogenous to labor supply, of which migration is only one component, and to labor demand, which is affected by the local economic cycle. To overcome this challenge we use the interaction of changes in violence levels across Mexican municipalities with observed preexisting migration networks as an instrument for the number of migrants arriving to each destination county every year. This instrument is based on the observation that variations in the intensity of violence in origin locations are drivers of the decision to migrate, and that the destination choice is further driven by the strength of social networks created by previous migration waves.

To fix ideas, let $M_{c,t}$ be the number of migrants arriving to U.S. county c on year t. (i.e. the number of first-time issued MCAS assigned to county c). Our goal is to find an instrument for the yearly Mexican immigration rate to each U.S. county c:

$$m_{c,t} = \frac{M_{c,t}}{P_{c,t^0}}$$

while the emigration rate leaving to the U.S. from municipality o on year t is

$$n_{o,t} = \frac{M_{o,t}}{P_{o,t^0}}$$

where P_{o,t^0} and P_{c,t^0} are, respectively, municipality and county populations in a fixed baseline year t^0 prior to the sample period.[4]

[4]In practice, we normalize all of our per capita variables according to the 2005 county and municipality population estimates calculated respectively by the U.S. Census and INEGI.

To test the premise that violence levels at origin municipalities are in fact correlated with migratory outflows we regress yearly municipality-level emigration rates $n_{o,t}$ on yearly homicide rates $V_{o,t} = \frac{\text{Homicides}_{o,t}}{P_{o,t^0}}$

$$n_{o,t} = \alpha + \beta V_{o,t} + \delta_t + \gamma_o + \varepsilon_{o,t} \tag{1}$$

where δ_t and γ_o are respectively year and municipality fixed effects.

Results for regression 1 are shown in Table 1. After accounting for both year and municipality fixed effects, our point estimate indicates that, each additional homicide in a municipality is associated with roughly 0.28 additional emigrants to the U.S. in that year. The magnitude of this correlation is similar to other estimates of the violence-at-origin effect on U.S. migration rates coming from other Central American countries (Clemens, 2021).

While we cannot tell if the observed association of violence and migrant outflows is causal, the existence of this strong correlation is enough motivation to use violence rates as the 'shift' component of our shift-share design. The intuition behind the second part of our instrument is that origin-destination migratory flows can be accurately predicted from aggregate municipality-level outflows multiplied by a measure of the strength of the historical settlement network between each municipality and each U.S. county. More precisely,

$$m_{c,t} = \frac{M_{c,t}}{P_{c,t^0}} = \frac{1}{P_{c,t^0}} \sum_o M_{o,c,t} \approx \frac{1}{P_{c,t^0}} \sum_o \left[M_{o,t} \times \phi_{o,c} \right] \tag{2}$$

where $M_{o,c,t}$ is the migration flow from m to c in t, and the share of total migrants from municipality m that arrived to county c during the 2006–2007 two-year period:

$$\phi_{o,c} \equiv \frac{M_{o,c,t^0}}{\sum_c M_{o,c,t^0}}$$

is our measure of migrant-network strength. Whether this measure is indeed a good predictor of subsequent migrant location decisions can be evaluated in the data: Figure A5 shows that this is indeed the case when using the MCAS data, and that network-predicted migration flows (i.e. $[M_{o,t} \times \phi_{o,c}]$ in equation 2) are accurate predictors of observed county-municipality migration flows $M_{o,c,t}$.

Leveraging the fact that changes in municipal homicide rates ($V_{o,t}$) influence emigration intensity, and that historical migration patterns are good predictors of destination choice,

we construct the following shift-share instrumental variable:

$$Z_{c,t} = \frac{1}{P_{c,t^0}} \sum_o V_{o,t} \times \phi_{o,c} \tag{3}$$

3.2 Empirical Strategy

To estimate the long-run effect of migration inflows on labor markets we compute the county-level change in outcomes between 2008 and 2019 and regress it on the annualized sum of yearly migration flows relative to county baseline population for the same period:

$$\Delta y_c = \beta_0 + \beta_1 m_c + X_c' \beta_2 + v_c, \tag{4}$$

where $\Delta y_c = y_{c,2019} - y_{c,2007}$ denotes the long difference in some county level outcome between 2008 and 2019, and $m_c \equiv \frac{1}{12} \sum_{t=2008}^{2019} m_{c,t}$, is the cumulative annualized migration rate. The vector X_c' is composed of controls for minimum-wage growth and long-differences in Bartik-style labor demand shocks.[5] Migration rates are instrumented with the sum of the shift-share variable across all periods $Z_c = \sum_{t=2008}^{2019} Z_{c,t}$:

$$m_c = \alpha_0 + \alpha_1 Z_c + X_c' \alpha_2 + \varepsilon_c, \tag{5}$$

Identification Migration inflows are endogenous to local economic conditions. Counties experiencing stronger growth in agricultural labor demand may attract more migrants, while other unobserved local shocks may simultaneously affect migration and agricultural outcomes. To overcome these threats, we interpret our shift-share instrument within the quasi-experimental framework of Adão et al. (2019), and Borusyak et al. (2022), in which identification relies on the exogeneity of the shifts rather than the exposure shares.

In our setting, the shares are the pre-2008 migration networks connecting Mexican municipalities to U.S. counties, while the shifts are the subsequent violence shocks in Mexican municipalities of origin. Historical migration shares are not exogenous, as they reflect persistent characteristics of destination counties, including historical labor-market conditions that are correlated with subsequent agricultural outcomes. Instead, our identifying variation comes from the interaction of these predetermined networks with the cross-county variation in cumulative exposure to municipality-of-origin violence.

[5]The inclusion of these controls is meant to control for time-varying unobservable characteristics that might affect county-level migration inflows. However, excluding them from the regressions does not have any impact in the results for any outcome. The Bartik shock is computed from the Census *County Business Patterns* (CBP) data. It combines the 2-digit NAICS code industry composition of each county in 2007 with yearly national-level industry growth rates.

Our design relies on two main identification assumptions. First, the violence shocks are as good as randomly assigned across Mexican origins with respect to the unobserved determinants of agricultural outcomes in the U.S. destinations to which those origins are connected. Following Borusyak et al. (2022), consistency additionally requires that the instrument combine a sufficiently large and dispersed set of origin shocks, with limited dependence across them, so that the identifying variation is not driven by a small number of Mexican municipalities. Second, the exclusion restriction requires that violence shocks at origin affect agricultural outcomes in U.S. counties only through the migration flows they induce. Thus, conditional on X_c, differential exposure to post-2008 violence through pre-existing migration networks should not capture other channels through which developments in Mexican municipalities directly affect the evolution of U.S. agricultural labor markets.

Section 4.2, examines several testable implications of these identifying assumptions and assessess potential threats to both the quasi-random assignment of the shifts and the exclusion restriction. We further provide evidence on the relevance of the instrument in Table A1 in the appendix.

4 Results

4.1 Main results

We estimate equation (4) on county-level average weekly wages, employment, and number of establishments, measured as long differences between 2008 and 2019. For each outcome we report results separately for workers hired directly by farm operators (NAICS 111), workers engaged through farm labor contractors and other intermediaries (NAICS 115), and H-2A guest workers.

Table 2 reports OLS and IV estimates of the effect of migration inflows on employment, measured as the change in the number of workers per 100 county residents. Counties receiving larger migrant inflows over the period experience faster growth in total agricultural employment, with a one standard deviation increase in annual migration rates (0.13 percentage points) raising total agricultural employment by 0.35 percentage points, equivalent to roughly 28% of the baseline mean agricultural employment rate of 1.24 workers per 100 population. The composition of this response is highly uneven across types of employment. About 57% of the point-estimated increase occurs through contract labor, while virtually none comes from directly hired crop workers. The remaining 42% is accounted for by the point estimate for H-2A employment, although this effect is statistically imprecise. We thus find no evidence that lower undocumented migration induces substitution toward

H-2A workers, but that rather that the most important margin through which agricultural employment responds to migrant labor availability is through changes in the use of contract labor.

Table 3 shows that the increase in agricultural employment is not accompanied by lower wages. If anything, wages rise in counties receiving larger migrant inflows. The IV estimates imply that a one-standard-deviation increase in migration raises average weekly wages by approximately 3.2% among directly hired crop workers and 3.4% among workers employed through farm labor contractors. The corresponding H-2A wage estimate is small and statistically indistinguishable from zero. Notably, the IV and OLS estimates for directly hired and contract-labor wages are similar in magnitude, suggesting that the positive wage effects are not driven by the correction for endogenous migrant location choices.

The joint increase in employment and wages is difficult to reconcile with a simple model in which migration only increases labor supply while agricultural labor demand remains fixed. Instead, the results suggest that migrant inflows are accompanied by an expansion in labor demand over the longer run. This may occur because greater labor availability allows agricultural producers to expand or reorganize production, change the activities in which they specialize, or alter how labor is recruited and combined with other inputs. We investigate these margins directly in Section 4.3.

Table 4 provides additional evidence that migration changes the organization of agricultural employment, as measured by the number of establishments registered by the QCEW.[6] Results show that the total number of agricultural establishments do not increase with migration, with an IV estimate that is negative but statistically insignificant. Beneath this aggregate effect, however, the composition of establishments shifts across the two modes of hiring. A one-standard-deviation increase in migration is associated with approximately a 5.6% decline in the number of directly hired crop-production establishments and a 3.5% increase in establishments providing contract labor. These results mirror the employment results in Table 2 and show greater migrant availability leads predominantly to a higher use of farm labor contractors and other labor intermediaries rather than in directly hired crop employment.

Taken together, Tables 2–4 show that counties receiving larger migrant inflows experience higher agricultural employment and higher wages, while employment shifts toward contract labor and the composition of establishments shifts toward labor intermediaries. These patterns show that response to migrant labor availability extends beyond a simple increase

[6]A QCEW establishment is an economic unit at a single physical location engaged in one predominant activity. The reporting unit is the UI account; employers operating more than one worksite in a state file a Multiple Worksite Report breaking employment out by worksite, required once secondary establishments total 10+ employees.

in the number of workers employed by a fixed set of farms, and motivate our analysis in Section 4.3 below of whether migration also changes the input mix and production choices within agriculture.

4.2 Robustness

We first assess the identifying assumptions underlying our shift-share design. Table A6 tests whether counties more exposed to post-2008 violence through their pre-existing migration networks were already on different agricultural trajectories before the beginning of our treatment period. We regress changes in outcomes between 2005 and 2007 on the cumulative violence instrument used in our main specification, and also report placebo 2SLS estimates in which the pre-period change is regressed on migration instrumented by subsequent violence exposure. We find no evidence of differential pre-trends in wages, and no significant pre-trends in total or directly hired employment. Contract-labor employment exhibits a small positive pre-trend that is marginally significant at the 10 percent level. The main exception is directly hired establishments, which were already declining more rapidly in counties subsequently more exposed to violence. We therefore interpret the establishment results with greater caution, consistent with their sensitivity across alternative estimation samples discussed below.

Table A7 examines the additional requirement shown by Borusyak et al. (2022) that identification be based on a large and sufficiently dispersed set of shocks rather than on a small number of influential origins. The long-difference instrument combines violence shocks from 2,424 Mexican municipalities and has an effective number of approximately 1,555 shocks. The largest municipality accounts for only 0.35 percent of total exposure and the ten largest together account for 2.7 percent. The underlying violence shocks are also highly dispersed across origins. These diagnostics indicate that the identifying variation is spread across a large number of Mexican municipalities rather than being driven by a small set of origins. The corresponding diagnostics are similarly strong for the yearly specification.

We next examine whether the results are sensitive to the choice of estimation sample. Because QCEW suppression restricts our baseline sample to counties reporting both NAICS 111 and 115 outcomes at the beginning and end of the period, Tables A2–A4 re-estimate the specifications under alternative balancing requirements and, where possible, using all counties with non-missing outcomes. The main labor-market results are stable. Directly hired wages remain positive and statistically significant across every sample, contract-labor wages are positive throughout, and contract employment increases while directly hired employment remains close to zero. H-2A employment is also positive across samples and

becomes statistically significant in the broader specifications, providing no evidence that lower undocumented migration is offset by greater use of H-2A workers. Establishment estimates are less robust: the decline in directly hired establishments is present throughout, while the positive effect on contract-labor establishments disappears in the unrestricted sample. Together with the pre-trend evidence above, we therefore view the establishment results as suggestive rather than as independently well-identified effects.

Finally, Table A5 reports estimates weighted by baseline county population. The main compositional patterns remain: contract employment increases, directly hired employment is unchanged, and the wage effects remain positive. A one-standard-deviation increase in migration raises directly hired and contract-labor wages by approximately 4.4 and 6.4 percent, respectively. The estimated effect on total employment falls to about 0.09 workers per 100 residents and becomes statistically insignificant. Thus, while weighting changes the magnitude of some aggregate effects, it does not alter the central finding that greater migrant availability is associated with higher wages and an expansion of agricultural employment concentrated in contract labor.

4.3 Mechanisms

The joint increase in agricultural employment and wages documented above suggests that migration affects not only labor supply but also the demand for agricultural labor. Over the long run, producers can respond to changes in labor availability by changing what they produce and the combination of labor, land, and capital used in production. In particular, a greater availability of migrant labor may induce producers to shift toward more labor-intensive crops and reduce incentives to adopt or use labor-saving machinery. Because agricultural goods are tradable, these adjustments can accommodate an increase in local labor supply through changes in the scale and composition of production rather than through lower wages alone (Burstein et al., 2020). We investigate these margins using the 2007 and 2017 Censuses of Agriculture, relating the same long-run migration measure used above to county-level changes in agricultural production practices over this period.

Table 5 first examines the number of farms, land use, and crop composition. Higher migration inflows are associated with an increase in the number of farms, with a one-standard-deviation increase in the annualized migration rate increasing the number of farms by approximately 2.5%. Given that the effect on total area operated is negative but statistically indistinguishable from zero this implies higher migration rates drive reductions in average farm sizes and suggests that greater migrant availability is associated primarily with changes in the organization and composition of production rather than with an expansion of

land use.

The composition of cultivated acreage does, in fact, change substantially with immigration flows. A one-standard-deviation increase in migration rates reduces total cropland by about 6.5%. Within this overall decline, acreage devoted to field crops falls by approximately 4.4%, while horticultural acreage increases by approximately 11% and vegetable acreage by about 19%. The estimated effect on fruits and tree nuts is also positive, but small and statistically imprecise. These results indicate that producers adjust the composition of production toward or away from more labor-intensive crops in response to changes in labor availability, a pattern consistent with the findings of Lafortune et al. (2015) for early twentieth-century U.S. agriculture.

We then examine whether these changes in production are accompanied by adjustments in input choices and broader changes in agricultural outcomes. Results shown in Table 6 first point to substitution between migrant labor and mechanization. A one-standard-deviation increase in migration reduces the total value of machinery owned by producers by about 2.1%. The corresponding estimate per acre is negative but smaller and statistically insignificant. The response of rented machinery is considerably stronger, with he same increase in migration reducing total expenditures on machinery rentals by approximately 5.9% and rental expenditures per acre by about 6.0%. Conversely, counties experiencing larger declines in migrant labor availability increase their reliance on machinery, consistent with producers readjusting capital investments to compensate for labor scarcity (Hornbeck and Naidu, 2014; Clemens et al., 2018).

Columns 5–8 of Table 6 examine whether these production adjustments are reflected in the value of agricultural land and in reported farm income. A one-standard-deviation increase in migration raises the total value of farmland and buildings by approximately 2.4% and their value per acre by about 3.5%. The increase in land values is consistent with greater migrant labor availability being capitalized into agricultural land values, potentially because access to labor makes a different and more labor-intensive set of production activities profitable. Higher land values, however, are not accompanied by higher contemporaneous reported income. A one-standard-deviation increase in migration reduces total reported income by approximately 4.0% and reported income per acre by about 3.9%. We therefore interpret the land-value results cautiously. They are consistent with labor availability increasing agricultural productivity and the value of agricultural land, but they do not provide evidence that migration increases contemporaneous measured farm income or profits. Understanding why land values rise while reported income falls is an important question that we leave for further analysis.

Taken together, the Census of Agriculture results show that migrant labor availability

induces changes in both the composition of agricultural production and the inputs used to produce it. Counties receiving larger migrant inflows have more farms, shift acreage away from field crops and toward horticulture and vegetables, and rely less heavily on machinery. These responses provide a mechanism through which migration can shift agricultural labor demand outward rather than simply increasing labor supply along a fixed demand curve.

5 Conclusion

Industry-wide labor shortages and migration policy are prominent issues in current policy debates. This paper contributes to these debates by quantifying the different margins through which agricultural producers adjust to changes in migrant labor supply. We find that, in the long run, larger Mexican migration inflows raise both agricultural employment and wages. The employment response occurs primarily through farm labor contractors and other labor intermediaries, while directly hired crop employment remains essentially unchanged. We also find no evidence that reductions in undocumented migration are offset by greater reliance on H-2A guest workers.

More broadly, our results show that migration changes the organization and composition of agricultural production, not simply the quantity of labor available to a fixed set of producers. Changes in migrant labor availability lead producers to alter crop choice, the organization of production, and the mix of labor and machinery: greater migrant inflows are associated with more farms, a shift away from field crops and toward horticulture and vegetables, and lower expenditures on machinery. These adjustments help explain how agricultural labor demand responds endogenously to changes in labor supply and why larger migrant inflows can be accompanied by increases in both employment and wages. The effects of migration policy on agriculture therefore extend beyond the size of the farm workforce to what farms produce and how they organize production. Understanding if these migration-driven changes in production have economically important effects on the price of agricultural products faced by consumers, and whether changes in agricultural productivity might have spillover effects on other sectors of the economy where a large share of workers are also foreign immigrants are two potentially fruitful avenues for future research.

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Table 1: Homicide rates and yearly emigration rates – Mexican municipality level

	Yearly emigration rate ($n_{o,t}$)			
	(1)	(2)	(3)	(4)
Homicides per capita	0.956***	1.293***	-0.213	0.283**
	(0.176)	(0.188)	(0.178)	(0.138)
Observations	29232	29232	29232	29232
Municipalities	2436	2436	2436	2436
Year FE	No	Yes	No	Yes
Municipality FE	No	No	Yes	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the municipality level in parentheses.

Table 2: Long-run migration rates and agricultural employment

	(1) Total	(2) Directly Hired	(3) Contract Labor	(4) H-2A Workers
Panel A: OLS Estimates				
Migration Rate (m_c)	4.183***	0.256	1.556**	2.371***
	(1.415)	(0.300)	(0.691)	(0.831)
N	503	503	503	503
Num Counties	503	503	503	503
Panel B: IV Estimates				
Migration Rate (m_c)	2.752**	0.029	1.564***	1.159
	(1.125)	(0.240)	(0.559)	(0.730)
N	503	503	503	503
Num Counties	503	503	503	503
Kleibergen–Paap F	216.31	216.31	216.31	216.31
Baseline mean	1.238	0.668	0.412	0.158

Note: *** p<0.01, ** p<0.05, * p<0.10. Clustered standard errors at the county level. Dependent variable: change in employment rate (per county population, ×100) between 2008 and 2019. Baseline mean is the mean 2008 level of the underlying outcome, computed over the counties used in each column.

Table 3: Long-run migration rates and agricultural wages

	(1) Directly Hired	(2) Contract Labor	(3) H-2A Workers	(4) H-2A (IHS)
Panel A: OLS Estimates				
Migration Rate (m_c)	0.246***	0.203*	0.077*	-0.726
	(0.060)	(0.109)	(0.047)	(1.077)
N	503	503	283	503
Num Counties	503	503	283	503
Panel B: IV Estimates				
Migration Rate (m_c)	0.246***	0.262*	0.076	-0.197
	(0.063)	(0.145)	(0.078)	(1.370)
N	503	503	283	503
Num Counties	503	503	283	503
Kleibergen–Paap F	216.31	216.31	152.7	216.31
Baseline mean	531.102	641.936	412.184	250.577

Notes: The dependent variable is the county-level log difference in the average weekly wage between 2008 and 2019. Wages are CPI-deflated (2015 = 100), so all levels are in constant 2015 dollars. *Baseline mean* reports the mean 2008 weekly wage of the underlying series, computed over the counties entering each column. Column (4) replaces the log difference in the H-2A wage with the inverse hyperbolic sine. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table 4: Long-run migration rates and establishment count

	(1) Total	(2) Directly Hired	(3) Contract Labor
Panel A: OLS Estimates			
Migration Rate (m_c)	-0.231**	-0.431***	0.156
	(0.108)	(0.142)	(0.123)
N	503	503	503
Num Counties	503	503	503
Panel B: IV Estimates			
Migration Rate (m_c)	-0.196	-0.429*	0.271*
	(0.178)	(0.220)	(0.155)
N	503	503	503
Num Counties	503	503	503
Kleibergen–Paap F	216.31	216.31	216.31
Baseline mean	74.505	54.085	20.419

Notes: Dependent variable: log difference in the QCEW annual average establishment count between 2008 and 2019. Baseline mean is the mean 2008 level of the underlying outcome, computed over the counties used in each column. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table 5: Migration and cultivation practices

			Area Harvested				
	(1) Number of farms	(2) Total area operated	(3) Total cropland	(4) Field crops	(5) Fruits and tree nuts	(6) Horticulture	(7) Vegetables
Migration Rate (m_c)	0.190***	-0.093	-0.520***	-0.345**	0.116	0.800*	1.345**
	(0.061)	(0.076)	(0.138)	(0.135)	(0.221)	(0.456)	(0.544)
Observations	3046	3032	3037	3011	1987	1002	1918
Kleibergen–Paap F	182.735	173.066	182.56	172.35	127.839	117.829	128.568

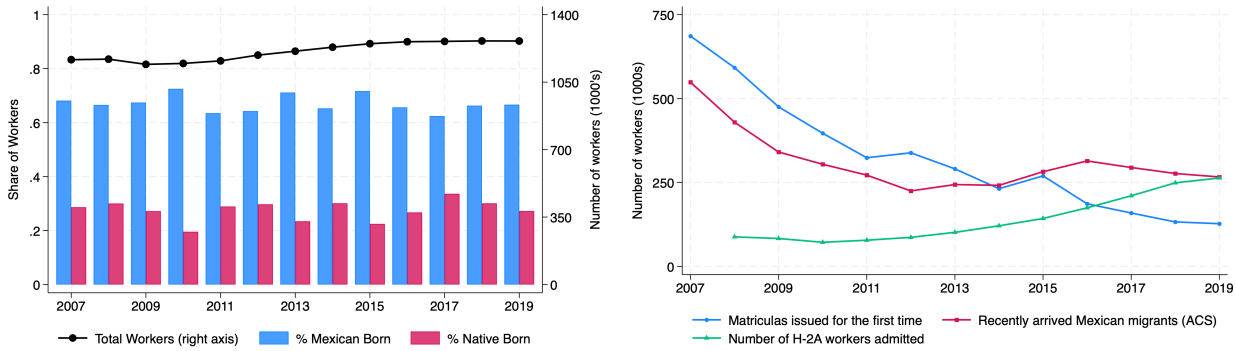
Notes: All outcomes are from the Census of Agriculture and are computed as the county-level log difference between 2007 and 2017. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table 6: Migration, mechanization, and productivity

	Machinery - Owned		Machinery - Rented		Farmland Value		Reported Income	
	(1) Total Value	(2) Value / acre	(3) Total Expense	(4) Expense / acre	(5) Total Value	(6) Value / acre	(7) Total Income	(8) Income / acre
Migration Rate (m_c)	-0.163**	-0.095	-0.467**	-0.476**	0.183**	0.268***	-0.312**	-0.304**
	(0.079)	(0.073)	(0.210)	(0.205)	(0.082)	(0.089)	(0.132)	(0.119)
Observations	3042	3028	2620	2615	3043	3030	2983	2972
Kleibergen–Paap F	186.276	176.226	175.048	166.417	182.583	172.928	176.366	166.837

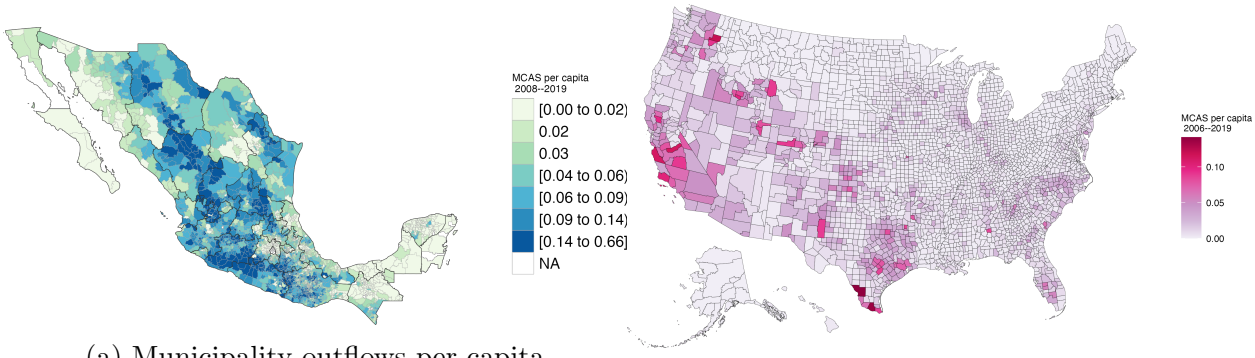
Notes: All outcomes are from the Census of Agriculture and are computed as the county-level log difference between 2007 and 2017. Columns (1)–(2) report the reported asset value of all machinery and equipment owned by producers; columns (3)–(4) expenditure on machinery and equipment rentals; columns (5)–(6) the value of agricultural land and buildings; and columns (7)–(8) total income reported across all commodities.*** p<0.01, ** p<0.05,* p<0.10. Standard errors clustered at the county level in parentheses.

Figure 1: U.S. Agricultural Workers and Mexican Migration Inflows - 2007–2019



Notes: National-level trends on agricultural sector workers and immigration flows from Mexico to the U.S. Left panel: Total number of hired workers in the agricultural sector according to the Quarterly Census of Employment and Wages (*QCEW*), and share of hired workers who are either Mexican-born or native born according to the National Agricultural Workers' Survey (*NAWS*). Right panel: Number of Matriculas Consulares de Alta Seguridad (*MCAS*) issued for the first time by all Mexican consulates in the U.S. (blue line); number of workers born in Mexico arrived to the U.S. within the previous year according to the American Community Survey (*ACS*) (red line); number of H-2A guest workers admitted by the Department of Labor (green line).

Figure 2: Migration rates in MCAS data – Municipality-level outflows and County-level inflows

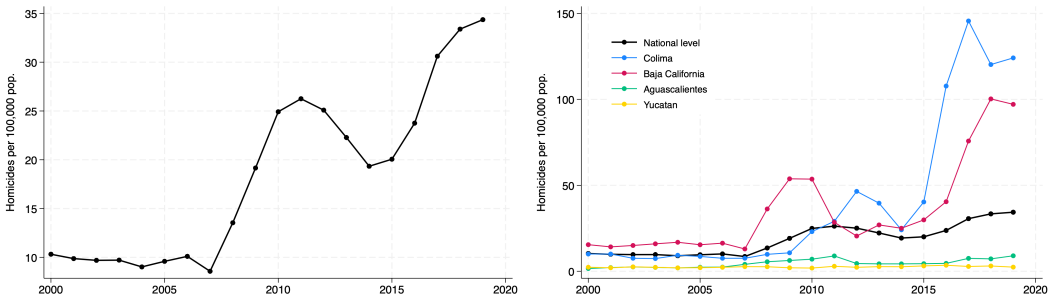


(a) Municipality outflows per capita

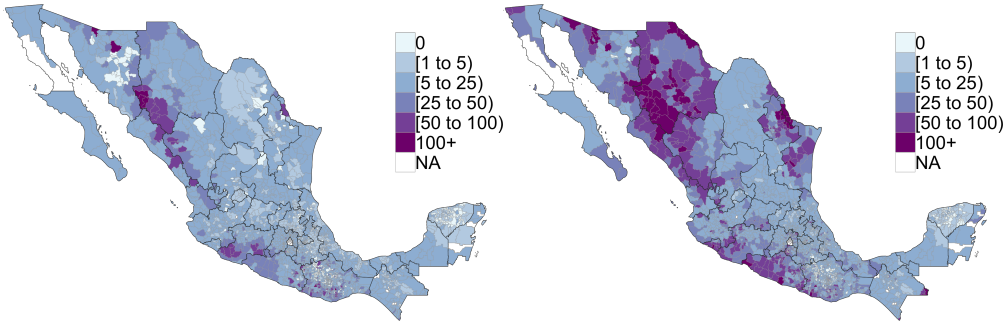
(b) County inflows per capita

Figure 3: Homicide Rates in Mexico – 2000–2019

(a) National homicide rate 2000-2019 (b) Homicide rates - selected States



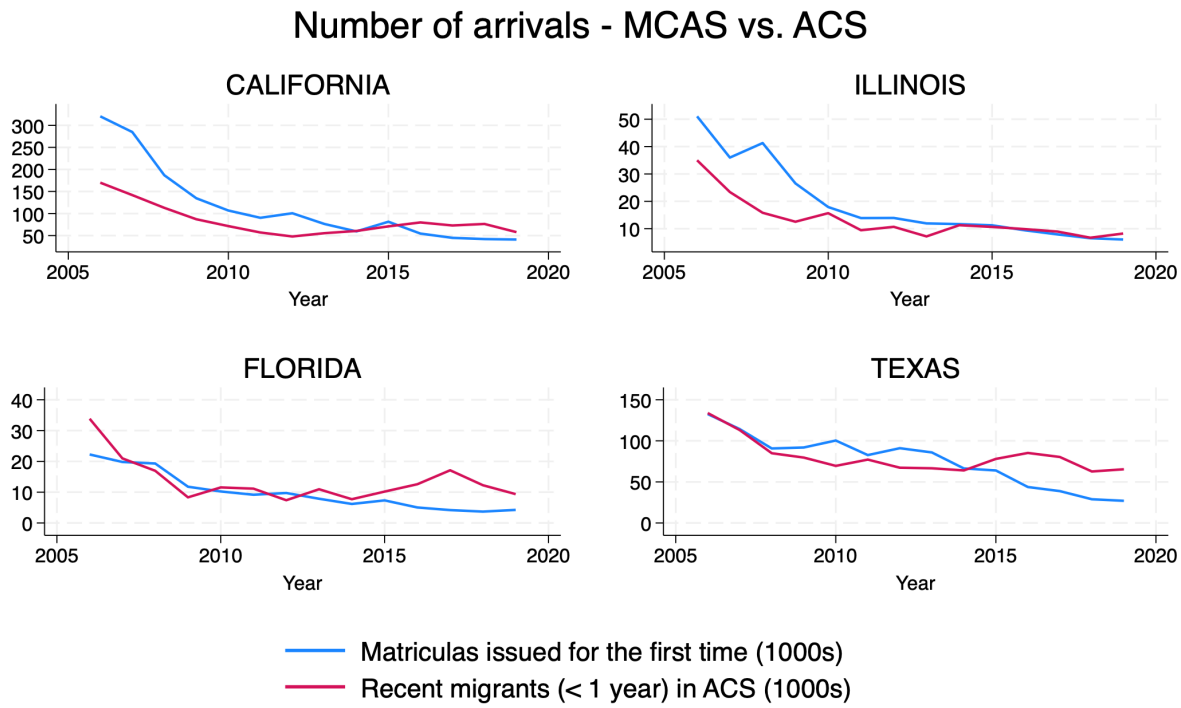
(c) Municipal homicide rates 2000–2007 (d) Municipal homicide rates 2008–2019



Notes: Yearly homicide rates per 100,000 population. Source: Mexican national statistics institute (INEGI).

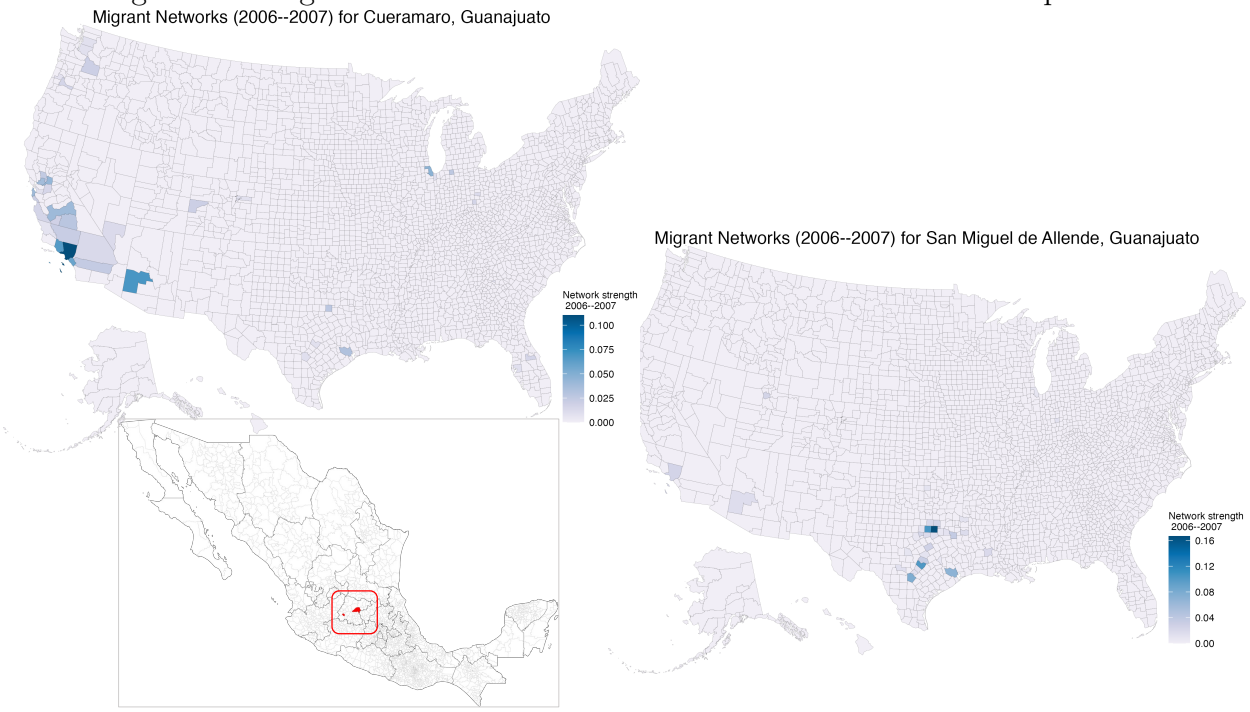
Appendix A Additional tables and figures

Figure A1: Migration inflows across data sources – State level trends



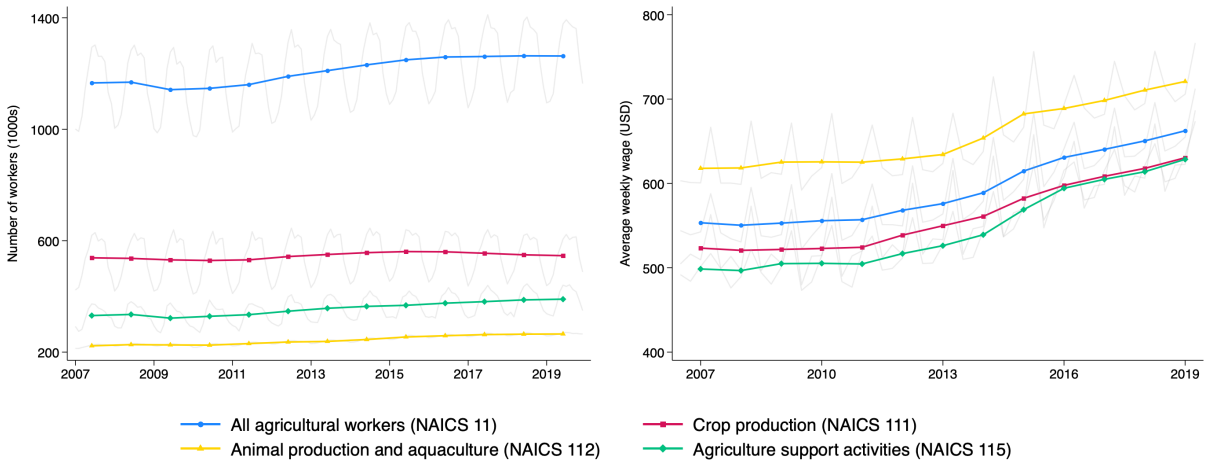
Notes: Number of yearly arrivals from Mexico comparing MCAS and ACS. Blue lines show the number of Matriculas Consulares de Alta Seguridad (*MCAS*) issued for the first time by all Mexican consulates in each state. Red lines show the number of migrants recorded in the ACS as having moved from Mexico to each state within the previous year.

Figure A2: Migration network differences across two Mexican municipalities



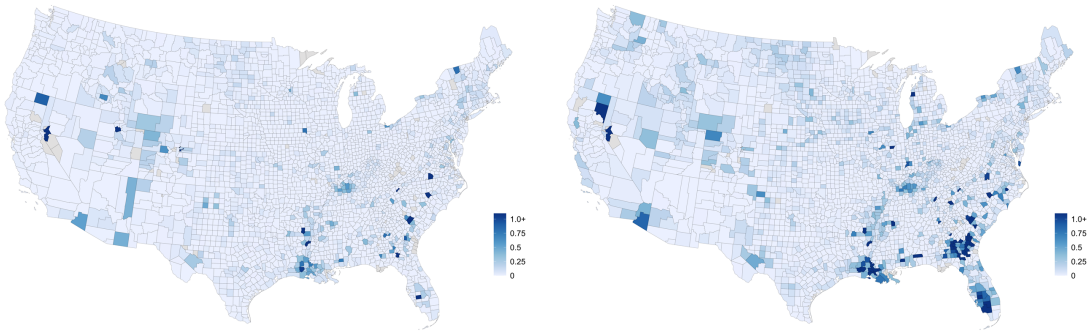
Notes: County-municipality migration network strength measured as the ratio between the number of migrants originated in each Mexican municipality moving to each U.S. county over the total number of migrants in the municipality. Left panel: Migration network for the municipality of Cueramaro, Guanajuato. Right panel: Network for San Miguel de Allende, Guanajuato.

Figure A3: Agricultural labor – National level trends



Notes: Data from the QCEW. Gray lines represent quarterly figures; solid color lines yearly averages.

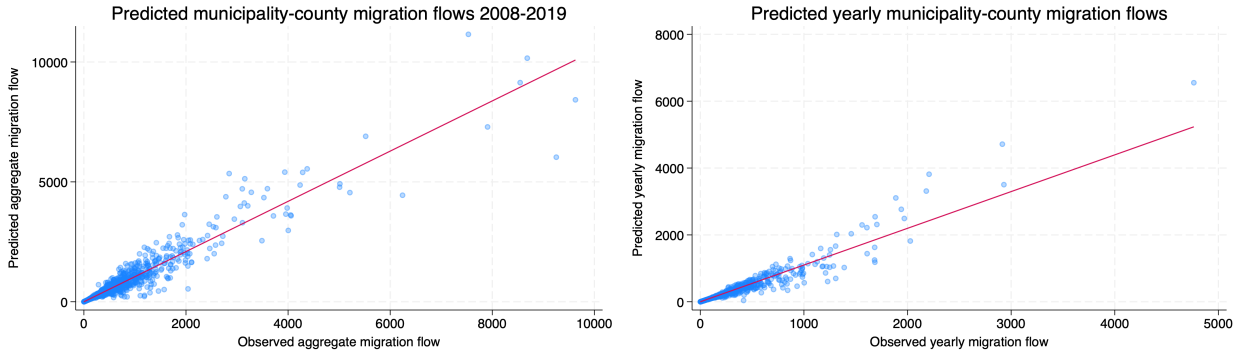
Figure A4: H-2A Visa requests by county – 2008-2018



(a) 2008 (b) 2018

Notes: Number of H-2A requests as fraction of total farm employment in county based on the QCEW. Individual H-2A request data from the Department of Labor (*DOL*).

Figure A5: Observed vs. network-predicted migration flows



Notes: Left panel: binscatter of aggregate (2008-2019) municipality-county observed migration flows and the predicted flow obtained from multiplying total municipality outflows by the network strength measure $\phi_{o,c}$. Right panel: yearly predicted and observed municipality-county migration flows.

Table A1: First-stage regressions: Violence IV and migration rates

	Short-run ($m_{c,t}$)			Long-run (m_c)	
	(1)	(2)	(3)	(4)	(5)
$Z_{c,t}$: Violence IV	3037.838***	3132.083***	3142.961***		
	(218.384)	(231.309)	(232.791)		
Z_c: Cumulative violence IV				342.274***	339.892***
				(22.341)	(23.110)
Observations	6036	6036	6036	503	503
Counties	503	503	503	503	503
R-sq	0.310	0.393	0.400	0.665	0.679
Year FE	No	Yes	Yes		
Controls	No	No	Yes	No	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.10. Clustered standard errors at the county level. Short-run columns use the yearly panel (2008–2019). Long-run columns use cumulative values.

Table A2: Long-run migration rates and employment, alternative samples

	(1) Baseline	(2) QCEW+H-2A	(3) Yr. balanced	(4) QCEW yr.	(5) Unrestricted
Panel A: Total Employment					
Migration Rate (m_c)	2.752**	1.776*	2.319	2.807***	2.752**
	(1.125)	(1.030)	(2.012)	(0.914)	(1.125)
Counties	503	257	102	281	503
Kleibergen–Paap F	216.31	169.1	91.81	307.03	216.31
Panel B: Directly Hired (NAICS 111)					
Migration Rate (m_c)	0.029	-0.173	-0.367	-0.075	-0.105
	(0.240)	(0.329)	(0.870)	(0.355)	(0.201)
Counties	503	257	102	281	1324
Kleibergen–Paap F	216.31	169.1	91.81	307.03	223.35
Panel C: Contract Labor (NAICS 115)					
Migration Rate (m_c)	1.564***	1.390***	0.858	1.398***	1.431***
	(0.559)	(0.496)	(1.021)	(0.524)	(0.514)
Counties	503	257	102	281	655
Kleibergen–Paap F	216.31	169.1	91.81	307.03	123.94
Panel D: H-2A Workers					
Migration Rate (m_c)	1.159	0.559	1.827	1.483**	0.707**
	(0.730)	(0.842)	(1.993)	(0.739)	(0.353)
Counties	503	257	102	281	3133
Kleibergen–Paap F	216.31	169.1	91.81	307.03	194.76

Notes: IV estimates only. Outcome is the county-level change in the employment rate (per county population, $\times 100$) between 2008 and 2019. Columns vary the estimation sample: (1) the balanced QCEW long-difference sample for NAICS 111 and 115, as in the main tables; (2) that sample intersected with the balanced H-2A long-difference sample; (3) the balanced yearly H-2A sample intersected with the balanced yearly QCEW 111/115 sample; (4) the balanced yearly QCEW 111/115 sample; (5) unrestricted sample, using all available data points for each outcome. Sample sizes vary across panels in column (5) because total employment requires both QCEW components to be non-suppressed, while the individual series do not. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table A3: Long-run migration rates and wages, alternative samples

	(1) Baseline	(2) QCEW+H-2A	(3) Yr. balanced	(4) QCEW yr.	(5) Unrestricted
Panel A: Directly Hired (NAICS 111)					
Migration Rate (m_c)	0.246***	0.268***	0.310***	0.283***	0.287***
	(0.063)	(0.075)	(0.118)	(0.070)	(0.064)
Counties	503	257	102	281	1324
Kleibergen–Paap F	216.31	169.1	91.81	307.03	223.35
Panel B: Contract Labor (NAICS 115)					
Migration Rate (m_c)	0.262*	0.134	0.362	0.381***	0.264*
	(0.145)	(0.174)	(0.232)	(0.122)	(0.138)
Counties	503	257	102	281	655
Kleibergen–Paap F	216.31	169.1	91.81	307.03	123.94
Panel C: H-2A Workers					
Migration Rate (m_c)	0.076	0.058	0.002	-0.012	0.131**
	(0.078)	(0.092)	(0.091)	(0.066)	(0.059)
Counties	283	234	101	165	1076
Kleibergen–Paap F	152.7	150.36	109.66	305.85	158.36
Panel D: H-2A Workers (IHS)					
Migration Rate (m_c)	-0.197	1.338	1.167	2.126	-0.609
	(1.370)	(1.176)	(1.208)	(1.693)	(0.887)
Counties	503	257	102	281	3133
Kleibergen–Paap F	216.31	169.1	91.81	307.03	194.76

Notes: IV estimates only. Outcome is the county-level log difference in the average weekly wage between 2008 and 2019. Columns vary the estimation sample: (1) the balanced QCEW long-difference sample for NAICS 111 and 115, as in the main tables; (2) that sample intersected with the balanced H-2A long-difference sample; (3) the balanced yearly H-2A sample intersected with the balanced yearly QCEW 111/115 sample; (4) the balanced yearly QCEW 111/115 sample; (5) unrestricted sample, using all available data points for each outcome. Panel D replaces the log difference in the H-2A wage with the inverse hyperbolic sine, which is defined at zero and so retains counties with no H-2A activity; Panel C is identified only off counties reporting positive H-2A wages in both endpoint years, which is why its county counts and first stage differ from the other panels. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table A4: Long-run migration rates and establishments, alternative samples

	(1) Baseline	(2) QCEW+H-2A	(3) Yr. balanced	(4) QCEW yr.	(5) Unrestricted
Panel A: Total (NAICS 111 + 115)					
Migration Rate (m_c)	-0.196	-0.507***	-0.496***	-0.469***	-0.560***
	(0.178)	(0.110)	(0.173)	(0.105)	(0.130)
Counties	503	257	102	281	2033
Kleibergen–Paap F	216.31	169.1	91.81	307.03	195.09
Panel B: Directly Hired (NAICS 111)					
Migration Rate (m_c)	-0.429*	-0.849***	-0.794***	-0.819***	-0.775***
	(0.220)	(0.151)	(0.224)	(0.142)	(0.157)
Counties	503	257	102	281	2473
Kleibergen–Paap F	216.31	169.1	91.81	307.03	163.62
Panel C: Contract Labor (NAICS 115)					
Migration Rate (m_c)	0.271*	0.179	0.087	0.219	-0.269*
	(0.155)	(0.153)	(0.252)	(0.142)	(0.155)
Counties	503	257	102	281	2248
Kleibergen–Paap F	216.31	169.1	91.81	307.03	219.78

Notes: IV estimates only. Outcome is the county-level log difference in the QCEW annual average establishment count between 2008 and 2019. Columns vary the estimation sample: (1) the balanced QCEW long-difference sample for NAICS 111 and 115, as in the main tables; (2) that sample intersected with the balanced H-2A long-difference sample; (3) the balanced yearly H-2A sample intersected with the balanced yearly QCEW 111/115 sample; (4) the balanced yearly QCEW 111/115 sample; (5) unrestricted sample, using all available data points for each outcome. Establishment counts are never suppressed or zero in columns (1)–(3), but the wider samples in columns (4) and (5) contain both, and counties recording zero establishments in either endpoint year drop out of the log specification. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table A5: Long-run migration rates, population-weighted IV estimates across outcomes

	(1) Total	(2) Directly Hired	(3) Contract Labor	(4) H-2A Workers
Panel A: Employment (workers per 100 residents)				
Migration Rate (m_c)	0.726	-0.054	0.509**	0.271*
	(0.451)	(0.091)	(0.255)	(0.163)
Counties	503	503	503	503
Kleibergen–Paap F	79.56	79.56	79.56	79.56
Panel B: Wages (log difference)				
Migration Rate (m_c)	-	0.338***	0.492**	-0.043
		(0.116)	(0.220)	(0.049)
Counties		503	503	283
Kleibergen–Paap F		79.56	79.56	31.85
Panel C: Establishments (log difference)				
Migration Rate (m_c)	0.059	-0.035	0.155	-
	(0.294)	(0.399)	(0.197)	
Counties	503	503	503	
Kleibergen–Paap F	79.56	79.56	79.56	

Notes: IV estimates weighted by county population in 2005, estimated on the baseline sample of 503 counties used in the main tables. Panel A is the change in the employment rate (workers per 100 county residents); Panels B and C are log differences in the average weekly wage and in the QCEW annual average establishment count. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table A6: Pre-trends test: pre-period outcome changes and the violence instrument

	Employment rate			Log weekly wage		Log establishments		
	(1) Total	(2) Direct	(3) Contract	(4) Direct	(5) Contract	(6) Total	(7) Direct	(8) Contract
Panel A: Reduced form on the instrument								
Violence IV (Z_c), unit SD	0.006	-0.009	0.021*	0.006	-0.002	-0.008	-0.014***	0.006
	(0.022)	(0.016)	(0.012)	(0.005)	(0.008)	(0.005)	(0.005)	(0.009)
N	388	460	413	460	413	503	503	503
Num Counties	388	460	413	460	413	503	503	503
Panel B: Placebo 2SLS								
Migration Rate (m_c)	0.053	-0.090	0.195*	0.062	-0.016	-0.074	-0.134***	0.053
	(0.204)	(0.152)	(0.105)	(0.052)	(0.073)	(0.045)	(0.049)	(0.088)
N	388	460	413	460	413	503	503	503
Num Counties	388	460	413	460	413	503	503	503
Kleibergen–Paap F	210.27	203.06	222.77	203.06	222.77	216.31	216.31	216.31

Notes: Dependent variable in every column is the county-level change in the outcome between 2005 and 2007. Columns (1)–(3) are changes in the employment rate; columns (4)–(5) are log differences in the average weekly wage; columns (6)–(8) are log differences in the QCEW annual average establishment count. "Direct" is NAICS 111, "Contract" is NAICS 115, and "Total" is their sum. Panel A regresses the pre-period change on the violence shift-share instrument Z_c. Panel B reports the placebo two-stage least squares coefficient on the migration rate instrumented by Z_c. Estimated on the baseline sample of 503 counties with the same controls and clustering as the main specifications; counts fall below 503 where the QCEW suppresses 2005 cells. *** p<0.01, ** p<0.05, * p<0.10. Standard errors clustered at the county level in parentheses.

Table A7: Shift-share: Effective sample size and shock distribution

	(1) Long difference	(2) Yearly panel
Panel A: Shock-level exposure weights		
Number of shocks	2,424	29,088
Effective sample size $(1/\sum_o s_o^2)$	1,554.6	18,655.7
Largest shock weight	0.0035	0.0003
Sum of 10 largest weights	0.0265	0.0029
Panel B: Distribution of shocks, weighted by s_o		
Mean	282.1	23.5
Standard deviation	340.4	48.2
10th percentile	31.9	0.0
25th percentile	83.4	0.0
Median	176.1	8.9
75th percentile	343.3	26.2
90th percentile	650.0	62.1
Mexican municipalities	2,424	2,424
U.S. counties	503	503

Notes: Shocks are Mexican municipal homicide rates and exposure shares are $s_{c,o} = \phi_{o,c}/P_c$, where $\phi_{o,c}$ is the share of municipality o's 2006–07 migrants who settled in county c and P_c is county population in 2005. Shocks in Panel B are expressed as homicides per 100,000 residents, cumulative over 2008–2019 in column (1) and annual in column (2), and are summarized weighting by s_o.