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The international transmission of local economic shocks through migrant networks☆

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ABSTRACT

Using newly validated data on geographic migration networks, we study how labor demand shocks in the United States propagate across the border with Mexico. We show that the large exogenous decline in US employment brought about by the Great Recession affected demographic and economic outcomes in Mexican communities that were highly connected to the most affected markets in the US. In the Mexican locations with strong initial ties to the hardest hit US migrant destinations, return migration increased, emigration decreased, and remittance receipt declined. These changes significantly increased local employment and hours worked, but wages were unaffected. Investment in children's education also slowed in these communities. These findings document the effects in Mexico when potential migrants lose access to a strong US labor market, providing insight into the potential impacts of stricter US migration restrictions.

1. Introduction

Goods trade and capital flows are well-studied economic mechanisms that integrate markets across international borders, but international migration represents another potentially equilibrating force (Chiswick and Hatton, 2003). Research suggests that potential international migrants consider relative economic conditions when deciding whether and where to move, and these choices affect the size and composition of the labor force in source and destination communities (Hanson and Spilimbergo, 1999; Borjas, 2001; Cadena, 2013; Cadena and Kovak, 2016). This earnings-maximizing behavior implies that local labor market conditions in

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potential destinations will affect demographic and economic outcomes in sending locations by changing both migration choices and the remittance behavior of existing migrants.

In this paper, we study how changes in US labor demand affect migration, demographic, and economic outcomes in migration-network-connected communities in Mexico. Changes in US labor demand should have important consequences in Mexico, as 98 percent of Mexicans living abroad are in the US and approximately 10 percent of the Mexican-born population lives in the United States.[1] We show that US labor demand declines during the Great Recession affect outcomes in Mexican sending areas with strong ties to the hardest-hit US local labor markets. This focus on sending communities contrasts with much of the literature on the economics of Mexico-US migration, which more often evaluates the impacts of Mexican migration on US destination markets.[2]

To motivate our empirical analysis, we derive a reduced-form estimating equation and shock measure from a simple location choice model, which shows how to leverage two key sources of variation: the heterogeneity across US destinations in employment declines during the Great Recession and differences in migration network connections between each Mexican source and each US destination. This type of empirical design requires detailed information on migration network connections between Mexican sources and US destinations, a challenge we overcome by using newly validated administrative data from the *Matrícula Consular de Alta Seguridad* (MCAS) identification card program. These data allow us to measure the distribution of US commuting zones chosen by migrants from each Mexican *municipio* (similar to a US county), a much more granular level of geography than other data sources.[3] The resulting empirical analysis compares the change in outcomes between source municipios whose migrants face larger and smaller effective declines in US employment due to their source location's mix of US commuting zones.

In order for this analysis to have a causal interpretation, a municipio's network-weighted US demand shock must be uncorrelated with other factors affecting its demographic and economic outcomes. This exogeneity assumption is likely to hold in part because the relevant demand shocks for each municipio occur in another country (the US) and are thus unlikely to be related to other changes in Mexican source communities. To strengthen the causal interpretation, we include Mexican state fixed effects so that we compare only geographically proximate municipios, and we allow for differential trends based on pre-existing characteristics of the source community. Further, we follow the model-motivated estimation strategy by controlling for contemporaneous changes in observable source-level characteristics such as drug-related violence and network-weighted averages of destination-level changes in local immigration enforcement policy. We also control for the possibility that the Great Recession affected Mexican outcomes through international trade by including a measure of each municipio's exposure to declining US-Mexico trade over the same time period. The results are robust to the inclusion of these controls, bolstering the interpretation of the key coefficient as the causal effect of declining US labor demand on Mexican source community outcomes.

Using Mexican Census data, we find that source communities with strong initial ties to the US destinations hardest-hit by the Recession experienced roughly 20 percent faster population growth from 2005 to 2010, driven in large part by a similar percentage increase in return migration and decrease in emigration. The change in migration also increased the share of the local workforce that is male, although the educational attainment distribution was relatively unaffected. Beyond the movement of people, we also find that households living in these Mexican sources experienced a 20 percent decline in the likelihood of receiving remittance payments from abroad.

These changes in population size and composition lead directly to a substantial increase in the size of the local labor force. Further, the loss of US remittance income creates an incentive for additional household members to enter the labor force. Using data from the Mexican Economic Census, we examine changes in municipio-level labor market outcomes. As expected, we find clear evidence of an expansion in labor supply, with source communities facing the largest declines in US employment opportunities seeing larger increases in employment and total hours worked, especially among women. We reinforce this result with descriptive evidence showing that the relationship between labor supply and US labor demand shocks appears only in households who had migrants in the US during the Great Recession period. Interestingly, we find no evidence that this expansion of labor supply led to a relative decrease in local wages. This result is not driven by changes in the composition of the local labor force and is consistent with much of the literature on the effect of immigration on host labor markets, potentially reflecting the fact that the return of migrants also increased local labor demand. We then document the effects of declining US labor demand on household investment behavior, both in durable goods and human capital. We find minimal effects on appliance ownership but find that children in the most affected communities are less likely to remain in school, especially at late primary school ages.

Taken together, these results demonstrate that migrant networks transmit changes in US local labor demand across the southern border with Mexico, leading to significant effects on a wide variety of outcomes in sending areas. Further, because we study job loss among migrants, the results show how losing access to US employment affects economic outcomes in Mexican migrant-sending communities. In addition to documenting the impacts of the US Great Recession across Mexican communities, our findings therefore provide insight into the potential impacts of proposed migration enforcement policies, such as requiring firms to check a job applicant's work authorization in an electronic database before hiring them (E-Verify).[4]

[1] Numbers living in the US and in other countries are available in de Relaciones Exteriores (2015). Population numbers for 2010 and 2015 are available at https://www.inegi.org.mx/temas/estructura/.

[2] See National Academies of Sciences, Engineering, and Medicine (2017) for a survey of the literature on the effects of immigration on earnings, employment, and wages in destination countries, and Mishra (2014) and Elsner (2015) for surveys of the literature on the effects of emigration on wages in source countries.

[3] Caballero et al. (2018) confirm the quality and representativeness of the MCAS data by comparing it against high quality household survey data. Other papers using various versions of the MCAS data include Massey and Espinosa (1997), Albert and Monras (2022), Allen et al. (2019), and Tian et al. (2022).

[4] Related papers document population responses to Arizona's statewide E-Verify policy, with migration results similar to what we find in this paper (Bohn et al., 2014; Caballero et al., 2018). The Comprehensive Immigration Reform Bill that passed the US Senate in 2013 included a mandatory national E-Verify provision. More recently, in February 2021, Senators Romney and Cotton proposed universal E-Verify as a condition for raising the federal minimum wage to $10 (King, 2021).

This paper contributes to multiple strands of literature. First, as mentioned above, many papers find that international migrants' location choices respond to local labor market conditions.[5] Borjas (2001) simulated how foreign-born workers' location choices might equalize native workers' wages across regional labor markets in the destination country, and Cadena and Kovak (2016) empirically measure these equalizing effects, showing that a metropolitan area's local population of Mexican-born workers with no more than a high school degree was strongly responsive to changes in local labor demand during the Great Recession. Here, we demonstrate that differential return migration to Mexico also contributes to the reallocation of immigrants across US markets, whereas previous work had provided only suggestive evidence of this channel's importance.

Second, this study expands our understanding of the role of networks in driving international migration. Larger numbers of migrants from a sending community increase the likelihood of subsequent migration by lowering migration costs, especially for those with relatively low levels of education (Winters et al., 2001; McKenzie and Rapoport, 2007; Garip and Asad, 2016). Migrant networks also affect migrants' destination locations, occupational choices, and labor market success (Munshi, 2003; Edin et al., 2003). We extend this literature by developing a tractable model showing how migrant networks lead to source communities facing differential changes in foreign labor demand from the same macroeconomic shock. The model-motivated empirical analysis demonstrates that these network connections serve to transmit local economic shocks from one side of an international border to the other.

Third, our results relate to the substantial literature examining the effects of international migration on family members who remain in the source country. As summarized nicely in Antman (2013), demand shocks at the destination are one of two commonly used instruments in this body of work.[6] Relative to this literature, our analysis is distinct in two ways. First, in contrast to typical studies in this literature that study increased emigration, we consider the effects of a decline in destination labor demand and thus the effects of increased return migration, deferred emigration, and a decline in remittances. Second, we consider outcomes at the municipio level rather than the household level, which allows us to use a wide array of high-quality survey and administrative data sources to measure the overall effects on local markets including any cross-household spillovers.

Finally, we extend the literature examining how destination-market policies or labor demand affect sending communities. The studies most closely related to this paper consider the effects of changes in the US environment on economic outcomes in Mexico. Caballero et al. (2018) and Allen et al. (2019) use MCAS migration network data to show that migration enforcement reduces international migration between affected sources and destinations, and Caballero (2022) uses the rollout of the Secure Communities program to show that local migration enforcement at the destination reduces school enrollment in connected sources. Multiple papers study the impact of US labor demand conditions on a variety of Mexican outcomes, such as occupational choices, entrepreneurship, inequality, and education (McKenzie and Rapoport, 2007; Schnabl, 2007; Fajardo et al., 2017; Conover et al., 2021).[7] While largely supporting the findings of this prior work, we make multiple additional contributions. Our location choice model clarifies how to combine information on migration network connections, variation in labor demand across US destinations, and source locations' exposure to the US labor market in an internally consistent empirical research design. We also use uniquely detailed geographic information in the US and Mexico, allowing us to measure shocks to well-defined US local labor markets and to compare outcomes among municipios within the same Mexican state, strengthening causal identification.

Another set of closely related papers considers the effects of shocks to emigrants' earnings on sending communities in contexts other than the US and Mexico. Yang (2008), Theoharides (2018), and Khanna et al. (2022) combine variation in the historical destination countries of migrants from different source communities within the Philippines with destination-level shocks. Gröger (2021) uses a similar methodology focusing on Vietnamese households with migrants in different destination countries at the onset of the Great Recession. Our research design is closely related and reaches similar conclusions in the Mexico-US context, which has the advantage of using variation in labor demand across migrant destinations within the same country. Because each municipio sends migrants almost exclusively to the US, our analysis is robust to other nationwide changes to the attractiveness of living abroad, including immigration enforcement, visa availability, or exchange rates. Dinkelman and Mariotti (2016) and Dinkelman et al. (2022) use a particularly compelling research design leveraging exogenous changes in emigration restrictions in Malawi to yield highly credible estimates of the causal effects of remittances on educational attainment, capital accumulation, and the structure of rural labor markets in migrant sources. In the absence of such policy changes in the Mexican context, our approach combines shocks across migrant destinations with persistent geographic migrant networks to generate similar variation across migrant sources in access to higher-paying foreign labor markets.

The remainder of the paper is organized as follows. Section 2 introduces our dataset and demonstrates that historical settlement patterns led to substantial variation in how Mexican source municipios experienced the US Great Recession. Section 3 develops the location choice model that leads to our estimation strategy. Section 4 discusses the US and Mexican data sources we compile to execute our analysis. Section 5 shows that larger negative labor demand shocks in the US led to increased return migration, decreased emigration, and a decline in the share of households receiving remittances. Section 6 then demonstrates that these changes increased local employment without decreasing average wages, while reducing school enrollment among children. Section 7 concludes.

[5] More generally, these results confirm the consistent finding that both initial and return migration respond to relative labor market conditions in sending and receiving communities (Wozniak, 2010; McKenzie et al., 2014; Abarcar, 2017; Bertoli et al., 2017).

[6] Examples include Antman (2011) and Cortes (2015).

[7] In historical contexts, Kosack (2021) studies the effect of differential access to the US Bracero program on Mexican human capital investment, and Brum (2019) studies the effects of economic shocks in US counties on migration from Italian municipalities.

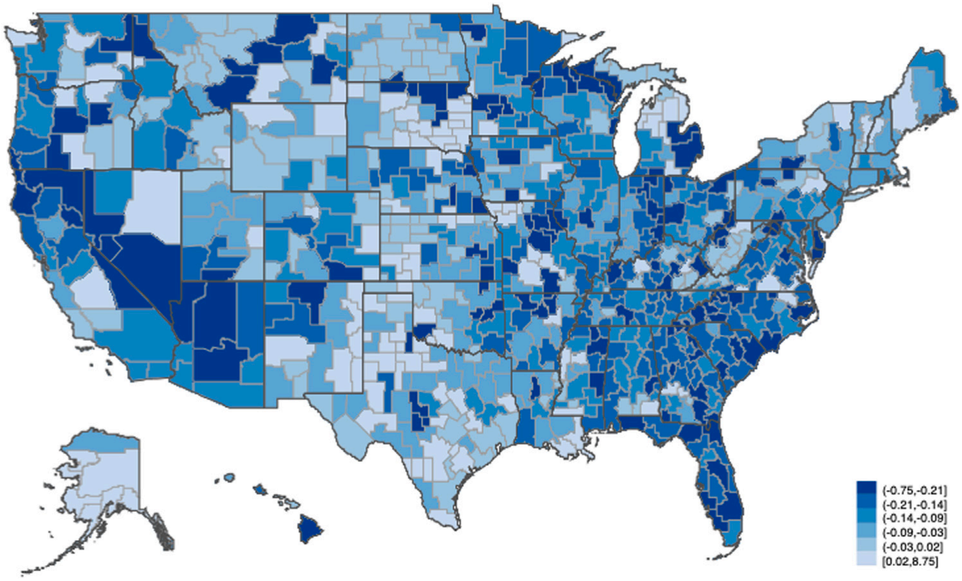

Fig. 1. Change in US employment across CZs.
This map shows proportional changes in employment between 2006 and 2010 (bracketing the Great Recession) for each US commuting zone (CZ), with darker colors indicating larger declines in labor demand. Our measure accounts for Mexican-born workers' industry distribution of employment in each commuting zone (see main text). We use data from the County Business Patterns (CBP) supplemented with data from the American Community Survey (ACS) to fill in employment in a few industries that are not covered by the CBP. This variation in labor demand declines across US destinations leads to variation in network-connected labor demand across Mexican sources with different destination distributions (as shown in Fig. 2).

2. Motivation and context

Mexican source communities face different changes in US labor demand for two reasons: (1) changes in local labor demand were different across US local labor markets, and (2) migrant-sending communities in Mexico have historical ties to different sets of destinations within the US. In this section, we provide descriptive evidence documenting these two key facts.

2.1. Geographic variation in job loss during the great recession

Identifying labor demand shocks is challenging because observed changes in employment and earnings normally reflect changes in both labor demand and labor supply. To overcome this challenge, we take advantage of the unique environment during the Great Recession. Beginning in December 2007 and lasting through June 2009, this decline in economic output was marked by a more than five-percentage-point drop in the prime age employment-to-population ratio. While there was a dramatic reduction in hiring and a large increase in layoffs, wages did not fall substantially (Rothstein, 2012; Daly et al., 2012). This pattern suggests that the labor market adjusted primarily along the employment margin rather than through wage reductions. Given downward-rigid wages, one can measure local labor demand shocks over the Great Recession period (2006–2010) using only changes in payroll employment (Cadena and Kovak, 2016; Clemens, 2022).

Fig. 1 shows the substantial variation in employment changes from 2006–2010 across US local labor markets.[8] This map uses data from the County Business Patterns (CBP) and the American Community Surveys (ACS) to show changes in employment in US Commuting Zones (CZ), which define destination labor markets throughout the paper.[9] We account for the industry mix of Mexican workers' US employment by measuring the relevant employment change in each commuting zone d as $\sum_i \frac{Emp^M_{id}}{Emp^M_d}\left(\frac{Emp^{2010}_{id}-Emp^{2006}_{id}}{Emp^{2006}_{id}}\right)$, where Emp^{year}_{id} is employment in industry i in destination commuting zone d and $\frac{Emp^M_{id}}{Emp^M_d}$ is the share of Mexican-born workers in commuting zone d working in industry i in 2006.[10] This measure accounts for the fact that Mexican-born workers are disproportionately represented in industries that are especially sensitive to the business cycle, such as construction.[11] Appendix C.1 provides descriptive statistics detailing the sources of spatial variation in this measure: variation in the pre-recession industry

8 Multiple factors contributed to the substantial spatial variation in local employment declines, including variation in ex-ante household indebtedness (Mian and Sufi, 2014) and in the magnitude of the pre-Recession housing boom (Charles et al., 2016).

9 See Appendix Section B.3 for details on the CZ definition.

10 Appendix Section B.3 explains how we combine CBP and ACS data in this measure.

11 The main results are qualitatively similar, however, when using unweighted CZ-level employment declines.

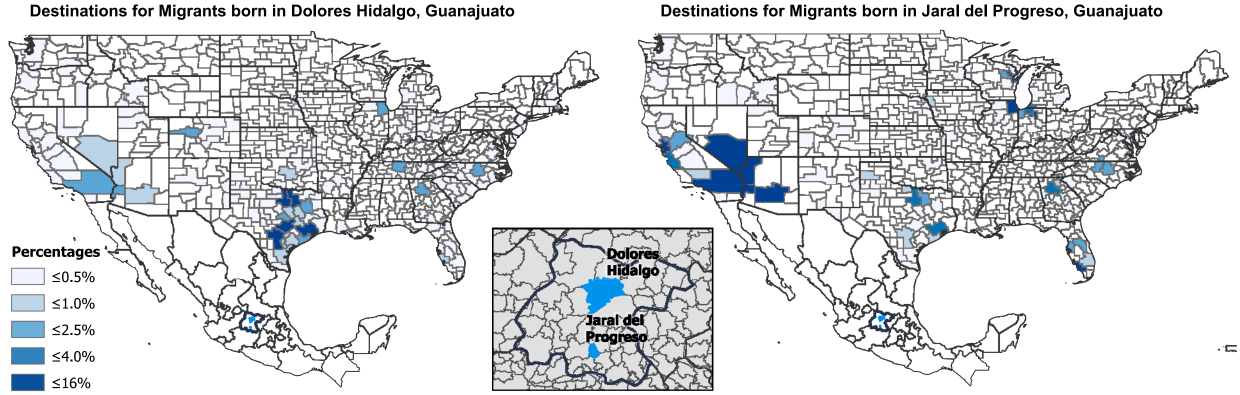

Fig. 2. Example migrant destination distributions for two municipios.
These maps show the distributions of US destinations for migrants from two different municipios located in the state of Guanajuato: Dolores Hidalgo and Jaral del Progreso. The destination distribution is calculated as the share of 2006 MCAS identity cards issued to migrants living in each US commuting zone among those born in each of the source communities, with darker colors indicating a larger share of migrants from the respective source. Despite the proximity of the two source municipios, they faced large differences in US labor demand during the Great Recession due to large differences in their destination distributions. Dolores Hidalgo tends to send migrants to US destinations that experienced relatively mild labor demand declines, while Jaral del Progreso tends to send migrants to US destinations that experienced large labor demand declines.

mix of employment among Mexican-born workers and spatial variation in industry-specific shocks. As Fig. 1 shows, although most commuting zones experienced a decline in employment, there was substantial variation, with a 17 percent decline at the 25th percentile and no change at the 75th percentile.

2.2. *Matrículas consulares de Alta Seguridad*

In addition to this spatial variation in US labor demand, we leverage variation in the destinations historically chosen by migrants from different Mexican source communities. We measure source–destination connections using administrative tabulations from Mexico's *Matrícula Consular de Alta Seguridad* (MCAS) program, in which Mexican consulates issue identity cards to Mexican-born individuals living in the US. The cards, which provide a secure form of identification and verified current residence for banking and other purposes, are issued primarily to those without authorization to live and work in the US and who therefore cannot access other forms of identification. Measuring connections between sending and receiving communities using the choices of unauthorized migrants is not a concern in our context for two main reasons. First, more than 90 percent of moves between Mexico and the US occur among unauthorized migrants during our sample period of 2006–2010 (authors' calculations using Mexican Migration Project data). Second, Caballero et al. (2018) show that the migration patterns in the MCAS data accurately reflect those of the broader Mexican-born population living in the US, irrespective of legal status.

To examine the variation in US destinations for migrants from different source municipios, we calculate $\frac{m_{sd}}{\sum_{d'} m_{sd'}}$, i.e. the share of card recipients born in source municipio s who settled in destination commuting zone d in 2006—the first year the MCAS tabulations are available. To calculate these shares, we use a customized extract from the MCAS administrative database that captures Mexican-born individuals' birthplace and county of residence in the US, which we aggregated to the CZ level.[12] The publicly available tabulations used in Caballero et al. (2018), in contrast, report only Mexican migrants' *state* of residence in the US.

2.3. *Migrants from nearby sources settle in distinct destinations*

As a motivating example of the variation in migrant destinations, Fig. 2 compares the destination distributions for two Mexican source municipios in the state of Guanajuato: Dolores Hidalgo and Jaral del Progreso. Our empirical analysis controls for Mexican state fixed effects, so we are especially interested in within-Mexican-state differences in chosen destinations. Despite these two source communities' close proximity, there are large differences in the US destinations selected. Migrants from Dolores Hidalgo tend to move to the main cities of Texas, while migrants from Jaral del Progreso concentrate in Chicago, the largest cities of California, and other cities in the Southwest. As shown in Fig. 1, the Texas cities faced particularly mild labor demand declines during the Great Recession, while southern California and the Southwest saw larger negative shocks. Thus, migrants from Jaral del Progreso experienced a larger effective decline in US labor demand compared to migrants from Dolores Hidalgo.

[12] See Appendix B for details on matching geographic locations in the MCAS extract to municipios and counties. Special thanks to Melanie Morten for providing the specific version of the extract used in this study.

3. Theoretical framework and research design

To formalize the idea that potential migrants from different Mexican source locations experienced the US Great Recession differently, we use a location choice model in which Mexican-born individuals choose to live in Mexico or in one of many potential US destinations. Potential migrants benefit from living alongside others from their place of birth, a model feature motivated by the variation in geographic migrant networks documented in Fig. 2. We use comparative statics from the model to motivate our estimating equation and to clarify the set of potential confounding variables that must be controlled for to identify the causal effect of US labor demand shocks on Mexican outcomes.

3.1. Location choice model

An individual j from Mexican source community s may choose to live in any destination d, including their municipio of birth s or any of the potential US destination commuting zones. For simplicity, we assume costless migration and ignore internal migration within Mexico. Individual j's utility from choosing destination d depends on three things: the common-across-sources value v_d of living in that location, a network component reflecting the presence of prior migrants from the potential migrant's source n_{sd}, and an iid type-I extreme value shock η_{jsd}.

$$u_{jsd} = \alpha v_d + n_{sd} + \eta_{jsd} \tag{1}$$

The probability that a person born in s chooses to live in d is then

$$P_s(d) = \frac{\exp\left(\alpha v_d + n_{sd}\right)}{\sum_{d'} \exp\left(\alpha v_{d'} + n_{sd'}\right)}. \tag{2}$$

We examine how population growth in each source municipio is affected by a set of shocks to the value of locating in the various potential destinations. Let M_s be the number of people born in Mexican source s, and let M_{sd} be the number of people born in source s living in destination d. The population residing in s is therefore $M_{ss} = M_s P_s(s)$, i.e. the number of people born in s multiplied by the probability that a person born in s stays in that location. Assume that the total number of people born in source s (M_s) is invariant to changes in destination values (i.e. shocks do not affect mortality). As shown in Appendix A, taking the total derivative of M_{ss} with respect to changes in values v_d for all possible destinations and evaluating the changes in choice probabilities using (2) yields the following expression relating the proportional change in source s population to the shocks to the value of living in each potential location:

$$\frac{dM_{ss}}{M_{ss}} = \alpha \xi_s \left[dv_s - \sum_{d \neq s} \varphi_{sd} dv_d \right] \tag{3}$$

$$\text{where} \quad \xi_s \equiv (1 - P_s(s)) \quad \text{and} \quad \varphi_{sd} \equiv \frac{P_s(d)}{1 - P_s(s)}$$

This expression is intuitive. The term ξ_s is the share of people from source s who had chosen to live in the US prior to the shock—baseline exposure to the US labor market. The first term in square brackets is the change in the value of living in the source community. As its own conditions improve, it attracts more residents, and this effect is larger when there are more residents abroad to attract. The second term in square brackets captures the effects of changing conditions in the US as mediated through the migrant network (n_{sd} in (1)). This term is a proper weighted average of shocks in US destinations, where the weights, φ_{sd}, reflect the baseline distribution of migrants from s across US destinations ($d \neq s$). As conditions in the US labor markets to which source s has existing network connections improve, more people leave s for the US.

To study how changes in labor demand across US destinations affected demographic and economic outcomes in Mexican source communities, we parameterize the value of living in each US destination commuting zone. The common value of living in US location d ($\neq s$) depends on expected earnings and other factors such that

$$v_d = w_d \cdot Pr(emp_d) + \Gamma_d, \tag{4}$$

where w_d is the real wage, $Pr(emp_d)$ is the probability of employment, and Γ_d captures other features affecting the attractiveness of destination d. We take the change in (4) holding w_d fixed based on the wage rigidity observed during the Great Recession (discussed in Section 2), and plug it into (3), yielding the following expression.

$$\frac{dM_{ss}}{M_{ss}} = \alpha \xi_s dv_s - \alpha \xi_s \left[\sum_{d \neq s} \varphi_{sd} w_d \; dPr(emp_d) \right] + \alpha \xi_s \sum_{d \neq s} \varphi_{sd} \; d\Gamma_d + \nu_s \tag{5}$$

This expression forms the basis of our reduced form estimation equation, which relates source municipio population growth to changes in the attractiveness of the source community (dv_s), changes in employment probabilities across US destinations ($dPr(emp_d)$), and other changes affecting the attractiveness of particular destinations within the U.S ($d\Gamma_d$).[13]

[13] Note that we normalize $d\Gamma_s = 0$, so the $d\Gamma_d$ for $d \neq s$ reflect changes in the attractiveness of US destination d relative to staying in Mexico.

3.2. Estimating equation

To empirically operationalize (5) we must first construct an observable measure of changes in expected earnings. We assume that (i) the employment probability facing Mexican-born residents of d is given by the employment to population ratio among the Mexican-born population, (ii) baseline expected earnings are equal across US destinations, and (iii) job losses in a given industry and commuting zone are allocated proportionately to Mexican-born and US-born workers.

Given these assumptions (see Appendix A),

$$\sum_{d\neq s}\varphi_{sd} w_d \; dPr(emp_d) = \delta \sum_{d\neq s}\varphi_{sd}\sum_i \frac{Emp_{id}^M}{Emp_d^M}\cdot\frac{d\;Emp_{id}}{Emp_{id}}, \tag{6}$$

where δ is the baseline expected US earnings for Mexican workers, assumed constant across destinations, Emp_{id} is employment in industry i in destination d, Emp_{id}^M is Mexican employment in i and d, and Emp_d^M is overall Mexican employment in d. In Appendix A, we show that, under the additional assumption that wages are constant across locations, this shock to expected earnings can be interpreted as the wage times the number of US jobs lost per migrant.[14]

In addition to US employment shocks, (5) shows that source-municipio population growth is also affected by changes in amenities in the source municipio (dv_s) or US destinations ($d\Gamma_d$). We account for changes in source-municipio amenities in three ways. First, we include Mexican-state (*entidad federal*) fixed effects, $\phi_{e(s)}$ to account for changes in the value of living in one's home community that are common to municipios within the same Mexican state. Second, we show that the estimates are robust to controlling for a vector ΔX_s of changes in municipio-level characteristics, including changes in local homicide rates and trade shocks. Third, we control for pre-Recession differences in outcome growth to account for any unobserved persistent changes in source-level amenities.

Eq. (5) shows that changes in destinations' non-earnings amenities also enter the expression in a weighted average, where the weights, φ_{sd}, are identical to those in the US employment shock measure. We therefore control for weighted averages of changes in CZ-level characteristics, ΔX_d, including local immigrant enforcement measures and employment policies. Our results are robust to including or excluding these various source- and destination-level controls.[15]

Finally, note that all of the terms on the right side of (5) are proportional to the source's exposure to the US labor market, ξ_s. For expositional clarity and to aid in interpreting the associated regressions, we divide the entire expression by ξ_s. This approach turns an estimating equation with heterogeneous effects by source s (5) into a version with homogeneous effects. We also plug in the controls just discussed and the observable US employment shock in (6), and replace the parameters α and δ with reduced-form regression coefficients, β, Λ, and Π, yielding the following estimating equation,

$$\frac{1}{\xi_s}\Delta y_s = \beta\left[\sum_{d\neq s}\varphi_{sd}\sum_i \frac{Emp_{id}^M}{Emp_d^M}\frac{d\;Emp_{id}}{Emp_{id}}\right] + \phi_{e(s)} + \Lambda\Delta\mathbf{X_s} + \Pi\sum_{d\neq s}\varphi_{sd}\Delta X_d + \varepsilon_s, \tag{7}$$

where $\varepsilon_s = v_s/\xi_s$, and Δy_s indicates a change in a generic source-level outcome. Note that the Mexican state fixed effects, $\phi_{e(s)}$, subsume the standard intercept term. This equation relates the exposure-normalized change in outcome in municipio s to the change in US employment faced by migrants from that destination.[16] Incorporating the measure of exposure ξ_s in (7) also resolves the "incomplete shares problem" emphasized by Borusyak et al. (2022), as exposure reflects the overall share of the source municipio's population in the US labor market.

Because dividing the dependent variable by ξ_s may introduce heteroskedasticity, we use feasible GLS weighting to improve the efficiency of our estimates, following Wooldridge (2013) Section 8.4. We present two sets of standard error estimates. First, we report standard errors clustered at the Mexican commuting-zone level when reporting any regression coefficient.[17] Second, we account for cross-municipio correlation in our shift-share shocks by calculating standard errors following Borusyak et al. (2022), shown in square brackets.

Our coefficient of interest, β in (7), compares the change in outcome between municipios in the same Mexican state whose migrants faced different US employment declines during the Great Recession. To interpret this relationship as causal, there must be no unobserved variables affecting municipio outcome growth that are correlated with the municipio-specific US employment declines. This assumption will be satisfied if the shocks are exogenous as in Borusyak et al. (2022), which is plausible in our context because unobserved developments in Mexican municipios are unlikely to be related to US labor demand shocks in the municipio's historical migrant destinations. Alternatively, this assumption could be satisfied through the "exogenous shares" approach of Goldsmith-Pinkham et al. (2020), which is also plausible in our setting, given that connections between Mexican municipios and US counties are often the result of historical accidents.[18]

[14] Thanks to Craig McIntosh for suggesting this interpretation.

[15] Table 1 presents specifications with and without the various controls, and Appendix C.2 shows specifications with subsets of controls for the remaining outcomes.

[16] The municipio-level US employment shock varies extensively for all values of exposure (Appendix C.2).

[17] See Appendix C.4 for unweighted results and Breusch–Pagan test statistics for heteroskedasticity supporting the conclusion that the weighted analysis improves efficiency. We define Mexican commuting zones following Atkin (2016), making manual adjustments for changing municipio boundaries.

[18] Appendix C.5 supports this interpretation by showing baseline balance on observable demographic, educational, and labor-market characteristics across municipios with different primary migrant destinations in the US.

Despite the plausible exogeneity of the shift-share shock variable, it remains possible that municipios' US labor demand shocks were correlated with changes in other factors that affected residents' location choices or labor market outcomes. For example, if industry mixes were similar in migrant sources and destinations, then common industry shocks could lead to spurious correlation in outcomes across countries. We therefore include additional controls for the municipio's estimated drop in export demand due to the US recession and for local drug-related violence using the functional form suggested by the model, and the results are robust to their inclusion.[19]

4. Data and measurement

Throughout our analysis, we treat Mexican municipios as independent migrant source communities and US Commuting Zones (CZs), which are designed to represent integrated labor markets, as potential migrant destinations.[20] The US employment shock is calculated using information on the migration network and changes in US employment from before to after the Great Recession. We measure the migration network term as $\varphi_{sd} = m_{sd} / \sum_{d'} m_{sd'}$, i.e. destination d's share of MCAS cards issued to migrants from source s in 2006. Emp_{id} is employment in industry i and commuting zone d in 2006, and $d\ Emp_{id}$ is its change from 2006 to 2010. $Emp^{M}_{id} / Emp^{M}_{d}$ measures the share of Mexican-born workers living in CZ d who work in industry i, which we calculate using the 2006 American Community Survey.

The exposure term, ξ_s, reflects the share of those born in a given source municipio who live in the US. Because this stock of migrants at the source–destination level, M_{sd}, is not directly observable in any data source that we are aware of, we combine 2006 ACS estimates of the stock of Mexican-born migrants living in each US destination with migrant network information from MCAS. Specifically, we apportion the 2006 Mexican-born population observed in each destination, M_d, to source municipios based the each source's share of identity cards issued to residents of that destination CZ in 2006: $M_{sd} = \left(\frac{m_{sd}}{\sum_{s'} m_{s'd}} \right) M_d \quad \forall d \neq s$. Finally, we calculate the Mexican-born population living in each source municipio, M_{ss}, using the 2005 Mexican Inter-Censal Count. The exposure for source s is then the share of people from the source living in the US: $\xi_s = \frac{\sum_{d \neq s} M_{sd}}{M_{ss} + \sum_{d \neq s} M_{sd}}$.

We examine the effects of US employment shocks on demographic and economic outcomes in Mexican municipios. We measure most outcomes using full-count tabulations from the 2005 Inter-Censal Count and 2000 and 2010 Mexican Censuses of Population. This survey timing allows us to measure key outcomes over the time period from 2005 to 2010 and to control for prior changes in outcomes from 2000 to 2005.[21] These dependent variables include population growth, return migration, the population sex ratio, educational attainment among adults, household appliance ownership, and school attendance among children. For emigration and household remittance receipt, we use the 2010 Census and the 2000 Census because the 2005 Inter-Censal Count omits questions on these topics. Finally, we measure municipio aggregate labor earnings and aggregate hours in the 1999, 2004, and 2009 Mexican Economic Census. This data source allows us to measure changes in earnings, hours, and earnings per hour from 2004 to 2009 and pre-existing changes from 1999 to 2004.[22]

In addition to pre-Recession outcome controls, we present specifications controlling for other municipio-level developments, including changes in the local homicide rate and changes in trade with the US. Because these controls may themselves be affected by the US employment shocks, we show that our findings are robust to including or excluding them from the analysis in Appendix C.2. We control for local homicides to capture the effects of drug-related violence using administrative data from the Mexican Statistical Office (INEGI) to calculate the number of homicides during 2005–2010 divided by the 2005 population from the Inter-Censal Count. We control for the sharp reduction in trade between Mexico and the US during the Great Recession using a weighted average of industry-level changes in trade value from the period 2001–05 to the period 2006–10, weighted by the municipio's initial industry mix of employment in 2004.[23] We also account for non-employment-based changes in US destinations' attractiveness to potential migrants (X_d). These controls include indicators for new state-level anti-immigrant employment legislation and indicators for new 287(g) agreements that allow local officials to enforce federal immigration law, with both variables from the immigration policy database complied by Bohn and Santillano (2017). For each of these measures, we follow (7) and calculate a weighted average of changes in the policy indicators using a source municipio's destination distribution as weights.

We limit our analysis to the source municipios for which we can accurately measure both the US employment shock and key dependent variables. Following the location-choice model in Section 3, we initially focus on municipio population growth and the contributions of decreased emigration and increased return migration. Because these dependent variables are measured as shares of the initial population, they are highly sensitive to measurement error in small-population municipios. Further, measuring a municipio's destination distribution accurately requires a sufficient number of MCAS observations. To address each of these concerns,

[19] Mendez (2014) provides evidence that differential ties to the US through the manufacturing sector were an important driver of spatial variation in labor market outcomes over this same period.

[20] See Appendix B for details on variable construction. Appendix C.6 shows results for Mexican Commuting Zones.

[21] Table 1 and Appendix C.2 show results with and without pre-shock outcome controls. Appendix C.7 presents placebo analyses relating pre-Recession municipio outcomes to the subsequent US employment shock.

[22] These pre-Recession outcome controls directly address the possibility that pre-existing population growth differed across sources facing different shocks (Monras, 2020a). This approach also partly absorbs variation that might confound the analysis if markets adjust slowly to prior shocks (Jaeger et al., 2019).

[23] See Appendix B for details. We control for the share of employment in nontradable sectors in 2004 to address the "incomplete shares problem" (Borusyak et al., 2022).

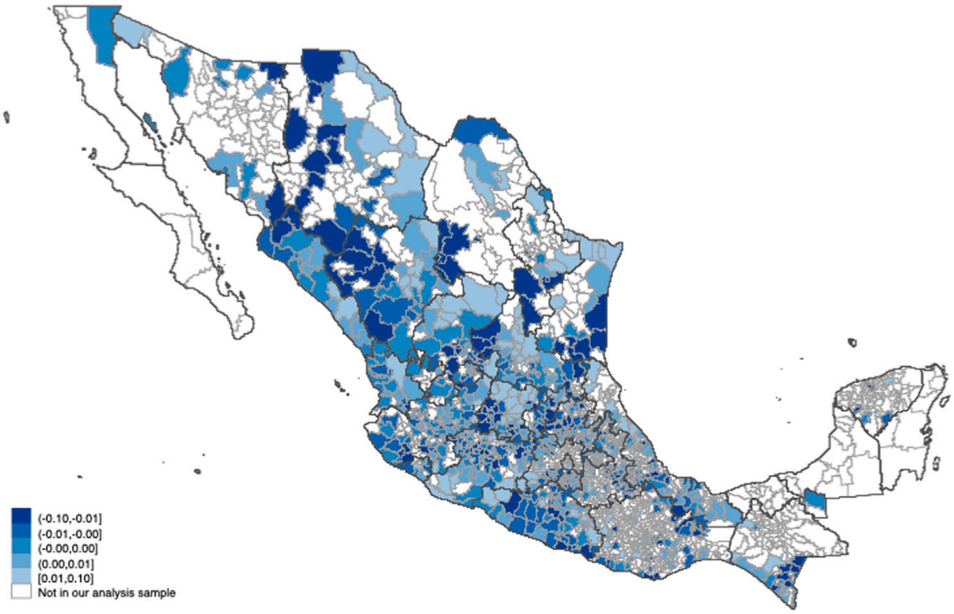

Fig. 3. US employment shock measure, controlling for Mexican-State fixed effects.
This map shows the distribution of network-connected changes in US labor demand (as defined in the main text) over the time period of the Great Recession for each Mexican municipio, controlling for Mexican-state fixed effects. Our sample omits municipios (shown in white) with less than 5,000 residents in 2005, with initial exposure less than 0.066, or with fewer than 100 *matriculas* issued in 2006. This sample restriction maintains 56% of the year-2005 working age Mexican population. Because our analyses include Mexican-state fixed effects as control variables, the variation displayed in this map is the key identifying variation in our analysis.

we limit the main analysis sample to the 866 municipios that had at least 5000 residents in the year 2005, had exposure $\xi_s > 0.066$ (the 25th percentile), and whose citizens received at least 100 MCAS cards in 2006.[24]

Fig. 3 demonstrates the geographic variation in employment shocks experienced by each Mexican source community, controlling for Mexican-state fixed effects. We show municipios facing larger US demand declines in darker blue and municipios connected to smaller declines in lighter blue. Municipios excluded from our analysis are shown in white. The differences in US employment shocks, even for geographically proximate municipios in the same state, provide the identifying variation driving the empirical results in the next section.

A full set of descriptive statistics for the shock variable, control variables, and the outcome variables appears in Appendix Table B1. The difference between the 90th percentile and the 10th percentile US employment shock is 7.5 percentage points, and the average municipio in our sample had an exposure to the US labor market (ξ_s) of approximately 25 percent, reflecting the fact that our sample uses municipios with relatively strong migrant ties to the US. We use these two facts below to help interpret the magnitudes of the estimated coefficients on US Employment shocks.

5. Results for population changes and remittances

Our empirical analysis begins by finding the effect of US employment shocks on the overall growth of a municipio's population, following the comparative static modeled in Section 3. We then examine the contribution of both emigration and return migration to the total population response. Next, we use the same empirical specification to document additional effects on the demographic composition of the municipio population and the likelihood that households received remittance income. Together, the substantial effects on these initial outcomes represent channels through which migrant networks transmitted US local economic shocks to Mexican sending communities.

[24] The municipios in our analysis sample account for more than 56 percent of the working-age Mexican population in 2005, and their residents received nearly 765,000 out of the roughly 923,000 MCAS identity cards issued in 2006. Appendix C.8 examines the robustness of the results to this sample choice and finds generally similar results when using the 1194 municipios with at least 100 MCAS cards in 2006, without additional restrictions on population or US exposure. The notable exception is population growth, which has a weaker and statistically insignificant relationship with the US employment shock in this alternative sample.

5.1. Effects on population size and migration

5.1.1. Population and migration measures

Our dependent variable for population growth is the proportional change in population ages 15–64 over a five-year interval, as measured every five years in the Census and in the Inter-Censal Count (Conteo). Both of these surveys also include questions about respondents' location of residence 5 years prior to the survey, allowing us to identify return migrants as those living in Mexico during the survey period and who lived in the US 5 years earlier.[25] Given the timing of the surveys, we can identify return migrants who moved from the US to Mexico during three five-year spans: 1995–2000, 2000–2005, and 2005–2010. We then measure return migration's contribution to population growth as the number of working-age return migrants to a given municipio, divided by the community's population at the start of the period. Note that this measure is not a traditional return migration rate, as the denominator is the municipio population rather than the number of people born in the municipio who were living abroad.

Our emigration outcome is the contribution of emigration to population growth, measured as the number of working-age emigrants during a five-year interval divided by the municipio's working-age population at the start of the interval. Information on emigration is not available in the 2005 Conteo, so we have emigration measures only from the 2000 and 2010 Censuses, which ask whether a household member emigrated to the US during the five years prior to the date of the survey—1995–2000 or 2005–2010, respectively. This question is asked of the approximately 10% of the population who received a long-form survey, and it captures instances where one or more family members move to the US while some of the household remains in Mexico. We are unable to observe whole-household emigration.

5.1.2. Results for population changes

Table 1 provides estimates of Eq. (7) using population growth and migration outcomes. Recall from Section 3 that we divide all dependent variables by the municipio's exposure to the US labor market, i.e. the share of people born in municipio s who were living in the US before the Great Recession. This adjustment accounts for the fact that population growth in sources with more people living in the US is more affected by any changes in the relative attractiveness of living at home or abroad.

Columns (1)-(3) provide results for population growth. The coefficient on the US employment shock is consistently negative and statistically significant, meaning that municipios connected to US destinations with larger job losses experienced larger increases in local population.[26] Column (1) presents the results of a regression of population growth from 2005–2010 on the US employment shock from 2006–2010 and Mexican-state fixed effects. In column (2), we control for population growth over the prior five-year period, allowing for pre-existing differences in population growth among municipios facing different demand shocks (see further discussion below in Section 5.1.4). Column (3) includes additional controls for destination immigration policies and for source-level trade shocks and homicide rates. The set of controls in column (3) may be affected by the US employment shocks, in which case this specification would be over-controlling. Nonetheless, while including these controls reduces the size of the coefficient of interest somewhat, it remains statistically significantly distinguishable from zero ($p < 0.05$).

Interpreting the magnitude of the coefficient requires two additional pieces of information: a difference in shock size, and a value for exposure to the US. From Appendix Table B1, the typical municipio in our sample had approximately 25 percent of its population living in the US, and the 90-10 percentile difference in shock size was 0.075. Therefore, the estimate in column (3) implies that when comparing two municipios with average exposure and a substantial difference in shock size, the more affected municipio experienced 2.1 percentage points faster population growth ($(-1.125)(0.25)(-0.075) = 0.021$). A similar calculation can be implemented to compare predicted outcomes for the pair of municipios shown in Fig. 2. Dolores Hidalgo and Jaral del Progreso both have exposure to the US of around 0.3 and have a difference in shock size of roughly 0.1, predicting 3.4 percentage points faster population growth in Jaral del Progreso ($(-1.125)(0.3)(-0.1) = 0.034$).

To facilitate interpretation of the coefficients of interest, we provide similar calculations in all tables reporting the effects of the US employment shock on outcomes. The row labeled "Implied shock impact" multiplies the coefficient on the US employment shock by $-0.01875 = (0.25)(-0.075)$. We also report the mean of the dependent variable (without dividing by exposure) for the quartile of municipios with the smallest declines in US employment demand. As an example of how these two values can be combined to understand the magnitude of the estimates, column (3) implies that the most-affected municipios saw population growth that was 18 percent higher compared to the least affected municipios (0.021/0.114).

5.1.3. Results for return migration and emigration

Fig. 4 shows that, in the aggregate, the decline in US labor demand was accompanied by both an increase in return migration to Mexico and a decline in emigration to the US. Following substantial net migration to the US in the 1990s and early 2000s, during 2005–2010 emigration to the US fell by 32 percent and return migration to Mexico quadrupled.[27]

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[25] The count of return migrants does not include those who moved to the US and back within the five-year window.

[26] When we allow the sample to include municipios with few migrants in the US (low values of ξ_s), the population estimate has smaller magnitude and loses statistical significance. See Appendix C.8.

[27] The substantial increase in the early 2000s has been documented elsewhere, including in Card and Lewis (2007), with explanations including the poor economic performance of Mexico after the ratification of the North American Free Trade Agreement (NAFTA) in 1990 and the Mexican Peso crisis of 1991 (Chiquiar and Salcedo, 2013; Monras, 2020b; Fajardo et al., 2017). Other analysis of higher-frequency data also shows a substantial slowdown over this time period, with annual net arrivals of fewer than 200,000 migrants (Passel et al., 2012). The nationwide emigration numbers shown in this figure are from CONAPO, which does not allow for the calculation of municipio-specific migration rates.

Table 1
Population growth, return migration, and emigration.

	Population growth 2005–10			Return migration 2005–10			Emigration 2005–10		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
US Employment Shock	−2.070*** [0.433] (0.573)	−1.520*** [0.454] (0.527)	−1.224** [0.482] (0.512)	−0.201** [0.095] (0.072)	−0.256*** [0.089] (0.066)	−0.171** [0.090] (0.069)	0.210* [0.132] (0.117)	0.222* [0.121] (0.116)	0.287** [0.147] (0.121)
Pre-shock Outcome		0.683*** (0.103)	0.653*** (0.104)		1.476*** (0.311)	1.444*** (0.308)		0.124*** (0.025)	0.112*** (0.025)
New 287 g Policy			0.271* (0.126)			0.073*** (0.017)			0.025 (0.025)
Employment Policy			−0.057 (0.092)			−0.007 (0.011)			0.002 (0.017)
Trade Shock			−0.079 (0.126)			0.023** (0.010)			0.049*** (0.013)
Non-tradable share of Employment			−0.143** (0.062)			−0.013* (0.007)			0.011 (0.012)
Homicide Rate 2005–10			−24.991** (9.648)			−4.752*** (0.976)			−7.315*** (2.485)
Mean raw outcome among less affected	0.114	0.114	0.114	0.029	0.029	0.029	0.030	0.030	0.030
Implied shock impact	0.039	0.029	0.023	0.004	0.005	0.003	−0.004	−0.004	−0.005
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	866	866	866	866	866	866	866	866	866
R-squared	0.163	0.508	0.523	0.332	0.504	0.533	0.271	0.298	0.320

This table examines the effect of changes in US labor demand on the 2005–10 population growth, return migration to, and emigration from each Mexican source municipio. Note that outcome and pre-shock outcome variables are divided by exposure, ξ_s, as in Eq. (7). We restrict attention to individuals age 15–64. Population growth is defined as the proportional change in population. Return migration is the number of individuals reporting living in the US 5 years prior to the relevant survey, divided by the municipio population in the survey year, while emigration is the number of household members who left for the US during the 5 years prior to the relevant survey, divided by the initial municipio population, measured using the roughly 10% long-form sample from the 2000 or 2010 Census (emigration information is not available in 2005). We use full-count tabulations from the 2000 and 2010 Mexican Censuses and the 2005 Conteo. All specifications in columns (1) to (6) use a GLS re-weighting procedure to address potential heteroskedasticity. The "Pre-shock Outcome" controls in columns (2), (5), and (8) are 2000–2005 population growth, 2000–2005 return migration, and 1995–2000 emigration, respectively. Columns (3), (6), and (9) additionally control for anti-immigrant employment legislation and new 287(g) agreements across US CZs, trade shocks across municipios (divided by 1,000,000), share of employment in Mexico's non-tradable sector, and changes in homicide rates across municipios. All specifications control for Mexican state fixed effects. "Mean raw outcome among less affected" is the average of the dependent variable without dividing by exposure for municipios in the quartile with smallest magnitude US employment shocks. "Implied shock impact" provides the predicted difference in the outcome (without dividing by exposure) for municipios with the 90-10 percentile difference in shock size (0.075) and average exposure (0.25). Standard errors clustered at the Mexican commuting zone level are shown in parentheses. Due to the shift-share structure of the US Employment Shock, we also present Borusyak et al. (2022) standard errors for this variable in square brackets.

*** $p < 0.01$ based on standard errors in brackets when present.

** $p < 0.05$ based on standard errors in brackets when present.

* $p < 0.1$ based on standard errors in brackets when present.

Columns (4)–(9) of Table 1 provide the results of estimating Eq. (7) using return migration and emigration as outcomes. Because these measures are scaled by the initial municipio population, they can be interpreted as the contribution of each migration flow to local population growth. The coefficients on the US shock have the expected sign for both outcomes: municipios exposed to larger US job losses saw substantially larger population growth from return migration among people living in the US (columns (4)–(6)) and substantially less emigration of the local population to the US from 2005–2010 (columns (7)–(9)). The coefficients on the US employment shock are relatively stable across specifications, and the magnitudes are similar (although oppositely signed) for both the return migration and emigration outcomes. This similarity suggests that both return migration due to lost jobs and potential migrants choosing not to leave for the US while demand was weak were important drivers of population adjustment in Mexican sources.

The estimated impact on the total population in column (3) is larger than the sum of the estimated contribution of increased return migration (6) and decreased emigration (9), a discrepancy we investigate in Appendix C.10. US Employment Shocks are not related to internal migration within Mexico nor to aging in to or out of the sample. Instead, the shocks are related to a residual

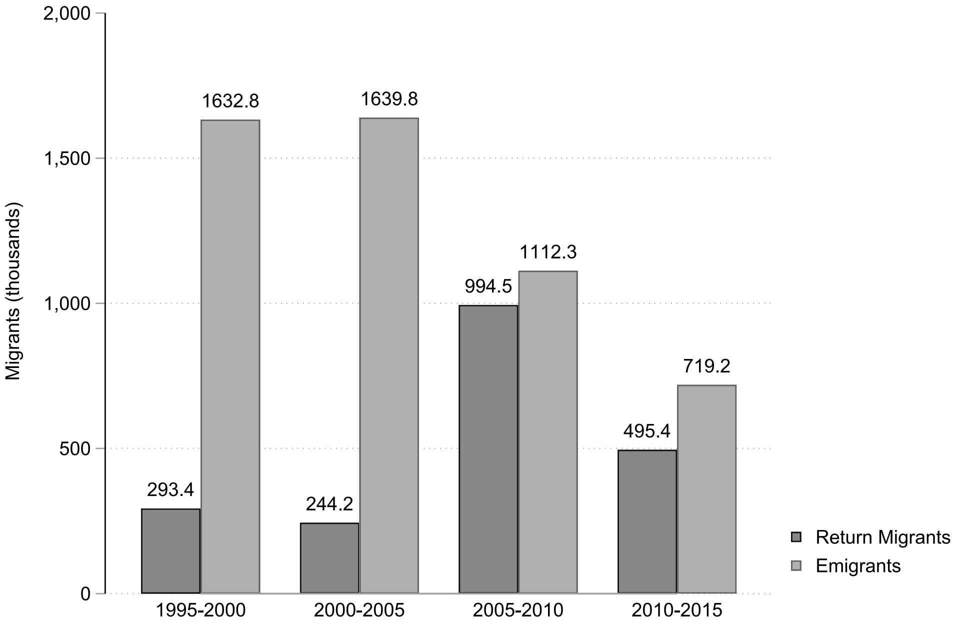

Fig. 4. Five-year migration flows between Mexico and the US.
Authors' calculations using data from INEGI and CONAPO. Return migration is calculated using the 2000 and 2010 Mexican Census, the 2005 Inter-Censal Count (*Conteo*), and the 2015 Inter-Censal Survey (*Encuesta Intercensal*). The return migration measure counts the number of people in Mexico reporting living abroad five years prior to the survey. Emigrants are calculated using data from the 2000 and 2010 Mexican Census and data from CONAPO for 2005 and 2015. The measure counts the number of emigrants leaving surveyed households within the five year period preceding the survey. Note the large increase in return migration to Mexico and the decrease in emigration from Mexico in 2005-10, during the US Great Recession.

component of population growth. This residual could come from unmeasured return migration – residents who were previously in the US failing to list that as their prior location – or unmeasured emigration of whole households. It could also represent statistical noise or some other channel of population adjustment. We nevertheless interpret Table 1 as showing that migration choices led to relative increases in population growth in the municipios most affected by the US Great Recession by roughly 1–2 percentage points, with the lower bound the combined effects on return migration and emigration and the upper bound the measured effect on overall population.

5.1.4. Pre-shock trends in population changes

Table 2 provides an additional set of results useful for interpreting the estimates in Table 1. It examines the relationship between changes in municipio outcomes *prior* to the Great Recession and the US employment shocks those municipios would later face *during* the Great Recession. Ideally, these pre-Recession trends would be unrelated to subsequent shocks, as the sudden appearance of a relationship between the outcomes and the shocks would provide strong support for a causal interpretation. A pre-existing relationship between the outcome variables and a future shock does not necessarily indicate that an observed post-shock relationship is spurious, however, and controlling for the prior trend in the dependent variable avoids misinterpreting the simple continuation of a prior trend as the response to a shock.

Table 2 shows that pre-existing trends are more prominent for some outcomes than for others. Columns (1) and (2) indicate that municipios that would later experience larger declines in US employment already had somewhat smaller population growth during the pre-Recession period, which is consistent with the fact that specifications in Table 1 that include the pre-shock population growth control – columns (2) and (3) – have meaningfully smaller coefficient estimates on the US employment shock. In contrast, columns (3)-(6) find no such pre-existing relationship for return migration or emigration, again consistent with the findings in Table 1.

Because failing to account for pre-existing trends would present a challenge to the interpretation of the results, all of the subsequent sets of results include controls for the prior change in the dependent variable. These specifications therefore examine whether the connected labor market shocks led to a change in trend rather than simply asking whether the shocks are related to trends in the outcome variables around the time of the shocks. For completeness, we provide pre-trend analyses analogous to Table 2 for all further outcomes in Appendix C.7.

5.2. Effects on population composition and remittance receipt

Along with effects on the *size* of local populations in Mexico, US employment declines may have altered the *composition* of the population if return migrants and discouraged emigrants had different characteristics than the overall population. Return migrants are identified in the Census, and we expect deferred emigrants, who are not identifiable, to have similar demographics. Appendix

Table 2
Pre-trend analysis: Population growth, return migration, and emigration.

	Population growth 2000–05		Return migration 2000–05		Emigration 1995–00	
	(1)	(2)	(3)	(4)	(5)	(6)
US Employment Shock	−0.904**	−0.947**	0.023	0.044*	−0.072	0.063
	(0.426)	(0.479)	(0.024)	(0.025)	(0.142)	(0.160)
New 287 g Policy		0.123		−0.003		0.038
		(0.133)		(0.007)		(0.051)
Employment Policy		−0.137*		0.008*		0.024
		(0.076)		(0.005)		(0.034)
Trade Shock		0.437***		0.007		−0.002
		(0.106)		(0.007)		(0.029)
Non-tradable share of Employment		−0.201***		−0.002		0.010
		(0.058)		(0.003)		(0.019)
Homicide Rate 2005–10		−23.310***		−1.031		−9.909***
		(7.238)		(0.755)		(2.921)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	866	866	866	866	866	866
R-squared	0.123	0.161	0.256	0.266	0.209	0.226

This table examines the effect of changes in US labor demand on the pre-shock population growth, return migration to, and emigration from each Mexican source *municipio* to determine whether there were pre-existing trends related to later shocks. Note that the pre-shock outcome variables are divided by exposure as in Eq. (7). We restrict attention to individuals age 15-64. Population growth is defined as the proportional change in population. Return migration is the number of individuals reporting living in the US 5 years prior to the relevant survey, divided by the municipio population in the survey year, while emigration is the number of household members who left for the US during the 5 years prior to the relevant survey, divided by the initial municipio population, measured using the roughly 10% long-form sample from the 2000 (emigration information is not available in 2005). We use full-count tabulations from the 2000 Census and the 1995 Conteo. All specifications in columns (1) to (6) use a GLS re-weighting procedure to address potential heteroskedasticity and control for Mexican state fixed effects. Standard errors clustered at the Mexican commuting zone level are shown in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Section C.9 provides a descriptive comparison of return migrants to non-migrants, demonstrating that return migrants are much more likely to be male (69 percent vs. 49 percent) and are more likely to have primary-school education rather than higher or lower levels. They are also more likely to be married, and they have higher levels of labor force attachment, each of which is likely related to the fact that return migrants disproportionately fall in the 25–45 age range.

The first five columns of Table 3 examine the relationship between changes in the composition of source communities and the US employment shock. The positive coefficient estimate in column (1) implies that the sex ratio in a municipio facing the 90th percentile shock fell by 0.009 more than in a municipio at the 10th percentile, which is 23 percent of a standard deviation in the change in sex ratio over this time period.[28] The results in columns (2)-(5) of Table 3, however, show no statistically significant relationship between the shock and the share of population with any particular level of education, despite the differing education levels of migrants and non-migrants.[29] Together, these results imply only a limited scope for the US shocks to affect wages in Mexican municipios because they primarily alter the aggregate amount of labor in a given municipio rather than the relative supplies of different skill levels. Consistent with this interpretation, we find no substantial wage effects in the next section.

Declines in US labor demand likely also decrease migrants' ability to send money back to Mexico. Column (6) of Table 3 examines the relationship between US shocks and the share of households receiving remittances from abroad in 2010. The positive and strongly statistically significant coefficient implies that households in the municipios facing larger declines in US labor demand were less likely to receive remittances, even after controlling for the baseline remittance share in 2000.[30] The point estimate of 0.47 in column (6) implies that, for municipios with average exposure to the US, a strongly affected community saw a roughly 1 percentage point larger decline in the share of households receiving remittances compared to a less affected community, which is a substantial decrease compared to the 5 percent mean among less-affected municipios.

Together, the results in this section show that US local labor demand shocks during the Great Recession affected Mexican sending communities through return migration, emigration, and remittance channels. In the following section, we examine how

[28] Table 3 shows specifications with the full set of controls; alternative specifications appear in Appendix C.

[29] These educational composition estimates are sensitive to controlling for the pre-Recession outcome measure (Appendix Table C3), so they should be interpreted with caution.

[30] The 2005 Conteo does not include questions regarding remittance receipt.

Table 3
Sex Ratio, Educational Attainment, and Households Receiving Remittances.

	△ Sex ratio (F/M) 2005–10	△ Less than primary 2005–10	△ Primary 2005–10	△ Secondary 2005–10	△ University 2005–10	Household remittances 2010
	(1)	(2)	(3)	(4)	(5)	(6)
US Employment Shock	0.479**	−0.019	0.049	−0.028	0.030	0.470***
	[0.241]	[0.113]	[0.203]	[0.124]	[0.058]	[0.126]
	(0.200)	(0.115)	(0.168)	(0.076)	(0.062)	(0.125)
Pre-shock Outcome	−0.224***	0.541***	0.713***	0.838***	0.705***	0.447***
	(0.032)	(0.025)	(0.067)	(0.037)	(0.035)	(0.045)
New 287 g Policy	−0.035	−0.082***	0.083**	−0.017	−0.001	0.003
	(0.048)	(0.029)	(0.037)	(0.018)	(0.014)	(0.027)
Employment Policy	0.010	0.009	−0.006	−0.009	0.006	0.022
	(0.037)	(0.021)	(0.029)	(0.012)	(0.011)	(0.018)
Trade Shock	−0.074***	−0.023*	0.290***	−0.180***	−0.017	0.044**
	(0.027)	(0.013)	(0.039)	(0.030)	(0.022)	(0.020)
Non-tradable share of Employment	0.015	0.002	0.080***	−0.008	−0.030***	0.023*
	(0.022)	(0.013)	(0.017)	(0.010)	(0.007)	(0.013)
Homicide Rate 2005–10	10.482***	3.294**	5.139***	0.401	−1.032	−4.623*
	(3.664)	(1.641)	(1.977)	(0.866)	(0.966)	(2.478)
Mean raw outcome among less affected	−0.042	−0.053	0.003	0.038	0.018	0.051
Implied shock impact	−0.009	0.000	−0.001	0.001	−0.001	−0.009
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	866	866	866	866	866	866
R-squared	0.294	0.733	0.590	0.713	0.648	0.343

This table examines the effect of changes in US labor demand on the 2005-10 change in the female to male sex ratio for the working age population (15-64), the 2005-10 change in the share of the working age population in each education level, and the share of households receiving remittances in 2010 for each Mexican source municipio. Note that outcome and pre-shock outcome variables are divided by exposure, ξ_s, as in Eq. (7). We measure the sex ratio and educational attainment using the 2000 or 2010 Mexican Census or 2005 Inter-Censal Count. We calculate the share of households receiving remittances as the number of households reporting receiving income from relatives living abroad divided by the municipio's total number of households in the Census year, using the 2000 or 2010 Mexican Census. All specifications in columns (1) to (6) use a GLS re-weighting procedure to address potential heteroskedasticity. The "Pre-shock Outcome" control in column (1) is the 2000–2005 change in the sex ratio. In columns (2)-(5) this control is the 2000–2005 change in the share of the municipio population with the listed level of schooling. In column (6), this control is the share of households receiving remittances in 2000. All specifications include controls for anti-immigrant employment legislation and new 287(g) agreements across US CZs, trade shocks across municipios (divided by 1,000,000), share of employment in Mexico's non-tradable sector, changes in homicide rates across municipios, and Mexican state fixed effects. "Mean raw outcome among less affected" is the average of the dependent variable without dividing by exposure for municipios in the quartile with smallest magnitude US employment shocks. "Implied shock impact" provides the predicted difference in the outcome (without dividing by exposure) for municipios with the 90-10 percentile difference in shock size (0.075) and average exposure (0.25). Standard errors clustered at the Mexican Commuting Zone level are shown in parentheses. Due to the shift-share structure of the US Employment Shock, we also present Borusyak et al. (2022) standard errors for this variable in square brackets.

*** $p < 0.01$ based on standard errors in brackets when present.

** $p < 0.05$ based on standard errors in brackets when present.

* $p < 0.1$ based on standard errors in brackets when present.

these changes in the size of the local labor force and the reduction in household budgets due to declining remittances affected employment, earnings, and household investment.

6. Labor market and investment outcomes

6.1. Labor market outcomes

We examine impacts on local labor markets using full-count tabulations from the 2004 and 2009 Mexican Economic Census, which covers all formal economic activity in Mexico outside agriculture, livestock, forestry and a few service industries. Outcomes include municipio-level employment (separately by gender), aggregate yearly earnings, and aggregate yearly hours worked in covered sectors.[31] We present municipio-level results here and provide results at the Mexican commuting zone level in Appendix C.6. Results are very similar regardless of the level of aggregation.

The loss of access to higher-wage jobs in the US is likely to affect local labor market outcomes in Mexico in three ways. First, a larger local working-age population increases both local labor supply and local labor demand, and the combination of these changes affects equilibrium wages and employment. Second, changes in net migration lead to important compositional shifts in the population of the municipio, with the average labor market attachment likely rising (Appendix Table C29). Finally, the loss of remittance income may lead some households to substitute into paid employment and away from home production.[32]

Table 4 examines the net effect of these forces and finds substantial increases in employment and hours worked but minimal changes in hourly earnings. Column (1) of Table 4 examines the change in the municipio employment-to-population ratio from 2004 to 2009, using employment from the Economic Census and population from the 2005 Inter-Censal Count or 2010 Census, respectively. The negative coefficient estimates for the US employment shock imply that sources facing larger US employment declines exhibited larger increases in the employment to population ratio. Panels B and C make clear that the overall effect in Panel A is driven almost entirely by women.[33] The coefficient of −0.563 in Panel B implies that a strongly affected municipio with average exposure to the US experienced a 1.1 percentage point larger increase in employment to population ratio among women compared to a similar municipio that was less affected. Employment rates for men, however, did not change differentially based on the municipio's US labor demand shock, which suggests that the (largely male) return migrants and non-emigrants did not substantially crowd out employment in source communities. The reduction in household income from losing access to US jobs, however, likely led more women to enter the workforce.[34]

Columns (2)-(4) demonstrate that local labor markets were able to accommodate substantial increases in the supply of hours worked without substantially reducing wages. The second and third columns show that both total municipio-level hours worked and total earnings increased in the most affected source communities, reflecting in part the increase in population shown in the previous section. Comparing two municipios at the 90th and 10th percentiles of the shock distribution, the more affected municipio experienced a 4.7 percentage point larger increase in local hours and a 5.2 percentage point larger gain in total earnings, both of which are meaningful changes compared to the average changes in less-affected municipios. Similar percentage effects on earnings and hours suggest minimal effects on hourly wages, which we confirm in the final column. The negative coefficient on the US shock implies a very small (and not statistically different from zero) increase in the average hourly wage rate for municipios facing more negative US shocks.[35]

This set of results is somewhat surprising, as one may have expected the relative increase in local labor supply to negatively affect wages. To understand this result, we first note that the lack of wage impacts is not driven by compositional effects—Appendix Table C2 shows that the results in Panel A of Table 4 are qualitatively unchanged when including controls for changes in each municipio's demographic and educational composition.[36] Second, positively correlated labor demand declines in migrant sources and destinations (not captured by our controls) are unlikely to explain the lack of negative wage effects, as this correlation would lead to negative bias on the US Employment Shock coefficient.

Instead, we interpret these results as consistent with the broader international migration literature, which typically finds modest effects of migration-related population growth on local equilibrium wages (National Academies of Sciences, Engineering, and Medicine, 2017).[37] The implied relative increase in local population due to the loss of US jobs is roughly 2 percentage points for municipios whose shocks differ by the 90–10 percentile gap (see Table 1). This is a meaningful change but still substantially smaller than the 7 percent increase in local population in Miami due to the well-known Mariel Boatlift (Card, 1990). Further, because there was no change in the skill mix in affected municipios (Table 3), the lack of a wage effect could be explained by modest capital adjustments over a five year period (Borjas, 2013). Additionally, former migrants often return with lump-sum savings (Amuedo-Dorantes et al., 2005), which could further stimulate local demand and mitigate downward wage pressure.

31 Service sectors that are not covered by the Economic Census include mass transit, taxis, farmers' insurance funds, political organizations, and domestic employees (INEGI, 2009).

32 It is also possible that these factors change workers' formality, but given the nature of our data, we are unable to examine this channel of adjustment empirically.

33 Although this analysis is not limited to married women, this result is similar to the "added worker effect" in which married women enter the labor force after their husbands lose employment. See Stephens (2002) for a thorough review of this literature. In Section 6.2, we present descriptive evidence suggesting that differences in labor supply are driven primarily by women in households with US migrants.

34 Although the focus of this paper is on economic adjustments immediately following the Great Recession, we are able to extend the analysis for this particular outcome through 2019. Appendix C.11 shows that both the increase in female employment and the lack of a change among men lasted through the end of that follow-up period.

35 With unweighted regressions, the estimate in column (4) of Table 4 is exactly the difference between the estimates in columns (2) and (3) – see Appendix Table C11.

36 The earnings data do not contain information about the characteristics of the workers, but we construct controls for changes in the gender mix, the age distribution (flexible bins), educational attainment (degree categories), and the local industry structure using Census data.

37 Note that we are unable to disaggregate earnings or hours by gender or migration status, so we cannot estimate wage effects on particular subgroups. Studies finding a negative effect of migration on incumbent populations typically do so for narrow subgroups of workers, such as in Borjas and Doran (2012).

Table 4
Employment-to-population ratio and earnings per hour.

	△ EPOP 2004–09	△ ln(Hours) 2004–09	△ ln(Earnings) 2004–09	△ ln(EarnPerHour) 2004–09
	(1)	(2)	(3)	(4)
Panel A. All				
US Employment Shock	−0.366**	−2.511*	−2.763	−0.266
	[0.160]	[1.459]	[2.330]	[1.816]
	(0.186)	(1.459)	(2.790)	(2.293)
△ EPOP 1999–04	−0.511***			
	(0.116)			
△ ln(Hours) 1999–04		−0.159***	0.262**	0.435***
		(0.046)	(0.122)	(0.100)
△ ln(Earnings) 1999–04		0.071***	−0.175***	−0.247***
		(0.023)	(0.062)	(0.049)
Mean raw outcome among less affected	0.013	0.126	0.345	0.219
Implied shock impact	0.007	0.047	0.052	0.005
Panel B. Women				
US Employment Shock	−0.563***			
	[0.137]			
	(0.177)			
△ EPOP Women 1999–04	−0.577***			
	(0.159)			
Mean raw outcome among less affected	0.015			
Implied shock impact	0.011			
Panel C. Men				
US Employment Shock	−0.112			
	[0.250]			
	(0.236)			
△ EPOP Men 1999–04	−0.408***			
	(0.087)			
Mean raw outcome among less affected	0.009			
Implied shock impact	0.002			
State FE	Yes	Yes	Yes	Yes
Observations	865	846	846	846

This table examines the effects of declines in US labor demand on the 2004–2009 change in the employment-to-population ratio, earnings, hours worked, and earnings per hours in each municipio, using employment, earnings and hours from the 1999, 2004 and 2009 Mexican Economic Census and population from the 2000 and 2010 Mexican Census and the 2005 Conteo. In Appendix Table C16, we implement the same analysis at the Mexican Commuting Zone level, which may better approximate local labor markets, finding similar results. Note that the outcome and pre-shock outcome variables are divided by exposure, ξ_s, as in Eq. (7). We trim the bottom and top 1 percent of the earnings distribution. All specifications in columns (1) to (4) use a GLS re-weighting procedure to address potential heteroskedasticity. All specifications include controls for anti-immigrant employment legislation and new 287(g) agreements across US CZs, trade shocks across municipios (divided by 1,000,000), share of employment in Mexico's non-tradable sector, changes in homicide rates across municipios, and Mexican state fixed effects. "Mean raw outcome among less affected" is the average of the dependent variable without dividing by exposure for municipios in the quartile with smallest magnitude US employment shocks. "Implied shock impact" provides the predicted difference in the outcome (without dividing by exposure) for municipios with the 90-10 percentile difference in shock size (0.075) and average exposure (0.25). Standard errors clustered at the Mexican Commuting Zone level are shown in parentheses. Due to the shift-share structure of the US Employment Shock, we also present Borusyak et al. (2022) standard errors for this variable in square brackets.

*** $p < 0.01$ based on standard errors in brackets when present.

** $p < 0.05$ based on standard errors in brackets when present.

* $p < 0.1$ based on standard errors in brackets when present.

6.2. Supporting evidence from cross-sectional analysis

Our interpretation of the results in Table 4 presumes that the observed labor supply responses occurred in Mexican households with US migrants, as these were directly affected by a loss of US employment opportunities during the Great Recession. An ideal

Table 5
Cross-sectional employment analysis 2010.

	State FE	State FE	Municipio FE
	(1)	(2)	(3)
Panel A. All			
US Employment Shock* $\mathbb{1}(\text{exposed}_h)$	−0.189***	−0.139**	−0.101
	(0.069)	(0.066)	(0.068)
$\mathbb{1}(\text{exposed}_h)$	−0.038***	−0.031***	−0.020**
	(0.008)	(0.008)	(0.008)
Observations	33,270,660	33,270,660	33,270,660
Panel B. Women			
US Employment Shock* $\mathbb{1}(\text{exposed}_h)$	−0.297***	−0.224***	−0.201**
	(0.086)	(0.084)	(0.087)
$\mathbb{1}(\text{exposed}_h)$	−0.048***	−0.038***	−0.026***
	(0.010)	(0.010)	(0.010)
Observations	17,511,744	17,511,744	17,511,744
Panel C. Men			
US Employment Shock* $\mathbb{1}(\text{exposed}_h)$	−0.054	−0.025	0.021
	(0.087)	(0.085)	(0.082)
$\mathbb{1}(\text{exposed}_h)$	−0.007	−0.003	0.005
	(0.009)	(0.009)	(0.009)
Observations	15,758,916	15,758,916	15,758,916

This table examines how labor supply behavior differs for households with and without US migrants in municipios facing different US shocks. We use cross-sectional data from the 2010 Census and define households exposed to US labor markets as those with either return migrants or with a household member living in the US. Columns (1) and (2) estimate the specification in Eq. (8), including the main effect of the US Employment shock as a control, while column (3) estimates a more general specification with municipio fixed effects and thus omits the US Employment Shock main effect. Column (2) shows the results including controls for anti-immigrant employment legislation and new 287(g) agreements across US CZs, trade shocks across municipios (divided by 1,000,000), share of employment in Mexico's non-tradable sector, and changes in homicide rates across municipios (and the municipio fixed effects in column (3) subsume all these controls). Standard errors clustered at the Mexican Commuting Zone level are shown in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

analysis would assess this interpretation using panel data to observe household-level *changes* in labor supply in response to return migration or a loss of remittances. Because no such panel dataset with municipio-level geography is available, we instead examine whether employment probabilities for members of households that had someone in the US during 2005–2010 are more strongly related to the US shocks compared to the same relationship among households without US migrants over that same time period.

We implement this complementary analysis using data from the 2010 Census. We define households that were directly exposed to the US labor market during the Great Recession as those with either (i) a member who had lived in the US in 2005 but returned to Mexico by 2010 or (ii) a former household member who moved to the US after 2005. In both cases, we can be sure the household had a member in the US during the Great Recession period. Individuals living in households meeting this definition are identified by the indicator function $\mathbb{1}(\text{exposed}_j)$ and referred to as "members of exposed households". We then use the following individual-level regression to ask whether the cross-sectional relationship between non-migrants' labor supply and US shocks is driven primarily by these individuals with direct ties to the US labor market.

$$\mathbb{1}(\text{employed}_j) = \beta_1 \mathbb{1}(\text{exposed}_j) \cdot \left[\sum_{d \neq s} \varphi_{sd} \sum_i \frac{Emp_{id}^M}{Emp_d^M} \frac{d\ Emp_{id}}{Emp_{id}} \right] + \beta_2 \mathbb{1}(\text{exposed}_j) + \beta_3 \left[\sum_{d \neq s} \varphi_{sd} \sum_i \frac{Emp_{id}^M}{Emp_d^M} \frac{d\ Emp_{id}}{Emp_{id}} \right] + \phi_{e(s)} + \Lambda \Delta X_s + \Pi \sum_{d \neq s} \varphi_{sd} \Delta X_d + \epsilon_j \tag{8}$$

If network-connected US job losses (the terms in square brackets) increase employment probabilities more for members of migrant households, the estimate of β_1 will be negative.

The results in Table 5 confirm this expected pattern. Columns (1) and (2) estimate the specification in (8), and column (3) estimates a more general specification subsuming all municipio-level terms into municipio fixed effects. In Panel A, which shows results using all residents, the interaction term's coefficient is negative and significant in column (1) (no controls), and column (2)

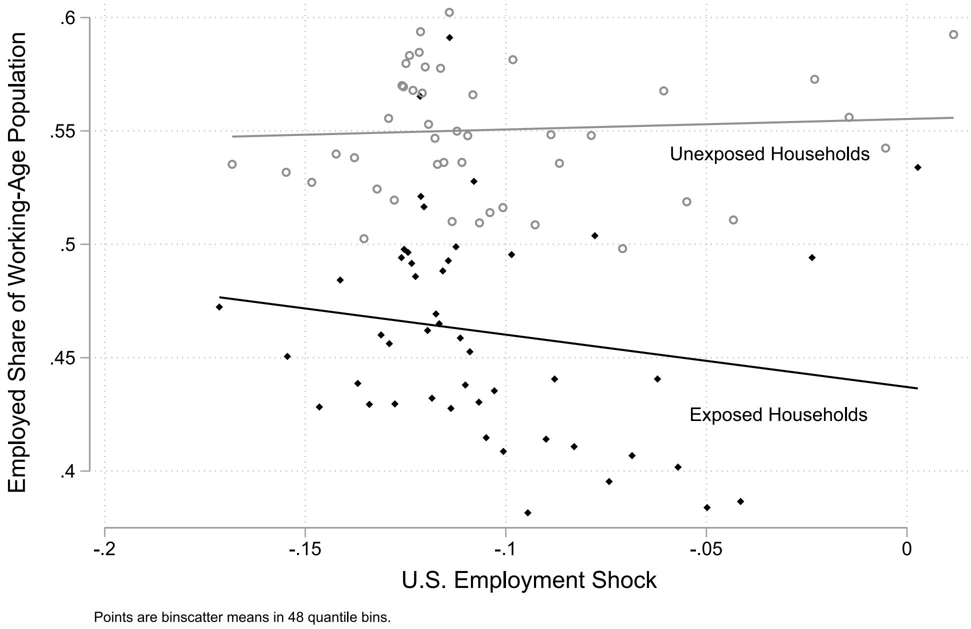

Fig. 5. Employment share of working-age population vs US employment shock.
This figure shows a binscatter plot of the variation identifying the main coefficient in column (1) of Table 5. Each gray circle shows the employment share of the working-age population living in households with no US migrants (unexposed households — see text for details) while each black diamond shows the employment share of the working-age population living in households with US migrants (exposed households). There is a strong negative relationship between the employment probability and the US employment shock for exposed households and essentially no relationship for unexposed households.

shows that this result is robust to the inclusion of the full battery of controls.[38] The interaction term is still negative but statistically insignificant in column (3) with municipio fixed effects. Moreover, just as in Table 4, these employment effects among exposed households are driven almost entirely by women, for whom we find a significant negative effect even in the very demanding specification in column (3) of Panel B, with municipio fixed effects.[39]

Fig. 5 shows a binscatter plot visualizing the variation identifying β_1 in column (1) of Table 5. The gray circles plot the employment share of working-age population for those in unexposed households and the black diamonds show employment shares for those in exposed households. For unexposed households, there is no relationship between the employment probability and the US employment shock; this is expected because unexposed households by construction were not directly affected by US employment declines. In contrast, there is a strong negative relationship for members of exposed households. Together, these cross-sectional results support the interpretation that when migrants' households lost income due to negative US employment shocks, other household members, particularly women, sought to compensate by entering the labor force.[40] We note, however, that in some specifications, there are similar patterns present in data from 2000 (see Appendix Table C22), which suggests interpreting this set of supporting results with caution.

6.3. Investment results

If households are unable to fully offset a loss of US labor market income, they may adjust on other consumption and investment margins. Table 6 shows the effects of US labor demand shocks on two sets of investment behaviors: ownership of household durables and human capital investment via school attendance. Each column provides the results of a separate regression, returning to the specification in (7). The first four columns consider the change from 2005 to 2010 in the share of households owning the relevant household durable, including personal computers, washing machines, refrigerators, and televisions. The coefficient on the US employment shock for televisions is positive and significant, suggesting that households in more negatively affected municipios may have slowed down their television purchases. However, this estimate is sensitive to controlling for pre-Recession outcome growth (Appendix Table C6), so we encourage caution in interpreting this result.

[38] Results are qualitatively similar to those in columns (1) and (2) of Table 5, though a bit less precise, when controlling for state × exposure status fixed effects.

[39] The coefficient magnitudes in Tables 4 and 5 are not directly comparable due to different data sources and research design, and because our measure of $\mathbb{1}(\text{exposed}_j)$ will not capture all households that were exposed to the US market.

[40] Because Mexican population-level tabulations do not include earnings or hours separately by gender, we are not able to examine the gender wage gap.

Table 6
Appliance ownership and school attendance.

	△ Computer 2005–10	△ Washing machine 2005–10	△ Refrigerator 2005–10	△ TV 2005–10	△ Attendance rate (ages 6–12) 2005–10	△ Attendance rate (ages 13–15) 2005–10	△ Attendance rate (ages 16–18) 2005–10
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
US Employment Shock	−0.122	0.057	0.211	0.474**	0.200***	0.371	0.011
	[0.096]	[0.246]	[0.248]	[0.241]	[0.082]	[0.296]	[0.348]
	(0.101)	(0.226)	(0.225)	(0.184)	(0.070)	(0.246)	(0.241)
△ Outcome 2000–05	0.873***	0.279***	0.337***	0.400***	−0.016	0.114***	0.176***
	(0.022)	(0.021)	(0.022)	(0.027)	(0.024)	(0.028)	(0.027)
New 287 g Policy	−0.030	0.064	0.052	0.012	0.025	0.086	0.035
	(0.056)	(0.057)	(0.048)	(0.017)	(0.058)	(0.058)	
Employment Policy	−0.036	−0.079**	−0.028	0.012	0.013	0.053	0.002
	(0.039)	(0.041)	(0.033)	(0.012)	(0.040)	(0.038)	
Trade Shock	−0.057	0.025	0.057	0.044	0.040***	0.115***	−0.010
	(0.056)	(0.041)	(0.031)	(0.013)	(0.027)	(0.037)	
Non-tradable share of Employment	−0.019	−0.045	−0.011	0.012	−0.008	−0.055**	−0.086***
	(0.029)	(0.037)	(0.030)	(0.008)	(0.026)	(0.030)	
Homicide Rate 05–10	0.512	1.418	5.125*	−0.957	−7.930**	−3.250	
	(2.906)	(2.778)	(2.820)	(1.176)	(4.008)	(4.501)	
Mean raw outcome among less affected	0.065	0.061	0.060	0.024	0.006	0.056	0.060
Implied shock impact	0.002	−0.001	−0.004	−0.009	−0.004	−0.007	−0.000
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	866	866	866	866	866	866	866
R-squared	0.848	0.580	0.546	0.500	0.096	0.305	0.330

This table examines the effect of changes in US labor demand on the 2005–10 change in ownership of household durables (personal computers, washing machines, refrigerators, and televisions) and in school attendance. We calculate the change in the share of households owning the relevant household durable and the share of the population in primary (age 6–12), secondary (age 13–15), and high-school (age 16–18) reporting having attended school using the 2000 or 2010 Mexican Census or 2005 Conteo. Note that the outcome and pre-shock outcome variables are divided by exposure, ξ_s, as in Eq. (7). All specifications in columns (1) to (7) use a GLS re-weighting procedure to address potential heteroskedasticity. All specifications include controls for anti-immigrant employment legislation and new 287(g) agreements across US CZs, trade shocks across municipios (divided by 1,000,000), share of employment in Mexico's non-tradable sector, changes in homicide rates across municipios, and Mexican state fixed effects. "Mean raw outcome among less affected" is the average of the dependent variable without dividing by exposure for municipios in the quartile with smallest magnitude US employment shocks. "Implied shock impact" provides the predicted difference in the outcome (without dividing by exposure) for municipios with the 90-10 percentile difference in shock size (0.075) and average exposure (0.25). Standard errors clustered at the Mexican Commuting Zone level are shown in parentheses. Due to the shift-share structure of the US Employment Shock, we also present Borusyak et al. (2022) standard errors for this variable in square brackets.

*** $p < 0.01$ based on standard errors in brackets when present.

** $p < 0.05$ based on standard errors in brackets when present.

* $p < 0.1$ based on standard errors in brackets when present.

The final three columns use municipio-level school attendance rates among different age groups – primary (age 6–12), early secondary (13–15), and late secondary (16–18) – as the dependent variables. The coefficients on the US employment shock are uniformly positive, meaning that declining US labor demand was associated with decreases in school attendance at all three levels. The coefficient is precisely measured only for the elementary school age outcome, however, where it implies a 0.4 percentage point smaller growth rate in school enrollment for a municipio with average exposure connected to a very negative shock compared to one with similar exposure but a mild shock.

Together, these results imply that the loss of access to a strong US labor market slowed investment in affected communities. These results are consistent with other research showing that sending communities' access to higher-paying foreign jobs improves children's schooling outcomes, especially Dinkelman and Mariotti (2016). Notably, in their context, the effects were longer-lasting, as the schooling gains continued even for cohorts who were of primary schooling age after workers lost access to the foreign labor market. The results in Table 6 comport with Caballero's(2022) findings, also in the US-Mexico context, in which school enrollment decreased in municipios with stronger migration ties to US destinations that adopted deportation policies.[41] More generally, these findings are important because these differences in schooling attendance across municipios could lead to persistent earnings inequalities among children who were at pivotal schooling ages during the Great Recession.

[41] Caballero (2022) also provides a model clarifying the key channels through which return migration or deferred emigration are likely to affect schooling investment.

7. Conclusion

This paper documents the role of migrant networks in transmitting the effects of the US Great Recession across the border to Mexico. In municipios whose migrants faced larger US labor demand declines, return migration increased more, emigration decreased more, and household remittances fell by more than in municipios facing smaller shocks. These changes in the local labor force, along with the reductions in household budgets due to lost remittance income, linked Mexican local labor market outcomes to US local labor demand shocks. The female employment-to-population ratio increased by more in harder-hit regions, likely as a way to compensate for lost US earnings among migrants. School enrollment for children age 6–12 also increased more slowly in these areas.

These findings demonstrate the substantial influence of the US labor market on Mexican demographic and economic outcomes, likely with long-lasting consequences. While this paper studies changes in US labor demand driven by the Great Recession, one can expect to observe similar effects if a large portion of Mexican migrants were to lose access to the US labor market due to changes in immigration and enforcement policies. For example, a well enforced universal E-Verify program would largely cut off labor market access for unauthorized immigrants, including approximately 43 percent of Mexican-born residents of the US in 2019 (Gonzalez-Barrera and Krogstad, 2019).

Along with these policy implications, our findings inform the broader literature on the effects of immigration on local labor markets. Specifically, we find that aggregate outflows from sending locations are strongly responsive to labor demand conditions in the subset of US destinations where previous migrants from that source had historically settled. This finding conflicts with a key assumption behind the instrument most commonly used to correct for the endogeneity of local immigrant inflows to local labor demand conditions.[42] The instrument treats aggregate inflows from each source as exogenous and focuses instead on resolving the potential endogeneity of migrants' location choices within the destination country, conditional on choosing to migrate. The finding that aggregate inflows from a source are endogenous to network-weighted demand suggests that US destinations with more positive values of the instrument may have systematically stronger unobserved labor demand growth. Finally, these findings reinforce the conclusion that US-Mexico migration operates through a series of tight connections between specific sources and destinations. Thus, we expect that any local shocks on one side of the border are likely to affect outcomes in migrant-connected localities on the other side.

Declaration of competing interest

None.

Data availability

https://data.mendeley.com/datasets/2t739hy2td/1.

Appendix A. Online appendix

The online appendix including model derivations, data construction, and additional results can be found online at https://doi.org/10.1016/j.jinteco.2023.103832.

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[42] This type of instrument was first introduced by Altonji and Card (1991), based on results in Bartel (1989). Although some papers attempt to identify specific source-level shocks to predict aggregate inflows from each source (Llull, 2018), most papers simply assume that the total inflow from each source is exogenous. Jaeger et al. (2019) provide a more complete overview of this literature and offer an independent critique of the instrument based on the dynamics of adjustment to previous waves of migration.

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