Immigrants Equilibrate Local Labor Markets: Evidence from the Great Recession*

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Abstract

This paper demonstrates that low-skilled Mexican-born immigrants' location choices in the U.S. respond strongly to changes in local labor demand, and that this geographic elasticity helps equalize spatial differences in labor market outcomes for low-skilled native workers, who are much less responsive. We leverage the wage rigidity that occurred during Great Recession to identify the severity of local downturns, and our results confirm the standard finding that high-skilled populations are quite geographically responsive to employment opportunities while low-skilled populations are much less so. However, low-skilled immigrants, primarily those from Mexico, respond even more strongly than high-skilled native-born workers. These results are robust to a wide variety of controls, a pre-recession falsification test, and two instrumental variables strategies. A novel empirical test reveals that natives living in cities with a substantial Mexican-born population are insulated from the effects of local labor demand shocks compared to those in cities with few Mexicans. The reallocation of the Mexican-born workforce among these cities reduced the incidence of local demand shocks on low-skilled natives' employment outcomes by more than 40 percent.

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1 Introduction

The recession that began in December 2007 and ended in June 2009, now commonly referred to as the Great Recession, represented the largest decline in GDP since World War II. Total employment fell by more than eight million jobs, and unemployment rose by more than five percentage points. In addition, there was substantial variation in the severity of the recession across geography, with some local labor markets losing more than 15 percent of employment while others experienced small gains.[1] These types of labor market conditions are of particular concern for workers with lower levels of education. Not only are low-skilled workers disproportionately affected by job losses over the business cycle (Hoynes 2002, Hoynes, Miller and Schaller 2012), but a substantial literature finds that they are much less likely to move across labor markets as local conditions deteriorate (Topel 1986, Bound and Holzer 2000, Wozniak 2010). Together, these features of the low-skilled labor market create the potential for sharply disparate outcomes across space. In fact, policymakers have recognized this problem and implemented policies such as extended unemployment insurance programs partly to cushion the blow of the recession in the hardest-hit markets.

In this paper, we examine mobility responses to geographic variation in the depth of the Great Recession, with the goal of determining how such mobility offsets geographic variation in demand shocks. The analysis reveals an important and novel finding: demand-sensitive migration by Mexican-born immigrants dramatically reduces the geographic variability of labor market outcomes among the entire low-skilled population. The reallocation of Mexican immigrants across cities weakens the relationship between local demand shocks and local employment rates among *natives* by roughly 40 percent. Consistent with the previous literature, we find that low-skilled native-born populations are nearly non-responsive to demand conditions, which further emphasizes the importance of the smoothing provided by

[1] Authors' calculations from County Business Patterns data. See below for details.

the Mexican-born.

Identifying changes in labor demand is the main practical challenge in examining workers' spatial responses to labor market conditions. During the Great Recession, however, the labor market exhibited downward-rigid nominal wages in a near zero-inflation environment with declining labor demand in nearly all markets. Under these conditions, changes in labor demand are reflected entirely through changes in employment, which are measurable with a high level of precision at the local level. Our empirical strategy leverages this insight to find the effect of demand shocks on local labor supplies, and the results confirm the previous literature's finding that more highly educated individuals are more geographically responsive to labor market conditions. For example, among highly skilled (some college or more) native men a 10 percentage point larger decline in local employment from 2006 to 2010 led to a 5.3 percentage point decline in the local population, compared with no measurable supply response among less skilled (high school degree or less) natives. In sharp contrast, less skilled Mexican-born men responded even more strongly than highly skilled natives, with a 10 percentage point larger employment decline driving a 7.6 percentage point larger decline in population. Immigrants thus play a crucial and understudied role in increasing the overall geographic responsiveness of less skilled laborers in the U.S., and this result adds a new dimension to the existing literature that focuses on workers' responsiveness to demand shocks based on education and demographics.[2]

These mobility differences reflect differential sensitivity to changing labor market conditions rather than different unconditional migration rates (see Molloy, Smith and Wozniak (2011) for a summary). Although Mexican-born individuals' overall mobility rates are only

[2]Bartik (1991), and Blanchard and Katz (1992) show that workers generally respond to declines in labor demand by migrating toward stronger labor markets. In the immigration context, Hanson and Spilimbergo (1999) show that migration flows between the U.S. and Mexico respond as expected to changes in real wages in each country. Topel (1986), Bound and Holzer (2000), and Wozniak (2010) demonstrate substantial differences in geographic responsiveness across education and demographic groups, while a more recent literature argues that educational attainment itself increases individuals' geographic elasticity (Hickman 2009, Malamud and Wozniak 2012, Machin, Salvanes and Pelkonen 2012, Böckerman and Haapanen 2013).

modestly larger than those of less skilled natives, they are much more likely to report moving for reasons relating to the labor market. Moreover, we show that observable characteristics such as age, education, family structure, and home ownership do not account for the differential responsiveness of natives and Mexicans. Instead, we present suggestive evidence that the differences are driven by stronger labor market attachment, likely resulting from migrant selection and from lower rates of benefit eligibility among the Mexican-born.

To reinforce our interpretation that the reallocation of Mexican-born labor was caused by demand changes, we implement a wide array of robustness checks, all of which support the central results. The strong labor supply elasticities among the Mexican-born are unaffected by controlling for diffusion of Mexican immigrants away from traditional enclaves (Card and Lewis 2007), new anti-immigrant employment legislation, and new immigration enforcement policies (Bohn and Santillano 2012). We further show in a pre-recession false experiment that the observed differences in mobility between low skilled natives and Mexicans were not part of an ongoing pre-recession trend. As a final set of robustness checks, we instrument for local labor demand using (i) the standard Bartik (1991) measure that predicts shifts in local labor demand based on the pre-Recession industrial composition of local employment and (ii) pre-recession household leverage, following Mian and Sufi (2012). Both sets of IV results are very similar to OLS, supporting the interpretation that changes in employment directly identify spatial differences in labor demand during the Great Recession.

Having established that less skilled Mexicans are highly geographically responsive to changes in labor market conditions while less skilled natives are not, we examine the implications of Mexican mobility for natives' employment outcomes. We find that in cities where the Mexican-born comprised a substantial share of the low-skilled workforce prior to the recession, there was a much weaker relationship between labor demand shocks and *native* employment probabilities than in cities with comparatively few Mexican workers. Natives living in cities with many similarly skilled Mexicans were thus insulated from local shocks, as the departure of Mexican workers absorbed part of the demand decline. Therefore, Mexican mobility serves to equalize labor market outcomes across the country and partially obviates the need for natives to move.

These findings have important implications for multiple literatures. First, as mentioned above, a number of papers find evidence for equalizing worker mobility and demonstrate its importance in smoothing labor market outcomes across space (Bartik 1991, Blanchard and Katz 1992). Differences in responsiveness across workers with varying demographics and education play an important role in determining the degree to which local shocks are realized in local outcomes for particular worker groups (Topel 1986, Bound and Holzer 2000). Prior work focuses on differences in responsiveness across education groups, which we confirm with the finding that less skilled workers respond very little to local market conditions. We further demonstrate that an even larger difference in responsiveness exists *within* the less skilled market, between immigrants and natives. The presence of highly responsive immigrants increases the overall geographic elasticity of the less skilled labor force and partly alleviates the very negative labor market consequences that otherwise would have been faced by less skilled natives in depressed local markets.

Second, endogenous location choices by immigrants represent a central challenge in the literature measuring immigrants' effects on natives' labor market outcomes. The potential endogeneity of immigrants' location choices to local economic conditions has led researchers to use instrumental variables based on the existing locations of immigrant enclaves (Card (2001), for example) or to use national time-series identification rather than cross-geography comparisons (Borjas 2003).[3] Our results confirm the hypothesis that immigrants' location choices respond strongly to local economic conditions. However, while much of the prior literature focuses on endogenous location choices of newly arriving immigrants, we show

[3]While most of the literature seeks to mitigate the effects of endogenous location choices, a few papers focus directly on immigrants' location choices in response to demand shocks, including Borjas (2001), Jaeger (2007), Cadena (forthcoming), and Cadena (2010).

that during the Great Recession more than 80 percent of Mexican immigrants' geographic response occurred through return migration or internal migration by previous immigrants, channels that are largely neglected in prior work.[4] This finding demonstrates that geographic arbitrage can occur even without much new immigration, as long as the labor market has a large stock of immigrants whose location choices are highly sensitive to employment opportunities.

Third, the most closely related prior work is Borjas's (2001) seminal paper, which considers the possibility of spatial arbitrage through the arrival of new immigrants to states with high wage levels and simulates the potential geographic smoothing effect on natives' wages. Although similar in examining geographic smoothing resulting from immigrants' location choices, the current paper differs in important ways. Our unit of analysis is the metropolitan area rather than the state, allowing us to more closely approximate local labor markets. Importantly, we focus on responses to plausibly exogenous labor demand shocks rather than to unconditional wage levels or wage growth. Further, as just mentioned, we examine the role of return migration and internal migration rather than focusing only on newly arrived immigrants. Finally, we introduce a novel test to demonstrate empirically the geographic smoothing that Borjas investigated through simulation. In this sense, our work confirms his hypothesis that immigration "greases the wheels of the labor market" while broadening the empirical findings to show that the phenomenon occurs in response to exogenous labor demand shocks and does not rely solely on immigrants' initial location choices.

The remainder of the paper is organized as follows: the next section provides context for examining labor supply elasticities in response to the Great Recession, including descriptive evidence supporting our central identification strategy. Section 3 provides the main results and multiple robustness checks of the Mexican/native-born differences in geographic respon-

[4]To our knowledge, the only prior study examining the earnings maximizing internal migration of existing immigrants is Maré, Morten and Stillman (2007), who study initial and subsequent location choices of immigrants to New Zealand.

siveness. Section 4 measures the degree to which Mexican immigrants' mobility smooths labor market outcomes for natives and demonstrates substantial smoothing in practice. Section 5 presents a decomposition of the supply responses into various channels and discusses potential reasons why Mexican-born immigrants may be uniquely positioned to serve as an equilibrating force in the low-skilled labor market. Section 6 concludes.

2 Conceptual Framework

2.1 Wage Rigidity and Demand Shocks

One of the most noteworthy features of the Great Recession was the prevalence of large employment declines and the absence of substantial wage cuts. In fact, as several authors have documented, inflation over this time period was minimal, and nominal wages continued to grow, albeit at a relatively slow rate (Daly, Hobijn and Lucking 2012a, Daly, Hobijn and Wiles 2012b, Rothstein 2012). As discussed by Daly et al. (2012a), the observed employment response in lieu of wage changes is consistent with employers facing a fairness constraint in bargaining with employees, wherein cuts to the nominal wage in response to demand changes are considered exploitative.[5]

Figure 1 shows the national employment to population ratio among prime age workers (25-54) from 1979 to 2013. This ratio fell sharply between late 2007 and late 2009, declining by five percentage points, indicating substantial labor market adjustment on the employment margin. Compared to the pre-recession trend, it is clear that employment growth stalled by

[5]Kahneman, Knetsch and Thaler (1986) provide survey results with direct support for this hypothesis. Respondents perceive real wage cuts in response to product demand declines as "unfair" in a low inflation environment (when nominal wages must be cut) but "fair" in a high inflation environment (when nominal wages are increased but at a rate lower than inflation). Consistent with this idea, Card and Hyslop (1997) provide empirical evidence that in previous recessions, inflation likely "greased the wheels" of the labor market by allowing firms to cut real wages without reducing nominal compensation below workers' reference point.

2007, so we consider 2006 as the pre-recession baseline period and 2010 as the post-recession period throughout our analysis.

Figure 2 compares employment and wage changes over this time period. This figure combines the employment to population ratio from Figure 1 with calculations from Rothstein (2012) of changes in wage rates over the same time period.[6] All values represent proportional changes compared to the same month in the previous year. Average wages are roughly constant over this time period, although they rise in real terms in 2008, which reflects a combination of approximately flat nominal wages and price deflation. Additionally, the lack of downward wage changes was not due to compositional effects. Using the panel dimension of the CPS, the "Within-Worker Wages" series exhibits mildly rising wages for workers observed in the reference month and in the preceding year. As a whole, these results show no evidence of falling wages, even when employment was falling by 4.5 percent per year in mid-2009.

Our identification strategy exploits this downward wage rigidity and the fact that nearly every local market experienced declining labor demand in order to construct a measure of the relative magnitude of local demand shocks. As demonstrated in Figure 3, under these conditions demand shocks are observable directly from changes in local employment. Initially, the market wage w and employment L^0 are determined by the intersection of labor demand, D^0, and labor supply, S. The market then faces a decline in labor demand, represented by a leftward shift in the labor demand curve to D^1. Given downward rigid wages, employment falls to L^1 with the magnitude of the employment change determined entirely by the difference between $D^1(w)$ and $D^0(w)$, i.e. by the size of the horizontal shift in the demand curve.

Thus, with a negative labor demand shock and downward rigid wages, one can directly observe the size of the demand decline simply by comparing the quantity of employment

[6]We are grateful to Jesse Rothstein for making this series available to us.

before and after the shock. Because the wage floor is binding, this measure of declining labor demand does not depend in any way on the shape of the labor demand or labor supply curve. Moreover, even if the supply curve moves left following the shock as a result of labor migration, the demand decline will still be directly observable in employment as long as supply does not decline by more than demand does. This condition will almost certainly hold when all local markets face negative demand shocks, and widespread unemployment suggests that the supply of workers continued to exceed demand.

Given these observations, in the remainder of the paper we measure each city's demand shock as the proportional decline in observed payroll employment, and then examine how local labor supply responded to the depth of these observable decreases in labor demand. It is important to emphasize that this approach is appropriate only because of the particular features of the labor market during the Great Recession and would not be applicable in periods with increasing labor demand or with flexible wages.

2.2 Geographic Variation in Labor Demand Shocks

As shown in Figure 4, there was considerable geographic variation in the depth of the recession. The hardest-hit states (e.g. Nevada, Michigan, Florida) lost more than ten percent of employment from 2006-2010, while a few states (including North and South Dakota and Texas) experienced modest employment growth over the same period.[7] Our empirical specifications define a local labor market as a metropolitan area, and Figure 5 provides time series information on employment for the metro areas with the largest decline, largest increase, and the median change in employment over this same time period, showing substantial variation across cities.

Uncovering the sources of theses differences is an objective of ongoing research. Mian and

[7] These employment increases were sufficiently small relative to population growth that it is reasonable to treat them as very mild declines.

Sufi (2012) show that counties with higher average household debt-to-income ratios in 2006 experienced larger declines in household expenditure and hence larger employment declines, particularly in non-traded industries. Greenstone and Mas (2012) show that counties whose small businesses borrowed primarily from banks that cut lending following the financial crisis experienced larger employment declines, and Chodorow-Reich (2013) provides direct evidence that firms with greater exposure to troubled lending institutions experienced greater employment losses. Further, certain industries (notably construction and manufacturing) experienced especially large losses in employment, and these industries comprised different shares of local demand for labor across markets.

Our empirical strategy leverages the resulting geographic variation in the depth of the recession from these and other sources to identify effects of labor market strength on individuals' location choices. We therefore rely on the assumption that the severity of the local employment declines is uncorrelated with other *changes* in the value of living in particular labor markets that might influence location choices. We address this assumption directly by including a number of controls for changes in amenities and by subjecting the results to a pre-recession falsification test. The findings are also robust to instrumental variables strategies that isolate a particular portion of the geographic variation using either pre-recession local household leverage, following Mian and Sufi (2012), or an industry shift-share approach based on Bartik (1991).

2.3 Geographic Mobility 2006-2010

Throughout our analysis, we consider locational supply responses separately by sex, skill, and nativity. Table 1 provides one-year mobility rates calculated from questions in the ACS about where respondents lived in the previous year, and the reported numbers are average annual mobility rates throughout our study period (2006-2010).[8] Notably, every demographic and skill group experienced substantial mobility over this time period, which suggests that there is scope for the reallocation of labor across markets to diffuse local shocks. In all cases the more educated portion of each demographic group exhibits a higher mobility rate, and, not surprisingly, the foreign-born are more likely to have moved internationally. In general, natives are more likely to have moved within the U.S. across an MSA border.[9]

We stratify our analysis by nativity not only because immigrants are somewhat more mobile in general, but also because they are likely more motivated by labor market conditions when selecting a location; in section 5.2, we provide direct evidence that immigrants, and the Mexican-born in particular, are more likely to report moving for economic rather than personal reasons. Thus, the differences across groups in supply responses that we document below do not simply reflect differences in the likelihood of making a long-distance move. Rather, they represent differential responsiveness to economic conditions despite similar unconditional migration rates.[10]

3 Population Responses to Demand Shocks

3.1 Data Sources and Specifications

Our empirical strategy examines changes in a city's working age population (separately by sex, skill level, and nativity) as a function of the relevant demand shock as reflected in changes to payroll employment. Our dependent variable is the proportional change in the population

[8]Although geographic mobility has been declining in the US since around 1980, there is little evidence that the recession reduced rates further than a continuation of the trend would predict (Molloy et al. 2011).

[9]Moves that begin or end in an area that is not identifiable or not in an MSA are counted in these averages unless both the current and previous location are not in a valid MSA.

[10]One potential reason for this discrepancy is a differential preference for living in one's home state, which estimates from structural migration models imply are large(Kennan and Walker 2011), particularly among less-skilled workers (Diamond 2012).

of the relevant demographic group from 2006-2010, calculated from the American Community Survey (ACS).[11] Note that the ACS sample includes both authorized and unauthorized immigrants.[12] Our sample includes individuals aged 18-64, not currently enrolled in school, and not living in group quarters. Because we will examine tightly defined groups of workers, we limit our analysis to cities with a population of at least 100,000 adults meeting these sampling criteria. Additionally, we drop cities with fewer than 60 sampled Mexican-born individuals in 2006 and cities with any empty sample population cells (for any demographic group) in the 2006 or 2010 ACS. These city-level restrictions are imposed uniformly, resulting in a sample of 97 cities in every regression.[13]

Although we do not estimate a formal location choice model, both Borjas (2001) and Cadena (forthcoming) provide theoretical (discrete-choice-based) justifications for using linear models to examine proportional changes in supply as a function of changes in expected earnings.[14] Note that with rigid wages, the proportional change in expected earnings that a labor market offers (prior to any mobility) will be approximately equal to the proportional change in the number of jobs. We therefore use proportional changes in employment as our primary measure of local demand shocks, which we calculate using employment information from County Business Patterns (CBP) data.[15]

[11] We obtained the data from IPUMS (Ruggles, Alexander, Genadek, Goeken, Schroeder and Sobek 2010).

[12] Official Department of Homeland Security estimates of the unauthorized immigrant population of the U.S. are based on the discrepancy between ACS estimates of the immigrant population and records from ICE (Hoefer, Rytina and Baker 2012). In addition, using proportional changes as the dependent variable eliminates the influence of any consistent undercount among unauthorized migrants.

[13] We experimented with various city sample criteria including a restriction based only on overall population without any qualitative change in results.

[14] The linearity assumption allows for the value of fixed amenities to be differenced out, which avoids the incidental parameters problem.

[15] The metropolitan area definitions used in the ACS and the CBP are not entirely consistent, so we aggregate county-level employment information in the CBP data to match the definitions used in the ACS. Further, the MSAs in Connecticut do not coincide well with counties. We therefore treat the entire state of Connecticut as a single metropolitan area.

Our specification is thus:

$$\frac{Pop_c^{2010} - Pop_c^{2006}}{Pop_c^{2006}} = \beta_0 + \beta_1 \frac{Empl_c^{2010} - Empl_c^{2006}}{Empl_c^{2006}} + \epsilon_c \tag{1}$$

One concern with this basic specification is that overall employment changes understate the change in expected earnings for low-skilled and foreign-born workers, who were disproportionately represented in the hardest-hit industries.[16] Figure 6 shows that there was considerable variation in employment declines across industries, and Figure 7 shows that Mexican-born workers (the largest single group among the low-skilled foreign-born) were more concentrated in the types of jobs that experienced the largest declines. We therefore construct group-specific employment changes that account for these differing industrial compositions.[17] Note that the proportional change in city c's overall employment can be expressed as a weighted average of industry-specific (i) employment changes, with weights equal to the industry's share of total employment in the initial period.

$$\frac{Empl_c^{2010} - Empl_c^{2006}}{Empl_c^{2006}} = \sum_i \varphi_{ic}^{t_0} \frac{Empl_{ic}^{2010} - Empl_{ic}^{2006}}{Empl_{ic}^{2006}}$$

with

$$\varphi_{ic}^{t_0} \equiv \frac{Empl_{ic}^{t_0}}{\sum_j Empl_{jc}^{t_0}}$$

We then calculate the relevant change in employment for a given demographic group using $\varphi_{ic}^{t_0}$ industry shares that are specific to each group, rather than the shares for the local economy as a whole.[18]

[16] Orrenius and Zavodny (2010) find that Mexican-born workers are especially hard-hit by recessions due with likely explanations including their comparatively low levels of education and concentration within more cyclical industries.

[17] As expected, the results using employment declines that are not specific to nativity groups show even larger differences in responsiveness between natives and the foreign-born. Results using shocks that are calculated at the the (city x skill group) level are available in the online appendix.

[18] We estimate these shares at the group $\times$ city level by running a multinomial logit predicting a worker's

The primary advantage of the CBP is that it obtains data from the universe of establishments in covered industries. Unfortunately, the CBP data do not cover employment in agricultural production, private household services, or the government. In our preferred specifications, therefore, we fill in the missing changes in employment using (city x industry) calculations from the ACS.[19] The only remaining concern, therefore, is the informal sector. If the employment losses in the informal sector are similar (in proportional terms) to losses in the formal sector, the results will be unaffected. It is nevertheless possible that foreign-born workers face larger employment declines than our measure indicates. Given the substantial difference in the responsiveness of native and foreign-born individuals, however, this issue seems unlikely to drive the results.

Our preferred specification also weights each city to account for the heteroskedasticity inherent in measuring proportional population changes across labor markets of various sizes. We construct efficient weights based on the sampling distribution of population counts, accounting for individuals' ACS sampling weights.[20] In practice, nearly all of the cross-city variation in the optimal weights derives from differences in the 2006 population, and results from population-weighted specifications are quite similar.[21] Additionally, unweighted specifications produce qualitatively similar results in most specifications, particularly for the native-born and Mexican-born low-skilled workers that we focus on.[22]

industry based on his/her location and demographic group using data from the 2005 and 2006 ACS. This approach addresses the relatively small cell sizes for some demographic groups. Details of this estimation, which also accounts for the racial and ethnic composition of native-born workers, are available in section A.1 in the appendix. Note that ignoring small cell sizes using simple shares from the ACS yields similar results. The 2000 Census would provide a larger sample size, but there were substantial changes in the industry distribution of employment between 2000 and 2006, particularly for foreign-born workers, so we did not pursue this approach.

[19]The results are qualitatively similar (although somewhat attenuated) when we instead treat these employment changes as missing. Additionally, we obtain similar results when using only the ACS to calculate employment changes at the city-industry level. Details of these alternative demand shock measures are available in the online appendix.

[20]Further details of this procedure are available in the appendix in section A.3

[21]These results are available in the online appendix.

[22]For demographic and skill groups with some very small cells (e.g. high-skilled Mexican-born workers and low-skilled non-Mexican immigrants), the weighted and unweighted results differ. In each of these cases,

A final potentially important interpretation issue stems from the assumption that changes in labor demand are reflected entirely in changes in employment rather than in changes to wages. While the data largely support this assumption, as discussed above, it remains possible that there is some correlation between employment changes and wage changes. If the two are positively correlated, then our analysis overstates the independent effect of employment on population changes. If employment and wage changes are negatively correlated, these specifications will instead understate the independent effect of employment. However, our primary interest is the *difference in elasticities across demographic groups* rather than the *level* of the effect per se. We see no reason to expect substantially different relationships between wages and employment for workers of different demographic backgrounds conditional on the same sex and skill level.[23] Thus, while wage changes may result in overstatement or understatement of the independent effect of employment on location choices, this potential bias should be similar across demographic groups, and cross-group comparisons remain valid.

3.2 Geographic Labor Supply Elasticities by Demographic Group

Table 2 provides estimated elasticities based on Equation 1 for groups defined by skill, sex, and nativity.[24] Each coefficient in the table comes from a separate regression, with the change in employment constructed separately for each worker type. The first column shows results for groups defined only by sex and education. The second and third columns report estimated elasticities separately for native-born and foreign-born populations. The first notable result is the distinct skill gradient in responsiveness. Within each nativity group, workers with at

the efficiency-motivated weighting reduces the estimated standard errors, which suggests that the weighted estimates are preferable. A complete set of unweighted results is available in the online appendix.

[23]In fact, we have examined the time series of wages separately for native-born and Mexican-born workers (similar to Figure 2), and we find no appreciable difference in the degree to which wages were downward rigid.

[24]Throughout the analysis, we group together workers without a high school degree and high school graduates. Evidence suggests that these two groups are nearly perfect substitutes, although workers with a degree represent more effective units of labor (Card 2009).

least some college education are much more responsive than are workers with at most a high school degree. As an example, for native-born men or women with at least some college, a ten percent relative increase in employment leads to between a four and six percent increase in the size of a city's local population with that education level. In contrast, the results for natives with at most a high school degree exhibit much smaller point estimates that cannot be statistically distinguished from zero.

There are also substantial differences among skill groups by nativity, with the foreign-born consistently more responsive than the native-born.[25] Most notably, the results for less skilled foreign-born workers are in stark contrast to those for native-born workers; these elasticities for low-skilled immigrants are of a similar magnitude to those of high-skilled natives and are strongly statistically significant.

The fourth and fifth columns of Table 2 show the results of estimating our primary specification using population and employment changes calculated separately for Mexican-born immigrants and for those from all other source countries. These estimates reveal that the large supply response among low-skilled foreign-born individuals is driven almost entirely by immigrants from Mexico.[26] In fact, the elasticity of Mexican-born population with respect to employment exceeds that of the highly responsive high-skilled native workers for both men and women. Additional testing reveals that the Mexican-born elasticities are statistically significantly different from both natives (p=0.008) and other immigrants (p=0.020) in the male subsamples.[27]

[25] This difference likely results in part from the fact that most immigrants with a college-level education are in the U.S. on an employment-based visa. Firms in places with higher relative demand almost surely apply for a disproportionate share of these visas, which will lead directly to a reallocation of high-skilled immigrants toward these cities. This dynamic among newly arriving immigrants, however, is of diminished importance when examining population changes over such a short time horizon.

[26] In additional analysis (not shown), we examined these elasticities separately for even less aggregated groups of natives and immigrants. For natives, we found no economically or statistically significant differences across races. For immigrants, we found no statistical evidence of a strong population response for any group other than the Mexican-born, although the elasticities for smaller immigrant groups were measured with fairly large standard errors.

[27] The female regression coefficients are more similar, with p-values of 0.08 and 0.83, respectively.

These results confirm the well-established empirical regularity that highly-skilled natives respond much more strongly to geographic variation in local labor demand than do less-skilled individuals. The fact that less-skilled Mexican-born immigrants respond so strongly is, to our knowledge, a novel finding. We therefore spend the remainder of the paper examining this result and its implications in detail.

3.3 Robustness of the Mexican-Native Elasticity Difference

Figure 8 shows the data underlying the results for low-skilled men, both native-born and Mexican-born. These scatter plots show that the relationships summarized in the regression results are not driven by any particular set of cities and appear to hold broadly throughout the country. In addition, the value of the optimal weighting scheme is readily apparent, as outlier cities in the figures are those with *ex ante* higher sampling variance in population changes. Finally, this figure provides a reminder that the positive elasticity is identified primarily by *less negative* changes to employment, with the Mexican-born population shifting from the hardest-hit cities to those with relatively milder downturns.

In order to interpret these results as evidence that the recession caused the reallocation of less skilled Mexican-born workers around the U.S., we consider a variety of robustness tests. First, we rule out other determinants of location choice that may be correlated with local changes in demand. Column (1) of Table 3 reproduces the baseline response of low-skilled Mexican-born men. In Column (2) we control for the Mexican-born share of each city's population in 2000 to account for the potential decline in the value of traditional enclaves discussed by Card and Lewis (2007).[28] Columns (3) and (4) add indicators for cities in states that enacted anti-immigrant employment legislation or new 287(g) agreements allowing local officials to enforce federal immigration law, based on the immigration policy database in

[28] Recall that the dependent variable is measured as the within-city change, which implies that this control allows for differential growth trends based on a city's traditional enclave status.

Bohn and Santillano (2012).[29] In Column (4), all of these controls enter with a negative sign, as expected. Also, while the addition of the controls reduces the magnitude of the geographic elasticity slightly, it increases the estimate's precision as well. Table 4 provides results analogous to column (4) of Table 3 for all nativity, skill, and gender groups. The results show that the pattern of elasticities identified in Table 2 remains, and the difference in response between low-skilled natives and Mexicans is still statistically significant (p-value of 0.013).[30]

Although the Mexican-born elasticity is robust to the controls just mentioned, it remains possible that unobserved factors other than local demand changes contributed to the observed relationship. We use a false experiment approach to rule out persistent unobserved factors by regressing pre-recession (2000-2006) population changes on the demand shocks from 2006-2010. Other than the change in the timing for the dependent variable, these specifications are identical to the main analysis. Figure 9 shows this falsification test for low-skilled Mexican-born and native-born men.[31] For both groups, we find a negative relationship. Thus, if anything, the large population responses among the Mexican-born in the latter half of the decade represent a reversal of pre-recession trends. These findings rule out the hypothesis that low-skilled Mexican-born workers were coincidentally leaving the cities that would be hardest-hit during the recession even before it began, and further emphasize the stark differences in mobility between low-skilled Mexican-born and native-born workers.[32]

[29]Perhaps the most notable of these types of policies was the Legal Arizona Workers' Act, which required employers to participate in the federal E-Verify program. This program, which had previously been optional, led to a decline in the foreign-born population of Arizona relative to other states (Bohn, Lofstrom and Raphael forthcoming). These policy controls also account for the possibility that unauthorized immigrant under-count rates in the ACS changed in response to anti-immigrant legislation.

[30]We may be overcontrolling by including the policy indicators, since a deep local recession may increase anti-immigrant sentiment. If so, we conservatively bias the results away from finding the observed differences between natives and Mexicans.

[31]The full sets of falsification results with and without controls are available in Appendix Table A-1.

[32]Note that cities facing larger employment *declines* during the Great Recession on average experienced larger employment *increases* during the pre-recession period. Thus, the negative relationship for Mexicans

A final possibility is reverse causality, in which unmeasured factors drive population changes, and these population changes result in changes in employment, either through decreasing product demand or by mechanically reducing the number of workers. We address this issue in two ways. First, we note that this mechanism would apply to all demographic and nativity groups. Thus, this alternative interpretation cannot explain the lack of a relationship between *native* population changes and employment changes, which exists despite substantial cross-city mobility (see Table 1). Moreover, since Mexicans often remit a substantial portion of their income rather than spending it locally, reverse causality through the demand channel would be stronger for natives and would bias the difference in elasticities in the opposite direction of the observed gap.

Second, we use two separate instrumental variables for employment changes that are plausibly exogenous to counterfactual population growth and that strongly relate to changes in local employment through well-understood economic mechanisms. The first instrument is the standard "Bartik instrument" (Bartik 1991), which predicts changes in local labor demand by assuming that national employment changes in each industry are allocated proportionately across cities, based on each city's initial industry composition of employment.[33] We calculate the instrument as

$$\eta_c = \sum_i \varphi_{ic}^{t_0} \frac{Empl_i^{2010} - Empl_i^{2006}}{Empl_i^{2006}}, \tag{2}$$

where $\varphi_{ic}^{t_0}$ is the fraction of city c employment in industry i in 2006, and $Empl_i^t$ is national industry i employment in year t.

The results when using η_c as an instrument for the local employment decline are pre-

in Figure 9 is consistent with the idea that Mexican workers respond to local labor market conditions during expansions as well.

[33]Other examples of the Bartik instrument appear in Bound and Holzer (2000), Blanchard and Katz (1992), Autor and Duggan (2003), Wozniak (2010), Notowidigdo (2013), and Charles, Hurst and Notowidigdo (2013).

sented in Table 5; these specifications also include the controls introduced in Table 3. We report first-stage coefficients on the instrument and partial F Statistics along with the IV elasticity estimates. Although the instrument is identical in all cases, the first-stage coefficients differ based on how well the Bartik measure predicts each group-specific employment decline. With the exception of highly skilled native women, we do not appear to face a weak instrument problem, and the first stage coefficients are similar in magnitude to those in the prior literature.[34] The IV elasticity estimates are similar to the OLS results and exhibit an even larger difference in responsiveness between less skilled natives and Mexicans, though the estimates are less precise.[35] Thus, our conclusions regarding strong responsiveness of less skilled Mexican immigrants and essentially no response among less skilled natives are supported when using this standard method of isolating demand shocks.

The second instrument is based on Mian and Sufi's (2012) finding that counties with more highly leveraged households experienced larger employment losses during the Great Recession. Importantly, they find that these employment losses were concentrated in industries providing goods and services locally, suggesting that the tightening of credit during the financial crisis led to a decline in consumer demand, and that this decline was largest among households that were more indebted.[36] This variable therefore isolates a portion of the geographic variation in employment changes that occurred as a result of changes in local demand through identifiable economic mechanisms related to the financial and housing

[34]Stock and Yogo (2005) report that a first-stage F statistic greater than 8.96 is sufficient to reject the null hypothesis that the actual size of a 5 percent test is greater than 15 percent.

[35]The significantly negative elasticity for less skilled non-Mexican immigrants is puzzling, though we note that in the pre-recession period, as shown in Appendix Table A-1, this population was already shifting away from cities that would experience weaker recession-era demand shocks. The negative result may therefore simply reflect the continuation of an ongoing trend.

[36]Mian and Sufi (2011) identify several mechanisms through which household leverage drove declining demand. Indebted households became less able to roll over their debt and were thus forced to spend a greater share of their incomes on debt service rather than consumption. Households in cities with higher average leverage had a large share of their debts in mortgages, and many may have treated the annual increase in home value as "income," which disappeared during the crisis. Finally, some households may have decided that their previous levels of consumption were unsustainable and decided to find a new equilibrium spending path.

crises.

We construct the household leverage ratio analogously to Mian and Sufi (2012), aggregating MSA-level variables from county-level information provided by Equifax (total household debt) and the Internal Revenue Service (total income).[37] Table 6 presents the results of these specifications, which also include the controls introduced in Table 3. On the whole, the results are quite consistent with the OLS results in Table 4. The pattern of elasticities continues to show strong differences by skill level, and among the low-skilled, only the Mexican-born population responds significantly to changes in local labor demand.[38]

The consistency of the OLS results with the IV results using each instrument suggests that the OLS specifications are unlikely to be contaminated by remaining omitted variables or simultaneity. In fact, they provide strong support to the interpretation that employment declines are an effective measure of demand shocks in this time period. Overall, the wide variety of robustness tests presented in this section confirm the sharp differences in the responsiveness of less skilled natives and Mexican immigrants to local labor demand shocks.

4 Mexican Mobility Smooths Employment Outcomes

The previous section provides robust evidence that Mexican-born workers leave labor markets experiencing larger labor demand declines in favor of markets facing smaller declines. This mobility will tend to equalize labor market outcomes across cities for these workers. Further, to the extent that Mexican-born workers compete with similarly skilled native-born

[37] Mian and Sufi (2012) provide more detail on the data sources. The Equifax data are available through the Federal Reserve Bank of New York. Our restriction to large MSAs avoids the concern that only a portion of the counties used in the original paper are publicly available, as the restricted data are for counties with small populations.

[38] One potential caveat to keep in mind is that the exclusion restriction may not hold if pre-recession indebtedness led to foreclosures and neighborhood blight that was orthogonal to resulting declines in labor demand and this resulted in out-migration. While this phenomenon could bias the IV estimates positively, it does not seem likely to be a quantitatively important effect. Moreover, we see no reason why this consideration should apply differently across nativity groups.

workers, the earnings-sensitive mobility of the Mexican-born will also serve to arbitrage away geographic differences in labor market outcomes for less mobile natives (and non-Mexican immigrants). In this section, we use a simple framework to quantify this smoothing effect in the context of the Great Recession.

We define smoothing as the degree to which migration equalized workers' expected earnings across space. Given rigid wages, proportional changes in expected earnings coincide with proportional changes in the probability of being employed, $d\ln\left(Pr(emp)_c * E[w_c|emp]\right) = d\ln Pr(emp)_c$. Assuming that the employment probability is reflected in the employment to population ratio, $epop_c$, one can measure the degree of smoothing based on the observed relationship between local changes in the employment to population ratio ($d\ln epop_c$) and the local demand shock ($d\ln L_c$). In the absence of any offsetting supply response, the labor demand decline in each city will be completely reflected in the local change in $epop_c$. In contrast, if earnings-sensitive migration is sufficient to equilibrate employment probabilities across cities, then there will be no relationship between the local change in $epop_c$ and the local demand shock.

To formalize this intuition, note that

$$d\ln epop_c = d\ln L_c - d\ln N_c, \tag{3}$$

where L is employment and N is population. One can therefore quantify the degree to which local labor markets are integrated across space by examining the relationship between local changes in $epop_c$ and the local demand shock in the following linear specification.

$$d\ln epop_c = \beta_0 + \beta_1 d\ln L_c + \epsilon_c \tag{4}$$

By omitting $d\ln N_c$ from this expression, $\hat{\beta}_1$ captures both the direct and indirect effects of declining labor demand. In particular,

$$\text{plim } \hat{\beta}_1 = \frac{\text{cov}(d\ln L_c,\ d\ln epop_c)}{\text{var}(d\ln L_c)}. \tag{5}$$

Plugging in the definition of $d\ln epop_c$ in which ν_c represents random sampling error that is uncorrelated with $d\ln L_c$,

$$\text{plim } \hat{\beta}_1 = \frac{\text{cov}(d\ln L_c,\ d\ln L_c - d\ln N_c + \nu_c)}{\text{var}(d\ln L_c)} = 1 - \frac{\text{cov}(d\ln L_c,\ d\ln N_c)}{\text{var}(d\ln L_c)}. \tag{6}$$

This expression makes clear that labor demand shocks have a proportional direct effect on local changes in $epop_c$, but that the observed effect may be mitigated by equalizing migration reflected in a positive correlation between $d\ln L_c$ and $d\ln N_c$.

Thus, $\hat{\beta}_1$ equals 1 without equalizing mobility and is less than 1 when mobility arbitrages away differences across cities. However, because we only observe industry-level employment changes, we can only approximate the employment losses incident on low-skilled workers, and it is likely that this measurement error will tend to attenuate the estimated coefficient.[39] We therefore mitigate the effects of measurement error by focusing on relative differences in coefficients rather than their absolute levels when evaluating the degree of smoothing.

We measure the smoothing effect of Mexican mobility by dividing our sample of cities into those above and below the median Mexican-born share of the low-skilled population.[40] Cities with few Mexican immigrants have little scope for outmigration in response to a larger-than-average demand decline. Further, when selecting a new location, Mexican movers tend

[39] If $d\ln L_c$ is measured with additive classical error given by η_c, then the entire expression on the right hand side of (6) is multiplied by

$$\frac{\text{var}(d\ln L_c)}{\text{var}(d\ln L_c) + \text{var}(\eta_c)} \in (0,1).$$

[40] Among the 97 cities in our sample, there is a great deal of variation in the share of the low-skilled population that is Mexican-born. Values range from just over one percent in cities like St. Louis and Miami to more than 40 percent in parts of Texas and California.

to choose cities with higher Mexican-born populations, either because these populations themselves are a direct amenity or because they proxy for unobserved amenities especially valued by the Mexican-born. Therefore, native employment probabilities in cities with many Mexicans should be less strongly related to labor demand shocks than are those in cities with few Mexicans, which do not have access to equalizing Mexican mobility.

To examine this hypothesis, we estimate a version of Equation (4) separately for cities with above- and below-median Mexican-born populations shares (among low-skilled men) in 2006.[41] We use the overall male low-skilled employment decline as the independent variable and the *native* employment to population ratio as the dependent variable. Importantly, the only mechanism through which Mexican mobility can affect this ratio is by altering the numerator, i.e. by changing the probability that native workers are employed.[42]

Figure 10 provides a visual representation of the results of these regressions. The slope of the fitted line for the below-median cities (black circles) is +0.58, while the slope of the fitted line for above-median cities (gray triangles) is +0.31. An interaction model reveals that these slopes are statistically significantly different ($p = 0.004$).[43] We also ran parallel analyses instrumenting for the employment changes using each of the instruments described in section 3.3. The results are similar across all specifications: the above-median cities have a slope that is 35-50 percent lower than that in the below-median cities. These results thus directly confirm the important role of Mexican immigrants in diffusing the influence of local

[41] The median Mexican-born share is roughly 15 percent. Sacramento has the highest share below the median and Omaha has the lowest share above.

[42] One potential concern with this interpretation is that a larger population share of the Mexican-born could also reduce the incidence of demand shocks if employers laid off Mexican workers first. To address this concern, we ran versions of this specification using overall employment to population ratios, and the results are nearly identical. This similarity suggests that, at least during the downturn, Mexican immigrants and native-born workers experienced similar changes in local employment probability within industry.

[43] We were concerned that the relatively small sample size (49 cities in each subsample) may lead to influential outliers. To address this problem, we estimated this relationship using local linear regressions, and the estimated slopes are quite similar for cities experiencing negative demand shocks. We were also concerned that the above-/below-median cut was too coarse, so we estimated this relationship separately by quartiles of pre-recession Mexican share. The pattern of results reveals negligible differences between the first and second quartiles and between the third and fourth quartiles, supporting the median split.

demand shocks across the national labor market.[44]

The fact that natives in cities with fewer Mexicans experienced employment outcomes that were more closely tied to their local demand shock raises the question of whether native populations in these cities responded more strongly than populations in cities with more Mexicans. We estimated the elasticities of the less skilled native male population separately for above- and below-median cities and found nearly identical point estimates (both below 0.1) that were not statistically different from each other. Thus, there is no evidence that the lack of native population response is a *consequence* of more elastic responses among the Mexican-born. Instead, these results reinforce the previous literature's finding of a lack of geographic responsiveness to local demand shocks among native-born low-skilled workers. In this context, the value of the geographic reallocation of the Mexican-born, which reduced the incidence of local demand shocks on local employment rates by nearly 50 percent, becomes even more apparent.

5 Extensions and Discussion

Given the central importance of the Mexican-born in smoothing labor market outcomes, in this section we study the mechanisms through which the population adjusted to shocks and investigate some hypotheses for why Mexicans respond so much more strongly than similarly skilled natives.

5.1 Channels of Population Adjustment

A city's Mexican-born population can change through the following channels:

[44]We additionally implemented a similar analysis for highly skilled workers. The relationship between employment probabilities and labor demand shocks was even weaker in the highly skilled market, with a slope estimate of 0.25, reflecting the high level of mobility among all highly skilled workers. Moreover, in contrast to the less skilled case there was no difference in the relationship across cities with above and below median Mexican population share, since highly skilled natives and Mexicans are similarly mobile.

- C^1: Mexicans arriving from abroad after 2006
- C^2: Cross-city movement of Mexicans who were residing in the country in 2006
- C^3: Previously resident Mexicans leaving the country
- C^4: Resident Mexicans who age in to or out of the sample
- C^5: Resident Mexicans who enter or leave the sample due to a change in schooling status

Index each channel by $\kappa = 1...5$. By definition,

$$PopMex_c^{2010} - PopMex_c^{2006} = \sum_{\kappa} C_c^{\kappa} \tag{7}$$

Given that the channels sum to the overall population change, one can decompose the overall response given by β_1 in (1) into components contributed by each channel by estimating

$$\frac{C_c^{\kappa}}{PopMex_c^{2006}} = \beta_0^{\kappa} + \beta_1^{\kappa} \frac{Empl_c^{2010} - Empl_c^{2006}}{Empl_c^{2006}} + \epsilon_c^{\kappa} \qquad \forall \kappa, \tag{8}$$

Since $\beta_1 = \sum_{\kappa} \beta_1^{\kappa}$, given estimates $\hat{\beta}_1^{\kappa}$, one can separate the overall shift in Mexicans location choices in response to local demand shocks into the portion occurring through each channel as $\hat{\beta}_1^{\kappa}/\hat{\beta}_1$.

Channel C^1 is directly observable in the ACS. All immigrants are asked their arrival year in every wave of the survey, and we can therefore estimate the number of Mexicans resident in each city who arrived before and after 2007. We partition the total change in the following way for each city (suppressing city subscripts):

$$PopMex^{2010} - PopMex^{2006} = PopMex_{new}^{2010} + (PopMex_{pre-2007}^{2010} - PopMex_{pre-2007}^{2006}). \tag{9}$$

In words, the change in the Mexican-born population consists of the number of immigrants who arrived in 2007 or later plus the change in the number of immigrants who arrived in the U.S. in 2006 or earlier. Notice that $PopMex^{2006}_{pre-2007}$ is simply the resident population in 2006 by definition. Given this breakdown, we can separately measure C^1 and the sum of C^2 through C^5.

Column (1) of Table 7 reproduces the result in column (1) of Table 3. The next two columns of Table 7 decompose that estimate into estimates of β_1^1 and $(\beta_1^2 + \beta_1^3 + \beta_1^4 + \beta_1^5)$. The coefficient in column (2) implies that 17 percent of the reallocation $(\frac{0.13}{0.76})$ occurred through differential inflows of new immigrants in response to differential demand shocks.[45] Note that fewer than 17 percent of Mexican-born immigrants living in the US in 2010 arrived over the preceding five years; thus these new arrivals are doing more than their "fair share" of the reallocation.[46] It is likely that during periods with larger immigration inflows, this channel would account for a larger share of overall adjustment, but net migration inflows slowed considerably over this period, and were essentially zero by the end of the decade (Passel, Cohn and Gonzalez-Barrera 2012). The remaining 83 percent of the reallocation occurred through channels C^2-C^5, and this aggregate effect is reflected in the coefficient in column (3) from a regression of the proportional change in pre-2007 arrivals on the employment shocks. The role of migration among previous arrivals is an important finding, as the majority of the previous literature focuses only on earnings maximizing location choices among newly arriving immigrants and neglects the channels captured in Column (3). Column (4) provides a direct estimate of the contribution of C^4 (net aging in) based on the number of individuals who are likely to have aged in and out of each city's sample, and the results imply that the contribution of this channel is negligible.[47] Although C^5 is not directly observable in the

[45] This sorting could have occurred through a given set of new arrivals choosing to go to alternate cities, by differential entry of potential migrants who would have targeted different cities, or through a combination thereof.

[46] This clustering of low-skilled new arrivals in high demand areas complements Kerr's (2010) finding that U.S. cities with relative increases in innovation (measured by patenting rates) from 1995-2004 increase the immigrant share of their inventors while cities with declining relative innovation experience a disproportionate decline in immigrant invention.

[47] People between the ages of 18 and 21 in 2010 who arrived prior to 2007 are assumed to have aged in. Individuals 61-64 in 2006 are assumed to age out.

ACS, it also likely contributes a negligible amount of the total.

Based on this decomposition, therefore, most of the reallocation occurred through migration among those who were resident in the country in 2006, either internally within the United States or by leaving the country (channels C^2 and C^3). There are, to our knowledge, no available data sources that allow reliable measurement of return migration flows to Mexico separately by US city during this time period.[48] In addition, the ACS asks respondents only about internal movement over the past year; the five year mobility question, standard in the decennial census, does not appear in the ACS. Thus, it is not possible to decompose the pre-2007 Mexican-born observations in the 2010 ACS into those who lived in the city in 2006 and those who lived in another US location. Nevertheless, one can construct a noisy estimate of internal net migration by aggregating internal inflows and outflows from each annual ACS survey. The regression in column (5) is based on this technique, and it reveals that measured internal migration can explain 25 percent of the reallocation of pre-2007 arrivals. Given the imprecise construction of the internal migration measure, however, this estimate is likely biased toward zero, so one cannot attribute the entire remainder to return migration. Nevertheless, it is clear that both migration internal to the US and return migration to Mexico contributed substantially to the overall local supply elasticity.

5.2 Why are the Mexican-Born More Responsive?

The preceding results establish that, on average, less-skilled Mexican-born workers were more responsive to labor market conditions than were natives during the Great Recession. We next consider the factors that may have led to this difference in elasticities. Recall from Table

[48]The Mexican Decennial Census, intercensal counts, and the Mexican National Survey of Employment and Occupation (ENOE) do not include sub-national geographic information for return migration sources in the U.S. The National Survey of Demographic Dynamics (ENADID) only includes U.S. state information and does not allow one to isolate return migration between 2006 and 2010. Finally, the Northern Border Migration Survey (EMIF) uses non-standard sampling procedures that raise questions of representativeness and interpretation.

1 that the Mexican-born are only slightly more mobile in unconditional terms than are their native-born low-skill counterparts. We first consider whether differences in demographic characteristics are driving the differential responses to employment opportunities. Table 8 presents results from a propensity score reweighting approach that examines mobility among the native-born population with demographics similar to the Mexican-born. We begin by running separate probit regressions in which we predict Mexican-born status based on either age, marital status, detailed educational attainment, home ownership, or all of these factors together. We then use the resulting propensity score weights to calculate city-level populations and industry shares (to calculate the relevant employment changes) using native workers whose observable characteristics, on average, match those of the Mexican-born. We then repeat our main analysis for this reweighted group of natives. The results of this methodology for low-skilled natives are shown in columns (1)-(5) of the table, with the baseline results for the Mexican-born and native-born samples provided for reference. Even after making these adjustments, we find no evidence that natives move toward cities with better job prospects. Thus, differences in these observable factors between natives and Mexicans cannot explain the groups' differences in geographic responsiveness.

Given that the Mexican-born are not substantially more likely than natives to move in general, Mexicans must be more likely to move for reasons related to labor market conditions. Table 9 provides direct evidence of this fact. The March supplement to the Current Population Survey asks those who have recently moved to a residence why they did so. This table compiles the stated reasons for moving among men ages 18-64 with at most a high school degree who have moved across county lines in the past year. Although all three demographic groups (natives, Mexican immigrants, and other immigrants) report similar rates of moving for a new job, the Mexican-born are especially likely to report moving to look for work or because they lost a previous job. In fact, among all possible answers, this category is the most common response among the Mexican-born (23.6 percent).[49] This descriptive evidence suggests that Mexican immigrants are much more likely to consider the strength of a local labor market when making a location decision.

A natural remaining question is what other factors motivate less skilled natives' cross-city moves and why differences in labor market conditions are of relatively little importance. One prime candidate is the substantial home bias that has been identified in the literature (Diamond 2012, Kennan and Walker 2011). In fact, over our study period, nearly half (47 percent) of all cross-city moves by low-skilled natives had the mover's state of birth as the destination. Further, this substantial likelihood of selecting a city in one's home state does not simply reflect a generally higher prevalence of within state moves. Of those beginning in a state other than their state of birth, only one third moved to a different city within the same state. Among those beginning from a city in their home state, in contrast, roughly two thirds chose another city in the same state.[50] Although not conclusive, these calculations suggest that much of the substantial cross-city mobility occurs for reasons related to family or other amenities of one's home state rather than for employment conditions.

In addition to having self-selected out of living near one's place of birth, there are several other reasons why Mexican immigrants may be especially responsive to differences in earnings prospects. First, they are less likely to be eligible for Unemployment Insurance (UI) and other social safety net programs, the existence of which tends to reduce geographic differences in total income (Tatsiramos 2009). More than half of Mexican-born immigrants are in the US without authorization (Passel 2005), and thus are ineligible for UI benefits.[51] Figure

[49] These numbers include individuals arriving from abroad. Nearly two thirds of Mexican-born arrivals from abroad report one of the bolded job related reasons. Among internal migrants, the Mexican-born are still twice as likely to report moving to look for work or because of a lost job as are natives or other immigrants.

[50] All of the calculations mentioned in this paragraph are based on the same sample used for Table 1.

[51] A worker who was using false documentation rather than being paid under the table may be able to make a claim by continuing to claim the previous identity as long as there are not other workers continuing to receive covered wages under the same social security number. This type of fraudulent claim, however, is certainly more difficult than the claiming process for a former employee who had legal authorization.

11 shows UI participation rates by nativity groups for low-skilled men among those who had a spell of unemployment in the previous year.[52] In all time periods, the foreign-born are substantially less likely to receive benefits, which implies that immigrants' total incomes are more dependent on their labor market earnings. There are not, however, substantial differences in claiming behavior between the Mexican-born and immigrants from other source countries.

Mexican-born immigrants may be especially likely to make an earnings-maximizing move because they have strong attachment to the labor market. In particular, many Mexican immigrants report moving to the U.S. intending a relatively short stay, often planning to work until having saved a particular amount of money to invest back in Mexico (Massey, Durand and Malone 2003). Additionally, Massey et al. (2003) describe the decision for some individuals to migrate to the U.S. from Mexico as part of a larger household's diversification of human capital across labor markets. Workers with either of these types of motivations will find extended periods of unemployment especially costly and may therefore be more willing to relocate in order to find new employment more quickly. Figure 12 presents time-series evidence on unemployment duration consistent with this hypothesis. Although unemployment durations rise for all groups during the recession, Mexican-born workers have markedly shorter unemployment durations in all time periods, consistent with a broader or more intense job search in order to find new employment sooner after losing a job.

Finally, the Mexican-born have access to particularly robust networks and a diffuse set of enclaves. In particular, there are nontrivial Mexican-born populations in many more of the nation's labor markets than there are for any other immigrant source country. Several studies have found that immigrants tend to locate in markets with previous migrants from the same source country, and the Mexican-born population has continued to spread out geographically

[52]The patterns across groups for high-skilled men are broadly similar, although the high-skilled are less likely to claim benefits in general.

over the previous two decades.[53] Further, networks lower moving costs and increase the probability that a move across labor markets will result in a favorable employment outcome (Munshi 2003).

In sum, while we are unable to explain with certainty the sources of the higher responsiveness among the Mexican-born, the available evidence implies that they are so responsive because they have particularly strong labor market motivations and the informational and informal financial resources necessary to make earnings-maximizing location decisions. Relative to natives, they also have less access to other programs such as unemployment insurance that make remaining in a weak labor market less costly.

6 Conclusion

This paper has demonstrated that low-skilled Mexican-born workers' location choices responded very strongly to the geographic variation in labor demand generated by the Great Recession. This behavior is in sharp contrast to low-skilled native-born workers who show little response, and their elasticity even exceeds that of highly skilled natives. Further, the reallocation of Mexican immigrants reduced the variation in employment outcomes for natives living in cities with substantial Mexican-born share. This novel finding represents economically significant behavior, and it is quite robust to a number of alternative interpretations.

The high degree of mobility among low-skilled Mexican-born individuals has a number of important implications. First, Mexican immigrants comprise an increasing share of the less skilled labor force, and their growing presence has raised this group's average geographic supply elasticity substantially. The rising share of the Mexican-born among the low-skilled therefore at least partially mitigates concerns that the relative lack of mobility among less

[53]The importance of ethnic enclaves was first shown by Bartel (1989). Card and Lewis (2007), among others, document the recent diffusion beginning in the 1990s.

skilled workers leads to large disparities in these workers' wages across local labor markets (Bound and Holzer 2000). As U.S. policy makers seek ways to normalize the status of unauthorized workers and put in place legal channels for less skilled temporary migrant workers, they should consider the geographic flexibility immigrants provide labor markets when they are free to change locations and employers in response to changing demand conditions.

Second, this paper provides evidence that immigration inflows respond to demand conditions, and it suggests that immigrants continue to alter their locations in response to labor demand after residing in the country for some time. Although we are unable to precisely disentangle the contributions of internal migration and return migration to Mexico, the evidence shows that both channels are important and that a substantial share of the geographic reallocation occurred among previously resident immigrants. This additional layer of responsiveness is an understudied phenomenon, and it deserves continued research.

Finally, these findings support previous evidence showing that immigrants' location choices respond to exogenous changes in labor market conditions (Cadena forthcoming, Cadena 2010), potentially confounding research designs relying on geographic variation in immigration inflows to identify immigrants' effects on natives. A further examination of the methods used to overcome this empirical challenge is likely warranted given the growing body of evidence favoring endogenous immigrant inflows.

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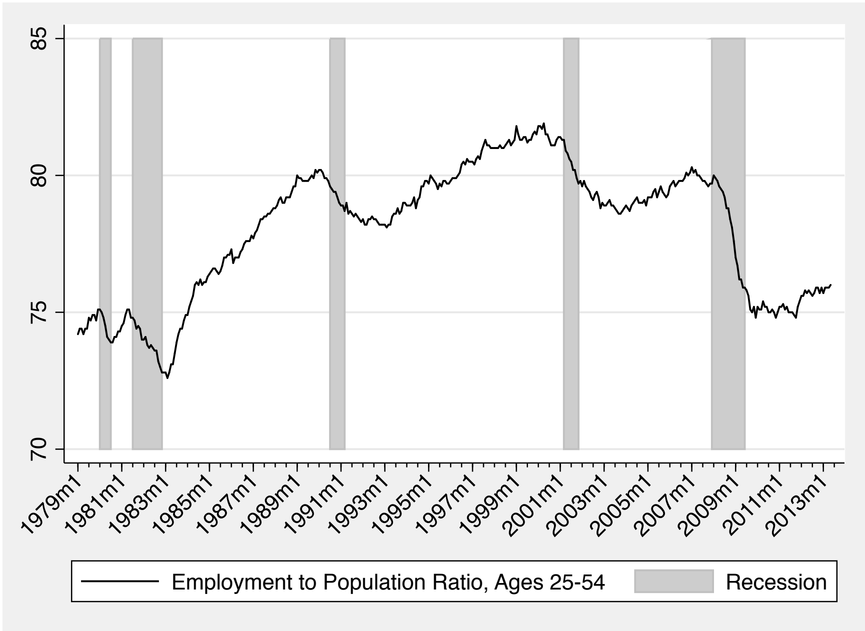
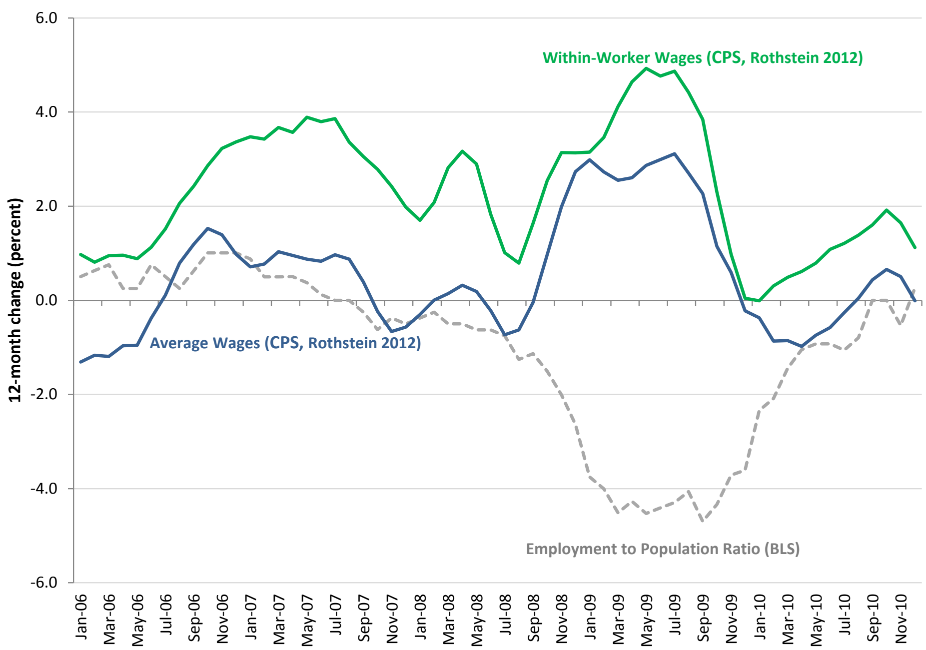
Figure 1: Time Series of National Employment to Population Ratio, Ages 25-54, 1979-2013



Sources: Bureau of Labor Statistics and National Bureau of Economic Research.

Figure 2: Time Series of Wages and Employment, 2006-2010



Sources: Authors' calculations from Bureau of Labor Statistics data; Rothstein (2012).

Figure 3: Demand Shocks with Rigid Wages

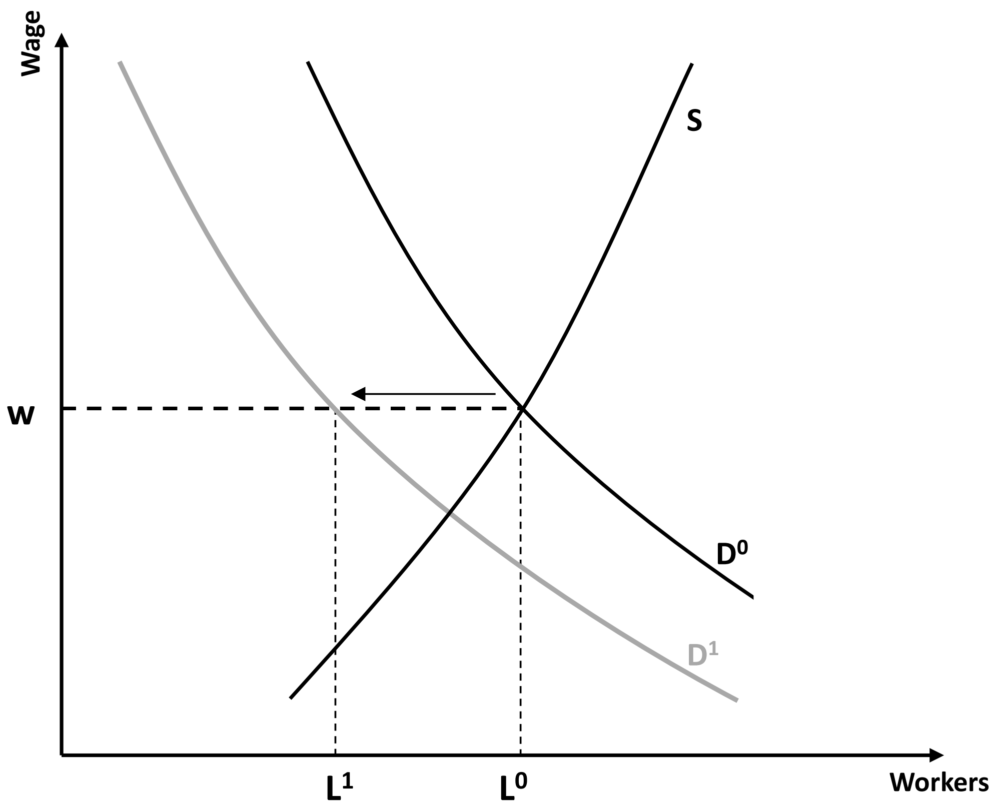
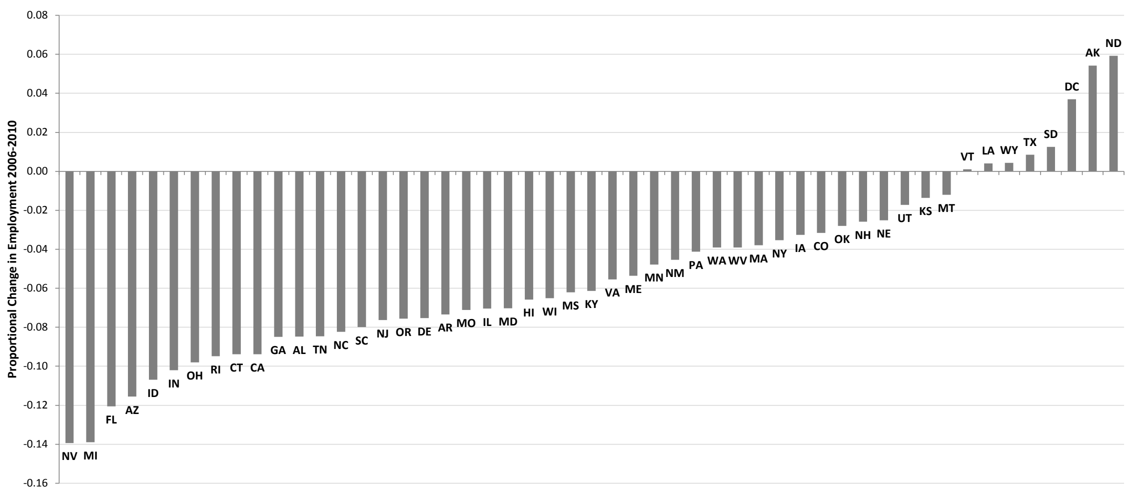
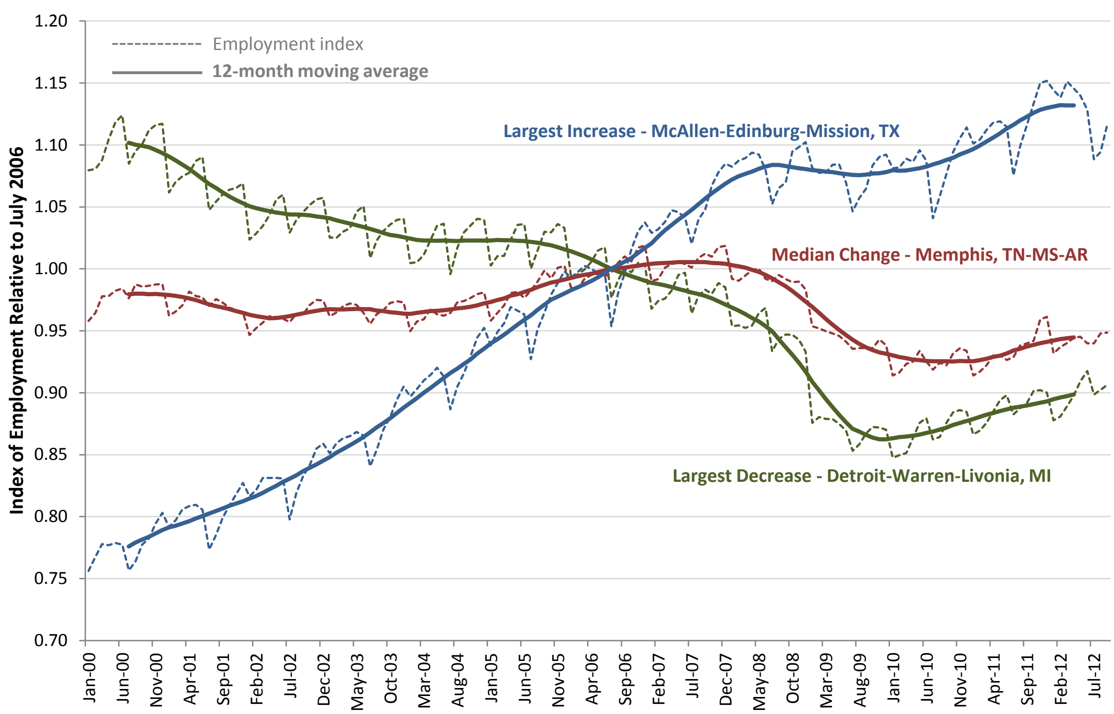


Figure 4: Changes in Employment 2006-2010, US States



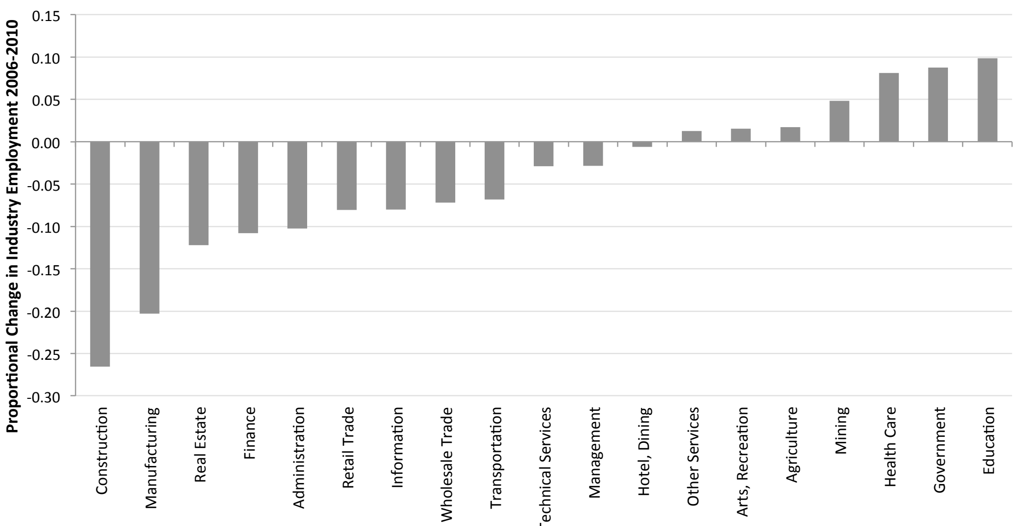
Source: County Business Patterns.

Figure 5: Employment 2006-2010, Selected Metro Areas



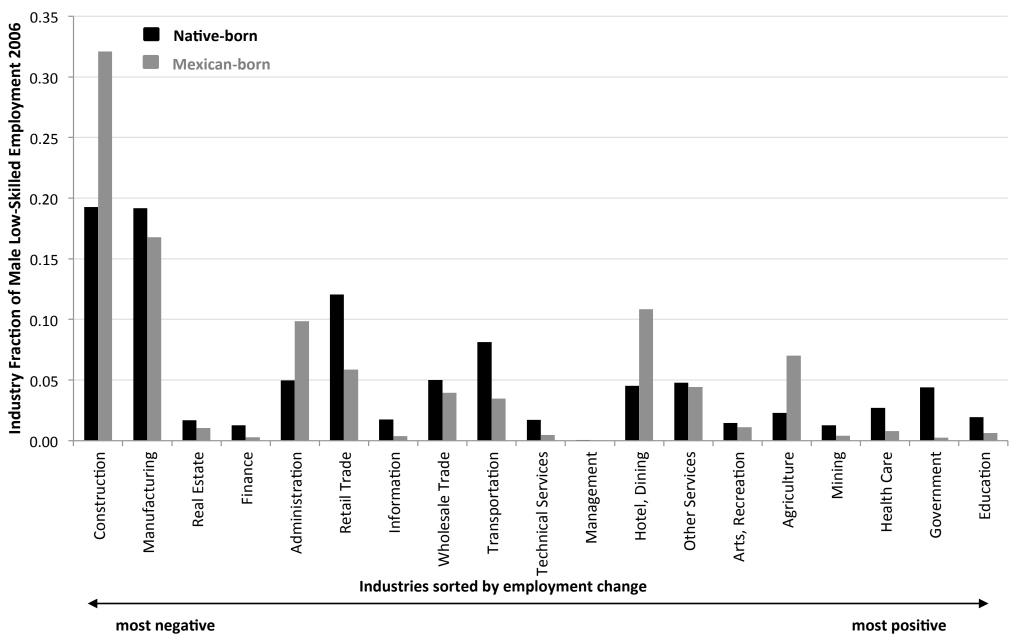
Source: Authors' calculations from Current Employment Statistics, metro area total non-farm employment. Normalized to 1 in July 2006.

Figure 6: Employment Changes by Industry 2006-2010



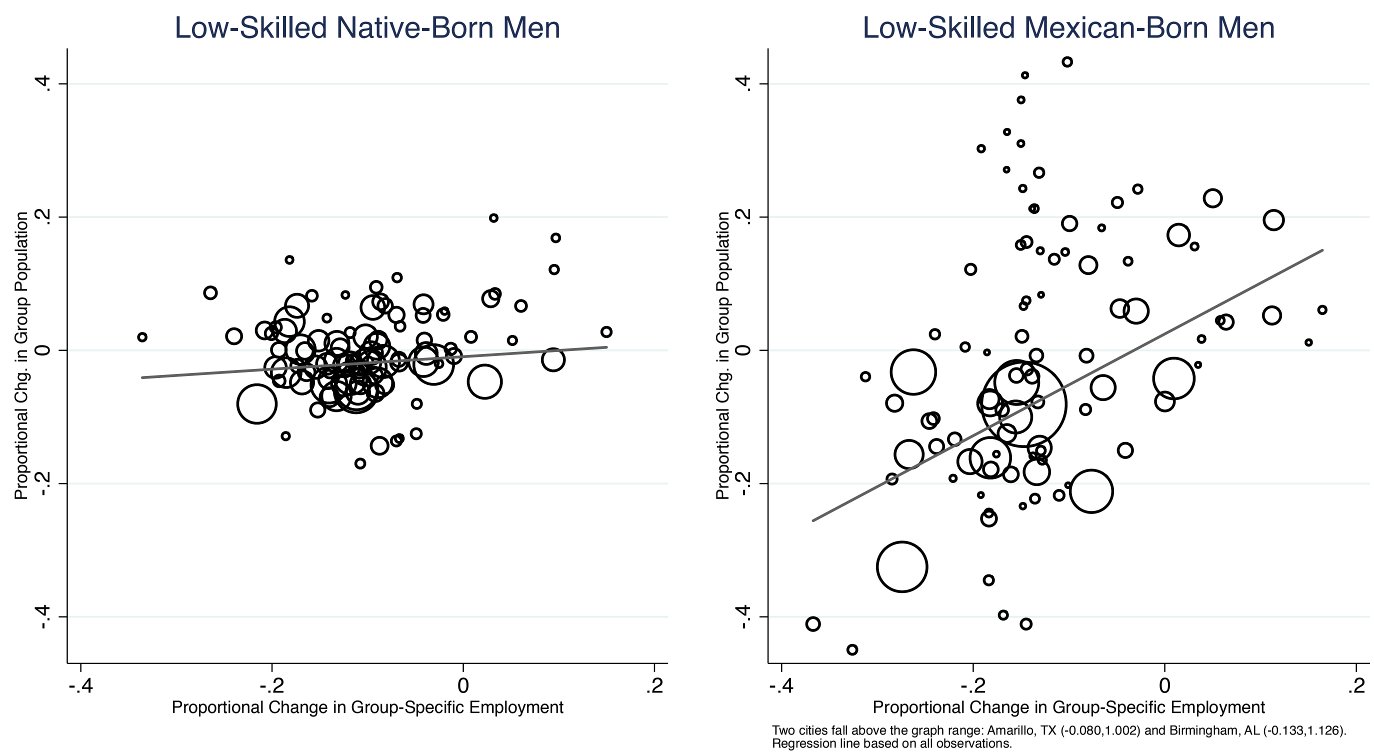
Sources: Authors' calculations from County Business Patterns (CBP) and the American Community Survey (ACS). CBP employment changes shown for all industries except those without without full coverage in the CBP: Agriculture, Other Services, and Government. ACS employment changes shown in those cases.

Figure 7: Employment Shares by Industry Among Low-Skilled Men, Native- and Mexican-Born, 2006



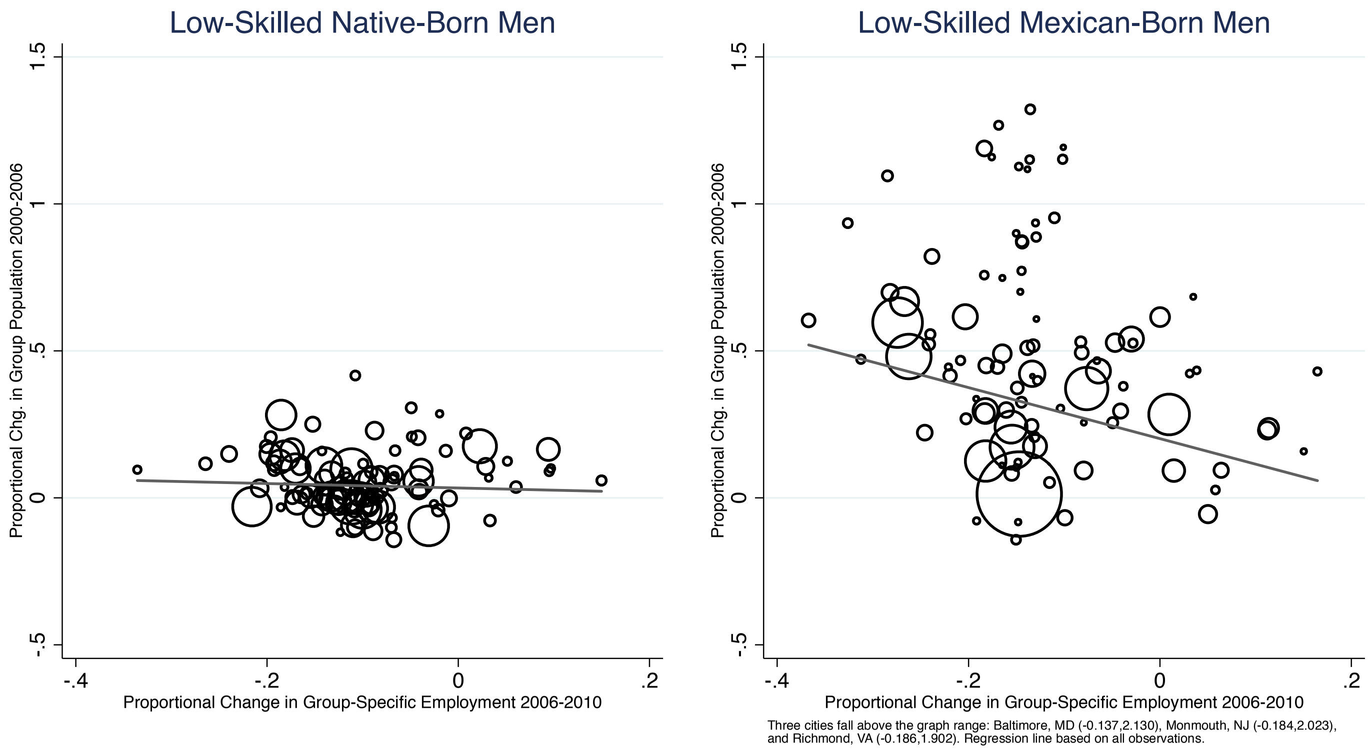
Sources: Authors' calculations from the 2006 American Community Survey. See text for individual sample restrictions. This figure reports information for men with no more than a high school education. See Figure 6 for industry employment changes used to sort categories.

Figure 8: Population Responses to Employment Shocks: Native-born and Mexican-born Low-Skilled Men



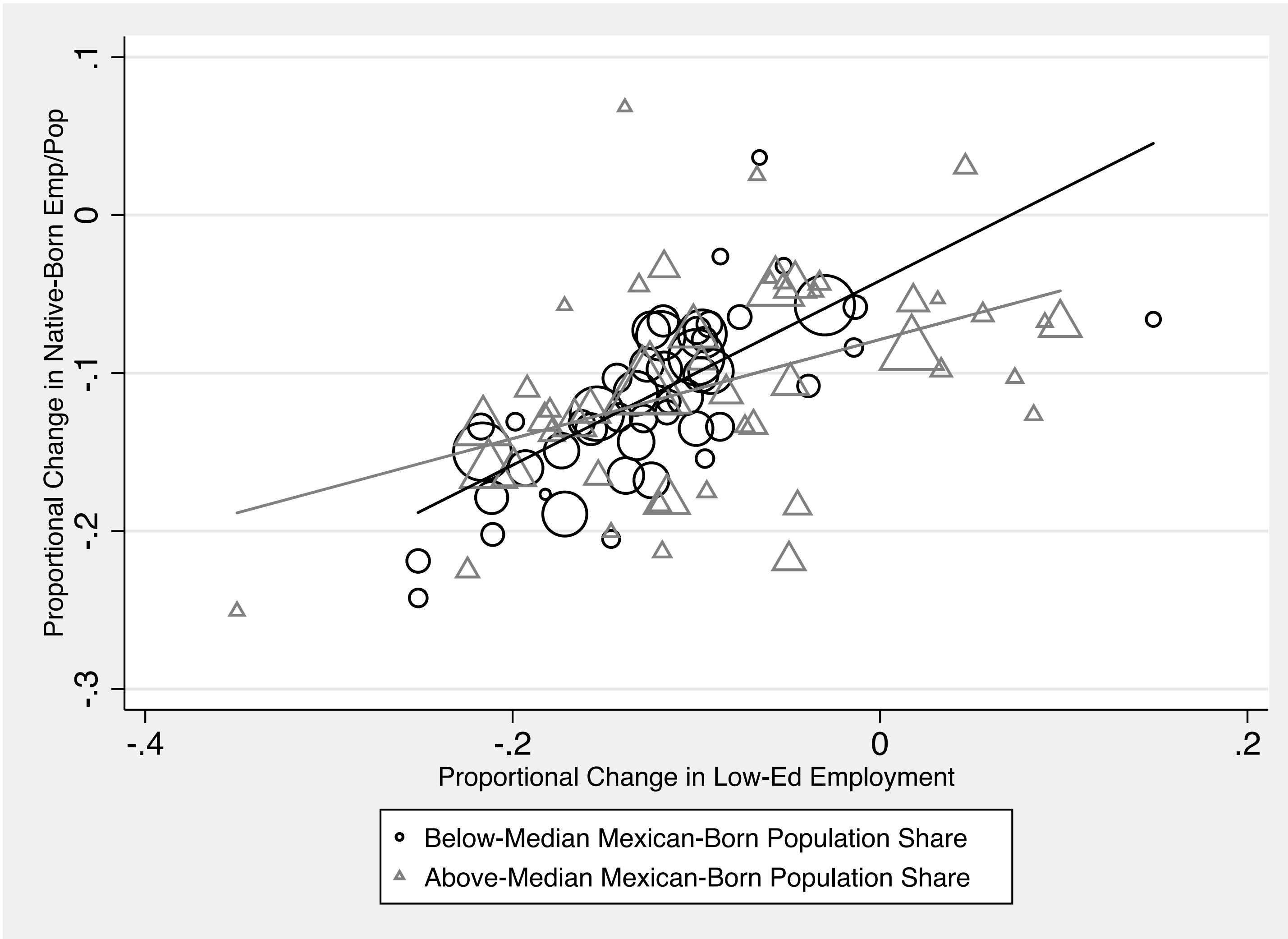
Source: Authors' calculations from American Community Survey and County Business Patterns. Proportional changes from 2006 to 2010. Individual sample, 97 city sample, and construction of group-specific employment changes described in the text. Weighted to account for heteroskedasticity (details in appendix).

Figure 9: Falsification Test: Population Change 2000-06 vs. Group-Specific Employment Change 2006-10



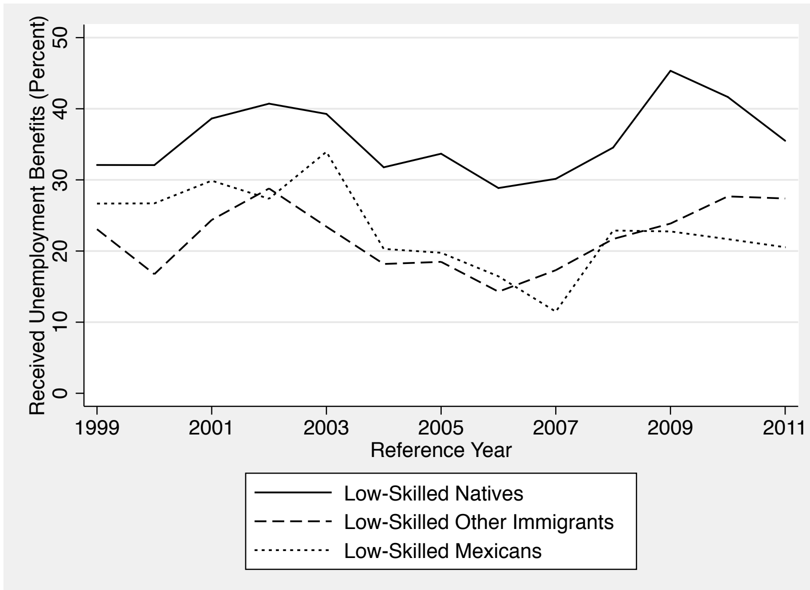
Source: Authors' calculations from American Community Survey and County Business Patterns. Falsification test with proportional population changes from 2000 to 2006 and proportional employment changes from 2006 to 2010. Individual sample, 97 city sample, and construction of group-specific employment changes described in the text. Weighted to account for heteroskedasticity (details in appendix).

Figure 10: Mexican Mobility Smooths Natives' Employment Outcomes:
Change in Native-Born Male Low-Skilled Emp/Pop Ratio vs. Change in Payroll Employment



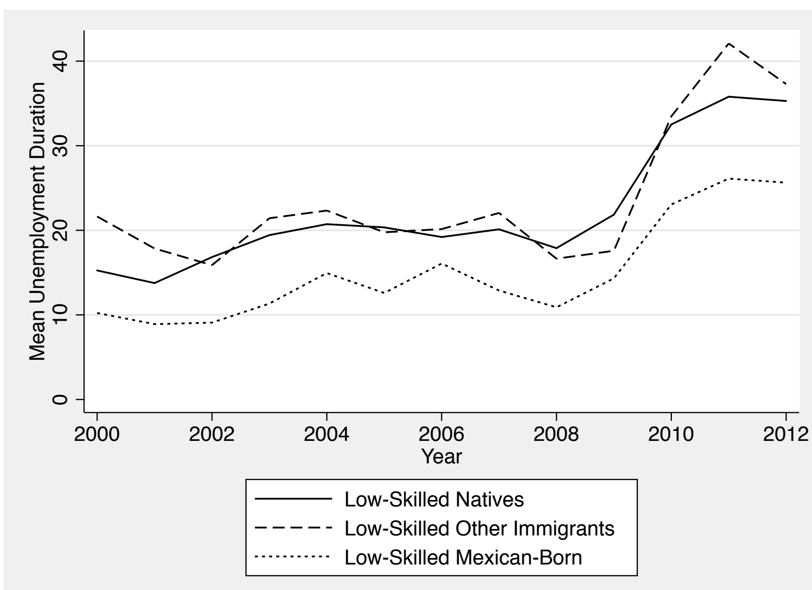
Source: Authors' calculations from 2006-2010 American Community Survey and County Business Patterns. Employment changes are calculated for low-skilled workers generally (without regard to nativity). Construction of group-specific employment changes and weights described in the text and in the appendix. Fitted lines are from a weighted regression using efficiency weights based on the entire low-skilled male population in each city. The size of the markers for individual points is proportional to these weights. The slope coefficients are +0.58 (below-median) and +0.31 (above median). This difference, 0.27 with a standard error of 0.09, is statistically significantly different from zero ($p = 0.004$).

Figure 11: Unemployment Benefit Receipt by Nativity 2000-2011



Source: Authors' calculations from Current Population Survey data. Sample includes men ages 18-64, not in school, not in group quarters, with at most a high school degree.

Figure 12: Unemployment Duration (Among Unemployed) by Nativity 2000-2012



Source: Authors' calculations from Current Population Survey data. Sample includes men ages 18-64, not in school, not in group quarters, with at most a high school degree. Average duration calculated among those who are unemployed in the reference month.

Table 1: One Year Mobility Rates 2006-2010

	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less				
Abroad Last Year	0.3%	2.0%	1.9%	2.2%
Moved Cities Last Year	4.1%	2.9%	2.6%	3.3%
Total	4.3%	5.0%	4.5%	5.6%
Panel B: Men, Some college or more				
Abroad Last Year	0.3%	2.8%	2.0%	2.9%
Moved Cities Last Year	4.7%	4.4%	3.0%	4.6%
Total	5.0%	7.2%	5.0%	7.5%
Panel A: Women, High-school or less				
Abroad Last Year	0.2%	1.9%	1.3%	2.4%
Moved Cities Last Year	3.7%	2.6%	2.2%	3.0%
Total	3.9%	4.5%	3.5%	5.5%
Panel B: Women, Some college or more				
Abroad Last Year	0.2%	2.8%	1.7%	2.9%
Moved Cities Last Year	4.5%	4.0%	2.8%	4.1%
Total	4.8%	6.8%	4.6%	7.0%

Authors' calculations from ACS Data 2006-2010. See text for individual sample criteria. Sample also limited to individuals who lived in an MSA in either the survey year or the previous year. Numbers may not appear to add to total due to rounding.

Table 2: Population Response to Labor Demand Shocks

	Dependent Variable: Proportional Population Change				
	All	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less					
Proportional Change in Group-Specific Employment	0.227***	0.094	0.553**	0.764***	-0.194
	(0.072)	(0.085)	(0.232)	(0.235)	(0.336)
Panel B: Men, Some college or more					
Proportional Change in Group-Specific Employment	0.591***	0.532***	0.830***	0.953	0.907***
	(0.097)	(0.099)	(0.227)	(0.840)	(0.221)
Panel A: Women, High-school or less					
Proportional Change in Group-Specific Employment	0.470***	0.248	0.681***	0.694***	0.605*
	(0.117)	(0.151)	(0.204)	(0.204)	(0.359)
Panel B: Women, Some college or more					
Proportional Change in Group-Specific Employment	0.496***	0.446***	0.989***	1.726	1.070***
	(0.143)	(0.132)	(0.328)	(1.396)	(0.327)

Each listed coefficient represents a separate regression of the proportional population change for the relevant group (from the American Community Survey) on the proportional change in group-specific employment (from County Business Patterns data, using the demographic group's industry mix). All regressions include an intercept term and 97 city observations. Observations are weighted by the inverse of the estimated sampling variance of the dependent variable (see appendix for details). Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%.

Table 3: Population Response to Labor Demand Shocks - Low-Skilled Mexican-Born Men With Enclave and Policy Controls

	Dependent Variable: Proportional Population Change - Mexican-born Men, High-school or less			
	(1)	(2)	(3)	(4)
Proportional Change in Employment	0.764***	0.753***	0.664***	0.612***
	(0.235)	(0.239)	(0.206)	(0.190)
Enclave Measure		0.079	0.021	-0.022
(Mexican-born Share of City Population)		(0.135)	(0.139)	(0.142)
New State Immigrant Employment Legislation			-0.059	-0.012
			(0.056)	(0.033)
New State 287g Policy				-0.105**
				(0.041)
Constant	0.025	0.011	0.018	0.022
	(0.032)	(0.044)	(0.044)	(0.042)
R-squared	0.264	0.266	0.289	0.329

Each column represents a separate regression of the proportional population change for Mexican-born men with a high school degree or less (from the American Community Survey) on the proportional change in group-specific employment (from County Business Patterns data, using the demographic group's industry mix). All regressions include an intercept term and 97 city observations. Observations are weighted by the inverse of the estimated sampling variance of the dependent variable (see appendix for details). Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%.

Table 4: Population Response to Labor Demand Shocks - With Enclave and Policy Controls

	All	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less					
Proportional Change in Group-Specific Employment	0.217***	0.095	0.378**	0.612***	-0.203
	(0.077)	(0.084)	(0.173)	(0.190)	(0.364)
Panel B: Men, Some college or more					
Proportional Change in Group-Specific Employment	0.560***	0.491***	0.847***	0.766	0.929***
	(0.083)	(0.092)	(0.205)	(0.958)	(0.216)
Panel A: Women, High-school or less					
Proportional Change in Group-Specific Employment	0.459***	0.224	0.685***	0.776***	0.533
	(0.121)	(0.150)	(0.188)	(0.196)	(0.371)
Panel B: Women, Some college or more					
Proportional Change in Group-Specific Employment	0.492***	0.426***	1.012***	1.565	1.118***
	(0.116)	(0.117)	(0.297)	(1.310)	(0.309)

Each listed coefficient represents a separate regression of the proportional population change for the relevant group (from the American Community Survey) on the proportional change in group-specific employment (from County Business Patterns data, using the demographic group's industry mix), with the enclave and policy controls in Column (4) of Table 3. All regressions include an intercept term and 97 city observations. Observations are weighted by the inverse of the estimated sampling variance of the dependent variable (see appendix for details). Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%.

Table 5: Population Response to Labor Demand Shocks - Bartik (1991) IV Estimates

	Dependent Variable: Proportional Population Change				
	All	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less					
IV Estimate					
Proportional Change in	0.271	0.016	0.480	1.289**	-0.878***
Group-Specific Employment	(0.072)	(0.111)	(0.498)	(0.572)	(0.301)
First Stage					
Predicted Employment Change	3.407***	3.214***	3.901***	4.293***	4.140***
	(0.603)	(0.602)	(0.709)	(1.165)	(0.569)
Partial F Statistic	31.93	28.49	30.25	13.57	52.995
Panel B: Men, Some college or more					
Proportional Change in	0.291	0.486*	-0.309	-0.774	-0.230
Group-Specific Employment	(0.214)	(0.261)	(0.336)	(1.082)	(0.392)
First Stage					
Predicted Employment Change	2.225***	2.220***	2.691***	4.860***	2.406***
	(0.557)	(0.601)	(0.461)	(0.832)	(0.449)
Partial F Statistic	15.94	13.66	34.13	34.12	28.65
Panel A: Women, High-school or less					
Proportional Change in	0.164	-0.449	0.278	1.706**	-0.904
Group-Specific Employment	(0.187)	(0.335)	(0.499)	(0.680)	(0.581)
First Stage					
Predicted Employment Change	1.890***	1.775***	2.269***	2.829***	2.020***
	(0.452)	(0.495)	(0.474)	(0.785)	(0.329)
Partial F Statistic	17.47	12.85	22.87	12.996	37.64
Panel B: Women, Some college or more					
Proportional Change in	-0.387	-0.316	-1.284	0.123	-1.577
Group-Specific Employment	(0.776)	(0.835)	(1.021)	(1.107)	(1.058)
First Stage					
Predicted Employment Change	0.738	0.719	1.341***	2.864***	1.139***
	(0.469)	(0.490)	(0.419)	(0.596)	(0.361)
Partial F Statistic	2.477	2.151	10.27	23.08	9.952

Each listed coefficient represents a separate instrumental variables regression of the proportional population change for the relevant group (from the American Community Survey) on the proportional change in group-specific employment (from County Business Patterns data, using the demographic group's industry mix). All regressions include an intercept term, 97 city observations, and the enclave and policy controls in Column (4) of Table 3. Observations are weighted by the inverse of the estimated sampling variance of the dependent variable (see appendix for details). Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%. We use the predicted employment change (based on Bartik (1991) and described in the text) as an instrument for the proportional change in group-specific employment. The first-stage coefficient on the instrument and the partial F statistic are reported below the corresponding IV estimate.

Table 6: Population Response to Labor Demand Shocks - Household Leverage IV Estimates

	Dependent Variable: Proportional Population Change				
	All	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less					
IV Estimate					
Proportional Change in	0.074	-0.128	0.323	0.550*	-0.389
Group-Specific Employment	(0.120)	(0.124)	(0.254)	(0.292)	(0.469)
First Stage					
Household Leverage	-0.095***	-0.086***	-0.106***	-0.114***	-0.090***
	(0.014)	(0.014)	(0.015)	(0.016)	(0.020)
Partial F Statistic	47.76	37.41	52.04	50.32	21.26
Panel B: Men, Some college or more					
Proportional Change in	0.620***	0.609**	0.653	-0.142	1.028*
Group-Specific Employment	(0.214)	(0.246)	(0.449)	(0.478)	(0.562)
First Stage					
Household Leverage	-0.051***	-0.049***	-0.053***	-0.105***	-0.045***
	(0.015)	(0.016)	(0.014)	(0.011)	(0.016)
Partial F Statistic	10.76	8.950	15.09	84.68	8.171
Panel A: Women, High-school or less					
Proportional Change in	0.120	0.054	0.753**	1.179***	-0.242
Group-Specific Employment	(0.176)	(0.223)	(0.499)	(0.322)	(0.889)
First Stage					
Household Leverage	-0.057***	-0.057***	-0.058***	-0.070	-0.039***
	(0.010)	(0.011)	(0.011)	(0.011)	(0.014)
Partial F Statistic	31.05	29.40	29.54	38.14	7.347
Panel B: Women, Some college or more					
Proportional Change in	0.659***	0.828***	0.587	0.242	0.257
Group-Specific Employment	(0.776)	(0.280)	(0.678)	(1.461)	(0.903)
First Stage					
Household Leverage	-0.042***	-0.041***	-0.039***	-0.059***	-0.033***
	(0.011)	(0.012)	(0.010)	(0.012)	(0.012)
Partial F Statistic	13.64	12.11	13.89	22.85	8.363

Each listed coefficient represents a separate instrumental variables regression of the proportional population change for the relevant group (from the American Community Survey) on the proportional change in group-specific employment (from County Business Patterns data, using the demographic group's industry mix). All regressions include an intercept term, 97 city observations, and the enclave and policy controls in Column (4) of Table 3. Observations are weighted by the inverse of the estimated sampling variance of the dependent variable (see appendix for details). Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%. We use average household leverage, calculated using household debt data from Equifax and household income data from the IRS (see text for details), as an instrument for the proportional change in group-specific employment. The first-stage coefficient on the instrument and the partial F statistic are reported below the corresponding IV estimate.

Table 7: Channels of Population Response - Low-Skilled Mexican-Born Men Population

	Dependent Variable: Proportional Population Change				
	(1)	(2)	(3)	(4)	(5)
	Total Elasticity	New Arrival Sorting	Change in Pre-2007 Arrivals	Net Aging In	Net Internal Inflows
Proportional Change in Employment	0.764***	0.133***	0.631***	-0.026	0.157**
	(0.235)	(0.028)	(0.232)	(0.024)	(0.073)
Constant	0.025	0.067***	0.957***	0.005	0.020
	(0.032)	(0.006)	(0.030)	(0.007)	(0.015)
Share of Total Elasticity	100.0%	17.4%	82.6%	-3.4%	20.5%
Share of Pre-2007 Elasticity	N/A	N/A	100%	-4.1%	25%
R-squared	0.264	0.160	0.222	0.010	0.022

Column (1) reproduces the corresponding estimate from Table 2. As described in the text, Columns (2)-(5) decompose this overall response into different migration components. All other specification details are identical to Table 2

Table 8: Propensity Score Reweighting of Less Skilled Natives to Match Mexican-Born Observables

	No Reweighting		(1)	(2)	(3)	(4)	(5)
			Reweighted Natives Based on Listed Covariates				
	Mexican-Born	Native-Born	Exact Education Only	Age Only	Rent vs. Own Only	Family Structure Only	All Covariates
Proportional Change in Group-Specific Employment	0.764***	0.094	0.065	0.180*	0.002	0.079	-0.058
	(0.235)	(0.085)	(0.128)	(0.102)	(0.109)	(0.093)	(0.211)
Constant	0.025	-0.010	-0.014	-0.018	0.016	-0.013	-0.012
	(0.032)	(0.009)	(0.015)	(0.011)	(0.011)	(0.013)	(0.030)
R-squared	0.264	0.018	0.003	0.047	0.000	0.008	0.002

Reproduces corresponding estimates from Table 2 for Mexican-born and native-born less skilled men. Columns (1)-(5) present population responses for natives, reweighted to match Mexican-born individuals' based on the listed characteristics. All other specification details are identical to Table 2. See text and appendix for details.

Table 9: Stated Reasons for Moving Among Cross-County Movers, 2001-2010

	Native-Born	Mexican-Born	Other Immigrant
Attend/leave college	1.7%	1.1%	1.7%
Change in marital status	6.6%	3.2%	5.1%
Change of climate	1.3%	0.2%	1.1%
For cheaper housing	5.2%	4.3%	4.0%
For easier commute	4.5%	4.3%	4.4%
Health reasons	1.9%	0.7%	0.4%
Natural disaster	0.3%	0.2%	0.1%
New job or job transfer	**16.3%**	**17.1%**	**15.1%**
Other family reason	16.7%	12.4%	16.3%
Other housing reason	6.9%	4.8%	6.5%
Other job-related reason	3.4%	4.7%	4.4%
Other reasons	4.5%	2.1%	8.0%
Retired	0.7%	0.0%	0.2%
To establish own household	7.0%	5.0%	5.0%
To look for work or lost job	**5.3%**	**23.8%**	**10.3%**
Wanted better neighborhood	3.3%	3.6%	2.9%
Wanted new or better housing	8.9%	9.6%	9.0%
Wanted to own home, not rent	5.7%	2.9%	5.5%

Source: Authors' calculations from March CPS data, 2000-2010. Sample includes men ages 18-64, not in school, not in group quarters, with at most a high school degree who are living in a different county in the survey year than in the previous year.

A Appendix

Additional results discussed in the text but not presented here are available in the online appendix, available at: `http://www.andrew.cmu.edu/user/bkovak/cadenakovak_greatrecession_online_appendix.pdf`

A.1 Details of the Multinomial Logit Estimation of Industry Shares

In constructing employment declines faced by each (skill × sex × nativity) group in each city, we need information on each group's city-level industry shares. We calculate these shares based on multinomial logit estimates. In earlier versions, we calculated shares by directly measuring the within-city share of the group working in each industry in the ACS. This approach is potentially problematic because the cell sizes can be quite small for particular industries. The remainder of this section describes the implementation of the approach we use, although we emphasize that none of these decisions are pivotal. In fact, the results are remarkably similar to those obtained using the simpler sample-based shares approach.

We predict the probability that an individual of type j living in city c works in industry i as a function of his/her type and location. Our explanatory variables are a full set of worker type dummies and city dummies, and we run separate models for each (skill × sex) group. Note that if we included dummies at the (type × city) level, the predicted probabilities would simply be the sample shares. Our method therefore imposes the assumption that the influence of worker type and city on the industry distribution of employment are separable in determining an individual's likelihood of working in a given industry.[54]

For further richness, we also account for the different composition of the native and foreign-born workforce across cities. For natives, we allow a worker's industry to depend on his/her racial and ethnic composition, with separate coefficients for non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, native-born Hispanics, and other non-Hispanics. Among the "other immigrants" category, we allow for a separate industry mix based on groupings of source countries including Western Hemisphere immigrants, Asian immigrants, and other immigrants.

After running these models, we predict individual-level probabilities of working in each industry. We then aggregate these predicted probabilities to the city level for the broader groups considered in the regressions (native-born, foreign-born, Mexican-born, other foreign-born).[55] We use these shares to create the employment shocks based on CBP data at the city-industry level.

[54]These factors can be considered as additively separable in a latent variable framework, although given the multinomial logit function form, they are multiplicatively separable in determining the probability.

[55]Note that this approach merely takes a weighted average of each of the finer groups within the more aggregate cells.

A.2 Specification Alternatives

We have conducted several specification checks for the main elasticity results as discussed in the main text. These include using employment declines that are not specific to each demographic group, various ways of addressing the CBP's non-covered industries, using the three-year samples of ACS data to calculate population changes, and alternative weighting schemes (including unweighted results). As mentioned in the text, each of these alternatives continues to support the central conclusions of the paper. For the interested reader, a complete set of the results of these specifications is available in the online appendix.

A.3 Heteroskedasticity Weights

The population growth measures we use as dependent variables are estimates derived from underlying micro data, and hence are likely to result in heteroskedasticity. Along with reporting heteroskecasticity-robust standard errors, we weight by the inverse of the sampling variance of the population growth estimates. This section describes how we construct these variance estimates.

For a particular city, c, our dependent variable is

$$\frac{\hat{p}_c^{2010} - \hat{p}_c^{2006}}{\hat{p}_c^{2006}} = \frac{\hat{p}_c^{2010}}{\hat{p}_c^{2006}} - 1,$$

where $\hat{p}_c^t$ is the estimated city population in year t. The variance of the dependent variable is thus

$$var\left(\frac{\hat{p}_c^{2010}}{\hat{p}_c^{2006}} - 1\right) = var\left(\frac{\hat{p}_c^{2010}}{\hat{p}_c^{2006}}\right)$$

We use the delta method and assume that sampling is independent across years, so that $cov(\hat{p}_c^{2010}, \hat{p}_c^{2006}) = 0$. Plug in sample estimates for means and variances of the population estimates to yield the estimated sampling variance of population growth in city c.

$$v\hat{a}r\left(\frac{\hat{p}_c^{2010}}{\hat{p}_c^{2006}}\right) \approx \left(\frac{\hat{p}_c^{2010}}{\hat{p}_c^{2006}}\right)^2 \left(\frac{v\hat{a}r(\hat{p}_c^{2010})}{(\hat{p}_c^{2010})^2} + \frac{v\hat{a}r(\hat{p}_c^{2006})}{(\hat{p}_c^{2006})^2}\right).$$

To calculate $v\hat{a}r(\hat{p}_c^t)$ accounting for individual sampling probabilities we follow Deaton (1997) equation (1.24):

$$v\hat{a}r(\hat{p}_c^t) = \frac{n^t}{n^t - 1} \sum_{i=1}^{n^t} (z_i - \bar{z})^2,$$

where n^t is the sample size, $z_i \equiv w_i \iota_{ic}$, w_i is inverse of individual i's probability of appearing in the sample, and ι_{ic} is an indicator for whether individual i appears in city c.

Combining the previous two expressions yields our estimate for the sampling variance of population growth. We use three-year ACS samples to calculate these variance estimates to avoid wildly inaccurate estimates for demographic groups with only a few individuals in a given city (this only appreciably affected the weights in a few cities for the "other foreign-born" group). In practice, these weights turn out to be very closely related to the 2006 population, with a correlation coefficient of 0.9896 when considering observations for all demographic groups in all cities. For completeness, in the online appendix we present versions of Tables 2 and 4 weighting by 2006 population with no substantive changes to the main results.

A.4 Falsification Results for All Groups

Figure 9 provided the results for the pre-trend falsification test for low-skilled men (native- and Mexican-born). For reference, Table A-1 provides analogous results for all (sex x skill x nativity) groups.

Table A-1: Falsification Test: 2000-2006 Population Change vs. 2006-2010 Labor Demand Shocks

	Dependent Variable: Proportional Population Change				
	All	Native-Born	Foreign-Born	Mexican-Born	Other Foreign-Born
Panel A: Men, High-school or less					
Proportional Change in	-0.299	-0.076	-1.115***	-0.868***	-1.638***
Group-Specific Employment	(0.288)	(0.236)	(0.375)	(0.280)	(0.585)
Panel B: Men, Some college or more					
Proportional Change in	-0.035	0.035	-0.843	-0.618	-0.898
Group-Specific Employment	(0.154)	(0.133)	(0.558)	(0.609)	(0.570)
Panel A: Women, High-school or less					
Proportional Change in	0.246	0.266	-0.134	0.022	-0.372
Group-Specific Employment	(0.309)	(0.261)	(0.606)	(0.623)	(0.757)
Panel B: Women, Some college or more					
Proportional Change in	0.376**	0.465***	0.401	3.421**	-0.158
Group-Specific Employment	(0.179)	(0.162)	(0.553)	(1.588)	(0.535)

Identical specification to Table 2, with the exception that the proportional population changes are calculated for 2000-2006.

A.5 Propensity Score Reweighting

Table A-2 provides the results of the probit specifications used to reweight the native population for the results described in section 5.2. The individual coefficients on each age are suppressed in column (3), but the log likelihood is included for reference.

Table A-2: Probit Regressions Predicting Mexican Nativity (2006)

	Dependent Variable: Mexican-born Indicator				
	(1)	(2)	(3)	(4)	(5)
High School Dropout	1.164***	1.195***			
	(0.0107)	(0.0100)			
Rents Home	0.423***			0.531***	
	(0.0108)			(0.00928)	
Married, Spouse Present	0.123***				-0.183***
	(0.0138)				(0.0112)
Any Children (1= yes)	-0.00228				-0.0286*
	(0.0193)				(0.0173)
Number of Children	0.197***				0.270***
	(0.00747)				(0.00682)
Age Dummies	YES	NO	YES	NO	NO
Observations	152,782	152,782	152,782	152,782	152,782
Log Likelihood	-7473000	-8175000	-9273000	-9262000	-9219000

Sample includes native-born and Mexican-born men with at most a high school degree who meet individual sampling criteria and live in the 97 cities in our sample. Heteroskedasticity-robust standard errors in parentheses - *** significant at the 1% level, ** 5%, * 10%.