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**Abstract**

How does the US labor market absorb low-skilled immigration? I address this question using the 1995 Mexican Peso Crisis, an exogenous push factor that raised Mexican migration to the US. In the short run, high-immigration states see their low-skilled labor force increase and native low-skilled wages decrease, with an implied local labor demand elasticity of -.7. Internal relocation dissipates this shock spatially. In the long run, the only lasting consequences are for low-skilled natives who entered the labor force in high-immigration years. A simple quantitative many-region model allows me to obtain the counterfactual local wage evolution absent the immigration shock.

Key Words: International and internal migration, local shocks, local labor demand elasticity.

JEL Classification: F22, J20, J30

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# 1 Introduction

Despite large inflows of immigrants into many OECD countries in the last 20 or 30 years, there is no consensus on the causal impact of immigration on labor market outcomes. Two reasons stand out. First, immigrants decide both where and when to migrate given the economic conditions in the source and host countries. Second, natives may respond by exiting the locations receiving these immigrants or reducing inflows to them. The combination of these two endogenous decisions makes it hard to estimate the causal effect of immigration on native labor market outcomes.

Various strategies have been employed to understand the consequences of immigration on labor markets. Altonji and Card (1991) and Card (2001) compare labor market outcomes or changes in labor market outcomes in response to local immigrant inflows across locations. To account for the endogenous sorting of migrants across locations, they use what has become known as the immigration networks instrument – past stocks of immigrants in particular locations are good predictors of future flows. They find that immigration has only limited effects on labor market outcomes in the cross-section or in ten-year first differences: a 1 percent higher share of immigrants is associated with a 0.1-0.2 percent wage decline.[1] Also doing an across-location comparison, Card (1990) reports that the large inflow of Cubans to Miami in 1980 (during the Mariel Boatlift) had a very limited effect on the Miami labor market when compared to four other unaffected metropolitan areas.[2]

In contrast to Altonji and Card (1991) and Card (2001), Borjas et al. (1997) argue that local labor markets are sufficiently well connected in the US that estimates of the effect of immigration on wages using spatial variation are likely to be downward-biased because workers relocate across space. Instead, Borjas (2003) suggests comparing labor market outcomes across education and experience groups, abstracting from geographic considerations. Using this methodology with US decennial Census data between 1960 and 1990, he reports significantly larger effects of immigration on wages. A 1 percent immigration-induced increase in the labor supply in an education-experience cell is associated with a 0.3-0.4 percent decrease in wages on average, and as much as 0.9 for the very least-skilled workers. This has been the main controversy in the immigration debate: whether we should look at local labor markets or should instead focus on the national market.

This paper builds on the previous literature to better understand the effects of immigrants on labor market outcomes, by using the exogenous push factor of the Mexican Peso Crisis of 1995 in conjunction with the migration networks instrument as my identification strategy. I show that the effect of immigration is large on impact for competing native workers – defined by skill and location groups – and that it quickly dissipates across space. My findings emphasize that in order to evaluate the labor market impacts of immigration, it is crucial to think about time horizons and the dynamics of adjustment. These results help to reconcile previous findings in the literature.

In December 1994, the government, led by Ernesto Zedillo, allowed greater flexibility of the peso vis à vis the dollar. This resulted in an attack on the peso that caused Mexico to abandon the peg. It was followed by an unanticipated economic crisis known as the “the Peso Crisis” or the “Mexican Tequila Crisis” (Calvo and Mendoza, 1996). Mexican GDP growth fell 11 percentage points, from a positive 6 percent in 1994 to a negative 5 percent in 1995. This occurred while US GDP maintained a fairly constant growth rate of around

[1] Altonji and Card (1991) estimates using first differences between 1970 and 1980 and instruments result in a significantly higher effect. The same exercise, using other decades, delivers lower estimates. See Table 6 in this paper, which uses differences between 1990 and 2000 and the same instrument Altonji and Card (1991) used.

[2] I discuss in detail the similarities and differences between this paper with Card (1990) in Section A.6 and I provide a longer discussion in Appendix A.6.

5 percent.

This deep recession prompted many Mexicans to emigrate to the US. Precise estimates on net Mexican immigration are hard to obtain (see Passel (2005), Passel et al. (2012) or Hanson (2006)). Many Mexicans enter the US illegally, sometimes escaping the count of US statistical agencies. However, as I show in detail in Section 2, all sources agree that 1995 was a high-immigration year.[3] As a result of the Mexican crisis, migration flows to the US were probably 50 percent higher, with around 200,000 more Mexicans immigrating in 1995 than in a typical year of the 1990s. This increase in the net Mexican inflows was a result of both more low-skilled – particularly young – Mexicans migrating to the US and fewer low-skilled Mexicans returning to Mexico. I can thus use geographic, skill and labor market experience variation to see if workers more closely competing with these net Mexican inflows suffered more from the shock.[4]

In this paper, I show that a 1 percent immigration-induced labor supply shock reduces low-skilled wages by around .7 percent on impact. Soon after, wages return to their pre-shock trends. This is due to significant relocation across states. While in the first year the immigration shock increases the share of low-skilled workers almost one to one in high-immigration states, in around two years it goes back to trend.[5] This helps to understand why, while the effect on wages is large on impact, it quickly dissipates across states. By 1999, the fifth year after the shock, the wages of low-skilled workers in high-immigration states were only slightly lower than they were before the shock, relative to low-immigration states. Thus the US labor market for low-skilled workers adjusts to unexpected supply shocks quite rapidly.

Given that there are spillovers across states, I cannot use the natural experiment to investigate the longer-run effects of immigration on labor market outcomes. I take two avenues to try to shed some light on these longer-run effects. First, I show that, when abstracting from locations, the wage increase between 1990 and 2000 for workers who entered the low-skilled labor market in particularly high-immigration years during the 1990s is smaller than for those who entered in lower immigration years. This is in line with what Oreopoulos et al. (Forthcoming) document for college graduates who enter the labor market in bad economic years. This is in the spirit of Borjas (2003) regressions but using the Peso Crisis as a factor generating exogenous variation in immigration inflows. Second, I introduce a dynamic spatial equilibrium model and calibrate it to US data to simulate the evolution of wages at the local level had the Peso Crisis not occurred. The model also allows me to interpret my reduced form estimates as structural parameters. Its two key parameters are the local labor demand elasticity and the internal migration sensitivity of local workers to local conditions. These, in turn, determine how much labor supply shocks are felt in wages and how fast these local shocks spread to the rest of the economy. In short, it helps to determine how long the long run is.

This paper contributes to two important literatures. First, it contributes to the understanding of the effects of low-skilled immigration in the US. Following the pioneering work by Card (1990) and Altonji and Card (1991), I use variation across local labor markets to estimate the effect of immigration. I extend their work by combining Card's immigration networks instrument with the Mexican Peso Crisis as a novel exogenous push factor that brought more Mexicans than expected to many – not just one as in Card (1990)

[3] Using data from the 2000 US Census, from the US Department of Homeland Security (documented immigrants), estimates of undocumented immigrants from the Immigration and Naturalization Service (INS) as reported in Hanson (2006), estimates from Passel et al. (2012) and apprehensions data from the INS, we see an unusual spike in the inflow of immigrants in 1995. I will discuss the numbers of immigration arrivals later in this paper.

[4] A similar instrumental strategy based on push factors and previous settlement patterns is used in Boustan (2010) study of the Black Migration. Also Foged and Peri (2013) use a similar strategy using negative political events in source countries.

[5] Over the 1990s the share of low-skilled workers in high-immigration states increased with immigration (Card et al., 2008). The relocation documented in this paper explains how unexpected labor supply shocks are absorbed into the national economy. Changes in the factor mix, absent unexpectedly large immigration-induced shocks, can be explained through technology adoption in Lewis (2012). I discuss this in detail in section 4.2.

– US local labor markets. This unexpectedly large inflow allows me to understand the timing and sequence of events in response to an immigration shock. When more immigrants enter specific local labor markets, wages decrease more than is suggested in either Card (2001) or Borjas (2003). This prompts net interstate labor relocation that leads the shock to dissipate across space. This explains why in the longer-run, as I document, the effect of immigration on wages is small across local labor markets but larger across age cohorts (Borjas, 2003). This paper adds to Borjas (2003) longer-run results an instrumental variable strategy based on the age distribution of the unexpected inflow of Mexican workers that resulted from the Mexican Peso Crisis.

Second, it contributes to the literature of spatial economics. A number of recent papers, using various strategies, have looked at the effects of negative shocks on local labor demand (see Autor et al. (2013a), Autor et al. (2013c), Autor et al. (2013b), Beaudry et al. (2010), Hornbeck (2012), Hornbeck and Naidu (2012), Notowidigdo (2013), Diamond (2013)). In line with most spatial models (see Blanchard and Katz (1992) and Glaeser (2008)), they report how affected locations lose population after a shock. The relocation of labor leads to a labor supply shock in locations that were not directly affected. Thus, knowing how local labor markets respond to labor *supply* shocks helps in understanding how local labor *demand* shocks spread to the larger national labor market, an important and sometimes neglected aspect in these studies.

# 2 Historical background and data

## 2.1 Mexican Inflows in the 1990s

As reported in Borjas and Katz (2007), in 1990 the great majority of Mexicans were in California (57.5 percent). During the decade of the 1990s, the largest increases in the share of Mexicans in a state's labor force were in Arizona, Colorado, California, New Mexico, and Texas. Within the 1990s, however, there was important variation in the number of Mexicans entering each year. There are a number of alternatives with which to try to obtain estimates on yearly flows between Mexico and the US. A first set of alternatives is to use various data sources to obtain a direct estimate of the Mexican (net) inflows. A second set of alternatives is to look at indirect data, like apprehensions at the US-Mexican border. I present these in what follows.

Perhaps the first natural source is the March Current Population Survey (CPS) from Ruggles et al. (2008). The CPS only started to report birthplaces in 1994. Figure 1 clearly shows that a significant number of Mexicans entered the US labor force in 1995, which coincides with most data sources. It is a bit more difficult to believe, given the net inflows of Mexicans during the 1990s suggested in the various sources, that the share of Mexicans in the low-skilled US workforce decreased in 1996.[6]

[Figure 1 should be here]

There are a number of ways to obtain alternative estimates other than by exclusively using the CPS. Many of them rely on the question in the Census 2000: "When did this person come to live in the United States?" (Ruggles et al., 2008). This yields an estimate of the number of Mexicans still residing in the US in 2000 who arrived in each year of the 1990s. Figure 2 shows these estimates.

[Figure 2 should be here]

[6]Throughout the paper, I define low-skilled workers as high school drop-outs and high school graduates.

The Census 2000 data in Figure 2 also document a spike in 1995. We observe an upward trend, partly the result of migrants who returned to Mexico or who died. The way in which this is accounted for distinguishes the different estimates of annual inflows available in the literature. Passel et al. (2012) estimates are the standard source. For these estimates, they first compute aggregate net inflows over the 1990s by comparing stocks of Mexicans in 1990 and 2000 using US Census data. The net inflow over the 1990s is estimated at about 4-5 million and this needs to be matched by any estimates of yearly inflows.[7] To obtain the yearly inflows, they use the US census question on year of arrival. Passel et al. (2012) adjust these estimates for undercount using information from the CPS and further inflate by 0.5 percent for each year before 2000 to account for mortality and emigration between arrival and 2000. Finally they match decade net inflows estimated using the 1990 and 2000 Censuses by further inflating the annual inflows by almost 9 percent. A summary of these numbers and of the Mexican counts of the US Censuses of 1990 and 2000 is provided in Table 1.

[Table 1 should be here]

There are two concerns with Passel et al. (2012) estimates that I address. First, Passel et al. (2012) do not take into account the possibility that fewer Mexicans residing in the US returned to Mexico in particular years. Second, they do not account for the possibility that the observed spike in 1995 is just a result of the fact that 1995 is a multiple of 5 and thus, more commonly reported by respondents to US Census questioning, as suggested in Card and Lewis (2007). I try to address these two concerns by combining several data sources to propose an improved account of net yearly Mexican inflows. It is worth noting that these aggregate numbers only matter for the quantitative exercise in section 4.2.8. For the reduced form estimates of section 3.2 I only need the adequate increase in Mexican migration in 1995. For this I use the CPS data, but I also discuss what would happen to my estimates if there was undercount.

To account for the possibility that fewer Mexicans than expected returned to the US when the crisis hit Mexico, I use data from the Mexican Migration Project. The Mexican Migration Project is a survey intended for research into the migration behavior of Mexicans. The survey is conducted both in Mexico and in the US and it is possible to use these data to construct the year of return of Mexicans that spent some time in the US during the 1990s and that were living in Mexico in the 2000s. The top panel of Figure C.3 in the Appendix C shows the share of these Mexicans by year of return. It clearly shows that fewer of them returned right after the Peso crisis hit. The upward trend is probably due to mortality and to the fact that there were fewer Mexicans in the US in the early 1990s (and thus fewer Mexicans returned to Mexico in the early 1990s than in the late 1990s simply because there were a smaller number of them in the US).

To obtain a measure of migration from Mexico, I use the question on year of arrival in the US in the 2000 US Census. Unlike Passel et al. (2012), to avoid concerns on artificial spikes in years that are multiples of five (Card and Lewis, 2007), I compute the number of Mexicans residing in the US each year relative to the number of low-skilled immigrants from the rest of the world, using the aforementioned question in the 2000 US Census. This can be seen in the bottom panel in Figure C.3. The upward trend in this figure is probably explained by the higher return rate of Mexican immigrants relative to immigrants of other nationalities.

[7] In the 2000 US Census, more Mexicans said that they arrived in the US in 1990 than the actual estimate in the 1990 US census. This suggests that undercount is an important issue or at least was in 1990. Hanson (2006) discusses the literature on counting undocumented migrants. There is some open debate on the size of undercount in 1990, but there is a wider consensus that the undercount was minimal in the 2000 US Census. Depending on the sources, this implies a range of possible estimates of Mexican net inflows over the 1990s of between 4 and 5 million.

In order to measure the actual net number of Mexicans migrating each year, I do the following. I first de-trend the series of computed emigration, immigration from Mexico, and in-migration presented in Figure C.3. I then use the percentage deviation from trend of these series to match the aggregate migration in the decade measured using the US Censuses in 1990 and 2000, following Passel et al. (2012). The gross numbers resulting from this exercise are summarized by Figure 3.[8]

[Figure 3 should be here]

It is also reassuring that other data sources, like the number of legal Mexican migrants recorded by the Department of Homeland Security or the number of undocumented migrants computed using Immigration Naturalization Service data (Hanson, 2006) also see a spike right after the Peso Crisis. In the Appendix B.1 I discuss indirect measures of Mexican inflows like apprehensions that confirm the same spike of 1995. While all my qualitative results are robust to using any of the above measures, since the main source of identification comes from the unexpected large net inflow of 1995, measures underestimating the increase in net inflows will overestimate the effects of immigrants. When discussing the wage estimates, I consider the possibility of a 5% undercount rate only in 1995 and show how my estimates would change in this scenario.

## 2.2 Labor Market Outcome Variables

I use standard CPS data to compute weekly wages at the individual level. I compute them by dividing the yearly wage income (form the previous year) by the number of weeks worked.[9] From individual-level information on wages, I can easily construct aggregate measures of wages. I also use the CPS data to compute other labor market outcome variables. I use CPS data to count employment levels and relocation. For employment levels, I simply compute the number of individuals who are in full time employment. For relocation, I compute the share of low-skilled individuals or population growth rates by skill groups. I define high-skilled workers as workers having more than a high school diploma, while I define low-skilled workers as having a high school diploma or less.

I also use CPS data to obtain the share of Mexican workers after 1994. When I show longer series, I rely on the Hispanic classification in the CPS. Appendix B provides some more details on the data. I consider all Mexicans in the CPS as workers, since some may be illegal and may be working more than is reported in the CPS. This makes the estimates I provide below conservative estimates. I define natives as all those who are non-Mexicans or non-Hispanics, and use the two interchangeably in the paper. I provide robustness evidence considering only US-born as natives in Appendix A.

In Appendix B.2 I discuss why I decide to use states as the unit of geography for this analysis.

[8]In the Appendix B I explain all the steps in more detail. The largest difference between my estimates and Passel et al. (2012) are 1998 and 1999. For instance, (Passel et al., 2012) reports that the net number of Mexican immigrants in 1999 was 700,000, while my estimates decrease this number to around 400,000. It is difficult to know with certainty which estimates are more accurate for these years. However, the fact that in the US census of 2000 350,000 answered that they moved to the US in 1999 suggests that my estimates might be more accurate than Passel et al. (2012) at least for 1999.

[9]The CPS also provides the real hourly wage. This is the reported hourly wage the week previous to the week of the interview, in March of every year. I do not report results using this variable in the paper, but all the results are unchanged when using this real hourly wage instead of the real weekly wage. An alternative to the March CPS data is the CPS Merged Outgoing Rotation Group files. I obtain similar estimates when using this alternative data set.

## 2.3 Summary Statistics

Table 2 shows the main variables used for the estimation of the causal effect of Mexican inflows on low-skilled native wages. They are divided into three blocks. The first block describes the various measures of net inflows at the state level, in absolute terms described in the aggregate data (see previous section). While Mexican inflows were negligible in many states, there are a few that received large numbers of new workers every year. The largest inflow is in California, which in 1995 received slightly more than 300,000 workers, which represents almost 9 percent of the state's low-skilled labor force. This is around 50 percent higher than in a normal year of the 1990s.

[Table 2 should be here]

The second block describes average labor market outcomes in 1994 and 1995. Average wages of low-skilled workers at the state level are significantly lower than those of high-skilled workers. There is some dispersion across states, as one would expect given the various shocks that hit the economy and given the potentially different amenity levels in each state. This second block uses exclusively CPS data (except for the share of Mexican workers in 1980 that relies on US Census data) and shows the data that I directly use in my short-run regressions.

The third block provides some descriptive statistics on GDP and trade. Those are used as controls in the short-run regressions. It shows that trade usually makes up a very small fraction of state GDP. In the case of California, the state receiving the largest amount of immigrants, the ratio of US exports to Mexico relative to state GDP was below .7 percent throughout the decade. Other states, like Texas, Michigan, Arizona, Alabama, Louisiana, South Carolina, and Delaware, have higher or very similar ratios of exports to Mexico to GDP. In other words, Mexican immigration is substantially more important for California than exports to Mexico.

# 3 Short-run effects of immigration

## 3.1 Main specification and first stage

In this section I investigate the short-run effects of immigration on labor market outcomes. To do so, I compare the changes in labor market outcomes across states, given the change in the share of Mexican immigrants among low-skilled workers:

$$\Delta Y_s = \alpha + \beta * \Delta \frac{\text{Mex}_s}{\text{N}_s} + \Delta X_s * \gamma + \varepsilon_s \tag{1}$$

where $Y_s$ is our labor market outcome of interest, $s$ are states, $\frac{\text{Mex}_s}{\text{N}_s}$ is the share of Mexicans among the labor market of interest, $X_s$ are time-varying state controls, and $\varepsilon_s$ is the error term.

I follow Bertrand et al. (2004) in first differencing the data and in abstracting from yearly variation. This is the recommended strategy when there is potential serial correlation and when clustering is problematic because of the different size of the clusters (MacKinnon and Webb, 2013) or an insufficient number of clusters (Angrist and Pischke, 2009). In the baseline specification, I simply compare 1994 and 1995. I also use different sets of years as the pre-shock period and group them as one period, while I always consider 1995 as the post-shock period.[10] This allows me to estimate the effect of the immigration before the spillovers between regions due to labor relocation contaminate my strategy. In my preferred specification, I control for possibly different linear trends across states and individual characteristics by netting them out before aggregating the individual observations to the post and pre-periods.

I run this regression in a year when Mexican migrants moved to the US for arguably exogenous reasons. This does not necessarily mean that they did not choose what states to enter given the local economic conditions. To address this endogenous location choice I rely on the immigration networks instrument. I use the share of Mexicans in the labor force in each state in 1980 to predict where the inflow of workers is going to be more important in the 1990s. This is the case if past stocks of immigrants determine where future inflows are moving to. The first stage regressions are reported in Table 3. They show the results of estimating the following equation:

$$\Delta \frac{\mathrm{Mex}_s}{\mathrm{N}_s} = \alpha + \beta * \frac{\mathrm{Mex}_s^{1980}}{\mathrm{N}_s^{1980}} + \Delta X_s * \gamma + \epsilon_s \tag{2}$$

where the variables are defined as before, and where the subscript 1980 refers to this year. The share of 1980 refers to the entire population, but nothing changes if I use the share of Mexicans in 1980 among low-skilled workers exclusively. I chose the former because immigration networks can be formed between individuals of different skills.

The first column on Table 3 shows that states that had a higher share of Mexicans in 1980 have a six times larger share of Mexicans in 1995. This is a natural consequence of the massive Mexican inflows over the 80s and early 90s and the concentration of these flows into particular states. The second column shows that the flows of Mexican workers between 1994 and 1995 also concentrated in these originally high-immigration states. This is the basis of the instrument. The third column simply adjusts the flow of Mexican workers towards the US between 1994 to 1995 by assuming that the special circumstances may have led to an undercount of the number of extra Mexicans that moved towards the US in that year. I assume an undercount rate of 5 percent. In the second stage regressions, this should provide a lower bound for the true estimates.

[Table 3 should be here]

The last two columns of Table 3 report the same regressions but for high-skilled workers. Column 4 shows that it is also true that the share of Mexicans among the high-skilled is higher in the states that originally attracted more Mexicans. It is not true, however, that the change of high-skilled Mexicans between 1994 and 1995 is also well predicted by the importance of Mexicans in the state labor force in 1980. In Appendix A.1 I discuss the exclusion restriction.

## 3.2 Short-run effects of immigration on wages

In this section I estimate the causal effect of immigration on US local wages. I use the following equation for estimation:

$$\Delta \ln w_s = \alpha + \beta * \Delta \frac{\mathrm{Mex}_s}{\mathrm{N}_s} + \Delta X_s * \gamma + \varepsilon_s \tag{3}$$

[10] Again, when using pre-1994 data, I define Mexicans using the Hispanic variable in the CPS. See Appendix B for more details.

where $\ln w_s$ are the average wages of low-skilled workers in state $s$, $\frac{\text{Mex}_s}{\text{N}_s}$ is the share of Mexicans among the low-skilled workers, $X_s$ are time-varying state controls, and $\varepsilon_s$ is the error term.

Before showing the main estimates, it is worth seeing in a graph what exactly identifies $\beta$. Figure 4 shows the evolution of the average low and high-skilled wages in high- and low-immigration states. High-immigration states are defined as those states that belonged to Mexico according to the 1848 borders.[11] Wages are normalized to 1 in 1994 to make the comparisons simpler and I exclude Hispanics when computing the average wage of low-skilled workers.[12] A few things are worth noting from Figure 4. First, low-skilled wages decreased in 1993 slightly more in high- than in low-immigration states. This mostly comes from the decrease in low-skilled wages in California, and not the other high-immigration states. Second, when comparing low- and high-skilled wages in high-immigration states we see that only low-skilled wages decreased in 1995. Afterwards, they recovered slightly, and started to follow their pre-shock trend, while the trend of high-skilled wages was unchanged in 1995. By the end of the decade, high-skilled wages increased in high-immigration states, probably showing the beginning of the dot com bubble in California. When instead we compare low-skilled wages in high- and low-immigration states, we observe that the decrease in high-immigration states is pronounced while the trend is unaffected in low-immigration states.

[Figure 4 should be here]

The estimation exercise identifies $\beta$ by comparing the sharp decrease in low-skilled wages in high-immigration states like California relative to lower-immigration states like New York in 1995. For the identification strategy, it is crucial to have both an exogenous push factor and to deal with the endogenous choice of where Mexicans decide to migrate to within the US. In some of the specifications, I account for the possible different underlying trends by first regressing wages on state-fixed effects and state-specific linear time trends and then taking the average of the residuals. I account for individual level characteristics in this way too.

[Table 4 should be here]

Table 4 reports the results of estimating equation 4. In the first two columns, I report the results of the regression of low-skilled average wages on the share of Mexican workers among the low-skilled labor force in 1995. We observe in column 1 that there is no correlation in the cross-section between wages and immigration. In column 2, I instrument the share of low-skilled Mexicans by the share of Mexicans in the labor force in 1980. The result is very similar. It points to the fact that in the cross-section there is no systematic relationship between more immigration and lower wages. Many things can explain this result. For example, the US labor market may have systematic ways of equilibrating the labor market returns across regions. This is in line with previous literature, and cannot be interpreted as evidence that immigration has no effect on wages.

In column 3, I make an important first step towards identifying the effects of Mexican immigration on US low-skilled workers. When first-differencing the data, we observe that between 1994 and 1995 – when for

[11] Some counties in Colorado also belonged to Mexico, but the entire state is left as a low-immigration state. See the article discussing this in `http://www.economist.com/news/united-states/21595434-old-mexico-lives` in the Economist. This provides a way to define high- and low-immigration states that is independent of where Mexicans migrated in the 80s and early 90s.

[12] See more details in the data section and in Appendix B.

exogenous reasons the inflow of Mexicans was larger – native wages decreased more in states where the share of Mexicans increased more. This is already an important thing to note and has been absent in previous immigration studies.

Column 3, however, does not take into account four important threats to identification. The first one is addressed in column 4. There may be variables related to the overall economic performance of the different states, or related to the trading relations of these different states with Mexico, that could be correlated with immigration and would explain the negative correlation reported in column 3. To deal with this concern, I add the change in (log) GDP, the change in (log) exports to Mexico and changes in (log) employment levels by skill group. The coefficient in column 4 is similar to that of column 3.

A second threat to identification is that Mexican migrants endogenously decided where to migrate within the US in 1995 based on the labor market conditions at destination. To address this concern, I use the share of Mexicans in the labor force in 1980 to know where – based on immigration networks – the Mexican immigration shock is more likely to be more important. Column 5 shows that this is important. It increases the size of the negative coefficient by sixty percent, suggesting that either Mexican workers do indeed decide based on local labor market conditions or that there is some classical measurement error in how the share of Mexican workers is computed in the CPS which attenuates the OLS estimates.

The third concern is addressed in column 6. It could be that the trend of low-skilled workers is different between states. To address this, I first regress wages on state-specific linear trends and I use the residuals to compute the change in wages between 1994 and 1995. This reduces the size of the negative estimate, but by little. More important is the fourth concern. Since the CPS is a repeated cross-section, it can be that the workers in different years systematically differ, creating differences in wages that are unrelated to the effect of Mexicans, but rather due to the data. Column 7 shows that when controlling for individual characteristics in a first stage Mincerian regression, and allowing for state-specific linear trends, we obtain an estimate of around -.7. In this column, the pre-shock period is 1992 to 1994. This is also another reason why the estimated coefficient is slightly smaller, since in 1993, wages in high-immigration states were slightly lower, as discussed previously. This is my preferred estimate. In column 8, I report the coefficient that results from assuming that the inflow of 1995 is undercounted by 5%. This could be the case if statistical agencies failed to count for unexpectedly large shocks. As expected, the estimate decreases. The -.4 estimate in column 8 is probably a lower bound of the magnitude of the true estimate.[13]

Table C4 in Appendix C repeats the exact same regressions of Table 4 but using the high-skilled workers' wages instead. The results show that low-skilled Mexican immigration did not affect the wages of high-skilled native workers. In the cross-section, as shown in columns 1 and 2, high-skilled wages in high-immigration states are slightly higher. When first differencing, independently of the specification used in Table 4, we observe that the unexpectedly large inflow of Mexican workers in 1995 did not decrease the wages of native high-skilled workers in high-immigration states.

The combination of Tables 4 and C4 is to estimate the equation:

$$\Delta \ln \frac{h_s}{w_s} = \alpha + \beta * \Delta \frac{\text{Mex}_s}{\text{N}_s} + \Delta X_s * \gamma + \varepsilon_s \tag{4}$$

where $h_s$ indicates the average wage of high-skilled workers, so that $\frac{h_s}{w_s}$ represents the wage gap between high- and low-skilled workers. This specification directly identifies the inverse of the elasticity of substitution in a model of perfect competition and two factors of production. I present such a model in section 4.2.

[13]Throughout, the R squares of these regression are a bit low. This is due to the large variance in small low-immigration states.

Table C5, also in Appendix C, shows that the inverse of the elasticity of substitution between high- and low-skilled workers is around .9.[14] Table C5 follows a similar structure to Table 4. In all cases, the wage gap is computed by allowing different linear state-skill specific trends as in my preferred estimates of Table 4. As before, the OLS regressions are likely to provide downward biased estimates of this structural parameter, either because the share of Mexicans is measured with error, or because Mexicans endogenously decide where to locate themselves within the US. The IV deals with these two concerns, and provides my preferred estimate. I use this estimate when I calibrate the model to the data.

In Appendix A, I discuss several robustness checks. First, I show that the results presented in this section are robust to excluding California, Texas, or both from the regressions, see Table C1. This is important since in this paper I use an exogenous migration inflow that affects various regions in the United States, something that Card (1990) did not have with the Cuban Mariel Boatlift migrants. I also show in the Appendix, see Table C2, that I obtain similar results if I consider the high school drop-outs or the high school graduates exclusively as the group of workers competing with the Mexicans. The standard errors increase substantially when using high school drop-outs exclusively. Finally, I show that the results are very similar if I include or exclude all foreign born people when defining natives – in the previous tables I only exclude Mexicans and define natives as the rest, see Table C3.

### 3.3 Relocation of workers

Do these labor market effects spill over between high- and low-immigration states? Does labor relocate across space in response to local shocks? The most important critique of cross-state or cross-city comparisons in the immigration literature is that workers may relocate when hit by negative wage shocks (Borjas et al., 1996). This is what the spatial equilibrium literature would also suggest. The exogenous immigration shock of 1995 is unevenly distributed across US states, offering an opportunity to see how workers relocate from high-immigration states to low-immigration states when hit by an unexpected inflow of low-skilled workers.[15].

Figure 5 shows evidence suggesting that this is the case. It shows three different graphs. The first two graphs plot the evolution of the share of native low-skilled workers and the overall share of low-skilled population in high- and low-immigration states.[16] These first and second graphs, at the top of Figure 5, show that the share of native low-skilled workers keeps decreasing over the decade both in high- and low-immigration states. This reflects the well-known secular increase in education levels in the entire US which has been documented in the literature on skill-biased technological change, see Katz and Murphy (1992) or Acemoglu and Autor (2011). This is also true for the *overall* share of low-skilled population, even if it decreases less fast in high-immigration states. Effectively, Mexican workers seem to be replacing native low-skilled workers in high-immigration states. This is reinforced by the observation, not directly observable in the graph because I normalize the different shares to one in 1994, that the share of native low-skilled population is *higher* in low-immigration states. This is perhaps not surprising, but it has not been emphasized in other papers. In the second graph we also see that the share of low-skilled workers stays stable or even increases slightly in 1996 and 1997 in low-immigration states (when there is a clear negative trend in all other years). This is the effect of internal relocation.

The third graph plots the ratio of the share of low-skilled workers to the share of native low-skilled

[14] This estimate does not contradict what Katz and Murphy (1992) found in their seminal contribution.

[15] Again, see the article discussing this in `http://www.economist.com/news/united-states/21595434-old-mexico-lives` in the Economist. This is how I define high- and low-immigration states.

[16] In this graph, since I use pre-1994 data, I defined Mexican workers using the variable Hispanic from the CPS. See more details in Appendix B.

workers, since this allows us to see more clearly some important extra facts. First, we see a spike in 1995 in the overall share of low-skilled workers, relative to the share of native low-skilled workers, exclusively in high-immigration states. This is the consequence of the Mexican inflow previously documented. Second, the trend of this ratio in high-immigration states is positive. This is again due to the increased presence of Mexicans among low-skilled workers in high-immigration states. Finally, we see that there is little evidence that the increase (at least relative to trend) in the share of low-skilled workers in low-immigration states is exclusively driven by Mexicans relocating inside the country, since the dashed line does not have any spikes in 1996 or 1997.

In what follows, I quantify the relocation responses of low-skilled workers, following the recommended approach established in the literature, see Peri and Sparber (2011) for a discussion. In Appendix A.5 I provide an alternative to the approach I follow in the main text. This alternative approach directly identifies the structural parameter discussed in section 4.2.8.

To quantify the relocation response of low-skilled workers is to follow Card (2005) and run the following regression:

$$\Delta \text{Share of low-skilled}_s = \alpha + \beta * \Delta \text{Share Mexicans}_s + \Delta X_s + \varepsilon_s \tag{5}$$

where the share of low-skilled is the share (among the entire population) of low-skilled individuals and is computed using both natives and immigrants. In this case, the inflow of low-skilled workers should increase one to one the overall share of low-skilled workers in the first year (if there is no immediate relocation) and then decrease in the subsequent year or years if there is some relocation.

Table 5 shows the results of estimating (5). As before, the first two columns show the cross-sectional regressions. They show that states with more Mexican migrants tended to have a slightly lower share of low-skilled workers in 1995. I investigate this further in section 4.3. Columns 3-5 present the first differenced regressions for 1995. An estimated coefficient $\beta$ equal to 1 would mean that there is no sign of immediate relocation, while if it were lower than one we could conclude that there are some immediate relocation responses. In the first column I show that, like in the rest of the literature, the share of low-skilled workers increases one for one with contemporaneous immigration. In column 4, I show that this is robust to including controls. Column 5 instruments the change in the share of Mexicans (over the entire population) by the share of Mexicans in the entire population in 1980. The coefficient estimated in column 5 is smaller than one, but the standard errors are sufficiently large to include 1 and, thus I cannot rule out there being no relocation in 1995.

[Table 5 should be here]

Columns 6 to 8 investigate what happened in 1996, one year after the unexpectedly large inflow of Mexicans that increased the share of low-skilled workers in the high-immigration states. We immediately see that with the OLS estimates we already obtain an estimate significantly smaller than one. The IV estimate, suggests, in fact, that the share of low-skilled workers reverts back to where it was. This is strong evidence that there was some labor relocation taking place the year after the unexpectedly large inflow of Mexican workers of 1995 and is in line with Figure 5.

A note of caution for these estimates is important. First, the estimates on the relocation tables are in general less precisely estimated than the tables on wages. Second, the evidence presented here is consistent with both the internal relocation of native and Mexican workers, and on returned Mexican migration. It is difficult to distinguish the two because of lack of better data. CPS data suggests some return migration – as the share of Mexicans in the US low-skilled labor force decreased slightly in 1996, while Census and Passel et al. (2012) data suggests that what I am finding is related to internal migration.

### 3.4 Local labor demand and migration response estimates in the literature

At first sight, the estimated local labor demand elasticity and the relocation responses may seem large. For example, for the local labor demand elasticity this is certainly the case if we compare the estimates presented in this paper with what most of the immigration literature finds when using across-space comparisons.[17] I have argued so far that this is due to the fact that most of the migration literature has not considered exogenous push factors and usually considers longer time horizons (i.e. ten year first differences). However, are these the only estimates that we have for these important parameters?

The literature on minimum wages provides an alternative strategy for estimating the local labor demand. How much an increase in minimum wages translates into decreases in employment of low-skilled workers depends on the local labor demand elasticity (obviously, conditional on the local labor market being well approximated by a competitive market).[18] With high local labor demand elasticities, the employment effects of minimum wages are small. This is exactly what has been found in a large amount of the literature (Allegretto et al., 2011; Card, 1992a,b; Card and Krueger, 1994, 2000; Dube et al., 2007, 2010). Even the papers that find the largest employment effects, see for example Neumark and Wascher (2000); Neumark et al. (2014), typically find local labor demand elasticities larger than 0.3 or 0.4. Thus, my estimates in this paper are very much in line with this literature.[19]

The literature on spatial relocation usually uses longer horizons as well (see for example Hornbeck (2012)). The studies that look into shorter time horizons usually find high responses of internal migration to local shocks. Blanchard and Katz (1992) suggest that internal migration is fast enough to dissipate local shocks within 4 to 8 years. Monras (2015) shows that internal city level in-migration rates are very responsive to local shocks, and can account for most of the responses of internal migration to negative shocks. Finally, Carrington (1996) finds both large and fast wage and internal migration responses when examining the construction of the Trans-Alaska pipeline in the early 70s.

In Appendix A.6 I discuss the similarities and differences between my findings and the seminal contribution by Card (1990).

## 4 Long-run effects of immigration

The fact that there is some relocation of low-skilled workers away from high-immigration states as a response to a negative shock to wages makes it more difficult to evaluate the longer run effects of immigration on labor market outcomes. There are a number of alternatives one can adopt. Empirically, I first estimate the evolution of low-skilled wages in high- relative to low-immigration states.[20] I then show the wage changes over the decade of the 1990s in the different states and relate them to Mexican immigrant inflows and

[17] Llull (2015) is an important exception.

[18] With search and match models of the labor market similar results can also be obtained, but the interpretation is less straight forward.

[19] There is some evidence using hurricanes that also report non-negligible wage effects. See for example McIntosh (2008) or De Silva et al. (2010).

[20] This is similar to Figure 4, but in this section I estimate the difference more precisely.

internal migration. Finally, I abstract from locations and assume, as Borjas (2003) does, that different age cohorts suffered the shock differently. In this case, while both younger and older workers suffered from the immigration shock, we can compare whether workers entering the labor market in higher or lower immigration years have lower wages or not in 2000, relative to similar workers in 1990. This would be consistent with the literature suggesting that entering during a downturn has lasting consequences Oreopoulos et al. (Forthcoming).

A final alternative is to use the reported short-run estimates on the local labor demand elasticity and the sensitivity of internal migration rates to local wages in a model built around these two key parameters. I can then calibrate the model and perform counterfactual exercises. The calibration exercise assumes two possible – though extreme – technological processes that govern the level of wages. The first one assumes fixed technology, while the second one assumes that normal inflows of Mexican workers are absorbed through local technology changes as argued in Lewis (2012). The main difference between these two technological processes concerns the distribution of workers across space after the immigration episodes takes place. I provide evidence on long-run relocation consistent with previous literature and with the story that normal inflows of Mexican workers are absorbed by technology changes, while unexpected inflows are absorbed through short-run wage decreases and internal relocation.

## 4.1 Empirical investigation of the longer run effects on wages

### 4.1.1 Wage Dynamics

Figure 4 can be used as the basis for an event type estimation strategy:

$$\ln wage_{ist} = \delta_s + \delta_t + \sum_t \beta_t \delta_t HIS_s + Controls_{ist} + \varepsilon_{ist}$$

where $HIS_s$ indicates whether the state is a high-immigration state, $\delta_s$ are state fixed effects and $\delta_t$ are year fixed effects. I include as controls the age and age square of the individual, race dummies, and occupation dummies.[21] Figure 6 plots the coefficients of the interaction of year fixed effects and the high-immigration state dummy, which is the differential effect of each year on wages of workers in high-immigration states:

[Figure 6 should be here]

The graph shows that in high-immigration states, the wages of low-skilled workers were around .025 log points lower before 1994. In 1995, they were almost .05 log points lower and they continued at this level until 1997. In 1998 they returned to the original .025 log points. To some extent this Figure is very similar to the raw wages shown in Figure 4, but makes the relative trends and changes more explicit. It confirms that, if anything, low-skilled wages may have a slightly decreasing trend in high-immigration states, something that may well be a consequence of immigration itself.[22] This slightly negative trend is picked by ten year differences estimated in the following section using Census data. It also shows the discrete decrease in 1995 and the relative recovery of wages in high-immigration states in 1998.

[21] See Appendix B for more details.

[22] If I allow for a high-immigration specific trend then the only estimates that are distinguishable from 0 are the ones for 1995-1997.

#### 4.1.2 Long-run effect on wages in decennial data

**Cross state comparisons**

Table 4 identifies the effect of immigration on wages from very short-run comparisons. The identification comes from the drop in wages of the specific group of workers, i.e., low-skilled, who are competing more closely with the Mexican arrivals. Figures 4 and 6 suggest that wages may have recovered in high-immigration states after the shock, at least to some extent, although the trend may be slightly more negative in high- relative to low-immigration states. To investigate this further I use the following regression:

$$\Delta^{00-90} \ln w_s = \alpha + \beta * \frac{\Delta^{00-90}\text{Mex}_s}{\text{N}_{s,90}} + \varepsilon_s \tag{6}$$

where $\Delta^{00-90}$ indicates the difference between 1990 and 2000 of the relevant variable. It is important to note that, in this specification, I use the relative inflow of Mexican workers instead of the change in the share because I consider the population at the beginning of the period to be the size of the relevant labor market. Given the population growth over the 90s in the United States, this strategy obtains a smaller estimate (in absolute value) than using the change in the share of Mexican workers. Thus, the results shown in what follows are conservative estimates.[23]

This specification is very similar to the ones used in Card (2001) and especially Altonji and Card (1991). As mentioned before, the presumption that Mexicans may be choosing where to migrate within the US motivated the construction of the networks instrument. To restate the idea of this instrument, it is a valid instrument if new inflows of Mexican workers are strongly influenced by the past stock of Mexicans in the US *and* there are no spillovers between states. I report the results in Table 6, commented below.

**Cross age comparisons**

An alternative specification for investigating the long-run impact of immigration is used by Borjas (2003). He assumes that there are spillovers between geographic units, and completely forgets about them in his main specifications. Instead, Borjas (2003) uses across-cohort or across-age variation to study the long-run effect of immigration. This is:

$$\Delta^{00-90} \ln w_a = \alpha + \beta * \frac{\Delta^{00-90}\text{Mex}_a}{\text{N}_{a,90}} + \varepsilon_a \tag{7}$$

The assumption in this case is that different age cohorts of potential migrants do not take into account the labor market outcomes of their own group when migrating. This last concern also suggests that we must find a valid instrument for this regression. In this paper I build such an instrument based on the unexpectedly large inflow of Mexicans in 1995 and on the fact that the age distribution of Mexican immigrants was very constant over the entire 1990-2000 decade. Specifically, I construct:

$$\text{Predicted migrants}_a = \sum_{j=1991}^{2000} \text{Share Migrants aged (a-(j-1990)) at t} * \text{Mex}_t \tag{8}$$

[23] In the previous short-run regressions, this distinction does not matter so much because the population growth in a given year is significantly less pronounced than over an entire decade. Note that without population growth, the two specifications are identical.

This is, I assign the inflow of Mexicans at year $t$ using the age distribution of the entire decade to match the particular age cohort that receives the shock.

**Results**

Table 6 shows the empirical results of the effect of Mexican migration in the long-run. The bottom part shows the first stage regressions. In column 2, we see, as in previous tables, that past stocks of immigrants are a good predictor of future inflows across states. The coefficient is around 1.4, suggesting that over the entire decade almost 4 times more Mexicans moved to high-immigration states than in 1995.[24] Note that this is in-line with the idea that Mexican workers are less concentrated in space over time as documented in Card and Lewis (2007) and as can be seen when comparing the distributions of Mexicans across states in 1990 and 2000 using US Census data. Column 4 of this bottom part of Table 6 shows that the predicted inflow of Mexicans by age cohort is a good predictor of the actual share of Mexicans in each age cohort. A coefficient smaller than one indicates that some Mexicans, presumably those for whom the labor market was worse, returned to Mexico.

[Table 6 should be here]

The upper part of Table 6 shows the cross-state (left part of the Table) and cross-age comparisons (right part) for low-skilled workers. As in previous literature, across-state Mexican inflows and wage changes are slightly negatively correlated, with point estimates that are not statistically different from zero. This is shown in column 1. In column 2, I instrument the OLS regression with the immigration networks instrument. The coefficient becomes slightly more negative, suggesting a long-run local labor demand elasticity of -.4. This is the slightly negative trend in high- relative to low-immigration states discussed in Figures 4 and 6 and is similar to previous studies.[25] Note that columns 1 and 2 simply follow the literature initiated by Altonji and Card (1991). Column 3 instead follows Borjas (2003). Like him, I find a negative estimate of around -.4. In column 4, I use the instrument proposed in equation 8. When instrumenting to take into account the possible selected immigration in particular years and selected return migration by Mexicans, I obtain an estimate of around -.74, surprisingly close to the estimate I obtained in the short-run regression shown in Table 4 using a completely different strategy.

The second panel of Table 6 shows the exact same regressions as in the upper part but using the change of high-skilled wages instead of low-skilled. All the estimates in this part of the table are close to 0. In other words, Mexican immigration seems to have affected only low-skilled workers in the long-run. And among those, the ones that suffered larger shocks when young, seem to have suffered more lasting consequences.

In the following section I further explore the dynamics of this adjustment using a model.

## 4.2 Model

While it is possible to evaluate the short-run effects using a clear natural experiment, spillovers across states due to labor relocation makes it more difficult to evaluate longer run effects. In the very short run, each local labor market, in this case states, is closed, so standard models of the aggregate labor market apply (see the canonical model discussed in Acemoglu and Autor (2011) or Katz and Murphy (1992)). In the

[24] This is half as large as if Mexicans did not relocate within the US.

[25] As shown in Borjas (2003), this coefficient decreases with geographic disaggregation.

longer run, internal migration flows link the various local labor markets, spreading local shocks to the rest of the economy. Standard models in the spatial economics literature in the spirit of Rosen (1974) and Roback (1982) are suited to analyzing the long run, once adjustment has taken place (see also Glaeser (2008), Moretti (2011) or Allen and Arkolakis (2013)). Fewer models in this literature are suited to studying the transition dynamics.

Two seminal contributions introduced transition dynamics into a model with many regions: Blanchard and Katz (1992) and Topel (1986). For instance, Blanchard and Katz (1992) report that wages seem to converge spatially after around 8 years, while unemployment rates converge faster. Their model has only one type of labor, but there is a downward sloping demand for labor in every region because regions do not necessarily produce the same goods. In the estimation of their model, they rely mainly on time series variation, although they also use Bartik (1991) type instruments like subsequent literature (see Diamond (2013) and Notowidigdo (2013)). They do not microfound the migration decisions, something that these more recent papers do using discrete choice theory. Both Diamond (2013) and Notowidigdo (2013) have two skill types and relocation costs, as in Topel (1986), but they model the relocation decision using a discrete choice model. Most spatial equilibrium models are, however, static. The discrete choice location decision determines the distribution of people across space, not where to move in the future.

The seminal contribution of Kennan and Walker (2011) introduces a dynamic migration model instead. The multiple locations and migration histories that workers can choose makes this problem particularly hard. They simplify in two respects. First, they only take into account a subset of the possible choices of workers. Second, their model is, in nature, partial equilibrium. They do not model the rest of the economy and the interactions between the different states as I do in what follows. In exchange, in the model that I present here I simplify the location decision by limiting the choice set to only the locations available for the subsequent period. I discuss these issues further in a one mobile factor model in Monras (2014) and Monras (2015). Relative to these, I have two mobile factors in this paper.

The model has $S$ regions representing US states. There is a single final consumption good that is freely traded across regions, at no cost. Workers, who can be high- or low-skilled, are free to move across regions but each period only a fraction of them considers relocating.[26] They live for infinitely many periods. At each point in time they reside in a particular location $s$ and need to decide whether to stay or move somewhere else. Once this decision is made, they work and consume in that location. Workers are small relative to the labor market so they do not take into account the effect they have on the labor market when relocating. Also, they have idiosyncratic tastes for living in each specific location. This is the basis for the location choice that derives optimal location using discrete choice theory (see McFadden (1974) and Anderson et al. (1992)). In the paper, I assume that workers only look at current economic conditions to determine their location. In the online Appendix I show that the implications are very similar to the case where workers are forward looking. The long-run equilibrium coincides with the equilibrium in standard spatial equilibrium models, where indirect utility is equalized across space. In contrast to more standard spatial equilibrium models, wages may be different across locations in the short run.

### 4.2.1 Utility Function

Workers derive utility from final good consumption, the amenities in a given location and the idiosyncratic valuation of the location:

[26] As written, the model abstracts from fixed factors (e.g., land) that can influence the scale of states in order to focus on incentives in light of disturbances to an initial equilibrium.

$$U^i_{s,s'} = A_{s'} c^i_{s'} exp(\epsilon^i_{s'}) \tag{9}$$

where $A_{s'}$ denotes amenities (that depend on the skill level), $c^i_{s'}$ denotes consumption of individual $i$ that lives in $s$ at time $t$ and moves to region $s'$. $\epsilon^i_{s'}$ is a random variable that represents individual idiosyncratic tastes when deciding where to live. A convenient assumption, as will become clear later on, is that amenities are proportional to the size of the local labor force. Workers earn the market wage of the location they reside in. Since there is only one good and no savings, they spend all of their wage on this good.

Indirect utility of workers is then given by the local wage for their skill type $\omega_{s'} \in \{w_{s'}, h_{s'}\}$, the amenities and the idiosyncratic draw they get for location $s'$, given that they live in $s$:

$$\ln V^i_{s,s'} = \ln V_{s,s'} + \epsilon^i_{s'} = \ln A_{s'} + \ln \omega_{s'} + \epsilon^i_{s'} \tag{10}$$

Note that indirect utility has a common component to all workers $\ln V_{s,s'}$ and an idiosyncratic component $\epsilon^i_{s'}$ specific to each worker. The variance of $\epsilon$ determines whether the common component or the idiosyncratic component has a higher weight in this decision.

#### 4.2.2 Location Choice

Workers decide where they want to reside, given the indirect utility they get in each place. That is, workers maximize:

$$max_{s' \in S}\{\ln V_{s,s'} + \epsilon^i_{s'}\} \tag{11}$$

The general solution to this maximization problem gives the probability that an individual $i$ residing in $s$ moves to $s'$:

$$p^i_{s,s'} = p_{s,s'}(A_s, \omega_s, F; s \in S) \tag{12}$$

Only a fraction $\eta$ of workers decide on relocation each period.[27] This parameter $\eta$ is important for the calibration, since the model would otherwise over-predict yearly bilateral mobility in the absence of shocks. By the law of large numbers we can then use equation (12) to obtain the flow of people between $s$ and $s'$:

$$P_{s,s'} = \eta * p^i_{s,s'} * N_s \text{ for } s \neq s' \tag{13}$$

where $N_s$ is the population residing in $s$. Note that this defines a matrix that represents the flows of people between any two locations in the economy.

#### 4.2.3 Dynamics

Like most other authors in the literature, I assume that $\epsilon$ is extreme value distributed.[28] This has the nice property that the difference in $\epsilon$ is also extreme value distributed and that this results in a closed form solution for the probability of an individual moving from $s$ to $s'$. We can use this to write the bilateral flows as follows:

[27]This fraction $\eta$ can be endogenized. I do this in Monras (2015) and show that it is empirically not very relevant. Given that the CPS data is of less quality than the American Community Survey data used in Monras (2015), I leave the detailed discussion outside the current paper and refer the reader to Monras (2015).

[28]Moretti (2011) assumes instead a uniform distribution, the other one that admits close form solutions.

$$P_{s,s'} = \eta N_s \frac{V_{s,s'}^{1/\lambda}}{\sum_j V_{s,j}^{1/\lambda}} \tag{14}$$

where $\lambda$ governs the variance of the error term. Lower values of $\lambda$, i.e., lower variance of the idiosyncratic error, make people more sensitive to the local economic conditions and thus relocation across local labor markets is faster.

Under these assumptions one can prove (see Monras (2014)) that the derivative of in-migration rates in $s$ with respect to (log) wages in $s$ is approximately $\frac{1}{\lambda}\frac{I_s}{N_s}$, while out-migration rates are generally less responsive. The intuition behind this result is the following. First, note that the most important thing for migration from $s$ to $s'$ is the wage in $s'$. Wages in $s$ only enter by changing the denominator in (14). This means that when a negative shock affects wages in $s$ it will have a strong influence on all the different flows of workers from any $k$ region towards $s$, while it will have a relatively smaller effect on outflows from $s$. This makes in-migration rates more responsive than out-migration rates, particularly when shocks are concentrated in one or a small number of regions. Furthermore, the estimate of a regression of internal in-migration rates on wages has a clear structural interpretation: we can recover the parameter $\lambda$ from the estimate and the change in low-skilled population growth rates in 1996. This can be expressed more concisely as follows:

**Proposition 1.** *If $\epsilon_s^i$ are iid and follow a type I Extreme Value distribution with shape parameter $\lambda$ then, in the environment defined by the model, we have that:*

1. $\partial(\frac{I_s}{N_s})/\partial \ln w_s \approx \frac{1}{\lambda}\frac{I_s}{N_s}$
2. $\partial(\frac{O_s}{N_s})/\partial \ln w_s > 0$, *but tends to 0 as the number of regions increases*
3. $\partial(\Delta \ln N_s)/\partial \ln w_s \approx \partial(\frac{\Delta N_s}{N_s})/\partial \ln w_s \approx \frac{1}{\lambda}\frac{I_s}{N_s}$, *as the number of regions increases*

*Proof.* See Appendix D. □

### 4.2.4 Production Function

The production function in all regions is the same: a perfectly competitive representative firm producing according to:

$$Q_s = B_s[\theta_s H_s^\rho + (1-\theta_s)L_s^\rho]^{1/\rho} \tag{15}$$

where $L_s$ is low-skilled labor and $H_s$ is high-skilled labor. $\theta_s$ represents the different weights that the two factors have in the production function, while $\rho$ governs the elasticity of substitution between low- and high-skilled workers. $B_s$ is Total Factor Productivity (TFP) in each state. We could also introduce factor augmenting technologies, as in Acemoglu and Autor (2011).[29]

### 4.2.5 Labor market

The marginal product of low-skilled workers is:

[29]None of the results that I will report below change if those technological levels are exogenous to immigration. On the contrary, if technology responds to immigration shocks, some of the results will change. As is common in the literature, I do not consider other factors of production like capital. As long as other factors enter the production function in a Hicks-neutral way this does not affect relative factor rewards. See also Card and Lewis (2007) and Lewis (2012).

$$w_s = p_s(1-\theta_s)B_s^{\frac{\sigma-1}{\sigma}} Q_s^{\frac{1}{\sigma}} L_s^{\frac{-1}{\sigma}} \tag{16}$$

where $\sigma = 1/(1-\rho)$ is the elasticity of substitution between high- and low-skilled workers. This defines the labor demand curve.

Similarly, the marginal product of high-skilled workers is:

$$h_s = p_s\theta_s B_s^{\frac{\sigma-1}{\sigma}} Q_s^{\frac{1}{\sigma}} H_s^{\frac{-1}{\sigma}} \tag{17}$$

We can normalize $p_s = 1$. Free trade will guarantee that prices are the same across regions.

#### 4.2.6 Equilibrium

The definition of the equilibrium has two parts. I start by defining the equilibrium in the short run. It satisfies three conditions. First, given the amenity levels and wages in each location, workers maximize their utility and decide where to live. Second, firms take as given the productivity $B_s$, the productivity of each factor $\theta_s$ and factor prices in each location to maximize profits. Finally, labor markets clear in each location. This equates the supply and the demand for labor and determines the wage in every local labor market. More formally:

**Definition I.** *A short-run equilibrium is defined by the following decisions:*

- *Given $\{A_s^l, A_s^h, w_s, h_s\}_{s\in S}$, consumers maximize utility and location choice*
- *Given $\{\theta_s, B_s, \sigma, w_s, h_s\}_{s\in S}$, firms maximize profits*
- *Labor markets clear in each $s \in S$ so that $\{w_s, h_s\}$ are determined*

We can define the long-run equilibrium by adding another condition. In words, I say the economy is in long-run equilibrium when bilateral flows of people of every type are equalized between regions. More specifically,

**Definition II.** *Given $\{\theta_s, B_s, \sigma, A_s^l, A_s^h\}_{s\in S}$, a long-run equilibrium is defined as short-run equilibrium with equalized bilateral flows of population across locations. This is:*

$$P_{s,s'} = P_{s',s}, \forall s, s' \in S$$

*for both high- and low-skilled workers.*

#### 4.2.7 Properties of the model

Only a share $\eta$ of workers considers relocating each period. This implies that, depending on the size of the local shock and the sensitivity of workers to local shocks, relocation may take some time to materialize. Thus, we can distinguish between the equilibrium properties of the model and the transitional dynamics.

In the long run, in the absence of changes in the location specific variables, the economy converges to a situation in which the marginal worker is indifferent across locations and where factor prices, net of amenities per capita, are equalized across locations.[30] Initial conditions and labor flows determine the size of each

[30] We can see this by equalizing bilateral flows, as I show later. I define amenities per capita as $a_s^{1/\lambda} = \frac{A_s^{1/\lambda}}{N_s}$.

location and the relative size of each skill in each location, determining the long-run equilibrium. In this long-run equilibrium there are still positive flows of internal migrants between the different regions. Net flows are, however, zero. In general, the equilibrium need not be unique: starting from different initial conditions, the economy may converge to different long-run equilibria.

When the steady state receives an unexpected shock then the economy changes and reaches a new steady state. The speed of convergence crucially depends on the relative importance that workers give to the idiosyncratic tastes versus the working conditions, governed by the variance of $\epsilon$. If this variance is larger, then idiosyncratic tastes become more important, while if it is zero, only labor market conditions matter and adjustment takes place instantaneously.

The case of interest for the current paper is when there is an unexpected increase in the size of the low-skilled labor force in location $s$. In this case, the increase in $L_s$ induces an instantaneous increase in the wage gap between high- and low-skilled workers in $s$. This makes location $s$ attractive to high-skilled workers, while it make it less attractive for low-skilled workers in $s$. Thus, some high-skilled workers move towards $s$ while some low-skilled workers move away from $s$.

**Proposition 2.** *An (unexpected) increase in $L_s$ in $s$ leads to:*

1. *An instantaneous decrease in $w_s$*
2. *An instantaneous increase in $h_s$*
3. *A relocation of low-skilled workers away from $s$*
4. *A relocation of high-skilled workers toward $s$*
5. *Gradual convergence of indirect utility across regions*

*Proof.* See Appendix D. □

It is possible to write similar propositions for exogenous changes in either the amenity levels or the productivity parameters.

#### 4.2.8 Calibration

The model can be used to explore various counterfactuals. First, I explain what would have happened if there had not been a Peso Crisis in late 1994. In this case Mexican immigration would have probably arrived at the same pace as in other years of the 1990s and wages would have not dropped significantly more in 1995 in California and other high-immigration states.

In the second counterfactual I analyze what would have happened if a state like Arizona had managed to effectively stop its inflow of Mexican immigrants. In this case, the direct effect of Mexican immigration would have disappeared and Arizona would have suffered the consequences of immigration only through the relocation of natives after the shock in other states. Before doing these exercises, however, I describe how I calibrate the model to the data.

There are 3+51*4=207 parameters in the model: $\{\sigma, \lambda, \eta, \theta_s, A_s^h, A_s^l, B_s\}$. $\sigma$ is the elasticity of substitution between high- and low-skilled workers in the production function. The wage regressions can be used to estimate this parameter. The estimates suggest that this elasticity is around 1, which I use in my calibration. By doing so, I am choosing the parameter estimated in Table C5. There is an extra benefit in choosing $\sigma = 1$: the CES function collapses to the well known Cobb-Douglas case.

The second parameter is also estimated using the low-skilled population growth rate equations. The estimated coefficient in these regressions is $\frac{1}{\lambda}\frac{I_s}{N_s}$ in the model and around .9 in the data. Given that the in-migration rate is around 3-4 percent, the resulting value of $\lambda$ is around 1/30. This implies a very strong reaction to local shocks. Given that the estimate in this paper is not very precise and that it is consistent with the more precisely estimated 0.2-0.3 in Monras (2015), which would imply a $\lambda$ over 1/5, I use the conservative value of $\lambda = 1/5$ in the calibration.[31]

I calibrate the rest of the parameters to match Census data in 1990. In particular, I use the relative labor demand to calibrate $\theta_s$ for each state:

$$ln(h_s/w_s) = \frac{\theta_s}{1-\theta_s} - \frac{1}{\sigma}ln(H_s/L_s) \tag{18}$$

when $\sigma = 1$, i.e. when the production function is Cobb-Douglas, then, $\theta_s = 1/(1 + (w_s L_s/h_s H_s))$. In an aggregate economy this would also coincide with the share of high-skilled workers. While this need not be true at the state level, Figure C.4 in the Appendix shows that there is also a tight relation between the share of high-skilled workers and the weight of high-skilled workers in the local production function.

The next set of parameters that I calibrate are the state-specific productivity levels. To find those I use the fact that, in perfect competition, the total wage bill should be equal to total production. Since total production is the productivity times the Cobb-Douglas production function, I can obtain productivities simply by dividing the total wage bill by the Cobb-Douglas production function given the $\theta_s$ and the worker levels in every state. Productivity levels align well with wage levels, as shown in Figure C.5, in the Appendix.

The final set of parameters that I calibrate are the amenity levels. To calibrate these I assume that the US is in spatial long-run equilibrium in 1990:

$$P_{s,s'} = P_{s',s}, \; \forall s, s' \in S \tag{19}$$

These equations allows me to obtain $A_s$, $\forall s$. For that we can use the definition of amenities per capita $a_s^{1/\lambda} = \frac{A_s^{1/\lambda}}{N_s}$ and simplify the algebra to obtain:

$$a_{s'}\omega_{s'} = a_s\omega_s \tag{20}$$

This equation allows me to obtain amenities, fixing a base location (in my case California). This equation also says that wages net of per capita amenities is equalized across regions, a natural feature in static spatial equilibrium models (Glaeser, 2008).[32] To obtain a value for $\eta$ I match the internal in-migration rate in California (3 percent). A value of $\eta = .88$ accomplishes that.

#### 4.2.9 Migration in the absence of the Peso Crisis

While at the beginning wage differences across space might be informative about the causal effect of immigration on wages, the shock then spreads to the rest of the economy leaving little spatial differences. The model introduced can help us think about what the longer-run effects of immigration might be.

I present the results under two extreme scenarios. On the one hand I show what happens according to the model if nothing else other than relocation accommodates Mexican immigration. As emphasized in

[31] The model is not very sensitive to these different values of $\lambda$. What really matters, and makes relocation fast, is that both high- and low-skilled workers relocate. Relocation is slower in the case of only one factor of production, as can be seen in Monras (2015).

[32] Following on a previous footnote, this property does not hold if instead I assume that there are fixed costs of moving across regions.

Card and Lewis (2007), technology could have adapted to absorb changes in factor endowments, something ruled out here by keeping $\theta_s$ constant. In the model, this implies that positive Mexican inflows during the 1990s directly translate into decreases in the wages of low-skilled workers in every state during this decade. An alternative assumption is that only unexpectedly large immigrant inflows matter. This is like assuming that "normal" Mexican inflows are absorbed through changes in the technology. The reality probably lies between these two extreme scenarios.

In this quantitative exercise, it is more important than before to use good estimates of the actual Mexican inflows in each year of the 90s. In what follows I use the aggregate estimates proposed in Figure 3 and discussed in Appendix B. I assign this aggregate yearly inflows using the distribution of Mexicans across states in 1990 US Census data.

To show the results, I use the comparison between California – a high- Mexican immigration state – and New York – a low- Mexican immigration state – to provide intuition. Figure 7 shows what would have been the difference with and without the shock provoked by the Pesos crisis in late 1994 under the assumption that all inflows matter.

[Figure 7 should be here]

Figure 7 shows how the wages of low-skilled workers decrease over the decade. They especially do so in high-immigration states like California, but internal migration ensures that wage decrease spill over to other states. In the long run, immigration affects all locations equally. Wage decreases of low-skilled workers vary from 10 percent in California to 5 percent in New York or even slightly lower in other states. These results imply a slightly higher effect of immigration on inequality than what was reported in Card (2009). As he argues, the key to this debate is whether high school drop-outs and high school graduates are perfect substitutes, something I have assumed here, and whether natives and immigrants are also perfect substitutes. Unlike Card (2009) I have shown that Mexicans and natives are probably perfect substitutes and this explains why immigration's effect on inequality is higher than what is discussed in Card (2009).

Figure 8 shows the case when only unexpected large inflows matter.[33] It shows that the unexpected large inflow of Mexican workers starting in 1995 decreased wages by around 3 percent in California and that wages started to recover in 1997. The drop is slightly smaller than in the observed data due to the fact that I calibrated the model to a slightly higher elasticity of substitution, but it captures very tightly the wage dynamics.

[Figure 8 should be here]

#### 4.2.10 Migration with a restrictive policy in Arizona

In 2010, Arizona tried to adopt a law, the most controversial aspect of which was to allow officials to ask for residence permits if they had some suspicion that particular individuals were not legal residents. Given that a large fraction of Mexican immigrants in the US are undocumented, to some extent this is a policy

[33] This is the case when normal inflows of workers are absorbed though changes in the technology – the $\theta_s$ in my model – or changes in the use of capital that substitutes low-skilled labor – not modelled in my paper, but discussed extensively in Lewis (2012).

that greatly reduces the incentives of Mexicans to move to Arizona. Other policies as well, like Operation Hold the Line and Operation Gatekeeper, previously discussed, are policies intended to stop immigration into particular states.

Motivated by these policies, in this section I try to answer what would have happened in Arizona if Arizona had had a policy that had effectively stopped Mexican immigration in the 1990s. The link between the different states through internal migration suggests that in the long run a single state can do little to avoid being affected by immigration. In this section, I investigate what would be the short-run gains of such controversial policies.

As in the previous counterfactuals, I consider two alternative scenarios. In the first case I assume that overall inflows matter, while in the second case only inflows above average. I study the Mexican inflows of the 1990s, and then I assume that they stop in 2000 to see the long-run consequences. Figure 9 shows these different wage dynamics. The exercises show that in the short run, in the worst years, Arizona's low-skilled wage was maybe 2 percent lower than what it would have been with a more restrictive immigration law. Wages were back to equilibrium soon after 2000. This suggests limited benefits from a unilateral law in one particular state to limit the amount of immigrants in that state.[34]

[Figure 9 should be here]

### 4.3 Long-run relocation in decennial data

A final piece of the evidence is to look at the patterns of long-run relocation across states. This can be used to disentangle the two scenarios used in the previous section. This also needs to be in line with the qualitative evidence in Figure 5. Finally, it is important to re-examine the long-run evidence using Census data, to put the current findings in perspective with those of previous literature. To do so, I use the specification 5 previously shown, but between 1990 and 2000.

[Table 7 should be here]

Table 7 shows the results. The first three columns show that in 1980 Mexicans entered states where the share of low-skilled workers was lower. Over the following two decades, the share of low-skilled workers increased more in initially high-immigration states, as can be seen in columns 2 and 3. Column 4 is yet another way of looking at the first stage regression of the immigration networks instrument used in the immigration literature. We observed that the importance of Mexicans in the low-skilled labor force in 1980 is a good predictor of where the share of Mexicans would increase more during the 90s. This is the instrument used in column 6 and 8. Columns 5 and 6 estimate the relocation equation 5. The OLS and IV estimates of columns 5 and 6 suggest that for every low-skilled Mexican entering a high-immigration state, the state gains 0.8 low-skilled workers. This estimate decreases to .6 when controlling for the 1980 distribution of low-skilled workers in the US. This is consistent with the estimates in Wozniak and Murray (2012). This is also certainly consistent with Figure 5 and with the story that while high-immigration states absorb an important share of low-skilled Mexicans by increasing the use of this factor locally, unexpected shocks can be accommodated through internal migration. Monras (2015) suggests that this is a consequence of reduced in-migration into shocked locations which explains the fast response, but CPS data is limited to explore this further in this paper.

[34] A recent paper (Watson, 2013) analyses how immigrants respond to these type of policies by relocating within the US.

# 5 Conclusion

Existing literature on the causal effect of immigration on native wages seems to find contradictory evidence. On the one hand, evidence presented in various papers by Card and some other authors would suggest that immigration has a small effect on native wages. In the particular case of low-skilled US workers, this would be a consequence of two important facts. First, if high school drop-outs and high school graduates are close substitutes in the production function then the pool of low-skilled workers absorbing low-skilled immigration into the US would be large, and thus aggregate wage effects small. Second, as first discussed in Ottaviano and Peri (2012), if low-skilled natives and immigrants are imperfect substitutes then former immigrants, not natives, absorb the labor supply shocks induced by newer immigrants.

On the other hand, Borjas (2003) and some earlier papers question the evidence coming from comparisons of local labor markets because they argue that the US labor market is well integrated. When abstracting from geographic considerations, Borjas (2003) concludes that the effect of immigration on native workers is significantly larger than what we would conclude from Card (2009) or Ottaviano and Peri (2012).

In this paper, I use the Mexican crisis of 1995 as a novel push factor that brought more Mexicans than expected to historically high-immigration states to document the causal effect of immigration on native wages. Using this natural experiment I show that a 1 percent immigration-induced supply shock decreases wages by 1-1.5 percent on impact. This is substantially higher than was reported either by Card (2009) or by Borjas (2003). It is important to keep in mind that this is a short-run effect.

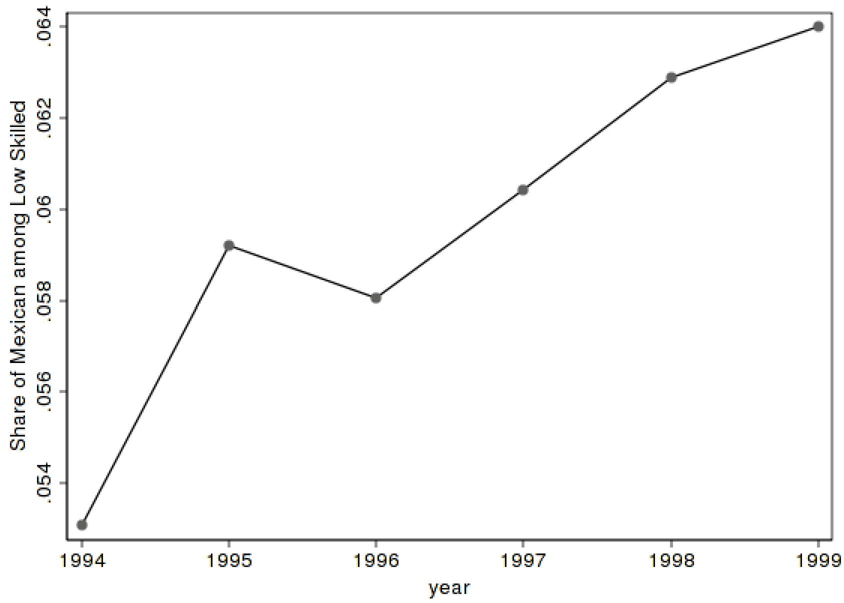
Labor relocation as a response to unexpected wage decreases ensures that immigration shocks spread across US regions. When the relative inflow of Mexicans increases by 1 percentage point, the share of low-skilled workers increases almost by 1 percent in the first year and then returns to its trend. This dissipates the shock across space, helping to explain why wage growth between 1990 and 2000 was only slightly lower in initially high-immigration states. At the same time, I have shown evidence that, when abstracting from geographic considerations like in Borjas (2003), age cohorts entering the labor markets in high-immigration years had significantly lower wage growth in the decade of the 1990s, which is in line with Oreopoulos et al. (Forthcoming). In other words, this paper documents how local shocks become national, an important step absent in Borjas (2003), and documents the causal effect of immigration in the short and long run.

Taken together, this evidence is consistent with the model presented in the last part of this paper, where I calibrated the model to US data and showed how it can be used to answer policy-relevant counterfactuals. The first counterfactual analyzed in this paper is a study of the wage evolution that would have occurred without the immigration shock. This allows me to evaluate over longer-time horizons the effect of immigration on low-skilled wages in every local labor market.

The second policy-relevant experiment studied in the paper tried to work out how effective a policy stopping Mexican migration into a particular state would be. The main insight from this exercise is to show how rapid internal relocation spreads immigration shocks and, thus, how the effects of such policies are likely to be limited.

# 6 Figures and Tables

Figure 1: Share of Mexicans in the US low-skilled labor force, CPS data

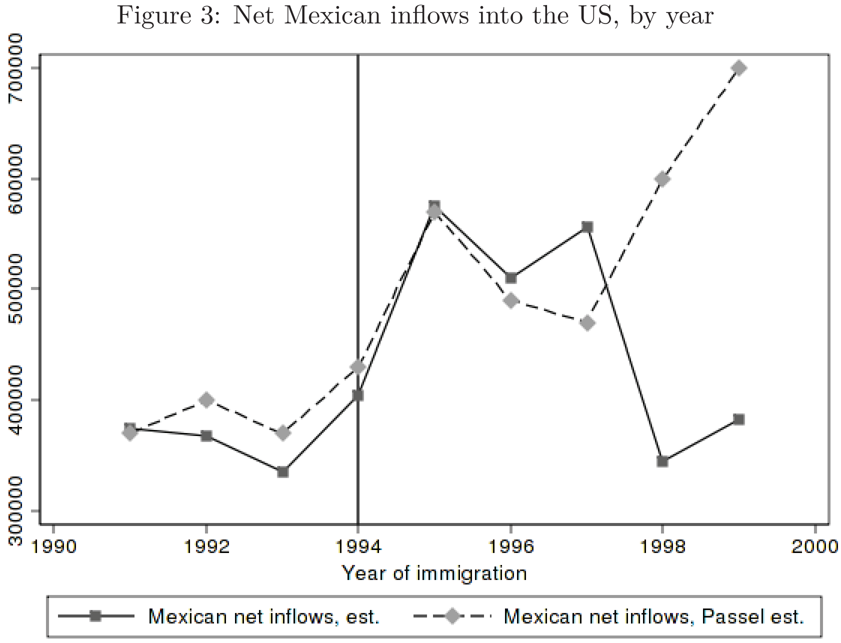



Notes: This figure plots the share of Mexicans among low-skilled workers in each year of the 1990s where CPS data is available. According to these data, there was a labor supply shock in 1995 just less than 1 percent. Other data sets suggest that the shock might have been slightly larger.

Figure 2: Mexicans in the US in 2000, by year of arrival

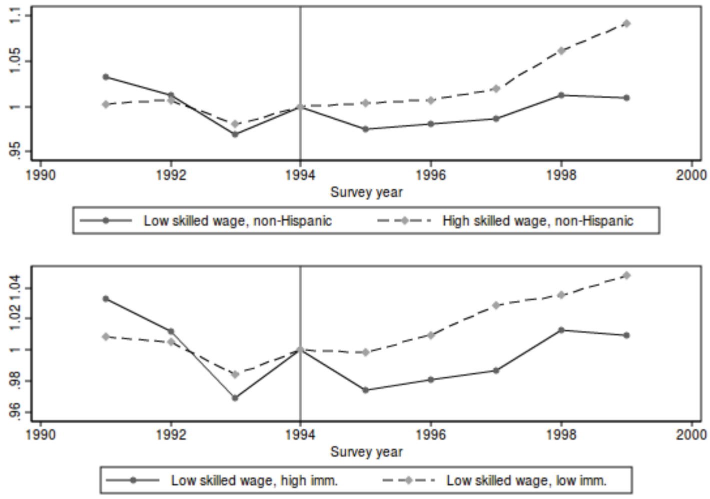

Notes: This figure plots the number of Mexicans that were in the US in 2000 by their reported year of arrival in the US. Note that the number of Mexicans who reported 1995 as their arrival year is around 50 percent higher than those who reported 1994 or 1996.

Figure 3: Net Mexican inflows into the US, by year




Notes: This figure shows the estimated net inflow of Mexicans by (Passel et al., 2012) and my own estimates using data from the US Census 2000 and the Mexican Migration Project.

Figure 4: Evolution of wages, raw data



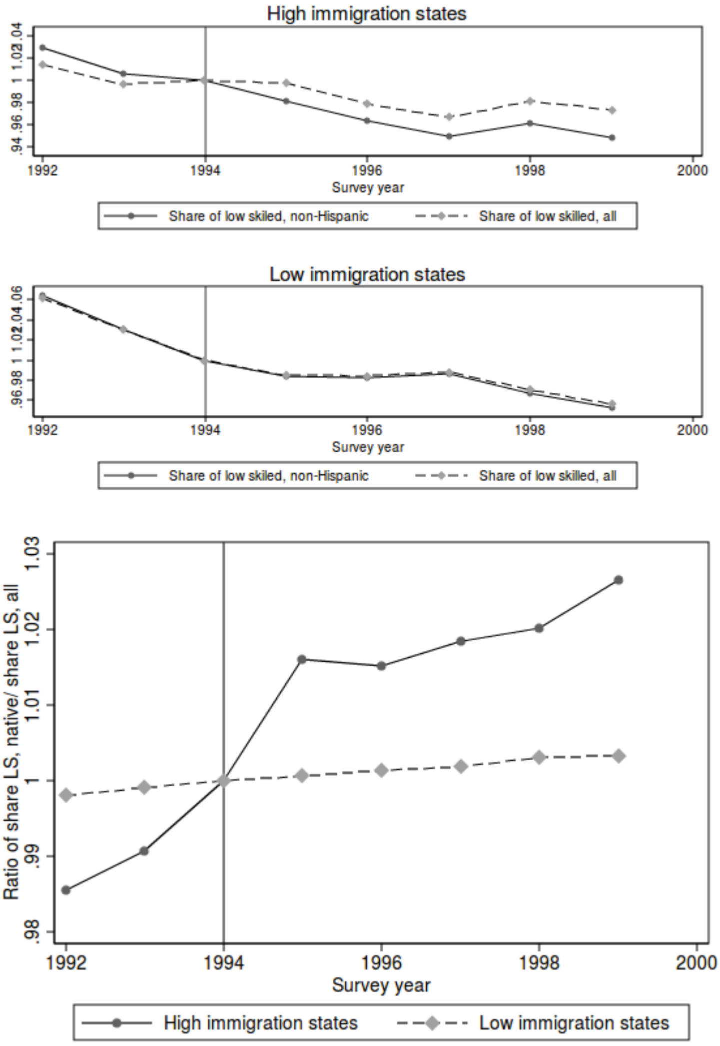

Note: The top graph reports the low- and high-skilled average wage in the high-immigration states, defined by the 1848 Mexican-US border. The bottom graph shows average low-skilled wages in high- and low-immigration states. I exclude Hispanics from the average low-skilled wage computations.

Table 1: Mexican Stocks and Inflows

| Variable | Source | Number | year |
|---|---|---|---|
| Mexican Stock | US Cen. 2000 | 4,274,710 | 1990 |
| Mexican Stock | US Cen. 1990 | 3,699,873 | 1990 |
| Mexican Stock | US Cen. 2000 + Mex. Cen. | 6,140,924 | 1995 |
| | | (=5,909,696+231,228) | |
| Mexican Stock | US Cen. 2000 | 7,970,009 | 2000 |
| Average Inflow 1990-2000 (workers) | US Cen. 2000 | 369,529.9 | 1990-95 |
| Average Inflow 1990-1995 (workers) | US Cen. 2000 + Mex. Cen. | 373,242.8 | 1990-95 |
| Average Inflow 1995-2000 (workers) | US Cen. 2000 + Mex. Cen. | 365,817 | 1995-00 |
| Mexican Inflow (total) | Passel et al. (2012) | 400,000 | 1992 |
| Mexican Inflow (total) | Passel et al. (2012) | 370,000 | 1993 |
| Mexican Inflow (total) | Passel et al. (2012) | 430,000 | 1994 |
| Mexican Inflow (total) | Passel et al. (2012) | 570,000 | 1995 |
| Mexican Inflow (total) | Passel et al. (2012) | 490,000 | 1996 |
| Mexican Inflow (total) | Passel et al. (2012) | 470,000 | 1997 |
| Mexican Inflow (total) | Passel et al. (2012) | 600,000 | 1998 |

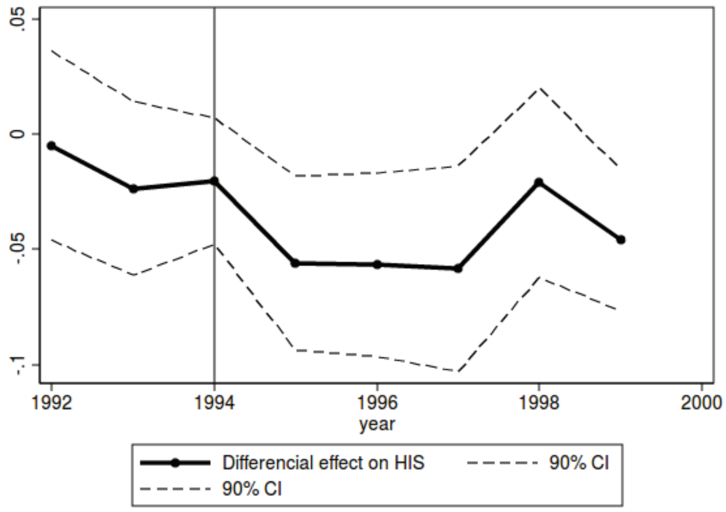
Notes: This table reports the stocks and inflows of Mexicans in the US in different years. Sources of the estimates are also reported. Data from Censuses comes from Ruggles et al. (2008). Further details are provided in the text.

Figure 5: Share of low-skilled population in high- and low-immigration states



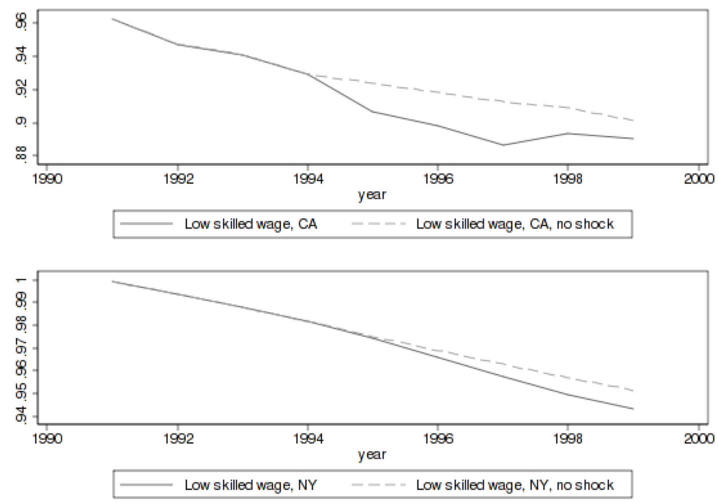

Notes: The top two graphs in this Figure show the overall share of low-skilled and the non-Hispanic share of low-skilled population in high- and low-immigration states, defined by the 1848 borders. The bottom graph shows the ratio of these two shares of low-skilled workers. We observe that in 1995 the share of low-skilled workers increases in high- relative to low-immigration states relative to the share of low-skilled non-Hispanics. With some lag the share of both all and non-Hispanic low-skilled workers increases in low-immigration states. This is evidence, as discussed in the text, on relocation between high- and low-immigration states in the short-run and of an increased presence of Hispanic low-skilled population in high-immigration states over longer run horizons, as observed by the upward sloping trend in the bottom part of this figure.

Figure 6: Wage differential by year



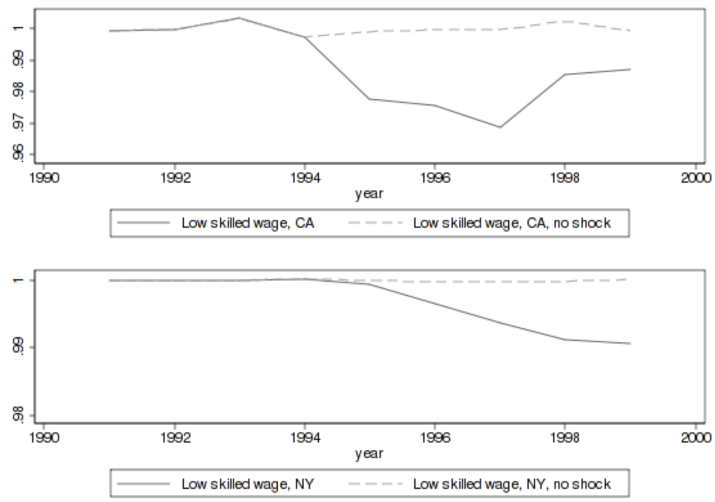

Notes: This graph reports the coefficient of a regression of (log) weekly wages at the individual level on the interaction between year dummies and an indicator dummy for high-immigration states (HIS). 1991 is the omitted year. The regression does not allow for a different time trend between high- and low-immigration states. Standard errors clustered at the metropolitan area are used to construct the confidence intervals. This should account for serial correlation while using clusters of similar size (see Angrist and Pischke (2009) and MacKinnon and Webb (2013)).

Figure 7: Counterfactual wage evolution




Notes: This figure shows the evolution of wages in the model with actual inflows of Mexicans and under the alternative that the Peso Crisis had not occurred. In this exercise, all inflows matter. This means that the accommodation of Mexican immigrants only occurs through labor relocation across states.

Figure 8: Counterfactual wage evolution




Notes: This figure shows the evolution of wages in the model with actual inflows of Mexicans and under the alternative that the Peso Crisis had not occurred. In this exercise, only inflows above average matter.

Figure 9: Counterfactual wage evolution


Notes: This figure on the left shows the evolution of wages in Arizona with actual inflows of Mexicans and under the alternative that Arizona had not received any Mexicans. In this exercise, all inflows matter. This means that the accommodation of Mexican immigrants only occurs through labor relocation across states. This figure on the right shows the evolution of wages in Arizona with actual inflows of Mexicans and under the alternative that Arizona had not received any Mexicans. In this exercise, only inflows above average matter.

Table 2: Summary statistics

| Variable | Mean | Std. Dev. | N |
|---|---|---|---|
| Mexican inflows at state level | | | |
| Mexican Inflows (own estimates) | 8,671.9 | 37,896.0 | 357 |
| Mexican Inflows (Passel et al. (2012) estimates) | 9,327.7 | 40,375.7 | 357 |
| Mexican Inflows (INS+DHS) | 7,215.3 | 31,555.8 | 357 |
| Maximum number of Mexican Inflows (in a state) | 326,305.7 | | |
| Labor Market Outcomes | | | |
| Average (log weekly) wage, low-skilled non-Mexicans | 5.953 | 0.099 | 102 |
| Observations low-skilled non-Mexicans | 378.52 | 289.313 | 102 |
| Average (log weekly) wage, high-skilled | 6.307 | 0.124 | 102 |
| Observations low-skilled | 516.647 | 425.843 | 102 |
| Full time employed, low-skilled | 756,413.587 | 779,010.954 | 102 |
| Full time employed, high-skilled | 984,069.74 | 1,093,654.666 | 102 |
| Share Mexicans, low-skilled | 0.055 | 0.119 | 102 |
| Share Mexican in 1980 | 0.005 | 0.012 | 102 |
| GDP and exports | | | |
| (ln) US-Mexico exports | 18.97 | 1.798 | 102 |
| (ln) state GDP | 11.336 | 1.024 | 102 |

Notes: These are the main variables used in the analysis of the causal effect of immigration on wages. The averages are unweighted, so do not necessarily coincide with the true US average. This data covers years the 1992-1998 for the overall inflows and 1994-1995 for the rest.

Table 3: First stage regressions for the estimation of the causal effect of Mexican immigration on wages

| VARIABLES | (1) Share Mexican LS OLS | (2) Δ Share Mexican LS OLS | (3) Δ Adj. Share Mexican LS OLS | (4) Share Mexican HS OLS | (5) Δ Share Mexican HS OLS |
|---|---|---|---|---|---|
| Share of Mexicans in 1980, LS | 6.005 | 0.431 | 0.731 | | |
| | (0.185) | (0.0882) | (0.0886) | | |
| Share of Mexicans in 1980, HS | | | | 4.829 | -0.189 |
| | | | | (0.208) | (0.324) |
| Observations | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.968 | 0.227 | 0.439 | 0.941 | 0.014 |

Notes: This table shows the regression of the share of Mexicans in the labor force at the state level in 1995 on the same variable in 1995. It also shows the same regression but first differencing the dependent variable. This table is the first stage regression for the IV in Table 4. Robust standard errors are reported. See more details in the text.

Table 4: Causal effect of immigration on wages, low-skilled workers

| VARIABLES | (1) Wage LS non-Mex OLS | (2) Wage LS non-Mex IV | (3) Δ Wage LS non-Mex OLS | (4) Δ Wage LS non-Mex OLS | (5) Δ Wage LS non-Mex IV | (6) Δ Wage LS non-Mex IV | (7) Δ Wage LS Ind. controls IV | (8) Δ Wage LS Ind. controls IV |
|---|---|---|---|---|---|---|---|---|
| Share of Mexicans, LS | -0.0143 | -0.0178 | | | | | | |
| | (0.0552) | (0.0539) | | | | | | |
| Δ Share of Mexicans, LS | | | -0.611 | -0.814 | -1.474 | -1.355 | -0.747 | |
| | | | (0.293) | (0.312) | (0.529) | (0.460) | (0.297) | |
| Δ Adj. Share of Mexicans, LS | | | | | | | | -0.428 |
| | | | | | | | | (0.161) |
| Δ (log) exports to Mexico | | | | 0.0114 | 0.0134 | 0.0100 | 0.00885 | 0.00862 |
| | | | | (0.0139) | (0.0126) | (0.0133) | (0.00967) | (0.0102) |
| Δ (log) state GDP | | | | 0.390 | 0.616 | 0.493 | 0.0923 | 0.0197 |
| | | | | (0.473) | (0.499) | (0.490) | (0.383) | (0.377) |
| Δ (log) high skilled labor | | | | -0.164 | -0.224 | -0.241 | -0.142 | -0.116 |
| | | | | (0.138) | (0.141) | (0.136) | (0.104) | (0.100) |
| Δ (log) low skilled labor | | | | -0.0118 | 0.0229 | 0.00460 | 0.0691 | 0.0542 |
| | | | | (0.118) | (0.114) | (0.110) | (0.0826) | (0.0806) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.001 | 0.001 | 0.081 | 0.142 | 0.062 | 0.083 | 0.107 | 0.115 |
| Wages detrended | no | no | no | no | no | yes | yes | yes |
| widstat | | 1058 | | | | 25.22 | 25.22 | 74.81 |

Notes: This table shows the regression of the average low-skilled native wage at the state level on the share of low-skilled Mexicans relative to low-skilled workers in 1995. The first two columns report the regressions in levels, while the next 5 report the first differenced (using 1994 data) regressions. It shows that wages of native low-skilled workers decrease with an immigration induced supply shock at the local level. ‘LS’ indicates ‘Low-skilled’, ‘UC’ indicates that the variable is adjusted for a 5 percent undercount of Mexican workers in 1995. Column 7 reports average wages controlling for individual characteristics using Mincerian regressions. It also uses 1992-1994 (instead of only 1994) as the pre-shock wage levels. Column 8 should be taken as a lower bound on the estimate of interest. Robust standard errors are reported. See more details in the text.

Table 5: The short-run relocation response

| VARIABLES | (1) Share LS 1995 OLS | (2) Share LS 1995 IV | (3) Share LS 1995 OLS | (4) Share LS 1995 OLS | (5) Share LS 1995 IV | (6) Share LS 1996 OLS | (7) Share LS 1996 OLS | (8) Share LS 1996 IV |
|---|---|---|---|---|---|---|---|---|
| Share of Mexicans (over population) | -0.234 | -0.253 | | | | | | |
| | (0.123) | (0.116) | | | | | | |
| Share of Mexicans (FD) | | | 0.830 | 0.870 | 0.235 | | | |
| | | | (0.331) | (0.367) | (0.436) | | | |
| (log) exports to Mexico (FD) | | | | -0.00215 | -0.00143 | | | |
| | | | | (0.00553) | (0.00576) | | | |
| (log) state GDP (FD) | | | | -0.0448 | 0.0121 | | | |
| | | | | (0.180) | (0.190) | | | |
| Lagged share of Mexicans (FD) | | | | | | 0.0392 | 0.142 | -1.342 |
| | | | | | | (0.460) | (0.446) | (0.747) |
| Lagged (log) exports to Mexico (FD) | | | | | | | -0.00983 | -0.00715 |
| | | | | | | | (0.00432) | (0.00466) |
| Lagged (log) state GDP (FD) | | | | | | | -0.0883 | 0.0749 |
| | | | | | | | (0.139) | (0.205) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.033 | 0.033 | 0.074 | 0.078 | 0.037 | 0.000 | 0.055 | . |
| First Differenced | no | no | yes | yes | yes | yes | yes | yes |
| widstat | | 2964 | | | 17.49 | | | 17.49 |

Notes: All regressions instrument the change in the share of Mexican by the share of Mexicans by state in 1980. Lagged variables are instrumented by the lagged instrument. Robust standard errors are reported.

Table 6: Long-run effect of Mexican immigration on low-skilled wages

| VARIABLES | (1) OLS | (2) IV | (3) OLS | (4) IV |
|---|---|---|---|---|
| | $\Delta$ (log) Low Skilled Wages, 1990-2000 | | | |
| Relative Inflow of Mexicans, 1990 - 2000 | -0.114 | -0.383 | -0.396 | -0.735 |
| | (0.171) | (0.175) | (0.103) | (0.141) |
| Observations | 51 | 51 | 48 | 48 |
| R-squared | 0.031 | -0.146 | 0.180 | 0.048 |
| Cross-state | yes | yes | | |
| Cross-age | | | yes | yes |
| widstat | | 35.38 | | 43.35 |
| | $\Delta$ (log) High Skilled Wages, 1990-2000 | | | |
| Relative Inflow of Mexicans, 1990 - 2000 | 0.185 | 0.0762 | 0.139 | -0.142 |
| | (0.0775) | (0.0807) | (0.161) | (0.212) |
| Observations | 51 | 51 | 48 | 48 |
| R-squared | 0.182 | 0.119 | 0.012 | . |
| Cross-state | yes | yes | | |
| Cross-age | | | yes | yes |
| widstat | | 35.38 | | 43.35 |
| | First Stage | | | |
| | Relative Inflow of Mexicans, 1990 - 2000 | | | |
| Share of Mexicans among Low Skilled in 1980 | | 1.369 | | |
| | | (0.230) | | |
| Predicted migrants competing with each cohort | | | | 0.473 |
| | | | | (0.0718) |
| Observations | | 51 | | 48 |
| R-squared | | 0.684 | | 0.427 |

Notes: This table shows the results of regressing the percentage change in native low-skilled weekly wage on the change in labor supply accounted for the Mexicans arriving in the US between 1990 and 2000. The IV for the cross-state comparisons is the immigration networks, while the IV for the cross-age comparisons is the interaction between the age distribution of immigrants and the aggregate yearly inflows in the 1990s. I use 48 age categories and 50+1 states. Robust standard errors are reported.

Table 7: The effect of Mexican immigration on the share of low-skilled workers across states in the long run

| VARIABLES | (1) Share LS 1980 OLS | (2) Share LS 1990 OLS | (3) Share LS 2000 OLS | (4) Δ Mexicans LS 1990-2000 OLS | (5) Δ Share LS 1990-2000 OLS | (6) Δ Share LS 1990-2000 IV | (7) Δ Share LS 1990-2000 OLS | (8) Δ Share LS 1990-2000 IV |
|---|---|---|---|---|---|---|---|---|
| Share of Mexicans in 1980 | -1.406 | | | 0.914 | | | | |
| | (0.247) | | | (0.0960) | | | | |
| Share of Mexicans in 1990 | | -0.567 | | | | | | |
| | | (0.121) | | | | | | |
| Share of Mexicans in 2000 | | | -0.0977 | | | | | |
| | | | (0.104) | | | | | |
| Δ Share Mexican, 1990 - 2000 | | | | | 0.782 | 0.794 | 0.632 | 0.613 |
| | | | | | (0.0544) | (0.0513) | (0.0913) | (0.0988) |
| Share of low skilled, 1980 | | | | | | | -0.115 | -0.119 |
| | | | | | | | (0.0416) | (0.0423) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.335 | 0.177 | 0.018 | 0.822 | 0.664 | 0.664 | 0.716 | 0.716 |
| widstat | | | | | | 90.49 | | 65.32 |

Notes: This table shows the effect of Mexican migration in the distribution of skills across states. Mexican migrants moved in the 1980s to states that initially had a low share of low-skilled workers. The imperfect relocation of workers across space increased the share of low-skilled workers in high-immigration states. Robust standard errors are reported.

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# Everything that follows is for online publication only

# A Appendix: Empirics

## A.1 Exclusion Restriction

The main threat to my identification strategy is that the devaluation of the Peso might have changed the trading relations between US and Mexico. This can have effects on the labor market, as Autor et al. (2013a) show with import competition from China. In this case, however, US imports from Mexico did not increase, relative to the trend, as shown in Figure C.2 in the Appendix. This figure also shows that exports from the US to Mexico in fact saw a significant decrease. If states exporting to Mexico are the same states where Mexican immigrants enter, then I might be confounding the effect of trade and immigration. Fortunately, even if there is some overlap, immigrants do not systematically enter states that export heavily to Mexico. The unconditional correlation between the relative immigration flows and the share of exports to Mexico (relative to state GDP) is below .5. Similarly, in an OLS regression with state and time fixed effects the covariance between these two variables is indistinguishable from 0.

Furthermore, even if exports to Mexico and immigration from Mexico occur in the same states, it is harder to explain through trade why the negative effect is mainly concentrated on workers with similar characteristics to the Mexican inflows. I document the largest labor market impacts on low-skilled workers in high-immigration states and no effects on high-skilled workers, which matches the nature of the immigration shock.

To avoid the possible contamination of my estimates from the direct effect of trade on wages I include in some of my regressions (log) US states' exports to Mexico and (log) state GDP. This should control for the possible direct effect of trade on the US labor market[35].

## A.2 Geography robustness

An important robustness check is to see whether the short-run results on wages are driven by California or Texas exclusively. I do so by excluding these two states, either separately or simultaneously from the OLS regressions presented in Table 4. I use OLS instead of IV because the first stage is, when excluding California and Texas, not sufficiently strong.

[Table C1 should be here]

Table C1 shows very similar estimates independent of whether I drop California, Texas or both.

## A.3 Substitutability between high school drop-outs and graduates

A second important robustness check is to use only high school drop-outs or high school graduates when computing low-skilled wages. Borjas (2003) distinguishes these two groups suggesting that they are imperfect substitutes, while Card (2009) strongly criticizes this assumption.

[35] Data for state exports to Mexico is provided by WISERTrade (www.wisertrade.org), based on the US Census Bureau. Exports are computed using "state of origin". "state of origin" is not defined as the state of manufacture, but rather as the state where the product began its journey to the port of export. It can also be the state of consolidation of shipments. Though imperfect, this is the best data available, to my knowledge, on international exports from US states.

[Table C2 should be here]

Table C2 shows that the results are very similar between high school drop-outs and high school graduates. This is consistent with Card (2009) argument that these two types of workers are closely competing. The standard errors increase for the smaller group of high school drop-outs, as should be the case.

### A.4 Excluding foreign-born from the computation of non-Mexicans? wages

A final robustness check that I present is that instead of excluding only Mexicans from the computation of low-skilled wages, I exclude all non-US foreign born. Doing so does not change the results, as can be seen in Table C3

[Table C3 should be here]

### A.5 Growth rate of low-skilled population

In this section I use an alternative specification used in the literature:[36]

$$\frac{\Delta N_s}{N_{s-1}} = \alpha + \beta * \frac{\Delta \text{Mex}_s}{N_{s-1}} + \Delta Controls_s + \varepsilon_s \tag{21}$$

where $N_s$ is the number of low-skilled workers in state $s$ and $s-1$ indicates the previous period. This specification has the virtue that, as I argue later, the estimate can be interpreted as a structural parameter of the model presented in section 4.2.

Table C6 shows the results of estimating equation 21. The first column in Panel A shows the first stage regressions. As we saw in Table 3, the share of Mexican workers in 1980 is a good predictor of where Mexicans decided to migrate in 1995. In column 2 and 3 we see that, contrary to 1995, in 1996, Mexicans left the originally high-immigration states. This is part of the relocation response that took place in 1996, which combined both Mexicans and native low-skilled workers.

[Table C6 should be here]

Panel B shows the reduced form evidence. When regressing the low-skilled population growth rate on the share of Mexican low-skilled workers in 1980, I obtain that we move from a 0 estimate to a negative between 1995 and 1996 – as shown in column 3 of panel B. This is evidence that the share of low-skilled workers decreased in high-immigration states one year after the immigration shock.

Panel C estimates the response of the low-skilled labor force to the local shock, and thus quantifies the internal migration response. In the model presented in section 4.2, this estimate is the sensitivity of internal migration to local shocks. When estimating this parameter by OLS, I obtain a slightly positive coefficient – showing that where Mexicans moved in the previous period seems to continue to attract low-skilled population. When instrumenting, I obtain a coefficient that is clearly below one and in fact negative, though not very precisely estimated. This negative coefficient suggests that for every Mexican who arrived in 1995 in high-immigration states, .9 low-skilled workers left the following year. This estimate is similar to the one reported in column 8 of Table 5.

[36] See Card and Lewis (2007), Card (2007), Card and DiNardo (2000)

A note of caution for these estimates is important. First, the estimates on the relocation tables are in general less precisely estimated than the tables on wages. Second, the evidence presented here is consistent with both the internal relocation of native and Mexican workers, and on returned Mexican migration. It is difficult to distinguish the two because of lack of better data. CPS data suggests some return migration – as the share of Mexicans in the US low-skilled labor force decreases slightly in 1996, while Census and Passel et al. (2012) data suggests that what I am finding is related to internal migration.

### A.6 Comparing the evidence from the Mexican Peso crisis and the Mariel Boatlift

I have argued before that my results are consistent with much of the literature. The one study for which this appears not to be true is Card's (1990) landmark study of the Mariel Boatlift. Card (1990) also looked at short-term effects of immigration inflows but, unlike this paper, found essentially no effects. What explains this difference? This section examines it in more detail.

In April 1980, Fidel Castro allowed Cubans willing to emigrate to do so from the port of Mariel. These Cubans – the "Marielitos" – were relatively low-skilled and some of them had allegedly been released from prisons and mental hospitals by Cuban authorities (Card, 1990). As a result, around 125,000 Cubans migrated to the US between late April 1980 and October 1980. Slightly under half of them probably settled in Miami. Card (1990) uses this natural experiment to assess the effect of immigration on the labor market. Using a group of four comparison cities – Tampa, Houston, Atlanta and Los Angeles – Card (1990) reports no effect of Cuban immigrants on any group of the Miami labor force.[37] These findings are contrary to what is reported in this paper.

Two reasons could explain these differences. A first point is simply that although Card's point estimates are near zero, the standard errors are not small enough to rule out effects of the size I document in this paper. In addition, I can show that his estimates are somewhat sensitive to the choice of data set. I am able to replicate Card's findings when using the CPS merged Outgoing Rotation files, but when using the alternative March CPS supplements I find that average wages of low-skilled workers decreased by almost 8 percent while wages of high-skilled workers increased by 4 percent. Both estimates are, however, imprecise. The results using the Mexican shock are not dependent on the data set I use.

Second, and perhaps more importantly, as Card (1990) acknowledges, the nature of the "Marielitos" – who were perhaps not ready to enter the labor market immediately – and the particularities of Miami may, in part, explain why there is no evidence of a negative effect on wages. By contrast, Mexicans moving to the US in 1995 do not appear to be specially selected nor did they migrate to a singular local labor market, and therefore, their effects may be more representative of the effects of low-skilled immigrants in the US.

## B Appendix: Data

### B.1 Indirect measures of Mexican inflows

As mentioned before, we can also look at more indirect measures of Mexican inflows. A first such measure is the marked increase in "coyote" prices starting in 1995 – the price of the smuggler who facilitates migration across the Mexican-US border, see Hanson (2006). This may be in part due to increased border enforcement, but it also probably reflects an increased willingness to emigrate from Mexico. In fact, the US border

[37] Card distinguishes by racial groups and quartiles in the wage distribution.

enforcement launched two operations in the early 1990s to try to curb the number of immigrants entering the US. Operation Hold the Line and Operation Gatekeeper – launched in El Paso, TX and San Diego, CA respectively – had different degrees of success (Martin, 1995). Operation Hold the Line managed to curb Mexican immigrants, while Operation Gatekeeper was less successful. To some extent, however, these operations redirected the routes Mexicans took to get to the US. There is some evidence suggesting that some of the Mexicans who would have otherwise entered through El Paso, TX did so through Nogales, AZ. In any case, the "coyote" prices only started to increase in 1995 and not when these operations were launched, suggesting that more people wanted to enter the US in 1995, right when the Peso Crisis hit Mexico, and that the increased "coyote" prices were not just a result of the increased border enforcement of the early 1990s.

Another piece of evidence suggesting higher inflows in 1995 is the evolution of the number of apprehensions over the 1990s (data from Gordon Hanson's website, see Hanson (2006) or Hanson and Spilimbergo (1999)). Figure C.1 shows the (log) monthly adjusted apprehensions. The spike in September 1993 coincides with the launching of Operation Hold the Line in El Paso, TX. At the beginning of 1995 there is a clear increase in the number of apprehensions that lasts at least until late 1996. This seems to coincide with the evolution of US low-skilled workers' wages, as I will discuss in detail in what follows. Arizona and California saw much steeper declines in low-skilled wages in 1995 than Texas, something that seems consistent with the greater success of Operation Hold the Line.

[Figure C.1 should be here]

## B.2 Geographic disaggregation

The geographic units that I use in this paper are US states. There is some discussion in the literature as to what the appropriate geographic disaggregation to represent a local labor market is. Card (2009) argues that metropolitan areas probably provide the appropriate level of analysis. When using Census data there are many metropolitan areas with many individual level observations. This is different with CPS data. As an example, there are only 11 metropolitan areas in the March CPS data for 1995 that have more than 500 individual level observations. Another drawback of using metropolitan areas is that we would lose nearly 24,000 individual observations that lack metropolitan area information. This is a lot of information given the sample size in the CPS.

This suggests using a partition of the US territory, an observation also made in Autor and Dorn (2009). They use commuting zones (CZ), which are constructed based on commuting patterns from the 1990 US Census based on the work by Tolbert and Sizer (1996). This results in 722 different CZs that cover the entire US. The number of commuting zones, however, is too large for the CPS data. The CPS data has around 150,000 observations per year.[38] This means that if I were to use all the CZs I would only have around 70 observations per CZ on average. Moreover, since I distinguish between high- and low-skilled workers I would end up with geographic units of around 35 observations. Given the variance in wages in the US, this is not a feasible geographic unit. This leaves me with states as natural candidates for a geographic disaggregation, which I use throughout the paper.

[38]This number includes all individuals irrespective of age. Around 60,000 observations can be used to compute wages.

## B.3 Definition of Mexicans

When using Census data or post-1994 CPS data I define Mexicans by the place of birth. When using CPS data before 1994 I use the variable HISPAN from the CPS. I use the category "Mexican(Mexicano)" – value 108 – when plotting or using data before 1994. When plotting various years, I keep the definition fixed at the pre-1994 definition.

For data after 1994 and US Census data, I use the variable BPLD from the March CPS and Census 1990 and 2000 files, Ruggles et al. (2008).

## B.4 Definition of low-skilled

Low-skilled workers are defined as having a high school diploma or less. I use the variable EDUC from the CPS to do so.

## B.5 Definition of worker

I use full-time workers to compute wages. This is constructed using the EMPSTAT variable from the CPS. I exclude from the wage computations workers who are self-employed or in group quarters. I correct for top coding following the literature. I limit the analysis to workers aged 18 to 65.

## B.6 Individual characteristics and weights

In some micro-level Mincerian regressions, I include individual characteristics as controls. These include age and age square, race dummies (using directly the CPS variable) and occupation dummies. I aggregate the occupation OCC1990 variable to 24 larger groups, based on the definition of this variable in Ipums.

In all the computations I use the weights coming from the WTSUPP.

When aggregating to the state level, I use the number of observations used to compute the averages in each cell. I use this in the regressions, using the analytic weights command from stata.

## B.7 Aggregation of occupations

I create these categories following the aggregation proposed in Ruggles et al. (2008): Management Occupations, Business Operations Specialists, Financial Specialists, Computer and Mathematical Occupations, Architecture and Engineering Occupations, Life, Physical, and Social Science Occupations, Community and Social Services Occupations, Legal Occupations, Education, Training, and Library Occupations, Arts, Design, Entertainment, Sports, and Media Occupations, Healthcare Practitioners and Technical Occupations, Healthcare Support Occupations, Protective Service Occupations, Food Preparation and Serving Occupations, Building and Grounds Cleaning and Maintenance Occupations, Personal Care and Service Occupations, Sales Occupations, Office and Administrative Support Occupations, Farming, Fishing, and Forestry Occupations, Construction Trades, Extraction Workers, Installation, Maintenance, and Repair Workers, Production Occupations, Transportation and Material Moving Occupations.

## B.8 Construction of alternative measure of Mexican inflows

In this section I give the details on how I constructed the aggregate net inflows from Mexico to the US.

As said in the main text, I try to improve Passel et al. (2012) estimates in two dimensions. First, fewer Mexicans than is usual may have returned to Mexico when the Mexican Pesos crisis started. Second, as pointed out in Card and Lewis (2007), when immigrants are asked by the US Census what year they arrived in the US, they more often tend to report years that are multiple of five.

To account for the first concern, I use Mexican Migration Project data. I use the people that were in Mexico after 2000 and that spent some time in the US during the 90s. I then compute what share of those arrived in each year of the 90s:

$$\text{Share returned to Mexico}_t = \frac{\text{Mexicans in Mexico who returned at } t}{\text{Mexican who were in the US in the 90s}}$$

This gives me the top panel of Figure C.3.

Figure C.3 should be here

For the second concern, I compute the number of Mexicans in the US that in the 2000 US Census reported arriving in the US before time $t$ relative to all low-skilled immigrants:

$$\text{Share Mexicans in the US}_t = \frac{\text{Mexicans in the US in 2000 that arrived before time } t}{\text{All immigrants in the US in 2000 that arrived before time } t}$$

This is shown in the bottom panel of Figure C.3. The two graphs have an upward trend. In the first case, the upward trend can be explained by the death rates, the changing stocks of Mexicans in the US and circular migration. Someone returning to Mexico in the early 90s is more likely to have died in the 2000s, more likely to have re-emigrated to the US and is drawn from a smaller pool of people (Mexicans in the US in the 90s) than people that return to Mexico. Similarly, the upward trend in Mexicans relative to the US could be explained by higher frequency of Mexicans in the US returning to Mexico. Mexico is closer to the US relative to other nations, so returns to the home country might be more frequent than from countries that are further away. This could mean that someone who migrated from Mexico to the US in the early 90s is more likely to have returned than a similar migrant from another country of origin. I assume that there is no upward or downward trend in this series, by de-trending them. I define the deviations from the trend as the series minus the expected value of the series evaluated using a linear regression that does not include the years of the shock (the straight lines in Figure C.3).

$$\hat{D}_t^I = \text{Share returned to Mexico}_t - \hat{A}^I - \widehat{trend}_I * t$$

$$\hat{D}_t^O = \text{Share Mexicans in the US}_t - \hat{A}^O - \widehat{trend}_O * t$$

I can then compute the percentage deviation from trend for both series by dividing by the expected value from the fitted regression. This is:

$$\hat{d}_t^I = \frac{\hat{D}_t^I}{\hat{A}^I + \widehat{trend}_I * t}$$

$$\hat{d}_t^O = \frac{\hat{D}_t^O}{\hat{A}^O + \widehat{trend}_O * t}$$

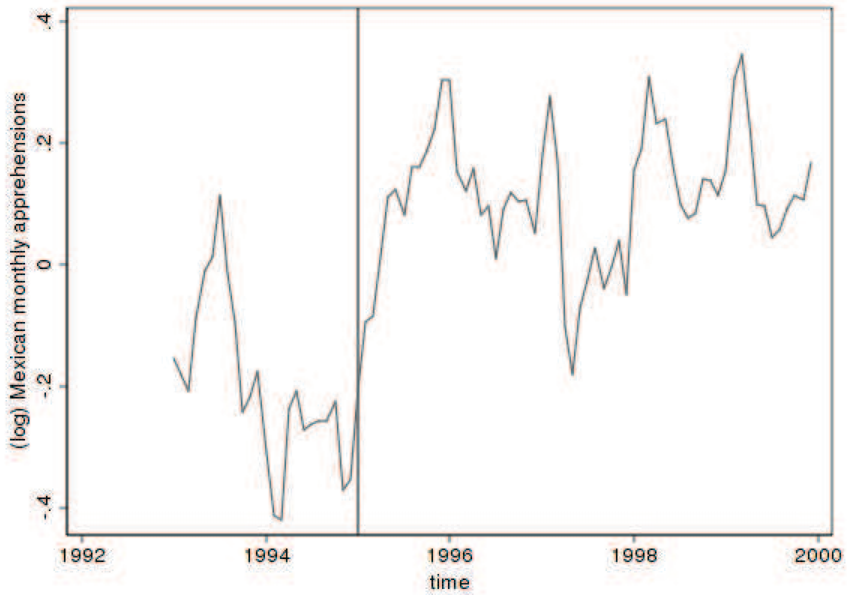
I finally assume that the net immigration flow has no trend, i.e. it is the average inflow on the decade of around 370,000 people a year, and that the deviations from the trend are given by the deviations of the trend from my measures that tried to account for inflows and outflows of Mexican immigrants to the US. This is:

$$\widehat{Mex_t} = (1 + \hat{d}_t^I - \hat{d}_t^O) * (\text{Average net Mexican inflow in the 90s})$$

Again, the numbers I obtain rest on the assumption that there isn't an upward trend in the number of Mexicans arriving to the US during the 90s.

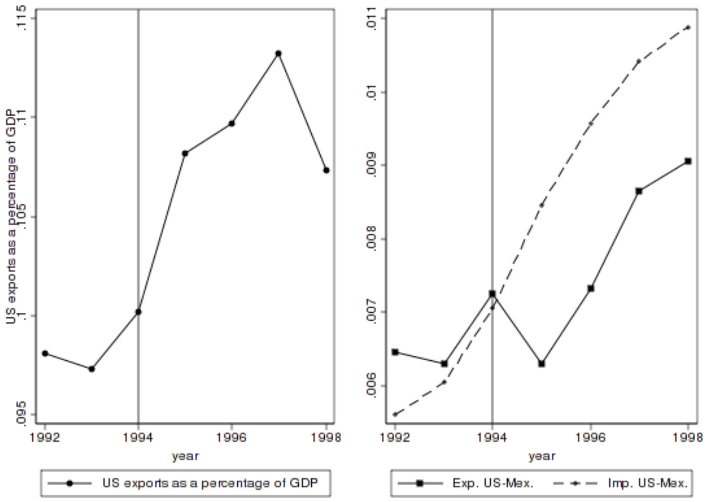
# C Appendix: Figures and Tables

Figure C.1: Annual Mexican apprehensions in the US-Mexican border



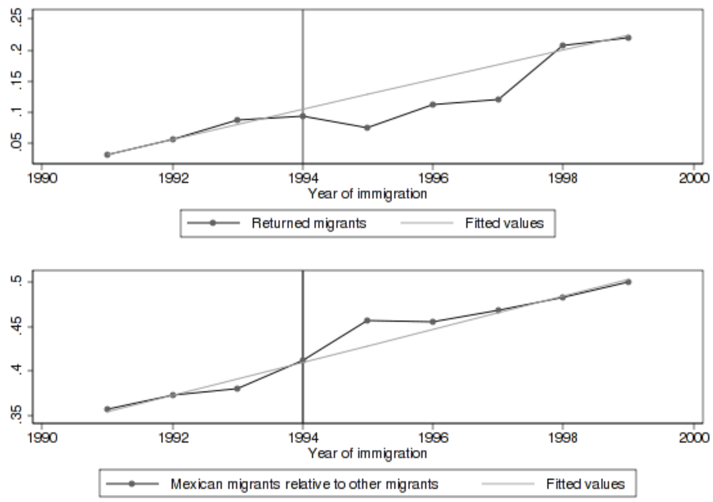

Note: This figure shows the (log) monthly apprehensions of Mexicans at the US-Mexican border. Month fixed effects are removed from the graph. Apprehensions data is highly cyclical, with most apprehensions occurring in the first few months of each year and less at the end of the year. Removing the month fixed effects helps visualize the longer run movements. Source: Hanson (2006).

Figure C.2: US trade with Mexico



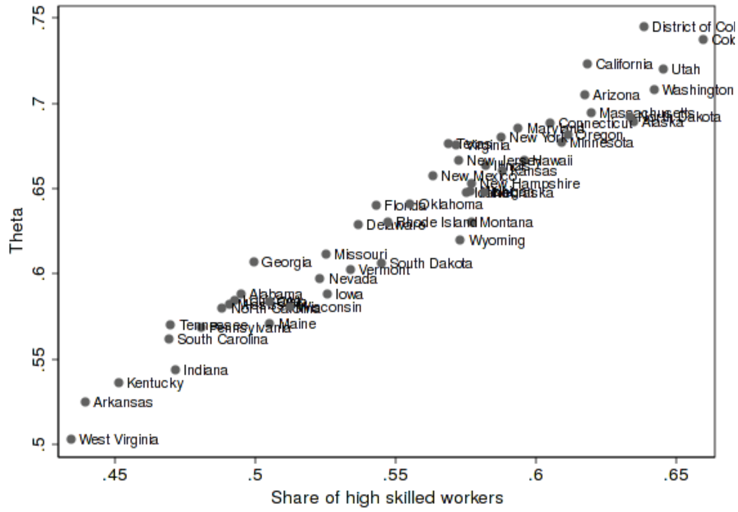

Note: Exports US-Mex are exports from the US to Mexico divided by US GDP. Imports US-Mex are imports to the US from Mexico divided by US GDP. Total US exports are exports from the US to the rest of the world divided by US GDP. Mexican exports to the US did not increase above trend in 1995, while US exports to Mexico decreased in 1995, potentially affecting labor market outcomes. At the same time US exports to the rest of the world were slightly above trend in 1995. Source: Census Bureau (http://www.census.gov/foreign-trade/balance/c2010.html)

Figure C.3: Yearly Mexican inflows and outflows measures



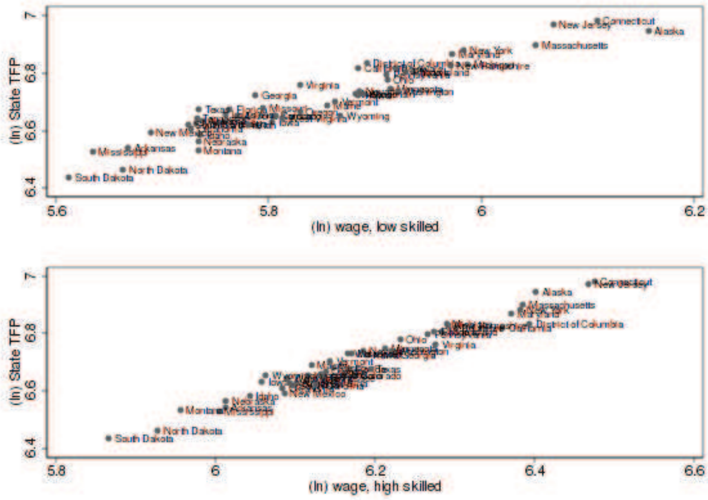

Note: The top panel shows the share of Mexicans residing in Mexico in the 2000s that claim to have returned to Mexico in the 1990s, by year of return. The lower panel shows the share of Mexicans residing in the US in each year of the 1990s, relative to immigrants from other destinations, using 2000 US Census information on the year of arrival of each individual. Taken together this evidence suggests that fewer Mexicans left the US and more entered as a consequence of the Mexican Peso Crisis.

Figure C.4: Share of high-skilled workers and production technology




Notes: This figure shows the share of high-skilled workers and the calibrated $\theta_s$ in 1990.

Figure C.5: Productivity levels and wages




Notes: This figure shows the productivity levels $B_s$ and high- and low-skilled wages in 1990.

Table C1: Causal effect of immigration on wages, geographic robustness check

| VARIABLES | (1)<br>Δ Wage<br>LS Ind. controls<br>OLS | (2)<br>Δ Wage<br>LS Ind. controls<br>OLS | (3)<br>Δ Wage<br>LS Ind. controls<br>OLS | (4)<br>Δ Wage<br>LS Ind. controls<br>OLS | (5)<br>Δ Wage<br>LS Ind. controls<br>OLS | (6)<br>Δ Wage<br>LS Ind. controls<br>OLS |
|---|---|---|---|---|---|---|
| Δ Share of Mexicans, LS | -0.503 | | -0.611 | | -0.544 | |
| | (0.258) | | (0.232) | | (0.275) | |
| Δ Adj. Share of Mexicans, LS | | -0.423 | | -0.512 | | -0.494 |
| | | (0.242) | | (0.170) | | (0.270) |
| Δ (log) exports to Mexico | 0.00921 | 0.00914 | 0.00777 | 0.00822 | 0.00862 | 0.00837 |
| | (0.0108) | (0.0108) | (0.0107) | (0.0107) | (0.0109) | (0.0109) |
| Δ (log) state GDP | 0.0201 | 0.0233 | 0.0113 | 0.0144 | 0.00325 | 0.0103 |
| | (0.385) | (0.389) | (0.383) | (0.385) | (0.386) | (0.384) |
| Δ (log) high skilled labor | -0.118 | -0.114 | -0.130 | -0.124 | -0.122 | -0.121 |
| | (0.110) | (0.110) | (0.108) | (0.106) | (0.110) | (0.110) |
| Δ (log) low skilled labor | 0.0530 | 0.0523 | 0.0539 | 0.0493 | 0.0486 | 0.0480 |
| | (0.0903) | (0.0906) | (0.0895) | (0.0882) | (0.0906) | (0.0911) |
| Observations | 50 | 50 | 50 | 50 | 49 | 49 |
| R-squared | 0.088 | 0.080 | 0.123 | 0.127 | 0.094 | 0.091 |
| State excl. | CA | CA | TX | TX | CA, TX | CA, TX |

Notes: This table shows the regression of the average low-skilled wage at the state level (controlling for individual level characteristics using Mincerian regressions) on the share of low-skilled Mexicans (relative to low-skilled workers) in 1995 relative to 1992-1994. 'LS' indicates 'Low-skilled', 'UC' indicates that the variable is adjusted for a 10 percent undercount of Mexican workers in 1995. This table shows OLS regressions excluding California and/or Texas. I do not report the IV results because in some cases the first stage is not sufficiently strong. See more details in the text.

Table C2: Causal effect of immigration on wages, high school drop-outs and high school graduates

| VARIABLES | (1)<br>Wage<br>HSDO non-Mex<br>OLS | (2)<br>Wage<br>HSG non-Mex<br>OLS | (3)<br>Wage<br>HSDO non-Mex<br>OLS | (4)<br>Wage<br>HSG non-Mex<br>OLS | (5)<br>Wage<br>HSDO non-Mex<br>IV | (6)<br>Wage<br>HSG non-Mex<br>IV | (7)<br>Wage<br>HSDO non-Mex<br>IV | (8)<br>Wage<br>HSG non-Mex<br>IV |
|---|---|---|---|---|---|---|---|---|
| Share of Mexicans, LS (FD) | -0.897 | -0.739 | -0.869 | -0.675 | -0.245 | -1.577 | -0.237 | -1.320 |
| | (0.865) | (0.277) | (0.882) | (0.239) | (0.820) | (0.369) | (0.785) | (0.295) |
| (log) state GDP (FD) | 0.580 | 0.452 | 0.380 | 0.353 | 0.309 | 0.755 | 0.117 | 0.586 |
| | (1.696) | (0.399) | (1.705) | (0.402) | (1.612) | (0.505) | (1.617) | (0.463) |
| (log) exports to Mexico (FD) | -0.0145 | 0.0187 | -0.0100 | 0.0152 | -0.0191 | 0.0218 | -0.0146 | 0.0176 |
| | (0.0471) | (0.0127) | (0.0489) | (0.0131) | (0.0461) | (0.0114) | (0.0477) | (0.0116) |
| (log) high skilled labor (FD) | -0.142 | -0.141 | -0.191 | -0.158 | -0.0568 | -0.217 | -0.109 | -0.217 |
| | (0.419) | (0.112) | (0.423) | (0.109) | (0.398) | (0.118) | (0.404) | (0.111) |
| (log) low skilled labor (FD) | -0.0310 | 0.00846 | -0.102 | 0.00550 | -0.0755 | 0.0553 | -0.146 | 0.0415 |
| | (0.341) | (0.113) | (0.340) | (0.107) | (0.336) | (0.117) | (0.336) | (0.108) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.027 | 0.163 | 0.029 | 0.150 | 0.015 | -0.000 | 0.017 | 0.045 |
| First Differenced | yes | yes | yes | yes | yes | yes | yes | yes |
| Instrumented | no | no | no | no | yes | yes | yes | yes |
| Wages detrended | no | no | yes | yes | no | no | yes | yes |
| widstat | | | | | 97.36 | 30.83 | 97.36 | 30.83 |

Notes: This table shows the regression of the average low-skilled wage at the state level separating high school drop-outs and high school graduates on the share of low-skilled Mexicans (relative to low-skilled workers) in 1995 relative to 1992-1994. See more details in the text.

Table C3: Causal effect of immigration on wages

| VARIABLES | (1)<br>Δ Wage<br>LS Ind. controls<br>OLS | (2)<br>Δ Wage<br>LS Ind. controls<br>OLS | (3)<br>Δ Wage<br>LS Ind. controls<br>OLS | (4)<br>Δ Wage<br>LS Ind. controls<br>OLS | (5)<br>Δ Wage<br>LS Non-FB<br>OLS | (6)<br>Δ Wage<br>LS Non-FB<br>OLS |
|---|---|---|---|---|---|---|
| Δ Share of Mexicans, LS | -0.433 | | -0.574 | | -0.866 | |
| | (0.201) | | (0.224) | | (0.296) | |
| Δ Adj. Share of Mexicans, LS | | -0.366 | | -0.466 | | -0.718 |
| | | (0.158) | | (0.167) | | (0.224) |
| Δ (log) exports to Mexico | | | 0.00832 | 0.00880 | 0.0170 | 0.0178 |
| | | | (0.0106) | (0.0106) | (0.0166) | (0.0165) |
| Δ (log) state GDP | | | 0.0328 | 0.0359 | 0.454 | 0.464 |
| | | | (0.381) | (0.384) | (0.508) | (0.509) |
| Δ (log) high skilled labor | | | -0.127 | -0.119 | -0.215 | -0.205 |
| | | | (0.109) | (0.107) | (0.141) | (0.139) |
| Δ (log) low skilled labor | | | 0.0600 | 0.0563 | -0.0103 | -0.0150 |
| | | | (0.0891) | (0.0878) | (0.119) | (0.116) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.062 | 0.066 | 0.115 | 0.115 | 0.172 | 0.177 |
| First Differenced | yes | yes | yes | yes | yes | yes |

Notes: This table considers different OLS specifications, and shows that excluding all foreign born from the computation of non-Mexican low-skilled wages does not change any of the results presented in the paper. Robust standard errors reported. See more details in the text.

Table C4: Causal effect of immigration on wages, high-skilled workers

| VARIABLES | (1)<br>Wage<br>HS non-Mex<br>OLS | (2)<br>Wage<br>HS non-Mex<br>IV | (3)<br>Δ Wage<br>HS non-Mex<br>OLS | (4)<br>Δ Wage<br>HS non-Mex<br>OLS | (5)<br>Δ Wage<br>HS non-Mex<br>IV | (6)<br>Δ Wage<br>HS non-Mex<br>IV | (7)<br>Δ Wage<br>HS Ind. controls<br>IV | (8)<br>Δ Wage<br>HS Ind. controls<br>IV |
|---|---|---|---|---|---|---|---|---|
| Share of Mexicans, LS | 0.133 | 0.153 | | | | | | |
| | (0.0950) | (0.0812) | | | | | | |
| Δ Share of Mexicans, LS | | | -0.383 | -0.361 | 0.189 | 0.220 | 0.224 | |
| | | | (0.277) | (0.298) | (0.375) | (0.420) | (0.201) | |
| Δ Adj. Share of Mexicans, LS | | | | | | | | 0.129 |
| | | | | | | | | (0.114) |
| Δ (log) state GDP | | | | -0.387 | -0.576 | -0.666 | -0.232 | -0.210 |
| | | | | (0.384) | (0.435) | (0.444) | (0.266) | (0.250) |
| Δ (log) exports to Mexico | | | | 0.00938 | 0.00770 | 0.00308 | 0.00800 | 0.00807 |
| | | | | (0.0129) | (0.0137) | (0.0133) | (0.00977) | (0.00955) |
| Δ (log) high skilled labor | | | | -0.0901 | -0.0404 | -0.0268 | -0.0185 | -0.0265 |
| | | | | (0.122) | (0.109) | (0.109) | (0.0707) | (0.0684) |
| Δ (log) low skilled labor | | | | -0.0599 | -0.0888 | -0.0792 | -0.0269 | -0.0224 |
| | | | | (0.147) | (0.144) | (0.145) | (0.0917) | (0.0908) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.035 | 0.034 | 0.031 | 0.063 | 0.009 | 0.006 | . | 0.006 |
| Wages detrended | no | no | no | no | no | yes | yes | yes |
| widstat | | 1058 | | | 25.22 | 25.22 | 25.22 | 74.81 |

Notes: This table shows the regression of the average high-skilled wage at the state level on the share of low-skilled Mexicans (relative to low-skilled workers) in 1995. It is the same table as 4 but using high-skilled wages as the dependent variable. It shows that low-skilled immigration did not affect high-skilled wages. The first two columns report the regressions in levels, while the next 5 report the first differenced (using 1994 data) regressions. ‘LS’ indicates ‘Low-skilled’ and ‘HS’ indicates ‘High-skilled’. Robust standard errors are reported. See more details in the text.

Table C5: Wage gap between high- and low-skilled workers

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Wage Gap | Wage Gap | Δ Wage Gap | Δ Wage Gap | Δ Wage Gap | Δ Wage Gap | Δ Wage Gap | Δ Wage Gap |
| VARIABLES | OLS | IV | OLS | OLS | OLS | IV | IV | IV |
| Share of Mexicans, LS | 0.0476 | 0.0564 | | | | | | |
| | (0.0324) | (0.0256) | | | | | | |
| Δ Share of Mexicans, LS | | | 0.389 | 0.447 | 0.477 | 0.877 | 0.874 | 0.939 |
| | | | (0.302) | (0.335) | (0.319) | (0.378) | (0.332) | (0.351) |
| Δ Relative labor supply | | | | 0.0422 | 0.0425 | | 0.0687 | 0.0698 |
| | | | | (0.0808) | (0.0823) | | (0.0759) | (0.0756) |
| Δ (log) state GDP | | | | | -0.166 | | | -0.327 |
| | | | | | (0.472) | | | (0.533) |
| Δ (log) exports to Mexico | | | | | 0.000996 | | | -0.000244 |
| | | | | | (0.00964) | | | (0.00932) |
| Observations | 51 | 51 | 51 | 51 | 51 | 51 | 51 | 51 |
| R-squared | 0.023 | 0.022 | 0.028 | 0.035 | 0.038 | . | 0.004 | 0.003 |
| widstat | . | 1058 | . | . | . | 23.83 | 37.38 | 27.37 |

Notes: This table shows the regression of the wage gap between high- and low-skilled workers on the share of Mexicans in the low-skilled labor force between 1994 and 1995. The wage gap is computed as the adjusted average wage of high-skilled workers, divided by the adjusted average wage of low-skilled workers. See more details in the text.

Table C6: The short-run relocation response, alternative specification

**Panel A**

| VARIABLES | (1)<br>Mexicans<br>growth rate<br>1995<br>OLS | (2)<br>Mexicans<br>growth rate<br>1996<br>OLS | (3)<br>Mexicans<br>growth rate<br>1996<br>OLS |
|---|---|---|---|
| Share of low skilled Mexicans in 1980 | 0.409 | -0.281 | -0.268 |
| | (0.101) | (0.105) | (0.109) |
| Lagged (log) state GDP (FD) | | | -0.0226 |
| | | | (0.0930) |
| Lagged (log) exports to Mexico (FD) | | | -0.00355 |
| | | | (0.00276) |
| Observations | 51 | 51 | 51 |
| R-squared | 0.268 | 0.254 | 0.276 |

**Panel B**

| VARIABLES | (1)<br>Low skilled<br>growth rate<br>1995<br>OLS | (2)<br>Low skilled<br>growth rate<br>1996<br>OLS | (3)<br>Low skilled<br>growth rate<br>1996<br>OLS |
|---|---|---|---|
| Share of low skilled Mexicans in 1980 | 0.00202 | -0.409 | -0.374 |
| | (0.247) | (0.235) | (0.244) |
| Lagged (log) state GDP (FD) | | | 0.171 |
| | | | (0.357) |
| Lagged (log) exports to Mexico (FD) | | | -0.0204 |
| | | | (0.0111) |
| Observations | 51 | 51 | 51 |
| R-squared | 0.000 | 0.031 | 0.077 |

**Panel C**

| VARIABLES | (1)<br>Low skilled<br>growth rate<br>1996<br>OLS | (2)<br>Low skilled<br>growth rate<br>1996<br>OLS | (3)<br>Low skilled<br>growth rate<br>1996<br>IV |
|---|---|---|---|
| Lagged Mexicans growth rate | 0.428 | 0.470 | -0.960 |
| | (0.415) | (0.429) | (0.794) |
| Lagged (log) state GDP (FD) | | 0.0163 | 0.315 |
| | | (0.336) | (0.510) |
| Lagged (log) exports to Mexico (FD) | | -0.0234 | -0.0202 |
| | | (0.0109) | (0.0122) |
| Observations | 51 | 51 | 51 |
| R-squared | 0.021 | 0.076 | . |
| widstat | | . | 13.19 |

Notes: All regressions instrument the change in the share of Mexican by the share of Mexicans by state in 1980. Lagged variables are instrumented by the lagged instrument. Robust standard errors are reported. See more details in the text.

# D Appendix: Theory

## D.1 Proofs of propositions

In section 4.2 of the paper, I make the claim that under the stated assumptions the derivative of (internal) in-migration rates with respect to (log) wages is approximately $\frac{1}{\lambda}\frac{I_s}{N_s}$. More specifically:

**Proposition 3.** *If $\epsilon_s^i$ are iid and follow a type I Extreme Value distribution with shape parameter $\lambda$ then, in the environment defined by the model, we have that:*

1. $\partial(\frac{I_s}{N_s})/\partial \ln w_s \approx \frac{1}{\lambda}\frac{I_s}{N_s}$
2. $\partial(\frac{O_s}{N_s})/\partial \ln w_s > 0$, *but tends to 0 as the number of regions increases*
3. $\partial(\Delta \ln N_s)/\partial \ln w_s \approx \partial(\frac{\Delta N_s}{N_s})/\partial \ln w_s \approx \frac{1}{\lambda}\frac{I_s}{N_s}$, *as the number of regions increases*

*Proof.* To proof this result, note first the following:

$$lnP_{s,s'} = \eta + lnN_s + \frac{1}{\lambda}lnV_{s,s'} - ln(\sum_j e^{\frac{1}{\lambda}lnV_{s,j}})$$

Note also that $V_{s,s'}$ depends, up to some constants, on $w_{s'}$ exclusively. Thus,

$$\partial lnP_{s,s'}/\partial lnw_{s'} = 0 + \frac{1}{\lambda} - \partial(ln(\sum_j e^{\frac{1}{\lambda}lnV_{s,j}}))/\partial lnw_{s'}$$

Now $\partial(ln(\sum_j e^{\frac{1}{\lambda}lnV_{s,j}}))/\partial lnw_{s'}$ is approximately 0:

$$\partial(ln(\sum_j e^{\frac{1}{\lambda}lnV_{s,j}}))/\partial lnw_{s'} = \frac{1}{\sum_j e^{\frac{1}{\lambda}lnV_{s,j}}} * (1/\lambda) * \frac{\partial lnV_{s,s'}}{\partial lnw_{s'}} = \frac{1}{\sum_j V_{s,j}^{\frac{1}{\lambda}}} * (1/\lambda)$$

where the last equality comes from realizing that $\frac{\partial lnV_{s,s'}}{\partial lnw_{s'}} = 1$. The denominator in the last expression increases as the number of alternative locations increase. Thus $\partial(ln(\sum_j e^{\frac{1}{\lambda}lnV_{s,j}}))/\partial lnw_{s'}$ is approximately 0. We have then that $\partial lnP_{s,s'}/\partial lnw_{s'} \approx \frac{1}{\lambda}$. We can now use this to compute the elasticity of in and out-migration rates to changes in wages:

$$\frac{I_s}{N_s} = \frac{1}{N_s}\sum_{k\neq s} P_{k,s} = \frac{1}{N_s}\sum_{k\neq s} e^{lnP_{k,s}}$$

So,

$$\partial\frac{I_s}{N_s}/\partial lnw_s = \frac{1}{N_s}\sum_{k\neq s} e^{lnP_{k,s}} * \frac{\partial lnP_{k,s}}{\partial lnw_s} \approx \frac{1}{\lambda} * (\frac{1}{N_s}\sum_{k\neq s} P_{k,s}) = \frac{1}{\lambda}\frac{I_s}{N_s}$$

We can use similar algebra to proof point 2 of the proposition.

$$\frac{O_s}{N_s} = \frac{1}{N_s}\sum_{k\neq s} P_{s,k} = \frac{1}{N_s}\sum_{k\neq s} e^{lnP_{s,k}}$$

This is:

$$\frac{\partial lnP_{s,k}}{\partial lnw_s} = 0 + 0 - \frac{1}{\sum_j V_{s,j}^{\frac{1}{\lambda}}} * (1/\lambda)$$

So,

$$\partial(\frac{O_s}{N_s})/\partial lnw_s = \frac{1}{N_s}\sum_{k\neq s} e^{lnP_{s,k}}\frac{\partial lnP_{s,k}}{\partial lnw_s} = \frac{1}{N_s}\sum_{k\neq s} N_s p^i_{s,k}(\frac{-1}{\lambda\sum_j V_{s,j}^{\frac{1}{\lambda}}})$$

This can be simplified to:

$$\partial(\frac{O_s}{N_s})/\partial lnw_s = \frac{-1}{\lambda}(1-p^i_{s,s})(\frac{1}{\sum_j V_{s,j}^{\frac{1}{\lambda}}})$$

And this last term is small, and gets smaller the more locations available there are.

The last claim is an immediate consequence of the former two.

□

The second proposition in the paper states the following:

**Proposition 4.** *An (unexpected) increase in $L_s$ in $s$ leads to:*

1. *An instantaneous decrease in $w_s$*
2. *An instantaneous increase in $h_s$*
3. *A relocation of low-skilled workers away from $s$*
4. *A relocation of high-skilled workers toward $s$*
5. *Slow convergence of indirect utility across regions*

*Proof.* 1. is clear from looking at the local labor demand for low-skilled workers:

$$w_s = p_s B_s(1-\theta_s) Q_s^{\frac{1}{\sigma}} L_s^{\frac{-1}{\sigma}} \tag{22}$$

Note that $\partial(\frac{1}{\sigma}lnQ_s)/\partial lnL_s = \frac{1}{\sigma}\frac{1}{Q_s^{\frac{\sigma-1}{\sigma}} L_s^{\frac{1}{\sigma}}}$ which is positive but smaller than $\partial(\frac{-1}{\sigma}lnL_s)/\partial lnL_s = \frac{-1}{\sigma}$.

2. is also clear from looking at the local labor demand for high-skilled labor.

For 3. we only need to look at the first proposition. In-migration rates decrease towards $s$, while out-migration rates are close to 0 (though slightly positive), so $s$ loses low-skilled population. A similar argument can be made for 4. given the argument in 2.

5. is simply a consequence of what is described in (1)-(4) and the fact that wages enter in indirect utility.

□