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If You Don't Build It...: Mexican Mobility Following the U.S. Housing Bust*

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Abstract

This paper demonstrates the importance of earnings-sensitive migration in response to local variation in labor demand. We use geographic variation in the depth of the housing bust to examine its effects on the migration of natives and Mexican-born individuals in the U.S. We find a strong effect of the housing bust on the location choices of Mexicans, with movement of Mexican population away from U.S. states facing the largest declines in construction and movement toward U.S. states facing smaller declines. This effect operated primarily through interstate migration of Mexicans previously residing in the U.S. and, to a lesser extent, through slower immigration rates from Mexico in states with larger housing declines. There is no evidence that return migration to Mexico played an important role in immigrants' migration response. We also find no impact of the housing bust on natives' location choices. We interpret these results as the causal impact of the housing bust on migration after confirming that they are robust to controls for immigrant diffusion and a pre-housing-bust false experiment.

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1 Introduction

The number of homes under construction in the United States fell from a peak of 1,418,100 in May 2006 to a low of 407,400 as of February 2011, the most recent available data, a 71% decline.[1] Yet the housing bust was not a consistent national phenomenon. Some local markets experienced larger declines in construction (the West region fell by 78%), while others had smaller declines (the Northwest fell by 44%). In this paper, we use this geographic variation in the depth of the housing bust to examine its effects on the migration of natives and Mexican-born individuals in the U.S.[2]

We find a strong effect of the housing bust on the location choices of Mexicans, with movement of Mexican population away from U.S. states facing the largest declines in construction and movement toward U.S. states facing smaller declines.[3] This effect operated primarily through interstate migration of Mexicans previously residing in the U.S. and, to a lesser extent, through slower immigration rates from Mexico in states with larger housing declines. Return migration to Mexico did not play an important role in immigrants' migration response. We also find no impact of the housing bust on natives' location choices. We interpret these results as the causal impact of the housing bust on migration after confirming that they are robust to controls for immigrant diffusion (Card and Lewis 2007) and a pre-housing-bust false experiment.

These findings highlight the role of geographically mobile immigrants acting as arbitrageurs in the face of geographically disparate labor demand shocks. In the absence of mobile immigrants, large geographic differences in the depth of the housing bust would be expected to generate large and disparate effects on labor market outcomes for construction

[1] Census Bureau New Residential Construction

[2] We focus on Mexican-born migrants because they play an important role in the U.S. housing construction industry, as shown in Section 3, and because of the availability of high-quality survey data on return migration from the U.S. to Mexico.

[3] Note that all data sources sample individuals without regard to legal migrant status in the U.S, so our sample includes both authorized and unauthorized Mexican migrants.

workers, who tend to have low levels of education and are not very geographically mobile (Bound and Holzer 2000). Yet in the U.S., Mexican immigrant workers hold a disproportionate share of construction jobs and are particularly geographically mobile.[4] Our results suggest that this mobile population of Mexican construction workers moved away from locations with the sharpest declines in labor demand and toward more favorable construction markets. The presence of a geographically mobile immigrant population likely helped smooth the geographic variation in labor demand shocks that otherwise would have been faced by less mobile natives, improving labor market outcomes in the hardest-hit states and diminishing them in states with smaller housing declines.

Earnings-sensitive migration figures prominently in the debate over the effect of recent waves of predominantly low-skilled immigration on natives' wages and employment. In particular, research using the spatial correlation approach (e.g. results surveyed in Smith and Edmonston (1997) and further analysis in Card (2001)) tends to find smaller negative effects of immigration than do approaches that treat the labor market as nationally integrated (c.f. Borjas (2003)). Borjas (2003) suggests that the results can be reconciled if immigrants tend to choose locations experiencing relative increases in demand for their type of labor. In this paper we find evidence of precisely this mechanism: the housing crisis generated different labor demand shocks across locations, and we find that immigrant workers respond by moving toward locations with more favorable job prospects.

As with other papers in the literature (e.g. Borjas (2001), Jaeger (2007), and Cadena (2010a)), we find compelling evidence of earnings-sensitive location choices among newly arriving Mexican immigrants. Moreover, we find that Mexican immigrants already residing in the U.S. before the housing crisis respond by relocating within the U.S. Although consistent with previous work, this is to our knowledge the first such demonstration of earnings-sensitive

[4]See Section 3 for evidence.

migration of immigrants between locations in their host country.[5]

Along with a shift across U.S. states, there was also a sharp decline in Mexican migration to the U.S concurrent with the housing crisis. In fact, the migration flow declined nearly in lockstep with the the decline in new housing construction, to the point where net emigration flows from Mexico were nearly zero by early 2010. Taken together, our results suggest that immigrant inflows are correlated with both local *and* national demand shocks for their labor. In this case, even a nationally integrated empirical approach to measuring the impact of immigrants on natives may understate the true impact of immigration on wages.

The fact that return migration plays no measurable role in the geographic response of Mexican immigrants during the housing bust suggests a potential deterrent effect of increased border enforcement. Angelucci (forthcoming) finds that increased border enforcement decreases return migration of unauthorized migrants, reflecting the increased cost of potentially returning to the U.S. in the future. Lessem (2011) estimates a dynamic forward-looking migration model with border enforcement and finds similar results in simulations of increased enforcement. Although our results are by no means conclusive on this issue, the lack of any increase in return migration following such a large negative labor demand shock faced by a substantial fraction of Mexican workers in the U.S. suggests that return migration is not viewed as a favorable alternative to waiting out the crisis in the U.S.

The paper proceeds as follows. Section 2 describes our data on housing construction and presents salient features of the housing bust. We demonstrate substantial variation in the depth of the bust across U.S. states and show that this variation was closely related to changes in construction employment. In Section 3, we discuss the various U.S. and Mexican household data sources utilized in our study, demonstrating that Mexican workers are both more mobile than natives and more connected to the construction industry. Section 4 implements the main analysis including an examination of Mexican and native mobility

[5]Please make us aware of any citations of earlier work that invalidates our claim that this is novel.

in response to the housing bust and a detailed examination of the channels through which Mexican relocation occurred. Section 5 concludes.

2 The Housing Collapse Across U.S. States

Throughout our analysis, we use the number of residential housing units currently under construction as a measure of the local demand for construction employment.[6] The U.S. Census Bureau's New Residential Construction statistics provide two data sources that can be used to quantify this component of demand for low-skilled labor. The first data source is based on a survey of local building permitting officials, the "Report of New Privately-Owned Residential Building or Zoning Permits Issued." This survey reports the number of residential housing building permits issued in each month for each U.S. state. The second data source is the Survey of Construction, which takes a sample of the newly issued housing permits and determines whether each project has been started or completed. The relatively small sample sizes for the Survey of Construction preclude representative state-level estimates, but information on houses currently under construction is available at the national and Census region level.

The Survey of Construction estimates, for each Census region, i) the delay between permitting and the start of construction, and ii) the time from start to completion. We combine the state-level information on permits issued with regional information on construction timing relative to permit issuance to calculate state-level estimates of the number of houses under construction in each month.[7] Details of the calculations are presented in Appendix A. Figure 1 compares our measure of houses under construction at the national level based

[6]The change in houses under construction accurately measures the decline in local construction labor demand if either a) houses are constructed using Leontief production technology in which each house requires a fixed number of construction workers, or b) construction worker wages are downward rigid.

[7]For brevity, we refer to new residential housing units as houses, whether they are single-family or contained within a multi-family dwelling.

on permit data to the direct estimate from the Survey of Construction. The two correspond very closely, suggesting that our measure, which can be calculated separately for each state, is accurately estimating construction levels. The most striking features of Figure 1 are the rise in housing construction between 2003 and 2006 and the incredible decline in construction between 2006 and 2010.

The sharp national decline in housing construction masks substantial variation across states, with some states experiencing historic declines in construction and others experiencing relatively mild slowdowns. Figure 2 shows our measure of houses under construction for each state, normalized to equal 1 in January 2005. While there is a clear downward trend in most states, the depth of the housing bust varied widely across states, with states like Michigan, Florida, and Georgia experiencing the largest declines, while the declines in the Dakotas, Wyoming, and Louisiana were more modest. The empirical analyses in this paper rely on this variation across states in the depth of the housing bust.

Figure 1 also shows a national decline in construction employment beginning in late 2007, based on Census Bureau's Quarterly Workforce Indicators. Given the variation across states in the decline in construction activity, it is likely that this decline in construction employment was concentrated in the states with the largest declines in ongoing construction of new houses. We examine this and other state-specific labor market outcomes using the 2005-2009 American Community Surveys (ACS), which collect data on employment, industry, nativity, and migration information for a representative 1 percent sample of the U.S. population. Unless specified otherwise, we restrict our sample to native and Mexican-born men aged 18-64, not currently enrolled in school, and without a college degree. Table 1 shows that this sample of men accounts for 70.1% of all construction workers in 2005 and 33.4% of the total non-student population aged 18-64 in 2005. Figure 3 confirms that declines in construction employment were concentrated in the states with the largest declines in housing construction. The regression line indicates that, on average, a state facing a ten log point larger decline in

housing construction experienced a 2.7 log point larger decline in construction employment in our sample.[8] Further, differential declines in the construction of new housing explain more than half of all of the variation in state-specific construction employment changes.

Because construction output is non-tradable, local shocks to construction demand will not be directly arbitraged across regions. Geographic equalization will instead occur, if at all, through the migration of workers between local labor markets. If workers select geographic labor markets in order to maximize their earnings, these large differences in demand shocks across states should create strong incentives for less-skilled workers to move away from locations experiencing large shocks toward places with smaller shocks.

We therefore treat the state-specific declines in housing construction as exogenous shocks to the local demand for construction labor and use that variation to examine the resulting labor market and migration responses of Mexican and native workers. Although the causes of variation in the depth of the housing bust across different markets are still being debated, one compelling explanation is suggested by Mayer and Pence (2009). They find that there was substantial variation across geography in the use of subprime mortgages. The subprime market essentially disappeared following the crash, implying that locations whose housing demand was more reliant on subprime lending likely experienced larger declines in overall housing demand than did other locations. In order to explicitly examine this potential source of variation, we have obtained tabulations of Home Mortgage Disclosure Act (HMDA) data by zip code for 2004-2006.[9] In future analysis, we will use these data to directly test whether the decrease in housing construction was larger in locations with more subprime lending.

[8]Given the extreme declines in construction activity in our data, the approximate equivalence of log points and percentage points for small changes does not hold. Instead, a ten log point difference in houses under construction corresponds with a roughly 4.5 percentage point larger decline.

[9]Special thanks to Karen Pence for providing these tabulations.

3 Household Data and Descriptives

In the analysis that follows, we calculate various measures of employment and migration behavior for natives and Mexicans using household survey data. Inter-state migration within the U.S. and immigration to the U.S. from abroad are calculated using ACS data, which reports each individual's state of residence in the previous year and how long each foreign-born individual has lived in the U.S. We also use Mexican survey data for summary statistics on international migration to and from Mexico and to estimate return migration rates of Mexicans from each U.S. state. We calculate total international migration to and from Mexico using the Encuesta Nacional de Ocupación y Empleo (ENOE), which repeatedly surveys households in the sample, allowing the identification of those leaving for and arriving from abroad.[10] Since the ENOE does not record a return migrant's former state of residence in the U.S. it cannot be used to measure return migration flows out of each U.S. state. Instead, we use information from the Encuesta sobre Migración en la Frontera Norte (EMIF), a border survey reporting return migrants' U.S. source state and Mexican destination state. Using the 2005-2009 surveys, we are able to calculate the number of Mexican-born individuals who returned to Mexico from each U.S. state during that time period.

We focus on Mexican-born migrants for various reasons. As just mentioned, we need source-country data on mobility to measure return migration flows back to the country of origin, and very detailed migration data are collected from Mexican migrants. The housing bust generated substantial geographic variation in the demand for construction workers, allowing us to examine the impacts of such disparate local labor demand shocks on workers' location choices. Mexican-born workers are disproportionately represented in construction. Table 1 shows that in 2005, 30.8% of non-student Mexican men aged 18-64 worked in construction, compared to 16.6% of the same sample of native-born men. Mexican-born men also

[10] See Appendix B for details on migration measurement in the ENOE.

constitute a substantial fraction of the total number of construction workers, 12.0% in 2005, while they accounted for only 3.0% of the overall non-student working-age population. In contrast, other foreign-born individuals are much less likely to work in construction, closely paralleling the native sample in this regard and further justifying our focus on Mexican-born individuals. Finally, Mexican-born individuals represent the largest immigrant group in the U.S., accounting for 30% of the foreign-born population.

Table 2 shows interstate and international mobility rates for native-born and Mexican-born workers in the 2006-09 ACS surveys. As seen in nearly all migration analyses since Sjaastad (1962), in both nativity groups younger workers are more mobile than older workers. Mexican-born individuals are more mobile, in terms of the fraction of individuals who resided in a different state or country in the previous year. Not surprisingly, a much larger portion of overall mobility among Mexicans reflects international migration rather than interstate mobility within the U.S. when compared to the same numbers for natives. Higher mobility rates in each age group, except those aged 25-34, and an age distribution skewed more toward younger, more mobile individuals leads Mexican-born individuals to exhibit a higher mobility rate than native-born men.

As we will see in the following section, variation in the housing bust across U.S. states resulted in substantial movement of Mexican men away from the most negatively affected states and toward states with smaller declines in housing construction. Natives do not exhibit a similar geographic response. The descriptive statistics discussed here suggest that the stronger effects for Mexicans may be driven by a stronger connection to the construction industry and by higher mobility rates among Mexicans.

4 Results: Mobility Following the Housing Collapse

As many of the outcomes that we analyze in this section relate to Mexicans' location choices and employment, we restrict our state-level analyses to states with at least 30 observations of Mexicans who meet our sampling criteria in each of the 2005 and 2009 ACS samples. Figure 4 shows the number of (unweighted) observations for Mexican-born males in our sample by U.S. state in the 2005 ACS. The horizontal line indicates the 30 observation cutoff, which results in the elimination of VT, ND, WV, DC, ME, MT, AK, SD HI, NH, RI, WY, and MA, leaving 38 states in the sample. Dropping states with such small numbers of observed Mexican individuals avoids introducing substantial noise in the calculation of state-specific Mexican-born population growth rates.

As discussed above, states experiencing larger declines in new home construction experienced larger declines in construction employment between 2005 and 2009. Figure 5 demonstrates this fact for the restricted sample of states with at least 30 observed Mexican individuals in the 2005 ACS.[11] Given that Mexican workers are disproportionately represented in construction and are highly geographically mobile, we move to examining the relationship between the decline in housing construction and changes in Mexican population. Let the Mexican-born population of U.S. state s in year t be given by mex_{st}. The fraction of the total Mexican population resident in the U.S. living in state s in year t is

$$\varphi_{st} \equiv \frac{mex_{st}}{\sum_{s't} mex_{s't}}. \tag{1}$$

Taking logs and long differencing between two years yields

$$\Delta \ln \varphi_s = \Delta \ln mex_{st} - \Delta \ln \left(\sum_{s't} mex_{s't} \right). \tag{2}$$

[11] Compare to Figure 3, the same relationship for all states, which is nearly identical to the restricted-state relationship.

Note that the first term on the right varies by state, while the second term represents the overall increase or decrease in Mexican-born population in the U.S. This expression demonstrates that the change in log population can be used to measure the change in a state's share of national population. We use this measure to examine how the Mexican population of the U.S. redistributed in response to the housing bust.

Figure 6 shows the relationship between the change in log male Mexican population, $\Delta \ln mex_{st}$, and the change in the log of houses under construction, $\Delta \ln h_s$. The regression line reveals a substantial negative relationship between the depth of a state's housing bust and the growth of the state's Mexican population. In particular, a state with a 10 log point larger decline in housing construction experienced a 2.4 log point larger decline in Mexican population share.[12] Figures 7 and 8 show the state variation in the change in log housing construction and the change in log Mexican population. The negative relationship shown in Figure 6 is apparent in these maps, with the red states changing to blue from map to map, especially for states far away from the median housing decline. Note that there is substantial variation in the size of the housing bust within regions of the country as well as within the subset of traditional destination states for Mexican immigrants. These results suggest a substantial geographic reallocation of Mexican men across U.S. states in response to the housing bust.

Interestingly, a similar geographic reallocation did not occur for natives. Figure 9 performs the same exercise by nativity and sex, with Figure 6 reproduced in the upper left panel. The results for native men and women are economically small, statistically insignificant at conventional levels, and report point estimates suggesting that, if anything, natives moved *toward* states with deeper housing declines. As discussed above, this may simply be due to less attachment to the construction industry and generally lower levels of mobility.

[12]For concreteness, pairs of states exhibiting a roughly 20 log point difference in the decline in housing construction are New York and Arizona or Utah and Florida.

Alternatively, native workers may have a longer time horizon in making location choices and the value of avoiding a presumably temporary labor market shock may therefore be lower. Mexican women respond similarly to Mexican men, but their location decisions are estimated with less precision. Since Mexican women are very unlikely to work in construction, as seen in Table 1, this result likely reflects the behavior of tied movers. Since the substantial shift in Mexican population was not matched by a similar shift in native population, these results imply that states facing larger housing collapses experienced a decline in the Mexican share of their population.

In order to interpret these results as evidence that the housing bust *caused* the reallocation of Mexican population around the U.S., we must rule out any other drivers of Mexican relocation that may coincidentally be correlated with the depth of the housing bust. As an alternative, suppose that the Mexican-born population began to shift away from traditional enclave destinations independently of the housing bust.[13] If states with large enclaves also experienced deeper housing declines, the observed relocation may simply reflect immigrant diffusion rather than the effect of the housing bust and the subsequent decline in employment. We address this concern by including as a control the Mexican-born share of each state's population in 2005, before the bust. Table 3 column (1) reproduces the baseline specification in Figure 6, without additional controls. Column (2) introduces the diffusion control. The point estimate is negative, which is consistent with movement away from traditional enclaves, but it is imprecisely estimated, and its inclusion has almost no effect on the coefficient for the housing decline.

Another potential confounder is the introduction of state-specific legislation decreasing the attractiveness of locating in a particular state. Bohn, Lofstrom and Raphael (2010) have collected information on various newly passed state immigration laws that may deter

[13] In fact, Card and Lewis (2007) document substantial diffusion of Mexican-born immigrants across the U.S. over the 1990s.

Mexican-born workers from locating in those states.[14] In subsequent revisions of this paper, we plan to use these legislative measures as an additional control variable in the analysis. Currently, we simply drop Arizona, which enacted the strongest measure deterring unauthorized workers, The Legal Arizona Workers Act, in January 2008. Dropping Arizona also has almost no effect on the measured impact of the housing decline on Mexican reallocation, as shown in column (3) of Table 3.

Although the reallocation result is robust to the controls just mentioned, it is still possible that some other unobserved factor other than the housing bust was driving Mexican men away from locations that happened to have larger housing declines. We use a false experiment approach to rule out persistent unobserved factors by regressing the pre-housing-crisis (2000-2005) change in log Mexican population on the housing decline during the crisis (2005-2009). A relationship between pre-crisis Mexican relocation and the subsequent change in housing construction would undermine the claim that the housing bust caused the subsequent shift in migration patterns. Figure 10 implements this false experiment analysis by nativity and sex. Each of the point estimates is small and statistically insignificant, and if anything, indicates small amounts of pre-crisis movement *toward* states with subsequently larger housing declines. Thus, our findings are not driven by preexisting trends, which supports interpreting the redistribution of the Mexican-born population in the wake of the housing bust as the causal effect of the decrease in demand for low-skilled labor created by the decline in construction activity.

In order to better understand the geographic shift in Mexican population in the U.S., we consider the channels through which the Mexican-born population reallocated across U.S. states between 2005 and 2009. There are five potential channels:

- C1: Inter-state movement of Mexicans who were already residing in the country

[14]Special thanks to Sarah Bohn and Magnus Lofstrom for agreeing to provide this information.

- C2: Mexicans arriving from abroad
- C3: Previously resident Mexicans leaving the country
- C4: Resident Mexicans who age into or out of the sample
- C5: Resident Mexicans who enter or leave the sample due to a change in schooling status

We can decompose the overall shift in Mexicans' locations into these channels by introducing a slight change to the measure of shifting population used in Figure 6. There we considered the change in log number of Mexicans in each state. This can be approximated as the growth rate - the change in the number of Mexicans in a state divided by the initial number,

$$\Delta \ln mex_s \approx \frac{\Delta mex_s}{mex_{s0}}. \tag{3}$$

For small changes, the two measures are identical, and even with the substantial changes observed in our data, the correlation coefficient between the two measures is 0.99. We use the growth rate because it can be additively decomposed into each of the above channels, while still maintaining the interpretation of describing a shift in the geographic distribution of Mexican population across U.S. states. We implement the decomposition as follows. By definition,

$$\frac{\Delta mex_s}{mex_{s0}} = \frac{C1_s}{mex_{s0}} + \frac{C2_s}{mex_{s0}} + \frac{C3_s}{mex_{s0}} + \frac{C4_s}{mex_{s0}} + \frac{C5_s}{mex_{s0}}. \tag{4}$$

Assume that each reallocation channel is linearly related to the change in log housing construction as follows.

$$\frac{C1_s}{mex_{s0}} = \beta_0^1 + \beta_1^1 \Delta \ln h_s + u_s^1 \tag{5}$$

$$\frac{C2_s}{mex_{s0}} = \beta_0^2 + \beta_1^2 \Delta \ln h_s + u_s^2 \tag{6}$$

$$\frac{C3_s}{mex_{s0}} = \beta_0^3 + \beta_1^3 \Delta \ln h_s + u_s^3 \tag{7}$$

$$\frac{C4_s}{mex_{s0}} = \beta_0^4 + \beta_1^4 \Delta \ln h_s + u_s^4 \tag{8}$$

$$\frac{C5_s}{mex_{s0}} = \beta_0^5 + \beta_1^5 \Delta \ln h_s + u_s^5 \tag{9}$$

Summing these equations yields

$$\frac{\Delta mex_s}{mex_{s0}} = \left(\beta_0^1 + \beta_0^2 + \beta_0^3 + \beta_0^4 + \beta_0^5\right) + \left(\beta_1^1 + \beta_1^2 + \beta_1^3 + \beta_1^4 + \beta_1^5\right) \Delta \ln h_s + \left(u_s^1 + u_s^2 + u_s^3 + u_s^4 + u_s^5\right), \tag{10}$$

$$\frac{\Delta mex_s}{mex_{s0}} = \beta_0 + \beta_1 \Delta \ln h_s + u_s, \tag{11}$$

where $\beta_0 \equiv (\beta_0^1 + \beta_0^2 + \beta_0^3 + \beta_0^4 + \beta_0^5)$, $\beta_1 \equiv (\beta_1^1 + \beta_1^2 + \beta_1^3 + \beta_1^4 + \beta_1^5)$, and $u_s \equiv (u_s^1 + u_s^2 + u_s^3 + u_s^4 + u_s^5)$. Given estimates of β_1^1 through β_1^5, one can divide the overall shift in Mexicans' location choices in response to the housing collapse into that occurring through each channel as $\frac{\beta_1^1}{\beta_1}$, $\frac{\beta_1^2}{\beta_1}$, etc. Channels C1, C2, and C4 are directly observable in the ACS data. Channel C5 is not easily observed in any data set and will be left as part of a residual category in our analysis. Channel C3, return migration, is not observable in the ACS, since the relevant individuals are no longer in the U.S. and are not surveyed, but we can use the EMIF border survey to estimate the amount of return migration of Mexican-born individuals leaving each U.S. state.

Aggregate data from the Mexican ENOE household survey suggest that the return-migration channel is unlikely to account for a substantial fraction of the reallocation of Mexican population.[15] Figure 11 plots the rates of international emigration leaving Mexico and international immigration into Mexico, along with US homes under construction from the Census of Construction. The rate of emigration out of Mexico fell precipitously dur-

[15]See Section 3 for a brief data description and Appendix B for details on how the longitudinal aspect of the survey was used to calculate international migration rates to and from Mexico.

ing the period of the housing bust, tracking the decline in U.S. housing construction quite closely. Strikingly, the rate of immigration to Mexico from abroad, which primarily reflects return migration from the U.S., stayed remarkably flat over the entire period. The seasonal return migration in the fall of 2009 is somewhat smaller than in previous years, due to the lack of seasonal emigration earlier that year, but the baseline level of immigration barely changes. Given these observations, the return migration channel, C3, is unlikely to explain a substantial portion of the reallocation.

Table 4 implements the decomposition of the cross-state Mexican reallocation.[16] Column (1) regresses the change in log population of Mexican men in each state on the decrease in log houses under construction between 2005 and 2009. Column (2) uses the growth rate of Mexican population as a dependent variable. The similarity between the results in columns (1) and (2) reflects the close approximation described in (3) between the two dependent variables. The remaining columns decompose the reallocation of Mexican population exhibited in column (2) into channels C1-C4 and a residual term including changes in schooling status (C5) and any error in our measures of the observable channels. Column (3) shows that states facing larger housing declines lost Mexican population through net inter-state migration. The point estimate is statistically different from zero and accounts for 43.9% ($= \frac{-0.112}{-0.255}$) of the overall reallocation. Column (4) shows that the slowdown in immigration to the U.S. from Mexico that was observed in Figure 11 was strongest in states facing larger housing declines. The point estimate accounts for 30.2% of the overall reallocation. Column (5) shows that return migration did not play a meaningful role in the reallocation of Mexican population across U.S. states. This is not surprising given that return migration rates remained unchanged during the housing bust. Similarly, Column (6) shows that aging in and out of the sample was also an insignificant contributor to the reallocation in both

[16]Note that all results are qualitatively similar when weighting by the size of the state's Mexican-born or native-born population.

economic and statistical senses.

The dependent variable in column (7) is constructed as the residual variation in Mexican population growth rates after subtracting our estimates of the observable channels:

$$resid_s \equiv \frac{\Delta mex_s}{mex_{s0}} - \frac{C1_s}{mex_{s0}} - \frac{C2_s}{mex_{s0}} - \frac{C3_s}{mex_{s0}} - \frac{C4_s}{mex_{s0}} \tag{12}$$

By construction, this residual will include the schooling sample channel (C5), and any measurement error in our estimates of the observable channels. Column (7) regresses this unexplained term on the change in log construction. Although the point estimate explains 28.8% of the overall reallocation, it is very imprecisely estimated. Any classical measurement error in the observable channels will bias them toward zero, mechanically driving up the unexplained component estimate, but introducing substantial noise into that measure. This situation is consistent with the results just described.

In summary, we find that cross-state variation in the depth of the housing collapse caused a substantial shift in the geographic distribution of Mexican population residing in the U.S. This finding is robust to controls for general diffusion of Mexican population away from traditional enclave destinations and to dropping Arizona, which implemented legislative measures likely to discourage immigrants from locating there. The relationship between Mexican relocation and the housing crash was not part of an ongoing trend, as demonstrated by a pre-crisis false experiment. There is no evidence that natives responded geographically to the housing crisis. The Mexican relocation occurred primarily through inter-state migration of previously resident Mexicans and deterred or deferred immigration from Mexico. Interestingly, there is no evidence that returning to Mexico played an important role in the response to the housing collapse. A similar decomposition for native-born individuals finds no significant relationship between any of the migration channels and the housing shocks, consistent

with the lack of overall response of natives shown in Figure 9.[17]

This shift in the geographic distribution of the Mexican-born population in the U.S. in combination with the lack of any native mobility has a number of important implications. Immigrants appear to make earnings maximizing location choices when choosing where to live in the U.S. Our findings suggest that immigrants act as geographic labor-market arbitrageurs, helping to diffuse the effects of geographically concentrated demand shocks, such as those induced by the housing bust. As immigrants move away from the most negatively impacted locations and toward more positively impacted locations, they improve labor market conditions for natives in source locations and diminish labor market outcomes in destination locations, effectively smoothing the geographic effects of the shocks faced by natives.[18] Through their mobility, immigrants effectively transfer employment probability from the least-affected areas to the most-affected areas. Thus, a negative demand shock in one portion of the country can affect the employment and wages of workers in a geographically distant part of the country, even in a non-traded sector.

5 Conclusion

This paper finds a substantial impact of the housing bust on the migration of Mexican-born individuals in the U.S., with movement of Mexican population away from U.S. states facing the largest declines in construction and movement toward U.S. states facing smaller declines. We have shown that this shift in Mexican population occurred primarily through interstate migration of Mexicans previously residing in the U.S. and, to a lesser extent,

[17]We also examined the internal migration channel for natives broken down by whether each individual rented or owned their home in their current location. We found extremely small and statistically insignificant relationships between the housing shock and internal migration for both groups, suggesting that the lack of response among natives was not isolated to home owners.

[18]Borjas (2001) described this possibility, noting that the movement of earnings-sensitive immigrants might obviate the need for natives to bear the costs of moving. Cadena (2010b) explicitly considers this phenomenon using plausibly exogenous state-level labor supply shocks resulting from welfare reform.

through slower immigration rates from Mexico in states with larger housing declines. We find no evidence that return migration to Mexico played an important role in immigrants' migration response. In fact, the immigration rate to Mexico remained nearly unchanged throughout the time period of the housing bust. These findings highlight the role of geographically mobile immigrants acting as arbitrageurs in the face of geographically disparate labor demand shocks. The findings also raise a number of questions suggesting avenues for future research.

Unlike Mexicans, natives appear not to have responded geographically to the large differences across states in the decline for construction labor. This raises two questions for future work. First, the movement of Mexican workers likely arbitraged away some of the regional differences in labor market outcomes for natives that would have been observed in the absence of equalizing Mexican migration. Quantifying this effect will require imposing some functional form restrictions on construction labor demand and labor supply, but would provide a clearer picture of the role of immigrants in equalizing disparate regional shocks through equalizing migration. Second, how were labor market outcomes for the much less mobile natives different than those for otherwise similar Mexican immigrants? Did natives in the hardest-hit states simply accept lower labor market outcomes? Were they more likely to switch occupations or pursue education and retraining? If so, this suggests different adjustment mechanisms for the different nativity groups: natives adjusting through occupational flexibility, while Mexicans adjusting through geographic flexibility.

Our finding that previously resident Mexican individuals migrated within the U.S. to avoid the deepest housing declines raises the question of how migrant networks affect location choices of immigrants after their first move away from home. In particular, how do previous migrants affect the choices of subsequent internally migrating immigrants? One could imagine two alternative scenarios: An immigrant who decides to leave their first location in the destination country is more likely to choose i) a second location with many

immigrants from their home country or region, or ii) a second location with many immigrants who had previously lived in the first location. The relative strength of these two migration networks reveals information about the relative importance of ties to the immigrant's home region versus the immigrant's enclave in the foreign country.

A substantial portion of the reallocation of Mexican population occurred through differential rates of new immigration. This adjustment may have occurred through two potential channels, depending on the rigidity of migrant networks at the sub-national level: i) The destination mix of emigrants from a particular Mexican state remained reasonably constant, and emigration out of Mexican states that traditionally send migrants to the hardest-hit U.S. states slowed most. ii) Emigration slowed roughly equally across all Mexican states, and each Mexican state shifted its mix of U.S. destination states away from the hardest-hit locations. Investigating which of these channels is most consistent with the observed migration patterns during the housing crisis will provide evidence on the persistence of migrant networks in the face of a very large and geographically disparate shock.

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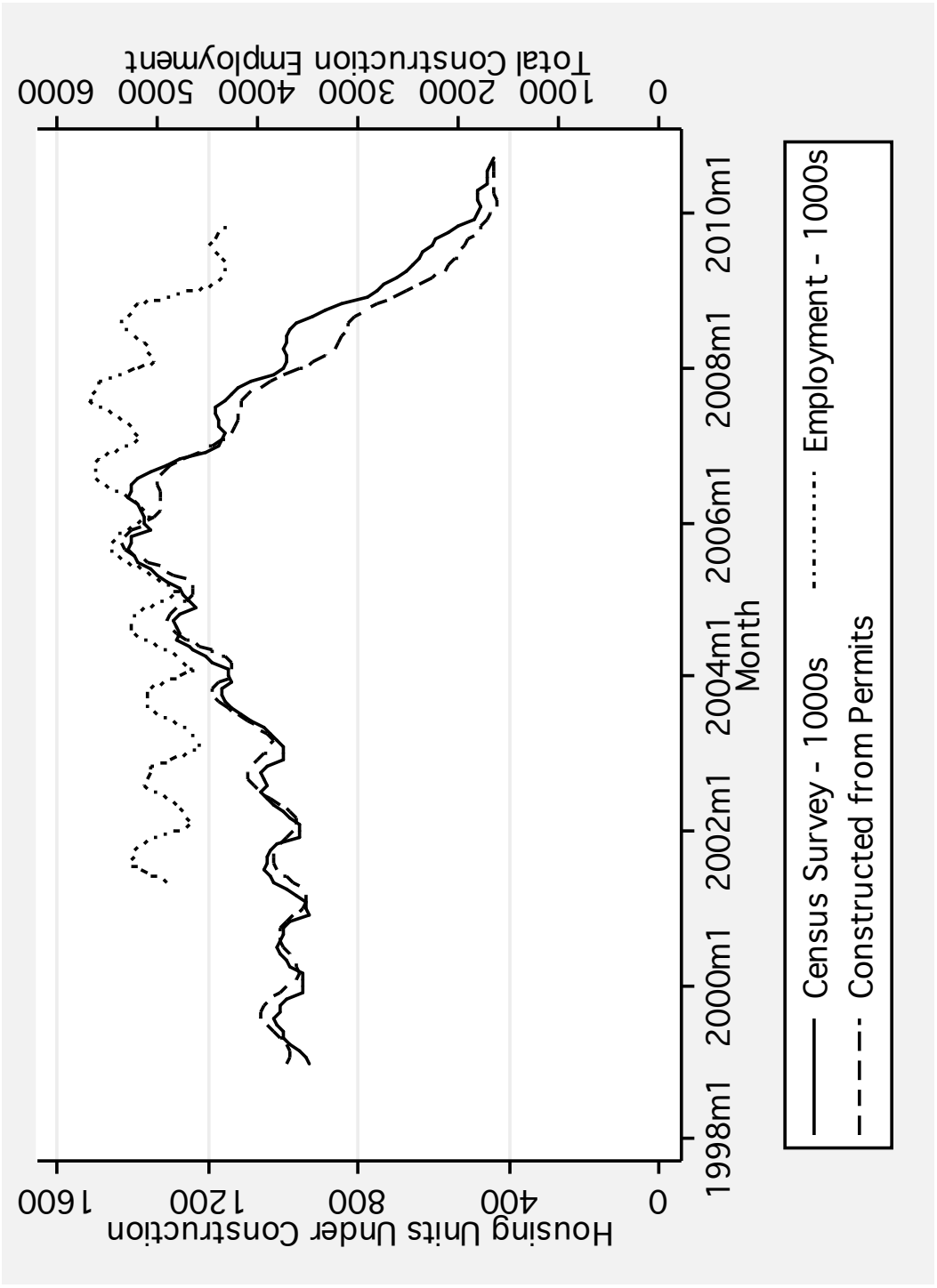
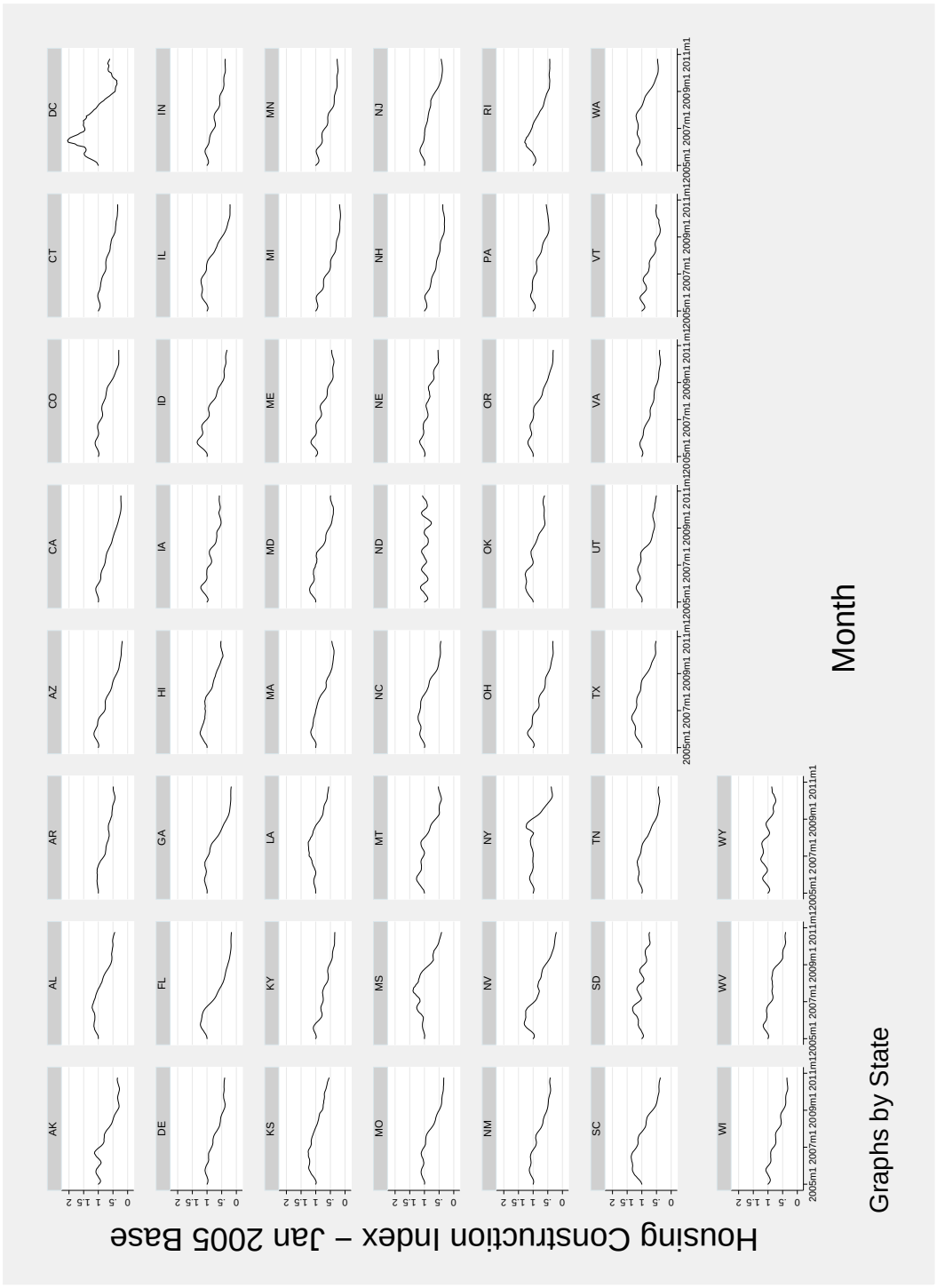
Figure 1: Houses Under Construction and Construction Employment



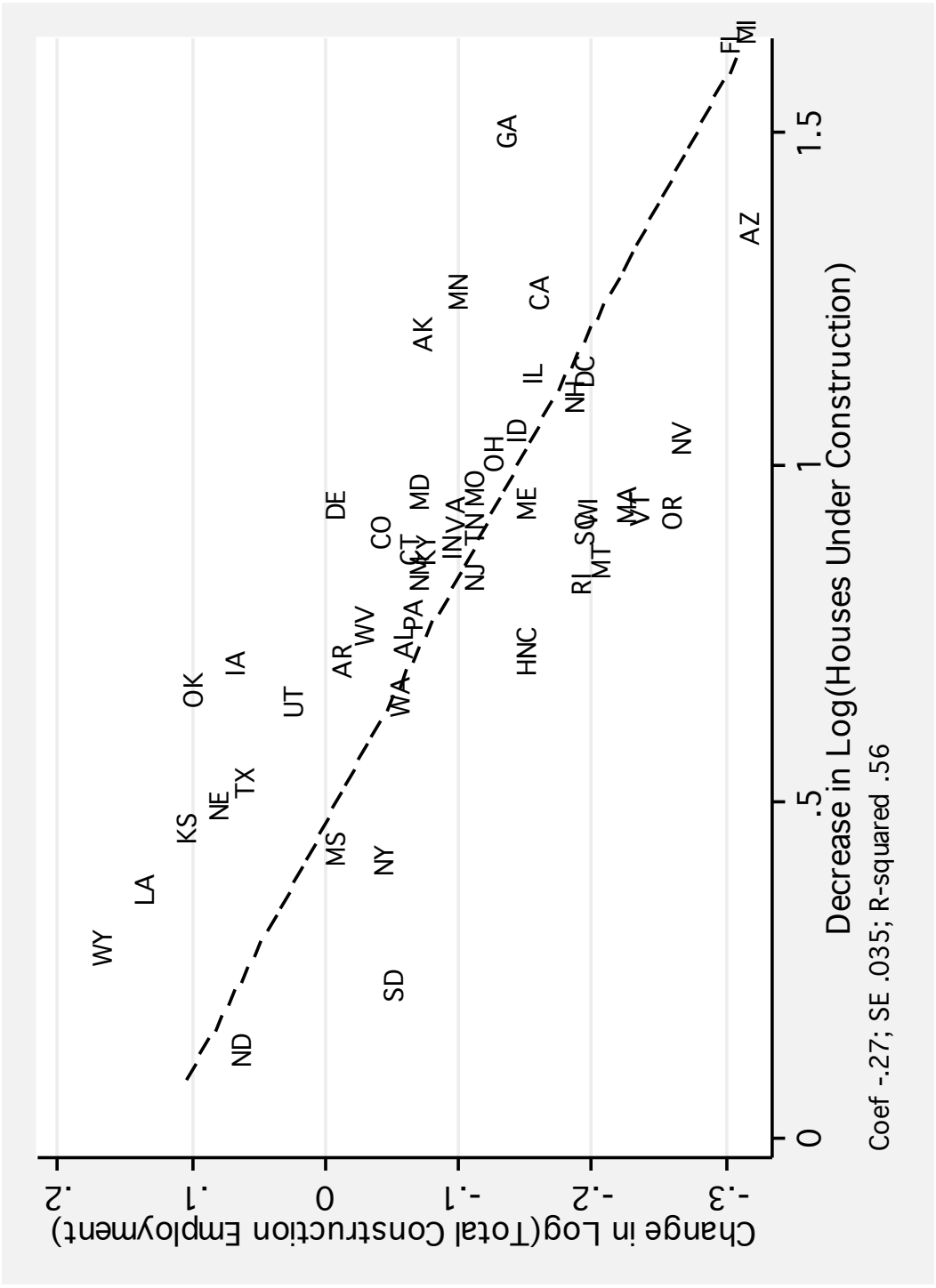
Source: Authors' tabulation of Census and QWI data. Estimation procedure described in the text.

Figure 2: Geographic Variation in Decline in Construction Activity



Note: The index is the estimated number of housing units under construction divided by the number under construction in January of 2005. The estimation procedure is described in the text.

Figure 3: Decrease in Housing Units Under Construction and Change in Construction Employment - All States (2005-2009)



Source: Authors' calculations from Census Building Permit and ACS data.

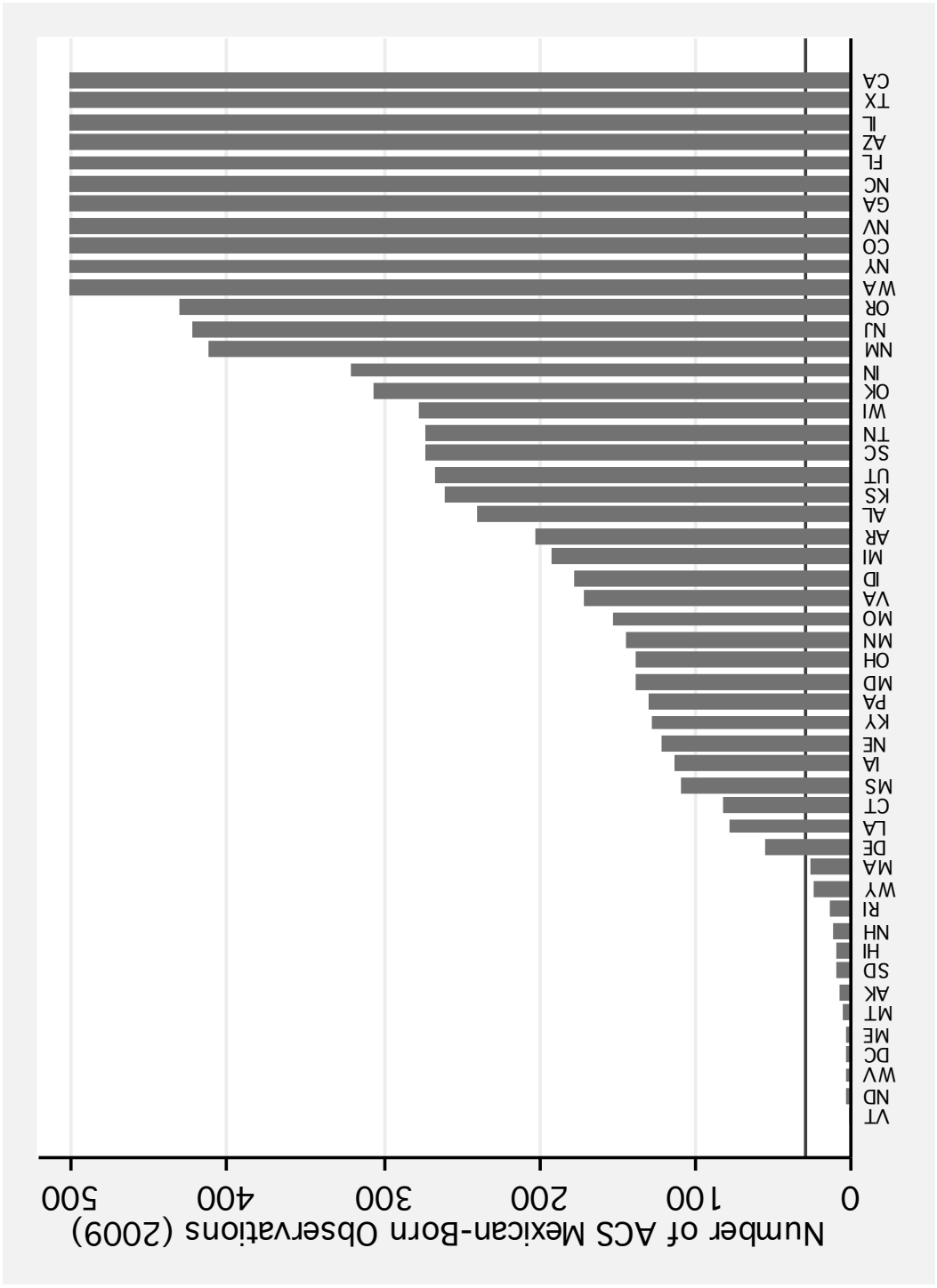
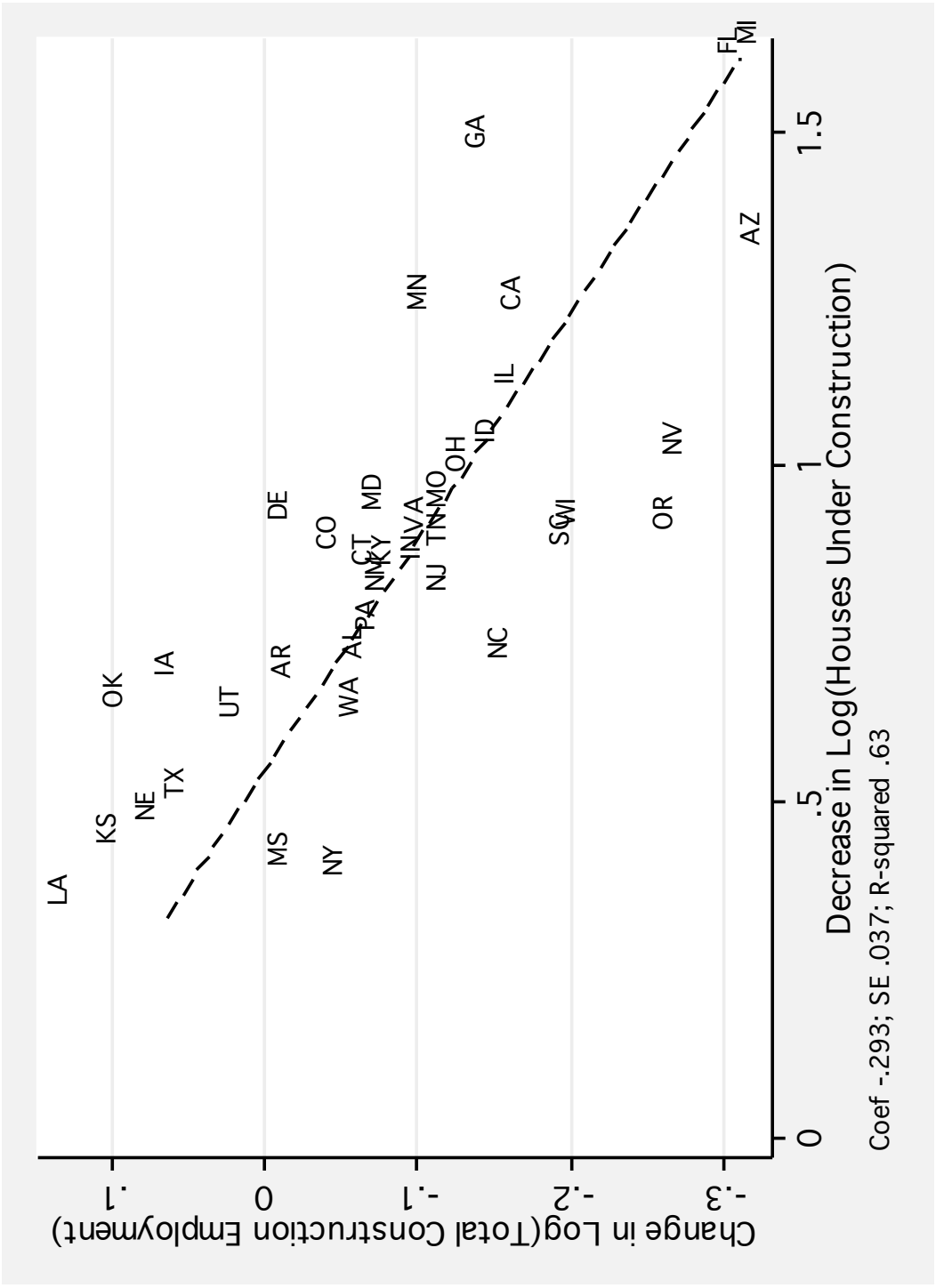


Figure 4: Number of Mexican-Born Sample Observations by State

Source: Authors' calculations from ACS data. The displayed number of observations is top-coded at 500, although the ordering of states reflects the true number. Later analysis excludes states with fewer than 30 observations (below the reference line).

Figure 5: Decrease in Housing Units Under Construction and Change in Construction Employment - Restricted State Sample (2005-2009)



Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

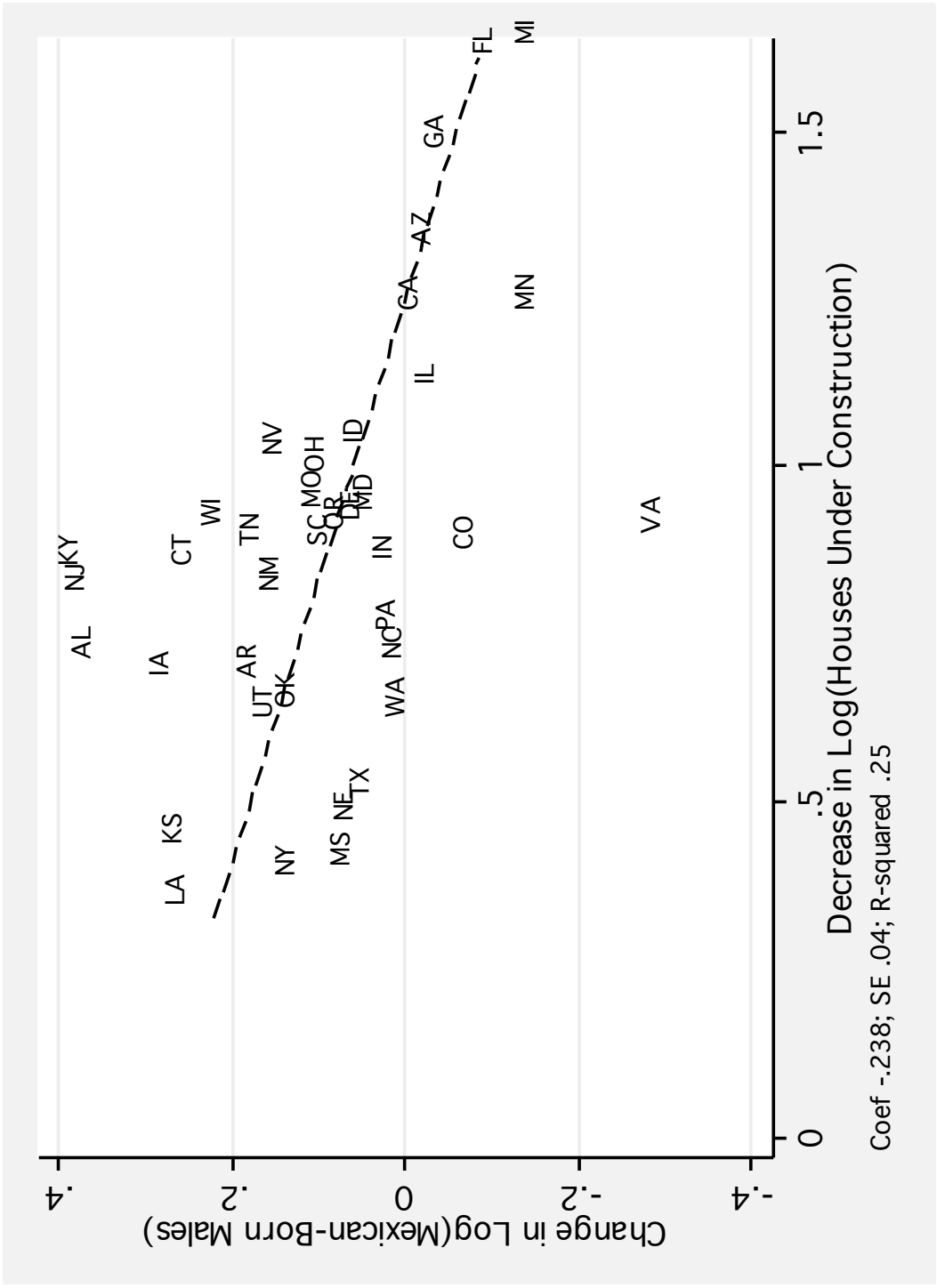


Figure 6: Mexican-Born Population Growth and Decrease in Housing Demand (2005-2009)

Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

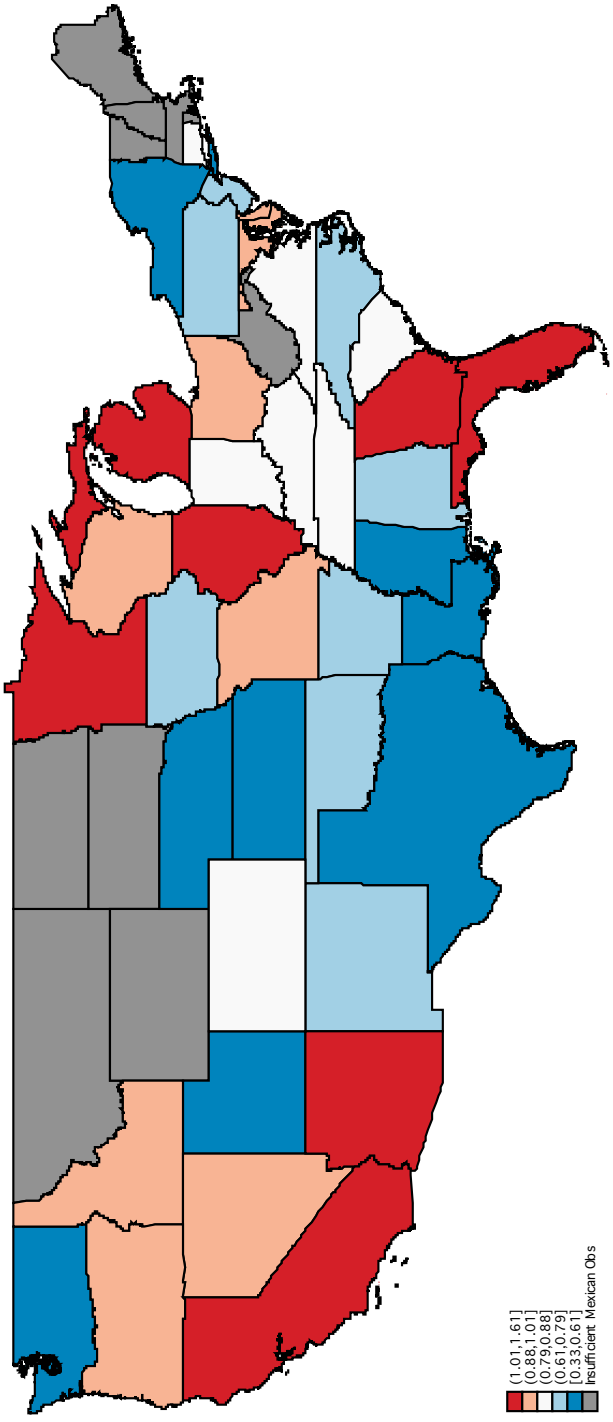
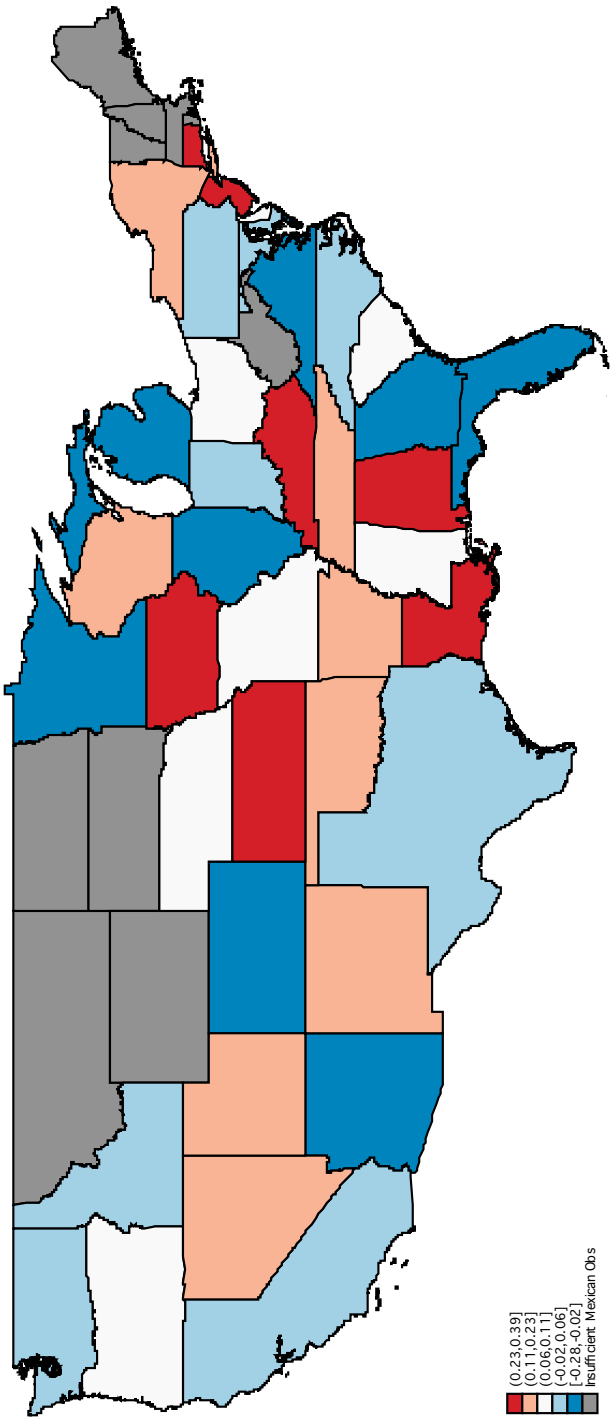


Figure 7: Decrease in Log(Housing Units Under Construction) 2005-2009

Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

Figure 8: Mexican-Born Population Growth 2005-2009



Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

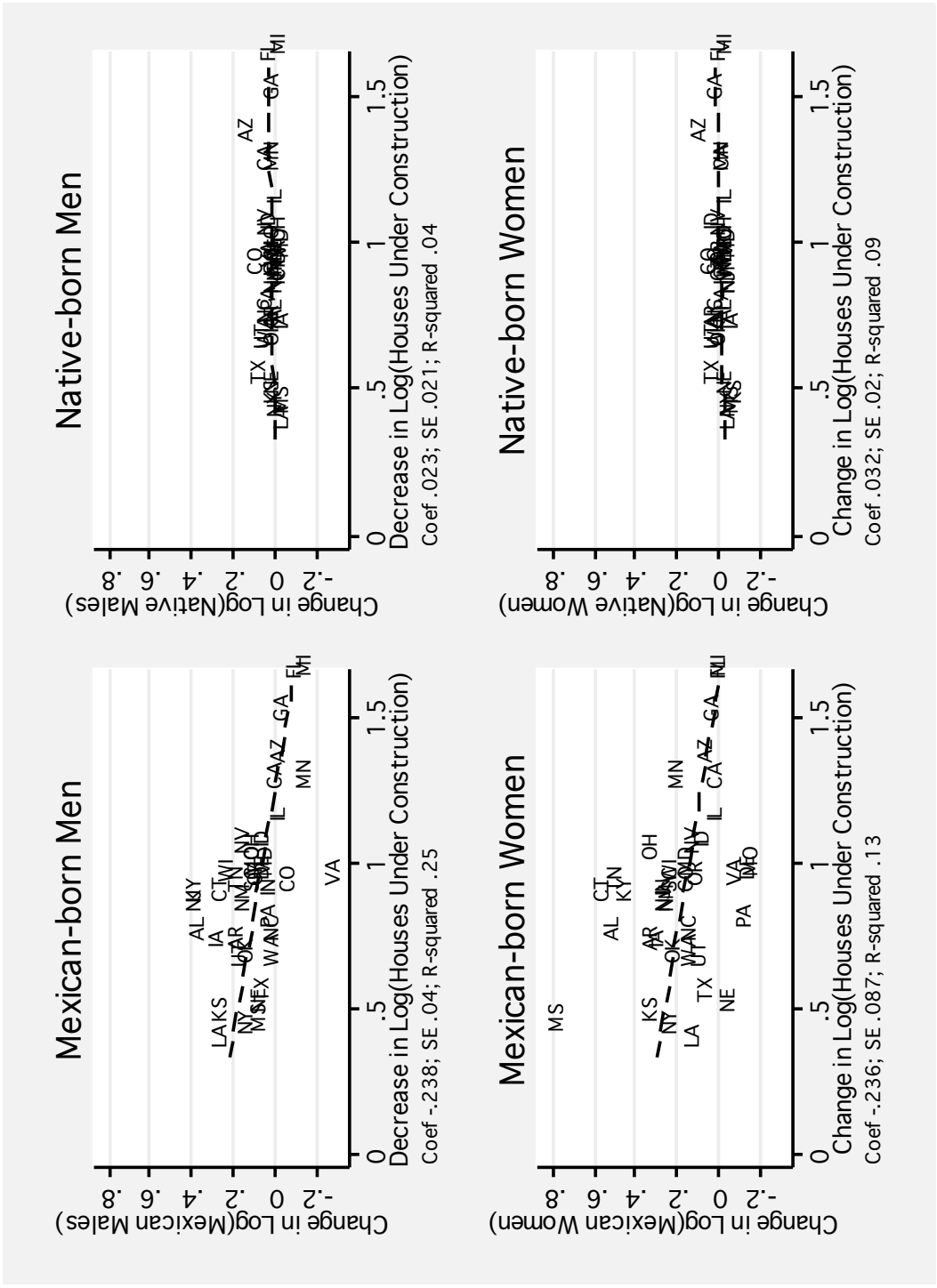


Figure 9: Population Growth and Housing Demand 2005-2009

Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

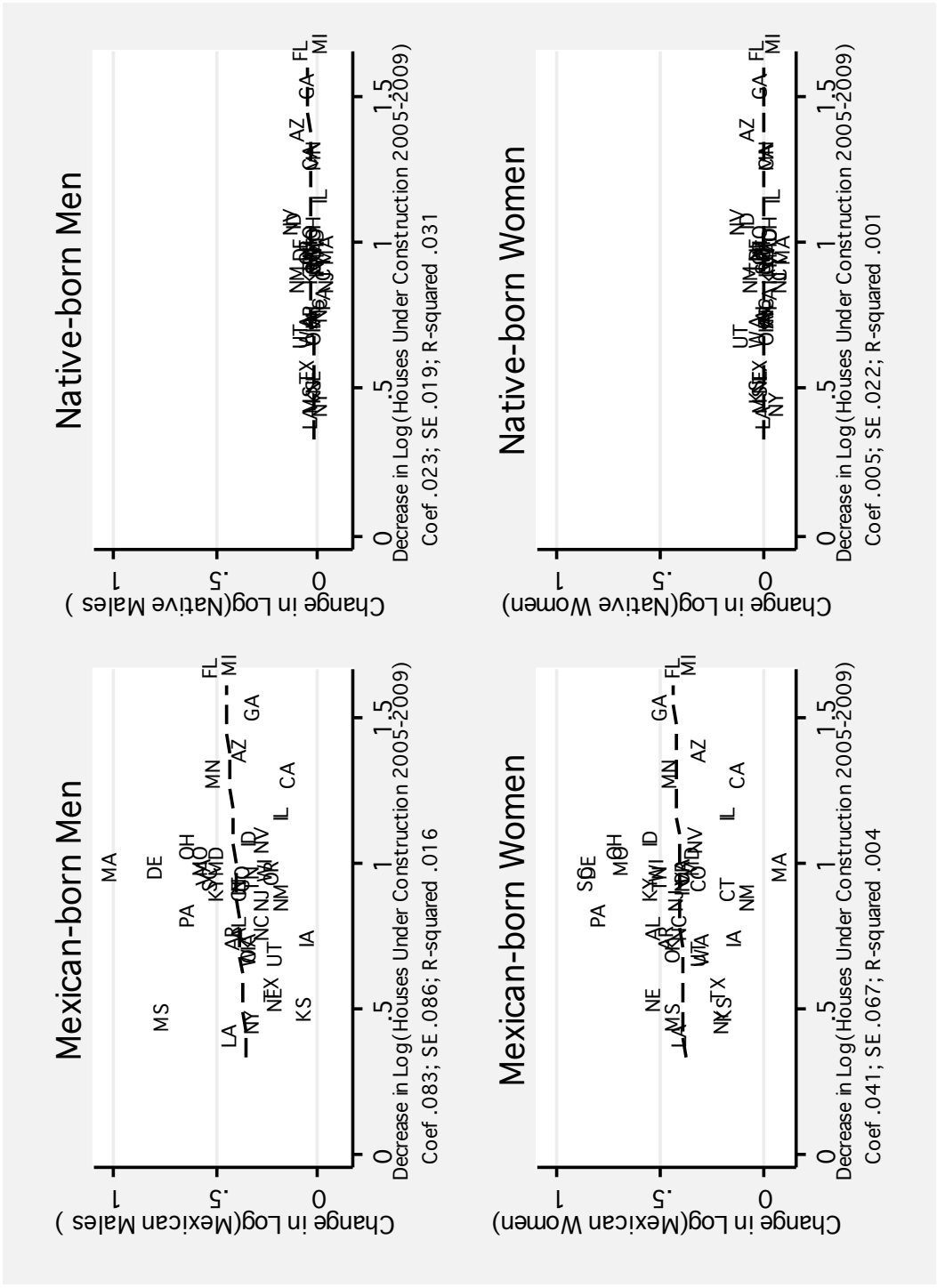


Figure 10: Falsification Test: Population Growth 2000-2005 and Decrease in Housing Demand 2005-2009

Source: Authors' calculations from Census Building Permit and ACS data. Sample limited to states with at least 30 Mexican-born ACS observations.

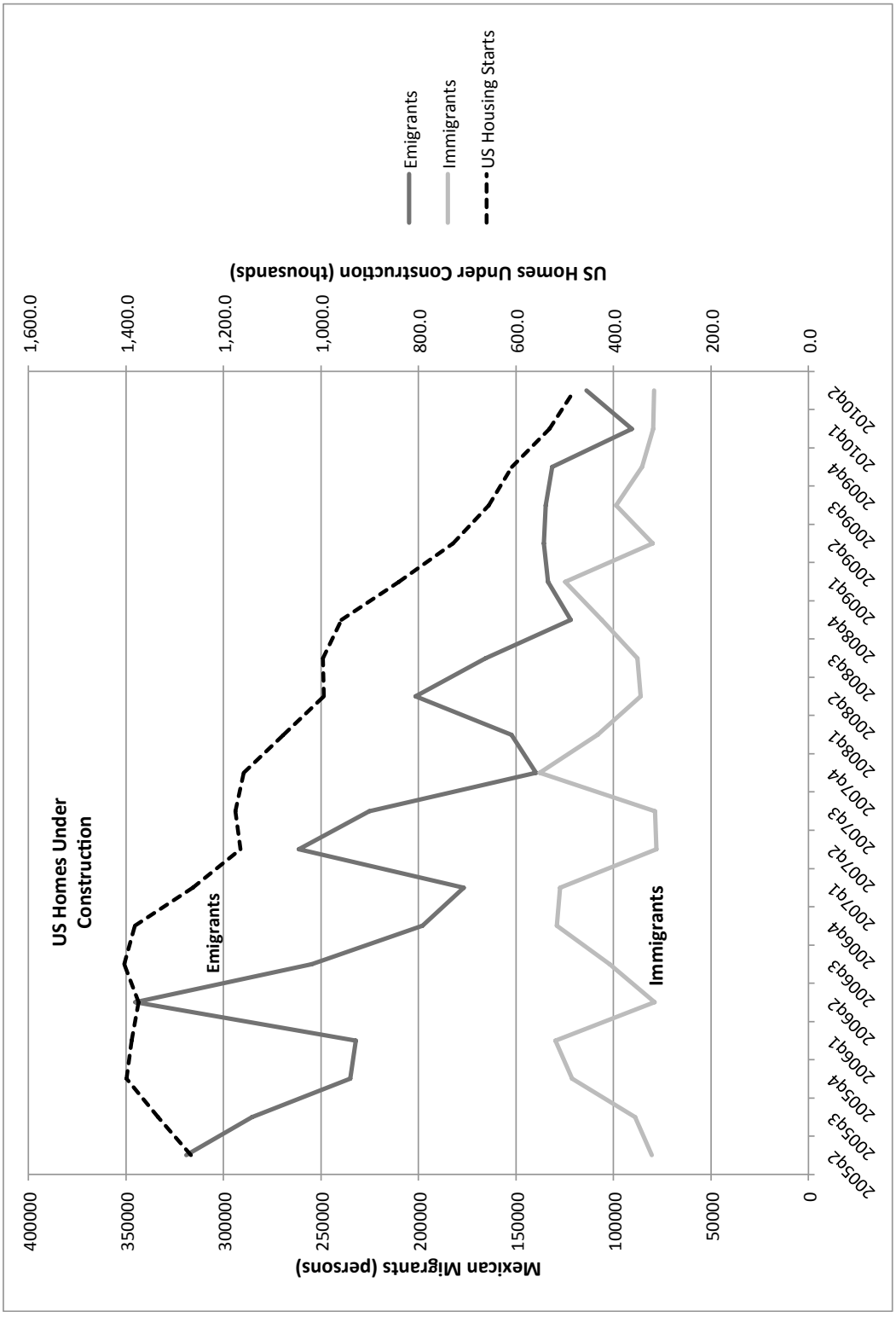


Figure 11: International Mexican Migration and U.S. Housing Demand

Source: Authors' tabulation of Census and ENOE data. Immigration and emigration rates calculated using official INEGI procedures.

Table 1: Mexican and Native Construction Shares

	Mexican-Born Sample		Native-Born Sample		Other Foreign-Born Sample	
	Men	Women	Men	Women	Men	Women
Percent of Employed Working in Construction	30.8%	1.4%	16.6%	2.1%	17.2%	1.1%
Share of Construction Employment	12.0%	0.2%	58.1%	6.2%	6.8%	0.3%
Share of Population (18-64 not in school)	3.0%	2.3%	30.4%	30.7%	3.3%	3.6%

Source: U.S. Authors' calculations from ACS microdata, 2005. Sample includes respondents ages 18-64, not enrolled in school, without a college degree.

Table 2: One-Year Mobility Rates by Age and Birthplace, ACS 2006-2009

	Mexican-Born			Native-Born		
	Not in Current State Last Year	Different State Last Year	Abroad Last Year	Not in Current State Last Year	Different State Last Year	Abroad Last Year
18-24	7.2%	2.1%	5.0%	4.8%	4.2%	0.5%
25-34	4.6%	2.1%	2.6%	4.8%	4.3%	0.5%
35-44	2.9%	1.4%	1.5%	2.7%	2.4%	0.3%
45-54	2.2%	1.1%	1.1%	1.7%	1.5%	0.2%
55-64	1.9%	1.0%	0.9%	1.5%	1.4%	0.1%
Total	3.9%	1.6%	2.3%	3.0%	2.7%	0.3%

Source: U.S. Authors' calculations from ACS microdata, 2005-2009. Sample includes men ages 18-64, not enrolled in school, without a college degree.

Table 3: Robustness of Mexican Population Growth and Housing Demand

	(1)	(2)	(3)
Decrease in Log(Houses Under Construction) 2005-2009	-0.238***	-0.230***	-0.232***
	(0.0403)	(0.0433)	(0.0441)
Mexican-Born Share of State Population (2005)		-0.502	-0.558
		(0.588)	(0.645)
Constant	0.298***	0.303***	0.306***
	(0.0455)	(0.0473)	(0.0491)
Includes Arizona	YES	YES	NO
Observations	38	38	37
R-squared	0.252	0.261	0.249

Source: U.S. Authors' calculations from ACS and Census Building Permits, 2006-2009. Sample includes men ages 18-64, not enrolled in school, without a college degree.

Table 4: Decomposition of State-Level Mexican-Born Population Growth Rates 2005-2009

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Decomposition Results				
	Change in log Mexicans	Growth Rate of Mexican Population	C1 Inter-state Migration	C2 New Immigrants	C3 Return Migrants	C4 Net Aging In	Residual
Decrease in	-0.238***	-0.255***	-0.112**	-0.0769**	0.00129	0.00562	-0.0734
log Houses Under Construction	(0.0403)	(0.0458)	(0.0452)	(0.0338)	(0.0324)	(0.00641)	(0.0644)
Constant	0.298***	0.330***	0.129***	0.219***	-0.114***	-0.0183***	0.114*
	(0.0455)	(0.0533)	(0.0465)	(0.0358)	(0.0316)	(0.00651)	(0.0628)
Observations (States)	38	38	38	38	38	38	38
R-squared	0.252	0.233	0.211	0.075	0.000	0.016	0.023

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: U.S. Authors' calculations from ACS, Census Building Permits, and EMIF. Sample includes Mexican-born men ages 18-64, not enrolled in school, without a college degree.

A Calculating Ongoing Construction Activity

Our measures of ongoing construction activity come from the Census New Residential Construction surveys.[19] The Census surveys a sample of approximately 9,000 permit-issuing places on a monthly basis, with the remaining approximately 11,000 places surveyed annually. We use the monthly estimates of the total number of permits in each state. The Survey of Construction takes a sample of the newly issued housing permits and produces estimates of i) the delay between permitting and the start of construction, and ii) the time from start to completion. These estimates are calculated separately for single-family vs. multi-family dwellings in each region and each year. Table A-1 presents an example of the available timing information for single-family units in 2009 at the national level.

We combine the information in the two data sources to estimate the number of houses under construction in each state and month. We do so using the following calculations. Refer to Table A-1 for concreteness, but keep in mind that we use a different set of estimates for each region, year, and dwelling type. For a particular permit in month t, the upper portion of Table A-1 determines the probability the permitted housing was started in each month from $t-1$ to $t+4$. Given the definition, "Prior to or same month as authorization," we assume that starts for permits reported in month t are split evenly between months $t-1$ and t. The next three rows report the probability of starting in months $t+1$ to $t+3$. We allocate all remaining probability to month $t+4$.

The lower portion of Table A-1 shows the distribution of the time from start to completion, which we use to determine the probability that a house started in month t is still under construction in month $t+k$. 100% of houses started in month t are under construction in month t. The table indicates that 76% (= 100% - 24%) of houses are still under construction in $t+3$. We linearly interpolate to assign probabilities of 92% to $t+1$ and 84% to $t+2$. We similarly interpolate for the remaining months and assume that all are complete within 16 months for single-family homes and 20 months for multi-family homes. Table A-2 implements these interpolation assumptions using the data in the bottom panel of Table A-1 and displays our assumed probability that a single-family home is still under construction in each month after starting construction.

We then combine the information on permits and the construction timing information to estimate the number of houses under construction in each month as follows. Consider 100 permits issued in month $t=0$. Column (1) of Table A-3 lists the fraction of houses starting in each month from -1 to 4, based on Table A-1 under the above assumptions. Column (2) considers the 28.5 houses starting construction in month -1 and imposes the distribution of construction timing in Table A-2. Column (3) considers the 28.5 houses starting in month 0, and so on. Column (8) sums the numbers of houses under construction in each period across the six potential starting months to estimate how many of the 100 permitted houses are under construction in each period. This process is implemented for every permit in the data set, using the appropriate version of Table A-1 for the housing type, year, and region to generate an estimate of the houses under construction in each state and month.

[19] See http://www.census.gov/const/www/newresconstindex.html for data and documentation.

Table A-1: Example Data on Timing from Permit Authorization to Start and Completion

	Percent
Month Construction Starts	
Prior to or same month as authorization	57
1 month	30
2 months	6
3 months	2
4 months or more	6
Time from Start to Completion	
3 months or less	24
4 to 6 months	37
7 to 9 months	14
10 to 12 months	8
13 months or more	16

Source: U.S. Census Bureau, Manufacturing and Construction Statistics, Survey of Construction. These national, single-family, data come from 2009. Data for every year, region, and unit type are available at http://www.census.gov/const/www/lengthoftimeindex.html

Table A-2: Fraction under construction after starting at month t

t	100.0
t+1	92.0
t+2	84.0
t+3	76.0
t+4	63.7
t+5	51.3
t+6	39.0
t+7	34.3
t+8	29.7
t+9	25.0
t+10	22.3
t+11	19.7
t+12	17.0
t+13	12.8
t+14	8.5
t+15	4.3
t+16	0.0

Table A-3: Estimated Ongoing Construction Corresponding to 100 Permits Issued in Month $t = 0$

Period	(1) Start	(2)	(3)	(4)	(5)	(6)	(7)	(8) Total Under Construction
		Probability Started and Ongoing, by Start Month						
		-1	0	1	2	3	4	
-1	28.5	28.5						28.5
0	28.5	26.2	28.5					54.7
1	30.0	23.9	26.2	30.0				80.2
2	6.0	21.7	23.9	27.6	6.0			79.2
3	2.0	18.1	21.7	25.2	5.5	2.0		72.5
4	6.0	14.6	18.1	22.8	5.0	1.8	6.0	68.5
5		11.1	14.6	19.1	4.6	1.7	5.5	56.6
6		9.8	11.1	15.4	3.8	1.5	5.0	46.7
7		8.5	9.8	11.7	3.1	1.3	4.6	38.9
8		7.1	8.5	10.3	2.3	1.0	3.8	33.1
9		6.4	7.1	8.9	2.1	0.8	3.1	28.3
10		5.6	6.4	7.5	1.8	0.7	2.3	24.3
11		4.8	5.6	6.7	1.5	0.6	2.1	21.3
12		3.6	4.8	5.9	1.3	0.5	1.8	18.0
13		2.4	3.6	5.1	1.2	0.4	1.5	14.3
14		1.2	2.4	3.8	1.0	0.4	1.3	10.2
15		0.0	1.2	2.6	0.8	0.3	1.2	6.0
16			0.0	1.3	0.5	0.3	1.0	3.1
17				0.0	0.3	0.2	0.8	1.2
18					0.0	0.1	0.5	0.6
19						0.0	0.3	0.3
20							0.0	0.0

B ENOE Migration Calculations

The Encuesta Nacional de Ocupación y Empleo (ENOE) surveys a rotating panel of households in which each household is surveyed in 5 consecutive quarters. This panel aspect of the survey makes it possible to identify emigration, when a person previously in the household leaves for a destination abroad, and immigration, when a new individual arrives in the household from abroad. The survey does not ask about the source/destination country, but merely records that it was outside of Mexico.

The first step in identifying international migrants in the ENOE involves merging across quarterly data files. The survey reuses individual-level key values; when a household and its constituent individuals rotate out of the survey after the 5th interview, their keys are potentially reassigned to another household's individuals entering the sample. In order to avoid incorrect matches across quarters, one must use both the key and the interview number to ensure that observations occurring after the 5th interview for a given individual are coded as a new individual.[20] Given matched observations for the same individuals across quarters, one can identify international emigrants as individuals who were present in one quarter, absent in the next, and who went abroad based on reports from other household members. International immigrants are those who were absent in the previous quarter, present in the current quarter, and report coming from abroad.

Although identifying observations corresponding to international migrants is straightforward, the sampling weights must be adjusted to generate population estimates of international migration flows. Consider estimating the number of immigrants in a given period. Individuals that happen to receive their first interview in that period are not at risk of being observed immigrating, since we do not observe their prior status. Hence, these individuals were not sampled regarding immigration between the prior quarter and the survey quarter, and their sampling weight must be removed from the calculations. We calculate a new set of weights for immigration calculations by rescaling the survey sampling weights for those at risk of being observed immigrating such that their total for each locality equals the sum of the original weights across all observations. These new weights are used to calculate the immigration flows in each quarter. Similar calculations are calculated for emigrants. Individuals who happen to receive their fifth interview in the relevant period are not at risk of being observed emigrating, and we rescale the at risk observations to account for this fact. This is the process used by INEGI to calculate official migration estimates.

[20] Thanks to Ruth Balderas at INEGI for clarifying this coding scheme.