U.S. Border Enforcement and Mexican Immigrant Location Choice

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Abstract

We provide the first evidence on the causal effect of border enforcement on the full spatial distribution of Mexican immigrants to the United States. We address the endogeneity of border enforcement with an instrumental variables strategy based on administrative delays in budgetary allocations for border security. We find that 1,000 additional border patrol officers assigned to prevent unauthorized migrants from entering a state decreases that state's share of Mexican immigrants by 21.9%. Our estimates imply that if border enforcement had not changed from 1994-2011, the shares of Mexican immigrants locating in California and Texas would each be 8 percentage points greater, with all other states' shares lower or unchanged.

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1 Introduction

Since the early 1990s, Mexican immigrants to the United States have increasingly chosen non-traditional locations, i.e., locations other than those, such as California and Texas, with historically high Mexican density (Card and Lewis 2007). The reasons for this diffusion of the Mexican migrant population are complex and varied, but not yet well quantified. A hypothesis advanced by Massey, Durand and Malone (2002) is that increased border enforcement in traditional migrant crossing areas has led migrants to choose alternative border crossing routes, and in turn to choose non-traditional destinations. According to this view, an unintended consequence of strengthened border enforcement is a change in traditional settlement patterns among Mexican immigrants. In fact, between 1980 and 2010, the share of Mexican immigrants in California and Texas—the two states where border enforcement increases were most concentrated—fell from 80 percent to 58 percent. Of course, enforcement is not the only potential driver of location choice. Economic opportunities, interior enforcement policies, and social factors are also hypothesized to play a role.

To our knowledge, however, no causal analysis of the effect of border enforcement on the diffusion of Mexican migrants has been conducted. Indeed, the hypothesis is difficult to evaluate because of data limitations (crossing locations of Mexican immigrants to the U.S. are not available) and the endogeneity of border enforcement (the level of enforcement is likely responsive to illegal crossing behavior). This paper quantifies the causal effect of border enforcement on immigrant location choice. We overcome the measurement problem by constructing an index that combines data on enforcement intensity across sectors of the southern border and over time with the historical destination choice of immigrants, drawing on methods developed in the literature (Pugatch and Yang 2011, Borger, Hanson and Roberts 2012). We address the endogeneity of the enforcement index to contemporaneous migration flows by relying on administrative delay in enforcement budget allocations. Because of this institutional structure, lagged values of our enforcement index provide identifying variation for the effect of enforcement on immigrant location choice.

We find that increases in border enforcement decreased the share of Mexican immigrants across U.S. destinations. Specifically, we find that every 1,000 additional border patrol officers assigned to prevent unauthorized migrants from entering a state decreases that state's national share of Mexican immigrants by 21.9%. These results are stable across subgroups, with slightly stronger effects for likely or estimated unauthorized population shares, and null effects for immigrants less likely to be border crossers. Our estimates imply that if border enforcement had not changed from 1994-2011, the shares of Mexican immigrants locating in California and Texas would each be 8 percentage points greater, with all other states' shares lower or unchanged.

This study is motivated by the change in immigrant settlement patterns depicted in Figure A1 and the coincident increase in border enforcement displayed in Figure 1. The concentration of Mexican immigrants in a handful of traditional destinations began to decline in the 1990s, with states in the Southeast, Great Plains, and Midwest experiencing the fastest growth in Mexican immigration over the last two decades.[1] At the same time, control of the southern U.S. border increased substantially. As shown in Figure 1, border enforcement increased in intensity concurrently with the falling share of Mexican immigrants in traditional destinations, prompting Massey et al. (2002) to hypothesize a causal relationship between them. "The massive buildup of enforcement resources in southern California, El Paso, and around other ports of entry," they wrote, "diverted the migratory flows away from traditional points of destination" (Massey et al. 2002, p. 127).

Gaining a better understanding of the effect of border enforcement on Mexican immigrant settlement patterns should be of major interest to policymakers. Immigrants play an important role in equilibrating local labor markets (Borjas 2001, Cadena and Kovak 2013), and their large share of the workforce has prompted renewed calls for national immigration reform in recent years. State legislatures have entered the immigration policymaking arena in the absence of federal reform, and evidence suggests that state policies themselves are driven by rapid inflows of new immigrant populations (Boushey and Luedtke 2011, Hopkins 2010). Because Mexicans constitute the largest immigrant group in the United States and have a high propensity to enter the United States without authorization, their location decisions hold particular importance. Moreover, attempts to thwart unauthorized immigration come at considerable expense, with the U.S. Customs and Border Patrol budget for 2012 at nearly $12 billion (Department of Homeland Security 2013). The role that

[1] These patterns are also amply documented in Card and Lewis (2007) and Singer (2004).

border enforcement plays in Mexican immigrant locations is thus important at both the national and local levels.

Before proceeding with exposition of our methodological approach, we briefly place this paper in the context of two broad literatures—one on impacts of border enforcement and the other related to immigrant location choice. The influence of border enforcement on aggregate migration flows is the subject of considerable previous research (see among others Kossoudji 1992, Hanson and Spilimbergo 1999, Cornelius 2001, Reyes, Johnson and Van Swearingen 2002, Orrenius 2004, Gathmann 2008, Angelucci 2012). Increases in border enforcement alter migrant crossing locations (Cornelius 2001, Massey et al. 2002, Sorensen and Carrion-Flores 2007) and increase migration costs (Orrenius 2004, Roberts, Hanson, Cornwell and Borger 2010). While apprehensions at the border are apparently correlated with increases in enforcement (Orrenius 2004), it is unclear that illegal immigration is correlated with enforcement, in part because it is difficult to measure attempted crossing. However, research has indicated that one unintended effect of increased border enforcement may be to increase the length of stays in the U.S. by discouraging immigrants currently located in the U.S. from engaging in return and circular migration (Reyes et al. 2002).

While these papers, and many others, have studied migration decisions to and within the U.S, none (to our knowledge) has evaluated the causal role of border enforcement on the full spatial distribution of immigrants. The closest antecedents to this study are Pena (2009) and Lessem (2012), both of which develop models in which border enforcement may influence Mexican immigrant residential locations, rather than just aggregate flows.[2] However, Pena's (2009) analysis is limited to agricultural workers in four U.S. states, while Lessem's (2012) sample is limited to returned migrants from rural Mexican communities that are not nationally representative. Crucially, neither study accounts for the endogenous response of border policy to migration flows. In contrast, our paper uses large-scale, nationally representative data on all Mexican immigrants to the U.S., and isolates plausibly exogenous variation in border enforcement.

Why might border enforcement influence the location of immigrants within the U.S. in addition to altering the magnitude of overall migration flows? As arguably the most mobile demographic

[2]Lessem (2012) does not explicitly address the role of border enforcement in immigrant location decisions within the U.S., but the structural model she develops could be used for this purpose.

group in the U.S., immigrants consider several factors when choosing where to reside, including the presence of others from their home communities (Bartel 1989, Munshi 2003), local employment opportunities (Cadena 2013a, Cadena 2013b), state immigration policies (Bohn, Lofstrom and Raphael 2011), and migration costs (Orrenius 1999, Chiquiar and Hanson 2005). The link between enforcement and location choice is most closely related to the latter. For illustration, suppose that there is a unique mapping between border crossing locations and U.S. destinations, so that crossing successfully in a particular location constrains migrants to locate in the associated U.S. destination. Then changes in enforcement at particular crossing points will alter the relative costs associated with U.S. destinations, leading marginal migrants to change both their border crossing and destination.

Of course, in reality migrants may reach any U.S. destination from any border crossing. Nonetheless, crossing locations vary in enforcement intensity, direct travel costs to reach a destination, foregone earnings during travel, and the availability of pre-existing networks to assist with arrival and employment at the destination. If enforcement intensity rises at the crossing location closest to a migrant's intended destination, alternate crossing locations become relatively more attractive. If migration costs to the originally intended destination become sufficiently large, the migrant's preference may change to an alternate destination. Alternately, a migrant intended for the original destination may remain in Mexico, with a migrant willing to reside in a different destination taking his place, consistent with previous studies that have documented changes in migrant composition in response to border enforcement (Orrenius and Zavodny 2005, Ibarrraran and Lubotsky 2007, Angelucci 2012, Lozano and Lopez 2013).

The propensity for return migration may also change differentially across destinations due to border enforcement, as circular migrants who anticipate more difficult round trips between the U.S. and Mexico choose instead to remain in the U.S. (Reyes et al. 2002). The effects on prospective immigrants and return migrants work in opposite directions, making the role of border enforcement in immigrant location choice theoretically ambiguous. This multiplicity of channels underscores the need for a theoretical framework and rigorous empirical analysis. We present a migration choice model that formalizes this argument and connects it to our empirical analysis in the following section. Our focus is on consistent estimation of the total effect of border enforcement on the distribution of the immigrant population across destinations. We leave the question of the spatial dimension of selection in response to border enforcement to future work.

2 Model and Methodology

Suppose, as in Sjaastad (1962) and Borjas (1987), that a migrant chooses to reside in the location that offers the highest utility net of migration costs. We adapt their models to a random utility framework, following closely the exposition of Scanlon, Chernew, McLaughlin and Solon (2002) and Cadena (2013a) while placing emphasis on the role of border enforcement in the migrant's location decision. Conditional on migrating,[3] the value function for immigrant i locating in U.S. destination k in period t is:

$$V_{ikt} = \theta e_{kt} + X_{kt}\beta + \epsilon_{ikt} \tag{1}$$

where e is the enforcement intensity associated with locating at the destination in that period, X is a vector of controls capturing the economic opportunities and other observable characteristics of a destination relevant to location choice, and ϵ is the error term. (The controls X do not carry an i subscript because we will conduct the analysis using destination-level aggregates.) The immigrant chooses destination k if $V_{ikt} \geq V_{ijt}$ for all $j \neq k$. Enforcement affects immigrant location choice by altering the costs of residing in a destination, as described in the introduction. We formalize this argument and provide more detail in Appendix A. In addition to altering costs for unauthorized immigrants, enforcement can also affect the destination choices of authorized immigrants if migrants from the same source country prefer to live in geographic proximity (Bartel 1989, Munshi 2003).

Although straightforward, several challenges arise immediately in this formulation. First, it is not obvious how to measure the level of enforcement e faced by potential migrants to a destination k, particularly for destinations in the interior. Second, even if enforcement can be measured for a

[3] The model could easily be extended to include the migration decision by specifying the choice to remain in the source country as the outside option. However, this choice will be unobserved when using U.S. data, so we focus on the case where a migrant is choosing among locations in the destination country.

destination, such enforcement is likely endogenous to immigrant location decisions. For instance, if the government responds to a rapid influx on unauthorized immigrants at a destination by increasing enforcement, then enforcement intensity e will be correlated with the error term, preventing us from consistently estimating θ. We address the first of these challenges before returning to a discussion of how we use (1) as the basis of our empirical specification. We close the section with a description of an instrumental variables strategy that addresses the second concern.

Consider the problem of measuring enforcement faced by a prospective migrant to destination k. No large-scale, nationally representative dataset exists that provides information on the current U.S. locations of Mexican immigrants and their point of entry. Even if such a dataset were available, it is not clear that enforcement at the migrant's point of entry is the proper measure of enforcement that he or she faced. Migrants have a choice among crossing locations, and could be influenced by enforcement at alternative locations as well. To address this issue, we build on methods developed by Pugatch and Yang (2011) and Borger et al. (2012) to construct a new measure of border enforcement intensity. We combine data on the historical border crossing and destination patterns of Mexican immigrants to the U.S. with current measures of border policy to assign a border enforcement index to U.S. locations.

The U.S. Customs and Border Protection (CBP) splits the southern border with Mexico into 9 sectors, with each sector responsible for preventing unauthorized crossings of people and goods in its territory. CBP adjusts enforcement intensity across sectors to meet perceived security needs, leading to variation in enforcement across sectors and over time. This variation will not affect the desirability of locating in all U.S. destinations equally. Suppose we observed, for example, that prior to our sample period all migrants to Missouri came from one of two sectors, the Rio Grande Valley (eastern Texas) and Laredo sectors. Suppose further that 10% of migrants crossing in the Rio Grande Valley sector located in Missouri, while Missouri's share of the Laredo sector was 5%. Then a natural measure of border enforcement intensity for Missouri would be to assign 10% of Rio Grande Valley and 5% of Laredo's enforcement to Missouri, with all other sectors contributing zero. This sector-weighted average of enforcement intensity leads to the following U.S. location-specific enforcement index:

$$e_{kt} = \sum_{s=1}^{9} \omega_{ks} e_{st} \tag{2}$$

where ω_{ks} is the share of immigrants who cross at border sector s who locate in destination k, and e_{st} is enforcement intensity at sector s at time t. We use the number of border patrol agents (in thousands) as our enforcement measure, so that the index e_{kt} may be interpreted as border patrol agents assigned to prevent unauthorized immigration to location k at time t. Importantly, the weights used to construct the index are predetermined with respect to enforcement levels, so that enforcement patterns do not cause the observed immigrant destination choices. Identifying variation for the effect of border enforcement on immigrant location choice therefore comes from three sources: spatial variation in border enforcement across sectors; time series variation in border enforcement within sectors; and cross-sectional variation in the propensity of immigrants to follow particular routes from border crossings to U.S. destinations.

Return now to (1), the migrant's value function for locating in a particular destination. Let $\epsilon_{ikt} = \eta_{kt} + u_{ikt}$, so that the error may be decomposed into a destination- and time-specific component η and an idiosyncratic component u that we assume to be i.i.d. Type I Extreme Value. Then the share of immigrants choosing destination k at time t, denoted π_{kt}, may be expressed as:

$$\pi_{kt} = \frac{\exp\left(\theta e_{kt} + X_{kt}\beta + \eta_{kt}\right)}{\sum_j \exp\left(\theta e_{jt} + X_{jt}\beta + \eta_{jt}\right)} \tag{3}$$

Note that this is just the familiar multinomial logit formula with an unobserved destination- and time-specific component η included. Letting the sample share of immigrants S differ from the population share π by a multiplicative error ν (assumed uncorrelated with π) and taking logs yields:

$$\log(S_{kt}) = \theta e_{kt} + X_{kt}\beta + \eta_{kt} - \log(D_t) + \nu_{kt} \tag{4}$$

where $D_t = \sum_j \exp\left(\theta e_{jt} + X_{jt}\beta + \eta_{jt}\right)$, with the subscript acknowledging that this term is identical across all destinations at time t. Assume that η_{kt} may be further decomposed into time-invariant and time-varying components as $\eta_{kt} = \zeta_k + \phi_{kt}$. Taking first differences of S yields:

$$\Delta \log(S_{kt}) = \theta \Delta e_{kt} + \Delta X_{kt} \beta - \Delta \log(D_t) + \Delta \phi_{kt} + \Delta \nu_{kt} \tag{5}$$

An empirical specification based on this first-differenced equation offers several benefits relative to multinomial choice estimation. First, it allows for linear estimation with easily interpretable coefficients; the coefficient of interest θ is the *ceteris paribus* effect of a one-unit change in enforcement intensity on the percent change in the share of immigrants choosing a destination. Second, the specification allows for straightforward incorporation of factors common to all destinations within a time period through the inclusion of period fixed effects, which estimate $\Delta \log(D_t)$. Third, the specification also controls for permanent attributes of a location, such as climate, amenities, and the role of durable immigrant networks through the term ζ, which differences out of the equation.

A remaining concern, however, is correlation between the destination- and time-specific innovation $\Delta\phi_{kt}$ and changes in enforcement intensity. If border officials respond to shocks that increase the share of immigrants choosing a location by increasing enforcement intensity, then our estimates of θ will be upward biased. We address this issue by instrumenting for Δe_{kt} with enforcement lagged two periods. As Borger et al. (2012) note, administrative delays in CBP budget approval lead to 2-year lags between initial requests and realized outlays. To set its budget, CBP implements a process known as the "Operational Requirements-Based Budget Program" (ORBBP), in which border patrol sectors request resources to enforce immigration and customs laws based on an assessment of current needs.[4] This assessment is based on all available information at the time of the request, including data maintained by CBP on current enforcement levels and apprehensions of undocumented migrants. ORBBP occurs annually, but the lag between initial requests and resource allocation exceeds one year.

Although budget allocations determined through ORBBP follow a fairly rigid process, the Department of Homeland Security may also address unexpected border enforcement needs through a "surge" of agents or other resources to particular border sectors. Because these additional resources may be contemporaneously correlated with immigrant flows, we are concerned about inconsistent

[4]We base this section on information learned in discussions with former Department of Homeland Security officials.

estimates obtained through OLS. However, initial budget requests are based on an assessment of enforcement needs before such unexpected shocks are realized. If these initial requests are uncorrelated with the change in unobserved factors realized two years later, then the identifying assumption that $e_{k,t-2}$ is uncorrelated with $\Delta\phi_{kt}$ will hold. This approach also mirrors one that has been used in the labor supply literature, as in Ziliak (1997).

The choice of control variables to include in X is also important to isolate the role of border enforcement from other factors influencing immigrant location choice. We include a host of destination-specific controls for economic conditions most relevant to prospective immigrants: unemployment rates, hourly wages, GDP per capita, manufacturing output, agricultural output, construction output, and new housing permits. The economic sectors are chosen because of the high concentration of Mexican immigrants employed in these industries. Moreover, including new housing permits separately from current output helps to capture the role of economic expectations in immigrant location decisions.

We also include measures of state-level legislation aimed at immigrants, which have proliferated since 2004. Arguably in response to increasing unauthorized immigrant populations and federal inaction on comprehensive policy reform, state legislatures have enacted hundreds of laws between 2004 and the present. Most immigrant-related state laws are intended to deter employment or restrict services to unauthorized immigrants, and a few have been shown to be effective deterrents, at least to immigrant location choice, if not to the law's stated intent (Bohn et al. 2011). Because policymakers see both border enforcement and state-level legislation as important deterrents to unauthorized immigration, including data on this legislation is critical to isolate the role of border enforcement in immigrant location decisions.

3 Data

To conduct the analysis, we need data on population shares of Mexican immigrants (and other subpopulations) by U.S. destination; enforcement intensity by border patrol sector; choices of border crossings and destinations by migrants to construct the weights used in the enforcement index; and destination-specific control variables. We describe the sources of these data below, with additional details in Appendix B.

The main source for population data is the U.S. Current Population Survey (CPS), 1994-2011. We classify immigrants by place of birth, while natives are those born in the United States. We also combine the 2000 U.S. Census and American Community Survey (ACS) 2001-2011 into an alternate dataset to check the consistency of the CPS results. We work with state-level aggregates derived from these sources.[5] Relative to the Census/ACS, the CPS provides a longer time series, including a set of years (1994-1999) with notable fluctuations in border enforcement. These features lead us to prefer the CPS despite the larger sample sizes available in the Census/ACS.

Figure A2 compares the numbers of Mexican immigrants between the Census, ACS, and CPS. The CPS has notably lower counts of Mexican immigrants than the other sources over most of the period, with a considerable dip in 2008 likely due to a change in the Census Bureau's revision to population controls in that year. In particular, the Bureau made sizeable changes to the methodology for estimating changes in population due to international migration—disproportionately affecting estimates of foreign-born persons (Passel and Cohn 2010). Although these differences are problematic for estimates of Mexican immigrant population levels, they are less likely to bias results for the national share of immigrants at a particular location, our outcome of interest. The lower immigrant counts in the CPS will bias our current results compared to the Census/ACS only if the two sources differ because the CPS is differentially correlated with border enforcement. We have no reason to believe that this is the case, and will present results using both data sources to check for consistent results. Additionally, excluding data for 2008 from the CPS sample does not alter our findings (results not shown but available upon request).

Data on border enforcement are from the U.S. Department of Homeland Security (DHS). DHS reports the number of border patrol agents employed through the Customs and Border Protection agency annually in each sector of the southern U.S. border. We would prefer to measure border enforcement using linewatch hours, a more direct measure of enforcement used in several related

[5] We prefer the U.S. state to other levels of geographic aggregation, such as the metropolitan statistical area (MSA), because there will be fewer state-year cells with zero immigrants than alternative geographic units. Passel and Cohn (2010) cautions against using the CPS and ACS for MSA-level analysis when focusing on unauthorized immigrants. States also leave greater scope to control for changing economic conditions because of greater data availability.

studies (Hanson and Spilimbergo 1999, Orrenius 1999, Hanson, Robertson and Spilimbergo 2002, Orrenius 2004, Gathmann 2008, Angelucci 2012, Lessem 2012), However, DHS stopped reporting linewatch hours in mid-2004, and denied our repeated Freedom of Information Act requests to obtain related information that could be used to extend the series. Figure A3 compares agent counts and linewatch hours for the years in which there is overlap. Although the graph shows slightly different trends in these series, reflecting higher average annual linewatch hours per agent in more recent years, the series nonetheless track each other closely. This high correlation comports with DHS reports indicating the primary activity of border agents is toward linewatch (Department of Homeland Security 2002, Simanski and Sapp 2013), and makes us confident that an enforcement index based on border patrol agents appropriately captures enforcement intensity.

Data on border crossing patterns used to construct weighted enforcement are from the Northern Border Migration Survey (EMIF), a survey of migrants along the U.S.-Mexico border conducted by the Mexican government annually since 1993. We use the survey to construct, for each border patrol sector, the probability of entering each U.S. state. To do so, we assign each survey respondent to a border sector and a U.S. state according to the crossing point and place of main U.S. residence on his or her last trip to the U.S. We drop any respondents whose last trip was more than 10 years prior to the interview date in order to mitigate recall bias. The shares of migrants whose last trip to the U.S. occurred between 1983-1993 at border crossing s whose last U.S. residence was in state k are used to construct the crossing probabilities ω that appear in (2).[6]

Control variables used in the analysis come from various sources, with details in Appendix B. Data on state-level economic conditions are from U.S. government sources. Data on state-level legislation aimed at immigrants was compiled from quarterly reports on all state laws related to immigrants from the National Conference of State Legislatures (NCSL). Our controls include passage of any deterrent state laws related to employment or enforcement, as of the date a law was signed by the state governor.

[6] Given the availability of data on an immigrant's crossing location and U.S. destination in the EMIF, one might reasonably ask why we do not use the EMIF to construct our outcome measures in addition to the enforcement weights. We prefer the CPS (and Census/ACS) for the outcome data because the much larger sample sizes (more than 1.5 million annually in the CPS compared to around 15,000 in the EMIF) will lead to more accurate measures of population shares. A similar argument applies to the Mexican Migration Project (MMP), which covers only selected Mexican communities, in addition to its relatively smaller sample.

The diffusion of Mexican immigrants to new U.S. destinations, the phenomenon that motivates our inquiry, is documented in Table A1. The concentration of Mexican immigrants in traditional destinations—as measured by the shares in the top 5 states, top 10 states, and in California and Texas—was nearly unchanged between 1980 and 1990. These shares dropped considerably between 1990 and 2000, however, with the share in the top 5 states falling from 90% to 76%. A further though less precipitous drop occurred between 2000 and 2010. Figure A1 gives a sense of which areas absorbed these new migrants, with states in the Southeast, Great Plains, and Midwest experiencing the fastest growth in Mexican immigration. As Figure 1 shows, over most of this period, declining concentration of immigrants in traditional destinations was correlated with increased investment in border enforcement. This correlation, as noted above, prompts the hypothesis that directed increases in enforcement diverted Mexican immigrant flows away from traditional destinations.

Figure 2 presents data broadly consistent with this story. Panel (a) shows border enforcement in selected sectors (only a subset are shown for clarity), including a substantial increase in enforcement in the San Diego border patrol sector in the mid-1990s that leveled off later in the decade. The Rio Grande Valley (eastern Texas) sector also experienced an increase throughout the period, ending on a similar level as San Diego. The sharpest increase was in the Tucson sector, however. Panel (b) shows the share of unauthorized Mexican immigrants crossing at each sector. After remaining flat for most of the period 1980-1995, San Diego began to lose share beginning the mid-1990s, while Rio Grande Valley ended the period at a similar level as its historical average. Tucson's share increased considerably over the same period as San Diego's decline. Although the evidence is circumstantial, the figures do show a clear shift in enforcement and crossing activity from the traditional gateways on the western and eastern edges of the border towards the center.

This paper seeks to determine if these patterns also led to changes in the residential locations of Mexican immigrants. If changes in border enforcement during our sample period led immigrants to change their crossing patterns but not their destinations, then we would expect to see a weaker link between crossing location and destinations over time. In fact, we observe the opposite. Across all border sector-U.S. state pairs, the correlation coefficient between the state's share of migrants from a crossing location (the weights ω in (2)) and the distance between them is -.29 during 1983-

1993, the period on which our weights are based. In the period 1994-2011, this correlation rose in magnitude to -.31. If migrants were changing their crossing locations in response to enforcement but not their destinations conditional on crossing, then border enforcement led to changes in immigrant locations. Although this simple correlation is not a substitute for a formal analysis, it does suggest that our premise matches basic patterns in the data.

The index we use to measure the border enforcement intensity faced by potential migrants to each U.S. state consists of two components: 1) enforcement intensity by border patrol sector and 2) weights representing the propensity of immigrants crossing at a sector to locate in a particular U.S. state. We have already presented data on (1). Figure 3 shows data on (2), in the form of maps showing Mexican immigrant destinations for selected border crossings. Panel (a) shows the locations chosen from 1983-1993 by migrants crossing in the Rio Grande Valley sector (eastern Texas, with representative city Brownsville circled). Unsurprisingly, the modal destination is Texas, with southeastern states also popular. Panels (b) and (c) show the analogous maps for the El Paso (western Texas and New Mexico) and San Diego sectors. As in panel (a), immigrants crossing in these sectors choose destinations that are geographically proximate. This variation in U.S. destinations, conditional on border crossing location, allows us to transform the variation in enforcement across border patrol sectors into state-specific measures of border enforcement intensity.

Figure 4 shows the resulting enforcement index for a representative state, Arizona. The solid line shows the enforcement index, which may be interpreted as the number of border patrol agents assigned to prevent unauthorized immigrants from entering Arizona. Enforcement in the Rio Grande Valley, San Diego, and Tucson sectors are also plotted. As shown in the graph, the correlation between Arizona's enforcement index and enforcement intensity in the Tucson sector is much higher than that for the other sectors. This is the result we would expect if enforcement in the Tucson sector is more relevant for potential migrants to Arizona than enforcement in the other sectors.

We close this section by presenting summary statistics in Table 1 on the panel of U.S. states used in the analysis. The mean Mexican immigrant share is (approximately) 2%, which is a mechanical result of the sample size of 50 states and the District of Columbia; we omit reporting shares of other population groups for this reason. The next several rows show average levels of various subpopulations (sample sizes vary because of state-year cells with zero shares, in accordance with the sample used in the regression analysis). The average state has 184,480 Mexican immigrants, compared to 4.1 million natives. Levels of other subpopulations are mostly as expected, although our estimate of the unauthorized Mexican immigrant population implies that 34% of Mexican immigrants are unauthorized, which is low compared to Hanson's (2006, p. 870) estimate of 56%. The average level of the enforcement index is 0.21, indicating 210 border patrol agents assigned to prevent unauthorized immigration to an average state annually. An alternate enforcement index that replaces border patrol agents with apprehensions of unauthorized migrants in (2) shows 21,200 apprehensions intended for an average state per year. The final rows of the table show border-sector specific enforcement, measured by number of agents. There is considerable variation across sectors, with San Diego, Tucson and El Paso assigned the largest numbers of agents.

4 Results

4.1 Main results

In estimating (3), we include in the vector of controls (X) unemployment rates, hourly wages, (log) GDP per capita, (log) manufacturing output, (log) agricultural output, (log) construction output, (log) new housing permits, and an indicator for passage of any punitive legislation aimed at immigrants, all in first differences. Unemployment rates and hourly wages are specific to the subpopulation whose population shares are under analysis. We also include a constant and year fixed effects. We cluster standard errors by state.

Before discussing results of estimating (3), we present in Table 2 the results of the first stage, in which we regress the first difference of the enforcement index on its second lag, with the same set of controls as described above. In column (1), the coefficient on the instrument is .073, indicating that every 1,000 border patrol agents assigned to a state two years ago corresponds to an increase of 73 agents in the past year.[7] The coefficient is precisely estimated, with an F-statistic of 74.2. In column (2) we restrict attention to the years 2000-2011, corresponding to the period of the

[7]For ease of exposition, the enforcement index based on border patrol agents is specified in absolute numbers of agents in Table 2, but in thousands in all other results.

Census/ACS sample. The coefficient falls slightly to .068, with an F-statistic of 59.

An alternate instrument that replaces border patrol agents with apprehensions of unauthorized migrants (in thousands) also produces strong first stage results. Column (3) shows the coefficient for the enforcement index based on apprehensions is 0.57, representing the additional agents assigned to a state for every 1,000 apprehensions two years ago. The coefficient using the Census/ACS sample in column (4) is very similar, and both have F-statistics greater than 25. We prefer the agent-based instrument for the second stage analysis, however, because it provides a stronger first stage.

Table 3 presents the main results from estimation of (3), with OLS results in Panel A and IV results in Panel B.[8] Column (1) uses a state's share of all Mexican immigrants located in the U.S. as the dependent variable. The OLS coefficient of -.176 indicates that an increase of 1,000 border patrol agents assigned to a state is correlated with a 17.6% decrease in a state's share of Mexican immigrants. In an average state with a 2% share, this would reduce the share to 1.65%. The corresponding IV coefficient in Panel B is -.219, meaning that a 1-unit increase in the enforcement index leads to a 21.9% decrease in a state's Mexican immigrant share. The larger magnitude of the IV coefficient is as we would expect if OLS coefficients are upwardly biased because enforcement intensity responds to immigrant inflows. Both coefficients are statistically significant at 1%.[9]

In subsequent columns of Table 3 we focus on subpopulations of Mexican immigrants to look for differential responses to border enforcement. In column (2) we restrict attention to males aged 16-50 with a high school education or less, a group with a high propensity to migrate. The IV coefficient is nearly 1.5 times both the corresponding OLS coefficient and that for all Mexican immigrants in column (1). The larger magnitude is as expected if this group is more likely to be affected by border enforcement. In column (3) we investigate the response of unauthorized

[8] First-stage F-statistics reported in Table 3 do not correspond exactly to those in Table 2, column (1) because estimation samples vary due to state-years with a zero population share, for which the log population share is undefined. Cells with a zero share also explain the uneven sample sizes across columns. We check the sensitivity of results to exclusion of these observations in Table A3.

[9] To give a further sense of the magnitudes of our estimates, the average change in the enforcement index is 0.017, representing an annual increase of 17 border patrol agents assigned to a state. Multiplying this figure by our IV estimate of -.219 results in a predicted annual decline of 0.37% in an average state's Mexican immigrant share. In the average state with a 2% Mexican immigrant share, this will result in a decline to 1.99% in one year, or a decline to 1.88% when compounded over the 17 years of our sample.

immigrants. U.S. government surveys do not ask about immigrants' legal status. Instead, we use state-level estimates of unauthorized immigrants from Warren and Warren (2013), multiplied by the proportion of immigrants who are Mexican (according to the state-year cell of the CPS panel) to obtain an estimate of a state's share of unauthorized Mexican immigrants.[10] The IV coefficient is -.324, significant at 1% and considerably larger than the coefficient for all Mexican immigrants, indicating a greater responsiveness of unauthorized Mexican immigrants to border enforcement, as we would expect.

Despite the lack of information about immigrant legal status in the data, data on U.S. citizenship can be used to identify a subgroup of immigrants with certain legal status. These immigrants are not at risk of deportation and therefore should not respond to border enforcement in the same manner as non-citizens. Splitting the sample of those born in Mexico into naturalized citizens and non-citizens in columns (4)-(5), we find that naturalized citizens are not responsive to border enforcement when deciding where to reside in the U.S., but non-citizens are. The non-citizen response is of similar magnitude as the unauthorized immigrant group examined in column (3).

Mexican immigration to the U.S. is characterized by high rates of circular migration, with migrants cycling back and forth between countries with some regularity (Rendon and Cuecuecha 2010). For migrants currently at a U.S. destination, greater enforcement increases the cost of return migration to Mexico by making it more difficult to engage in circular migration. This increases the incentives for migrants to remain at their U.S. destination when border enforcement tightens (Kossoudji 2002, Angelucci 2012). Although U.S. government surveys do not ask directly about circular migration, they do ask for a respondent's migration status one year ago. Mexican immigrants who report being abroad last year were presumably residing in Mexico, and are likely re-entrants or newly arrived migrants to the U.S., compared to those who report residing in the U.S. the previous year. We split Mexican immigrants into groups by their migration status one year ago in columns (6)-(7). In column (6), the IV coefficient for those residing abroad one year ago is nearly zero, while the coefficients for those not abroad one year ago are similar to those for the full sample. The results are consistent with border enforcement leading to postponement of

[10] Appendix B provides more detail on the methodology used by Warren and Warren (2013). These data end in 2010, leading to fewer observations than the main sample.

return migration to Mexico, rather than deterring re-entry or new migration to the U.S.

If migrants are responding to local shocks other than border enforcement, then they may switch locations within the U.S. rather than change their entry or exit decision. While our specification controls for many shocks at the state level, the data allow us to further test these responses by classifying Mexican immigrants as internal migrants if they resided in a different U.S. state one year ago, and a non-internal migrant otherwise. We expect border enforcement to exert a greater influence on non-internal migrants. The IV coefficient for non-internal migrants in column (9) is almost identical to that for the full sample in column (1). In column (8), however, the IV coefficient for internal migrants is positive but not statistically significant. These findings show that the effect of border enforcement on location choice is driven by movements across the border, not between U.S. states. This differential response helps alleviate concerns that the enforcement index is correlated with a more general, but unobserved, adverse environment for all Mexican immigrants at a location.

In Table 4 we repeat the specification of (3) using additional population groups. In these regressions, we replace controls for the Mexican immigrant unemployment rate and hourly wage with those for the relevant subpopulation, but all other covariates are unchanged. In columns (1)-(2), we analyze shares of all non-Mexican immigrants and non-Mexican unauthorized immigrants, respectively, where the latter are constructed by multiplying the Warren and Warren (2013) estimates by the state's proportion of immigrants who are non-Mexican. In both cases, the OLS and IV coefficients are statistically indistinguishable from zero, in contrast to our earlier findings for Mexican immigrants. The results are sensible because unauthorized immigrants from countries other than Mexico are probably more likely to arrive by air, sea, or through the northern border.

Column (3) shows the response of natives to border enforcement. Although fear of deportation should not lead natives to respond to border enforcement, they might nonetheless respond indirectly through the effect of border enforcement on the location decisions of other groups. The results show that this is the case, with the IV coefficient positive and significant. This result is consistent with natives engaging in wage arbitrage as immigrants relocate from high to low enforcement intensity states. The response is relatively mild, however: the IV coefficient of .037 implies that an increase of 1,000 border patrol agents assigned to a state increases the native population share by 3.7%, or from 2% to 2.07% in the average state.

In column (4) we examine the response of Puerto Ricans, who provide a useful falsification test for our main results because of their linguistic and cultural similarities with Mexicans and their U.S. citizenship. We find no statistically significant movements of Puerto Ricans in response to border enforcement, as might be expected. Column (5) shows the response of Central Americans, with the IV coefficient on the enforcement index of -.201 significant at 5%. This is an interesting result, suggesting that Central Americans respond to border enforcement in similar fashion as Mexicans, consistent with anecdotal evidence of relatively large flows of unauthorized Central Americans into the U.S. through Mexico and the southern U.S. border.

4.2 Robustness checks

In Section 3, we discussed the reasons we preferred the longer panel based on the CPS relative to the shorter Census/ACS panel. However, the Census/ACS panel provides larger sample sizes than CPS, and thus is a better source for the years over which the panels overlap. Table A2 shows results analogous to Table 3 using the Census/ACS panel, which covers the years 2000-2011. The results are quite similar to those from the CPS panel. In particular, all negative and statistically significant IV coefficients on the enforcement index from Table 3 are also negative and statistically significant when using Census/ACS data. The negative coefficient on naturalized citizens is now significant at the 5% level in column (4), suggesting that border enforcement influences location choices for Mexican immigrants beyond concerns about legal status. This effect would be consistent with immigrant preferences to live with others from their home country (Bartel 1989, Munshi 2003).

In all results presented to this point, state-year observations with a zero population share were omitted from the analysis, because the log population share is undefined for these cells. We check whether including these observations leads to different results by adding one person to all state-year subpopulations and recalculating the population shares, so that the log share is defined for all cells. The results, presented in Table A3, are similar to Table 3. Although some IV coefficients that are statistically significant in Table 3 lose significance when including all state-year cells, the signs and magnitudes are mutually consistent.[11]

4.3 Discussion: how much does border enforcement matter for location choice?

Given the robustness of our results, it would be instructive to determine the extent to which U.S. border enforcement accounted for the spatial diffusion of Mexican immigrants during the sample period. To quantify the effect of border enforcement, we compare actual state shares of the Mexican immigrant population to those implied by our estimates under a counterfactual of no change in enforcement. To calculate these counterfactual population shares, we subtract our baseline estimate of the border enforcement effect (the IV coefficient reported in Table 3, column [1], multiplied by observed changes in border enforcement during the sample period) from actual changes in population shares. Details of the calculation appear in Appendix C.

Table 5 presents results of this exercise. Columns (1)-(2) show each state's observed share of the Mexican immigrant population at the beginning and end of the sample period. Column (3) shows the end-period share if border enforcement had not changed over the same period. Taking the first state in the list, Alabama, as an example, we observe that between 1994 and 2011 its share of the Mexican immigrant population rose more than tenfold, from 0.05% to 0.51%. This change is indicative of the diffusion of Mexican immigrants to southeastern states. In column (3), we see that our estimates imply that if border enforcement had not changed since 1994, Alabama's share would be only 0.26%. The corresponding 0.25 percentage point discrepancy reported in column (4) indicates that border enforcement played an important role in the increased presence of Mexican immigrants in Alabama during the sample period.

Similar insights appear throughout the table. Of particular note are our estimates for the southern border states. We find that Mexican immigrant shares in California and Texas would be considerably higher if border enforcement had remained static, by more than 8 percentage points

[11] Because our model stems from a multinomial logit formulation, it will be misspecified if the independence of irrelevant alternatives (IIA) is violated, for instance if nearby states are closer substitutes for a given destination than states farther away. To allow for this possibility, we run specifications with enforcement in nearby states as an additional control variable. In one version of this specification, we include the a population-weighted average enforcement index of neighboring states; in another, we include the average enforcement of all other states, weighted by the inverse distance between state centroids. Results, which are not shown but available upon request, are similar in magnitude to our main estimates, with the coefficients on the enforcement index estimated at -.200 and -.373, respectively, and significant at the 1% level.

in each case. Conversely, immigrant shares in Arizona and New Mexico would be lower, consistent with the Massey et al. (2002) hypothesis of enforcement in high-traffic areas of the border leading to increasing crossing and settlement in border areas with less historical traffic. In fact, our estimates imply that all states would have a lower (or unchanged) share of Mexican immigrants if enforcement had not changed, with the exceptions of California and Texas. The maps presented in Figure 5 help to visualize the results presented in the table. Panel (a) shows the empirical change in Mexican immigrant shares, while panel (b) presents our estimates from Table 5, column (4). The map shows that the Mexican immigrant population would not have diffused as extensively across the country if enforcement had remained unchanged.

Although the estimates in this section stem from an empirical specification derived from a theory of immigrant location choice, several caveats are in order. First, we ignore the effects of border enforcement on aggregate flows between Mexico and the United States, and focus only on the spatial distribution of immigrants across states. Second, the empirical specification embeds policy and economic variables, such as state-level legislation targeted to immigrants and conditions in industries with large concentrations of immigrant workers, that would also likely change in response to any changes in border enforcement. Nonetheless, we think this exercise is instructive to gauge the relative importance of border enforcement in the diffusion of Mexican immigrants to new U.S. destinations in the past two decades.

5 Conclusion

To our knowledge, no causal analysis has been conducted on the impact of border enforcement on immigrant location choice. The influential Massey et al. (2002) hypothesis is difficult to evaluate because of data limitations, the presence of competing factors in location choice, and in particular the endogeneity of border enforcement. We attempt to overcome this latter problem by proposing an instrumental variables approach. We construct an index of enforcement intensity that varies across time and place, that, on a lagged basis, we argue provides exogenous variation. Our strategy controls for a host of location choice factors including state economic conditions and deterrent state immigration policy.

We find evidence that increases in border enforcement decrease the share of Mexican immigrants, on the order of a 21.9% decrease in share for every 1,000 additional border patrol officers. These results are stable across subgroups, with slightly stronger effects for likely or estimated unauthorized population shares, and null effects for immigrants less likely to be border crossers. Our estimates imply that California and Texas lost shares of Mexican immigrants to other parts of the country due to border enforcement, consistent with the hypothesis in Massey et al. (2002).

Understanding the causal effect of border enforcement efforts on immigration location choice has implications for policy at various levels of government. Major efforts are devoted to controlling who enters the U.S. across its southern border, with arguably great success. U.S. Secretary of Homeland Security Janet Napolitano recently testified that the Southwest border has "never been stronger," with illegal crossings on the decline (Dinan 2013). However, border policy is presumed to have less (if any) control over where immigrants settle once they cross the border. These results tell a different story—we quantify an economically sizeable effect of border enforcement on destination choice. As such, the results may be useful to policymakers at the federal and state level, concerned with the size and nature of immigration flows into the U.S. and into individual states.

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A Border enforcement and location choice model

We adapt the pioneering work of Sjaastad (1962) and Borjas (1987), and assume that a prospective migrant from Mexico will relocate to the United States if his utility net of migration costs in the U.S. exceeds his utility in Mexico, such that the following inequality holds:[12]

$$u_{US} - c(e, d) > u_{MX} \tag{6}$$

where u_{US} is utility in the U.S., u_{MX} is utility in Mexico, and $c(\cdot)$ is the cost of migrating to the U.S. from Mexico. Assuming the migrant cannot cross the border legally, the cost is comprised of border enforcement e and the distance d to the choice of location, and is increasing in each argument.[13]

The model is easily extended to multiple potential destinations in the U.S. Initially assume that there is a unique mapping between border crossing locations and destinations, so that migrants crossing successfully in a particular location are constrained to locate in the associated U.S. destination. The migrant will choose U.S. destination k over U.S. destination l if the following inequality holds (and the left-hand side is non-negative):

$$u_k - u_{MX} - c(e_k, d_k) > u_l - u_{MX} - c(e_l, d_l) \tag{7}$$

where enforcement is made destination-specific in the sense developed in the paper. It follows immediately that changes in enforcement at particular crossing points will alter the relative costs associated with U.S. destinations, leading marginal migrants to change their locations.

The effect operates through two channels, as shown in Sorensen and Carrion-Flores (2007): deterrence from any migration to the U.S., and diversion of some migrants from one crossing location (and hence destination) to another. Both effects will increase the share of migrants locating at the destination with decreased relative enforcement.

Now consider the more realistic setting in which a potential migrant to a destination may choose among multiple crossing locations. Crossing locations vary in their associated smuggling fees and probabilities of apprehension. For each destination, crossing locations also vary in their distance cost, where "distance" is defined broadly to include direct travel costs, ease of travel through pre-existing networks associated with the destination, foregone earnings during travel time, and probability of apprehension in the interior. For each U.S. destination k, the value of migration is:

$$V_k = u_k - \min_s [c(e_s, d_k^s)] \tag{8}$$

where s indexes border crossing sector and d_k^s is the distance cost from crossing s to destination k. A migrant will choose destination k if $V_k > u_{MX}$ and $V_k > V_l$ for all $l \neq k$. As in the case of a single crossing location per destination, with multiple crossing locations changes in enforcement at border sector s can lead to changes in migrant destinations. Because the cost-minimizing crossing

[12]We thank Scott Borger for discussions that helped develop this section.

[13]Enforcement affects smuggling fees f and the probability of apprehension p. Although not all illegal migrants choose to pay for smuggling services, in general they will face a trade-off between paying for smuggling or facing a higher probability of apprehension, as in Gathmann (2008). We abstract from this decision and assume that the migrant chooses the cost-minimizing combination of (f, p), summarized as e.

location can vary across destinations, crossing sector-specific changes in migration costs can alter a migrant's ranking of destinations. For instance, suppose San-Diego/Tijuana is the preferred crossing location for migrants to California (CA). Increased enforcement at this sector may decrease V_{CA} sufficiently to switch a migrant's preferred destination from California to an alternate destination, such as Arizona or New Mexico.

Moreover, if the shape of the value function varies in the population of potential migrants, as is likely, then the composition of migrants may also change. Relatively risk-averse migrants may be deterred from attempting to locate in traditional U.S. destinations as enforcement increases, while more risk-tolerant migrants will be induced to settle in non-traditional destinations where the economic and social environment is less familiar.

Specifying the right-hand side of (8) as a linear function of border enforcement, observable characteristics, and an idiosyncratic error, and adding individual and time subscripts i and t, leads to (1), our point of departure in Section 2.

B Detail on data sources

Population data sources used to construct outcome variables are the U.S. Current Population Survey (CPS) 1994-2011, U.S. Census 2000, and American Community Survey (ACS) 2001-2011. In each case, microdata maintained by the Minnesota Population Center's Integrated Public Use Microdata Series (IPUMS) are aggregated by U.S. state (including the District of Columbia) and year. The 2000 Census are a 5% random sample of the full Census. CPS data for 2011 are from March only, as this was the only month available at the time the analysis was conducted; all other years include CPS data from all months.

Estimates of the unauthorized immigrant population by state-year are from Warren and Warren (2013). Warren and Warren (2013) use a residual method to estimate unauthorized population by state for each year from 1990 to 2010. This method, common to the migration and demography literature, compares the total number of immigrants based on survey data (in this case, ACS and Decennial Census) to the total number of authorized immigrants based on administrative information (DHS records of legal permanent and non-immigrant residents). The Warren and Warren (2013) estimates are the most detailed state-year estimates of unauthorized immigrants to date.

In constructing the weights ω used to create the enforcement index in (2), we use the Northern Border Migration Survey (EMIF) modules on migrants to the U.S. and voluntary returnees from the U.S. to Mexico. Because the weights span those whose last trip to the U.S. was between 1983-1993 and we drop any respondents whose last trip was more than 10 years prior to the interview date, we use EMIF waves conducted between 1993-2003.

Control variables used in the analysis come from various sources. Unemployment rates, hourly wages, and annual income come from the IPUMS versions of the U.S. Current Population Survey 1994-2011, U.S. Census 2000, and American Community Survey 2001-2011, in concordance with the dataset used in the analysis. Data on gross domestic product (total, agricultural, and manufacturing) are from the U.S. Bureau of Economic Analysis. Data on new housing permits are from the U.S. Census Bureau Building Permits Survey. Data on state legislation regarding immigrants are from the National Conference of State Legislatures Immigration Policy Project. Since 2005, the NCSL has collected information on laws and resolutions enacted by state legislatures to address immigrant-related issues. NCSL uses a comprehensive search to identify all immigrant-related laws, both deterrent and attractive, as well as those signed or vetoed by the governor. Our policy control variables account for the passage of any deterrent laws, signed by the governor and related only to employment and enforcement. Similar laws have been shown to have significant impacts on the location choice of immigrants, as in (Bohn et al. 2011). Additional laws, for example those constricting immigrant access to public services, may also be relevant to immigrant location choice.

C Calculation of counterfactual population shares

We use our estimates of the effect of border enforcement to calculate state shares of Mexican immigrants that would prevail if enforcement had not changed over the sample period. To do so, we subtract our estimated border enforcement effect from each state's (log) population share over the sample period:

$$\log(S_{k\widehat{T}) - \log}(S_{k0}) = \sum_{t=0}^{T} \left(\Delta \log(S_{kt}) - \hat{\theta}\Delta e_{kt}\right) \tag{9}$$

where $t = 0$ and $t = T$ denote the beginning and end of the sample, $\hat{\theta}$ is the estimated IV coefficient on the enforcement index, and all other notation is as in (5). We solve for $\widehat{S_{kT}}$ by rewriting the left-hand side of (9) and performing some algebraic manipulations:

$$\exp\left[\widehat{\log\left(\frac{S_{kT}}{S_{k0}}\right)}\right] \times S_{k0} = \widehat{S_{kT}} \tag{10}$$

Finally, we normalize $\widehat{S_{kT}}$ so that the shares sum to 1.

Table 1: Summary statistics

Variable	N	Mean	S.D.
Mexican immigrants			
share	840	0.02	0.07
all	840	194,931	631,422
males 16-50	810	73,869	217,852
unauthorized	790	65,322	203,200
naturalized citizen	790	47,152	164,748
not naturalized citizen	816	154,978	481,895
abroad last year	220	1,674	3,951
not abroad last year	840	194,396	630,026
internal migrant	280	834	2,058
not internal migrant	839	194,814	631,187
Other population groups			
non-Mexican immigrant	867	466,837	941,395
non-Mexican unauthorized	816	126,225	255,302
natives	867	4,876,839	4,898,778
Puerto Rican	743	29,911	70,619
Central American	836	47,433	121,534
Enforcement			
index (agents)	840	0.21	0.75
index (apprehensions)	840	21.2	76.9
weights (state-sector pairs)	423	0.02	0.10
border patrol agents (sector-years)			
all sector-years	153	1,177	810
Rio Grande Valley (TX)	17	1,491	615
Laredo (TX)	17	1,035	496
Del Rio (TX)	17	963	421
Big Bend (TX)	17	298	194
El Paso (TX & NM)	17	1,529	747
Tucson (AZ)	17	2,048	1,065
Yuma (AZ)	17	492	303
El Centro (CA)	17	682	337
San Diego (CA)	17	2,058	365

Table shows summary statistics from U.S. state-years 1995-2011 (unless otherwise indicated). Population data from Current Population Survey. Unauthorized Mexican/non-Mexican immigrants are estimates from Warren and Warren (2013), multiplied by the proportion of Mexican/non-Mexican immigrants in the state-year cell. Enforcement index = $\sum_s \Pr(\text{US destination}|\text{cross at border sector } s) \times \text{enforcement at sector } s$, where enforcement is thousands of border patrol agents or apprehensions of unauthorized migrants. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination. Enforcement weights (crossing probabilities) calculated from EMIF crossings 1983-1993. Border patrol agents and apprehensions from Department of Homeland Security.

Table 2: First Stage

	enforcement index, first difference			
	(1)	(2)	(3)	(4)
agent index, $t-2$	0.073	0.068		
	(0.009)***	(0.009)***		
apprehension index, $t-2$			0.57	0.60
			(0.095)***	(0.120)***
Observations	863	612	914	612
R-squared	0.38	0.37	0.39	0.33
1st stage F-statistic	74.2	59.0	36.3	25.4
data source	CPS	ACS	CPS	ACS

Table shows regressions of first difference of enforcement index on its second lag. Sample is U.S. state-years (including D.C.) from Current Population Survey, 1995-2011 in column (1), U.S. Census 2000 and American Community Survey 2001-2011 in column (2). Enforcement index $= \sum_s \Pr(\text{US destination}|\text{cross at border sector } s) \times$ enforcement at sector s. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination, where enforcement is number of border patrol agents or apprehensions of unauthorized migrants (thousands), as indicated. Crossing probabilities calculated from EMIF crossings 1983-1993. Border patrol agents from Department of Homeland Security. All regressions include year fixed effects and the following controls (in first differences): Mexican immigrant unemployment rate, Mexican immigrant hourly wage, log GDP per capita, log agricultural GDP, log manufacturing GDP, log construction GDP, log new housing permits, and a dummy for passage of any punitive immigration legislation. Robust standard errors in parenthesis, clustered by state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3: Mexican immigrant population shares and border enforcement

	all	males 16-50 HS or less	unauthorized	naturalized citizen		abroad last year		internal migrant	
				yes	no	yes	no	yes	no
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: OLS									
enforcement index	-0.176	-0.204	-0.200	-0.075	-0.209	-0.3	-0.175	-0.571	-0.175
	(0.058)***	(0.057)***	(0.057)***	(0.050)	(0.056)***	(0.272)	(0.058)***	(0.350)	(0.058)***
R-squared	0.04	0.03	0.03	0.02	0.03	0.07	0.04	0.12	0.04
Panel B: IV									
enforcement index	-0.219	-0.316	-0.324	-0.047	-0.304	-0.003	-0.214	0.205	-0.218
	(0.075)***	(0.078)***	(0.075)***	(0.066)	(0.090)***	(0.316)	(0.074)***	(0.292)	(0.073)***
Observations	839	809	789	789	815	220	839	280	838
1st stage F-stat	75.6	75.6	80.8	75.4	75.7	49.4	75.6	53.8	75.7

Table shows regressions of log population share on enforcement index, in first differences. Sample is U.S. state-years (including D.C.) from Current Population Survey, 1995-2011. Population share is state's share of Mexican immigrants within each category. Enforcement index = $\sum_s$ Pr(US destination|cross at border sector s) $\times$ enforcement at sector s, where enforcement is thousands of border patrol agents. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination. Instrument in IV specifications is second lag of enforcement index. Crossing probabilities calculated from EMIF crossings 1983-1993. Border patrol agents from Department of Homeland Security. Unauthorized Mexican immigrants calculated by multiplying unauthorized immigrant estimate of Warren and Warren (2013) by the proportion of immigrants who are Mexican in the state-year cell. All regressions include year fixed effects and the following controls (in 1st differences): Mexican immigrant unemployment rate, Mexican immigrant hourly wage, log GDP per capita, log agricultural GDP, log manufacturing GDP, log construction GDP, log new housing permits, and a dummy for passage of any punitive immigration legislation. Robust standard errors in parenthesis, clustered by state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Population shares and border enforcement

	non-Mexican		native	Puerto	Central
	immigrant	unauthorized		Rican	American
	(1)	(2)	(3)	(4)	(5)
Panel A: OLS					
enforcement index	0.017	0.006	0.017	0.004	-0.095
	(0.030)	(0.017)	(0.014)	(0.068)	(0.070)
R-squared	0.04	0.03	0.05	0.03	0.04
Panel B: IV					
enforcement index	-0.03	-0.027	0.037	0.017	-0.201
	(0.044)	(0.053)	(0.017)**	(0.105)	(0.084)**
Observations	863	812	863	739	832
1st stage F-statistic	75.6	80.9	75.2	75.5	75.7

Table shows regressions of log population share on enforcement index, in first differences. Sample is U.S. state-years (including D.C.) from Current Population Survey, 1995-2011. Population share is state's share within each category indicated. Enforcement index = $\sum_s \Pr(\text{US destination}|\text{cross at border sector } s) \times$ enforcement at sector s, where enforcement is thousands of border patrol agents. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination. Instrument in IV specifications is second lag of enforcement index. Crossing probabilities calculated from EMIF crossings 1983-1993. Border patrol agents from Department of Homeland Security. Unauthorized immigrants are estimates of Warren and Warren (2013), multiplied by the proportion of immigrants who are non-Mexican in the state-year cell. All regressions include year fixed effects and the following controls (in 1st differences): unemployment rate of indicated group, hourly wage of indicated group, log GDP per capita, log agricultural GDP, log manufacturing GDP, log construction GDP, log new housing permits, and a dummy for passage of any punitive immigration legislation. Robust standard errors in parenthesis, clustered by state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: State shares of Mexican immigrants, 1994-2011

State	observed		counterfactual	change
	1994	2011	2011	
	(1)	(2)	(3)	(3)-(2)
Alabama	0.05%	0.51%	0.26%	-0.25
Alaska	0.03%	0.04%	0.02%	-0.02
Arizona	4.50%	5.03%	4.72%	-0.30
Arkansas	0.15%	0.29%	0.15%	-0.14
California	54.02%	38.16%	46.40%	8.24
Colorado	0.57%	1.78%	1.02%	-0.76
Connecticut	0.00%	0.18%	0.12%	-0.05
Delaware	0.06%	0.19%	0.10%	-0.09
District of Columbia	0.02%	0.06%	0.03%	-0.03
Florida	2.17%	1.95%	1.09%	-0.86
Georgia	1.28%	1.95%	1.02%	-0.92
Hawaii	0.01%	0.08%	0.04%	-0.04
Idaho	0.36%	0.57%	0.30%	-0.27
Illinois	6.53%	5.56%	3.02%	-2.54
Indiana	0.09%	0.82%	0.42%	-0.40
Iowa	0.11%	0.54%	0.28%	-0.26
Kansas	0.12%	0.63%	0.33%	-0.30
Kentucky	0.03%	0.32%	0.16%	-0.15
Louisiana	0.07%	0.21%	0.11%	-0.10
Maine	0.00%	0.01%	0.00%	-0.01
Maryland	0.09%	0.43%	0.22%	-0.21
Massachusetts	0.17%	0.05%	0.03%	-0.02
Michigan	0.12%	0.87%	0.45%	-0.42
Minnesota	0.28%	0.48%	0.25%	-0.23
Mississippi	0.03%	0.12%	0.06%	-0.06
Missouri	0.11%	0.25%	0.13%	-0.12
Montana	0.01%	0.03%	0.02%	-0.01
Nebraska	0.13%	0.54%	0.28%	-0.26
Nevada	1.14%	1.93%	1.02%	-0.91
New Hampshire	0.00%	0.00%	0.00%	0.00
New Jersey	0.37%	1.80%	0.92%	-0.88
New Mexico	1.08%	0.99%	0.56%	-0.43
New York	1.33%	1.84%	0.95%	-0.89
North Carolina	0.53%	2.03%	1.09%	-0.94
North Dakota	0.01%	0.00%	0.00%	0.00
Ohio	0.11%	0.34%	0.18%	-0.17
Oklahoma	0.56%	0.44%	0.23%	-0.21
Oregon	1.09%	0.74%	0.39%	-0.35
Pennsylvania	0.19%	0.38%	0.20%	-0.19
Rhode Island	0.02%	0.04%	0.02%	-0.02
South Carolina	0.06%	0.54%	0.28%	-0.26
South Dakota	0.00%	0.03%	0.01%	-0.01
Tennessee	0.03%	0.65%	0.34%	-0.32
Texas	20.85%	22.45%	30.63%	8.17
Utah	0.32%	0.64%	0.33%	-0.31
Vermont	0.00%	0.00%	0.00%	0.00
Virginia	0.12%	0.85%	0.44%	-0.41
Washington	0.47%	1.84%	0.97%	-0.88
West Virginia	0.00%	0.01%	0.00%	-0.01
Wisconsin	0.56%	0.79%	0.41%	-0.38
Wyoming	0.05%	0.05%	0.03%	-0.02

Table shows state shares of Mexican immigrants in 1994, 2011, and 2011 under counterfactual in which border enforcement did not change, in columns (1)-(3), respectively. Final column shows percentage-point change in state share due to enforcement, found by subtracting column (3) from column (2). Column (3) found by using estimated IV coefficient on enforcement index from Table 3, column (1) to determine predicted change in population share in each state due to changes in enforcement. This change is then used to predict each state's population share in 2011 as though no change in enforcement occurred. Details in Appendix C. Data source: CPS, 1994-2011.

Table A1: Shares of Mexican Immigrants

Year	Share in top 5 states	Share in top 10 states	Share in California and Texas
1980	0.92	0.96	0.80
1990	0.90	0.95	0.79
2000	0.76	0.86	0.63
2010	0.71	0.82	0.58

Table shows shares of Mexican immigrants in state groupings by year. Sources: U.S. Census for 1980-2000, American Community Survey for 2010.

Table A2: Mexican immigrant population shares and border enforcement (Census/ACS)

	all	males 16-50 HS or less	unauthorized	naturalized citizen		abroad last year		internal migrant	
				yes	no	yes	no	yes	no
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: OLS									
enforcement index	-0.083	-0.005	-0.072	-0.024	-0.02	-0.028	-0.08	0.145	-0.087
	(0.061)	(0.037)	(0.056)	(0.049)	(0.053)	(0.077)	(0.059)	(0.094)	(0.060)
R-squared	0.08	0.17	0.08	0.07	0.09	0.08	0.07	0.11	0.09
Panel B: IV									
enforcement index	-0.222	-0.191	-0.205	-0.125	-0.195	-0.051	-0.225	0.126	-0.224
	(0.083)***	(0.075)**	(0.081)**	(0.062)**	(0.074)***	(0.193)	(0.079)***	(0.160)	(0.086)***
Observations	557	547	506	550	552	396	557	423	557
1st stage F-stat	74.8	74.8	98.6	74.5	74.9	90.5	74.8	91.6	74.8

Table shows regressions of log population share on enforcement index, in first differences. Sample is U.S. state-years (including D.C.) from U.S. Census 2000, American Community Survey 2001-2011. Population share is state's share of Mexican immigrants within each category. Enforcement index = $\sum_s$ Pr(US destination|cross at border sector s) $\times$ enforcement at sector s, where enforcement is thousands of border patrol agents. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination. Instrument in IV specifications is second lag of enforcement index. Crossing probabilities calculated from EMIF crossings 1983-1993. Border patrol agents from Department of Homeland Security. Unauthorized Mexican immigrants calculated by multiplying unauthorized immigrant estimate of Warren and Warren (2013) by the proportion of immigrants who are Mexican in the state-year cell. All regressions include year fixed effects and the following controls (in 1st differences): Mexican immigrant unemployment rate, Mexican immigrant hourly wage, log GDP per capita, log agricultural GDP, log manufacturing GDP, log construction GDP, log new housing permits, and a dummy for passage of any punitive immigration legislation. Robust standard errors in parenthesis, clustered by state. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A3: Mexican immigrant population shares and border enforcement (all cells)

	all	males 16-50 HS or less	unauthorized	naturalized citizen		abroad last year		internal migrant	
				yes	no	yes	no	yes	no
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: OLS									
enforcement index	-0.18	-0.208	-0.200	-0.139	-0.175	0.262	-0.179	-0.846	-0.174
	(0.058)***	(0.080)**	(0.058)***	(0.090)	(0.098)*	(0.475)	(0.058)***	(0.841)	(0.063)***
R-squared	0.05	0.04	0.03	0.01	0.06	0.16	0.05	0.14	0.05
Panel B: IV									
enforcement index	-0.245	-0.242	-0.375	-0.1	-0.259	0.345	-0.24	-0.063	-0.167
	(0.105)**	(0.157)	(0.083)***	(0.092)	(0.142)*	(0.777)	(0.104)**	(0.911)	(0.136)
Observations	863	863	812	863	863	863	863	863	863
1st stage F-stat	75.6	75.6	80.9	75.6	75.6	75.6	75.6	75.6	75.6

Table shows regressions of log population share on enforcement index, in first differences. Sample is U.S. state-years (including D.C.) from Current Population Survey, 1995-2011. Population share is state's share of Mexican immigrants within each category. One person added to all state-year cells so that log of zero population share is well-defined. Enforcement index = $\sum_s \Pr(\text{US destination}|\text{cross at border sector } s) \times$ enforcement at sector s, where enforcement is thousands of border patrol agents. Index may be interpreted as amount of enforcement dedicated to preventing arrival of unauthorized migrants at destination. Instrument in IV specifications is second lag of enforcement index. Crossing probabilities calculated from EMIF crossings 1983-1993. Border patrol agents from Department of Homeland Security. Unauthorized Mexican immigrants calculated by multiplying unauthorized immigrant estimate of Warren and Warren (2013) by the proportion of immigrants who are Mexican in the state-year cell. All regressions include year fixed effects and the following controls (in 1st differences): Mexican immigrant unemployment rate, Mexican immigrant hourly wage, log GDP per capita, log agricultural GDP, log manufacturing GDP, log construction GDP, log new housing permits, and a dummy for passage of any punitive immigration legislation. Robust standard errors in parenthesis, clustered by state. * significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1: Mexican immigrant diffusion and border enforcement

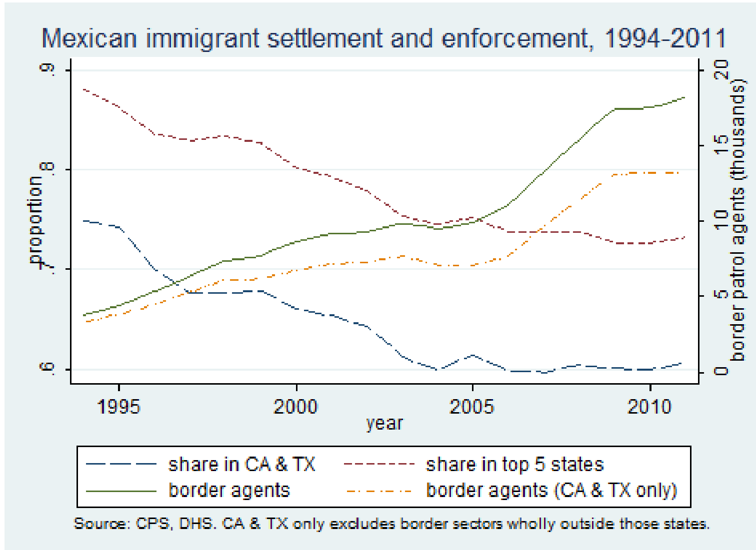
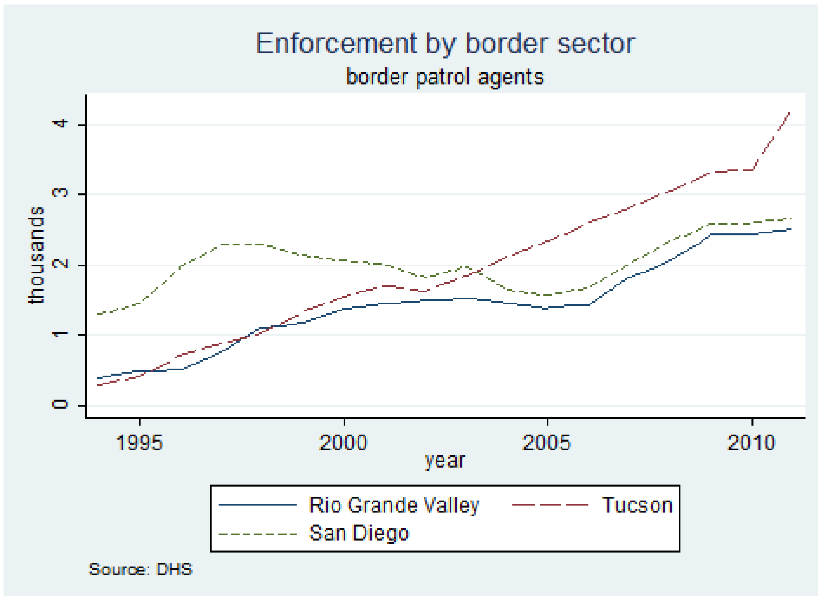


Figure 2: Mexican migrant enforcement and crossing patterns

(a)



(b)

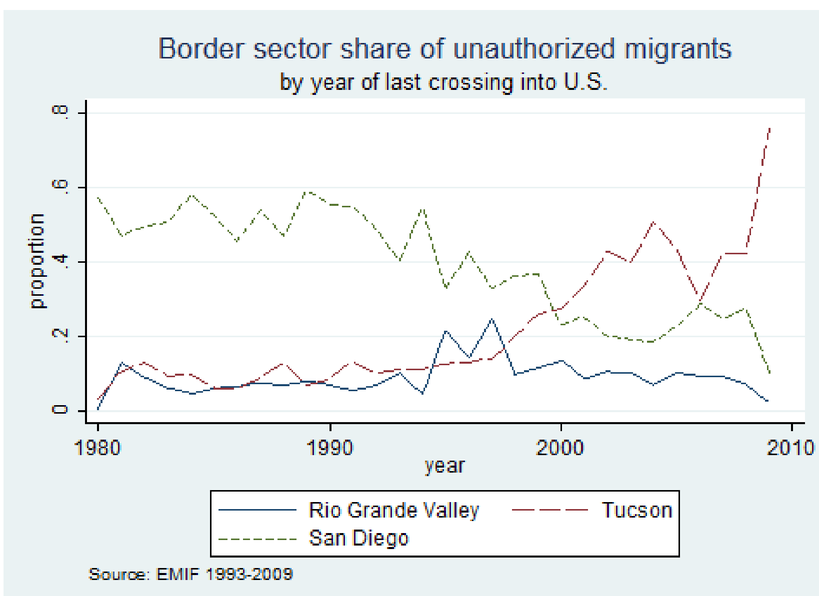
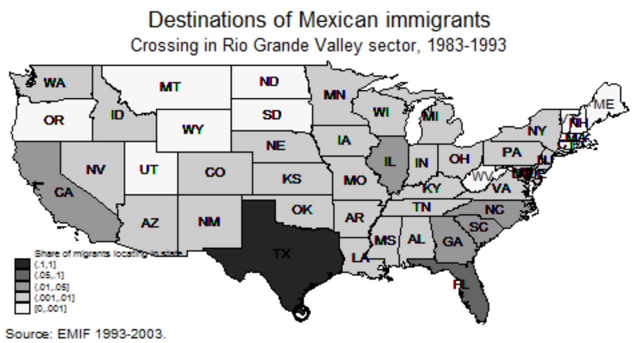
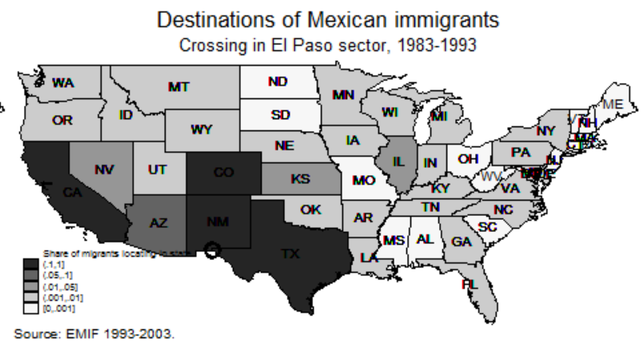


Figure 3: Mexican migrant crossing patterns

(a)



(b)



(c)

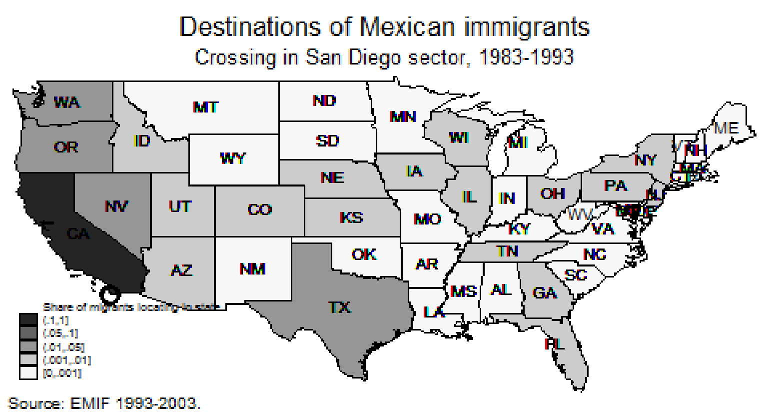


Figure 4: Enforcement index

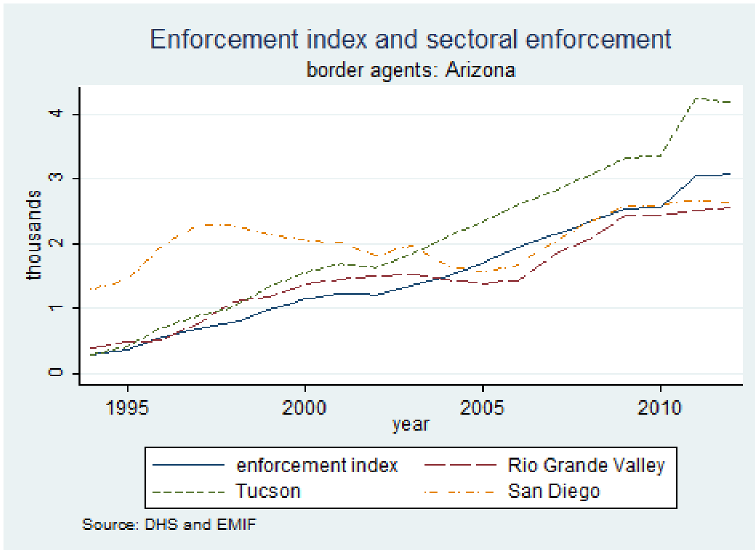


Figure 5: Change in state shares of Mexican immigrants, observed and counterfactual

(a) (b)

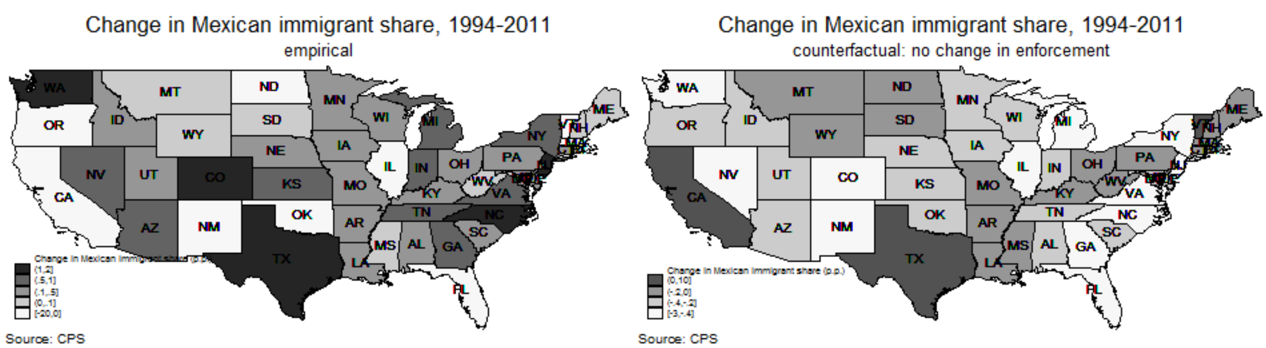


Figure A1: Mexican immigrant diffusion

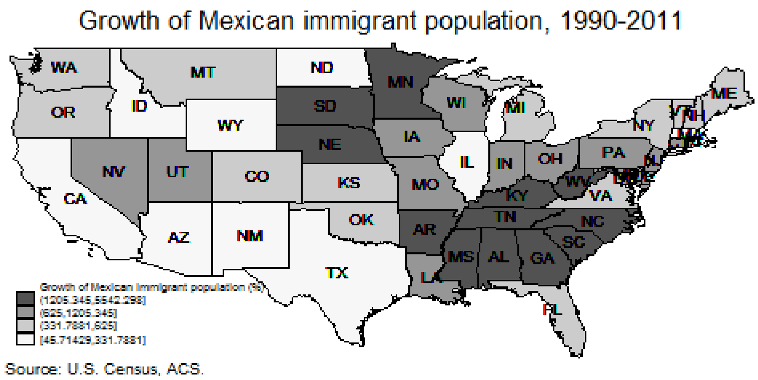


Figure A2: Mexican immigrant population, by data source

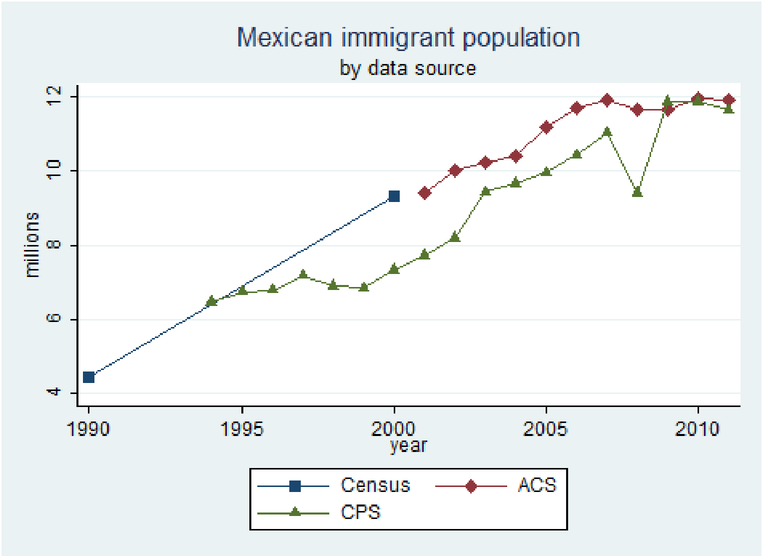


Figure A3: Border patrol agents and linewatch hours