Are Immigrants Stealing American Jobs?: A Study of Unauthorized Immigration and Unemployment in the Southwest United States

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Abstract

Unauthorized Immigration and Unemployment in the Southwest United States

This research analyzes the effects of unauthorized immigration on unemployment levels in the states of Texas and California in the United States. Data from the Department of Homeland Security is utilized to best estimate the size of unauthorized populations. This research finds that a one person increase in the unauthorized population in the region leads to a 1.1556 person decrease in the region's unemployed population. This estimate implies that increases in unauthorized immigration has a net negative effect on unemployment levels, meaning that unauthorized immigration encourages higher levels of employment in these regions for foreign and native workers alike.

Keywords: unauthorized immigration, unemployment, native labor, immigrant labor

1 Introduction

Almost everyone, regardless of political affiliation, can agree that the United States' immigration system is flawed. It can take years, if not decades for individuals to receive the proper documentation to enter the United States legally. At the same time, the face of immigration has evolved greatly over time. In the past, the largest groups of immigrants that arrived in America were predominately of European and African descent, due to settlement of the Americas and the establishment of slavery. Today we have seen a large demographic shift as most immigrants entering the United States come from Latin American countries. One aspect of immigration that has not changed is the fact that many individuals arrive in the United States seeking greater economic opportunity and prosperity. The United States is a country that represents the opportunity to climb the social ladder for many individuals who were born in a place where social position at birth definitively dictates their future and the future of their children.

The United States government has implemented its fair share of immigration laws and policies since its conception. The Immigration Act of 1882 instituted a tax of fifty cents on each immigrant and banned the entry of "idiots, lunatics, convicts," and persons likely to become burden to the public (U.S. Citizenship and Immigration Services, 2015). This sentiment has grown stronger in the United States, as some native-born citizens seek to ensure that their government prioritizes the well-being of native citizens before the well-being of immigrants. Especially with the recent financial crisis in 2008-2009, there has been growing interest in the impact unauthorized immigrants have on labor markets within the United States.

Today, most unauthorized immigrants come from Central America, particularly Mexico, and settle in the southwestern region of the United States. Does the restriction of immigration into the United States harm U.S. citizens economically? Or on the contrary, do increases in immigration, even unauthorized immigration, promote greater productivity and efficiency within the United States economy? A way to approach these issues with more specificity would be to ask, do increases in unauthorized immigration from Central America increase overall unemployment rates in the southwest states of California and Texas?

This research examines the impacts of increases in the unauthorized population from Central America, including Mexico, on unemployment in the states of California and Texas. With the vast amount of public focus on measurements, such as overall unemployment, to gauge economic health and subsequently

personal satisfaction, the importance of understanding the determinants of such a measurement has never been more important.

The remainder of the paper is organized as follows. Section 2 defines and provides further information on unauthorized immigration from Central America and the unemployment rate as a measurement utilized within the United States. Section 3 analyzes past studies involving unauthorized immigrant workers and their effects on the United States economy. Section 4 addresses the data used and when and where it is sourced from. Section 5 describes the three models utilized and the use of controls. Section 6 analyzes the three time series regressions and addresses any important results. Section 7 concludes and presents an analysis of labor policy implications.

2 Defining unauthorized immigration and unemployment rate

2.1 Unauthorized immigration

The unauthorized immigrant population is defined as all foreign-born citizens who are not in the United States with appropriate legal documentation. Most of these unauthorized individuals entered the country through non-traditional immigration pathways or were admitted temporarily but then have stayed past their required date to leave (U.S. Deparment of Homeland Security, 2010).

Table 1: Country of Birth of the Unauthorized Immigrant Population

Country of birth	Estimated population in January		Percent of total	
	2012	2010	2012	2010
All countries	11,430,000	11,590,000	100	100
Mexico	6,720,000	6,830,000	59	59
El Salvador	690,000	670,000	6	6
Guatemala.	560,000	520,000	5	4
Honduras.	360,000	380,000	3	3
Philippines.	310,000	290,000	3	2
India	260,000	270,000	2	2
Korea	230,000	220,000	2	2
China	210,000	300,000	2	3
Ecuador.	170,000	210,000	2	2
Vietnam.	160,000	190,000	1	2
Other countries	1,760,000	1,720,000	15	15

Source: United States Department of Homeland Security, (2013)

Table 1 presents data based on estimates for 2012 and shows that illegal immigration from the Central American countries of Mexico, El Salvador, Guatemala, and Honduras accounted for nearly three-quarters of the total unauthorized immigrant population in the United States (Baker and Rytina, 2013).

Table 2: State of Residence of the Unauthorized Immigrant Population

State of residence	Estimated population in January		Percent of total	
	2012	2010	2012	2010
All states	11,430,000	11,590,000	100	100
California	2,820,000	2,910,000	25	25
Texas	1,830,000	1,780,000	16	15
Florida	730,000	730,000	6	6
New York	580,000	690,000	5	6
Illinois	540,000	550,000	5	5
New Jersey	430,000	440,000	4	4
Georgia	400,000	430,000	3	4
North Carolina	360,000	390,000	3	3
Arizona	350,000	350,000	3	3
Washington	270,000	260,000	2	2
Other states	3,110,000	3,040,000	27	26

Source: United States Department of Homeland Security, (2013)

In addition, table 2 shows that as of 2012, a little less than half of the unauthorized immigrant population resided in the states of Texas and California (Baker and Rytina, 2013). In addition, the individual sizes of these populations should not be considered insignificant. As of 2012, almost three million unauthorized immigrants called California home and these three million individuals comprised approximately 6 percent of the state's population. In states such as California and Texas, opinions on the relationship between unauthorized immigration and native unemployment can be highly critical, which is no surprise as almost one in ten workers in California are working without proper legal documentation (Hayes and Hill, 2017).

In 2014, the approximately 8 million unauthorized immigrants in the U.S. that were either working or actively seeking work made up about 5 percent of the total U.S. labor force. Echoing patterns we see in the general unauthorized immigrant population, based on 2014 estimates, California and Texas were the two states with the largest number of unauthorized immigrants in their workforces with 1.7 million and 1.1 million unauthorized immigrants respectively. In California, unauthorized immigrants account for about 9 percent of the labor force and in Texas 8.5 percent, both greater than the national percentages (Pew Research Center, 2016b).

Figure 1: Unauthorized Immigrant Populations by State
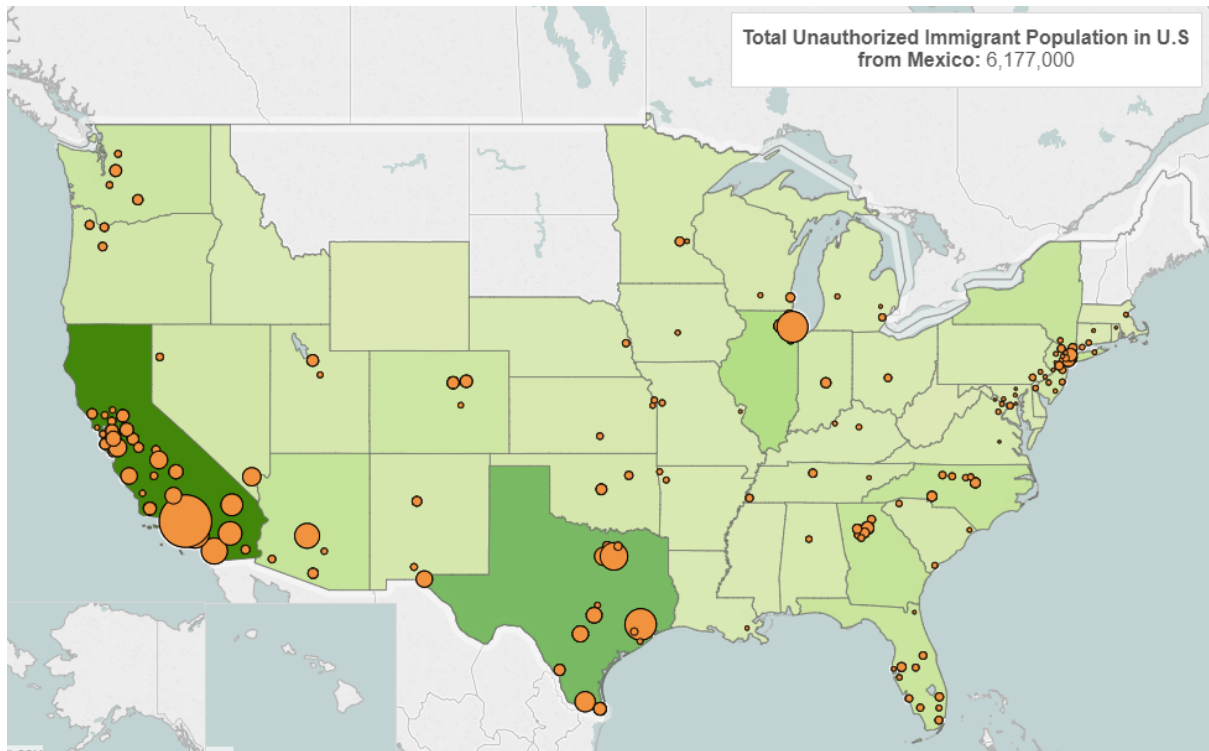
Source: Migration Policy Institute, (2014)

Figure 1 displays the concentration of all unauthorized immigrants residing in the United States and helps to illustrate the high concentration of unauthorized immigrants in the states of California and Texas. In this figure, darker shades of green designate states with larger populations of unauthorized immigrants and the size of each orange circle illustrates the density of unauthorized populations in specific areas of each state. For example, the largest orange circle in California represents Los Angeles County, where 661,000 of the 1.06 million (62 percent) unauthorized immigrants come from Mexico (Migration Policy Institute, 2014).

Figure 2: Country of Birth of the Unauthorized Immigrant Population

In millions
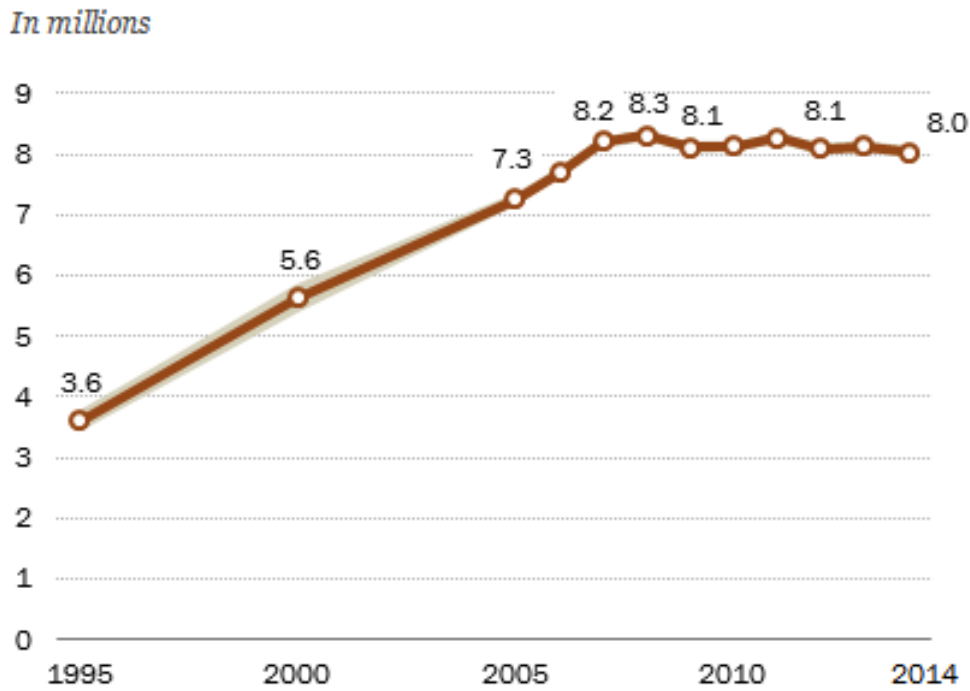
Source: Pew Research Center, (2016a)

Figure 2 shows that the estimated number of unauthorized immigrants in the U.S. labor force increased steadily between 1995 and 2009 and has since stabilized around 8 million, a trend that mirrors trends of the overall unauthorized immigrant population (Passel and Cohn, 2016a).

The United States receives 28 percent of all its immigrants from Mexico, but what sets all Central American countries apart from other immigrant-sending regions is the high proportion of immigrants who enter the United States without official permission. For example, in 2005 alone, between 80 and 85 percent of immigrants from Mexico arrived in America without their necessary documents, which is abnormally high compared to immigrants the United States receives from other regions of the world (Passel, 2005). It is important to note that while the number of unauthorized Mexican immigrants residing in the United States has declined by over 1 million in the last decade, as of 2014, over half (52 percent) of unauthorized immigrants living in the United States had come from Mexico (Gonzalez-Barrera and Krogstad, 2017).

Figure 3: Countries of origin for unauthorized immigrant populations in the United States

| Mexico 6.2 million | Guatemala 723,000 | El Salvador 465,000 | Honduras 337,000 |
	China 268,000	India 267,000	Korea 198,000
	Philippines	Ecuador	Colombia
	Other countries 2.1 million		
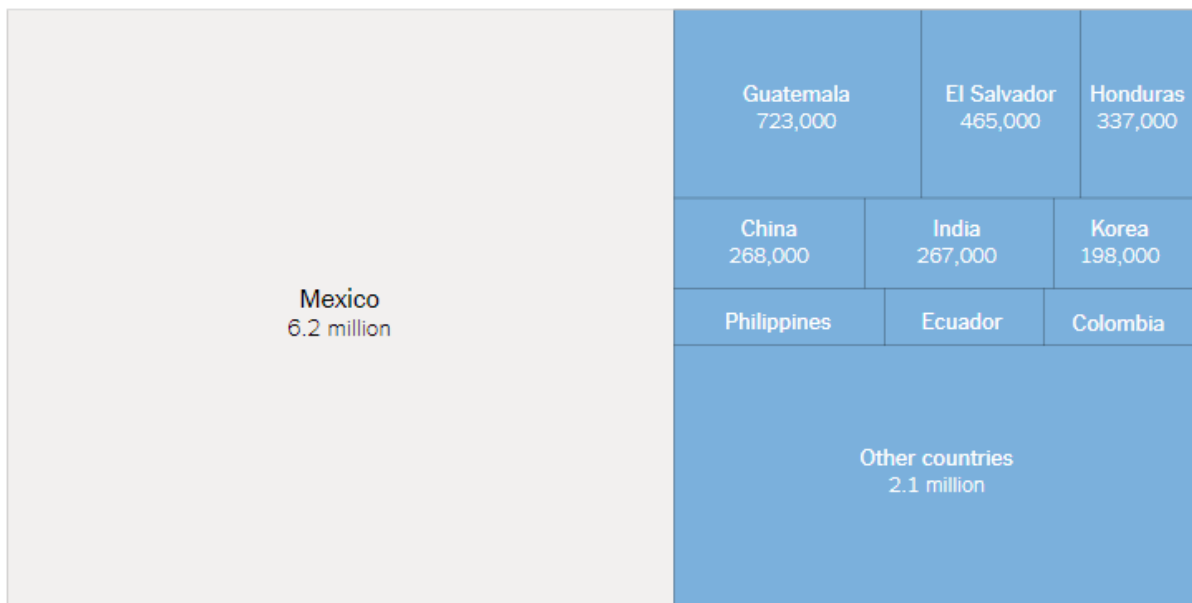
Source: Figure from The New York Times, (2017)

Figure 3 shows the country of origin for unauthorized immigrants residing in the United States. It illustrates the fact that almost a half of unauthorized immigrants are from Mexico and almost three-quarters of unauthorized immigrants are originally from Latin America in general.

Figure 4: Overall Number of U.S. Unauthorized Immigrants from Mexico, 1990-2015
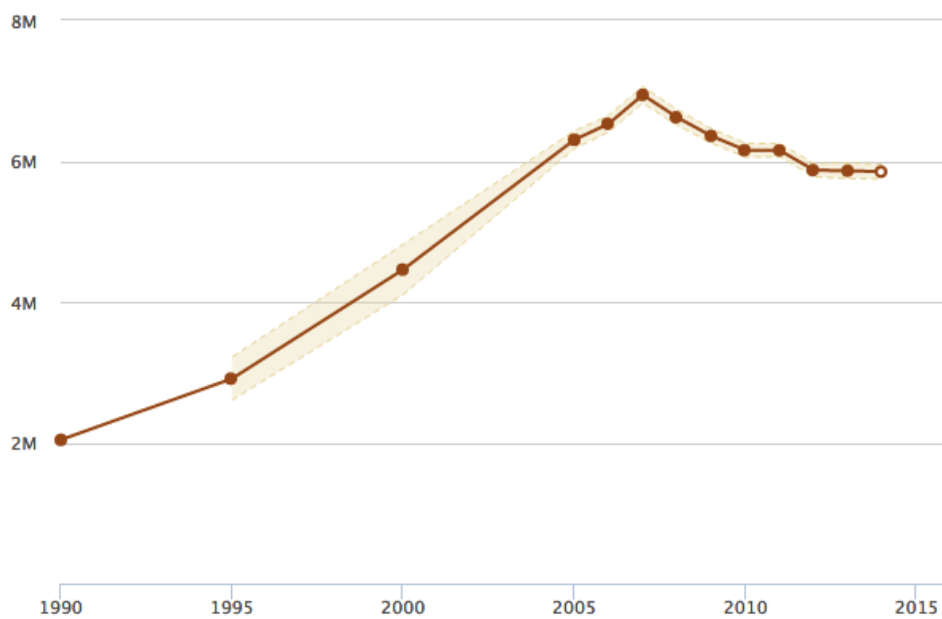
Source: Pew Research Center, (2016a)

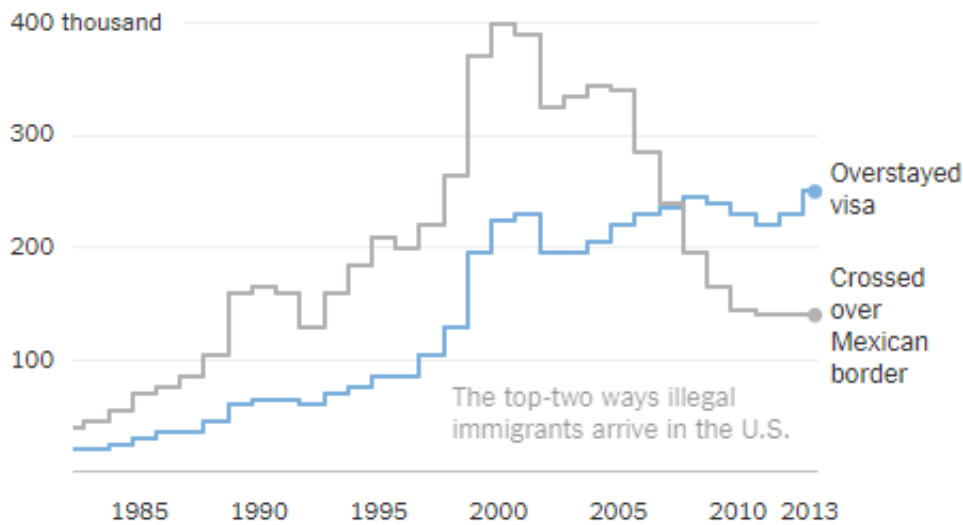Figure 5: Overall Number of U.S. Unauthorized Immigrants from Central America, 1990-2014
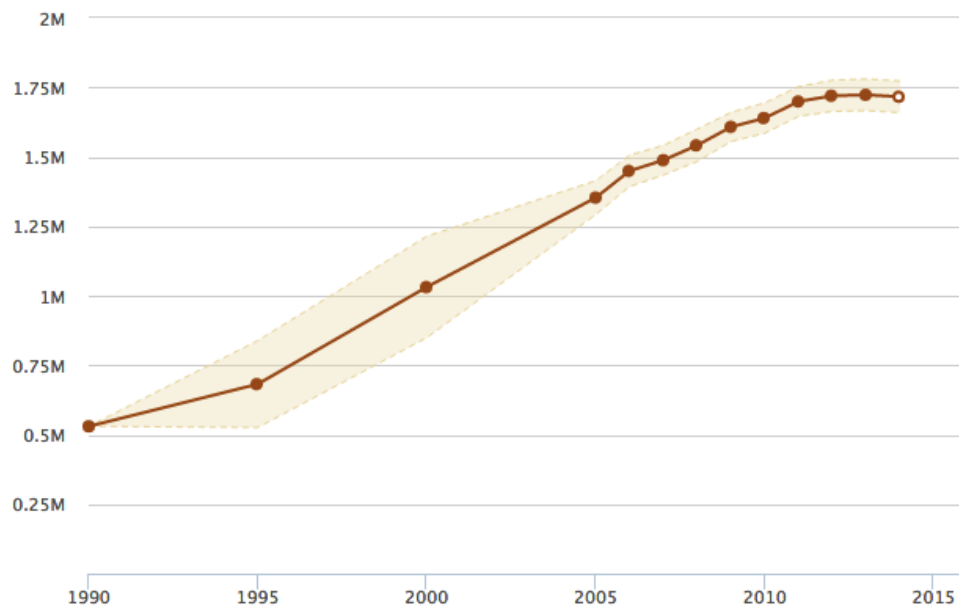
Source: Pew Research Center, (2016a)

Figure 4 illustrates that immigration from Mexico reached its peak pre-Great Recession and then began to fall steadily and has only recently appeared to stabilize. Figure 5 shows that overall unauthorized immigrant populations from Central America (not including Mexico) have grown steadily and then stabilized in recent years (Pew Research Center, 2016a).In both figures, the shading surrounding the lines represents low and high points of an estimated 90 percent confidence interval. This stabilization is most likely due to the net inflow of unauthorized immigrants decreasing in the last decade. In recent years, the number of unauthorized immigrants entering the United States was roughly equal to the number of unauthorized immigrants who were deported, left the U.S. for other reasons, gained legal status, or passed away (Passel and Cohn, 2016b).

Unauthorized immigrants from Latin America find themselves in the United States in various ways. Today, an increasing number of unauthorized immigrants simply over stay their temporary visitor permits (visas).

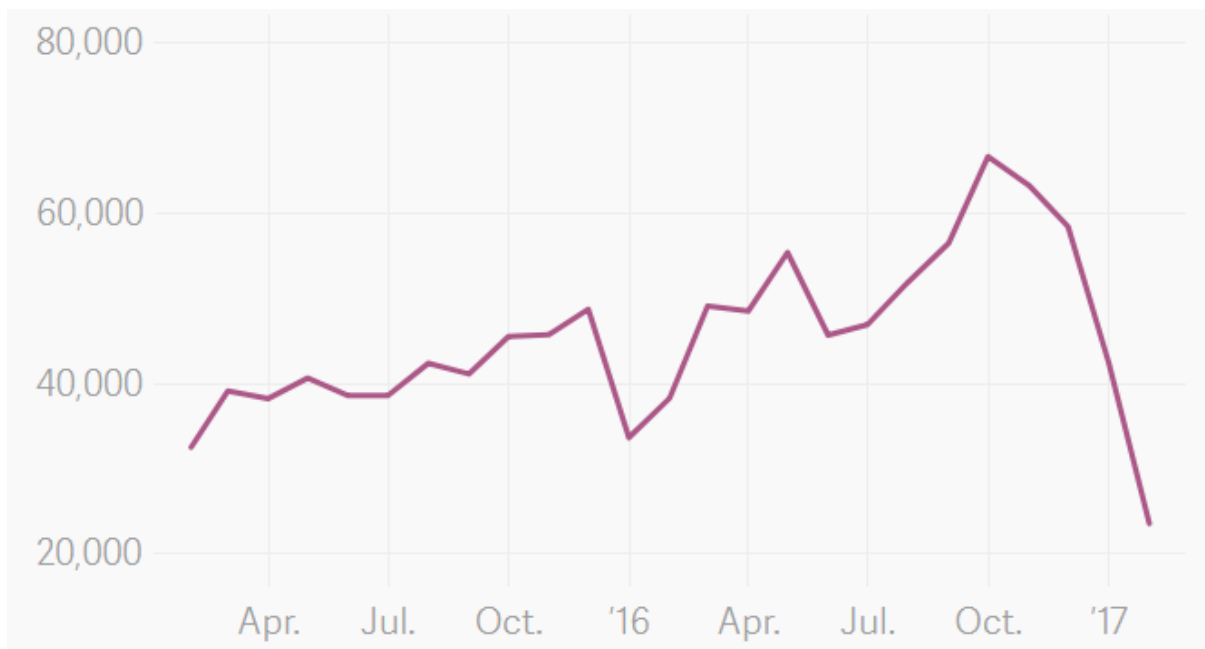Figure 6: How Unauthorized Immigrants Arrive in the United States

Note: Data are estimates rounded to the nearest five thousand.

Source: The New York Times, (2017)

Figure 6 shows that in the last decade the number of unauthorized immigrants overstaying their visas has surpassed the number of unauthorized immigrants arriving via more traditional routes (Yee et al., 2017). It is difficult to estimate the number of unauthorized immigrants who arrived by overstaying their visas. Estimates from 2006, however, revealed that the number could be as high as 4.5 to 6 million of unauthorized immigrants, or 40-50% (Pew Research Center, 2006).

Nevertheless, some individuals continue to cross the border in the traditional way – by foot, train, or boat. Many achieve this by choosing the increasingly dangerous and expensive option of being smuggled across the border by human smugglers, also known as "coyotes". In the past year, the number of unauthorized immigrants who were caught by U.S. Border Patrol attempting to cross the border has dropped significantly. The Trump administration attributed this significant reduction to their intense crackdown on border security; however, this may not be the case. Intense border scrutiny has two definitive outcomes: increases in the amount "coyotes" charge immigrants and riskier routes and methods for smuggling individuals across the border. The consequences of the risks being taken by human smugglers can be seen in sharp increases in the number of unauthorized immigrant remains that are found at Arizona's border (Campoy and Groskopf, 2017).

Figure 7: Apprehensions of unauthorized immigrants by U.S. Border Patrol

Figure 8: Remains recovered at Arizona border per 100,000 apprehensions
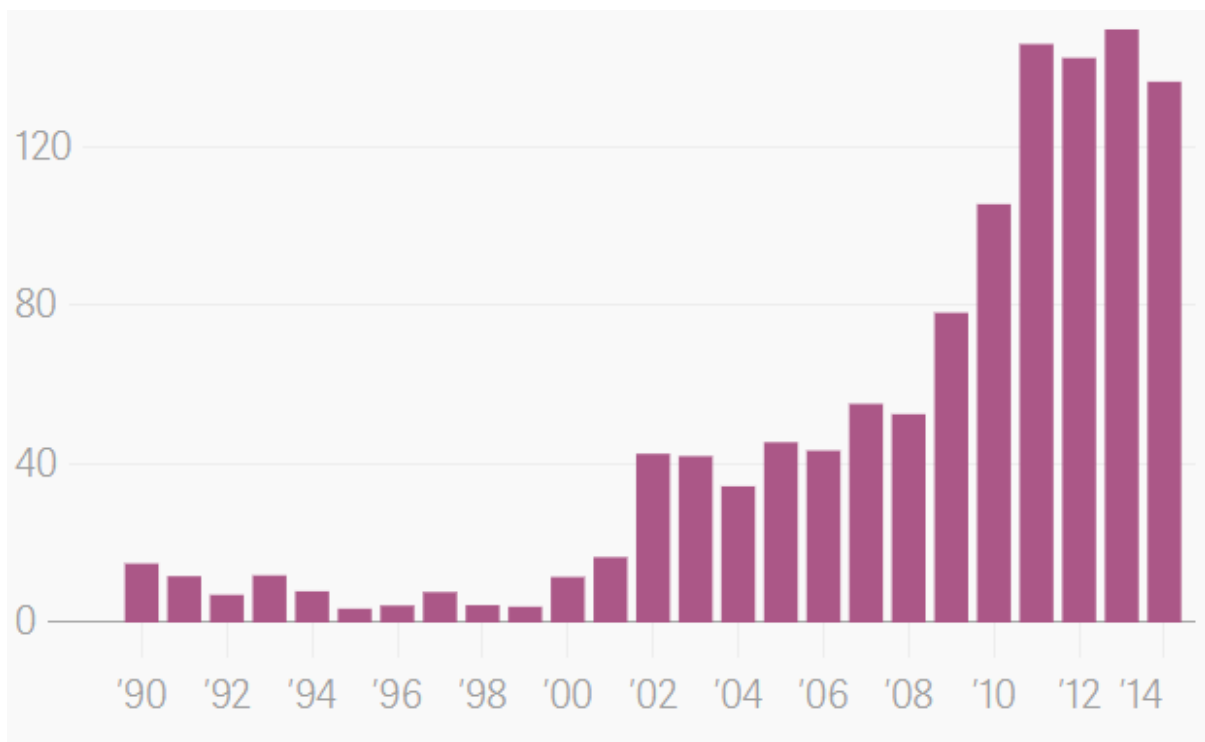
Figure 7 displays the number of apprehensions of unauthorized immigrants attempting to cross the United States-Mexico border by U.S. Border Control from the 2016 through 2017. Figure 8 shows the

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number of remains recovered per 100,000 border apprehensions at the Arizona-Mexico border from 1990 to 2016. While border apprehensions have decreased significantly in the last year, the number of border deaths as a proportion of those apprehensions has increased significantly in the last 5 years. However, the increase in number of remains discovered occurred before the sharp decrease in border apprehensions. These trends imply the dangers of crossing the border have increased and that roughly the same number of individuals are taking on those risks. As previously stated, the ways in which individuals cross the southern border into the United States have only become more dangerous. Increased border enforcement has meant that many individuals choose riskier routes to avoid apprehension. For many years, this increased security and risk did not appear to significantly deter border crossings, however, in the last year it appears as though this trend may have changed. It is helpful to note that the Trump administration came into power in January of 2017.

2.2   United States unemployment

In the United States, the unemployment rate is a representation of the number of individuals lacking employment as a percent of the overall labor force. An unemployed person is further defined as all individuals who are 16 years or older who are not employed but are available for work and were actively searching for a job during the past month (Bureau of Labor Statistics, 2016). For the purpose of this research, the unemployment rate will be considered a definitive representation of overall levels of unemployment that are measured in number of individuals.
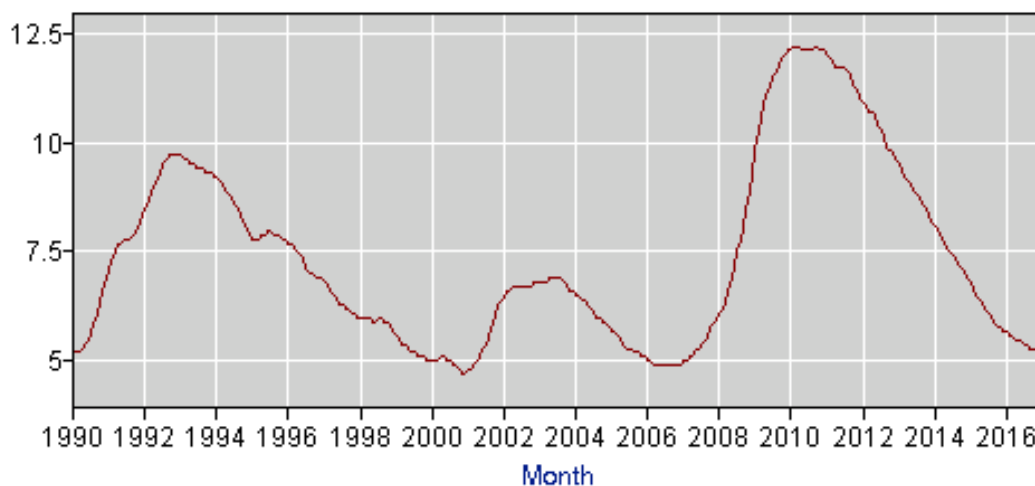
Figure 9: United States Unemployment Rate, 1990-March 2017
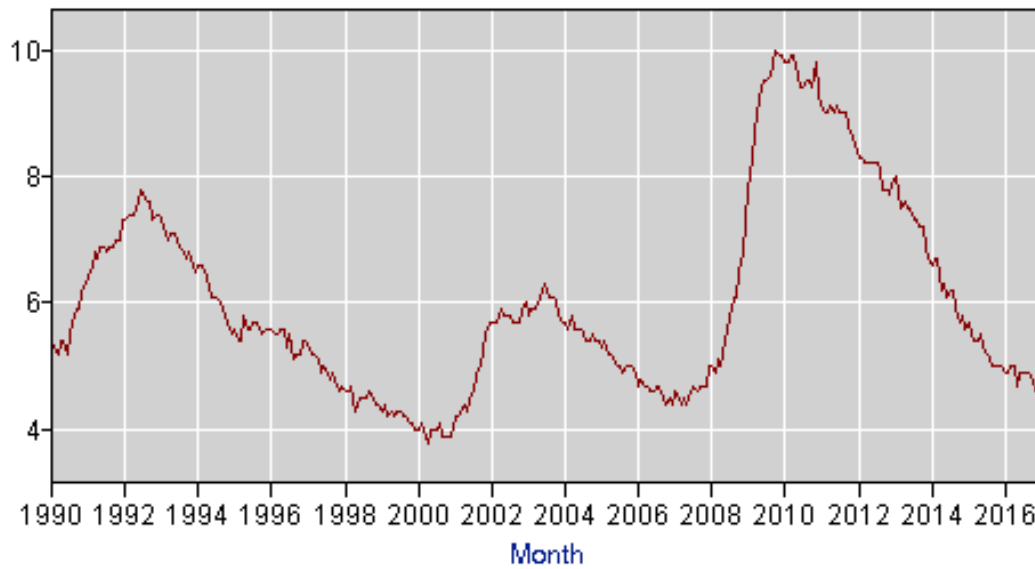
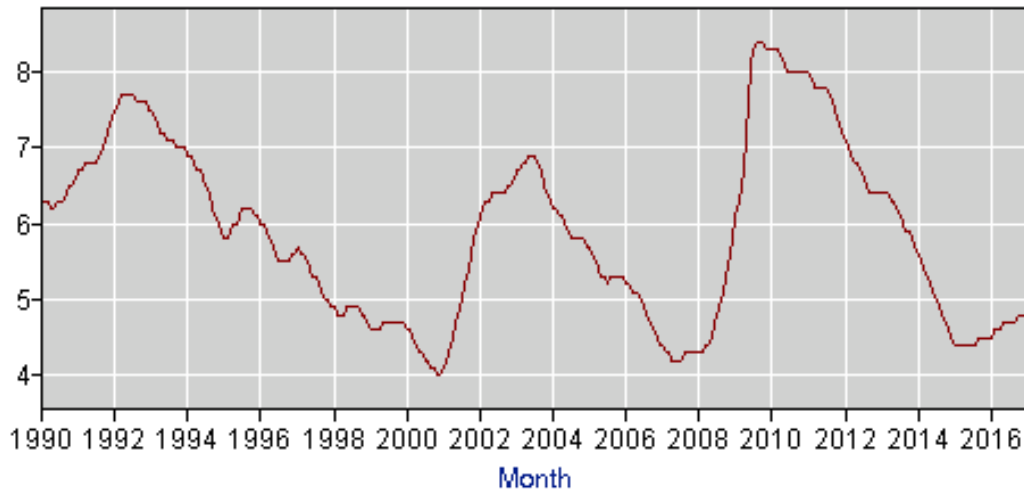Source: United States Bureau of Labor Statistics, (2017a)

Figure 9 exhibits the United States unemployment rate and how it has fluctuated between 1990 and present day, with its peak reaching ten percent in 2009 during the height of the United States' Great Recession (Bureau of Labor Statistics, 2017a). Since then it has stabilized around four-and-a-half percent and is considered to be at a pre-recession level.

Figure 10: California Unemployment Rate, 1990-March 2017

Source: United States Bureau of Labor Statistics, (2017b)

Figure 11: Texas Unemployment Rate, 1990-March 2017

Source: United States Bureau of Labor Statistics, (2017c)

Figures 10 and 11 show that in general California and Texas followed the national trend, however California suffered a higher unemployment rate and Texas experienced a lower unemployment rate during the Great Recession years, relative to the national unemployment rate (Bureau of Labor Statistics, 2017b) (Bureau of Labor Statistics, 2017c). To understand unemployment in relation to unauthorized immigrants, it is first important to understand how unauthorized immigrants fit into overall levels of employment within the United States.

Figure 12: Percentage of Immigrants Providing Labor in Various Industries
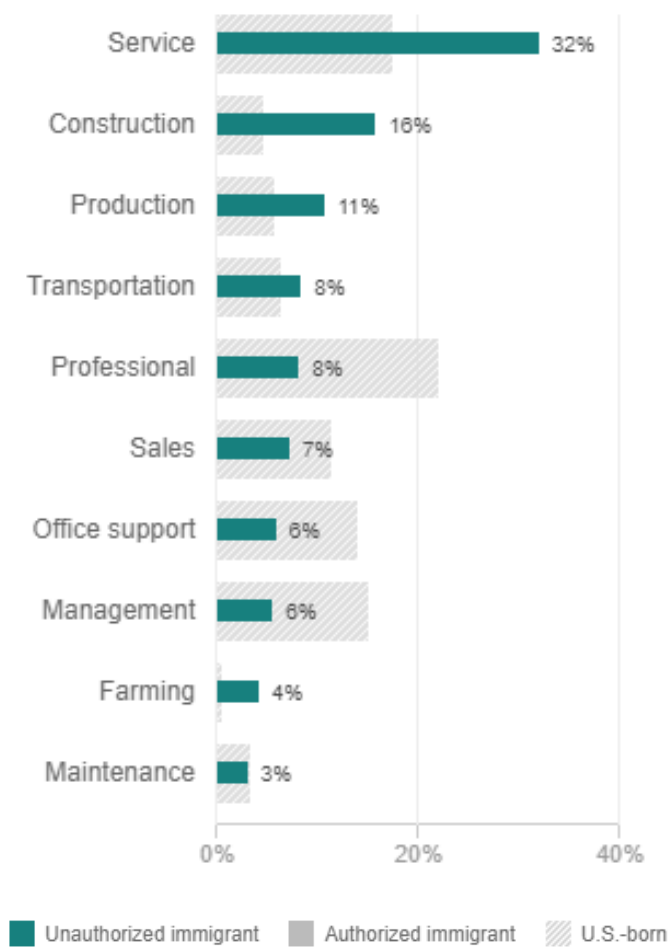
Source: Pew Research Center, (2017)

Figure 12 displays how many unauthorized immigrants are in various industries, as a percentage of all unauthorized immigrants. Note that authorized immigrants are not listed in figure 12. Almost one-third (32 percent) of all unauthorized immigrants rely on the service industry to earn an income while only 18 percent of native-born workers supply labor for the service industry. This trend can also be seen in the construction, production, transportation, and farming industries. These trends are especially important to understand in terms of the relationship between overall industry labor supply and unauthorized immigrant populations, especially in cases where unauthorized immigrants make up significant portions of the labor supply.

Figure 13: Percentage of Industry Labor Comprised of Unauthorized Immigrants
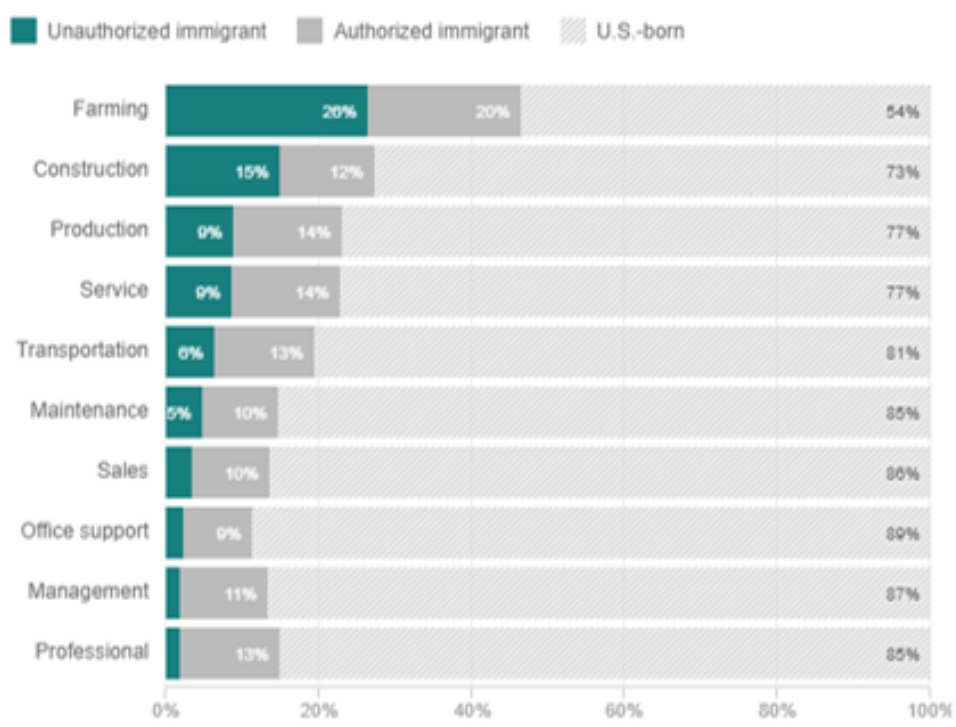
Source: Pew Research Center, (2017)

Figure 13 shows the percentage of labor supply comprised of unauthorized immigrants. This figure highlights how important unauthorized immigrant labor supply is, especially in farming, where unauthorized immigrants comprise over a quarter of the labor supply. Again, in this case, if this population were to disappear, labor supply problems could arise. It is clear from the above figure that if the United States were to witness mass deportation of unauthorized immigrants, the majority of jobs that would be vacated would be unskilled jobs. Whether or not this would benefit Americans in the end would depend on native workers' willingness to accept the vacated jobs at the prevailing market wage rate. If native workers were to accept the jobs at such a wage rate, the overall price level should stay relatively constant. However, if native workers were unwilling to accept such jobs, there would be a decrease in labor supply which would lead to upward pressure on wage rates to try to attract more labor. This increase in wage rates would eventually translate into a price level increase for all individuals residing within the United States. At the same time, these higher wages could actually create increases in unauthorized populations as the higher wages provide a greater incentive for immigrants to take on the risk deportation (Severe, 2017).

In addition, because unauthorized immigrants tend to spend almost all their income on consumption,

mass deportation would mean that a great number of individuals would no longer be boosting national GDP by consuming goods within the United States. Both the issue of willingness to accept jobs and decreases in consumption are addressed in section 3.

3 Past studies involving unauthorized immigrant workers in the United States

A major argument that has presented itself in the last few decades involves the use of immigrants, especially unauthorized immigrants, to supply unskilled labor in areas where native-born Americans do not desire to supply that specific type of labor. Huddle (1993) calls this unwanted labor "dirty work" (Huddle, 1993). The research work done by Huddle (1993) focused on Project Jobs, a 1982 experiment by the Immigration and Naturalization Service in which the Reagan administration deported thousands of unauthorized immigrants to create jobs during a time of economic recession within the United States. At the time, the United States was still feeling the negative effects of a 7% national unemployment rate and an even higher rate among young Hispanics and African-Americans who were unauthorized immigrants' largest competitors for jobs. The experiment aimed to measure the willingness of individuals to obtain "dirty jobs" usually held by unauthorized immigrants in three different areas in Houston, Texas.

Huddle (1993) notes multiple stories in which the jobs of illegal immigrants became occupied by resident individuals who then quickly quit, complaining that the danger or intensive labor that they were subjected to was not adequately compensated by their hourly wages. Nevertheless, Huddle (1993) concedes that based on the study approximately 80% of the vacated jobs were filled, at least initially by local citizens or legal immigrants, which could arguably be due to reporting of relatively high wages to attract needed labor. Regardless, Huddle (1993) uses this data to state that at least in the short-run, the deportation of illegal immigrants appeared to be an effective way to create jobs and decrease unemployment costs for the American taxpayer.

The effect of inflows of immigrants on the employment of natives is often cited when it comes to calls for immigration reform. Grossman (1982) established economic models to test the substitutability of native workers and immigrant workers in production industries (Grossman, 1982). The analysis showed that the short-run employment elasticity of increased immigrant inflows in relation to natives was -0.08

and the long-run employment elasticity was -0.10. In either case, the results of the paper implied that moderately large inflows of immigrants who may appear to be close substitutes to native workers, have little to no economic effect on native employment. Grossman (1982) admits that although the nationwide cross-price elasticity is small between immigrants and natives, this may be due to an initial unequal distribution of immigrants. For example, at first most immigrants settle in the southwest, however later, when second-generation natives settle in other regions within the United States, the substitutability becomes much stronger and more stable.

Others argue that it is the policies established in the host country's labor market that determines whether illegal immigrant workers are a burden or a benefit. Agiomirgianakis and Zervoyianni (2001) created a model based on a simple and small open economy to better understand the macroeconomic effects of illegal immigration on the host country's economy (Agiomirgianakis and Zervoyianni, 2001). They concluded that in economies that have stronger labor unions for skilled workers, an increase in illegal immigrants will increase native persons' welfare and have no effect on unemployment for native workers. Conversely, in economies that have weak or "soft" labor unions, increases in illegal immigrants will increase unemployment for native skilled workers and contribute to a lower level of social welfare for both native and immigrant workers. Agiomirgianakis and Zervoyianni (2001) argue that this helps to explain the differences in opinions we witness in various countries. For example, in some of the countries of southern Europe where trade unions are strong, citizens appear to be more accepting and tolerant of illegal immigrants than countries that have weaker labor union systems. This makes sense, as countries with stronger labor unions would presumably have more effective regulations that protect native workers in the presence of unauthorized immigrant labor.

The consequences or benefits of an increased inflow of illegal immigrants can have different effects on different groups of workers. Liu (2009) uses a dynamic general equilibrium model to examine the effect of illegal immigration on the U.S. labor market (Liu, 2009). In his model, native and illegal workers are imperfect substitutes competing for the same jobs in the same labor market. Through various models, Liu (2009) evaluated the effects of illegal immigration via changes in consumption and leisure as part of a utility function for either domestic households or illegal immigrant households. These effects are then extended to models that help to better understand changes in wage rates or employment for native workers.

Equation 1:

$$c^* = w^* s_2^{D^*} + (\rho - g)\frac{k^*}{1-m}\frac{\pi^*}{1-m}$$

Source: Liu, (2009)

In equation 1, c denotes consumption of each individual member of a household, w denotes the wage rate for domestic workers, $s_2^{D^*}$ denotes the fraction of members in a domestic household that are employed, ρ denotes the rate of time preference ($\rho > 0$), g denotes population growth rate (g > 0), m denotes population share of unauthorized immigrants, k denotes the per capita level of capital, and π denotes dividend income for domestic households.

Equation 2:

$$\frac{dc^*}{dm} = \left[\underbrace{w^* \frac{ds_2^{D^*}}{dm}}_{\text{the displacement effect (-)}} + \underbrace{s_2^{D^*} \frac{dw^*}{dm}}_{\text{the wage-depressing effect (-)}} \right] + \left[\underbrace{\frac{1}{1-m}\frac{d\pi^*}{dm} + \frac{\pi^*}{(1-m)^2}}_{\text{the exploitation effect (+)}} \right] +$$

$$\left[\underbrace{\frac{1}{1-m}(\rho - g)\frac{dk^*}{dm} + \left((\rho - g)\frac{k^*}{(1-m)^2}\right)}_{\text{the capital consumption effect (-)/(+)}} \right]$$

Source: Liu, (2009)

In equation 2, he differentiates with respect to m to evaluate each component in terms of instantaneous rates of change.

In his model, the displacement effect and the wage-depressing effect represent the number of domestic individuals who are displaced from their job by unauthorized immigrants and the decrease in wage rate for domestic workers due to increased competition, respectively. Both effects are found to have negative effects on domestic consumption. The exploitation effect reflects the fact that the decreases in wages lead to increases in firm profit and therefore increases in dividend income for the domestic population. This effect on domestic consumption is positive. Finally, the capital consumption effect represents the idea that unauthorized immigrants do not contribute to the capital accumulation in their host country and therefore use output that could be utilized for additional domestic consumption. This effect could either have a positive or a negative effect on domestic consumption. It could be negative if unauthorized immigrants use capital that could have been used for investment, but it could be positive because, ceteris paribus, each domestic consumer would have a larger share of capital stock. Liu (2009) finds that while these results may be negative in the short run, the positive effects eventually overpower the negative

effects in the long run.

At the end of his research, Liu (2009) concluded that with an increase in the long run, illegal immigration supports a welfare increase and therefore a higher wage and lower unemployment for skilled domestic labor. However, he also conceded that increases in illegal immigration harm unskilled workers in the same labor market in the short run as it lowers their wage and increases their unemployment.

4 Labor force data involving unauthorized populations in California and Texas

The California and Texas unemployment data collected for this research was obtained from the United States Bureau of Labor Statistics and is based on the years 1990 to 2014. Data for 2013 unauthorized immigrant populations was not available and therefore this year was omitted from the final data set. Data on unauthorized immigrant populations come from annual estimations created by the United States Department of Homeland Security. These estimates are based on the population of unauthorized immigrants who are currently applying for legal residency but are, in the meantime, considered to be within the United States unlawfully. Because of the nature of the estimates, one can assume that the true unauthorized immigrant population is larger than the numbers within this data set.

The nature of the estimates is important to note, as there are inherent conflicts with the ways in which the Department of Homeland Security collects its data on unauthorized immigrant populations. Research done by Mark Hugo Lopez and Ana Gonzalez-Barrera focused on rates of naturalization by Latin American immigrants relative to other unauthorized populations (Gonzalez-Barrera and Lopez, 2013). In 2012, a survey was conducted by the pair as part of the Pew Hispanic Center and it revealed that roughly 93 percent of undocumented Hispanic immigrants desire to become citizens of the United States. However, the research showed that only about 46 percent of immigrants who are eligible to become naturalized citizens have done so, compared to a 71 percent naturalization rate for other groups of immigrants who are not Hispanic. Specifically, Mexican immigrants face the lowest naturalization rates at about 36 percent. These low rates can mostly be attributed to the prohibitive cost of paying for the application process and an immigration lawyer. Nevertheless, the prohibitive nature of the application process can complicate the data by making estimates of the unauthorized population much lower than

the true number of unauthorized immigrants residing in each state. However, this is the only reliable data collected by any federal or state government because, in the end, the unauthorized immigrant population is here without the proper legal permissions and therefore have little incentive to make themselves known to any government entity.

In both models within this research paper, the unauthorized population and unemployment data are measured in whole numbers representing individuals.

5 Regression models for unauthorized immigrants and unemployment

5.1 OLS Time Series Regression Model

This research uses a multivariate time series regression model for unauthorized populations residing in the states of Texas and California, regressing the number of unauthorized immigrants from 1990 to 2014 (2013 data omitted) onto the number of unemployed, labor force, United States GDP growth, United States population growth, and time. β_0 is constant and u is the error term of the model.
Equation 3:

$$ue = \beta_0 + \beta_1 uapop + \beta_2 lf + \beta_3 usgdpgr + \beta_4 uspopgr + \beta_5 time + u$$

Source: Author

In equation 3, *ue* represents total unemployment in the states of California and Texas, measured in number of individuals, *uapop* represents unauthorized immigrant populations residing in the states of California and Texas, measured in number of individuals, *lf* represents total number of individuals in the labor force in the states of California and Texas, measured in number of individuals, *usgdpgr* represents United States gross domestic product (GDP) growth as an annual percentage, *uspopgr* represents United States population growth as an annual percentage, and *time* represents each year from 1990 to 2014 and is used as a control for correlated trends over time. Labor force measurements were included to account for general fluctuations in labor force participation and unemployment rates. GDP growth is included to reflect overall economic health by accounting for cyclical economic changes that may affect unemployment within the United States. Population growth changes are included to control for changes in overall population that may cause fluctuations in labor demand and supply. Finally, as stated previously,

time is included to ensure that trends correlated with time are accounted for within the model.

In this case, the null hypothesis is that β_1, the coefficient for *uapop*, equals zero, meaning that changes in the unauthorized population have no effect on levels of unemployment in the southwestern United States. If in the end the null hypothesis is rejected, it would follow that changes in the unauthorized population do impact levels of unemployment in the region.

5.2 Regression with State Dummy Variable

In addition to the base regression model, a regression was performed with a dummy variable for state (Texas or California). The dummy variables were added to account for any unique characteristics of each state. For example, if Texas were to have a much more conservative approach to fiscal labor policy, the state may experience a level of unemployment that reflects that. In that case, the level of unemployment may be correlated to the state and its fiscal policies more than fluctuations in unauthorized populations and this effect may not be accounted for in a model that contains both states.

5.3 Newey-West Lagged Time Series Regression

A prominent concern regarding this data is that the variables are serially correlated over time. Serial correlation creates significant problems in OLS regressions because it implies a lack of both homoskedasticity and serially uncorrelated errors. The Gauss Markov Theorem requires the presence both of those components in order for the OLS coefficients to be considered the best linear unbiased estimator. In other words, if this data were found to be serially correlated, the OLS standard errors and test statistics would not be considered valid (Wooldridge, 2000). The Newey-West standard errors method works to correct heteroskedasticity and arbitrary forms of serial correlation with larger sample sizes.

The idea is that as $|t-t'|$, the distance between two time periods, increases, $\sigma_{|t-t'|} \to 0$, meaning that the covariance of the parameters over time approaches zero. Through this process, the lags (L) 1, 2, 3, 4, and 5 were chosen and it was then assumed that $\sigma_{|t-t'|} \approx 0$ for all $|t-t'| > L$. In the end, this regression is performed to analyze whether or not any of the beta values lose significance once heteroskedasticity and serial correlation are accounted for and corrected.

6 Analysis of results from multivariate time series regression

6.1 Results from OLS Time Series Regression

A time series regression was computed for the Southwest United States (the states of California and Texas).

Table 3: Multivariate Time Series Regression Output

	(1)
	ue
uapop	-1.156***
	(0.224)
lf	0.346***
	(0.0495)
usgdpgr	2247.9
	(21201.2)
uspopgr	17105.0
	(494441.7)
time	34156.6*
	(14700.7)
_cons	-70021450.6*
	(29934775.6)
N	48
R^2	0.746

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author, Stata

The multivariate time series regression is displayed in table 3. In this model, changes in levels of unemployment were regressed onto unauthorized populations for the years 1990-2014 (2013 data omitted).

Equation 4:

$$\widehat{ue} = 7.00 \times 10^7 - 1.1556uapop + 0.3464lf + 2247.93usgdpgr + 17105.01uspopgr + 34156.64time$$

Source: Author

Equation 4 expresses the results from the above regression output in table 3.

To begin, the overall fit of the model can be interpreted via the R-squared value which is about 0.746, meaning that almost three-quarters of the variance in the dependent variable (unemployment) can be explained by the independent variables.

The main hypothesis of this research aims to better understand if the relationship between *uapop* and *ue* is significant enough to come to any meaningful conclusions. Based on the preceding regression output in table 4, a one person increase in the region's unauthorized population leads to a 1.1556 person decrease in the region's unemployed population. For the p-value test, the null hypothesis will be rejected if $p < \alpha$. From the Stata regression output, $p - value = 0.000$, which is less than $\alpha = 0.01$ and therefore we reject the null hypothesis and conclude that the result is significant at the 1 percent significance level.

Based on the p-value test, the impact of *uapop* on *ue* is conclusively significant at the 1 percent significance level. A 1.1556 person decrease in the region's unemployed population for every 1 person increase in the unauthorized population is a significant finding of this research. This reveals an impact greater than one individual, meaning that this result would be multiplied throughout the entire economy. This shows that increases in unauthorized populations lead to less unemployment for the general population, implying that unauthorized immigrants are not definitively taking the jobs of native workers but are perhaps instead promoting the overall expansion of employment for all individuals. This conclusion aligns well with previous research discussed in section 3 and the reasoning discussed in section 6.4. This impact is especially important when it comes to addressing current policies that discourage immigration from Latin American countries. Based on the results of this regression, immigration should be promoted as a way of encouraging decreases in overall levels of unemployment in the Southwestern states.

As a note separate from the main model, the data for the unauthorized population is assumed to be an underestimation of the true number of unauthorized immigrants residing within the states of Texas and California. To model the problems associated with this lack of data, we can assume that there exist two variables representing unauthorized populations: *uapop1* which represents the unauthorized population within the data set that is currently applying for legal residency and *uapop2* which represents the

unauthorized population not counted within the data set. The omitted variable bias formula is utilized to express the relationship between the original variable for *uapop* and the omitted variable.

Equation 5: True Model for Omitted Variable Bias

$$ue = \beta_0 + \beta_1 uapop1 + \beta_2 uapop2 + u$$

Equation 5 represents the true, hypothetical model in which the omitted variables are included. In this model, all other x_1 variables are omitted to maintain clarity.

Equation 6: Estimate for Omitted Variable Bias

$$ue = \beta_0 + \beta_1 uapop + v$$

Equation 6 represents the estimate that is being utilized in the analysis of the data for this research. In this estimate, the second variable is omitted, presumably causing some level of bias.

Equation 7: Omitted Variable Bias Formula

$$OVB = \frac{\beta_2(uapop1, uapop2)}{var(uapop1)}$$

Source: Wooldridge (2000)

Equation 7 represents the omitted variable bias formula that displays the relationship in covariance between the included and omitted variable. It can be assumed that the covariance between *uapop1* and *uapop2* is positive, as in general, increases in those who are seeking residence without the proper documentation varies consistently with increases in those who are seeking the proper documentation for residency within the United States. However, the sign for the coefficient of β_2 is unknown and therefore the overall effect cannot be definitively determined. It is expected that β_2 would be negative because the included unauthorized immigrants and the omitted unauthorized immigrants are likely to impact their local labor markets in the same way. Based on the assumption that β_2 is negative and the assumption that the covariance between the two groups is positive, it can be assumed that the overall omitted variable bias is negative. In the end, the overall effect of omitting this variable is expected to be an overestimation of the magnitude of the effect of the changes in unauthorized population on unemployment levels. For example, if the larger unauthorized population were to be included, it is plausible that a 1 person increase in said unauthorized population would lead to a smaller than 1.1556 decrease in unemployment. Nevertheless, while the magnitude of this variable may change, it is highly probable that this relationship would still be negative.

For the remaining independent variables, the results show that a one person increase in labor force (lf) leads to a 0.3464 person increase in the unemployed population. In other words, a three person increase in the labor force leads to one more unemployed individual. This result is showing that as the labor force grows, unemployment may grow steadily with it as a natural process within the economy. It is important to note that this is a change in labor force holding all other included variables constant. In the context of this model, this means that as labor force is increasing, GDP is staying constant and therefore, it would make sense that unemployment would be rising. This result was found to be significant at the 1 percent level with a p-value $p-value = 0.000$.

Next, the output reveals that a one percent increase in United States GDP growth ($usgdpgr$) leads to approximately a 2,247 person increase in the unemployed population within the southwestern states of Texas and California. At first glance, this may appear to be counter-intuitive. The relationship between unemployment and the growth of the economy rely on the relationship between the real growth rate of the economy and its potential growth rate. Based on Okun's Law, the real growth rate of an economy must exceed its potential growth rate to induce reductions in unemployment (Wen and Chen, 2012). Based on this model, it would be unwise for any real conclusions to be drawn from this relationship between United States GDP growth and unemployment. In any case, the effect of this variable is extremely insignificant with $p-value = 0.916$.

Also, the regression output shows a one percent increase in United States population growth ($uspopgr$) leads to a 17,105 person increase in the unemployed population within the southwestern states of Texas and California. This result is most likely reflective of the fact that changes in population are not necessarily significant when labor force is being held constant. This result is highly insignificant with $p-value = 0.973$.

Finally, the results in table 3 show that for every year that passes (represented by $time$) there is a 34,156.63 person increase in unemployment. Again, this result is most likely because of the natural fluctuations in unemployment over time and the difference between levels of unemployment for the states of Texas and California as compared to those of the entire United States. At the same time, this result could also be due to the recession taking place near the end of the time frame of this research.

6.2 Results from Regression with State Dummy Variable

A second time series regression was computed for the same region (California and Texas) with a dummy variable included for state.

Table 4: Regression with State Dummy Variable Output

	(1)	(2)
	Base Model	Dummy Model
uapop	-1.156***	-1.125***
	(0.224)	(0.220)
lf	0.346***	0.00402
	(0.0495)	(0.203)
usgdpgr	2247.9	-4905.9
	(21201.2)	(21110.7)
uspopgr	17105.0	-176991.5
	(494441.7)	(495616.1)
time	34156.6*	87094.0*
	(14700.7)	(33630.9)
cali		2088204.4
		(1199655.1)
_cons	-70021450.6*	-172176514.6*
	(29934775.6)	(65566483.5)
N	48	48
R^2	0.746	0.763

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author, Stata

Table 4 shows regression output for the base model and the models containing dummy variables for

California and Texas. The coefficient for *uapop* shows a decrease in magnitude but no sign change as well as no change in level of significance. The output for the dummy variable *cali* reflects the fact that California has a much higher number of unemployed individuals than Texas. Nevertheless, it is important to note how close the estimates are for *uapop* within both models. Based on this, it appears that there are no significant omitted variables correlated to a specific state that may be skewing the data.

6.3   Results from Newey-West Lagged Time Series Regression

A third time series regression was performed utilizing the Newey-West method for correcting for heteroskedasticity and arbitrary serial correlation.

Table 5: Newey-West Lagged Time Series Regression Output

	(1)	(2)	(3)	(4)	(5)	(6)
	Base	Lag(1)	Lag(2)	Lag(3)	Lag(4)	Lag(5)
uapop	-1.156***	-1.156**	-1.156**	-1.156**	-1.156**	-1.156**
	(0.000)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)
lf	0.346***	0.346***	0.346***	0.346***	0.346***	0.346***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
usgdpgr	2247.9	2247.9	2247.9	2247.9	2247.9	2247.9
	(0.916)	(0.906)	(0.902)	(0.900)	(0.897)	(0.899)
uspopgr	17105.0	17105.0	17105.0	17105.0	17105.0	17105.0
	(0.973)	(0.980)	(0.980)	(0.980)	(0.981)	(0.981)
time	34156.6*	34156.6	34156.6	34156.6	34156.6	34156.6
	(0.025)	(0.082)	(0.083)	(0.083)	(0.079)	(0.076)
_cons	-70021450.6*	-70021450.6	-70021450.6	-70021450.6	-70021450.6	-70021450.6
	(0.024)	(0.079)	(0.079)	(0.080)	(0.076)	(0.073)
N	48	48	48	48	48	48
F	24.61	11.97	10.49	10.74	12.10	14.23
df_m	5	5	5	5	5	5
df_r	42	42	42	42	42	42

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author, Stata

The output from table 5 highlights the effects of a series of five lags in the error term on the time series data in comparison to the base model regression. In other words, the error term in time t is allowed to be correlated with the error term in up to the last five years. For example, column one of table 5 allows for one lag in the error term, column two allows for two lags in the error term, and so on. The variable *uapop* loses some significance after the first lag meaning that there is some form of correlation among the

variables over time. In this case, the other variables do not lose a large amount of significance and in fact, still remain statistically significant at the 1% significance level. Based on this, the serial correlation is not strong enough to cause meaningful losses in significance in the original parameter estimates, meaning that the base model regression results are still compelling sources of information.

6.4 Analysis of Trends in Time Series Data

Figure 14: Unemployment and Unauthorized Immigration in California and Texas
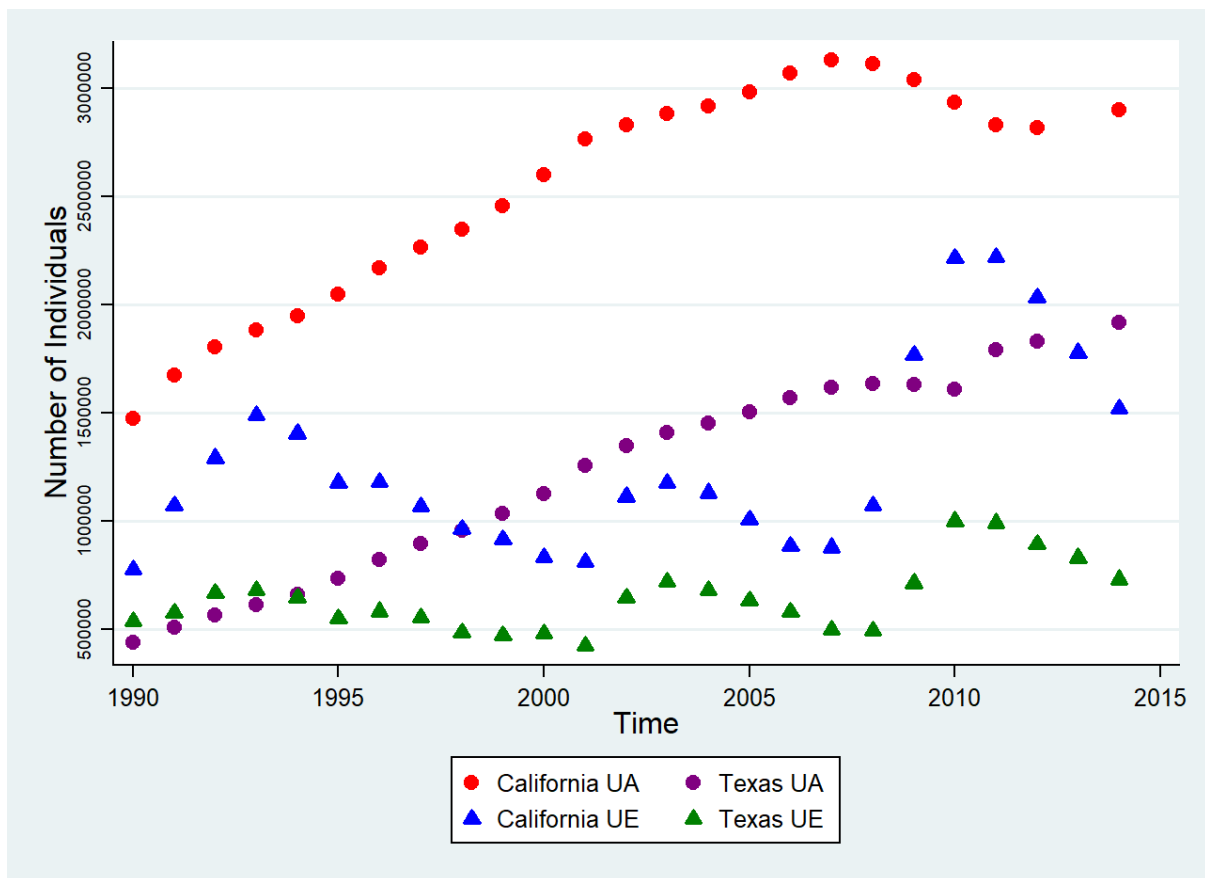
Source: Author, Stata

Figure 14 shows trends in unemployment and unauthorized populations for the region. The split lines reflect the differences in data between the states of California and Texas, where the state of California has both a higher level of unemployment and a larger unauthorized population mostly due to its overall larger population.

Based on this graph, increases in unemployment do not necessarily follow increases in unauthorized populations. In fact, it appears that unauthorized population levels reach a peak during unemployment peaks and then either stagnate or decrease. However, the graph does show that unauthorized immigrant

populations appear to react to the overall economic health of the United States. For example, during and after the Great Recession of 2008-2009, unauthorized immigrant populations appear to have decreased, presumably due to the overall lack of employment. Also, from 1993 to the early 2000s we see distinct decreases in unemployment, reflecting a healthy and expanding economy. During this time, we also see steady increases in unauthorized populations, meaning that not only were unauthorized immigrant populations growing but so were the number of available jobs.

To further expand, we can see that unemployment reached a peak for both California and Texas during the 2008-2009 Great Recession. Starting around 2006 unemployment levels begin to rise and by 2008 unauthorized populations begin to decrease, presumably in response to the lack of employment in the two states. In addition, the graph shows that changes in unauthorized populations follow changes in levels of unemployment. This reiterates the idea that unauthorized immigrants are responding to changes in levels of unemployment instead of levels of unemployment responding to changes in unauthorized populations. In other words, this means that unauthorized immigrants are arriving and taking jobs that are readily available and when these jobs begin to disappear, they are deciding to leave rather than staying and attempting to take what jobs remain. Current political commentary would argue that these unauthorized immigrants arrive and cause high levels of unemployment in these regions however, these results prove that, those arguments are simply not founded on facts.

A general trend in which larger unauthorized populations lead to lower unemployment may be due to the nature of the work that undocumented immigrants are able to accept. For example, many undocumented immigrants only accept work which is labor intensive and unwanted by native workers and because of this, we may see a trend in which native workers are transferring to other industries and undocumented immigrants are just filling the gaps. There may be a larger industry trend in which new industries are being developed and therefore need more native workers.

For the next part of my research, I compared the fluctuations in unemployment and unauthorized populations for each state in two different ways. First, I solely compared the two variables for California and then for Texas.

Figure 15: Unemployment and the Unauthorized Population in California from 1990-2014
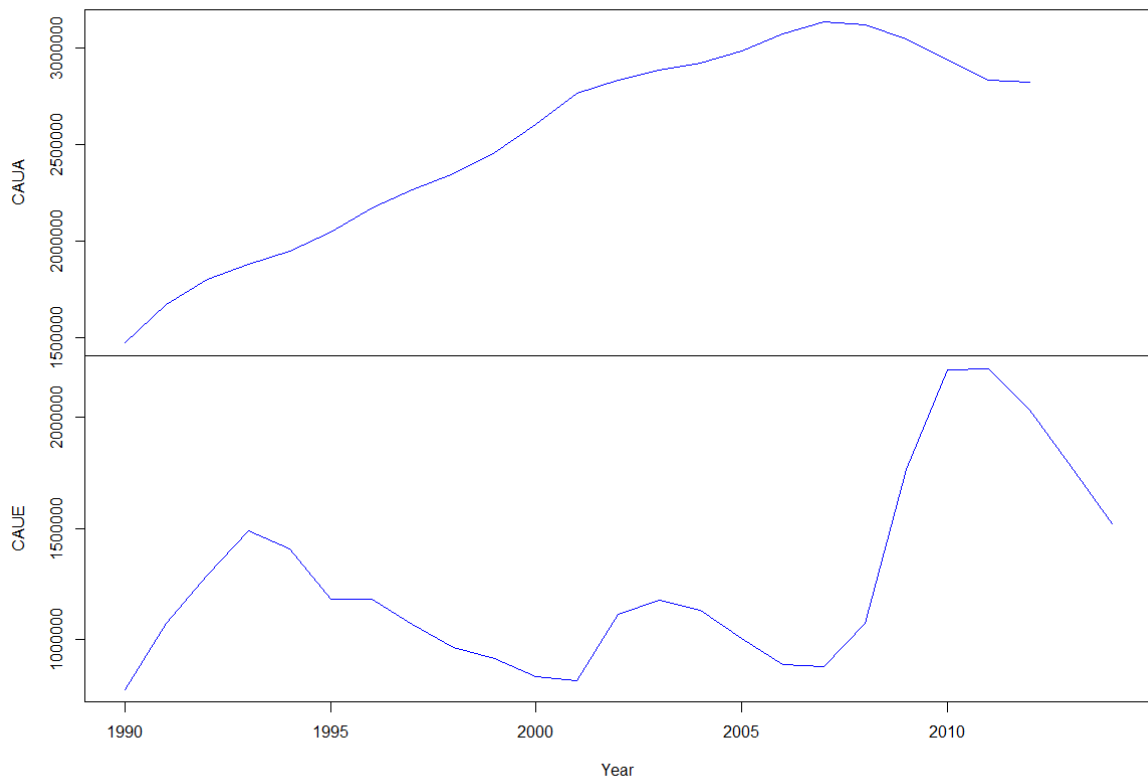
Source: Author, R

Figure 15 displays time series data for the unauthorized population within California as well as fluctuations in California unemployment for the years 1990 through 2014 (2013 unauthorized population data omitted). The level of unemployment is much more volatile over this period when compared to the steady growth of the unauthorized population. What is important to note about the data displayed in this figure is the steady increase in unauthorized immigrants during times of low unemployment. It appears that the unauthorized population within California levels out at the height of the Great Recession within the United States, when unemployment was at its highest. This is to be expected as immigrants have more economic incentive to migrate to the United States when there are more jobs available which would be times in which unemployment is low.

Figure 16: Unemployment and the Unauthorized Population in Texas from 1990-2014
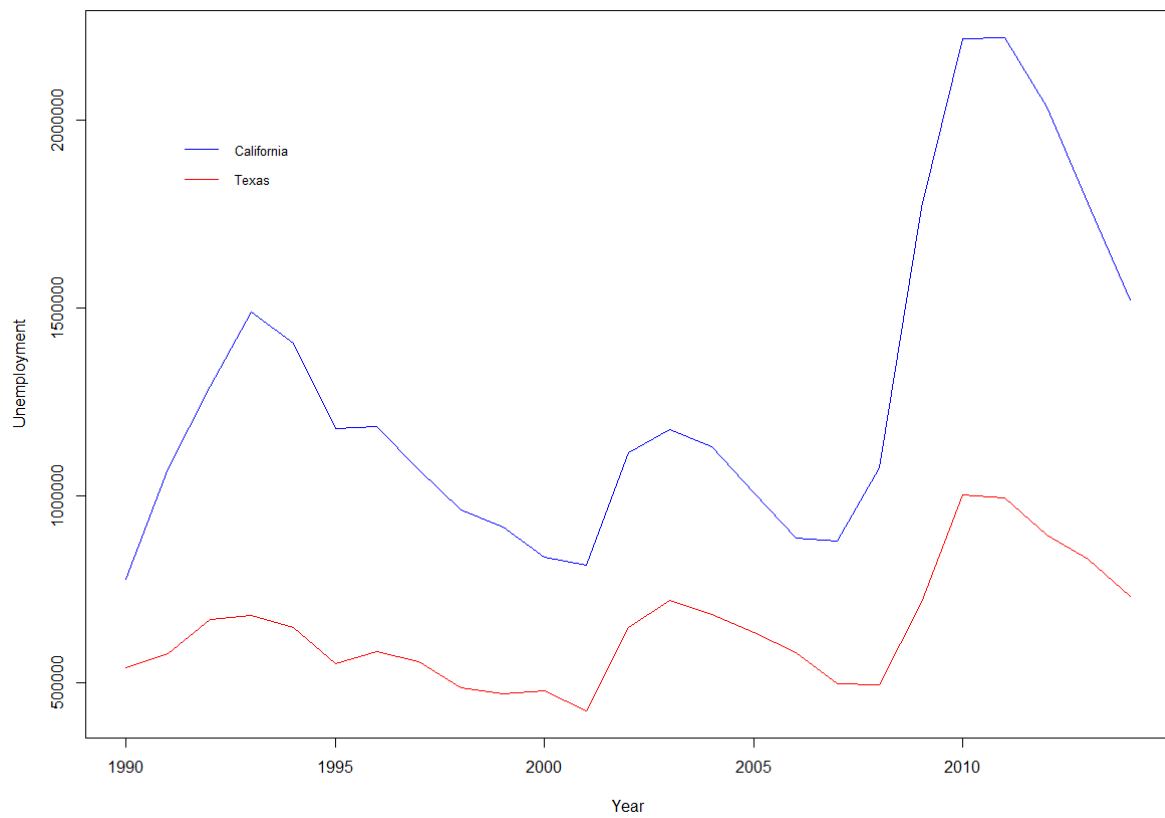

Source: Author, R

Much like figure 15, figure 16 displays the time series data for the unauthorized population and unemployment within Texas for the years 1990 through 2014 (2013 unauthorized population data omitted). Again, unemployment seems to fluctuate much more than the unauthorized population and appears to begin to become more level and even decrease during the peak of the 2009 economic recession in the United States.

While the number of unauthorized immigrants in the United States does not change dramatically when unemployment fluctuates, this is probably due to the inelasticity of the supply of immigrants within the United States. What is meant by this is that levels of unemployment can change much more quickly than immigrants can decide to move in or out of the country. What would be most interesting to see would be if unauthorized populations are affected by high amounts of unemployment that are sustained over long periods of time.
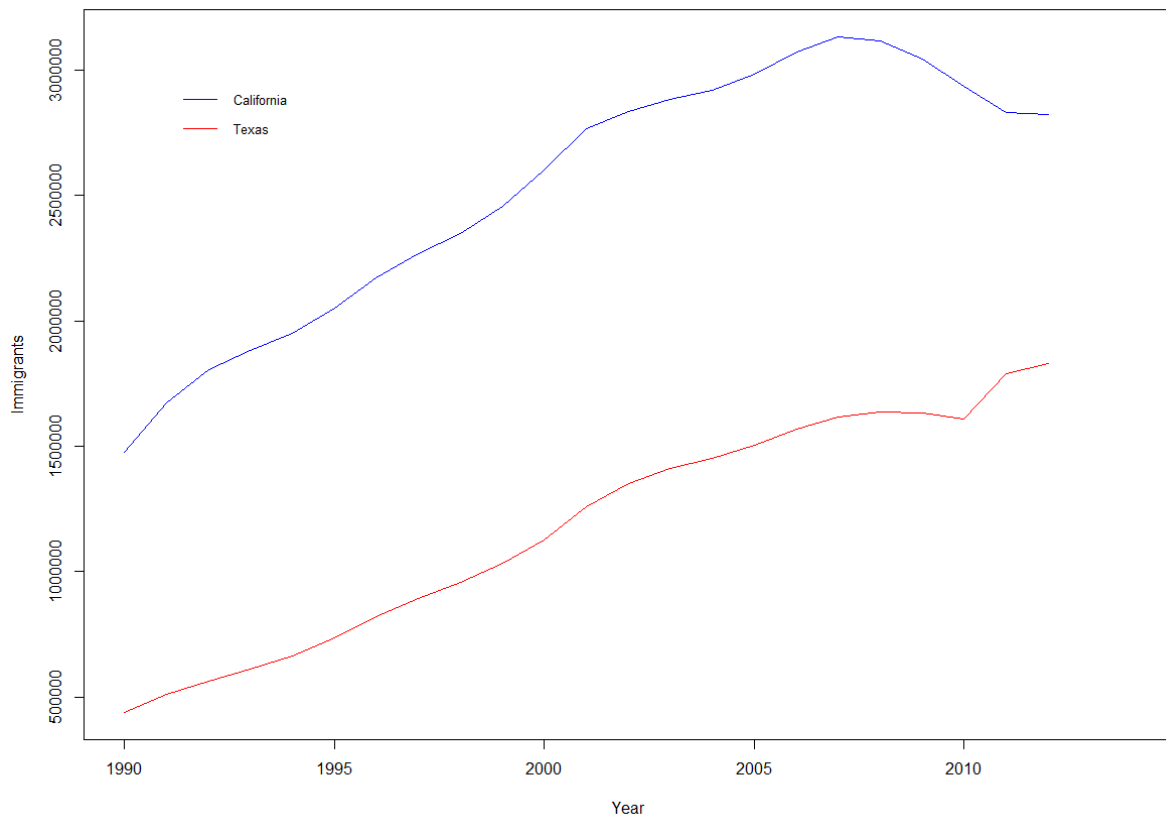
Next, I looked at the separate variables with respect to each state to better understand how similar the data from the two states was over time.

Figure 17: Unemployment in California and Texas, 1990-2014

Source: Author, R

Figure 18: Unauthorized Immigrants in California and Texas, 1990-2014

Source: Author, R

Figures 17 and 18 show the trend of unemployment and unauthorized immigrants in the states of California and Texas from 1990 to 2014. In general, it appears that unemployment in California tends to be higher than unemployment in Texas which aligns with the national trends that were referenced earlier in this paper. In addition, unemployment fluctuated much more than the unauthorized population in both states during this period. Unauthorized populations grow steadily for both California and Texas and it is important to note that for both states, unauthorized populations have appeared to level out around the time of the Great Recession in the United States, when unemployment was at its highest. The one main difference between the two states' unauthorized population trends is that during 2008-2009, California witnesses the beginning of a decrease in its illegal immigrant population, while Texas still appears to be leveling out.

Additionally, it is interesting to note that California not only experiences higher levels of unemployment, but also larger unauthorized populations. This seems counter intuitive, as lower unemployment rates (and therefore higher employment) tends to incentivize individuals to immigrate into the United

States. This may be due to the geographical placement of California or more likely the abundance of large cities with established Hispanic communities for immigrants to integrate themselves into. At the same time, there is sometimes more work available for unauthorized immigrants in larger cities. Arguably the most probable reason is that illegal immigrants are more willingly accept low paying jobs than native workers. In this case, the quantity of labor demanded for illegal immigrants may increase because employers prefer to hire them because they can increase profits by choosing labor that corresponds to lower wage rates. In turn, with an increase in labor demand, we should eventually see an increase in labor supply as the labor market adjusts.

7 Conclusion

Many other researchers have completed successful work that investigates the relationship between immigrant populations and the labor market within the United States. The specific relationship between unemployment and unauthorized immigrants is important to understand due to the nature of the employment that immigrants accept. If further research into this topic was conducted, it would be interesting to focus on industry-level labor supply and demand changes in response to changes in unauthorized populations. Unauthorized immigrant populations tend to supply specific types of labor based on education level and therefore influxes of unauthorized immigrants may affect specific industries in significant ways. In general, the most likely case is that immigrants affect labor markets at first, but as dispersion occurs naturally over time, the effect becomes much less significant.

My research aligns well with previous research that had been conducted. It appears that unauthorized immigration from Central America has a negative effect on unemployment within the southwest United States, meaning that increases in unauthorized immigration lead to decreases in unemployment. In other words, the data shows that increases in unauthorized immigration from Central American countries benefit native workers by promoting employment for all workers residing within the United States. This may be because unauthorized immigrants are accepting jobs that most other native workers do not desire which in turn increases the overall welfare of more skilled workers. Regardless, my research and prior research shows that unauthorized immigrants are not flooding the labor market and causing significant losses in the employment of native workers who have a job or are desiring a job. Fluctuations in unemployment in the last two decades cannot be wholly attributed to changes in unauthorized immigrant

populations. Changes in employment levels have much more to do with economic cycles and structural employment cycles than immigration in general. With that being said, immigrant populations may sometimes contribute to short-term negative effects at the micro-level, but these negative effects are often diminished in the long-run.

As our country moves further away from agricultural work, it will be interesting to see if immigrants, documented or undocumented, start to integrate themselves into other industries within the southwest or even more skilled industries nationally. When labor demand changes, the supply will change in turn and there very well may be a shift in the amount or type of unauthorized immigrants we receive from Central America. Either way, the most efficient way to establish a stable labor economy, even in the presence of immigration, is to create a system in which immigration is controlled and accessible for anyone who desires a better or more successful future.

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