UNIVERSITY OF CALIFORNIA, SAN DIEGO

Mexican Migration to the U.S.: Patterns and the Role of Remittances, Networks and Globalization

A Dissertation submitted in partial satisfaction of the Requirements for the degree Doctor of Philosophy

in

Economics

by

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The Dissertation of Jose Martinez Navarro is approved, and it is acceptable in quality and form for publication on microfilm:

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DEDICATION

I dedicate this dissertation and my degree to my wife Rosa and to my daughter Natalia. Without their help and support, completing the Ph.D. program would have been impossible. I would also like to dedicate my degree to my parents, my brothers and sisters and to God.

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ABSTRACT OF THE DISSERTATION

Mexican Migration to the U.S.: Patterns and the Role of Remittances, Networks and Globalization

by

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The Mexican migration to the U.S. is a phenomenon that has been studied extensively in the literature. Lately, it has acquired particular attention in the media and has now become a permanent component of the political dialogue in the U.S. To understand this phenomenon, many authors have analyzed the magnitude and selectivity of migrants from Mexico to the U.S.,

and many others have investigated the determinants of the migration decision. However, there is still no clear agreement on the determinants, patterns and the magnitude of the Mexican migration to the U.S. phenomenon.

In this dissertation, I work to further the understanding on the topics of selectivity of migrants and the determinants of migration and to shed light on the causes for the lack of consensus in the literature. The first chapter follows the typical social capital approach to analyze the migration decision, but it also considers the impact of family remittances, a component that has been typically ignored when analyzing the migration decision. The main results show that both family remittances and migration networks promote migration abroad from poor rural communities in Mexico. The second chapter investigates why there are so many discrepancies on estimates of the magnitude and the selectivity of migrants from Mexico. This paper shows that such discrepancies result simply from the decision of what data source to use. As an alternative, this paper proposes the use of the Net Migration methodology to obtain estimates of the number of migrants, gender composition, age distribution and educational attainment. The main estimates obtained tend to fall between estimates that use U.S. data and estimates that use Mexican data. Finally, the third chapter analyzes several globalization measures taken by the Mexican government in the 1990s and their potential impact on the migration incidence. Contrary to the existing literature, this paper does not focus solely on the contribution of FDI, imports and

maquiladora exports to GDP to asses the impact of globalization on migration. It considers also the impact of other globalization measures that severely affected agricultural communities and find that these measures had a strong positive impact on migration.

Migration and Remittances in Poor Rural Communities in Mexico

Abstract

This paper analyzes data from PROGRESA, a Mexican government program aimed at improving the health, nutritional and educational conditions of people living in poor rural areas, to examine the role of municipality level migration networks and family remittances on the odds of having a household member migrate abroad. Once potential omitted variables biases in the two main variables of interest are addressed using an instrumental variables strategy, the results suggest that the extent of the migration networks and family remittances are both strong predictors of family migration decisions northward.

1.1 Introduction

Migration, and particularly illegal migration, has once again gained considerable attention in the U.S. Most emphasis is on the extent and the growing trend of the immigrant population living in the U.S. According to the 2000 U.S. census, more than 12 percent of individuals residing in the U.S., some 35 million, are foreign-born. Of this foreign-born population, 27 percent came from Mexico[1]. In terms of illegal migration, Passel (2005) claims that almost 30 percent of foreign-born individuals in the U.S. are unauthorized immigrants and almost 2/3 came from Mexico.

Figure 1.1 illustrates the trend of the Mexican-born population in the U.S. since the beginning of the last century, and it shows that the majority of the Mexican-born population came in the 1980-1999 period.

From the perspective of Mexico, the picture is even more dramatic. According to INEGI, the Mexican National Institute of Statistics, Geography and Information, the Mexican population residing in the U.S. has grown from 1.6 percent in 1970 to 5.9 percent in 1990 of the total population born in Mexico. In 2000, almost 1 in every 10 individuals born in Mexico resided in the U.S.

[1] U.S. Census figures are not adjusted for the potential undercount of illegal migrants. Constanzo et al, (2001) considers an undercount rate between 15 and 20 percent.

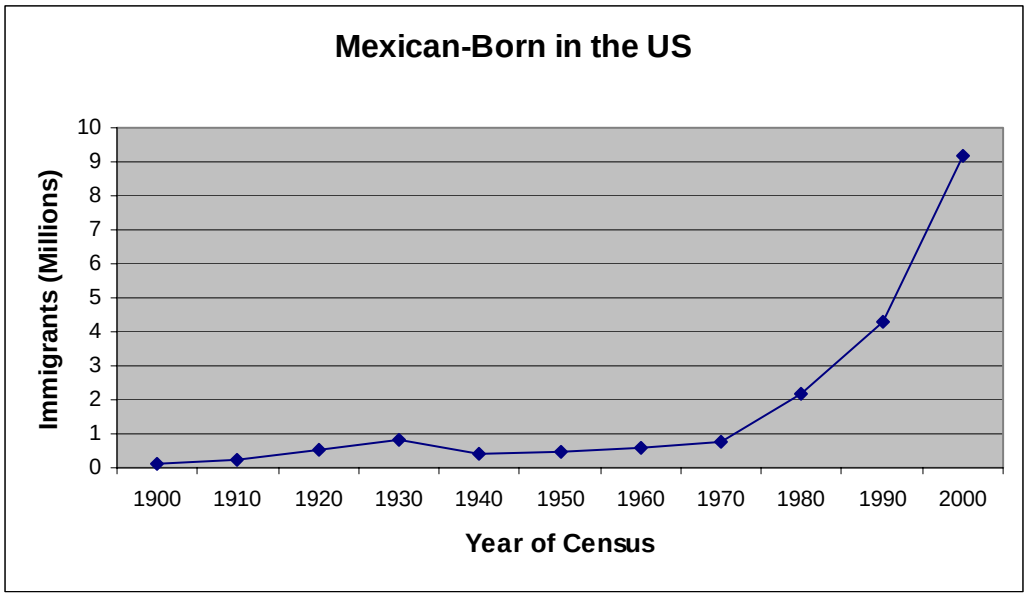

Figure 1.1 Stock of Mexican-Born in the U.S.
Source: U.S. Census Bureau

The money that Mexican-born individuals working in the U.S. send to their communities of origin, called remittances, is a topic that is intrinsically related to migration, and its recent growth rate has been as impressive: Figure 1.2 depicts the growth of family remittances in the last few years. It shows that Mexican households received more than sixteen billion dollars in remittances in 2004, a twenty-four percent increase over the previous year[2]. In 2005, remittances were more than twenty billion, surpassing foreign direct investment[3].

[2] These figures include estimates of by-hand transfers
[3] Sources: Remittances-Banco de Mexico, FDI-Mexico, Secretaria de Economia

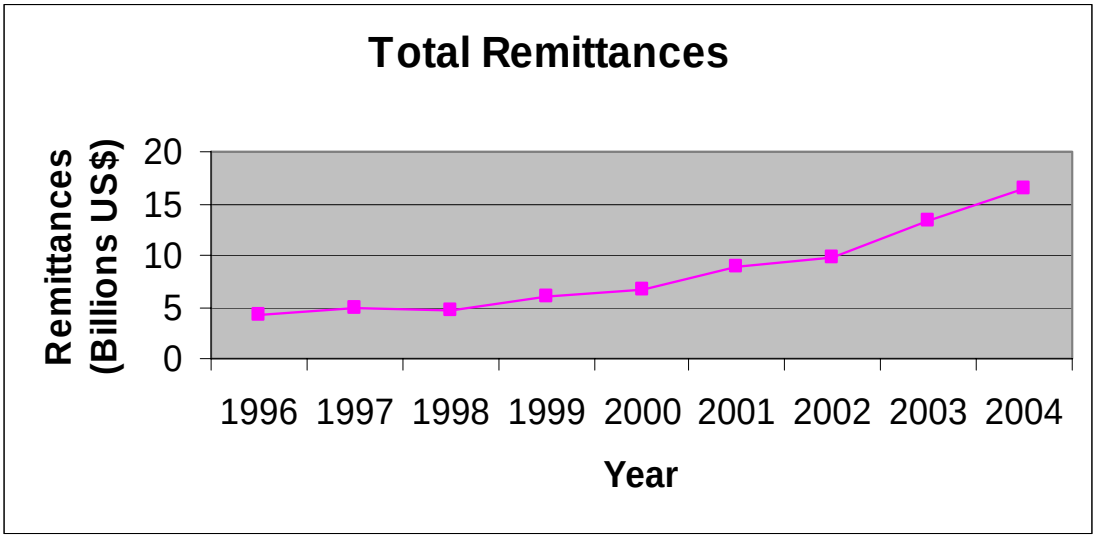

Figure 1.2 Remittances received in Mexico.
Source: Banco de Mexico.

Thanks in part to the magnitude of these figures, there is a vast literature on the Mexico to U.S. migration phenomenon and on the remittances Mexican-born individuals in the U.S. send to their communities of origin. On the remittances side, the literature has focused mainly on the effects remittances have on members of receiving households in Mexico and the conditions that affect the decision to remit. Most empirical studies have found positive effects of remittances on human capital, health outcomes, self-employment and entrepreneurship. For migration, a large part of the literature is based on the social capital theory, and it focuses on how having ties to a person with migration experience or living in a community with a high incidence of people with migration experience affects the odds of migration of others. A typical result in this literature suggests that having access to

migration networks significantly increases the probability of migration of others, and that the closer the tie to previous migrants, the greater the effect.

Some of these studies using remittances and social networks as explanatory variables have recognized that estimates of their effects might be biased by the presence of omitted variables that can be correlated with these effects, so they have resorted to the use of instruments. Munshi (2003), for example, investigates the effects of community of origin's network size on labor market outcomes in the U.S. The author acknowledges that network size effects might be biased due to the presence of shocks to the U.S. economy, for example, so he instruments for network size by using measures of rainfall in the community of origin in Mexico. In a similar way, Woodruff and Zenteno (2001) use historical migration rates to instrument for current migration stocks when analyzing micro-enterprises in Mexico.

Overall, not many studies in the social capital literature have considered concurrently the effects of social networks and the effects of family remittances on migration. This paper contributes to the literature on migration networks and remittances by investigating the effects of migration networks and family remittances on household migration decisions, while addressing potential omitted variables biases related to these two explanatory variables. This paper analyzes the effects of social networks, measured by the percentage of households in the community with a migrant to the U.S., and family remittances, measured by the percentage of households in the

community receiving remittances from abroad, on the odds of having a member of the household migrating abroad in the last twelve months[4]. Potential omitted variables biases related to these two variables are addressed by implementing an instrumental variables strategy. This strategy employs as instruments the distance from the municipality to the nearest stop in the main railroad line in 1900 and the presence of small savings and lending institutions called “Cajas”, the latter one not previously used in the literature. The IV results support the social capital theory of migration and present evidence that remittances promote migration abroad in poor rural areas in Mexico.

The layout of the rest of the paper is as follows. Section two presents the theoretical motivation for this paper and how it relates to the current literature on social networks and family remittances. In section three I develop the empirical strategy and describe the data. Section four presents the empirical results, and section five concludes.

1.2 Background

The theory of social capital or the “cumulative causation” of migration has focused mainly on the Mexico to U.S. migration phenomenon, and is based on the assumption that migration is a costly and risky enterprise. These costs are not only in terms of taking the actual trip northward, but also in terms

[4] I acknowledge that this approach that uses aggregated measures of migration and family remittances subsumes family effects of both of these measures.

of work and housing search. The risk comes in that any prospects of an economically successful experience are uncertain, not to mention the physical risks associated with crossing the border in dangerous ways. Therefore, any migration information gathered by prospective migrants has the potential to lower both costs and risks of migration. Once a person takes the trip northward, she acquires her own migration information through her experiences, and such information can later be diffused to her immediate family and the community as a whole. Consequently, the migration experience increases further the pool of available information to prospective migrants and lowers further the costs and risks associated with migration. In addition, potential migrants can benefit from having a migrant already established in the U.S. that can provide them with a place to stay once in the U.S. Taken all together, the social capital theory of migration present the Mexico to U.S. migration as a self-perpetuating phenomenon that feeds on itself and makes migration more prevalent throughout Mexico.

In terms of the empirical literature, the effects of migration networks have been tested both at the household and the community level (Massey and España (1987)). The typical specification estimated has the migration outcome as the dependent variable and the migration network variables among the explanatory variables. Massey and Espinosa (1997) tests for both family and community level migration network effects on the migration decision of household members. One of the main findings is that the strongest predictor of

taking the initial trip northward is the extent of the family level migration network. However, potential omitted variables biases in both family and community level networks are not addressed. The worry here is that there could be some unobservable variable that is correlated with both the current household migration decisions and the conditions that led to the earlier formation of migration networks. If so, this will lead to biased estimates of the effect of migration networks on migration decisions.

Alternatively, Orrenius (1999) tests the effects of family migration networks on migration using retrospective panel data from the Mexican Migration Project (MMP). It addresses potential problems of using family migration networks by including individual fixed effects[5]. The claim is that individual fixed effects remove the potential bias related to common conditions that affect the potential migrant and the family network. However, this claim would be valid only if the conditions that affect shared migration tastes, say local economic conditions, have remained constant across time, which is highly unlikely[6].

[5] The Mexican Migration Project data was collected between 1987-1995 in 35 communities in western Mexico. It contains socioeconomic and demographic characteristics as well as retrospective information of household heads.

[6] Addressing a similar potential problem, Alberto Palloni et al. (2001) estimates the effects of family migration ties on individuals' migration decisions using also MMP data on siblings' pairs. They use a multistate hazard model and control for observed and unobserved conditions that influence migration risks for all family members to measure the effects of one sibling's migration on the other. It controls for unobserved conditions by using pairs of siblings only and by assuming that the conditions that affect the migration decision affects both siblings equally. One of their main findings is that having an older sibling with migration experience in the household increases the odds of migration for younger siblings threefold.

In terms of the literature on remittances, the focus has been on assessing the impact of remittances on members of the receiving households and the conditions that influence the decision to remit. Analyzing receiving households, studies have found positive effects of remittances on human capital, small business investment and business formation. Cox and Ureta (2003) examined the effect of remittances on children's educational attainment using data for El Salvador. Remittances are found to have a large and significant effect on school retention, even in households with parents with low levels of schooling. Woodruff and Zenteno (2001) looked at the effect remittances have on the level of investment in Mexican micro-enterprises. They find that the effects of having access to remittances flows account for one quarter of the capital invested throughout urban Mexico. That particular paper addresses the possibility that family remittances and migration are correlated with investment levels by implementing an instrumental variable strategy that uses historical migration rates as an instrument for remittances.

In summary, the empirical literature on migration networks has found strong effects of migration networks on migration, while the literature on remittances has found strong effects on investment activities at home. Therefore, the combined effect is ambiguous, not only because the competing positive and negative pressures, but also due to economic reasons. First, a household with access to remittances might be influenced differently by social networks and family remittances than a household without them. For

financially constrained households, remittances might serve simply to meet basic needs of the very poor, Unger (2005). For others, remittances may serve as a way to finance migration abroad or to repay migration loans (Rapoport and Docquier 2005), and for other households, remittances might allow its members to capitalize on other investment opportunities, such as education or self-employment. That is, migration probability and income present an inverse-u shaped relationship, Stecklov et al, (2005). Second, the effect of remittances might depend on the set of available investment opportunities in the community; for some households investing in human capital might be the most efficient investment, but for others, migration abroad might be the best choice given the lack of investment alternatives.

This paper tries to assess the effects of migration networks at the community level, measured by the percentage of households with a migrant to the U.S., and the effect of remittances, measured by the percentage of households in the community receiving remittances from abroad, on the odds of having a member of the household migrating abroad in the last twelve months. I control for economic and other households characteristics.

To address potential omitted variables biases, I use the distance to the nearest railroad stop of the main line connecting Mexico to the U.S. border in 1900 and the presence of small private savings and lending institutions called “Sociedades de Ahorro y Credito Publico (SACPs) or Cajas” as instruments for the percentage of households in the municipality with a migrant to the U.S and

for the percentage of households receiving remittances from abroad in the community[7]. The latter instrument, to the best of my knowledge, has not been used in the literature before.

1.3 Empirical Specification and Data

The empirical strategy of this paper is based on a random utility approach (McFadden 1974). This approach conforms to the New Economics of migration in that the household is the decision making entity. In this case, the household attaches a level of utility to each of the alternatives considered, and chooses only one alternative from a set of alternatives. However, the household has incomplete information, so the decision making process is based on a random variable to reflect the uncertainty, Manski (1977).

In the case of migration, the household decides whether or not to have one or more of its members migrating abroad and attaches a level of utility to each alternative[8].

$$U^{j}_{mig} = V^{j}_{mig} + \varepsilon^{j}_{mig} \qquad (1)$$

[7] Lopez-Cordova (2006) uses a similar approach when trying to evaluate the impact of migration and remittances on health and development outcomes. He uses the distance from the municipality to the railroad in 1920 plus the distance to the nearest U.S. border and the state's migration rate in 1955-1959 as a proxy for migration networks and a measure of historical rainfall as an instrument for the percentage of households in the community receiving remittances.

[8] This is consistent with the more general formulation in which (1) represents the utility of a household choosing to send the optimal number of migrants abroad, as opposed to not sending any.

$$U^{j}_{no\_mig} = V^{j}_{no\_mig} + \varepsilon^{j}_{no\_mig} \qquad (2)$$

(1) represents household j's utility attached to the migration alternative, and (2) represents household j's utility in the case of no migration. V_a^j represents the deterministic part of the utility derived from alternative a, and ε_a^j represents all the uncertainty associated with the migration process and with the decision not to send migrants abroad. The ε_a^j's are assumed to follow a bivariate normal distribution, so the decision making process can be modeled as a probit, which can be generated from a simple latent variable model.

The estimated regression takes the following specification:

$$P(MIGRATED = 1 \mid X) = \Phi(X'\beta) \qquad (3)$$

Where *MIGRATED* is a dichotomous variable capturing whether or not there was at least one migrant to the U.S. in the household in the last twelve months. **X** is a vector that contains community and household level characteristics that might influence the migration decision, such as the percentage of workers earning at least twice the minimum wage and the highest education level among household heads. It also contains the

percentage of households with a migrant to the U.S. and the percentage of households in the community receiving remittances from abroad.

To estimate (3), I use household and municipality level data from a sample used in the evaluation of PROGRESA, a federal program in Mexico introduced in 1997 and designed to improve the educational, health, and nutritional status of poor families living in rural areas. The evaluation sample consists of repeated observations collected for 24,000 households from 506 rural localities in seven states of Mexico (Guerrero, Hidalgo, Michoacan, Puebla, Queretaro, San Luis Potosi and Veracruz). It contains data on education, work, health, income, migration and characteristics of the house. Figure 1.3 depicts the geographical location of the seven states participating in PROGRESA.

The preliminary stage of PROGRESA was conducted in 1997 as a survey of socio-economic conditions of rural Mexican households (*Encuesta de Caracteristicas Socioeconomicas de los Hogares* or ENCASEH) to determine which households would be eligible to receive benefits. This paper uses data only from the preliminary stage of PROGRESA[9]. It should be mentioned that, at this point, households have not yet received any aid, but they knew whether or not they would be receiving PROGRESA benefits in the future.

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[9] I decided not to use data for subsequent years due to changes in the migration questions. The base survey asks about temporal and permanent migrants in the family, while subsequent surveys ask only about permanent migrants. Not surprisingly, the number of migrants falls almost 75% from the preliminary survey to the first follow-up survey.

Figure 1.3 Mexican States in Progresa

Omitted Variables Biases

Running the baseline specification without addressing potential omitted variables biases would likely lead to inaccurate estimates of the effect of both variables of interest. Considering the percentage of households having a migrant, there could be some unobservable conditions that are correlated with

both current migration decisions and the conditions that have influenced the incidence of migration in the community. Take for example NAFTA. Its negative effects on poor rural communities with high incidence of small basic crops producers could have had profound influences on previous migration decisions that led to the formation of social networks. At the same time, its enduring effects could be still influencing the migration decisions of households in these communities and the extent of current social networks.

The inclusion of remittances might present a similar problem. It's possible that a household currently receives remittances today from a member in the U.S. in response to an unfavorable event, the death of a relative or the prevalence of difficult economic conditions, for example. At the same time, these events might encourage other household members to migrate abroad also.

To address both of these potential problems, I introduce two instruments. I use the distance from the municipality to the nearest railroad stop of the main line connecting Mexico to the U.S. border in 1900 and the presence in the municipality of "Cajas" or Sociedades de Ahorro y Credito Popular (SACP).

Regarding the distance instrument, the intuition is as follows. From 1942 to 1965, the Bracero program allowed the lawful entry to the U.S. of millions of Mexicans, mainly from the central region of Mexico, to work mainly in agricultural industries in the U.S. Evidence suggests that the railroad was

main mode of transportation for Mexican workers to U.S. border at Paso del Norte, now Ciudad Juarez. That suggests that the smaller the distance from the municipality to the railroad stop of the main line connecting to the U.S. border, the lower the costs its members have to incur to migrate. If this is the right story, it should be the case that there was higher migration incidence in municipalities closer to the railroad system. Based on the self-perpetuating properties of migration, that would lead to higher migration incidence in municipalities closer to the railroad system today[10]. I find a negative correlation of .34 between current migration rates and the distance to the railroad system in 1900.

The validity of this instrument requires that its effect on current migration must be exclusively through its effect on migration networks or family remittances, so it's not currently affecting directly people's migration decisions and it has not led to economic conditions that have influenced the incidence of migration in the community. One way in which the distance to the railroad system might affect current migration decisions could be if people have kept using the train as their main mode of transportation, but there is evidence that the train is no longer widely used. Transportation by bus and airplane are by far the current most common types of transportation in Mexico[11]. According to INEGI, 3 million people used the railroad system in

[10] Hanson and Woodruff (2003) find a .76 correlation between 2000 state rural migration rates and the Bracero program over 1955-1959.
[11] Also, the geographical location of the railroad system in the 1900s doesn't follow closely the location of the main highway system in Mexico today.

1950, when the total population was 25 million. In 2000 there were less than one million passengers and a total population of 97 million in Mexico. However, distance to the railroad stop does appear to be weakly associated with current economic conditions. I found a .11 negative correlation between the distance to the railroad system and GDP per capita, and a .14 negative correlation with the percentage of workers earning at least twice the minimum wage in the municipality[12]. To control directly for current economic conditions, I include, among others, GDP per capita and the percentage of workers earning at least twice the minimum wage in the baseline specification.

I also use as an instrument the presence in the municipality of "Cajas" or Sociedades de Ahorro y Credito Popular (SACP). These savings and lending institutions serve as banks, but they are typically smaller and they are concentrated in the center and south region of Mexico. The idea is that rural areas tend to have poor access to formal banks, but better access to SACPs[13]. These institutions tend to offer better returns on small deposits and charge lower rates on small loans than formal banks[14]. At the same time, these institutions facilitate the reception and deposit of remittances to their members. For these reasons, the presence of one of these SACPs might be

[12] Both figures are weighted by population. For GDP per-capita, only the municipalities containing the state capital are used, given that GDP data is only available at the state level.
[13] Rural areas also receive more in per-capita remittances than urban areas.
[14] SACPs also offer loans with fewer requirements than formal banks. According to a 2004 survey in rural areas in Mexico by BANSEFI, a government institution that tries to promote savings and investments in rural areas, 30 percent of personal loans were requested to SACPs, 28 percent to family and friends, and only 3 percent to formal banks. The rest of the loans came from several sources. The average loan is for about 900 US dollars.

correlated with the extent of the remittances at least in rural communities.. I found a .26 positive correlation between these institutions and the percentage of households receiving remittances.

Again, the validity of this instrument requires that its effect on current migration decisions is exclusively through its effect on remittances or migration networks. One way in which the presence of SACPs might be promoting current migration would be if people were taking loans at these institutions to finance the migration northward, but there is no evidence of this. According to a survey by the Mexican Bank of National Savings and Financial Services (BANSEFI) in 2004, less than one percent of individuals who asked for a loan at a SACP responded they did so to finance the migration of a family member. Less than 10 percent of all loans were used for productive purposes like sowing, investing, and buying animal stock, while almost 50 percent were for household expenditures and health related services. I also found a .08 weighted correlation between the number of SACPs in the municipality and the change in labor force participation rates between 1990 and 2000, so I include it in the baseline specification. In all, it seems that it is unlikely that SACPs are directly promoting economic growth and current migration in poor rural areas in Mexico.

In terms of the relevancy of both instruments, the first stage regressions of the IV Probit confirm that both of them are strong predictors of the extent of

migration networks and family remittances. I present these results in the following section.

1.4 Means and Results

Table 1.1 presents summary statistics of the main variables used in the analysis. The first variable is the dependent variable of the baseline specification, and it measures whether or not any family member migrated abroad in the last 12 months[15]. It shows that 5.3 percent of households in the PROGRESA sample are in this category. The percentage of households with at least one migrant to the U.S. in the last 5 years from the 2000 Mexican population census is included for comparison purposes. This measure shows that municipalities in the PROGRESA sample have higher migration incidence on average[16]. In a similar way, the percentage of households receiving remittances is higher in the PROGRESA sample than in the entire country, but it is lower when compared to historical migration states. Taken together, households in the PROGRESA sample have greater migration rates and are more likely to receive remittances than the country as a whole.

Table 1.1 shows that PROGRESA households have on average more members than the country as a whole, and households with migrants tend to be larger than households without migrants. One interesting feature is that

[15] In the case of Mexico, migration abroad and migration to the US are almost synonymous. According to the 2000 population census, 98 percent of international migrants migrated to the U.S.

[16] The average is weighted by population, and its difference is statistically different from zero at the 95 % level.

Table 1.1 Means

Description	PROGRESA			2000 Census
	Households with migrants	Households without migrants	All	
% households with a migrant abroad in the last 12 months			5.3	
% households with at least one migrant in last 5 years			8.1	5.2
			(7.8)	(5.4)
% households receiving remittances from abroad			6.1	4.4
			(6.4)	(4.9)
Number of family members	6.0	5.2	5.2	4.4
	(2.7)	(2.6)	(2.6)	(2.2)
% households with a family member speaking a dialect	11.4	37.4	36.0	7.1
School attainment				
0-6 yrs	60.6	71.8	71.2	64.2
7-9 yrs	37.6	26.0	26.6	19.5
10-12 yrs	0.9	1.0	1.0	9.7
12+ yrs	0.7	1.2	1.1	6.6
Position at Work			14.8	62.5
Day laborer			47.2	8.1
Owner			0.5	2.6
Self-Employed			14.1	22.6
Unpaid family worker			13.6	4.2
% households eligible by PROGRESA	64.5	78.8	78.1	
% households owning land	57.9	62.8	62.6	
Average hectares for Land owners	4.9	5.2	5.2	
% households living In a locality with electricity	89.9	79.1	79.7	
% households in locality With middle school	1.1	1.3	1.3	

Table 1.1 Continued

Description	PROGRESA			2000 Census
	Households with migrants	Households no migrants	All	
% households in locality With high school	1.0	1.4	1.3	
% households in locality with Health services	26.9	18.5	19	
Change in labor force participation (12+ years old)			4.4 (5.8)	6.8 (2.5)
Municipality rate of working population earning at least twice the minimum wage			15.6 (9.3)	44 (19)
Municipality illiteracy rate			18 (7.3)	9.5 (8.8)
Number of observations	1,276	22,801	24,077	

households in the PROGRESA sample are much more likely to speak an indigenous language compared to the country as a whole, and this can have an effect on the results obtained in this paper's analysis given that it has been shown that indigenous households tend to send few migrants abroad, CONAPO (2003).

Based on empirical studies, the level of education might have an impact on the migration incidence due to higher returns to education in Mexico than in the U.S., so I use the schooling attainment of household heads and classify them into 4 groups; 0-6, 7-9, 10-12 and more than 12 years of schooling. I

then assign to the household the highest level of attainment among household heads. Table 1.1 shows that education levels for the whole PROGRESA sample are generally worse than for the entire country, and that households with migrants tend to have better educational outcomes that households without migrants.

In terms of occupation, almost 50 percent of workers are day laborers[17]. The PROGRESA sample is special in than more than 50 percent of households have at least one member who owns land, and 96 percent of the localities reported having agriculture as their main economic activity.

The variable “eligible” relates to the way the household was classified by PROGRESA in the preliminary stage, and it basically indicates whether or not the household is classified as poor. The percentage of eligible households is higher among households without international migrants than among those with them, and this difference is statistically different from zero. This suggests that either migration improves the economic conditions of the sending household or that poor households usually cannot afford to send one of its members abroad.

The data on locality education and health services is obtained from the locality survey of PROGRESA and it shows the striking conditions prevalent in poor rural areas in Mexico. Less than one percent of the localities in the

[17] Day laborer refers to agricultural workers exclusively.

PROGRESA sample have a high school, and only 19 percent of these localities have a health services institution.

I use also a variable on employment growth that was constructed using data from the 1990 and 2000 Mexican population census. It measures the change in the employment rate of individuals 12 years and older. Table 1.1 shows that localities in the PROGRESA sample lagged behind the entire country in terms of employment growth.

Lastly, table 1.1 also shows that localities in the PROGRESA sample lagged behind the entire country in terms of the percentage of working individuals earning at least twice the minimum wage and in terms of literacy rates. In summary, the PROGRESA sample tends to compare unfavorably to the entire country in terms of individual, household and community level characteristics. At the same time, households without migrants tend to have higher illiteracy rates, more likely to speak an indigenous language and more likely to qualify for PROGRESA aid than households with migrants.

Results

Table 1.2 presents the baseline Probit results for the two main variables of interest[18]. All the specifications in tables 1.2-1.4 use robust errors by clustering at the state level and restrict the sample to households with individuals of working age, 16-64 years, to try to capture migration decisions

[18] Statistical significance: *** 1%, ** 5% and * 10%. All regressions include state dummies, indicators for school presence and health services institutions, illiterate rates at the municipality and GDP per capita. All are not significant.

related to working opportunities. Column 1 and 2 include all households, but column 2 leaves out the variable that captures family remittances. Columns 3 and 4 are similarly structured, but they restrict the sample to households classified as non-eligible by PROGRESA. The idea of restricting the sample this way is to investigate whether or not less financially constrained households react differently to the presence of migration networks and family remittances in their communities. The first results are presented in table 1.2, but they do not account for potential omitted variables biases in the two main variables of interest.

Column 1 shows that, consistent with the social networks literature, the extent of the migration network has positive and statistically significant effects on current migration decisions, Alberto Pallony et al (2001) and Massey and Espinosa (1997). However, the magnitude of the coefficients seems to be small. This might be due to three issues. One, the inclusion of family remittances in the estimation captures part of the effect of migration networks on migration incentives. Notice how its magnitude for the coefficient for migration networks increases when the percentage of households receiving remittances is omitted. Two, the high percentage of families that have a member who speaks an indigenous language in my sample; there is empirical evidence that poor communities do not send many of its members abroad. Chiapas, for example, is a highly marginalized southern state with high levels of income inequality and poverty and historically has not sent many migrants

abroad, which suggests that the overall effects of both migration and remittances to be found in this paper might be low in magnitude. And three, the presence of omitted variables. To account for the latter, I run the Instrumental Variables Probit and present the results in table 1.3.

Table 1.2 Probit results

	Dependent Variable: Migrated			
	All hhs		Non Eligible hhs	
	(1)	(2)	(3)	(4)
Migration	0.021 **(0.01)	0.028 ***(0.01)	0.026 **(0.01)	0.028 ***(0.01)
Remittances	0.013 (0.01)		0.004 (0.01)	
Observations	22,788	22,788	5,160	5,160
R-Square	0.19	0.18	0.18	0.18

The IV Probit results are shown only for the two main variables of interest, along with the first-step estimates and the marginal effects. The top part of table 1.3 shows that the coefficients for migration networks and family remittances are both positive and statistically significant and that the effects of migration networks increase when family remittances are omitted. Once the sample is restricted to non-eligible households for PROGRESA aid, the magnitude of the coefficients for migration networks and family remittances increase significantly. This represents evidence that financially constrained

Table 1.3 IV Probit results.

IV Probit		Dependent Variable: Migrated			
		All hhs		Non Eligible hhs	
		(1)	(2)	(3)	(4)
Migration		0.14 ***(0.03)	0.16 ***(0.03)	0.37 ***(0.13)	0.34 ***(0.10)
Remittances		0.09 *(0.05)		0.13 *(0.06)	
First-Step					
	Instruments				
Migration	Distance	-0.93 ***(0.07)	-0.93 ***(0.07)	-0.61 ***(0.14)	-0.61 ***(0.14)
	Cajas	0.49 ***(0.11)	0.49 ***(0.11)	0.03 (0.22)	0.03 (0.22)
Remittances	Distance	-0.04 (0.06)		0.22 *(0.12)	
	Cajas	0.86 ***(0.09)		1.19 ***(0.19)	
Marginal Effects					
		All hhs		Non Eligible hhs	
Migration		0.05 *(0.03)	0.07 ***(0.02)	0.28 ***(0.04)	0.32 ***(0.06)
Remittances		0.04 *(0.02)		0.10 ***(0.02)	

households cannot fully exploit the presence of family remittances and migration networks in their communities that would facilitate their migration abroad.

The first-step estimates show that the distance to the railroad in 1900 and the presence of Cajas are relevant instruments for migration networks and family remittances. These estimates show that, as expected, the distance to the nearest railroad stop is a strong predictor for migration networks and the presence of Cajas is a strong predictor of family remittances at the municipality level.

The marginal effects presented at the bottom of table 1.3 are all evaluated at the median values and are all positive and statistically significant. These results show that a marginal change in the characteristics of the median household in terms of migration networks and family remittances would significantly increase the probability of households to send migrants abroad. It is also shown that these marginal effects are statistically higher for households classified as non-eligible to receive PROGRESA aid. Again, this is consistent with having some financially constrained households that cannot exploit the existence of migration networks and family remittances in their communities.

In results not shown, the coefficient on remittances is reduced significantly and even becomes negative when the sample is restricted to non-eligible households in municipalities with less than 50 percent of households living in rural areas, which represents only 11 percent of the full sample. This

suggests that remittances serve as a way to finance other investments in urban areas and not so much migration, which is consistent with Woodruff and Zenteno (2001).

In summary, the estimates for migration networks are positive and statistically significant and are consistent with the existing literature that have shown that migration networks facilitate migration abroad of households in the community. The sign on the coefficient of remittances suggests that receiving remittances increases the odds of international migration in poor rural areas in Mexico. At first sight, these estimates seem to go against the empirical literature that has shown that remittances promote investment behavior at the receiving households. On the other hand, adverse economic conditions prevalent in poor rural communities might reduce the set of profitable investment opportunities available to its members, making migration one of the most attractive alternatives. As mentioned in Massey and Parrado (1998) when discussing the low impact of remittances on employment in rural areas, maybe what we observe is not a product of migration or remittances per se, but a reflection of the opportunities available to people in these communities.

Table 1.4 presents the complete IV Probit results that include the estimates for several controls used. The coefficient on the numbers of family members is positive and statistically significant in all 4 specifications, which is consistent with Massey and Espinosa (1997). The intuition is that in rural areas, where job prospects are generally not good, bigger families might be

Table 1.4 Complete IV Probit results.

IV Probit Results		Dependent Variable: Migrated			
		All hhs		Non Eligible hhs	
		(1)	(2)	(3)	(4)
Migration		0.14 ***(0.03)	0.16 ***(0.03)	0.37 ***(0.13)	0.34 ***(0.10)
Remittances		0.09 *(0.05)		0.13 *(0.06)	
Members		0.08 ***(0.01)	0.08 ***(0.01)	0.08 ***(0.02)	0.08 ***(0.02)
Dialect		0.09 (0.10)	0.01 (0.09)	0.46 (0.31)	0.24 (0.23)
Illiteracy		-0.22 ***(0.04)	-0.23 ***(0.04)	-0.07 (0.12)	-0.12 (0.09)
Schooling (yrs)	7-9	0.16 ***(0.04)	0.12 ***(0.04)	-0.01 (0.13)	-0.05 (0.10)
	10-12	0.12 (0.17)	0.06 (0.16)	-0.19 (0.39)	-0.29 (0.32)
	12+	-0.11 (0.18)	-0.13 (0.17)	-0.08 (0.36)	-0.18 (0.30)
Self-Employed		-0.13 ***(0.05)	-0.12 ***(0.05)	0.04 (0.14)	-0.01 (0.11)
Own land		0.03 (0.05)	0.01 (0.04)	0.45 *(0.24)	0.29 *(0.17)
Eligible		-0.22 ***(0.04)	-0.24 ***(0.04)		
Minsal2		-0.06 ***(0.02)	-0.04 ***(0.01)	-0.17 **(0.07)	-0.10 **(0.04)
Employment growth		0.05 ***(0.02)	0.04 **(0.02)	0.21 (0.09)	0.14 **(0.06)

able to send some of their members to look for better work opportunities outside their communities and abroad. This could be more likely given the fact that the main economic activity in these communities is agriculture and a high fraction of the population owns land, which requires some people to stay in the community and attend the land.

The coefficient on the indicator of whether or not a member of the households speaks an indigenous dialect is positive but statistically insignificant. This comes as a surprise, given that many studies have found that communities with high concentration of indigenous people tend to have low levels of international migration.

According to the Mexican National Population Council (CONAPO), communities with high concentration of indigenous people (at least 70 percent of population age 5 and older) tend to have low and very low rates of U.S. migration[19]. In the PROGRESA sample, 8 percent of households with a migrant in the last 12 months have at least one member who speaks a dialect. For households without a migrant, this figure is 33 percent. In results not shown, the coefficient on remittances becomes small and negative, but statistically insignificant, when the sample is restricted to households with at least one member speaking an indigenous language. Conversely, when the sample is restricted to non-dialect speaking households the coefficient on remittances increases by about 30 percent. Furthermore, when households

[19] Indigenous communities historically have mainly participated in rural-urban migration and not on international migration.

with dialect speakers and households classified as eligible for PROGRESA are excluded, the estimated coefficients on remittances and social networks increases significantly.

According to the negative selection theory of migration, higher education and migration would be negatively correlated, assuming constant migration costs across migrants and given higher returns to education in Mexico than in the U.S. (Borjas 1987)[20]. On the other hand, Hanson and Chiquiar (2005) and Cuecuecha (2005) claim that time-equivalent migration costs are negatively correlated with education, resulting in the positive selection of migrants. If this is the case, the coefficient on education should be positive. The results in columns 1 and 2 are in support of the negative or intermediate selection story and show that high levels of education among household's heads results in lower migration probabilities relative to households with low levels of schooling, but the results are mostly statistically insignificant. This lack of significance might be a direct result of the educational characteristics of the sample used, i.e., 88 percent of the population had 6 years of schooling or less. When the sample is restricted to non-eligible households, the coefficients support the negative selection story, but these estimates are all statistically insignificant.

The coefficients on being eligible for PROGRESA benefits are negative and statistically significant. This suggests that being classified as poor lower

[20] Chiquiar and Hanson (2005) show evidence that returns to education are lower for recent immigrants relative to earlier immigrants.

the odds of migration, which support the theory that financially constrained individuals or households cannot exploit the existence of migration networks or family remittances that would enable them to migrate abroad. I believe this variable captures information about the household that is not otherwise included in the main specification. Consider a household who is classified as eligible for benefits, and at the same time belongs to an indigenous community. In this case, migration networks might not be able to lower the expected migration costs enough to make them affordable. At the same time, remittances might only serve as a way to finance basic household consumption and not other productive investments, including migration. Interestingly, 40 percent of the households in my sample are classified as eligible and also as having at least one member speaking an indigenous language.

Given the high percentage of landowners, the indicator on land ownership was modified to include only land with some irrigation system to better measure the land actually used for production. The obtained coefficients remain positive across the different specifications, but they are only statistically significant when the sample is restricted to households not classified as poor. This suggests that, among not financially constrained households, having land with irrigation system increases the odds of migration.

The last three variables are the community measures of electricity, the percentage of labor force earning at least twice the minimum wage and the employment growth of individuals 12 years of age and older. The first two are positive, but only the second one is consistently statistically significant. That is, having better employment opportunities at home reduces the odds of migration abroad. However, the coefficient for the employment growth variable is positive, suggesting that better labor market condition leads to more migration. This suggests that having a reasonable paying job has more effect than having improving labor market conditions.

1.5 Conclusions

In this paper I investigated the effect of community level migration networks and family remittances on the odds a family member migrates abroad using data from a survey done in poor rural areas in Mexico. I accounted for the potential omitted variables biases in the two main explanatory variables using a measure of distance from the municipality to the nearest railroad stop in the line connecting to the U.S. border in 1900 and the presence of private savings and lending institutions or SACPs.

One of the main findings is that migration networks significantly affect the odds of migration, which is consistent with the existing literature. This effect remains significant even when I include a measure of family remittances and account for potential omitted variables biases related to both variables of

interest. The results are even stronger when the sample is restricted to non-eligible households, which is consistent with having some financially constrained households that cannot exploit the presence of migration networks in their communities that would facilitate migration abroad. In terms of remittances, the Probit results indicate that remittances have a positive but statistically insignificant effect on migration. Once remittances are instrumented, the magnitude of its coefficient increases and becomes statistically significant. This suggests that remittances, instead of promoting economic or human capital investments at home, serve as a way to finance people's migration abroad in poor rural areas of Mexico.

Given the recent trends in migration and remittances flows, the main results of this paper point to a continuing and strengthening of social networks effects, even in regions where these have not been traditionally important. In other words, this paper represents evidence of the self-perpetuating properties of the Mexico to U.S. migration phenomenon. In addition, the estimates on remittances suggest that remittances are working together with social networks in promoting migration abroad, at least in poor rural areas of Mexico, where desperate economic conditions are prevalent and good investment opportunities few.

In terms of policy implications, this paper's results suggest that the Mexican government should do something about the lack of productive investment opportunities in poor rural areas of Mexico if it really wants to

diminish the magnitude of the migration phenomenon. This might be more urgent now that there is an ever-growing extent of migration networks and family remittances that could make migration less costly. On the other hand, the Mexican government could help facilitate the transmission of family remittances in urban areas, given that there is evidence that these tend to promote investment, at least to small firms.

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Selectivity of Migrants from Mexico: What does Net Migration Tell Us?

Abstract

The Mexican-born are the largest immigrant group in the United States. There is disagreement in the literature about whether migrants from Mexico are positively or negatively selected. Data from the Mexican census suggest migrants are negatively selected; data from the U.S. census suggest intermediate selection. We propose an alternative method for estimating the characteristics of Mexican migrants. We argue that the estimates we obtain using net migration techniques provide a less biased picture of migrants than previous estimates. We reach three main conclusions. First, the net flow of Mexicans to the United States during the 1990s was about 10 percent less than the U.S. census data suggest. Second, migrants are younger and less female than suggested by the U.S. census, but older and more female than suggested by the Mexican census, and third, the education attainment of migrants also lies between previous estimates obtained from the two censuses, but is much closer to the estimates obtained from the Mexican census.

"You see just beneath the surface of the mud…
There's more mud here…
Surprise"

David Crosby

2.1 Introduction

The 2000 population census counted 33 million individuals born outside of the United Sates in 2000. The Mexican born, estimated to be 9.3 million, represent the largest percentage from any single country. That the Mexican-born differ in educational attainment and age distribution from the native born population is uncontroversial. But there is less agreement on how migrants from Mexico compare with the Mexican population remaining in country. Borjas (1996) argues that high returns to education in Mexico lead to negative selection of migrants, as the better educated face better prospects in Mexico. Ibarraran and Lubotsky (2007) provide evidence supporting this using the 2000 Mexican population census. Chiquiar and Hanson (2005), on the other hand, argue that migration costs can reverse the prediction of negative selection. If all migrants pay comparable fixed costs to migrate, then lower skilled workers will have to work longer to offset those costs, making migration to the United States a less attractive option for them. Chiquiar and Hanson provide evidence from the 2000 U.S. population census suggesting that migrants come disproportionately from the upper half of the education and

wage distribution in Mexico. Cuecuecha (2003) uses data on the Mexican born in the Current Population Survey to reach a similar conclusion.

Why does the literature reach such diverse findings? Quite simply, those who use data from Mexico find more negative selection, while those using data from the United States find more positive selection. We argue that there is reason to believe that data from both the Mexican and U.S. census are biased, but in opposite directions. We propose an alternative method of estimating migrant flows and argue that, while not without error, our method does not suffer from the obvious biases of the estimates relying entirely on one of the other census.

The 2000 Mexican population census data are derived from a question asking whether anyone in the household has migrated outside of Mexico within the previous five years. Those responding affirmatively are asked the age and gender of the migrant(s), the country to which each individual migrated, and whether the individual has returned to Mexico. Ibarraran and Lubotsky (2007) use these data to estimate the education levels of migrants from the education of those remaining in the household. They find that migrants have education levels which are, on average, lower than the population remaining in Mexico. Chiquiar and Hanson (2003) point out that the Mexican census question will fail to count households that migrate out of Mexico in their entirety. They argue that these households are more likely to be urban and more highly educated than households sending single members

to the United States. Hence, the Mexican census data biases downward the educational attainment of migrants to the United States. Instead, Chiquiar and Hanson (2003) use data from the U.S. Census on the characteristics of the Mexican-born residing in the Untied States, comparing them with the population resident in Mexico. The U.S. census data suggest that migrants have far higher education levels than the Mexican census does, resulting in Chiquiar and Hanson's conclusion that migrants have schooling levels which are higher than the population remaining in Mexico.

The two data sources produce a different picture with respect to the age and gender of migrants as well. Among the Mexican born arriving in the United States between 1995 and 2000, U.S. census data indicate that 60% are male and 40% are female. Among those who left Mexico for the United States without returning during the same years, the Mexican census reports that 75% are male and only 25% are female.

Supporting Hanson and Chiquiar's argument, the U.S. census data suggest that 2.7 million Mexicans arrived in the United States between 1995 and 2000. The Mexican census measures only 1.3 million Mexicans leaving the country for the United States during the same five-year period[1]. This suggests that half of the migrants from Mexico are not counted by the question asked in the Mexican census. But there are reasons to believe that the data from the U.S. census present a distorted picture as well. The best estimates

[1] This number does not include those who returned and resided in Mexico at the time of the 2000 census. Including those who returned, the Mexican census counts 1.6 million emigrants to the United States.

suggest that about 10 percent of Mexican-born migrants were not counted in the 2000 census. The census is widely understood to undercount the Mexican-born population in a systematic way (Constanzo 2001). Young, single, low-wage workers are less likely to live at a fixed address and more likely to be undercounted. The uncounted are more likely to have low levels of education relative to other migrants and relative to natives (Borjas and Katz 2005 and Bean et al. 2001). Additionally, there are issues with the language translations for schooling levels used in the Spanish version of the U.S. census. For example, the census refers to high school as “secundaria” while high school in Mexico is referred to as “preparatoria” or “bachillerato.” In Mexico, “secundaria” refers to the junior high school level.

Given the issues with the current estimates of the size and characteristics of migration flows, we pursue in this paper an alternative approach of estimating the net outflow and characteristics of migrants from Mexico during the 1990s. We use data from the 1990 and 2000 Mexican and U.S. population censuses to calculate net migration from Mexico. Net migration compares the size of an age cohort in an earlier census with the size of an appropriately older cohort in a later census, after adjusting for mortality. For example, we compare the number of 8-12 year olds in 1990 with the number of 18-22 year olds in 2000. We use data on the number of deaths to account for the reduction in cohort size due to mortality. The difference between the adjusted cohort sizes represents the estimate of net migration

during the decade. By comparing age, education and gender cohorts, we provide a profile of migrants. However, there is no way to know where these migrants left to, but we are confident that the net migration estimates are a very good estimate of the net flows from Mexico to the United States given that about 98 percent of those who migrated from Mexico came to the United States, according to the 2000 Mexican population census.

We face several significant challenges in pursuing the net migration approach. For example, the percentage of the population with an unreported age is significantly higher in the 2000 Mexican census than the 1990 Mexican census, and the tendency for ages to be reported as numbers ending in 0 or 5 also changes between the censuses. The proportion of the population in the U.S. census which is categorized as foreign born, country not specified, is much higher in the 1990 census than in the 2000 census (Cresce et al 2001). These changes across time likely result less from changes in the responses of households and more from decisions by the census bureaus with respect to allocating non-responses to categories. The percentage of the population in the United States uncounted by the census is also widely seen as having fallen between 1990 and 2000.[2] We describe how we address each one of

[2] The U.S. Census Bureau's Executive Steering Committee for Accuracy and Coverage Evaluation (ACE) estimated that the undercount was reduced from 1.61% of the population in 1990 to 1.18% in 2000. The ACE also concluded that the improvement was especially marked among Hispanics and other minority groups. The estimated undercount rate for Hispanics fell from 4.99 in 1990 to 2.85 in 2000. Farley (2001) discusses some of the methods the Census Bureau used to increase the accuracy of the 2000 count, including an advertising campaign, an increased number of enumerators, and partnerships with community organizations in difficult-to-count populations. Hogan (2001) offers corroborating evidence of the more complete count by comparing census counts with data on school and Medicare enrollments.

these and related issues in more detail later in the paper. They may add some noise to our estimates, but we believe that the estimates of migration flows coming from our analysis are much less biased than those relying on data from either the Mexican or U.S. census.

Our first main finding is that the net flow of Mexicans to the United States was about 10 percent less than the U.S. census data suggest. While the U.S. census data indicate that 4.39 million Mexicans aged 3-72 (in 1990) came to the United States during the 1990s, our best estimate of the flow is 4.04 million. Second, we find that the age distribution of migrants lies between that obtained using U.S. data and that obtained using Mexican data, but is closer to that obtained from the U.S. data. Third, we find that the education attainment also lies between that obtained from the two censuses, but is much closer to the estimates obtained from the Mexican census. This suggests that the U.S. census significantly overstates the educational attainment of Mexican migrants. We note that since there is much less reason to think that the educational attainment of the children born to Mexican migrants is similarly biased, this implies that the gain in schooling from the first to second generation is much larger than the literature currently estimates.

The rest of this paper is organized as follows. In Section 2 we discuss the Net Migration methodology and potential issues with the methodology. Section 3 presents our best estimates of the distribution of age and gender of migrants, and discusses the sensitivity of these estimates to various ways a

handling data issues. Section 4 does the same for the distribution of educational attainment of migrants. We summarize and offer a few concluding remarks in Section 5.

2.2 The Net Migration Methodology

The net migration methodology is one of the "residual" methods of estimating migration flows, commonly used by demographers to overcome the lack of data on migration flows in most censuses of the 20th century. The method relies on the difference between changes in total population and changes in the natural population between two periods.

The net migration estimate can be represented as:

$$M = (P_{t,a+t} - P_{o,a}) - \sum_{i=1}^{t} (B_i - D_i) \qquad (1)$$

where *M* represents the net migration flow. The first component in the right-hand side is the difference between the population of age *a* at time 0 and the population of age *a*+*t* at time *t*. The second component on the right-hand side is the difference between births and deaths in this cohort over the *t* years. In this case, a positive value for *M* would imply that, on net, more people came into the country than went out and vice versa.

For reasons that we discuss later in the paper, we exclude the cohort which was 0-2 years of age in 1990 and 0-12 years of age in 2000. Thus, births are not a factor in our analysis. However, an accurate mortality rate will be critical. The most reliable method for accounting for mortality is to use data on deaths from the vital statistics of the country (Siegel and Hamilton 1952, Hill and Wong 2005).

One of the main advantages of the net migration method is that it does not require migration specific questions in the census. In the present case, net migration has another significant advantage: the method does not result in the biases inherent in using either U.S. or Mexican census data. One drawback, minor in our view, is that the method generates only the net flow and does not allow for separate estimates of outflows and inflows. There are, however, more serious concerns which derive from changes in census methodologies over time. For example, as Bogue et al (1982) point out, changes percentage of the population enumerated by the census or changes (de facto or de jure) in the method of allocating non-responses from the enumerated population will accrue to the estimate of net migration if not properly accounted for. In addition, incorrect or incomplete measures of mortality may also affect the estimates. In our case, mortality figures are available only by age and gender, so we must assume they are independent of education levels. If mortality rates are negatively correlated with education levels, then this will likely underestimate the educational attainment of migrants. However, for individuals

aged 10-55, mortality rates are quite low, so this is not likely to lead to considerable mis-measurement.

We should also worry about the phenomenon of “educational drift.” Various researchers have noted that individuals tend to report a higher educational level as they age. This is particularly common among individuals with low levels of education. This appears to be a real phenomenon, but clearly not exclusive of Mexican data (Ashenfelter and Krueger 1994). In any case, this would affect any estimate of the educational attainment of migrants using these data. We address this issue by deriving an estimate for the level of educational drift, as described in the appendix.

We face another issue in that we are interested in migration from Mexico to the United States. The net migration method, applied to the Mexican census data, gives us an estimate of all migrants from the country. There is no way to isolate migration to the United States. This concern is reduced because the United States is the destination of about 98 percent of the migrants reported in the Mexican census. But the Mexican census data indicate that among households reporting migrants going to Europe, the education level of the household head is much higher (12.7 years) than the level of household heads with migrants to the United States (4.9 years). This will result in a small upward bias of the educational attainment of migrants from Mexico to the United States, but this could be seen as an upper bound for the educational content of migrants to the United States.

2.3 Migration Selection and the U.S. and Mexican Census Data

How different are the estimates of migration derived from the U.S. and Mexican censuses? Both in numerical counts and in characteristics of migrants, they are very different. Table 2.1 shows the age and gender distribution of migrants leaving Mexico between 1995 and 2000, estimated using the Mexican population census (Column 2, including migrants who have returned), and arriving in the United States, estimated using the U.S. population census (Column 3) between 1995 and 2000.[3] Since the Mexican census fails to count families migrating as a unit, we should expect the Mexican data to understate the number of children and females.[4] Since migrants residing in the United States as a family are less likely to be missed in the count (because they are more likely to reside in a fixed residence, for example), we should expect these same groups to be over-represented in the United States. Consistent with these expectations, Table 2.1 shows that while only 5 percent of migrants in the Mexican census are 14 years of age or younger, 22.6 percent of those enumerated in the U.S. census are of the same age. Similarly, only a quarter of migrants in the Mexican census are females, while females comprise almost 42 percent of the Mexican born population in

[3] For Mexico, the 1995-2000 data are from the 2000 population census, which was conducted in February 2000. The data for 1990-1995 come from the inter-censal Conteo, conducted in November 2005. Hence the period March-October 1995 is counted twice and March-October 1990 is not counted at all. This is likely to have only a small impact on the estimates.

[4] Both females and younger children are more likely to migrate as a part of an entire household and/or for reasons of marriage (United Nations 2006), more likely to live in apartments or houses once arriving in the United States and more likely to be counted by the U.S. census.

the U.S. census. On the other hand, the Mexican data indicate much larger participation in migration by the 15-24 year olds: 54 percent of migrants are in this group for Mexico versus 37 percent for the U.S. This is the age range which is most likely to live outside of traditional housing—such as migrant camps—or in multi-family households, and hence be undercounted by the U.S. census.

Table 2.1 Mexican Migrants to the U.S.

Table 1
Mexican Migrants to the U.S.

	(1) Mexican Population	(2) Mexican Census Migrated 1995 – 2000	(3) U.S. Census Arrived 1995 – 2000
Age / Gender	%	%	%
0-4	11.4	1.5	7.1
5-9	11.7	1.3	9
10-14	11.2	2.2	6.5
15-19	10.4	27.2	13.8
20-24	9.4	27.1	23.3
25-29	8.4	15.1	15.9
30-34	7.4	8.6	8.7
35-39	6.6	5.6	5.5
40-44	5.4	3.5	3.4
45-49	4.2	2.2	2.2
50 +	13.5	3.2	4.1
Male	48.7	74.8	58.1
Female	51.3	25.2	41.9

We now turn to estimating the net migration from Mexico to the United States. We derive three estimates. The first utilizes the Mexican census data, and the second the U.S. census data. The two censuses produce different estimates even of the total flow of migrants because in each country, the

percentage of the population uncounted in the census differs. Our third net migration estimate accounts for improvements in census coverage between 1990 and 2000 in both countries. We return to this estimate below.

There are several data issues we must address in making the net migration estimates. We list the issues here, and describe briefly how we address them. The issues are:

1) In the Mexican data, there is a tendency for people to report ages ending in 0's or 5's. For example, in 1990 around 300,000 individuals are reported as being 59 years old, 640,000 as 60 years old and 170,000 as 61 years old. The clumping suggests that people claim they are 60 years of age when in reality they could be 59 or 61 years old.[5] Clumping increases with age—that is, it is more severe around 60 than it is around 30, and clumping is more apparent in 1990 than it is in 2000. Using cohorts spread across the ages will mitigate problems with clumping. We address this by grouping ages into five-year cohorts, centered around the ages ending in 5 and 0. That is, we compare the number of males aged 3-7, 8-12, etc. in 1990 with the number of males aged 13-17, 18-22, etc. in 2000.

2) The percentage of the Mexican sample with missing age is higher in 2000 than in 1990. We address this issue by increasing the percentage of the 1990 sample with missing ages so that it matches the percentage with missing

[5] A similar issue exists with U.S. census data but to a lesser extent, perhaps because ages are smoothed by allocations made by the census bureau. See the appendix for more detail.

age in 2000. These adjustments are discussed in greater detail in the appendix.

3) In the U.S. census, the percentage of the foreign-born population with the country of birth not specified is much higher in 1990 than in 2000. In 2000, the census bureau assigned a country of birth to most of the individuals who report being foreign born but do not report a country of birth. The allocation was done based on the place of birth of members of nearby households. We allocate the place of birth in the 1990 census using the percentage of the foreign born population (by age and gender) in the individual's public use micro area (PUMA) which was born in Mexico.

4) Summing up the population born in Mexico from the population censuses of both countries, we find about 1 million more children aged 10-12 in 2000 than there were children aged 0-2 in 1990. The net migration calculations indicate large net in-migrations of children aged 0-2 in 1990 in *both* Mexico and the United States. This appears to result from households not reporting very young children in the population census. We therefore exclude this cohort from the discussion, and focus on those 3-72 years of age in 1990.[6]

The first two columns of Table 2.2 show the raw out/in migration flows from the Mexican and U.S. censuses, respectively. The Mexican data show much smaller migration flows, reflecting the fact that households leaving in

[6] A similar pattern is evident in the census data from Brazil, Chile, Argentina, and even from the U.S., to a lesser extent. Looking at the population by each single year of age suggests that the phenomenon is limited to those under age 2.

their entirety are not counted in the Mexican census. The lower percentage of female migrants in the Mexican data reflects the same phenomenon.

The third and fourth columns of Table 2.2 show our estimates of migrant flows developed using the net migration methodology applied to both the Mexican (Column 3) and U.S. (Column 4) censuses, adjusted for the issues just discussed. Column 1 of Table 2.2 presents the net migration estimate derived from the Mexican census data. For the Mexican data, we use the 10 percent samples from the 1990 and 2000 Mexican censuses.[7] The 1990 sample is unweighted and representative at the state level. The 2000 census is weighted and representative at the *municipio* (county) level. Smaller counties are over-sampled, and sampling weights are provided. We use the sampling weights for all of our calculations. Following equation (1), and given that we are going to follow age cohorts over time, equation (1) can be rewritten as:

$$M_{aj} = (P^{2000}_{(a+10)\,j} - P^{1990}_{aj}) + \sum_{t=1990}^{2000} D_{ajt} \qquad (2)$$

where *a* and *a+10* refer to age cohort and *j* refers to gender.

[7] We also obtained data from the complete census by age, gender and education from INEGI to compare to our sample results. The net migration estimates based on this data do not deviate considerably from those based on sample data, including the estimates on education (see appendix for estimates based on the complete data). The sample allows us to address the data related issues in a more sophisticated and accurate manner, so we use the samples to generate all of the reported results.

Annual data on deaths were obtained from the Mexican National Statistical Institute (INEGI)[8]. These data contain deaths by age cohort, gender and municipio of usual residence of the deceased. For example, we have the number of deaths for males age 0 to 4 for each year from 1990 to 2000 for each municipio.[9]

For the U.S. data, we use the 5% Public Use Micro Survey data, aggregated using the weights provided in the census. Mortality data comes from the National Center for Health Statistics, for the entire U.S. population. The results are not sensitive to the choice of mortality rates. We obtain very similar results if we use mortality rates for the Hispanic population or even the Mexican mortality rates.

Consistent with expectations, the estimates derived from the U.S. census data show a much smaller flow of migrants aged 8-17 (in 1990, and age 18-27 in 2000). Those in this age range are more likely to be uncounted in the U.S. census. The U.S. data also suggest that a larger portion of the migrants are female, consistent with the greater likelihood of missing single males in the count. Note, however, that the estimates using the different censuses produce not only a different distribution of migrants, but a different

[8] See appendix on how we calculated the number of deaths for each cohort.
[9] There is a minor timing issue with the mortality data, but we don't expect it has much effect on the results. The 1990 population census took place in the beginning of March, but we use deaths for the entire year. By contrast, we don't account for the deaths that occurred in the first two months of 2000. To the extent that the number of deaths in the first two months of 1990 differed greatly from the first two months of 2000, we would be misreporting considerably the number of deaths. Fortunately, once we disaggregate into age-gender cohorts, the size of this discrepancy for each cohort becomes negligible.

total flow of migrants. The U.S. data suggest a net flow of almost 4.4 million Mexican migrants aged 3-72 (in 1990), while the Mexican data find only 3.8 million migrants in the same age range. The difference in total flow results from an improvement in the census coverage over the decade. In other words, the census bureaus did a better job of counting the population in 2000 than in 1990. An improved count in Mexico will tend to reduce estimates of net migration, since we will find people in the 2000 data who were not covered in 1990. An improved count in the United States will have the opposite effect.

Table 2.2 Mexico-U.S. Migration flows 1990-2000.

Table 2
Mexico-U.S. Migration flows 1990-2000, by Age and Gender

	Gross outFlow / Inflow Raw Data		Net Migration			
			Unadjusted		Adjusted*	Adjusted %
Age	Mexico	U.S.	Mexico	U.S.		
0-2	-25,806	229,014	864,607	205,761	242,240	NA
3-7	-216,091	412,118	-219,772	408,162	-328,583	8.1%
8-12	-615,474	820,351	-1,074,803	837,573	-933,176	23.1%
13-17	-698,257	982,373	-1,326,294	1,054,981	-1,163,421	28.8%
18-22	-363,469	638,111	-697,656	761,116	-723,452	17.9%
23-27	-221,390	356,441	-346,915	514,632	-436,191	10.8%
28-32	-127,866	215,399	244,545	308,327	-70,552	1.7%
33-37	-91,502	128,896	-265,799	184,597	-212,560	5.3%
38-42	-63,529	86,347	-125,645	119,567	-114,862	2.8%
43-47	-38,915	51,266	19,387	67,803	-24,019	0.6%
48-52	-26,806	37,778	-90,495	49,567	-58,253	1.4%
53-57	-16,306	23,800	105,840	29,894	35,178	-0.9%
58-62	-5,092	15,886	-30,655	29,398	-19,453	0.5%
63-67	-3,655	10,687	-100	18,123	1,637	0.0%
68-72	-1,326	5,899	2,849	11,176	11,455	-0.3%
0-72	-2,515,484	4,014,366	-2,940,905	4,600,678	-3,794,011	
3-72	-2,489,678	3,785,352	-3,805,511	4,394,917	-4,036,251	
% Female	26.8	43.4	40.2	43.6	39.4	

* Data are adjusted for the improvement in the covereage of the census in Mexico and the United States. The improvement is allocated between the two countries in a manner described in the text.

The data from the combined censuses indicate that the 2000 censuses counted a higher percentage of the actual population born in Mexico than did the 1990 censuses. Combining data from the Mexican census with data on the Mexican-born population resident in the United States, we find an additional 614,547 individuals born in Mexico in the 2000 census. We must then allocate these individuals between the two countries. The Census Bureau's Executive Steering Committee for Accuracy and Coverage Evaluation (ACE) estimated that the undercount was reduced from 1.61% of the population in 1990 to 1.18% in 2000. The ACE also concluded that the improvement was especially marked among Hispanics and other minority groups.[10] We know of no independent estimate of the improvement of coverage in Mexico, [11] so instead we use the estimates in the improvement in coverage in the United States. We estimate that 25% of the Mexican-born population was uncounted in 1990 and 12.5% was uncounted in 2000. Together, these suggest that 256,797 of the improvement in coverage should be assigned to the United States. That implies that 357,749 of the improved coverage should be assigned to

[10] The undercount rate for Hispanics went down from 4.99 in 1990 to 2.85 in 2000. Farley (2001) discusses some of the methods the Census Bureau used to increase the accuracy of the 2000 count, including an advertising campaign, an increased number of enumerators, and partnerships with community organizations in difficult-to-count populations.

[11] The Mexican Population Bureau (CONAPO) estimates that the undercount fell from 3.64 percent in 1990 to 2.54 percent in 2000. However, the CONAPO estimates incorporate data on the number of Mexicans in the United States from the Current Population Survey, and hence are not based on improvements in collection methods in Mexico.

Mexico.[12] We assign these improvements by age/gender cohort. After making these adjustments, the two censuses produce identical estimates of net migration flows. These estimates are shown in Column 5 of Table 2.2.

2.4 Educational Attainment of Migrants

The debate on the selectivity of Mexican migrants has focused on the educational attainment of migrants. The Mexican census questions about migration gather information only on the gender and age of migrants, not on the educational attainment. Ibarraran and Lubotski (2007) estimate the educational attainment of the migrants reported in thee Mexican census using the characteristics of the remaining members of the household, along with the age and gender of the migrants. However, if households migrating as a unit have characteristics which differ from individuals migrating from households, then these data may paint a distorted picture of migration from Mexico. Younger, more urban (and hence better educated) individuals are more likely to migrate as a household.[13]

In fact, the data from U.S. sources, including the census and the CPS, indicate that the education levels of migrants are much higher than is indicated by the Mexican census data. This could be because migrants to the United States obtain substantially more schooling after arrival. But there are reasons

[12] The improvement in the coverage in Mexico apparently occurred without a major increase in resources. The only major change between 1990 and 2000 was an increase in the collection time from one week to two weeks. This allowed for a reduction in the number of interviewers from 500,000 in 1990 to 260,000 in 2000, suggesting only a minor increase in person/days.
[13] Individuals living in urban areas are also less likely to live in extended families.

to believe the U.S. data may overstate the educational attainment of migrants. First, lower educated migrants are more likely to have lower-paying jobs, and to live in non-traditional housing. Hence, those with lower education are more likely to be undercounted. Second, there are issues with the translation of the education categories in the Spanish version of the U.S. census. In particular, "*secundaria*" is used to indicate high school, while *secundaria* refers to the junior high school level in Mexico.

With these issues in mind, we use the net migration data to estimate the educational attainment of the net flows of migrants from Mexico to the United States. As with the estimates of the age / gender composition of migrants, there are issues we must address to make the calculations. While these issues add some noise, we believe the resulting estimates are less biased than either those based on the Mexican census questions or the U.S. census data.

Ideally, we would obtain the education distribution for a given cohort in 1990 and then compare it to the corresponding cohort in 2000, adjusted for mortality. However, four issues compromise our ability to do this.[14] First, there is the chance that people acquire more schooling between censuses. Non-migrants in Mexico are likely to increase their education between censuses. . Ignoring this issue would yield estimates that understate the educational attainment of migrants. Instead, we adjust for this effect using the percentage

[14] There is an extra issue related to people overstating their educational attainment as they get older. We look at it in more detail when we present the results on education.

of individuals of a given age and educational attainment who report they are attending school. The appendix describes these adjustments in more detail. We also minimize this issue by carefully constructing the age and education cohorts. For example, most individuals who will complete primary school have done so by age 15, so we construct our first cohort to include people age 15 to 22 in 1990 and adjust for the remaining percentage of population still attending. In this age cohort, we split the sample only into two groups: those with more than or less than six years of schooling.

A second issue is that, as with age, there are differences in the 1990 and 2000 Mexican censuses in the percentage of individuals with no education specified. For example, for those aged 15 to 22, a smaller percentage have missing responses on schooling attainment in 1990 than in 2000. Again, failing to account for this would lead to incorrect estimates of the educational attainment of migrants. We address this concern by implementing a method similar to the one we used for the missing age issue: We estimate education for enough of those missing education in 2000 so that the percentage of the samples with missing education data is comparable in the two samples. Details of this are described in the appendix.

Third, we must allocate the improvement in the count between 1990 and 2000 to different levels of schooling. We do this in a strictly proportional manner. If anything we expect that the improvement might have been greater among those with lower levels of schooling. If that is the case, then the

proportional distribution will tend to overstate the educational attainment of migrants. Given the numbers involved, we expect the effect of this will be small. Finally, we use the same mortality figures for all schooling levels. However, there is some evidence that education is negatively correlated with the rate of preventable deaths (Kenkel et al., 2006). That would imply that our estimates understate the educational attainment of migrants. Given that we use only individuals aged 15-38 in our education estimates, the mortality rates are very low. Differences by education level will not have a visible effect on our estimates.

An alternative way to obtain estimates of the educational content of migrants, and that doesn't require any adjustments, is a difference-in-differences analysis using states with high and low migration rates. The intuition is that the only sources of variation for the states' education distribution between 1990 and 2000 are mortality, assuming is not proportional to education cohort size, continuing education and migration abroad. For low migration states, the latter should be less of a problem compared to states with high migration rates. For high migration states, this would reduce the size of the cohort from where migrants were drawn from. For example, if among 18-22 year olds, migrants were drawn mainly from the 5-8 years of education group, this will lower the size of this cohort in 2000. However, if migration is proportional to education cohort size, it will have no effect on the educational distribution.

If we assume that mortality is negatively correlated with migration, the education distribution should shift to the right from 1990 to 2000. However, the fact that we are considering young age cohorts for which mortality is small should attenuate this effect. In terms of continuing education, this would also have the effect of shifting the education distribution to the right. However, the percentage of individuals in each age cohort who are still attending school is low. For example, 1.5 percent of 18-22 year olds were still attending school and had 5-8 years of schooling in 1990, but only less than half a percent of the 0-4 years of education cohort were still attending school. In summary, there should be a small shift to the right in the education distribution between 1990 and 2000 for all states in Mexico, but there could be other changes in the distribution for high migration states depending on where migrants are drawn from.

Table 2.3 presents the education distribution and the difference-in-difference estimates using 5 states with the highest and lowest migration rates in Mexico in 2000[15]. It includes estimates for two age cohorts; 18-22 and 23-27 year olds in 1990. Table 2.3 shows that in 1990 high migration states had higher educational attainment than low migration states. As expected, there is a small shift to the right of the education distribution for low migration states from 1990 to 2000.

[15] Migration rates are based on percentage of households with at least one migrant to the United States from 1995-2000. Low migration states are Tabasco, Quintana Roo, Chiapas, Campeche and Yucatan with an average migration rate of 1 percent. High migration states are Aguascalientes, Durango, Guanajuato, Michoacan and Zacatecas with an average migration rate of 12 percent.

Table 2.3 Difference-in-Differences estimates of education.

Age 18-22 (in 1990)		Education Distribution %		
		0-4	5-8	9+
Low Migration States	1990	29.3	29.2	41.4
	2000	27.6	27.2	45.2
Difference		-1.8	-2.0	3.8
High Migration States	1990	19.2	37.0	43.9
	2000	19.9	32.8	47.4
Difference		0.7	-4.2	3.5
Difference-in-Differences		2.5	-2.2	-0.3

Age 23-27 (in 1990)		Education Distribution %			
		0-4	5-8	9-11	12+
Low Migration States	1990	39.1	25.3	16.3	19.3
	2000	37.4	24.5	17.1	21.0
Difference		-1.7	-0.8	0.8	1.7
High Migration States	1990	28.2	33.2	19.6	19.0
	2000	27.7	31.7	18.8	21.9
Difference		-0.5	-1.5	-0.8	2.9
Difference-in-Differences		1.2	-0.7	-1.6	1.2

The difference-in-differences estimates suggest that the 18-22 and 23-27 year old migrants to the United States come from the low and medium portions of the education distribution, which is consistent with the negative selection literature, and more importantly, with our estimates using the net migration methodology. The latter are presented below.

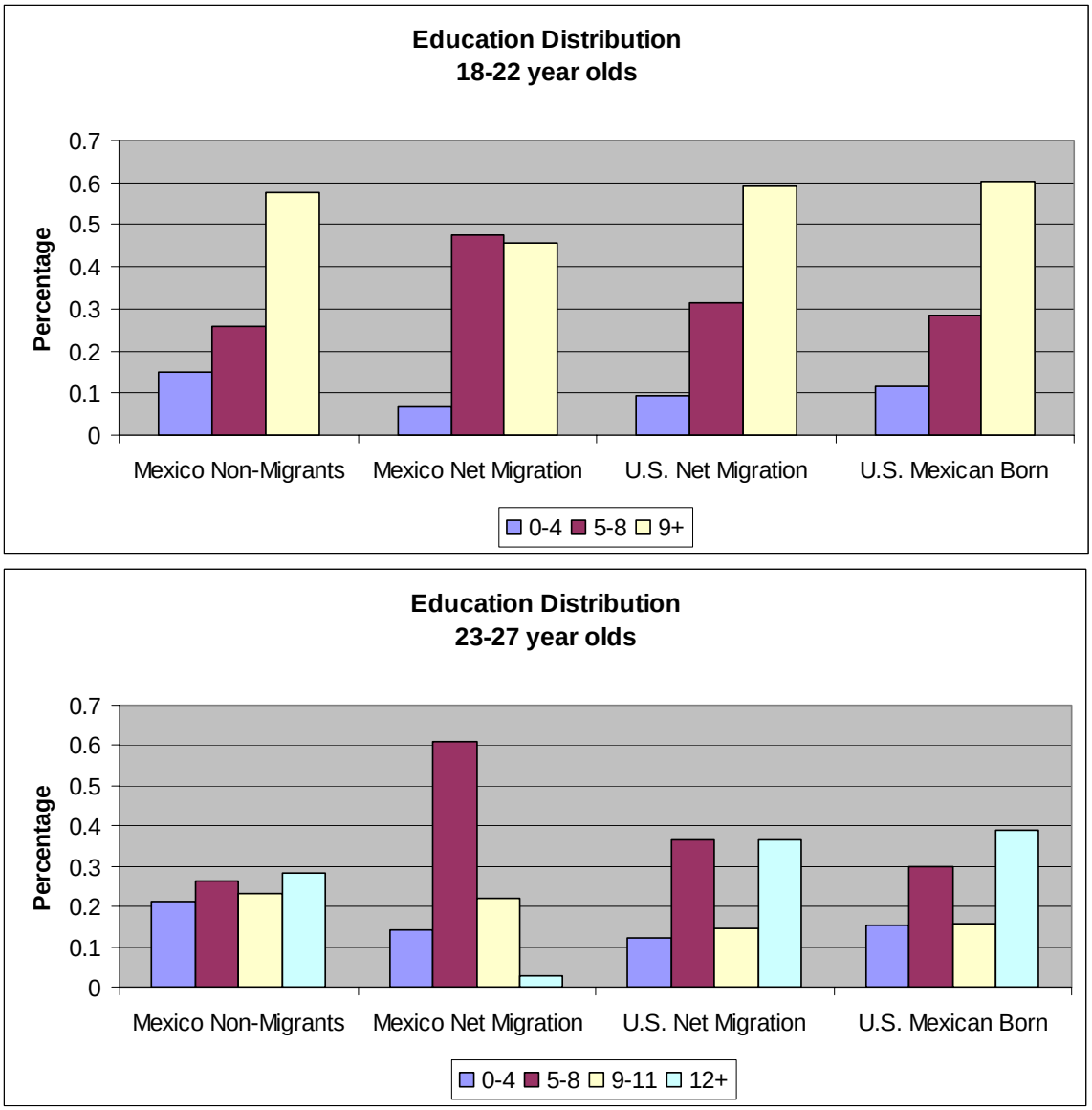


Figure 2.1 Net migration estimates of education.

Figure 2.1 shows the net migration distribution of educational attainment of migrants in two age groups. For each age group, we estimate four separate distributions. The first age group is comprised of individuals aged 18-22 in 1990. The majority of people finishing lower secondary school have done so by age 18. The same cannot be said for upper secondary schooling. So, we divide this sample into only three education groups: 4 years or less, 5-8 years and 9 or more years. The third age group is individuals 23-27 years of age. We expect the majority of those completing high school will have done so by age 23. For both age groups, we make adjustments for some continuation of schooling by older individuals, in a manner explained in the appendix.

The figures show the distribution of educational attainment for those residing in Mexico in 2000 and for those identified in the U.S. census as having arrived from Mexico between 1990 and 2000. In addition, we show the attainment of the flows estimated by net migration using both the Mexican and U.S. census data. The net migration estimates are adjusted to account for all four of the factors discussed above.

The first thing to note is that the distribution of educational attainment among migrants estimated using net migration and the Mexican census data differs widely from the distribution obtained by net migration using the U.S. data. Since we have matched migrants by age and gender, the differences in the distribution show that individuals report different levels of schooling in the

U.S. than they do in Mexico. Why might this be the case? One reason is that migrants to the United States might obtain schooling after arrival. This seems unlikely to be a major contributor, because the highest schooling category is junior high school for those 18-22 and high school for those 23-27. We find it unlikely that 18 year-old migrants are completing junior high school in the United States. A second possibility is that those not counted by the census may have a different education profile than those counted. If those uncounted in the U.S. census have lower schooling levels, than the U.S. census is likely to overstate the educational attainment of migrants. Finally, it seems likely that at least some part of the difference is caused by individuals responding differently to the U.S. census question than to the Mexican census question. The Spanish version of the U.S. census refers to high school as “secundaria” and college as “bachillerato.” In Mexico, secundaria refers to junior high school and bachillerato to high school. For these reasons, we believe the Mexican net migration data present the more accurate picture of the educational attainment of migrants from Mexico.

The education distributions on Figure 2.1 can be viewed from two different perspectives. From the perspective of migrant selection, we compare migrants to those remaining in Mexico. We focus the discussion on migrants measured by net migration using the Mexican data. For the 18 to 22 age cohort, the data indicate that migrants are more likely to have 5-8 years of schooling and less likely to have 0 to 4 and 9 or more years of schooling than

is the population remaining in Mexico. For the 23-27 year olds, migrants are much more likely to have 5-8 years of schooling (60% vs. 27%), and less likely to have any other schooling level, specially 12 or more years of schooling. As migrants are less likely to have 0-4 years of schooling, these data can be interpreted as supporting the intermediate selection of migrants. However, relative to the population remaining behind, the net migration estimates suggest that migrants have lower schooling levels.

Figure 2.1 also provides a check on the accuracy of the educational data reported by Mexican migrants in the U.S. Census. Comparing the Mexican net migration data with the U.S. census data, we see that the net migration data suggest migrants in the 23-27 year old cohort are as likely to have 0-4 years of schooling, but less likely to have 12 or more years of schooling. In the younger cohort, the distribution estimated by net migration is shifted to the left relative to the U.S. census data. Migrants are more likely to have 5-8 years of schooling and less likely to have 9 or more years.

In results not shown, we account for the potential negative correlation between education and mortality by adjusting the rate of lower education cohorts to be twice the rate for higher education cohorts. Such adjustments increase the level of positive selection of migrants, but not considerably due to the size of the adjustment relative to the size of the cohort. We also look at the issue of people overstating their educational attainment as they get older, the educational drift. This phenomenon would imply that results tend to understate

the level of positive selection, so the adjustment to the results is meant to represent an upper bound for the positive selection. The results for the 23 to 27 year olds in 1990 are included in the appendix, including a brief explanation on how the adjustment was done.

In summary, net migration estimates of the educational attainment of migrants using U.S. data differ greatly from estimates based on Mexican census data. Net migration estimates for Mexico suggest migrants from Mexico tend to have low or medium levels of education, while U.S data suggests they tend to have medium to high levels of education. At the same time, Mexican estimates using net migration do not consistently fall between estimates based on Mexican predicted data and U.S. data, as we expected. We observe this pattern only for a subset of age/education cohort or when we compute total averages for each group.

2.5 Conclusions

In this paper, we used the net migration methodology as an alternative to obtain estimates of the age, gender, educational attainment and number of migrants from Mexico. Our first finding is that migration from Mexico to the united State during the 1990s was about 300,000 less than the estimate obtained from the U.S. census data. We also find that migrants from Mexico are somewhat younger than suggested by Mexico’s census data on migration but older than estimates based on U.S. census data. Likewise, net migration

estimates suggest females have a higher migration participation rate than it is suggested by Mexican data on migrants, but a lower rate than it is suggested by U.S. data.

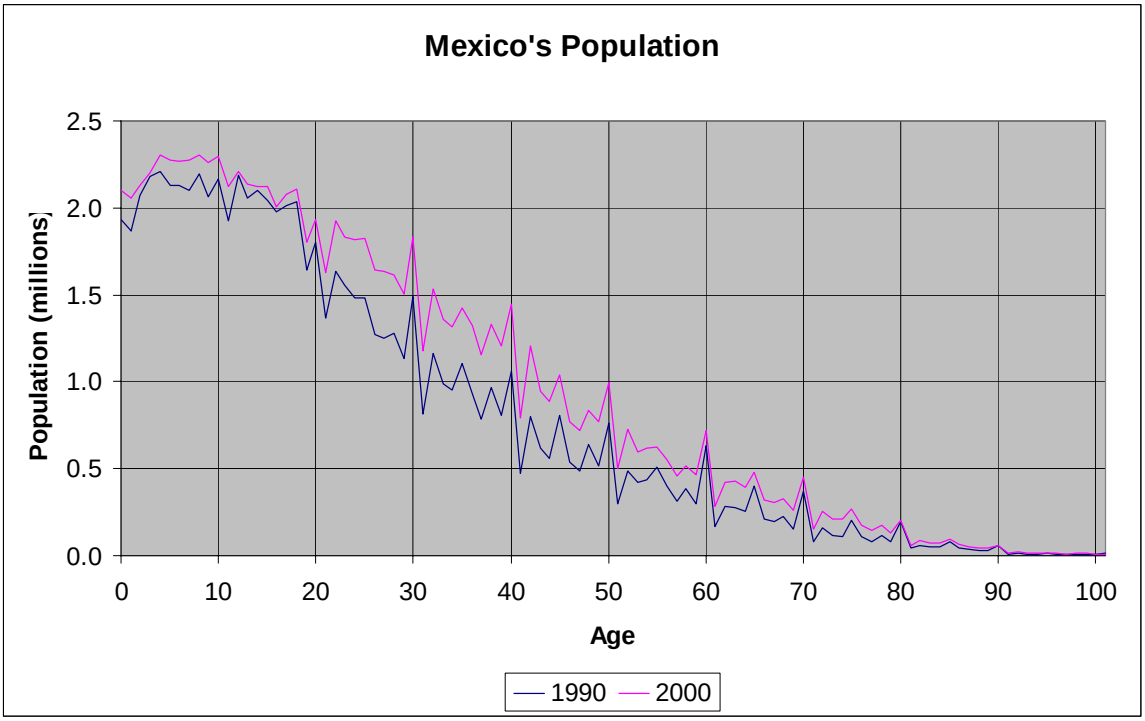
For education, the net migration estimates suggest that the educational attainment of migrants reported in the U.S. census is overstated. This is particularly true for the highest education categories, 12 or more years of schooling. There is reason to believe that the factors contributing to the overestimate of education are limited to the first generation respondents. This suggests there is an even larger jump in education levels between the first and second generation Mexican immigrants.

2.6 Acknowledgements

Chapter 2, in full, was co-authored by Christopher Woodruff. The dissertation author was the primary investigator and author of this paper.

Appendix

Age clumping around 0's and 5's.



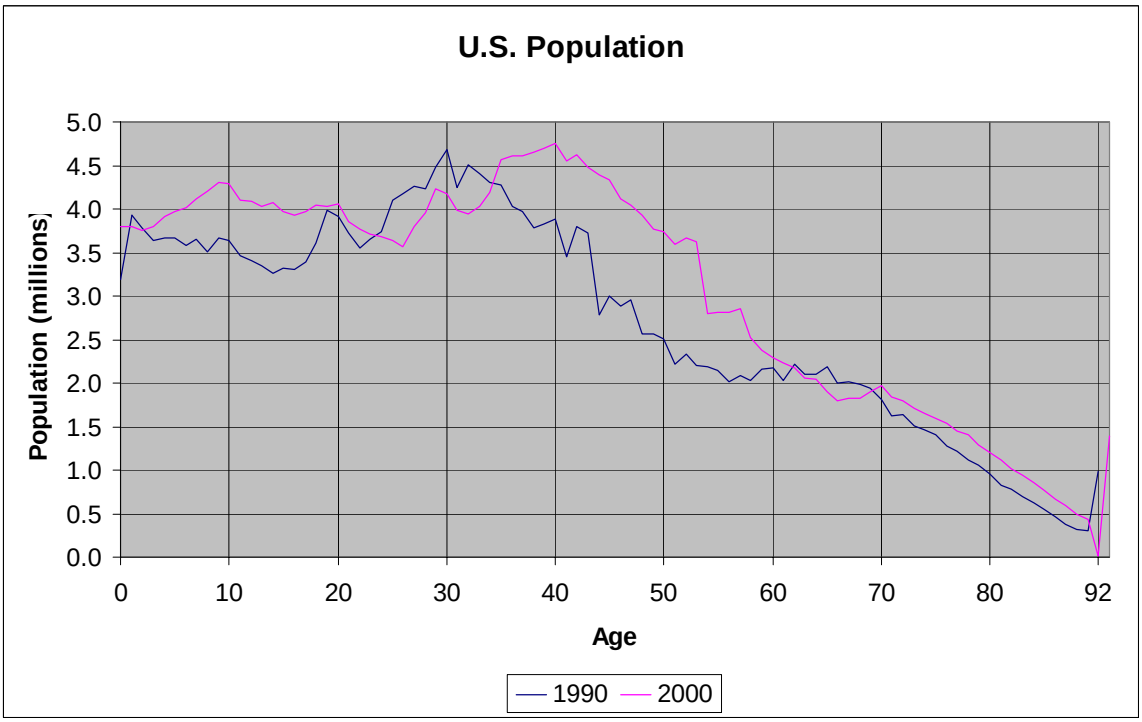


Figure 2.1A Mexico and U.S. population by age.

Age cohorts' mortality adjustment

Mortality data from Mexico for 1990-2000 is available by age cohort, gender and municipio of usual residence of the deceased. It shows, for example, number of deaths in each municipio for males age 5-9 in 1991. Age cohorts are 0-2, 3-7, 8-12, 13-17, etc…, so the adjustments for mortality follow the cohorts across years. For example, the adjustment for the 3-7 age cohort for females is as follows:

df0307 = .5*df010490 + .6*df050990 + .25*df010491 + .8*df050991 + df050992 + .8*df050993 + .2*df101493 + .6*df050994 + .4*df101494 + .4*df050995 + .6*df101495 + .2*df050996 + .8*df101496 + df101497 + .8*df101498 + .2*df151998 + .6*df101499 + .4*df151999

That is, in 1990 the 3-7 cohort uses half the number of deaths of the 1-4 cohort and 3/5 the number of deaths of the 5-9 cohort. By 1991, this cohort is now 4-7, so the adjustment adds ¼ of the 1-4 deaths and 4/5 of the 5-9 deaths. A similar procedure is used up to 1999.

Age cohorts for the education section are different than the ones used before, but their adjustment for mortality follow the same manner.

Using complete census data for 1990 and 2000

We requested to INEGI the data from the complete 1990 and 2000 census to compare to our estimates based on the 10 percent samples. The analysis followed the same procedure as with the samples. However, two additional issues emerged. First, the requested data includes only age, gender and educational attainment, so we cannot regress having age missing due to the lack of explanatory variables. To match the percentage missing in 1990 and 200 for each cohort, we used the age distribution of those reclassified as missing by the regression probabilities. For example, half a percent of those reclassified as missing were 18 in 1990, so the 1990 data for people age 18 was reduced by half a percent of the additional missing required to match the percentage missing in 1990 and 2000. Second, the adjustment to match the percentage with missing education in 1990 and 2000 had to be done in a similar manner than the adjustment for missing age due to the lack of explanatory variables. With these in mind, table 2.2A and Figure 2.2A present the net migration estimates and the estimates for the educational attainment using the complete census data for 1990 and 2000.

Table 2.2A. Net migration estimates using complete data.

Age Group (in 1990)	Mexican Census (INEGI) Net Migration 1990-2000		
	Females	Males	Total
8-12	-274,423	-791,122	-1,065,545
13-17	-459,454	-814,084	-1,273,539
18-22	-257,016	-313,763	-570,779
23-27	-185,125	-117,553	-302,677
28-32	89,164	179,445	268,609
33-37	-157,883	-98,479	-256,362
38-42	-72,623	-44,686	-117,310
43-47	-3,724	22,167	18,443
48-52	-36,157	-28,100	-64,257
53-57	62,013	59,390	121,402
58-62	993	20,724	21,717
63-67	5,299	34,171	39,470
68-72	19,088	45,868	64,956
8-72	-1,269,850	-1,846,022	-3,115,872

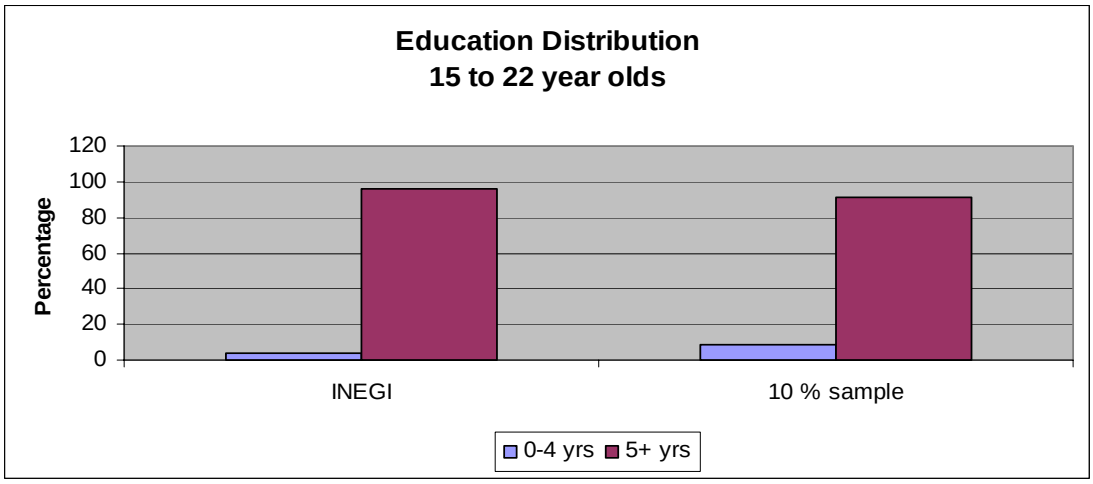
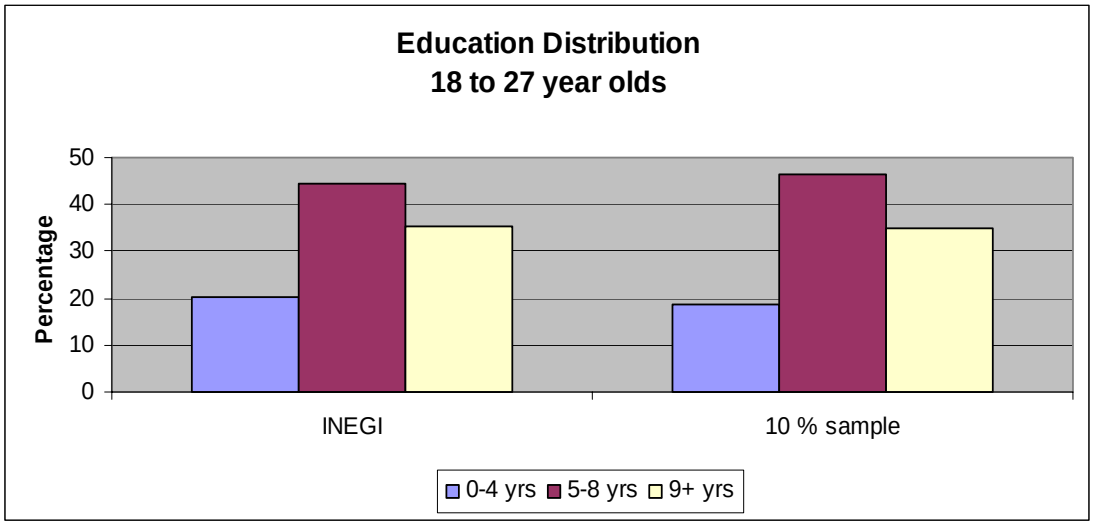


Figure 2.2A Net migration estimates using complete data



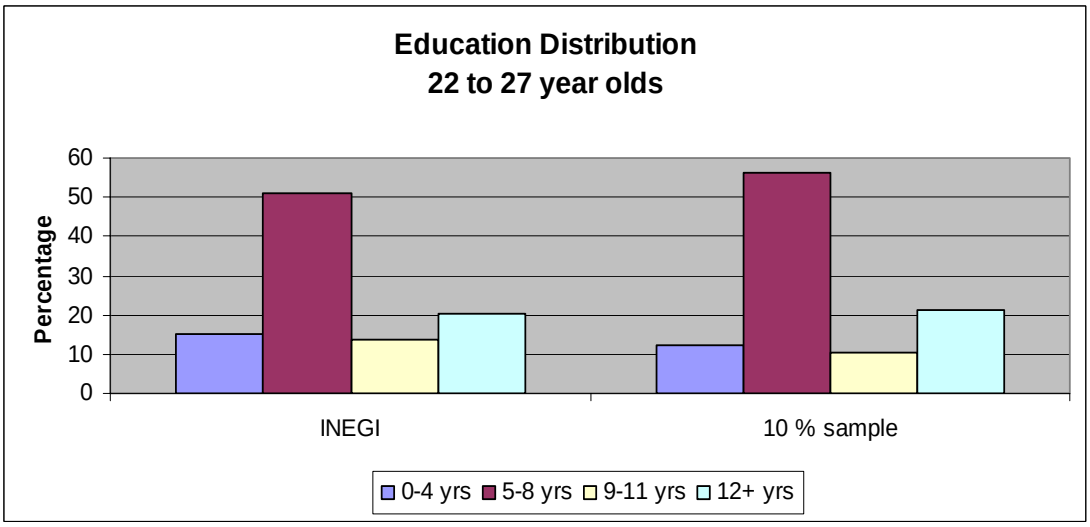


Figure 2.2A Continued

Adjustment for missing age

According to the 10 percent sample of the 1990 Mexican census, 0.103 percent of individuals have no age reported. In 2000, this amounts to 0.30 percent. INEGI offers no explanation for such condition. They claim it is just a natural result of the data collection process, so it cannot be explained why this condition exists in the data. The only major changes between 1990 and 2000

were the increase in the collection time from one to two weeks and the reduction in the number of interviewers. However, we do not know how these changes would lead to more cases of age not reported.

As mentioned before, by not adjusting the data to have the same percentage missing in 1990 as in 2000, we would likely be mis-reporting the extent of migration. The adjustment was done by regressing an indicator for missing age on personal characteristics, including family size, number of children, relation to household head, marital status, etc… We changed the obtained probability values of those with missing age to one, and then use a cut off point for the probability to switch to missing. For example, observations with probability of having age missing greater than .05 were changed to having age missing. Once changes were made, both samples had .30 percent of observation with no age reported.

Education Adjustments

There are two issues with the education data that need special attention. The first one was related to the percentage of individuals in each age cohort with no reported education level. Given that we wanted to make inferences on the educational attainment of a given age cohort, we needed to have the same percentage of individuals in each cohort with no education reported. Not having done this adjustment would have led to obtaining likely wrong estimates of the educational attainment of migrants.

Here are the actual percentages of individuals with no education level specified for the 3 cohorts we use.

	1990	2000
15-22	0.87	1.90
18-27	1.70	1.16
22-27	1.95	0.74

For the first cohort, we needed to increase the number of missing in 1990 so that it matched the percentage missing in 2000. The opposite was done for the other two cohorts.

The adjustment for missing education is similar to our adjustment for missing age. However, we do the adjustment for each cohort separately. That is, we perform the regressions and use the predicted values for each cohort separately. Again, regressions were made using personal characteristics, including family size, number of children, relation to household head, marital status, age, etc…After this, all 3 cohorts had the same percentage of individuals with no education reported. U.S. data did not present this problem given that there is no individuals with age or education level missing.

The second issue with the education data is related to having people acquiring more education between censuses, and it applies equally to U.S. and Mexico data. As explained before, we obtain the educational attainment estimates by looking at the educational distribution in 1990 and 2000 and adjusting for mortality. For example, if after adjusting for mortality there were

1,000 fewer people with less than 5 years of education in the 15 to 22 age cohort in 2000 than in 1990, then we could say that these people in this educational group have migrated. However, there is a chance that there are fewer people in this age/education group due to some people obtaining more education and not due to migration.

As explained before, we construct our age cohorts to try to minimize this problem. Our educational cohorts are 0-4, 5-8, 9-11 and 12 and more years of schooling. To illustrate the issue, consider the 15 to 22 cohort in 1990. This cohort starts at 15 given that it is at age 15 that most people have finished their first 4 years of schooling (more than 98 percent). There are however some individuals age 15 to 22 that are still attending school but have less than 5 years of schooling. By 2000, these individuals are likely to have acquired additional schooling, so an adjustment for the percentage of people should be made. That is, we reduce the 0-4 education cohort and augment the 5+ cohort by the corresponding percentage. By doing this, we would be assuming that all people still attending move to the following education cohort by the next census and no further. If those people still attending drop out of school completely or acquire more education than contained by the next educational cohort, our estimates would be mis-representing the educational attainment of migrants. Fortunately, the size of our adjustment is small and not likely to influence our estimates considerably.

Educational Drift

To adjust for the possibility of people overstating their educational attainment as they get older, and therefore understating the level of positive selection, we use data from people living in low-migration states in Mexico: Campeche, Chiapas, Quintana Roo and Tabasco. We take the 1995 Mexican census and use only the data for people who claim are no longer attending school at each age cohort. Then, we use data from the 2000 census for the same states for non-migrants who claim they were not attending school at that time and were living in the same state in 1995.

The education distribution for the 22 to 27 year olds in 1990 for 1995 and 2000 is shown below. An increase in proportions was observed for the less than four and nine to eleven years of education cohort, while a reduction was observed in the remaining two groups.

Education	1995	2000	Difference
<=4	25.0	26.4	1.4
5-8	30.3	28.6	-1.7
9-11	18.6	19.9	1.3
12+	25.9	24.9	-1.0

The results suggest more people claimed they had less than five years of schooling in 2000 than in 1995. This is somewhat puzzling because we would expect people to overstate their education, and not the other way.

However, this could be in part due to the data itself, which shows a way higher percentage of people without education specified in 1995 than in 2000. In a sense, the results reassure us due to the lack of a clear pattern of changes from 1995 to 2000. In any case, we restate below the results for the 22 to 27 year olds in 1990 adjusted for the potential drift in education in the nine to eleven years of education group.

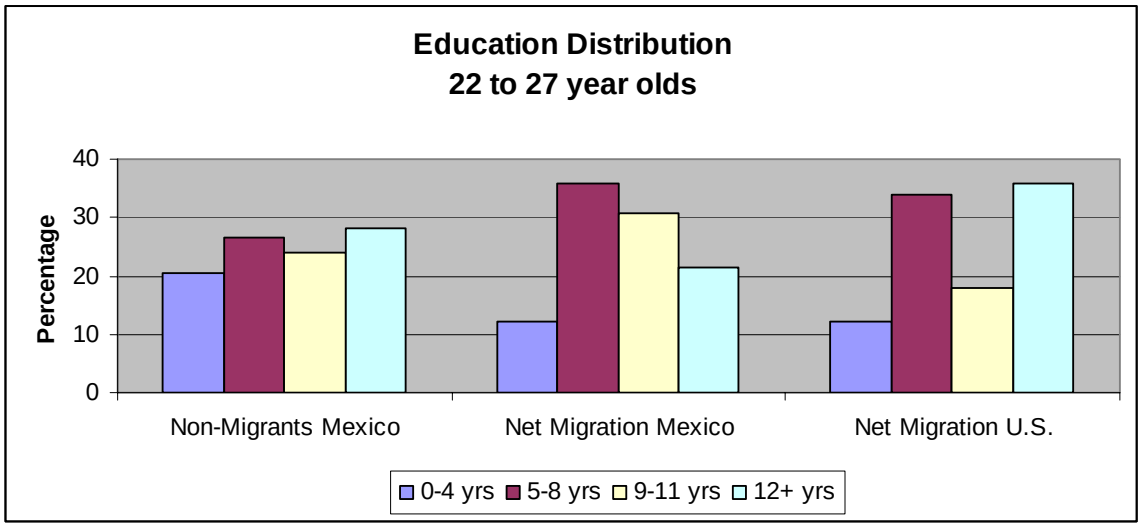


Figure 2.3A Net migration estimates adjusted for drift.

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Globalization and its Impact on Migration in Agricultural Communities in Mexico

Abstract

In this paper, I examine several market liberalization measures taken in Mexico in the first half of the 90's and their impact on municipalities' migration incidence. Specifically, I look at events that affected generally small agricultural producers of basic crops, such as the removal of price supports and input subsidies, changes in laws governing the property rights of communal landowners and the reduction in tariffs on agricultural imports brought about by NAFTA, and their impact on migration to the U.S. I find that reliance on basic crop production is positively and significantly associated with municipality level U.S. migration incidence. I also find small effects of exposure to changes in property rights of communal landowners and negative but insignificant effects of exposure to globalization on migration to the U.S.

3.1 Introduction

In 1994, Mexico, Canada and the U.S. entered the North America Free-Trade Agreement, NAFTA. This agreement was aimed at reducing and eventually eliminating trade restrictions on most goods traded among these countries, including agricultural products. In many respects, Mexico's entry into a trade agreement with the U.S. and Canada represented an ideal case to test standard trade theory predictions, like the ones made by the Heckscher-Ohlin model. The typical version of the model would predict that Mexico's unskilled workers, its abundant factor, would benefit from open trade with U.S. and Canada. This would entail an improvement in their economic conditions and consequently a reduction in the economic incentives for international migration. Accordingly, the Mexican government, in line with the Washington consensus, claimed that globalization would lower migration incentives overall by improving economic conditions in Mexico through increases in FDI and international trade. This was summarized by the Mexican President's slogan used to promote NAFTA,

"Mexico wants to export goods, not people."

Analogously, the empirical literature has focused on the impact of FDI and increased international trade on economic conditions, especially for the communities that receive them. Feenstra and Hanson (1997) examine the

impact of FDI on income inequality and find that FDI flows increase the relative wages of skilled workers. In a similar way, Hanson (2005) examines changes in the distribution of labor income across regions in Mexico during the 1990s and finds that high exposure to globalization, based on FDI and the contribution of international trade to GDP, shifts the income distribution to the right, relative to low-exposure communities.

In terms of migration, empirical studies have typically found that FDI and international trade deter migration domestically and abroad[1]. Aroca and Maloney (2005) find that a state's exposure to FDI deters out migration within Mexico, with its effects operating partly through the labor market. Similarly, Ritcher, et al (2005) uses panel data from a survey done in some rural areas in Mexico to analyze the impact of globalization on international migration. Their main estimation uses a single variable to capture the impacts from globalization, specifically whether or not NAFTA was in place in a given year, and they find evidence that NAFTA deters migration to the U.S. from rural areas in Mexico.

The predictions that come out of the previous literature for reduced migration from increases in FDI or in participation in international trade seem to be at odds with the continuing trend in international migration in the 1990s.

[1] Boucher, et al., (2005) use a retrospective survey in rural communities in 8 out of the 32 states in Mexico to estimate a model that has the percentage of villagers in U.S. farms as the dependent variable. They found that a coefficient for NAFTA, measured as a dummy = 1 after 1994, is positive and statistically significant.

Figure 3.1 shows there is a strong positive correlation between FDI flows and the stock of Mexican-born in the U.S. in the 1990s.

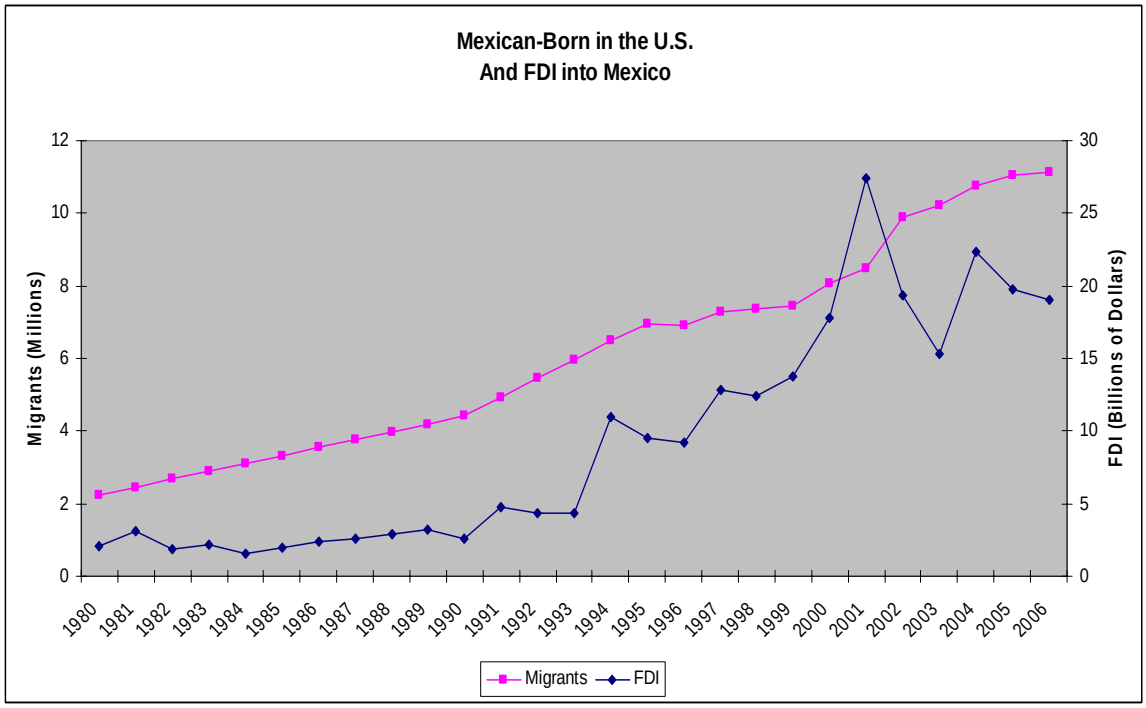

Figure 3.1 Stock of Mexican migrants in the U.S.

Part of the explanation of this trend in migration is that the Mexican government failed to foresee that opening the borders to trade could have profound impacts on communities that rely heavily on the production of basic crops. This results from the fact that basic crops production in Mexico is for the most part unskilled labor intensive and therefore much less productive than in the U.S. In addition, basic crops production in the U.S. is highly subsidized, which allows for competitive prices internationally. But more importantly, NAFTA started operating soon after producers of basic crops in Mexico stopped receiving subsidies and price guarantees from the National Council

for People's Subsistence (CONASUPO). For all these reasons, trade liberalization brought about by NAFTA and other liberalization measures left many Mexican producers of basic crops to compete with U.S. producers in an uneven field. This would likely affect negatively their economic conditions, and therefore increase the economic incentives for migration within Mexico and abroad.

That suggests that focusing on FDI and international trade to measure the impact of globalization on economic conditions and migration in Mexico in the 1990s presents an incomplete and distorted picture[2]. A more complete approach would take into account other factors, like the potential negative effects of NAFTA on basic crops prices through increased competition from the U.S. and the fact that other measures, besides NAFTA, were taken by the Mexican government in favor of trade and market liberalization in the 1990s. In this paper, I analyze the impact of several globalization and market oriented measures on migration incidence and find evidence that, contrary to what the Mexican government wished to accomplish, some of the globalization measures taken in the 90s had a positive and statistically significant effect on international migration in communities that relied heavily on basic crops production.

[2] For example, areas that focus on basic crops production are less likely to receive FDI or to benefit from increased international trade, but also more likely to be affected by the negative effects on producer prices from NAFTA. This would make it more likely for positive effects of NAFTA on economic conditions to be found when comparing communities with high and low exposure to FDI.

The rest of this paper is organized as follows: section 2 provides some background on the liberalization measures taken by the Mexican government that concluded with the signature of NAFTA, and on the role of CONASUPO in the production and distribution of basic crops in Mexico; section 3 reviews previous research on the effects of economic conditions on migration; section 4 presents the data used and the empirical strategy I employ; section 5 presents the main estimates and section V concludes.

3.2 Background

In 1982, Mexico suffered a financial crisis that lasted for several years and resulted in a 70% devaluation of the Peso, 100% inflation and a reduction in output and real wages. This crisis marked the end of the Import Substitution economic model in Mexico and the beginning of the market oriented era based on the liberalization of production and labor markets and the opening of the economy to international competition, all recommendations of the Washington Consensus. One important step in this direction was the signature of the General Agreement on Tariffs and Trade (GATT) in 1986, which reduced the maximum effective tariff from 80% to 20%, (Robertson, 2003). Nevertheless, Mexico received special treatment as a developing country that allowed it to protect most of the agricultural and animal products from foreign competition.

In 1988, Carlos Salinas de Gortari, a U.S. trained Economist, became president of Mexico. One defining characteristic of his presidency was his strong support for trade liberalization and market deregulation in general. He led the re-privatization of banks in 1991, the liberalization of financial markets and the sale of some state-owned enterprises. In particular, his presidency saw the reduction, elimination or privatization of entities designed to assist in the production, technical assistance and marketing of agricultural products, of which CONASUPO played an important role. He also signed in 1992 an amendment to Article 27 of the Constitution regarding the property rights of Ejidatarios[3].

However, his most prominent step toward trade liberalization was the signing of NAFTA, which started operating in 1994. Contrary to GATT, Mexico did not receive much special treatment in the agricultural and animal products sectors under NAFTA. The Mexican government's argument for liberalization of the agricultural sector was based on comparative advantage in the production of fruits and vegetables that the Mexican climate favors. However, that meant that the basic crops production sector would observe increased competition from abroad, so producers in that sector would have to modernize and compete globally or move to other areas or sectors of production.

[3] After the Mexican revolution, the government provided land for agricultural use to many groups of landless rural peasants as part of the Agrarian Reform. These groups are called ejidos and their individual members Ejidatarios. Each Ejidatario claimed a portion of the ejido as his/her own and was allowed to pass ownership only to kin. However, there were several restrictions on land use, for example, owners were prohibited from renting or selling their individual plots of land and they could not skip cultivation of their plots in two consecutive years.

All these liberalization measures were taking place at the same time that the government's intervention in agriculture was significantly reduced. Government intervention before 1990 was extensive and took several forms. It offered loans to private farmers and ejidatarios at below-market rates and provided agricultural producers with technical assistance and official insurance services at low prices. The government was also involved in price supports, input subsidies and in the distribution of basic crops to low income consumers at low prices. Additionally, it maintained high tariffs and quotas on all agricultural products in whose market CONASUPO intervened through producers' price supports.

CONASUPO, a major state-owned-enterprise up until 1990, was created in the mid- 1960s to maintain the purchasing power of low income consumers and the income of small basic crops' producers through input subsidies and sell price guarantees, and to promote the domestic commerce and distribution of these goods. CONASUPO managed stores to sell basic products to the rural and urban poor at low prices and used to sell fertilizer and modified seeds to producers at low prices. It also provided technical support and exerted control in eleven basic crops, which at some point represented 30% of Mexico's gross domestic basic crops production (Yunez-Naude 2003)[4],

[4] CONASUPO exerted some control over the production of barley, beans, copra, corn, cotton, rice, sesame seed, sorghum, soybeans, sunflowers and wheat.

but its influence was severely diminished by reforms that were part of the market liberalization process that started after the 1982 financial crisis.

Starting in 1990, the influence of CONASUPO was severely limited due to changes in its operations and funding shortages. These changes were gradual and eventually led to the elimination of price guarantees to most basic crops in 1992, except for corn and beans which lasted until 1995. This led CONASUPO to become only a last resort buyer to basic crops producers[5]. In 1991, ASERCA was created to take CONASUPO's role in promoting the distribution of agricultural products. ANAGSA, the agriculture insurance contract program, disappeared in 1990 and was replaced by AGROASEMEX, but with more stringent rules that ruled most small producers ineligible. Credito a la Palabra (Word for Credit), Alianza Para el Campo (Alliance for the Countryside) and other programs were created to help with the financing of agricultural production and the transition to other crops, but not all producers qualified and the amount of loans was typically insufficient.

To try to help agricultural producers, The Program of Direct Support to Agriculture (PROCAMPO) was created, and in 1994, it started distributing monetary funds to agricultural producers of basic crops. This aid was meant to help producers of basic crops modernize or switch to more profitable crops in response to the opening of the agricultural sector to international competition. The Mexican government claimed that, because it was a direct subsidy, it

[5] After 1992, the prices CONASUPO paid for basic crops were often below market prices.

would not create market or price distortions. However, given the insufficient amount of the transfer per eligible hectare and the lack of adequate financing, this aid became more of a subsidy for basic consumption.

Overall, the changes in the agricultural sector brought about by the government move towards market liberalization affected negatively many producers of basic crops by reducing the aid and subsidies they previously received, by not adequately financing their modernization that would have allowed them to compete globally or to switch to more profitable crops and by the negative impact on prices received by producers of basic crops because of NAFTA.

Figure 3.2 presents some evidence that producer prices for basic crops have decreased since 1992 at the same time that prices for fruits, a product likely to benefit from NAFTA, have increased. Yunez-Naude and Barceinas-Paredes (2004) found econometric evidence that NAFTA led to the convergence of producers' fruit prices in Mexico to international prices. They also find consistent deterioration of prices for basic crops since NAFTA. However, this trend was present before NAFTA took effect[6].

[6] Agricultural data also shows that the number of hectares used in the production of corn and basic crops in general decreased in this period, at the same time that the yields per hectare increased. This might be due to small producers exiting the market. In the case of fruits, the average number of hectares used in the production of fruits increased as well as their yields per hectare.

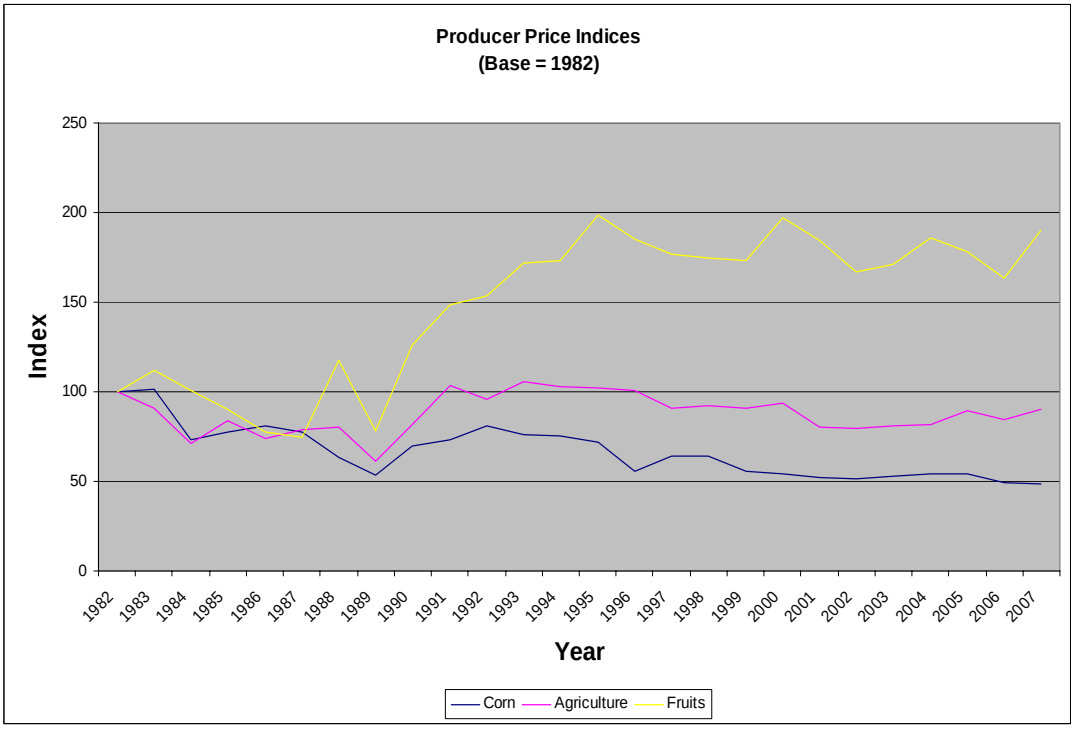

Figure 3.2 Agricultural producer price indices in Mexico.

3.3 Economic Conditions and Migration

There is a vast literature on migration from Mexico to the U.S. in terms of its impact on both, the receiving and the sending country, and the characteristics and events that condition its incidence among communities in Mexico. Of the latter, the most common are studies on the effect of migration networks and economic conditions in Mexico and the U.S. on migration. After all, the neoclassical theory of migration, which has been used the most, depicts the migration decision as being dependent on all economic conditions in Mexico and abroad that affect potential earnings.

Massey and Espinosa (1997) use retrospective data from a survey done between 1987-1992 in 25 Mexican communities in historically high migration states and find that, aside from the presence of migration networks, macroeconomic variables like the real interest rate in Mexico and whether or not they live in an agrarian community are strong predictors for first trip migration to the U.S. of undocumented workers. This implies that individuals living in agrarian communities might be more likely to migrate abroad due to the lack of credit to make productive use of the land they own or due to low profitability in the production of basic crops. However, they also find that expected wage ratio between Mexico and the U.S. is not a strong predictor of migration. On the other hand, Hanson and Spilimbergo (1996) find that a reduction in real Mexican wages increases border apprehensions, which is a proxy for border crossing attempts.

In a similar way, Richter,et al (2005) use data from rural areas and find strong positive effects on migration from macroeconomic variables such as GDP growth in Mexico and the U.S. and Peso devaluations. This might imply that, in rural areas, low income individuals take advantage of good economic conditions to migrate abroad. It is also possible that Peso devaluations benefit potential migrants who receive remittances from abroad and therefore allow them to finance the trip northward.

All the fore mentioned events and others that took place in the 1990’s had some economic impact on all communities in Mexico in some form or

another, from the fall of CONASUPO, which affected mainly small producers of basic crops to the 1994 financial crisis, which affected most parts of the country. Such effects ranged from an increase in unemployment in some sectors to changes in the distribution and levels of income, and they likely affected the economic incentives for migration to the U.S. In this paper I incorporate measures that could potentially differentiate between communities with high and low concentration in basic crops production.

3.4 Empirical Strategy and Data

Empirical Strategy

The goal of this paper is to analyze how different globalization measures in the first part of the 1990s affected the migration incidence of municipalities in Mexico between 1992 and 1997. Among these measures, those that affected mainly communities that rely heavily on basic crops production are of most interest. To do so, I use a balanced sample of municipalities from 1992 and 1997 and employ the typical difference-in-differences estimation. The baseline specification takes the following form:

(1)

$$MigRate_{it} = \alpha + (\beta_1 * 1997_t + \delta_1) BasicCrops_i + (\beta_2 * 1997_t + \delta_2) NAFTA_i + (\beta_3 * 1997_t + \delta_3) Ejido_i + \beta_4 * 1997_t + (\Omega * 1997_t + \Gamma) X_{it} + \varepsilon_{it}$$

The dependent variable is the migration rate in municipality *i* at time *t.* 1997 is the post-treatment dummy. To account for the impact of the removal of price supports, input subsidies and other shocks to basic crops producers, I include the variable *BasicCrops*. This variable is constructed by interacting the municipality's percentage of the labor force in agriculture and the percentage of agricultural land used in basic crops, so it takes on values between 0 and 1. β_1 is the coefficient on the variable of interest, and it captures the impact of exposure to basic crops shocks on migration. Given that events like the fall of CONASUPO were likely to have a negative effect on producers of basic crops, I expect β_1 to be positive.

To control for the impact of NAFTA through investment flows and increased international trade on migration, I include the variable NAFTA. This variable is constructed following Hanson (2005) and it uses FDI as a percentage of the state's GDP and the share of the state's GDP in imports and maquiladora exports to rank states in terms of their exposure to globalization[7]. One key aspect to note here is that this is a typical measure of globalization used in the literature, which does not account for the impact on agriculture producer prices.

Another important globalization measure taken by the Mexican government in the first part of the 1990s was the change to Article 27 of the Constitution regarding the property rights of Ejidatarios. This change in the law

[7] This data is only available at the state level. Source: INEGI/ Banco de Informacion Economica. Maquila exports is the only data available for exports at the state level.

was signed in 1992 and basically gave Ejidatarios complete property rights on their individual plots of land. To account for the potential effect of this change on migration, I include the variable *Ejido*, which represents the percentage of agricultural land in the municipality that belongs to an ejido.

To control for heterogeneity across municipalities in Mexico, the vector X_{it} includes municipality economic and demographic characteristics. It includes the municipality population in 1990, measures of historical rainfall, the percentage of land with irrigation system, the percentage of households with a member who speaks an indigenous language, etc. At the end, the identifying assumption for β_1 is that no other events took place in the period of analysis that affected differently communities depending on their exposure to basic crops shocks.

Data

I use municipality and state level data from the 1992 and 1997 National Survey of Demographic Dynamics (ENADID), the 1990 Population Census and the 1991 Censo Agricola-Ganadero (Agriculture-Livestock Census). The 1992 ENADID was the first nationally representative survey data on international migration. It contains data on dwelling and individual characteristics, education, employment, births, mortality and migration[8].

[8] Data from the ENADID survey is not representative at the municipality level, so the main specification restricts the sample of municipalities based on the number of households surveyed. I restrict the sample to municipalities that had at least 40 households surveyed in

Using the ENADID data, I construct the municipality migration rate as the number of households with at least one migrant to the U.S. in the last 5 years divided by the number of households surveyed in the municipality, but also as the percentage of individuals age 15-30 with migration experience in the last 5 years. I include the migration rate among 15-30 year olds based on previous estimates that suggest migration is most prevalent for this age group, Martinez and Woodruff (2007). That means that, if exposure to basic crops production shocks is a determinant for migration, these effects would be particularly strong for this age cohort.

The 1990 population census provides data on the municipality population and the percentage of labor force in agriculture. The 1991 agricultural census provides data on land use, the types of crops cultivated and the number of hectares used on 9 of the 11 basic crops previously controlled by CONASUPO. It also contains information on percentage of private, communal and ejido land, as well as on the availability of irrigation systems.

1992 and 1997. To check the reliability of the migration estimates using this data, I compare the ENADID municipality migration rates from 1992 and 1997 to those from the 1995 and 2000 population census. The correlation between the 1992 ENADID estimates and the 1995 population census is 0.75 and 0.80 between the 1997 ENADID and the 2000 population census. For the migration rate based on individuals, the correlations are 0.72 and 0.85 respectively. The 1995 census data is also not representative at the municipality level.

Means

Table 3.1 presents some summary statistics. Compared to the 1995 population census, municipalities in the ENADID sample have higher migration incidence. Around 10 percent of the households in the municipality have at least one migrant and around 7 percent of individuals age 15-30 have migration experience. In terms of exposure to basic crops shocks, the average exposure is around 9 percent, compared to around 5 percent for the country as a whole.

Municipalities have medium levels of exposure to globalization. Again, this measure is based on the state's contribution to GDP from FDI, imports and maquiladora exports. In terms of ejido ownership, the average proportion of agricultural land that belongs to ejidos is 40 percent, compared to the country's average of less than 30 percent.

In summary, municipalities in my sample tend to have higher migration incidence, lower contributions of FDI, imports and maquiladora exports on GDP, higher concentrations of agricultural land in ejidos and larger agricultural areas compared to the country as a whole. Other family and household characteristics follow the same pattern; slightly higher family sizes and illiteracy rates, worse access to health services institutions and to water, slightly higher proportion of households with a member that speaks an indigenous language, etc.

Table 3.1 Means

Summary Statistics	
Municipalities	744
% Households with migrants	9.72 (12.08)
% of Individuals age 15-30 with Migration experience	6.90 (9.65)
Basic Crops Exposure (0,1)	0.09 (0.10)
NAFTA (1=not exposed, 6=very exposed)	3.66 (1.46)
% of Agricultural land owned by Ejidos	39.55 (26.36)
Family size	5.61 (2.48)
Number of children ever born	4.04 (0.92)
% of Adults that know how to read and write	73.44 (10.53)
% of Working adults that are Self-employed	10.84 (6.31)
% of individuals with access to health services institution	35.57 (21.97)
% of Households with hard floors	77.21 (21.05)
% of Households with water	58.61 (34.07)
% of Households with electricity	88.20 (16.63)
% of Households with person speaks indigenous language	6.49 (13.61)

Standard of dev. in parenthesis

3.5 Results

All the results in this section use robust standard errors by clustering at the state level. The sample is restricted to the set of municipalities with at least 40 households surveyed in 1992 and 1997[9]. The first set of results uses the percentage of households with at least one migrant as the dependent variable and the second set uses the migration rate based on individuals age 15-30. Column 1 presents the results from regressing the municipality migration rate only on the exposure to basic crops, the dummy for 1997 and their interaction, so it represents the typical unconditional difference-in-difference estimation. It suggests that in 1992 exposure to basic crops shocks was positively associated with migration rates, and that from 1992 to 1997 this relationship increased significantly. However, these results do not account for the likelihood of omitted variables that could be correlated with both, exposure to basic crops shocks and migration incidence and trends, so in column 2, I include family, household and community characteristics. I include family size, illiteracy rates, a measure of rain variability, percentage of households with a member that speaks an indigenous language, etc.

The estimates from column (2) show negative coefficients for the exposure to basic crops shocks, suggesting that in 1992 the time invariant component of the municipality's exposure to basic crops was negatively

[9] More stringent restrictions, e.g. 60 households, lead to quantitatively similar results.

Table 3.2 Regression results

Dependent Variable: % of households with migrants				
	(1)	(2)	(3)	(4)
Basic Crops	12.88	-3.82	-2.95	
	(8.51)	(7.94)	(7.51)	
Basic Crops * 1997	9.19	13.59	13.72	
	**(4.32)	***(5.07)	***(5.22)	
Ejido			-0.02	
			(0.02)	
Ejido * 1997			0.01	
			(0.02)	
NAFTA			-0.43	-0.90
			(0.77)	(0.85)
NAFTA * 1997			0.29	0.28
			(0.54)	(0.57)
Dependent Variable: % of individuals age 15-30 with migration experience				
	(1)	(2)	(3)	(4)
Basic Crops	9.72	-3.12	-2.34	
	(5.77)	(5.91)	(5.47)	
Basic Crops * 1997	6.03	6.58	6.61	
	*(3.38)	*(3.60)	**(3.40)	
Ejido			-0.01	
			(0.01)	
Ejido * 1997			-0.01	
			(0.01)	
NAFTA			-0.54	-0.92
			(0.59)	(0.36)
NAFTA * 1997			0.26	0.14
			(0.40)	(0.44)

associated with migration rates. However, these estimates are not statistically significant in both sets of results. On the other hand, the coefficients for the variable of interest are positive and statistically significant in both sets of results. These estimates suggest that a one standard of deviation increase in the exposure to basic crops would lead to a 1.4 percent increase in the percentage of households with migrants and a .7 percent increase in the percentage of individuals age 15-30 with migration experience. However, these results do not take into account the impact of changes to ownership laws of ejidos and the impact of NAFTA through FDI, imports and maquiladora exports.

Column (3) adds to the previous specification a variable for the percentage of agricultural land belonging to an ejido and the globalization variable NAFTA to try to account for their impact on migration rates, and this represents the main specification. The coefficients in the first row suggests that exposure to basic crops in 1992 was negatively associated with migration rates. This negative relationship might be due in part to the presence of poor indigenous communities in the sample used. In general, poor and indigenous communities in Mexico do not send many migrants abroad[10]. The fact that the magnitude and statistical significance for the variable of interest do not change much when the NAFTA and Ejido variables are added to the specification is

[10] However, the migration patterns are changing in Mexico making migration more prevalent across the entire country, The National Population Council (CONAPO).

reassuring and suggests that exposure to basic crops is the best predictor in explaining the increase in migration rates from 1992 to 1997[11].

Comparing the two sets of results, the magnitude of the first set of results is greater, but this has to do with the way the measures are constructed. Again, the second set of results suggests that if a municipality increased its exposure to basic crops shock by one standard of deviation, its migration rate would have increased by .7 percentage points, a large increase considering that the average migration rate is 7 percent. In results now shown, I use also the migration rate based on individuals age 15-60 and 30-60 as dependent variables and run regressions as in column 3 to compare the results. The coefficients for both new independent variables are positive but statistically smaller than the results for people age 15-30, specially the one based on individuals 30-60. This supports the findings in Martinez and Woodruff (2007) that claim this age cohort is overrepresented by migrants to the U.S., and therefore more responsive to changes to economic shocks.

In terms of the effects of NAFTA through FDI and international trade, I find that in 1992 exposure to globalization was negatively associated with migration, consistent with Aroca and Maloney (2005), but these results are small and statistically insignificant. The interacted term on the other hand is positive but also statistically insignificant, consistent with Boucher et al, (2005). In summary, I claim that prior to the reforms, municipalities with high FDI and

[11] Unfortunately, there are no other estimates in the literature to compare the magnitude of my estimates.

international trade participation had no statistically different migration rates than other municipalities, but also no differential change in the migration rate in 1997. This might be due in part to the fact that the variable NAFTA accounts only for the impact of NAFTA through FDI and increased international trade at the state level and that there is a high level of heterogeneity among municipalities even in states with high participation in international trade.

I also find small and statistically insignificant impacts of exposure to changes in property laws of ejidos on migration. The magnitude of this coefficient might be explained in part by the potentially competing effects of changes in property rights of ejidatarios on migration rates; the improvement in the property rights could have assisted migration by allowing land owners to sell or rent their plots of land, but it could have also increased the level of investment by land owners due to clearer property rights, and therefore decreased migration[12]. Another potential explanation for the small magnitude observed could be the high correlation between basic crops production and ejido ownership. What this might entail is that the effect of exposure to basic crops production shocks might pick up a considerable part of the effect of the changes to Article 27 on migration. In results not shown, I rerun the specification in column 2 but I omit the variable for basic crops shocks and replace it by the Ejido variable, and I find that the coefficient for the percentage of land in ejidos increases substantially and it becomes statistically significant.

[12] The latter is similar to Pranab Bardhan's (Forthcoming) argument of the effect of property rights on long term investment.

Overall, the results suggest that changes to Ejido law had positive but statistically insignificant impact on changes in the migration incidence between 1992 and 1997. Considering also the coefficient for exposure to basic crops shocks, it suggests that the type of harvest matters more than type of ownership.

Other control variables have generally the expected signs. The coefficient for the percentage of households with at least one member who speaks an indigenous language is negative and statistically significant in both sets of results. The coefficients for the percentage of households with electricity and drainage system are negative, but they are both statistically insignificant. The coefficient for the average family size is positive but small and statistically insignificant. The coefficient on the percentage of agricultural land with irrigation system is also negative but statistically significant. This suggests that having a high percentage of the agricultural land with an irrigation system is associated with low migration. This can be explained in part if having irrigation system is a proxy for more productive agriculture.

As mentioned before, the typical specification in the literature that investigates the impacts of globalization on migration uses only measures of FDI and international trade and ignores other liberalization measures that might have had considerable impact on municipalities. This typical specification is presented in column (4). Some magnitudes change, but the conclusion is the same; I find no evidence that exposure to FDI and

international trade had a differential impact on migration across municipalities in my sample.

Overall, the results from the main specification suggest that municipalities with high exposure to basic crops shocks experienced significantly higher changes in their migration incidence between 1992 and 1997 relative to municipalities with low exposure. I also claim that municipalities with higher exposure to changes in ownership laws of Ejidos and/or increase FDI and international trade did not experience statistically different changes in migration rates from 1992 to 1997 relative to low exposure municipalities.

An important question at this point would be, what does the coefficient on the variable of interest really capture? Based on the identifying assumption, it only captures the impact of the elimination of price supports and input subsidies on migration, which came with the dismantling of CONASUPO. It also captures the impact of NAFTA through agricultural producers' prices and increased competition from the U.S. on migration, as well as any impact the changes in ownership laws of Ejidatarios might have had on producer prices.

Now that the results have shown that municipalities with higher exposure to basic crops shocks experienced higher migration incidence between 1992 and 1997 and given the high degree of heterogeneity among municipalities, it would be interesting to see whether or not the effect of exposure to basic crops shock is non-linear. I include the square term of

exposure to basic crops shocks and run the same regressions as in table 3.2. The results show only the coefficients for the interacted terms.

Table 3.3 Regression results 2

Dependent Variable: % of households with migrants			
	(1)	(2)	(3)
Basic Crops * 1997	15.62	29.01	29.59
	(11.54)	**(11.32)	**(12.17)
Basic Crops Square *1997	-15.61	-36.55	-38.67
	(23.98)	*(19.89)	*(21.74)
Ejido * 1997			0.01
			(0.02)
NAFTA * 1997			0.38
			(0.51)
Dependent Variable: % of individuals age 15-30 with migration experience			
	(1)	(2)	(3)
Basic Crops * 1997	12.00	16.42	16.67
	(8.86)	**(7.85)	**(8.08)
Basic Crops Square * 1997	-16.88	-25.12	-26.36
	(18.83)	*(13.89)	*(14.68)
Ejido * 1997			0.00
			(0.01)
NAFTA * 1997			0.30
			(0.38)

Table 3.3 show that the coefficient for the square term of exposure to basic crops shocks is negative and statistically significant. This suggests that the effect of exposure to basic crops shocks on migration between 1992 and

1997 is non-linear and presents an inverse-u shape[13]. It also shows that the coefficients for the ejido and NAFTA remain small and statistically insignificant.

Robustness

The maintained assumption in this paper is that the elimination of price supports and input subsidies had significant effect on migration rates between 1992 and 1997 and that these effects are captured by the variable for exposure to basic crops shocks. A concern for the validity of such claim would be that the main results presented are not truly capturing the impact of basic crops shocks on migration. That is, there is no secular trend in migration that is different between municipalities with different exposure to basic crops shocks. That would mean that what I am really capturing could be the effect of unobservables not considered in the analysis. If this is true, running a placebo test using another period would lead to similar results. If it doesn't, then that could serve as support to my results.

A period prior to 1992 would be ideal to compare to. However, as I mentioned, 1992 was first time representative data on migration was available, so that preclude us from looking at an earlier period[14]. In that case, the only available option is to look for a period beyond 1997. Given the current

[13] Based on the results, the point of inflection for the relationship between exposure to basic crops shocks and migration rates would be around .4 and .3 for the first and second set of results, respectively. Only between 5 and 10 percent of the municipalities in the sample have an exposure level beyond the estimated inflection points.

[14] There are other data sources that some authors have used to analyze other periods like the Mexican Migration Program (MMP). This data source contains retrospective information from family heads living in communities with high migration incidence.

availability of data, the only alternative is to use the 1997 ENADID and the 2000 population census. However, it is possible that the impact of liberalization measures on agriculture might have extended beyond 1997, so this might bias the results towards finding positive effects of exposure to basic crops on migration.

The analysis is again restricted to municipalities with at least 40 households surveyed in the 1997 ENADID. I include the same controls as before and calculate the migration rates in both 1997 and 2000. The results are presented in table 3.4.

A couple of small changes to note are that the 2000 population is used instead of the 1990 population and that I now use the percentage of households receiving PROCAMPO or PROGRESA. The latter is a very important program developed by the Mexican government to try to better the living conditions of poor families living in rural areas through financial aid[15].

Column (3) continue representing the main specification. None of the results are statistically significant, which supports my previous results in tables 3.2 and 3.3. However, there are some things to say about the signs and magnitudes of some coefficients. For example, the sign for the exposure to basic crops shocks is now negative and much smaller than before. This gives me more confidence that the variable of interest truly capture the impact of shocks to basic crops, like the dismantling of CONASUPO.

[15] PROGRESA aid is conditional on school attendance and attendance to regular health clinics and check-ups, which could have a negative (Stecklov et al, 2003) or positive (Angeluci, 2004) effect on international migration.

Table 3.4 Regression results 3

1997-2000 Data				
Dependent Variable: % of households with migrants				
	(1)	(2)	(3)	(4)
Basic Crops * 2000	-7.16	-3.93	-4.12	
	(5.67)	(6.99)	(6.96)	
Ejido * 2000			0.01	
			(0.01)	
NAFTA * 2000			-0.46	-0.50
			(0.35)	(0.34)
PROGRESA/PROCAMPO * 2000		-1.22	-1.75	
		(1.20)	(1.31)	
Dependent Variable: % of individuals age 15-30 with migration experience				
	(1)	(2)	(3)	(4)
Basic Crops * 2000	-3.54	-0.07	-0.39	
	(2.54)	(4.03)	(3.73)	
Ejido * 2000			0.01	
			(0.01)	
NAFTA * 2000			-0.19	-0.23
			(0.24)	(0.23)
PROGRESA/PROCAMPO * 2000		-0.71	-1.05	
		(0.70)	(0.81)	

The coefficient for the exposure to NAFTA is now negative and the magnitude is higher than before, so it is now consistent with the existing literature. The coefficient for the exposure to changes to property rights of ejidatarios remains positive and statistically insignificant. The coefficient for the

percentage of households receiving PROCAMPO or PROGRESA is negatively correlated with migration. This suggests that the Mexican programs using direct subsidies and conditional monetary transfers could be having their intended results.

3.6 Conclusions

In this paper, I examined the impact of several market liberalization measures taken by the Mexican government on the migration incidence of municipalities. Instead of focusing on FDI and the contribution of imports and exports to the state's GDP, I focused on several liberalization measures that might have had profound impact on municipalities that relied heavily in basic crops production. After controlling for several initial conditions and characteristics, including measures of rain variability, ejido ownership, exposure to NAFTA, the regression estimates show that exposure to basic crops production shocks is a strong predictor of changes in the incidence of migration to the U.S. between 1992 and 1997. My estimates suggest that a one standard of deviation increase in the exposure to basic crop shocks of municipalities would have increased the migration rate between 1992 and 1997 by 1.4 percent, which is considerable given an average municipality migration rate of 10 percent. By adding a square term, I also find evidence that the effect of exposure to basic crops shocks on migration in non-linear.

I also obtained measures of the impact of NAFTA on FDI and international trade and of changes to property rights of ejidatarios on migration. The coefficients for both measures are small and statistically insignificant, suggesting that communities with high exposure to globalization and changes to ejido property rights did not experience significantly different changes in their migration incidence between 1992 and 1997, relative to other municipalities.

Again, the sample of municipalities in this paper comes from the 1992 and 1997 ENADID survey, so it's possible that municipalities in the ENADID sample are not representative for the country as a whole. In other words, the results that I obtain might depend on the sample used. If this is true, and this might explain in part the discrepancy with some of the existing literature in terms of the impact of globalization on migration.

In summary, there is a vast literature that has tried to analyze the impact of NAFTA on the economic conditions and internal and international migration. This paper finds no similar effects. However, this paper finds that there were other more important events that significantly affected the migration incidence among municipalities, such as the fall of CONASUPO. Far from reducing migration abroad, this paper presents evidence that the market liberalization measures taken by the Mexican government represented strong incentives for U.S. migration for communities that relied heavily on basic crops production.

Appendix

I present in this section the results as in table 3.2, but restricting the sample of municipalities to those with at least 60 households surveyed, instead of 40. As shown in table 3.1A, the results do not vary considerably under this specification, and neither when the sample of municipalities is restricted to those with at least 20 households surveyed. Restricting the number of municipalities for those with more than 100, for example, reduces considerably the sample size.

Table 3.1A. Regression results 2A.

Dependent Variable: % of households with migrants			
	(1)	(2)	(3)
Basic Crops * 1997	9.49 **(4.41)	15.37 ***(5.18)	14.76 ***(5.29)
Ejido * 1997			0.01 (0.02)
NAFTA * 1997			0.30 (0.55)
Dependent Variable: % of individuals age 15-30 with migration experience			
	(1)	(2)	(3)
Basic Crops * 1997	6.08 *(3.47)	7.32 *(3.77)	6.88 *(3.73)
Ejido * 1997			0.00 (0.01)
NAFTA * 1997			0.27 (0.41)

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