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# Essais sur la migration mexicaine vers les États-Unis

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#### UNIVERSITÉ DE LYON - ÉCOLE DOCTORALE DE SCIENCES ÉCONOMIQUES ET DE GESTION UNIVERSITÉ LUMIÈRE LYON 2

Groupe d'Analyse et de Théorie Économique

## ESSAYS ON MEXICAN MIGRATION TO THE US

Thèse de Doctorat de Sciences Économiques Présentée et soutenue publiquement par

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## 1 General Introduction

This dissertation studies Mexican migration to the United States from three different perspectives. It constitutes an attempt to provide a holistic view of how this phenomenon has evolved, where it lies today, and how recent challenges are faced by thousands of individuals that undertake the dangerous journey, seeking better opportunities ahead. Thus, the study begins with the analysis of the determinants of the decision to migrate, focusing on a domestic perspective to search for potential ways in which local governments can provide incentives for individuals to decide to stay put. Nevertheless, the migration decision cannot ignore the destination country's policies for which this aspect is introduced in the second chapter of this work. Although there is an extensive literature on the effects of US immigration policy on migration flows, our study is complemented by adding local development variables proved to be important in the first chapter. In addition, the recent effects of the Mexican Drug War are also analyzed within the first two chapters, as crime organizations have been proven as an additional danger for the migrants' journeys. Finally, after analyzing the determinants from both a foreign and a domestic perspective in the migration decision, the final chapter looks at the migration effects. In particular, this work studies the educational mobility of children of migrants, shedding some light on the adverse long-term effects of migration.

This introduction hence intends to provide a thorough context for each and all three chapters of the dissertation.

#### 1.1 History of Mexican migration to the US

To understand the determinants of Mexican migration, it is pertinent to trace back to its roots. The Mexican population in the US can trace back to the times were certain regions in the US were still part of independent Mexico from the 1820's. Shortly after the Mexican Independence in 1821, a new war started in 1846 due to border disputes with the US. Texas had declared independence from Mexico and subsequently annexed to the US while the Mexican government had not acknowledged the sovereignty of this state. The American victory was signed in 1848 and as a consequence the territories of California and New Mexico were ceded to the US in exchange of a modest payment. The US granted citizenship to many Mexicans living in these territories, starting the ethnic group of Americans of Mexican descent.

The first large wave of Mexican migration to the US dates back to 1849 with the discovery of gold mines in former Mexican territory, California. The *Gold Rush* attracted immigrants from all around the world, pursuing to make fortune in a land in discovery. The huge increase of non-native population from 1,000 to an estimated 100,000 led to the first restrictive immigration laws in the US. Although not yet targeting the Mexican population, which continued migrating to the US.

During the years 1910-1920, migration heavily increased as a result of the violence of the Mexican Revolution, combined with labor shortage in the US due to the First World War, in which Mexicans were encouraged to work in the US. However, the migration phenomenon only gained major importance during the Second World War as the Bracero program began, aiming to increase production in a country in need after a huge labor force loss. Mexican laborers would go to the US under temporary working contracts in different sectors of the economy. After the Second World War was over, the agreement continued for the agricultural sector until its official end in 1964.

Thus, large immigration from Mexico during the following decades led to a series of restrictive immigration policies up to recent days.

#### **1.2** Immigration Laws

When one thinks about how the US try to control for Mexican immigration, the first image coming to one's mind is the massive wall the United States built at the fence since 2008 and that current president Trump wants to have turned into a fortified and augmented wall. The US Customs and Border Protection estimated a cost of USD \$6.5 billion to keep deploying and maintaining the fence over 20 years (Preston, 2011). Trump's wall is said to cost nearly USD\$21.6 billion not including maintenance (Ainsley, 2017). However, the US have not always been prone to spend such amounts of money to curb the rise of illegal immigrants from Mexico. Indeed, as aforementioned, during and after the Second World War, the Americans organized a large-scale migration of temporary workers, called the Bracero Program. It is only since 1965 that new immigration legislation laws were voted to reduce Mexican migrants' arrivals.

The Bracero program was agreed by the governments of the US and Mexico in 1942 and was designed to give exceptionally favorable terms for Mexican migrants. They could receive a minimum wage (which was not implemented yet for American farmers at the time), transport, housing and health benefits. The program was reinforced during the Korean War only to be ended by the Kennedy Administration in 1965. By then, 4.8 million Bracero contracts had been signed. Epstein, Hillman, and Weiss (1999) provide a theoretical framework of the Bracero program, arguing that it may have increased the stock of illegal workers, by having some of the individuals remaining illegally after the end of their contracts. In addition, this program created networks that would later be used by incoming Mexican migrants, building the largest share of unauthorized population in the US which has been estimated in as much as 59% in 2011 (Hoefer, Rytina, and Baker, 2011) as shown in Figure 1.

Figure 1 – Unauthorized US Population by Country of Origin



Source: Author's calculations using data from Hoefer, Rytina, and Baker (2011)

Thus, major reforms were carried about immigration laws. First in 1965, the Immigration and Nationality Act (INA) shaped various principles remaining nowadays: establishing country-based visa quotas instead of race-based quotas, favoring family-based migration and limiting the number of employment-based demands. This shift in legislation led to a change in migration type as what before was a a flow of temporary migrants became one of illegal immigrants, becoming a national issue.

In 1986 the Immigration Reform and Control Act (IRCA) came granting undocumented migrants a legalization path while it increased border and work-site enforcement, establishing penalties to avoid employers hiring illegal migrants. During the 1990s laws became more and more restrictive of immigrants rights in the US, allowing deportation, increasing restrictions on welfare benefits for immigrants and collecting information on legality status of children in schools (Skrentny, 2011).

During the Bush administration in the 2000s, the focus was rather the security of the border, and laws primarily seek to increase Border Patrol Agents from 9,100 in 2001 to 20,000 in 2010, and the authorization of the construction of a border fence in 2006 with the Secure Fence Act (Rosenblum and Brick, 2011; Skrentny, 2011). Although the border fence project was left unfinished with its cancellation in 2011.

In the late 2000s, the Obama administration marked a change in restrictive policies with an intent to provide naturalization to undocumented migrants. Although measures to stop migrant inflows were also taken, legalization of those already in the US could be obtain after 8 years conditioned in learning English, pay taxes and not committing a crime. The Deferred Action for Childhood Arrivals (DACA) and the Deferred Action for Parents of Americans and Lawful Permanent Residents (DAPA) shielded millions of undocumented immigrants from deportation. Nevertheless, at the same time the the administration seem to welcome the immigrant population, federal funding for border security was increased, signaling that open policies would only be directed to those with roots already in the country.

During the same years The Arizona Senate Bill 1070 in 2010, followed by copycat laws

in Utah, Georgia, Alabama and South Carolina in 2011 were passed, trying to convey more power to policemen to control for people's immigration status if they suspected them to be immigrants and force employers to control for it too. The Bills were nevertheless repealed in 2012 by the federal Justice Department due to its unconstitutionality and fear of discrimination towards minorities.

With the new administration in place that has always carried an anti-migrant sentiment, it becomes clear that harsher policies will now take place. Trump's border wall plans are ongoing and his determination of erasing Obama's legacy are evident. In early September 2017 Trump declared his intention of ending Obama's DACA, with already a suspension of any new applications from the  $DREAMers^1$  to be granted.

#### **1.3** Estimating the Number of Illegal Immigrants

Given its illegality status, it is very difficult to assess the actual number of unauthorized population in the US. First of all, illegal migration itself encompasses two types of migrants, the undocumented and the overstayers. While the undocumented are those individuals who entered the US without legal documents (i.e. smuggled in), the overstayers are those who entered with a valid visa, or Border Crossing Card<sup>2</sup>, yet overstayed the legal time their documents provided. The share of each type in the total amount of illegal immigrants has been estimated and differs within the data sources. On the one hand, Passel (2006) suggested in 2006 that despite the fact that only a small 1% percentage of total visa holders become overstayers, the world's population with a visa is so large that a small share still represents a large sum of individuals. In the case of Mexico the center estimated that 1.7% of Mexicans entering with visas become overstayers every year, accounting for 16% of all overstayers. Other nationalities present higher shares of overstayers given that it is more difficult for Mexicans to acquire visas as requirements comprise having a job and a notable

<sup>&</sup>lt;sup>1</sup>The term DREAMer comes from the initial name of the act presented by the Obama administration, namely the Development, Relief and Education for Alien Minors (DREAM) Act.

 $<sup>^{2}</sup>$ This type of document is given to allow temporal entrance in the US' border region. It is generally given to Mexicans living in Mexico and working or studying in the US border region.

income. According to the author's estimates, based on the methodology proposed by Warren  $(1990)^3$ , between 50 and 61% of the unauthorized population in the US by 2005 were illegal entrants, while the rest comprises overstayers with either a visitor visa or a Border Crossing Card.

Another methodology for estimating illegal entrants was developed by Espenshade (1995), who provides a theoretical model linking border apprehensions to the total undocumented population. The author also provides evidence using border apprehension data from the US Immigration and Naturalization Service (INS) that suggests a high correlation of both apprehensions and illegal entrance flows, for which apprehensions can be used of as an indicator of fluctuations of illegal migrant flows, yet they under-represent total figures.

For estimating the total amount of unauthorized population in the US, a common methodology is the *Residual method*, developed by Warren and Passel (1987) which consists of subtracting all the naturalized US citizens and legal alien residents living in the US from the foreign born population reported in the US census, as this difference would yield all the unauthorized aliens living in the country. Warren and Passel (1987) estimated that by 1980, Mexican illegal immigrants represented 55% of the total unauthorized population, which meant 1.1 out of 2 millions. By 1990 the INS (2004) estimated this number to be over 2 million and almost 5 million by 2000. Indeed, using this technique, two institutions report annual estimates which only diverge due to differences in used assumptions, such as emigration and mortality rates. Table 1 reports estimates from both institutions using this technique for the years 2009 and 2010, where we can appreciate the aforementioned differences. Warren and Warren (2013) use the same methodology and provide annual estimates as well as dis-aggregated figures by state. The authors suggest they also account for under representation of migrants in the Census data and propose other estimates that yield an even larger share of unauthorized immigrants.

 $<sup>^{3}\</sup>mathrm{The}$  author developed an estimation methodology matching data of arrival and departure forms of US visitors.

|                          |             |      | Foreign-   | Total         | Mexican |
|--------------------------|-------------|------|------------|---------------|---------|
| Authors                  | Institution | Year | born       | illegal       | illegal |
|                          |             |      | (millions) | (millions $)$ | (%)     |
| Passel and Cohn          | Pew         | 2009 | 39.4       | 11.1          | 60.4    |
| Hoefer, Rytina and Baker | DHS         | 2010 | 32         | 10.8          | 61.1    |
| Warren and Warren        |             | 2010 | $25.4^{*}$ | 11.7          |         |

Table 1 – Estimates of Unauthorized Immigrants in the US through the Residual Method

*Note:* \*Number accounts for foreign-born population entered after 1990. Pew refers to Pew Hispanic Center; DHS refers to the US Department of Homeland Security. Foreign-born population are those accounted in the Census that were not born within the US. Total Illegal are those estimated by sub-tracting all legal residents, after accounting for emigration and mortality rates, from the foreign-born. Mexican illegal is the share of Mexican nationals from the total illegal population.

Source: Author with data from Passel and Cohn (2009, 2011); Hoefer, Rytina, and Baker (2011); Warren and Warren (2013).

Other techniques have been developed to determine the migration inflows the US receives through its border with Mexico, which are summarized in Hanson (2006). Apart from the Residual method, some authors limit their analysis to micro-level data of household surveys, from which they can infer the share of illegal migrants from the total migrants. However, estimates using this method may vary quite largely. Using the Mexican Migration Project (MMP), McKenzie (2005) suggest 89% of migrants between 1970 and 1990 did their first migration illegally; while using the 1997 Mexican Demographic Dynamics National Survey (ENADID) yields such percentage in 91%. Both of these estimates are higher than the 60% estimated by Rosenblum and Brick (2011). Nevertheless, the percentages might differ by the proportion of seasonal migrants compared to the permanent, as well as neglecting individuals that change legal status after migrating.

Despite the different techniques, estimates are not yet perfect and although similar, do not exactly converge. An important aspect to take into account is that, as suggested by Hanson (2006), surveys are rarely representative of the migrant population: while census data underestimate migrants, projects targeting migrants usually over-represent them. Nevertheless, estimates provide a clear picture of the large share Mexican migrants represent from the total unauthorized population in the US.

#### 1.4 Organized Crime and Migration

In August, 2010, 72 dead bodies were found in San Fernando, Tamaulipas state in Mexico, calling attention to a series of events that had been going on since the year of 2007: the kidnapping and trafficking of undocumented immigrants who where risking their lives seeking the American dream for their families back home. This event came as a wake-up call, as it came to the knowledge of so many people throughout Mexico and the world.

Since 2006, the number of immigrants that have opted to reach the US has been decreasing, as a result of the downturn of the economic conditions in their destination country and the strengthening of policies and surveillance curbing illegal migration. According to SEGOB (2010) the highest annual flow of migration from Central America to Mexico, with the objective to stay or to go through to United States, was achieved in 2005, with approximately 450,000 migrants. By 2008 this number had drastically reduced to 171,000.

During the six months comprehended by September 2008 – February 2009, it was estimated by CNDH (2009) that 9,758 immigrants were kidnapped. According to their data, the CNDH projected that at least 18,000 people were being kidnapped annually, and that the number figure could be underestimated given the fact that many immigrants decide not to present any charges due to fear from the authorities. Moreover, a big number of the hostage immigrants get killed and are hidden through the vast Mexican territory, where many are unlikely to be found.

Even though the number of migrants has been decreasing since 2006, the number of kidnappings has increased, as it was subsequently estimated in CNDH (2011) that for the six months period between April and September of 2010 there were 11,333 captured immigrants. Although most of the kidnapped immigrants were from other Latinamerican countries, around 10% were Mexican.

The testimonies of those rescued suggest that at least 55% of the kidnappings happened in the southeast of the country, mainly in the states of Veracruz and Tabasco. Almost all of the immigrants travel through the country using the cargo train referred to as *La Bestia*  - *The Beast* due to the high danger that such type of transportation enhances with many getting injured trying to hide controls by riding on the roof of the train. Figure 2 shows the typical migrant routes through Mexico.



Figure 2 – Migration Routes through Mexico

Source: Internacional (2010)

Given the large quantity of immigrants traveling trough *La Bestia*, most of the kidnappings occur in the areas surrounding the train stations and railroads. The *modus operandi* inferred is that these acts are usually committed by an organized group who sometimes fooled migrants making them believe they will help them cross the northern border so that they voluntarily follow them into their captive houses, other times they would just surround the migrant group with armed offenders who would take them hostage right away. Then, the bandits would threaten them into giving them their family's phone numbers so that they could get money as a rescue. Those who claimed that they did not have anybody to call were sometimes killed or sometimes released. Other occasions what the kidnappers were seeking was to recruit people into their forces, so they would threaten those who refused, and obliged them to be trained as assassins or to lure more migrants to these places. Figure 3 shows the zones of danger for migrants in their way through Mexico.



Figure 3 – Zones of Danger of Migrant Kidnapping

Source: CNDH (2011)

Most of the victims interviewed reported having been physically and emotionally hurt, deprived with water and food and being held under houses with insanitary conditions (CNDH, 2009, 2011). Furthermore, although migrants are still generally men, it is estimated that one fifth of the hostages were women and girls, whom at least 6 out of 10 were sexually abused Internacional (2010).

#### 1.5 Trends in US Foreign Aid Policy

Searching for determinants of the allocation decision, the hidden agenda of foreign aid has been studied widely in the literature. Dreher, Nunnenkamp, and Thiele (2008) empirically studied whether US aid influences the voting patterns in the United Nations General Assembly and found positive results regarding program aid, grants and untied aid. Moreover, the authors replicated the models for the rest of the G7 countries and did not find similar results. Using panel data on US aid to 119 countries from 1960 to 1997, Fleck and Kilby (2005) also prove that aid flows are not only allocated according to development concerns. Commercial importance of the recipient country also matters. Thanks to the proxy they defined for each allocation criterion, they also show that the determining factors change according to the ruling political party. Berthélemy (2006) on the other hand, suggests that donors cannot be considered to allocate aid based on the same principles and provides evidence of differences in selfishness and altruism among different donors.

The US began its foreign aid policies during the Second World War helping the reconstruction of western European economies that had been devastated from the war. However, that was not the only agenda behind their initial aid. As the Soviet Union was expanding, the US employed foreign aid to get allies to stop the spreading of socialism. Under that context was that US donations to Latin America began in 1946, followed then by the Cold War in which inflows of money increased to make resistance to Cuba and the USSR's allies and to fight any arising leftist movements. After the Cold War ended, US's foreign assistance has increased in form of humanitarian emergency assistance, aiming to promote economic growth in the region, and more importantly, to fight organized crime in Colombia and more recently in Mexico (Meyer and Sullivan, 2012).

Figure 4 presents the trend that US's foreign aid has had for Latin America and the Caribbean, and Mexico since 1946 to 2011. The first peak we observe was in the early 1960's in which President Kennedy introduced an anti-poverty program as a means to stop Soviet influence in the region. Then in the 1980's US Aid was given to Nicaragua to fight the leftist movement of the Sandinistas. As the dissolution of the USSR happened, US Aid to Latin America decreased as democratic republics were generally established. As mentioned above, since the 1990's US Aid has been granted in forms of humanitarian assistance and in counter-narcotics programs.



Figure 4 – US Foreign Aid to Latin America and Mexico

Source: Author's calculations with USAID data

Figures 5 present the trend US Aid has had for Mexico, economic and military respectively. We can observe that the highest peak for both types of aid was recently achieved as a result of the Merida Initiative, an agreement signed in 2008 by both countries aiming to fight the drug cartels in Mexico.



Figure 5 – US Economic and Military Aid to Mexico

Source: Author's calculations with USAID data

#### 1.6 Summary

This introduction has covered several subjects that have shaped today's Mexican migration to the US. From a historical perspective, we suggested early determinants of the phenomenon, which has had an impact on today's migration patterns through social network. For this reason, it is common to find in the literature many studies such as Woodruff and Zenteno (2001, 2007); Hanson and Woodruff (2003); McKenzie and Rapoport (2007), among others, using historical data as strong instrumental variables for today's migration decisions.

Although a diverse set of estimates have been developed accounting for both the legal and illegal immigrant populations, there is still uncertainty on the actual numbers. According to the US Census Bureau, Mexicans in the US represent the largest share from the unauthorized population, and about a third of the total foreign-born population. The total amount has been estimated to more than 11 million<sup>4</sup> in 2014. Such large amounts of Mexican immigrants have yielded increasingly restrictive laws and policies, culminating with Trump's controversial proposal to build a wall all along the US-Mexico border.

Adding to the restrictive immigration policies from the US, a new threat for migrants has gained force in recent years. With Mexico's Drug War since 2006, crime organizations have found new finance potential in the kidnap and extortion of migrants intercepted on the long trajectory through Mexico. Thus, while having to avoid apprehension from US authorities at the border, migrants now fear apprehension from crime organizations along the way, being typical migration routes a risk point for kidnapping.

With the increase of violence in Mexico, new trends in US foreign aid policy have also emerged. Indeed, while economic assistance has been reduced, it has been substituted by military assistance with the objective of fighting crime.

With all these stylized facts in mind, the next chapter of this dissertation studies the domestic determinants of migration from a local perspective. The analysis seeks to find the

<sup>&</sup>lt;sup>4</sup>U.S. Census Bureau, 2015 American Community Survey 1-Year Estimates.

impact of local development on the migration decision in order to uncover possible means of action for Mexican governments to cope with migration. We further incorporate organized crime in the analysis to account for the recent additional risk of the migrants' journey. Our results suggest the relevance of the domestic side of the picture that had not been fully accounted in the literature before.

The second chapter of this dissertation studies the domestic and foreign perspectives from a holistic overview. Providing a theoretical framework based on the Mexico-US context, we provide empirical evidence from a cross-country comparison approach showing the impact of foreign aid, development and organized crime on bilateral migration flows.

After a careful analysis of migration determinants in the first two chapters, the last chapter of this dissertation is focused instead on the impacts of migration on the left behinds' welfare. The chapter studies educational mobility of today's adults according to the migration status of their parents. We exploit historical migration data to instrument for the endogenous migration decisions and hence provide causal inference of the effect of migration on the intergenerational transmission of education in the Mexican context.

In all, this dissertation attempts to provide further evidence on the migration decision and to highlight the potential detrimental effects of migration on the long term. Thus, through this research I intent to provide policy implications to contribute to the the Mexican migrant's welfare.

## 2 Chapter 1

# Local Development and the Decision to Migrate: Evidence from Mexican Migration to the US

The Mexican migration phenomenon is one of the largest and most studied in the literature. Despite the fact that intrinsic motivations of migrants as well as the effect of the US migration policies have been thoroughly documented, there seems to be little evidence regarding the effect of the Mexican government's role. Motivated by a simple game theoretic model, this paper stresses the importance of the Mexican authorities in determining the migration decision by exploiting the heterogeneity in local development outcomes to estimate the probability of migrating. To control for unobservable characteristics of migrants, a willingness to migrate variable is used. The results suggest that the domestic government should not be disregarded when studying migration patterns.

Keywords: International Migration; Local Development; Public Policy.

JEL Classification: D720, J610, O200.

#### 2.1 Introduction

From its roots to its effects, Mexican migration to the United States has been subject of a wide range of studies as fitting to one of the largest migration phenomena in history, with more than 11 million<sup>5</sup> of Mexicans living in the US by 2014. Evidently, it remains a subject of debate and policy focus as Mexicans account for nearly one third of the US's foreign-born population<sup>6</sup>, and about 10% of Mexico's total population. Despite the large literature, little attention has been given to the supply-side part of the question, which as it will be shown throughout this paper is also of importance.

There are relevant differences to take into account when modeling legal and illegal migration, yet most theoretical literature focuses on the legal type. Indeed, when studying illegal migration one has to account for a degree of uncertainty that is not present when considering legal migration, that is, the uncertainty of successfully arriving to destination. From a macroeconomic perspective, Todaro and Maruszko (1987) incorporated this aspect to the traditional Harris-Todaro model of labor migration, while adding the fact that illegal migrants have access to a fraction of the market wage given their illegality status. Hence, the authors conclude that illegal migration rates rely solely on the expected income differentials between the host and source country, with the source of uncertainty deriving from unemployment and border control.

Most of the remaining literature on illegal migration is considerably focused on the host country's side of the picture (Ethier, 1986; Djajić, 1987; Hanson and Spilimbergo, 1996; Woodland and Yoshida, 2006; Friebel and Guriev, 2006). While focus on the supply-side perspective is rather scarce, Bandyopadhyay and Bandyopadhyay (1998) consider the effect of the source country's trade liberalization policies as a determinant of illegal migration. Modeling a three-sector economy, their results suggest that liberalization in the agricul-

<sup>&</sup>lt;sup>5</sup>U.S. Census Bureau, 2015 American Community Survey 1-Year Estimates.

<sup>&</sup>lt;sup>6</sup>According to the US Census Bureau, the foreign-born population comprises all individuals who were not US citizens at birth, including naturalized citizens, lawful residents, temporary and humanitarian migrants, as well as unauthorized migrants.

tural sector increases illegal emigration, while liberalization in the high-skilled technological sector reduces it. However, no attention is made to other possible source country policies. Angelucci (2012a) focusing on poor households, finds that conditional cash transfer programs may increase migration by relaxing credit constraints, while it may reduce it through the conditioning of transfers.

From an empirical perspective, the literature on the determinants of migration is also vast, yet pull factors from the receiving countries are generally the focus. The early work of Jenkins (1977) favors push factors rather than pull factors in determining both braceros and illegal migrants. Blejer, Johnson, and Porzecanski (1978) also study both legal and illegal Mexican immigration to the US and find a common factor determining both types of migration, given by the difference in the rate of unemployment between Mexico and the US. Bratsberg (1995), on the other hand, uses data from illegal migrants that get amnesty after the Immigration Reform and Control Act (IRCA) of 1986. Studying source country characteristics of such migrants using aggregated macroeconomic data, the author finds that migrant flows are highly responsive to economic growth. From an event-history approach, Massey and Espinosa (1997) analyze over 40 characteristics determining a migrant's decision, including individual, household, community and Mexico and US macroeconomic level variables. Their results suggest the importance of networks, migration experience and the economic conditions in both countries, which appear to have a larger effect than the restrictive immigration policies of the US. Even though the authors consider some community level data, this paper focuses on other municipality development variables, from which we can derive relevant policy implications about ways local governments can tackle migration.

Empirical studies of public policies have also been mostly focused at understanding the effect of the US's immigration policies (Donato, Durand, and Massey, 1992; Espenshade, 1994; Espenshade and Acevedo, 1995) while scarce evidence is found studying the role of Mexican policies in determining illegal migration flows. Few exceptions are found in Caponi (2010), who uses a calibration strategy to evaluate the educational level of Mexican migrants

in the US and finds that Mexico's Oportunidades<sup>7</sup> program may have better ability in selecting more qualified migrants compared to the US's restrictive immigration policies. While Angelucci (2015) empirically studies the effect of the Oportunidades program and concludes that treated individuals are more likely to migrate given that their credit constraints are relaxed by the transfers.

As recently done in the literature, (Contreras, 2014; Chort and De La Rupelle, 2016) we also incorporate organized crime in our analysis because of its likely impact on migration through migrant kidnapping.<sup>8</sup> Crime organizations might be making migration trajectories even more dangerous in the Mexican context, decreasing the probability of successfully migrating. Additionally, having higher crime rates at home may have two contrary effects. On one hand, the rise in violence due to organized crime may trigger individuals to migrate in order to improve their living conditions, while on the other hand, given that it is often the male and head of the household who migrates, it would be less appealing to leave their wife and family behind in such a dangerous context. As our findings suggest, it is the latter rather than the former which is found in the data in terms of international migration, while domestic migration could be taking place to cope with the former, while not subject of the present paper.

Our paper hence contributes to the scarce literature of illegal migration while it also provides a new viewpoint from the supply country. Moreover, this study contributes to the literature of the determinants of migration twofold. Firstly, it provides a simple theoretical framework to understand the interaction between the local authorities and the potential migrant population. Secondly, it provides empirical evidence on the effect of local development variables on the decision to migrate controlling for unobservables of the decision to migrate itself. In addition, our paper incorporates an innovative, recently discovered aspect in the

<sup>&</sup>lt;sup>7</sup>Mexico's conditional cash transfer program aimed at increasing school enrollment and attendance of children in poor households, previously named Progresa.

<sup>&</sup>lt;sup>8</sup>Records have documented more than 11 thousand kidnapped migrants during the period April-September 2010, suggesting even larger numbers throughout the rise of crime organizations in Mexico's Drug War (CNDH, 2009, 2011).

case of Mexican migration by analyzing potential ways in which organized crime may impact migration flows.

The paper is organized as follows. Section 2.2 introduces a simple theoretical model to study the relationship between development outcomes, organized crime and the migration decision. Section 2.3 describes the data used for the empirical analysis presented in section 2.4 and section 2.5 then provides estimation results. Finally, section 2.6 summarizes and concludes.

#### 2.2 The model

The aim of the model is to illustrate the relationship between development outcomes and the decision to migrate and hence to motivate and provide a framework for the following empirical analysis.

The model consists of a sequential game composed by a local government playing first, and a population of N potential migrants playing second. Figure 6 presents the extensive form game for the local government and an individual  $i \in N$ . The government decides how much to invest in development D of the locality, while individuals decide whether to migrate illegally or stay put. Given the sequential nature of the game, we solve it by backward induction. Hence, this section is organized by describing the individual's problem firstly and then continue to the government's. It is important to state that the model cannot reflect the extent of the issue due to its simplicity. Yet, despite the weaknesses of the model, it sufficiently illustrates the situation analyzed in this paper, for which adding complexity is not necessarily desired. This simple model only focuses on illegal migration. As mentioned before, both groups bear different types of risks for which they should be studied separately. Indeed, the uncertainty in legal migration comes merely from the probability of finding a job in the destination, while our model focuses on the home-country factors. Nevertheless, legal migrants will also be analyzed in the empirical section in order to show the significant differences both types of individuals have and to motivate the analysis in a dis-aggregated fashion.





Notations:  $D^*$  is level of development chosen by the government, incurring in cost  $f(\cdot)$  and receiving t taxes as income; i is a potential migrant with alternatives to migrate (m = 1) or to stay put (m = 0). An individual's income at home is expressed by  $y_H$  and by  $y_M$  after migrating,  $\gamma$  stands for the costs of migration,  $p(\cdot)$  is the probability of successful migration,  $e(\cdot)$  is an externality from C, which stands for the organized crime level.

#### 2.2.1 Potential Migrants

We model a population of N potential migrants who decide whether to migrate illegally to a foreign country, or to stay put after observing the government's expenditure in development D. By staying put, the individual receives the home country wage  $y_H(D)$ , which is assumed to be an increasing and concave function of D, and pays the tax rate t. The scenario is based in a country like Mexico, where organized crime plays an important role in today's economy from various perspectives. In our model the potential migrant's utility function incorporates a negative externality of the crime level e(C) with e'(C) > 0. From figure 6 we observe two possible outcomes if the individual migrates, decided by nature according to probabilities p(C) and 1-p(C), with p' < 0 and p'' > 0. The first outcome is the case in which the migrant arrives successfully to the destination country, where he receives the revenue  $y_M^i$  that we will refer to as the value of successful migration as it incorporates not only the foreign country income but also the intrinsic value an individual i gives to migrating. We assume that this value has a uniform distribution in the population and that each individual can be ordered increasingly according to their value. A successful migrant does not pay a tax but engages in a migration cost  $\gamma$ . This cost is assumed to be the same for all individuals, which means that  $y_M^i$  is a net value from all individual-level costs. The other outcome when migrating is being kidnapped by a crime organization, for which the individual receives zero gains.

Hence, after observing D, the individual chooses to migrate if his expected gains are higher than the gains from staying, in line with Sjaastad (1962); Todaro (1969) and Todaro and Maruszko (1987). The peculiarity of the expected gains is that the source of the uncertainty is not merely based on the likelihood of finding a job or the probability of apprehension but rather on the probability of successfully getting to the US and not being kidnapped by a crime organization. This adds a new, unstudied angle. Yet, by not incorporating the other sources of uncertainty, we would be assuming that individuals in the model do not face such risks. Note that this assumption is made for simplicity and due to the fact that the aim of this paper is to study mainly the domestic conditions that motivate illegal migration and these other sources derive indeed from the US-side only. We can then write the individual's optimal strategy as:

$$max\{y_H(D) - t - e(C); p(C)(y_M^i - \gamma))\}$$
(1)

For a certain D and the distribution of individuals ordered by their migration value, there exists an individual whose expected utility of migrating equals that of staying put.<sup>9</sup> We can call him the marginal migrant  $m^*$  who is indifferent between both options and who determines the cut-off point to find the fraction of migrants  $n_m = N - m^*$ . The marginal migrant's migration value is given by  $y_m^{m^*}$ . Figure 7 represents such notion.

<sup>&</sup>lt;sup>9</sup>We need to normalize migration values  $y_m^i$  as their rank in the population distribution such that  $i = y_m^i \ \forall i \in N$ 

Figure 7 – Finding the number of migrants



We can then derive  $m^*$  from the marginal migrant's condition:

$$m^* = \frac{y_H(D) - t - e(C)}{p(C)} + \gamma$$
(2)

The number of migrants, given by  $n_m = N - m^*$ , can be shown to be decreasing in  $\gamma$  and D, increasing in t and having an arbitrary effect with respect to C. These results are easily computed through the partial derivatives of  $n_m$ :

$$\frac{\partial n_m}{\partial \gamma} = -1 < 0$$
$$\frac{\partial n_m}{\partial t} = \frac{1}{p(C)} > 0$$
$$n_m \qquad y'_H(D)$$

$$\frac{\partial n_m}{\partial D} = -\frac{y'_H(D)}{p(C)} < 0$$

$$\frac{\partial n_m}{\partial C} = \frac{e'(C)p(c) + p'(c)(y_H(D) - t - e(C))}{(p(C))^2} < 0 \Leftrightarrow \frac{p(C)}{p'(C)} > \frac{y_H(D) - t - e(C)}{e'(C)}$$

These comparative statics are intuitive. On the one hand, increases in migration costs  $\gamma$  must reduce the migration alternative's expected utility, hence reducing the number of migrants by augmenting the marginal migrant's place in the distribution. We find the opposite direction for the taxes given that it is a cost of staying home. Development outcomes increase the value of staying home and have no impact in the expected utility of migration. Finally, organized crime decreases the stay-put alternative's utility and it decreases the slope of the expected utility of migration. Hence, the effect of *C* depends on the relative effect of the changes of probability and the changes in the utility of staying home due to the externality. Figures 9, 10, 11, and 12 included in the appendix, present these comparative statics for a visual comprehension.

#### 2.2.2 Local Government

The local government is assumed to be non-benevolent in the sense of Buchanan and Tullock (1962) in which the government is motivated by the ability to extract a rent from the economy. Given that we model the local authority instead of a central one, assuming a non-benevolent government is not so counter-intuitive, especially for the cases of developing and middle-income countries, where high levels of corruption are usually observed. Table 2 supports this assumption, as we observe Mexico ranking very low in control of corruption in the Governance Indicator. (Kaufmann, Kraay, and Mastruzzi, 2011)

| Countries              | Percentile rank |  |  |  |
|------------------------|-----------------|--|--|--|
| High income - OECD     | 85              |  |  |  |
| High income - non OECD | 74              |  |  |  |
| Upper Middle Income    | 49              |  |  |  |
| Lower Middle Income    | 37              |  |  |  |
| Mexico                 | 26              |  |  |  |
| Low Income             | 20              |  |  |  |

Table 2 – Worldwide Governance Indicator: Control of Corruption 2014

*Source:* Author's elaboration using data accessed through the World Bank's website.

We characterize the government as having a budget B obtained from the tax t payed by the individuals who did not migrate. The budget can be spent on development outcomes Dat a cost  $f(D)^{10}$ , or spent in other activities from which the government extracts a rent<sup>11</sup>, we denote such activities as R. Hence, a rent-seeking government maximizes R which can only be done by minimizing its cost f(D) with the trade-off that spending too little in Ddecreases the government's budget as more individuals may migrate. Thus, the government's program is defined as:

$$\max_{D} tm^{*} - f(D)$$
s.t. 
$$m^{*} = \frac{y_{H}(D) - t - e(C)}{p(C)} + \gamma$$
(3)

As the local government can predict the potential migrants' choice, it maximizes its profit subject to  $m^*$  which is a function of D. Hence, the government's first order condition yields:

$$\frac{ty'_H(D)}{p(C)} = f'(D) \tag{4}$$

 $<sup>^{10}\</sup>mathrm{It}$  is intuitive to assume  $f(\cdot)$  to be increasing and convex

<sup>&</sup>lt;sup>11</sup>Such activities may be so called *pet projects*, which governments pursue for personal reasons rather than for the benefit of the population.

Intuitively, in equation 4 we find that in the optimum, the marginal cost of expenditure in development equates the marginal loss in revenue generated by the migration flow. Hence, the optimal expenditure in development is given by  $D^* = D^*(t, C)$ . By calculating the total derivative of equation 4, it can be easily shown that  $D^*$  is increasing in t. Moreover, we find that, regardless of the sign of the effect of C on  $m^*$ , assuming  $f(\cdot)$  convex, it is always negative for D. Indeed, the total derivative of equation 4 is given by:

$$\frac{y'_H(D)}{p(C)}dt + \frac{ty'_H(D)p'(C)}{p(C)^2}dC = \left[f''(D) - \frac{ty''_H(D)}{p(C)}\right]dD$$
(5)

From where we can derive the aforementioned relations:

$$\begin{split} \frac{\partial D}{\partial t} &= \frac{\frac{y'_H(D)}{p(C)}}{f''(D) - \frac{ty''_H(D)}{p(C)}} > 0\\ \frac{\partial D}{\partial C} &= \frac{\frac{ty'_H(D)p'(C)}{p(C)^2}}{f''(D) - \frac{ty''_H(D)}{p(C)}} < 0 \end{split}$$

To sum up, the results of this simple framework suggest a negative effect of development outcomes in the decision to migrate. Migration cost,  $\gamma$ , also decreases migration, while the effect of C remains unknown and depends on further assumptions of the functions in the model. From the government's results, we can infer that C happens to have a negative effect in the level of D. Additionally, migration cost  $\gamma$  plays no part in the optimal D.

The aim of this simple theoretical framework is to motivate the following empirical analysis, and to test whether in fact increments in development outcomes lower migration flows. At the same time, the other, here exogenous, variables  $\gamma$  and C will be tested. It is important to mention, however, that the role of these variables in determining development outcomes will not be analyzed. One could argue that there could be a link between the municipality's taxes and the development outcome variables. However, this link is not likely to be strong in the municipality-level given that local authorities do not collect taxes themselves, but rather their income derives mostly from federal and state transfers. Table 3 presents means of the percentile composition of the municipality's income weighted across the surveyed sample. The first columns represent municipalities without any migrants, the second those with at least one individual who migrated illegally and the last with at least one who migrated legally.

|                   | Ν       | Von-migrai | nt      | Ill     | Illegal Migrants |         | Legal Migrants |         |         |
|-------------------|---------|------------|---------|---------|------------------|---------|----------------|---------|---------|
|                   | 2000    | 2005       | 2010    | 2000    | 2005             | 2010    | 2000           | 2005    | 2010    |
| Local Taxes       | 9.06    | 10.19      | 9.28    | 6.71    | 6.85             | 5.29    | 8.28           | 11.02   | 6.69    |
|                   | (0.073) | (0.077)    | (0.067) | (0.089) | (0.067)          | (0.063) | (0.053)        | (0.84)  | (0.060) |
| Own Income        | 19.97   | 21.71      | 18.73   | 14.23   | 16.81            | 11.70   | 18.73          | 23.29   | 15.40   |
|                   | (0.121) | (0.133)    | (0.118) | (0.124) | (0.123)          | (0.101) | (0.098)        | (0.132) | (0.111) |
| Federal Transfers | 72.75   | 68.84      | 69.12   | 79.82   | 74.59            | 81.55   | 72.52          | 67.41   | 74.10   |
|                   | (0.137) | (0.154)    | (0.154) | (0.137) | (0.147)          | (0.125) | (0.120)        | (0.154) | (0.146) |
| Observations      | 19,130  | 20,741     | 17,938  | 126     | 128              | 65      | 44             | 112     | 70      |

Table 3 – Composition of Municipality's Income by Year and Migrant Type (percent)

Source: Author's elaboration using data from the Mexican Statistics Institute (INEGI).

Local taxes are those charged by the municipality itself, which mostly comprise the home-ownership tax. Own income refers to the local taxes plus all other income that the municipal authorities collect themselves due to services provided such as water distribution. We can see from Table 3 that local taxes represent at most 11%, while total own income reached a maximum of 23%. Furthermore, we observe that federal transfers represent the largest share of total income, being over 67%. There is, however, a statistically significant difference (at 1%) between illegal-migrant sending municipalities and the rest, where we observe a lower tax collection and a higher share of federal funds. This would suggest an even weaker link between development outcomes and taxes, and may be due to the fact that these municipalities are in fact poorer, for which their own resources might be too low. This difference will be addressed in the empirical section when controlling for municipality wealth.

#### 2.3 Data

When analyzing determinants of migration, it is common to use individual and household data from nationally representative surveys. Hamilton and Savinar (2015) suggest the possibility of finding biases in Mexican surveys due to having entire households migrating or migrants not reported by their family members, two aspects that are not taken into consideration for the sample selection of the surveys. Therefore, instead of looking at aggregated figures that may be biased or present measurement errors, we can rather look at dis-aggregated data and estimate the importance of the desired variables and how they might trigger the migration decision. However, the data used in the empirical analysis allows us to differentiate only by the type of entrance into the US. Hence, throughout this paper, we will refer to those who enter undocumented as illegal migrants, while we call legal migrants those who used either a visa, green-card or any other document that allowed them legal entrance to the US. It is possible that some individuals in the latter group are over-stayers but our data does not allow us to discern. Moreover, as we look into the migration decision from the sending-country perspective, it is reasonable to assume that the determinants for both should not differ substantially.

Our empirical strategy is based on data from the Mexican Family Life Survey (MxFLS), a longitudinal, multi-thematic household survey representative of the Mexican population at the national, urban, rural and regional level. At the time of elaboration of this analysis, the survey contained information for a 10-year period, collected in three rounds: 2002, 2005-2006 and 2009-2012. The survey has information both for adults and for their children, yet surveys for each group are not the same. More specifically, retrospective yearly migration data is only available for the adults. The total adults sample comprises more than 60,000 observations for all the rounds, that is about 20,000 individuals in the panel. The data was organized in three five-year periods given the fact that not all data in the survey was available on a yearly basis as migration data.

It is important to mention that we only take into consideration return migrants, as that

is the information available to us. The implications this may have in the following empirical analysis will be properly addressed. An additional concern with respect to longitudinal data is that of attrition, yet the MxFLS presented a low attrition rate. The attrition rate of migrants who were only present in the first round was only of 7.5%, while 8% for non-migrants. With respect to the second round, new members plus original members present in the second round but not in the third round were 10% for migrants and 15% for non-migrants. Moreover, we studied baseline characteristics of lost individuals compared to those still present during the last wave, and although differences were statistically significant, the magnitude of the differences were minor.<sup>12</sup> Hence, attrition is not a concern in this case.

Table 5 presents the descriptive statistics for migrants and non-migrants, as well as a difference-in-means test. The migrant sample contains individuals that migrated at least once during the 1996-2010 period, while non-migrants did not. For the empirical specification presented below, it should be noted that each individual and household-level time-changing variable was calculated according to the availability of the data, and their description may be found in the appendix. However, most data for the first period come from the first round, the second one was used for the 2001-2005 period, and the third for the 2006-2010 period. The appendix contains a more detailed explanation on the data mining process and the creation of the main variables used in the analysis.

<sup>&</sup>lt;sup>12</sup>These results, available upon request, suggested a 1% difference in willingness to migrate and less than a half percentage point of actual US migration.

|   | Non-Migrants   | Migrants  |
|---|--|---|
| Individual Characteristics<br>Age                     | 31.34<br>(11.55)                                     | $30.14^{***}$<br>(10.67)                            |
| Female Dummy  | $\begin{array}{c} 0.55 \ (0.50) \end{array}$         | $0.29^{***}$<br>(0.45)                              |
| Years of Education                                    | 10.55<br>(4.12)                                      | $10.49 \\ (3.70)$                                   |
| Married   | $\begin{array}{c} 0.58 \\ (0.49) \end{array}$        | $0.63^{***}$<br>(0.48)                              |
| Individual Monthly Income                             | $1973.64 \\ (42141.36)$                              | $2061.97 \ (3897.54)$                               |
| Relative Individual Income                            | $337.68 \\ (42053.49)$                               | $761.35 \\ (3889.71)$                               |
| Social Networks                                       | $\begin{array}{c} 0.37 \\ (0.76) \end{array}$        | $\begin{array}{c} 0.84^{***} \\ (1.41) \end{array}$ |
| Willingness to Migrate                                | $0.04 \\ (0.20)$                                     | $0.22^{***}$<br>(0.42)                              |
| Household Characteristics<br>Household Monthly Income | $7089.87 \\ (62224.73)$                              | 5962.95<br>(7679.51)                                |
| Relative Household Income                             | $5453.90 \\ (62072.93)$                              | $\begin{array}{c} 4662.33 \\ (7550.93) \end{array}$ |
| Household Size  | $5.48 \\ (2.64)$                                     | $5.71^{**}$<br>(3.06)                               |
| House ownership                                       | $0.82 \\ (0.38)$                                     | 0.84<br>(0.37)                                      |
| Vehicle ownership                                     | $ \begin{array}{c} 0.31 \\ (0.46) \end{array} $      | $0.37^{***}$<br>(0.48)                              |
| Social Programs Income                                | $\begin{array}{c} 1223.16 \\ (12736.13) \end{array}$ | $1896.40 \\ (6172.31)$                              |
| Observations  | 59,795   | 1,459   |

Table 4 – Sample Mean Characteristics of Migrants and Non-migrants

Source: Author's elaboration using MxFLS data.

*Note:* Mean sample characteristics by migrant status at baseline. Standard deviations in parentheses. Second column includes significance stars from a difference

Second column includes significance stars from a difference in means test with  $p^* < 0.1$ ,  $p^* < 0.05$ ,  $p^{***} < 0.01$ .
Apart from the gender and migration-related variables, we do not observe great differences between migrants and non-migrants. However, if we discern by the type of migration, summary statistics differ more as it is shown in Table 5. These migrant-type variables were constructed in a similar way as the migrant variable described above, where the variable for undocumented migration takes the value of one if the individual entered the US illegally at least once during the period, and the variable for legal migration takes the value of one if the individual entered the US using valid documents at least once during the period.

|   | Non-Migrant  | Illegal   | Legal  | Illegal - Legal |
|---|--|---|--|-----------------|
| Individual Characteristics<br>Age                     | 31.34 (11.55)  | $28.53^{***}$<br>(9.26)                             | $32.30^{*}$<br>(12.01)                             | ***             |
| Female Dummy  | $\begin{array}{cccccccc} 0.55 & 0.18^{***} & 0.44^{*} \\ (0.50) & (0.38) & (0.50) \end{array}$ |   | $0.44^{***}$<br>(0.50)                             | ***             |
| Years of Education                                    | $ \begin{array}{c} 10.55 \\ (4.12) \end{array} $   | $9.85^{***}$<br>(3.27)                              | $11.36^{***} \\ (4.06)$                            | ***             |
| Married   | $0.58 \\ (0.49)$   | $0.66^{***}$<br>(0.48)                              | $\begin{array}{c} 0.59 \\ (0.49) \end{array}$      | *               |
| Individual Monthly Income                             | $1973.64 \\ (42141.36)$  | 2151.88<br>(3542.17)                                | $1931.90 \\ (4307.81)$                             | NO              |
| Relative Individual Income                            | $337.68 \\ (42053.49)$   | $993.76 \\ (3524.30)$                               | $\begin{array}{c} 436.48 \\ (4291.85) \end{array}$ | ***             |
| Social Networks                                       | $\begin{array}{c} 0.37 \ (0.76) \end{array}$   | $\begin{array}{c} 0.82^{***} \\ (1.12) \end{array}$ | $0.88^{***}$<br>(1.74)                             | NO              |
| Willingness to Migrate                                | $0.04 \\ (0.20)$   | $0.23^{***}$<br>(0.42)                              | $0.23^{***}$<br>(0.42)                             | NO              |
| Household Characteristics<br>Household Monthly Income | $7089.87 \\ (62224.73)$  | $5237.59 \\ (6299.01)$                              | $7002.67 \\ (9140.31)$                             | ***             |
| Relative Household Income                             | $5453.90 \\ (62072.93)$  | $\begin{array}{c} 4079.47 \\ (6213.51) \end{array}$ | 5507.25<br>(8999.19)                               | ***             |
| Household Size  | 5.48<br>(2.64)   | $5.96^{***}$<br>(3.17)                              | $5.38 \\ (2.85)$                                   | ***             |
| House ownership                                       | $\begin{array}{c} 0.82 \\ (0.38) \end{array}$  | $\begin{array}{c} 0.83 \ (0.37) \end{array}$        | $\begin{array}{c} 0.85 \ (0.36) \end{array}$       | NO              |
| Vehicle ownership                                     | $ \begin{array}{c} 0.31 \\ (0.46) \end{array} $  | $\begin{array}{c} 0.29 \\ (0.45) \end{array}$       | $0.50^{***}$<br>(0.50)                             | ***             |
| Social Programs Income                                | $\begin{array}{c} 1223.16 \\ (12736.13) \end{array}$   | $1894.34 \\ (6335.86)$                              | $1878.37 \\ (5886.25)$                             | NO              |
| Observations  | 59,795   | 860   | 616  | $1,\!459$       |

# Table 5 – Sample Characteristics by Type of Migration

Source: Author's elaboration using MxFLS data.

Note: Mean sample characteristics by type of migrant at baseline. Standard deviations in parentheses. Columns 2 and 3 include significance stars from a difference in means test with respect to non-migrants, and column 4 shows difference in means test by migrant type. Significance stars denote \*p < 0.1, \*p < 0.05, \*\*p < 0.01.

From Table 5 we observe several differences among illegal migrants and the non-migrant population, as well as within migrant type. Illegal migrants are younger, while legal ones are older. This is not surprising if we think about the way each group migrates. Indeed, entering the US illegally is physically harder, for which age is an important factor determining the individual's success. We can also note a significant difference with respect to the gender of the migrants. For both cases we observe they are mainly males, yet the proportion is a lot higher for the illegal type. This can also be explained due to the difficulty and risks related to entering illegally. With respect to education, we find legal migrants to be more educated than non-migrants and even more so than illegal migrants. This corroborates the fact that returns to education are higher for legal migrants than for illegal ones. Although there is no statistical difference on the individual or household income of migrants and non-migrants, we do find differences between the types of migrants. Illegal migrants are individually richer, while this relation is reversed at the household level. Also with respect to wealth, we observe similar proportions of house ownership, yet legal migrants are more likely to own a vehicle than both illegal migrants and non-migrants. Hence, overall, legalmigrant sending households are richer. Lastly, there does not seem to be a difference on the household income from social programs. The two migration-related variables are clearly significantly higher for both types of migrants. The social networks variable was calculated as the number of US migration done in the locality<sup>13</sup> minus the individual's current migration over the surveyed people in the locality in migration age. Willingness to migrate is a variable denoting the percentage of individuals that declared a desire to migrate to the US in the future. This variable will be used to control for potential unobservable characteristics of migrants.

In addition to the MxFLS, I collected municipality level data from the Mexican Institute of Statistics and Geography (INEGI for its Spanish acronym). Given that the MxFLS uses INEGI's municipality codes, I was able to link the municipal data to the individuals. Table

<sup>&</sup>lt;sup>13</sup>A higher degree of geographical dis-aggregation than municipality, but for which it is not possible to link to external data due to low availability and the fact that localities are kept confidential in the survey.

6 presents the descriptive statistics for the INEGI data by type of migrant. Note that we will exploit the fact that while development variables are not solely determined by local authorities, a municipality's authority is accountable for most of the expenditure decisions. Indeed, while 30% of a municipality's funding is composed by labeled transfers from the federal and state governments which use is somehow restricted, another 30% of the revenue derives from unlabeled federal and state resources and 10% from local taxes, all of which constitute discretionary expenditure that has to be authorized by the state. (Peña Ahumada, 2011; INEGI, 2002-2005, 2004-2007) Thus, municipalities are accountable for most part of their expenditure decisions, creating a degree of heterogeneity that can be exploited to investigate their effect on the population's decisions regarding migration.

In the theoretical framework, the effect of local taxes was found to be of relevance. However, as aforementioned, given the fact that the main income in the municipalities derives from federal taxes and only a small percentage refers to those locally collected, it was decided not to incorporate such variable in the empirical strategy as it would not present the desired variability among the municipalities. It is important to mention that in order to keep the nationally representative composition of the survey, those individuals who migrated domestically to municipalities that were not surveyed in the first round, were dropped.<sup>14</sup>

 $<sup>^{14}\</sup>mathrm{In}$  addition, similar results are found from the original entire sample including before dropping domestic migrations.

|                                 | Non-migrant | Illegal              | Legal                | Illegal - Legal |
|---------------------------------|-------------|----------------------|----------------------|-----------------|
| Public playerounds and gardens  | 0.30        | 0.32                 | 0.30                 | NO              |
| r jo a a company                | (1.03)      | (1.30)               | (0.95)               |                 |
| Schools (per 1000 students)     | 8.92        | 12.05***             | 10.05***             | ***             |
|                                 | (6.31)      | (7.35)               | (5.46)               |                 |
| Teachers (per 1000 students)    | 50.02       | 51.61 <sup>***</sup> | 51.53 <sup>***</sup> | NO              |
|                                 | (7.86)      | (7.88)               | (7.90)               |                 |
| Health care units               | $0.50^{-1}$ | 0.92***              | 0.61                 | NO              |
|                                 | (2.51)      | (4.85)               | (1.69)               |                 |
| Doctors                         | 2.95        | 2.33*                | 3.06                 | NO              |
|                                 | (8.39)      | (9.00)               | (10.47)              |                 |
| Trucks from registered vehicles | 0.42        | 0.53***              | $0.50^{***}$         | ***             |
|                                 | (0.18)      | (0.20)               | (0.20)               |                 |
| Housing credits                 | 17.86       | $21.54^{*}$          | 13.93                | **              |
|                                 | (54.13)     | (63.79)              | (36.29)              |                 |
| Water treatment plants          | 0.02        | 0.04***              | $0.05^{***}$         | NO              |
|                                 | (0.13)      | (0.26)               | (0.25)               |                 |
| Piped water systems             | 0.51        | 0.47                 | 0.66                 | NO              |
|                                 | (2.25)      | (2.15)               | (3.75)               |                 |
| Housing water systems           | 388.00      | 267.68*              | $514.76^{*}$         | *               |
|                                 | (1502.16)   | (1307.16)            | (2598.92)            |                 |
| Draining systems                | 0.23        | $0.47^{***}$         | $0.53^{***}$         | NO              |
|                                 | (1.14)      | (1.84)               | (2.03)               |                 |
| Electric power systems          | 464.84      | 499.47               | 568.03               | NO              |
|                                 | (1597.15)   | (1624.79)            | (2613.93)            |                 |
| Population (in $100\ 000$ )     | 3.01        | $1.46^{***}$         | 2.29***              | ***             |
|                                 | (4.03)      | (2.72)               | (3.32)               |                 |
| Added Value (per capita)        | 36.57       | 19.52***             | 35.88                | ***             |
|                                 | (141.83)    | (119.23)             | (183.98)             |                 |
| Homicides                       | 0.30        | 0.40*                | 0.38                 | NO              |
| <b>F</b>                        | (1.38)      | (2.00)               | (1.91)               |                 |
| Remittances (per capita)        | 0.09        | 0.14***              | 0.13*                | NO              |
|                                 | (0.38)      | (0.64)               | (0.25)               |                 |
| Development Variables Index     | (1.00)      | 0.08                 | 0.07                 | NO              |
|                                 | (1.36)      | (1.93)               | (1.44)               |                 |
| Observations                    | 59,795      | 860                  | 616                  | 1,459           |

Table 6 – Municipal Characteristics by Type of Migration

Source: Author's elaboration using MxFLS data.

*Note:* Mean municipality characteristics by type of migrant at baseline. Variables expressed by a 1000 people in municipality except otherwise stated. Standard deviations in parentheses. Columns 2 and 3 include significance stars from a difference in means test with respect to non-migrants, and column 4 shows difference in means test by migrant type.

Significance stars denote \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

Table 6 shows significant differences in migrant-sending municipalities. With respect to education variables, we observe significantly more schools, a quantitative measure, and slightly more teachers per students, a qualitative measure, for both migrant municipalities, with higher differences in the illegal-migrant type. Health care units are also higher in both migrant-sending municipalities, while doctors are only higher for legal-migrant sending municipalities. Yet the differences are only significant between the illegal and the non-migrant groups. The trucks percentage can be interpreted in two ways, one can argue that it represents the municipality migration cost while it can also be a sign of development given by transportation infrastructure. Regarding the descriptive statistics, we could think the variable goes in line with the migration costs hypothesis, as it is significantly higher for migrant-sending municipalities. Housing credits can be thought of as a measure of financial institutions availability in the municipality. Surprisingly, we find it significantly higher in illegal-migrant sending municipalities, and its difference to the other groups is statistically significant. We then have a series of public utility related variables, regarding water and electricity distribution systems. The variables with statistical significant difference are inconclusive as some seem higher for illegal-migrant municipalities while one is significantly lower. Despite the fact that most of the development outcome variables are higher in illegal migrant-sending regions, we find that they are significantly poorer, with the added value per capita almost half of that of the non-migrant and legal-migrant municipalities. The organized crime variable appears significantly higher for illegal-migrant-sending municipalities, suggesting that this variable could have a positive effect in migration, which would indicate that the externality part in the model in section 2.2 dominates the dangers effect on illegal migration. As would be expected, remittances are statistically significantly higher in both migrant-sending municipalities. Finally, an index compiling several development variables was calculated using the principal component analysis methodology.<sup>15</sup> No significant difference was found in this index among the municipalities.

The descriptive statistics on the municipality variables would intuitively contradict the biggest result of the theoretical framework, that development outcomes decrease the number

<sup>&</sup>lt;sup>15</sup>The index was calculated by incorporating one variable from each type of development outcome. In concrete, the variables used were Public areas and gardens, teachers, doctors, housing credits and draining systems.

of illegal migrants as we have seen higher means for most of such variables. The following empirical analysis aims to study whether these patterns are consistent when considered together and controlling for individual and household level characteristics.

## 2.4 Empirical strategy

From the model presented in section 2.2 the next objective is to estimate how relevant the different variables in the migration decision are. More precisely we aim at evaluating both the effect of the government's different development targets, and whether organized crime acts as a deterrent or as a push factor when deciding to migrate. Our dependent variable  $M_{imt}$  is a dichotomic variable that takes the value of zero if the individual *i*, living in municipality *m*, remained in Mexico during period *t* and one if he migrated to the US. Using a logit model, I estimate the following specification:

$$M_{imt} = \beta_0 + D_{mt}\beta_1 + \beta_2\gamma_{mt} + \beta_3C_{mt} + X_{it}\beta_4 + e_{imt} \tag{6}$$

where D is a vector of the development outcome variables from health, education and infrastructure,  $\gamma$  represents the relative cost of migration and is proxied by the percentage of trucks from all registered vehicles. C is the organized crime variable, which we proxy by the homicide rate, also available at the municipality level. The prediction of the effect of this variable is inconclusive from the theoretical framework. Finding a positive coefficient would mean that the negative externality effect of organized crime at home overpowers that of higher risk of failure when migrating. X a set of standard demographic characteristics, both at the individual and the household level that are used to control for observables. Finally,  $e_{imt}$  is a composite error term containing the individual, municipal and time characteristics that may influence the decision to migrate that are not captured by the regressors.

To avoid potential multicollinearity of regressing our model with all available, and possibly correlated, development variables, correlations of these were calculated and the group of variables with lower correlation was chosen. To keep at least one variable for each type of development outcome, three variables were selected for the D vector. As mentioned earlier, a municipality development index was built using the principal component methodology. The municipality development index and separate development variables are used alternatively in the estimations. <sup>16</sup>

## 2.5 Estimation results

As a first remark, it should be noted, that by decomposing the explanatory power of the model, we found a similar contribution of the municipality component to that of the individual and household characteristics, suggesting that however little our model achieves to explain, a large proportion is found due to municipal characteristics.

As aforementioned, equation 6 was estimated using a non-linear pooled logit model on the probability of deciding to migrate to the US using clustered standard errors on the individual and municipality levels.<sup>17</sup>

<sup>&</sup>lt;sup>16</sup>Although multicollinearity would not be a concern using this approach, adding more variables would result in a loss of data due to missing values in the municipality-level variables.

<sup>&</sup>lt;sup>17</sup>A linear probability model provided similar results in signs. Yet, the magnitude was a lot lower, causing an even lower explanatory power of the model.

|  | (1)   | (2)  |
|--|---|--|
| Development Variables Index  | -0.133*<br>(-1.98)                              |  |
| Doctors  |   | -0.0513***<br>(-3.53)                            |
| Teachers   |   | $\begin{array}{c} 0.00531 \\ (0.92) \end{array}$ |
| Draining systems   |   | -0.00247<br>(-1.89)                              |
| Trucks from registered vehicles                                    | $1.790^{***}$<br>(10.53)                        | $1.712^{***}$<br>(9.97)                          |
| Homicides per 1000 people  | $\begin{array}{c} 0.120 \\ (1.58) \end{array}$  | $0.325^{***}$<br>(3.48)                          |
| Individual & Household Characteristics<br>Age                      | $0.0486 \\ (1.51)$                              | $\begin{array}{c} 0.0496 \\ (1.55) \end{array}$  |
| Age Squared  | -0.000974<br>(-1.95)                            | -0.000987*<br>(-1.98)                            |
| Female Dummy   | -1.109***<br>(-9.80)                            | -1.104***<br>(-9.76)                             |
| Years of Education   | -0.00877<br>(-0.68)                             | -0.00665<br>(-0.51)                              |
| Married  | $0.279^{*}$<br>(2.12)                           | $0.282^{*}$<br>(2.14)                            |
| Social Networks  | $0.154^{*}$<br>(2.41)                           | $0.143^{*}$<br>(2.48)                            |
| Willingness to Migrate   | $1.667^{***}$<br>(13.62)                        | $1.665^{***}$<br>(13.57)                         |
| Household Size   | $\begin{array}{c} 0.0208 \\ (1.07) \end{array}$ | $\begin{array}{c} 0.0199 \\ (1.02) \end{array}$  |
| Vehicle ownership  | $0.258^{*}$<br>(2.41)                           | $0.260^{*}$<br>(2.43)                            |
| Social Programs Income   | $0.00219^{*}$<br>(2.09)                         | $0.00159 \\ (1.46)$                              |
| <i>Time Fixed Effects</i><br>2001-2005                             | $0.108 \\ (0.90)$                               | $0.139 \\ (1.14)$                                |
| 2006-2010  | -0.180<br>(-1.36)                               | -0.125<br>(-0.93)                                |
| $\begin{array}{c} \text{Observations} \\ Pseudo \ R^2 \end{array}$ | $46,174 \\ 0.10$                                | $46,174 \\ 0.10$                                 |

Table 7 – Estimating the Likelihood of Migration to the US.

 $Source:\,$  Author's elaboration using MxFLS data.

*Note:* Logit estimation results. Lagged municipality variables by 1000 people. t-statistics in parentheses.

Significance stars denote  $p^* < 0.1, p^* < 0.05, p^* < 0.01$ .

The first column in Table 7 presents the model using the development index while the second column presents the model with the three development outcome variables chosen. The municipality-level variables are calculated with the data from the last year of the previous period. First, we find no significant effect on the time fixed effects, validating the choice of the pooled model.

With respect to our main variables of interest, the municipal-level ones, we find that even without differentiating by migration type, the development index, as well as the number of doctors, a measure of the health system's quality, have both negative and statistically significant coefficients. Draining systems are also found negative and close to being statistically significant, while teachers, measuring education system's quality, is positive yet not significantly. The coefficient of the migration cost variable is positive, supporting the theoretical framework's results. The organized crime variable is positive in both cases, yet only statistically significant in the second column. Hence, the evidence would suggest that the effect of the negative externality of organized crime dominates that of the decrease in the probability of successful migration. These empirical results go in line with the predictions of the theoretical framework.

For the case of the individual and household level variables, we do not observe as many significant results as was expected given the summary statistics presented in Table 4. Given that we do not differentiate by migration type, we are pooling together variables of individuals from two heterogeneous groups, which are closer in average to the non-migrant group. To account for this heterogeneity, Table 8 presents results using a multinomial logit approach. The effects are estimated on the two types of migration separately, using non-migrants as base outcome. These results can be found in Table 8 below.

|                                 | (1)                                    | )                                   | (2)                                    |                                     |  |
|---------------------------------|--|-------------------------------------|--|-------------------------------------|--|
|                                 | Illegal                                | Legal                               | Illegal                                | Legal                               |  |
| Doctors                         | -0.100**                               | -0.0195                             |  |                                     |  |
| Teachers                        | (-2.94)<br>0.00147<br>(0.10)           | (-1.33)<br>0.0113<br>(1.20)         |  |                                     |  |
| Draining systems                | (0.19)<br>-0.00263<br>(-1.54)          | (1.39)<br>-0.00179<br>(-0.92)       |  |                                     |  |
| Development Index               |  |                                     | -0.263**                               | 0.0148                              |  |
| Trucks (%)                      | $1.640^{***}$                          | $1.857^{***}$                       | (-2.84)<br>1.740***                    | (0.16)<br>$1.934^{***}$<br>(7.04)   |  |
| Homicides                       | (8.06)<br>$0.474^{***}$<br>(3.84)      | (0.71)<br>0.148<br>(1.22)           | (8.89)<br>$0.191^{*}$<br>(2.29)        | (7.04)<br>0.00672<br>(0.05)         |  |
| Individual & Household Controls | (0.01)                                 | (1.22)                              | (2.20)                                 | (0.00)                              |  |
| Age                             | $0.241^{***}$                          | -0.0748                             | $0.240^{***}$                          | -0.0760                             |  |
| Age Squared                     | (4.89)<br>-0.00462***                  | (-1.66)<br>$0.00147^{*}$            | (4.89)<br>-0.00460***                  | (-1.68)<br>$0.00148^{*}$            |  |
| Female Dummy                    | (-5.55)<br>$-1.733^{***}$<br>(-10.44)  | (2.27)<br>-0.399*<br>(2.45)         | (-5.54)<br>$-1.741^{***}$<br>(-10.47)  | (2.29)<br>-0.404*<br>(2.40)         |  |
| Years of Education              | (-10.44)<br>$-0.0734^{***}$<br>(-5.15) | (-2.43)<br>$0.0990^{***}$<br>(4.45) | (-10.47)<br>$-0.0769^{***}$<br>(-5.46) | (-2.49)<br>$0.0987^{***}$<br>(4.45) |  |
| Married                         | 0.540***                               | -0.187                              | 0.532***                               | -0.184                              |  |
| Social Networks                 | (3.37)<br>$0.151^{*}$<br>(2.40)        | (-0.89)<br>$0.148^{*}$<br>(2.55)    | (3.33)<br>$0.163^{*}$<br>(2.26)        | (-0.88)<br>$0.160^{*}$<br>(2.40)    |  |
| Willingness to Migrate          | (2.40)<br>$1.582^{***}$<br>(10.22)     | (2.55)<br>$1.813^{***}$<br>(0.21)   | (2.50)<br>$1.586^{***}$<br>(10.26)     | (2.49)<br>$1.813^{***}$<br>(0.30)   |  |
| Household Size                  | (10.22)<br>0.0410<br>(1.79)            | (9.21)<br>-0.00816<br>(-0.23)       | (10.20)<br>0.0423<br>(1.85)            | (9.30)<br>-0.00787<br>(-0.22)       |  |
| Vehicle Ownership               | 0.0936                                 | 0.514**                             | 0.0848                                 | 0.517**                             |  |
| Social Programs Income          | (0.64)<br>0.00200<br>(1.65)            | (3.13)<br>0.00101<br>(0.53)         | (0.58)<br>$0.00283^{*}$<br>(2.47)      | (3.14)<br>0.00126<br>(0.66)         |  |
| Time Effects                    | (1.05)                                 | (0.55)                              | (2.47)                                 | (0.00)                              |  |
| 2001-2005                       | -0.0416                                | $0.442^{*}$                         | -0.0958                                | $0.438^{*}$                         |  |
| 2006-2010                       | (-0.27)<br>$-0.383^{*}$<br>(-2.19)     | (2.21)<br>0.321<br>(1.45)           | (-0.63)<br>-0.507**<br>(-3.01)         | (2.23)<br>0.337<br>(1.55)           |  |
|                                 | (-2.10)                                | (1.40)                              | (-0.01)                                | (1.00)                              |  |
| Observations $D = L D^2$        | 46,1                                   | 74                                  | 46,17                                  | 4                                   |  |
| Pseudo K <sup>-</sup>           | 0.12                                   |                                     | 0.12                                   |                                     |  |

Table 8 – Estimating the Likelihood of Migration to the US by Migration Type

Source: Author's elaboration using MxFLS data.

*Note:* Multinomial logit estimation results. First specification uses separate municipality development variable, second specification uses a municipality development index. Lagged municipality variables by 1000 people. t-statistics in parentheses. Significance stars denote \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

We can observe larger coefficients for the development variables in the case of illegal migration to those found in Table 7, while nothing is found for legal migrants, meaning in

fact the latter group was biasing downwards (in absolute terms) our results. The percentage of registered trucks appears to have a positive impact on both groups, while slightly larger for legal-migrants, which further supports the idea of this variable as a proxy for migration costs. The organized crime variable appears positive and statistically significant for the illegal migrants group, while nothing is found for the legal one. Moreover, the rise in organized crime activity happened during the Calderon's government after 2006. Hence, the significant results found for the 2006-2010 period fixed-effect for illegal migrants is intuitive, as they would be more exposed to kidnapping risks.<sup>18</sup> On the contrary, for legal migrants, we find a significant coefficient for the 2001-2005 effect. These differences in time effects explain why we do not find such results in the specifications of Table 7, as these are averaging each other out.

There is a household level variable that could be analyzed together with the development variables: Social Programs Income. Although it is calculated at the household level from the MxFLS data, it represents the municipality's expenditure in social programs, which is an important factor in the development policies. The variable is only significant for the second column of the illegal migrants, yet it is positive, and similar in magnitude to that of the first column. Hence, programs that increase the household's current income are found to increase the probability of migrating, which is not surprising if we consider that having a higher income allows individuals to perform such a costly activity. This result is also found by Angelucci (2015) who argues that social transfers relax credit constraints of migrants, and thus increase migration rates.

For the case of individual and household variables, we find that age has a positive effect on the probability of migrating illegally, while none is found for legal migrants. Yet, we find this effect not to be linear as age squared is negative for illegal and positive for legal

<sup>&</sup>lt;sup>18</sup>It is also possible that this negative fixed effect incorporates the aspect of the financial crisis of 2008. Given the economic downturn of the US economy, unemployment rates increased, which could explain part of the decrease of migrants during this period. As mentioned earlier, however, this aspect would have an impact overall on the municipalities, which is why US factors were not taken into account in this dis-aggregated study.

migrants. This difference clearly emphasizes the physical difficulties of migrating illegally. Gender is also clearly significant and negative for both groups, yet a larger effect is found for the illegal group, as would be expected. Years of education have a negative and significant effect for illegal migrants, while positive and significant for legal migrants, showing the differences in returns to education between these groups. If we consider this aspect and the results found on the income from social programs, we could conclude that a program such as Oportunidades would have a positive impact on illegal migration in the short-term, yet as it increases the educational levels, it should have a deterrent effect in the long-run. Marriage only increased the probability of illegal migration, and had no effect on legal migration. At the same time, household size presents a positive coefficient, close to being statistically significant. Hence, it could be the case that, as illegal-migrant households are on average poorer, pressure to migrate in order to support the household economically is higher. Social networks and willingness to migrate are both positive and similar in magnitude for both groups, although the latter is slightly higher for legal migrants.

### 2.5.1 Robustness checks

The results found in Table 8<sup>19</sup> provide supporting evidence for the theoretical framework of section 2.2 when considering illegal migration. However, one could think of potential issues that could dispute our results. First of all, the municipality wealth level may be related to both the development infrastructure and migration rates simultaneously. This would suggest that our results may be due to an omitted variable that was not captured by the development variables itself. As can be seen from the first two columns of Table 9, adding per capita added value as a proxy for GDP per capita to control for the municipality wealth does not change our results. Moreover, this variable does not appear to have an effect on the probability of migration.

Another concern would be reverse causality of our variables of interest and migration.

<sup>&</sup>lt;sup>19</sup>Individual and household variables were included in all specifications and results remained rather constant across all models, suggesting these results are robust.

Indeed, it has been documented that migration increases development in the sending communities through the remittances received. We could argue this should not be a concern in our case since the data used refer only to those of the public system, while remittances could rather have an impact in the private sector. Nevertheless, columns three and four present results when controlling for remittances received by municipality. Our results do not change when adding such variable, which was found to have no effect on the migration decisions.

Finally, the empirical model addressed the organized crime issue only partially. Given that the variable used only accounts for the crime rate in the individual's municipality in Mexico, it could measured only the negative externality while neglecting the kidnapping risk migrants face during the whole journey. To solve for this, I calculated the approximate shortest walking distance to the US border from each municipality and interacted it with the period average homicide rates of the border states. Columns 5 and 6 show the results of adding such variable in the regressions. We can observe a negative coefficient as would be expected for the illegal migrants.

|                             | (1)                               | (2)                                | (3)                               | (4)                                | (5)                              | (6)                                |
|-----------------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|----------------------------------|------------------------------------|
| Doctors                     | -0.0936**                         |                                    | -0.0942**                         |                                    | -0.103*                          |                                    |
| Teachers                    | (-3.12)<br>0.000629<br>(0.08)     |                                    | (-3.09)<br>0.000533<br>(0.07)     |                                    | (-2.51)<br>-0.00525<br>(-0.66)   |                                    |
| Draining systems            | -0.00232                          |                                    | -0.00233                          |                                    | -0.00217                         |                                    |
| Development Index           | (-1.01)                           | $-0.266^{**}$                      | (-1.00)                           | $-0.254^{**}$                      | (-1.01)                          | $-0.347^{***}$                     |
| Trucks (%)                  | $1.488^{***}$                     | (-2.94)<br>$1.572^{***}$<br>(7.47) | $1.485^{***}$                     | (-2.05)<br>$1.583^{***}$<br>(7.55) | $1.457^{***}$                    | (-3.31)<br>$1.548^{***}$<br>(7.34) |
| Homicides                   | (0.00)<br>$0.463^{***}$<br>(3.81) | (7.47)<br>$0.199^{*}$<br>(2.48)    | (0.04)<br>$0.465^{***}$<br>(3.85) | (7.55)<br>$0.197^{*}$<br>(2.40)    | (0.07)<br>$0.423^{**}$<br>(3.04) | (7.34)<br>0.215<br>(1.04)          |
| 2001-2005                   | (3.81)<br>0.0237<br>(0.15)        | (2.48)<br>-0.0175<br>(0.11)        | (3.83)<br>0.0199<br>(0.12)        | (2.49)<br>-0.000446<br>(0.00)      | (3.04)<br>0.0769<br>(0.45)       | (1.94)<br>0.0662<br>(0.40)         |
| 2006-2010                   | (0.13)<br>-0.324<br>(1.83)        | (-0.11)<br>$-0.438^{*}$<br>(-2.56) | (0.12)<br>-0.327<br>(1.81)        | $(-0.421^{*})$                     | (0.40)<br>-0.289<br>(1.60)       | (0.40)<br>$-0.406^{*}$<br>(2.20)   |
| Per capita Added Value      | (-1.03)<br>-0.00541<br>(-1.37)    | (-2.30)<br>-0.00634<br>(-1.45)     | (-1.81)<br>(-0.00541)<br>(-1.37)  | (-2.39)<br>-0.00637<br>(-1.45)     | (-1.00)<br>-0.00577<br>(-1.48)   | (-2.29)<br>-0.00679<br>(-1.61)     |
| Remittances per capita      | (-1.57)                           | (-1.40)                            | (0.0338)                          | (-1.40)<br>-0.122<br>(-0.33)       | (-1.40)<br>0.104<br>(0.24)       | (-0.0265)                          |
| Distance * Border Homicides |                                   |                                    | (0.00)                            | (-0.00)                            | (0.24)<br>-0.0762***<br>(-3.42)  | $(-0.0927^{***})$<br>(-4.31)       |
| Doctors                     | -0.0198                           |                                    | -0.0315                           |                                    | -0.0315                          |                                    |
| Teachers                    | (1.33)<br>0.0112<br>(1.36)        |                                    | (1.20)<br>0.00986<br>(1.21)       |                                    | (-1.20)<br>0.00977<br>(1.19)     |                                    |
| Draining systems            | -0.00179                          |                                    | (1.21)<br>-0.00180<br>(-0.93)     |                                    | -0.00181                         |                                    |
| Development Index           | (-0.55)                           | 0.0120<br>(0.13)                   | (-0.55)                           | -0.0105                            | (-0.55)                          | -0.0135                            |
| Trucks (%)                  | $1.818^{***}$                     | (6.16)<br>$1.896^{***}$<br>(6.87)  | $1.769^{***}$                     | (6.85)                             | $1.771^{***}$                    | $1.880^{***}$<br>(6.87)            |
| Homicides                   | (0.00)<br>0.150<br>(1.24)         | (0.01)<br>(0.00902)<br>(0.07)      | (0.94)<br>(0.196)<br>(1.21)       | (0.05)<br>(0.0151)<br>(0.11)       | (0.30)<br>(0.196)<br>(1.20)      | (0.01)<br>(0.11)                   |
| 2001-2005                   | (1.24)<br>$0.461^{*}$<br>(2.31)   | (0.01)<br>$0.458^{*}$<br>(2.34)    | (1.21)<br>$0.431^{*}$<br>(2.18)   | (0.11)<br>$0.443^{*}$<br>(2.26)    | (1.20)<br>$0.435^{*}$<br>(2.16)  | (0.11)<br>$0.455^{*}$<br>(2.28)    |
| 2006-2010                   | (2.31)<br>0.334<br>(1.51)         | (2.34)<br>(0.349)<br>(1.61)        | (2.10)<br>(0.320)<br>(1.46)       | (2.20)<br>0.335<br>(1.55)          | (2.10)<br>0.321<br>(1.46)        | (2.20)<br>0.337<br>(1.56)          |
| Per capita Added Value      | -0.000676                         | (1.01)<br>-0.000691<br>(-1.38)     | -0.000661                         | -0.000686                          | -0.000672                        | (1.50)<br>-0.000733<br>(-1.43)     |
| Remittances per capita      | ( 1.00)                           | ( 1.00)                            | 0.219<br>(1.03)                   | 0.0813<br>(0.42)                   | (1.12)<br>(1.220)<br>(1.04)      | (0.0870)                           |
| Distance * Border Homicides |                                   |                                    | (1.00)                            | (0.42)                             | (-0.00533)<br>(-0.17)            | (0.44)<br>-0.0223<br>(-0.76)       |
| Observations                | 46174                             | 46174                              | 46174                             | 46174                              | 46174                            | 46174                              |
| Pseudo R <sup>2</sup>       | 0.13                              | 0.12                               | 0.13                              | 0.12                               | 0.13                             | 0.13                               |

Table 9 – Estimating the Likelihood of Migration to the US by Type of Migration

#### Source: Author's elaboration using MxFLS data.

*Note:* Multinomial logit estimation results for selected variables for illegal migrants above and for legal migrants below. Specifications in columns 1, 3 and 5 use separate municipality development variables, specifications in 2, 4 and 6 use a municipality development index. Lagged municipality variables by 1000 people. t-statistics in parentheses. Significance stars denote \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

As an additional robustness check we tried to address the low explanatory power found in our models, which could be explained by the small number of migrants in the sample. We tried to address this aspect by reducing the sample of the non-migrants, and thus increasing the proportion of migrants. A good counterfactual for our analysis would be a group composed of similar individuals to the migrant groups, so we used propensity score matching using only individual and household characteristics to select a reduced subsample of individuals from the non-migrant group. Given the longitudinal characteristic of the survey, different techniques found in the literature were implemented to select the matched samples. After performing the multinomial logit models to this reduced groups, we observed similar results in magnitude and significance, yet the explanatory power of the model was not improved.

## 2.6 Concluding remarks

This paper provides a simple game-theoretic framework to illustrate the effect of development outcomes on the decision to migrate illegally. It shows that government policies that increase local development may halt migration as do migration costs and organized crime.

Using data on migration from Mexico, we further test the predictions of the model and estimate the probability of deciding to migrate to the US using willingness to migrate data to control for unobservable characteristics of migrants. Pooled logit estimation provide results supportive of the model. Yet, it could also be the case that the effect is different between legal and illegal migrants. By performing multinomial logit on the baseline specification, results suggest that the theoretical framework holds for illegal migrants while no evidence is found supporting the model for the legal group. The results are robust to adding municipality wealth and remittances as potential sources of endogeneity.

Our empirical results show that development outcomes have a negative effect on the probability of migrating illegally as measured by a development index computed by principal components analysis, or by a measurement of health care system quality. A proxy for transport infrastructure was used to study the effect of migration costs, which is also found in line with the model, suggesting a positive and statistically significant effect on the migration probability for both types. Finally, organized crime, proxied by the municipality homicide rate, yields a positive coefficient for illegal migration. In the theoretical framework this variable was found inconclusive because individuals could fear being caught by crime organizations during the journey and migrate less, while crime works also as a negative externality pushing individuals to migrate. Our homicides variable contains only data on the crime rate at the municipality of residence in Mexico and therefore might not be capturing the effect over the migrant's journey. Accounting for the distance and crime rate in border states successfully incorporated this aspect and was found to have a negative impact in illegal migrant's decision to migrate.

The results found in this paper shed light on the effect of the Mexican government's policies on migration patterns at a local level. Despite finding that individual and household characteristics continue to play an important role in such decision, we found evidence suggesting that increasing development factors on a local scale can prevent individuals to undergo such a dangerous activity. Furthermore, we found some evidence suggesting social transfer programs may increase illegal migration rates on the short-term, in line with the literature, as it increases current income. Yet, the long-run effect could be the opposite, given the negative effect of education on illegal migration.

Neither development nor organized crime variables seemed to have an impact for documented migrants. Only migration costs appear to have a negative impact, as so do some individual and household characteristics. Nevertheless, fewer individual and household characteristics are significant in determining the migration decision compared to illegal migrants. This could be explained by a greater degree of heterogeneity in this group, given that it could be including overstayers and authorized migrants, which we can not discern in our data.

## 2.A Appendix

### 2.A.1 Data Mining Process

The MxFLS<sup>20</sup> is a longitudinal, multi-thematic survey representative of the Mexican population at the national, urban, rural and regional level. Currently, the survey contains information for a 10-year period, collected in three rounds: 2002, 2005-2006 and 2009-2012. Given the length and the different levels of unit of observation of the survey, it is presented in two different sections, one containing the household-level databases, the other containing the individual-level data. The household-level section is answered only by the head of the household and contains three books each with different databases: the control book contains summary information of the household and its members; book I contains consumption data; and book II contains the household and it contains 8 different books. Figure 8 shows the structure of the MxFLS.





<sup>&</sup>lt;sup>20</sup>See Rubalcava and Teruan (2006a,b, 2013) for a comprehensive description of the MxFLS database.

Given that some municipality-level data are only available on a quinquennial basis, the survey data would need to follow the same design. Some variables are only available for survey years while others, like migration and marital status, can be extracted from retro-spective data on a yearly basis. However, using quinquennial data on the individual and household-level variables would yield to a relevant loss of information. Therefore, I created three five-year periods encompassing the information to match with the municipality data: 1996-2000; 2001-2005 and 2006-2010.

Subsequently, I generated and merged municipal data. Table 10 describes the different municipal data that were merged to the survey data.

| Data                              | Periodicity  | $1^{st}$ Year | Variables Generated   | Format                    |
|-----------------------------------|--------------|---------------|---|---------------------------|
| Public Finance                    | Yearly       | 1989          | Value first year of period<br>Sum/Mean of period<br>Percentual Change | Millions<br>Proportions   |
| Population                        | Quinquennial | 1990          | Value first year of period  | Millions                  |
| Added Value (GDP proxy)           | Quinquennial | 1999          | Value first year of period<br>Sector Participation in GDP             | Per capita<br>Proportions |
| Homicides (Organized Crime proxy) | Yearly       | 1990          | Value first year of period<br>Sum/Mean of period                      | Per 1000 people           |
| Housing Conditions                | Quinquennial | 1995          | Value first year of period  | Proportions               |
| Education Infrastructure          | Yearly       | 1994          | Value first year of period<br>Sum/Mean of period                      | Per 1000 people           |

| Table | 10 - | Municipa | ality-Level | Data | Description |
|-------|------|----------|-------------|------|-------------|
| 10010 | 10   | mannerpe | <i></i>     | Dava | Dependent   |

Source: Author's own elaboration.

# 2.A.2 Additional Figures



Figure 9 – Changes in Organized Crime

Figure 10 – Changes in Migration Costs







Figure 12 – Changes in Development Outcomes



# 3 Chapter 2

# Foreign Aid, Illegal Migration and Organized Crime

## Abstract

The link between foreign aid, illegal migration and development is studied in a game-theoretic framework. The model suggests migration flows are reduced by development expenditure. Given the existence of organized crime, lower levels of development and foreign aid are observed as it works as a tool for stopping illegal migration. The model is then tested empirically through a simultaneous equation model using cross-country data on migrant sending countries to developed donor countries. Most model results are supported by our empirical specification.

Keywords: Illegal Migration; Foreign Aid; Development; Organized Crime.

JEL Classification: F22, F35.

## 3.1 Introduction

There is an undeniable link between aid an migration that has been subject to study in the economics literature. As suggested by Bermeo and Leblang (2015) foreign aid has been proved as a powerful tool to control migration flows through development, while it can also improve networks between countries, then increasing migration flows. However, it has also been argued that the existence of a secret agenda behind aid might not be in the receiver's benefit. Azam and Berlinschi (2010) showed how sometimes aid can be used to reduce migration flows disguised as development projects, while Azam and Thelen (2010) demonstrate the secret agenda of reducing terrorist attacks while actually seeking geostrategic interests. Moreover, Berthélemy (2006) has shown empirically that donors' motives comprise both egoistic and altruistic objectives, concluding in favor of different degrees of self-interest among donors.

The purpose of this paper is to further investigate, both theoretically and empirically, the aid-migration relation, while incorporating an aspect that, to the best of our knowledge, has not yet been explored in this context: organized crime. Using a game-theoretic approach, we further investigate the effect of foreign aid on migration flows, searching for a hidden agenda in the case of bilateral aid. In this context, we also take into consideration the dual effect of organized crime that may impact both variables simultaneously. On the one hand, organized crime may make migration trajectory more dangerous, hence decreasing migration flows. On the other hand, the fact that migration is reduced through organized crime may decrease a donor's interest of helping fighting crime.

Our model relies on the context of Mexican migration to the US, where Mexicans represent the largest share of foreign-born population. Besides geographic proximity, migration from Mexico is characterized by push factors, such as limited economic opportunities and the recent Drug War. On the other hand, the US also attracts migrants mostly through large wage differentials. Additionally, with such a high proportion of Mexicans in the US, social networks have become larger and stronger with time, helping new migrants by lowering migration costs, while increasing the networks in the process. Little theoretical literature is found studying both aid and migration simultaneously, while existing studies fail to incorporate all these factors that are pertinent for the current Mexican context.

Gaytan-Fregoso and Lahiri (2000) analyze the impact of foreign aid on illegal migration, taking into account remittances. The authors find a reduction of illegal immigration when the level of aid is high and there is exogenous repatriation of income given that it reduces migration costs. They also find similar patterns for the case when there is a shift from border control resources to foreign aid, for small amounts of aid. These theoretical results suggest the importance of migration costs as well as of the border control resources invested by the donor country in the illegal migration process. Through a general equilibrium model, Bandyopadhyay, Chambers, and Munemo (2014) find that foreign aid could not reduce immigration flows. The improvement in recipient's income could be countervailed by a change in commodity terms of trade, in return increasing immigration flows towards the donor country. However, data on the US validate that the direct income effect of aid on immigration dominates the indirect effect of aid-induced changes in the terms of trade. As a result, aid reduces illegal immigration overall, even if the US strategy is weakened.

The reduced empirical literature focusing on the impact of foreign aid on migration flows provides divergent results about the effectiveness of aid on immigration. While Bermeo and Leblang (2015) neglect the simultaneity issue, Berthélemy, Beuran, and Maurel (2009) use an innovative empirical approach to solve for it. The authors confirm the results in Faini and Venturini (1993), which show that growth does not necessarily decrease migration flows. Thus, they propose two channels of aid's effect on migration: bilateral aid informs about labor market conditions in the donor country, while the total amount of aid increases wages in recipient country, fostering the ability to migrate. Although our theory and results go in line with the first of the channels, our findings show no impact of total amount of aid on migration.

Moreover, all aforementioned studies neglected the impact of organized crime on both

migration and aid. On one hand, the effect of organized crime on migration might seem ambiguous. Although we may argue that having higher levels of organized crime in the country may increase the desire to leave, when taking into account the dangers of the illegal migration process, the opposite can be argued. Indeed, since the Drug War started in Mexico during Calderon's presidential term (2006-2012), the kidnapping and trafficking of undocumented immigrants reached thousands. (CNDH, 2009, 2011)

On the other hand, organized crime could be a potential factor donors take into account in their allocation decisions. US aid has been used in the past in order to fight organized crime in Colombia, as it has been used during the recent Mexican Drug War. Hence, analyzing current trends in aid might bring insightful information regarding current donor's agendas.

This paper aims at contributing the literature of aid and migration, while taking into account a variable that to the best of our knowledge has not been analyzed in this context before. As both our theoretical and empirical results suggest, organized crime may have insidious effects in both aid allocation and migration for which it shall not be disregarded in the analysis.

The rest of this paper is organized as follows, Section 3.2 describes our model, Section 3.3 details the data and empirical strategy followed to test the model's results, Section 3.4 provides empirical results and Section 3.5 concludes.

## 3.2 The model

We model a three-stage game where a population of potential migrants take their migration decisions after observing the optimal development, border patrol and organized crime levels chosen by a domestic and a foreign government. We assume a foreign power playing first, establishing their immigration and foreign aid optimal policies, which are credible for the domestic government, who plays second. Hence, after observing the foreign power's policies, the domestic government decides its optimal investment in development, by which it is indirectly also choosing the number of individuals that will try to migrate to the foreign country. The population of N individuals play third, choosing their migration investment and finally nature decides with an endogenous probability the success of getting to their destination or the failure by being captured by crime organizations in the home country. Given the sequential nature of this game, we describe more thoroughly each of the players inversely to their order of play, so as to determine their optimal strategies by backward induction and hence to solve for the subgame perfect Nash equilibrium.

### 3.2.1 Potential Migrant

The context is situated in a migrant-sending country with an N population. A potential migrant i maximizes her expected utility deciding an optimal investment in migration  $m_i^*$ , which will be thought of as migration level, subject to her budget constraint. Her optimization problem is given by:

$$\max_{c_i,m_i} E(u_i) = c_i + p(C, G, m_i)v_i$$
  
s.t.  $c_i = y - \gamma m_i$  (7)

where  $c_i$  is her consumption level in the home-country and  $v_i$  is the individual's subjective value of successful migration which she obtains with probability  $p(\cdot)$ . Such probability is assumed to be decreasing in the organized crime level  $C^{21}$  in the home country as well as in border guards in the destination country  $G^{22}$ , and increasing in the migration investment  $m_i$ . For simplicity, we will further assume separability in the probability function such that  $p(C, G, m_i) = h(m_i)q(C, G)$  with  $h'(m_i) > 0$ ;  $h''(m_i) < 0$  and  $\frac{\partial q}{\partial C} < 0$ ,  $\frac{\partial^2 q}{\partial C^2} > 0$ ,  $\frac{\partial q}{\partial G} < 0$ ,

<sup>&</sup>lt;sup>21</sup>This assumption comes from the large number of reports of kidnapping of migrants in Mexico, which has risen since the beginning of the Drug War after 2006. Indeed, we argue that organized crime is yet another barrier for migrants. Another view is that organized crime may make people want to leave their homes due to the rise in insecurity as argued, for instance, by Contreras (2014). However, the author only analyzed border communities, for which his results may be due to the short distance migrants would travel to reach the US and may not hold for longer distances that make the migrant trajectory riskier. This is suggested by the negative results found in Chort and De La Rupelle (2016) using data of all Mexican states.

 $<sup>^{22}</sup>$ This assumption is somewhat more straightforward. We argue that increments in border enforcement in the destination country increase the probability of apprehension, hence decreasing the probability of successful migration. This argument is further supported by Hanson and Spilimbergo (1996). Moreover, as our further hypotheses on G suggest, we argue such effect is not linear.

 $\frac{\partial^2 q}{\partial G^2} > 0$ . The  $v_i$  value follows a distribution such that  $v_i \sim F(v_i, D)$ , where  $v_i$  is the range of the individuals intrinsic value, say given by their individual characteristics, and D is the development level in the home-country which is an exogenous variable for the population, hence only having an impact in the distribution of these  $v_i$  values among the population. We also assume  $\frac{\partial F(\cdot)}{\partial D} > 0$ , which means that higher levels of D imply a smaller probability of having high  $v_i$  values. This is because D is modeled in relative terms for which increasing Din the home-country would decrease the proportion of individuals who highly value migrating to the foreign country. The individual's wealth is noted by y, and  $\gamma$  is a parameter of the relative price of migration. Both y and  $\gamma$  are assumed the same for all the individuals, we are implicitly assuming that the  $v_i$  values also absorb any individual-level cost and benefits, implying that the intrinsic values  $v_i$  are a net value of migrating relative to staying.

We can then rewrite the individual's problem as follows:

$$\max_{m_i} E(u_i) = y - \gamma m_i + h(m_i)q(C,G)v_i$$
(8)

The first order condition is:

$$h'(m_i)q(C,G)v_i = \gamma \tag{9}$$

which implicitly defines for each individual *i*, the optimal level of migration as a function such that  $m_i^{\star} = m_i^{\star}(\gamma, v_i, C, G)$ .

**Proposition 1** The individual optimal level of migration is a decreasing function of the cost of migration  $\gamma$ , the organized crime C and the border guards G, and an increasing function of his migration value  $v_i$ .

**Proof.** See Appendix 3.A.1 for mathematical proof. The graph in figure 13 depicts the comparative statics of the optimal migration-level function. Due to the concavity of  $h(\cdot)$  we derive a decreasing first order condition from equation 9.<sup>23</sup> Hence, by augmenting  $\gamma$ , the curve is not displaced but rather a lower  $m_i^{*'}$  is found within the curve. By contrast, such

<sup>&</sup>lt;sup>23</sup>Note that the convexity of  $h'(\cdot)$  is not necessary, yet intuitive.

 $m_i^{\star\prime}$  can be also achieved by displacing the curve downwards to the left by decreasing  $v_i$ , or by an increment in either C or G.

Figure 13 – Optimal migration level



After optimizing the level of migration  $m_i^*$  for individual *i* and with an outside option rendering utility level  $\bar{u}$ , the potential migrant's decision rule is to migrate if  $E(u_i^*) = y - \gamma m_i^* + h(m_i^*)q(C,G)v_i > \bar{u}$ , stay put otherwise. For the observed  $\gamma$ , *C* and *G*, and the optimized level  $m_i^*$ , the function  $E(u_i^*)$  is increasing and convex<sup>24</sup> in the  $v_i$  value given by the distribution function  $F(v_i, D)$ . Hence, taking the *N* population ordered by  $v_i$ , for a given  $\bar{u}$  and the observed levels of  $\gamma$ , *C*, *G* and *D*, which are the same for the whole population, there exists a marginal individual whose value for migration will be noted  $v^*$ , and for whom  $E(u_i^*) = \bar{u}$ . Hence, the equation denoting the marginal migrant who is indifferent between migrating and staying put is  $E(\gamma, v_i, C, G) = \bar{u}$ . This defines the value for migration of the marginal migrant  $v^* \equiv v(\gamma, C, G)$ .

Furthermore, we can determine the number of migrants  $n_m^*$  as the fraction of individuals with migration values  $v_i > v^*$ , namely  $n_m^* \equiv N[1 - F(v^*, D)]$ . Thus, the number of migrants is a function of the exogenous variables of the model for the potential migrant population, so that  $n_m^*(\gamma, C, G, D) = N[1 - F(v(\gamma, C, G), D)]$ .

 $<sup>\</sup>frac{\partial^{24} We \text{ can see that } \frac{\partial E(u_i^*)}{\partial v_i} = h(m_i^*)q(C,G) + \frac{\partial m_i^*}{\partial v_i} \left[ v_i h'(m_i^*)q(C,G) - \gamma \right] = h(m_i^*)q(C,G) > 0 \text{ by the first order condition. Furthermore, } \frac{\partial^2 E(u_i^*)}{\partial v_i^2} = h'(m_i)\frac{\partial m_i^*}{\partial v_i}q(C,G) > 0 \text{ by Proposition 1.}$ 

**Proposition 2** The value for migration of the marginal migrant  $v^*$  is an increasing function of  $\gamma$ , C, and G. Moreover, the number of migrants  $n_m^*$  is decreasing in  $\gamma$ , C, G and  $D^{25}$ .

**Proof.** See Appendix 3.A.2 for mathematical computation. Figure 14 shows the comparative statics of  $v^*$ . Firstly, it can be seen that when D increases the distribution of individuals shifts as in the dashed curved in the upper figure, increasing the proportion of  $v_i$  values lower than the cut-off point. Hence, although the cut-off  $v^*$  value is not displaced with an increase of D, we do find a lower proportion of migrants. On the other hand, when either  $\gamma$ , C or G decrease, the expected utility curve is displaced to the left, represented by the dashed curve in the lower figure, we thus find a lower cut-off point which increases the proportion of migrants. <sup>26</sup>





<sup>&</sup>lt;sup>25</sup>Assuming stochastic dominance of  $F(\cdot)$ 

<sup>&</sup>lt;sup>26</sup>Note that we do not allow for negative  $v_i$  values nor a negative expected utility of migration for simplicity.

### 3.2.2 The Home-Country Government

We assume a non-benevolent government whose utility is given by spending in some pet projects P from which it can extract a rent. However, the government can only spend in P what is left of its budget after spending on development projects D. The government's budget is assumed to be a decreasing and convex function of the number of migrants  $B(n_m)$ as it could be thought of as a proportion of the population that is no longer taxable for the government.<sup>27</sup> The domestic government chooses its optimal investment in development  $\tilde{D}$  after observing the border patrol G and the foreign aid A policies chosen by the foreign power. Moreover, the government knows  $n_m^*$  and that by choosing  $\tilde{D}$  it can have a direct impact on  $n_m^*$  so that it can actually choose its optimal level of migration.

Hence, we can write the domestic government's optimization problem as follows:

$$\max_{D} P$$
s.t.  $B(n_m) = P + D$ 

$$n_m = N \left(1 - F\left(v^{\star}\left(\gamma, C, G\right), D\right)\right)$$
(10)

The assumption of a non-benevolent government is justified by the fact that higher levels of corruption are observed in the less-developed countries. However, we observe the tradeoff that by decreasing expenditure on D, the available resources decrease as well due to a higher proportion of migrants. Hence, the fact itself that the government experiences a trade-off limits its ability to extract resources. The domestic government's problem can also be expressed as:

<sup>&</sup>lt;sup>27</sup>Note that the cost inflicted by the migrants to the home-country government should be considered net given that it might also perceive gains from migration. Indeed, remittances may contribute development in the home country, lowering the government's development costs. However, not to engage in the remittances-development debate, we do not incorporate such relation in our model. Moreover, migrant's revenues are only taxed in the host country (if at all), supporting our hypothesis as remittances would not impact the budget directly. Moreover, developing countries usually have scarce data of the real amounts remitted at the national level, as supported by De Luna Martinez (2005), which would complicate the empirical analysis if we were to incorporate it.

$$\max_{D} \quad B(n_m) - D$$
s.t. 
$$n_m = N \left( 1 - F \left( v^{\star} \left( \gamma, C, G \right), D \right) \right)$$
(11)

From where we find the optimal levels of  $\widetilde{D}$  and  $\widetilde{n_m}$  for the domestic government, given by the first order condition (equation 12) and the trade-off equation given by the constraint (equation 13). Furthermore, these equations suggest that  $\widetilde{D}$  and  $\widetilde{n_m}$  are functions of  $\gamma$ , Cand G:

$$1 = -B'(n_m)N\frac{\partial F}{\partial D} \tag{12}$$

$$n_m = N\left(1 - F\left(v^{\star}\left(\gamma, C, G\right), D\right)\right) \tag{13}$$

**Proposition 3** The domestic government's optimal expenditure in development  $\widetilde{D}$  and number of migrants  $\widetilde{n_m}$  are decreasing functions of  $\gamma$ , C and G if  $\frac{NB''(\widetilde{n_m})}{B'(\widetilde{n_m})} < -\frac{1}{(1-F)}$  and  $\frac{\partial^2 F}{\partial \widetilde{D} \partial v^*} \geq 0.$ 

**Proof.** See Appendix 3.A.3 for mathematical computation. Figure 15 shows the comparative statics of the domestic government's optimal choices. First of all, the indifference curve's slope is found decreasing and convex given the assumption on the convexity of  $B(\cdot)$ . Indeed we find the slope from the objective function's total derivative  $\frac{dn_m}{dD} = \frac{1}{B'(n_m)}$ . The slope of the trade-off is given by  $\frac{dn_m}{dD} = -N\frac{\partial F}{\partial D}$ . Hence by equaling both slopes we get the optimality condition in equation 12. Changes in  $\gamma$ , C and G affect the optimal choices similarly and are shown by the dashed displaced curves in the figure below. Firstly, increments in such variables shift the trade-off downwards given that it is a negative function of  $F(\cdot)$  which is increasing in such variables through  $v^*$ . The same happens to the indifference curve as  $B(\cdot)$  is decreasing in such variables through  $n_m$ . Now, given that the slope of the trade-off does not depend on  $n_m$  it should be the same when keeping D constant while  $n_m$  is reduced, which is what happens in blue in the figure. Similarly, the slope of the indifference curve

does not depend on D, so it must be the same when keeping  $n_m$  constant while D changes, which is marked in green in the figure. Hence, both curves will only have a common slope, in accordance with the optimality condition somewhere between the points of tangency of the displaced curves and the initial slope. Hence, the  $\widetilde{n_m}$  and  $\widetilde{D}$  values are located between such points in the figure.

Figure 15 – Optimal Strategies for the Domestic Government



#### 3.2.3 Foreign Power

The host country is a foreign power that perceives a loss from receiving illegal migrants,<sup>28</sup> for which he decides how much border control G to provide at price  $\omega$  so as to reduce the number of migrants  $n_m$ . We further assume that the foreign power has a negative externality from the organized crime level C in the sending country. It can be argued that the higher the organized crime, the more the foreign country receives contraband products such as drugs, which explains why the foreign power would be affected by organized crime. We model the externality by a decreasing function C(A), where A is the level of aid the foreign power

 $<sup>^{28}</sup>$ It is not straightforward to assume that the foreign power incurs in a loss from receiving migrants. In fact, many studies have found that immigrants actually contribute more to the public finance than what they receive in benefits. (Liebig and Mo, 2013; Dustmann, Frattini, and Halls, 2010) Not to get involved in this debate, we will simply argue that the foreign government only *perceives* immigration as a net cost, which could be explained by political reasons rather than economic.

gives the home country to fight crime at a price  $\mu$ .<sup>29</sup> Moreover, the foreign government also has domestic expenditures not related to the migrant-sending country, which we do not incorporate in the model, arguing that the foreign power's objective function is a loss function of the foreign policy variables G and A instead, as it reduces it's available resources for domestic policy. Hence, we can write the government's problem as a minimization of such loss function:

$$\min_{G,A} \quad L_F = n_m + \delta C + \omega G + \mu A$$
s.t.  $C = C(A)$ 

$$n_m = \widetilde{n_m}(\gamma, C, G)$$
(14)

We can substitute the constraints in the objective function to get:

$$\min_{G,A} \quad L_F = \widetilde{n_m}(\gamma, C, G) + \delta C(A) + \omega G + \mu A \tag{15}$$

with the following first order conditions:

$$\frac{\partial L_F}{\partial G} = \frac{\partial \widetilde{n_m}}{\partial G} + \omega = 0 \tag{16}$$

$$\frac{\partial L_F}{\partial A} = \frac{\partial \widetilde{n_m}}{\partial C} C'(A) + \delta C'(A) + \mu = 0$$
(17)

Intuitively, the foreign power's marginal expenditure in border guards  $\omega$  should equal the marginal gains from reducing the number of migrants in the optimum. In the same fashion, the marginal gains from reducing the externality through aid should equal foreign aid's

<sup>&</sup>lt;sup>29</sup>It is true that fighting organized crime is only one among many other uses of foreign aid. This kind of aid can be thought of as military assistance, different to economic assistance whose objective is economic development. Unfortunately, there is no data available regarding the type of aid given by OECD donors except for the case of the US. Using such data we found military assistance represented 22% in average of all US bilateral aid during the period 1990-2013, a percentage that should not be disregarded. Moreover, evidence of the effects of aid on the reduction of violence can be found in De Ree and Nillesen (2009), showing aid flows may reduce the duration of civil conflicts. Nevertheless, introducing these two types of aid would be an interesting future extension that we discuss in subsection 3.2.5.

marginal cost plus the cost of the effect on the number of migrants through the reduction of crime.

Let us first analyze the simple case where  $A = \overline{A}$ , which is given and not a variable of choice for the foreign power. The only first order condition would be given by equation 16 and optimal expenditure in border control knowing  $\widetilde{D}$  and  $\widetilde{n_m}$  would be a function of  $\gamma$  and C, which is itself a function of the given  $\overline{A}$ . Hence, the foreign power chooses an optimal  $n_m$ level through its choice of G. From equation 16 we can take the total derivative to find:

$$\frac{\partial \widehat{G}}{\partial \bar{A}} = -\frac{\frac{\partial^2 \widetilde{n_m}}{\partial \widehat{G} \partial C} C'(\bar{A})}{\frac{\partial^2 \widetilde{n_m}}{\partial \widehat{G}^2}}$$
(18)

The denominator in equation 18 is intuitively positive, hence, the assumption on the sign of  $\frac{\partial^2 \tilde{n}_m}{\partial \tilde{G} \partial C}$  determines the effect of aid over G. As we have that by increasing  $\bar{A}$  a lower C is observed in the home-country, the number of migrants would be increased. Hence, an increase in  $\bar{A}$  would need to be followed by an increase in G in order to remain in equilibrium. This intuition would lead to assuming equation 18 to be positive.

Hence, the first order condition with respect to G (equation 16) leads to the optimal level of border control for the foreign country, such that the marginal benefits of reducing migration through tighter border control should be equal to the marginal cost of border control itself. Furthermore, given that such optimal G is a function of the number of migrants, it will implicitly be a function of  $\gamma$ , C.

On the other hand, equation 17 gives the optimality condition of the level of aid. This equation is easily transformed to the case where no migration is observed to conclude the following:

**Proposition 4** The foreign power's expenditure in aid  $\widehat{A}$  is lower than optimal  $A^*$  of the case of no migration, for which the level of organized crime  $\widehat{C}$  is higher than the optimum  $C^*$ .

**Proof.** Let us define the optimal expenditure in aid the amount  $A^*$  that would be chosen

in the absence of illegal migration. Hence, equation 17 would be instead  $C'(A) = -\frac{\mu}{\delta}$ . By incorporating illegal migration, the benefits from spending in aid are reduced due to the fact that migration is decreasing in organized crime by proposition 2. Therefore, we can see without making any assumption on the functional form of equation 17, that the slope of the curves in the equilibrium would be higher in absolute terms than in the optimal scenario, which induces a lower expenditure in foreign aid. This result is better represented by figure 16, where the dashed line represents the slope of the optimality condition when there is migration, and the straight line depicts the case without migration.

Figure 16 – Optimal Foreign Aid and Organized Crime



Hence, we can argue that the foreign power tolerates a certain amount of organized crime as an additional cost of reducing illegal migration.

### 3.2.4 Results and Interpretation

The goal of this paper is to analyze the impact of the different set of variables over international migration flows. In our theoretical model, individuals make their migration decisions after observing both the domestic and the foreign government's optimal choices regarding their expenditures. Hence, our empirical strategy will estimate the impact of the variables in our model on migration flows. From our model's results by proposition 2, we would expect domestic development to reduce migration flows. Indeed, development decreases the probability of having individuals with high values of migration. The value of successful migration has a positive impact on migration, for which the variables determining such value in our model would carry on to migration flows. In particular, given that border guards and organized crime reduce the probability of success when migrating, we would also expect both variables to have a negative effect on migration flows in our estimation results. Migration costs also decrease the value of migrating, and hence should also reduce migration flows. Finally, foreign aid affects migration through its negative effect on organized crime, resulting in a positive effect on migration flows as the trajectory risk is reduced through aid.

Now, the literature of international migration, and in particular Berthélemy, Beuran, and Maurel (2009), suggest an endogeneity problem when estimating the effect of aid on migration flows. In this sense, the authors suggest the use of a simultaneous equation model that solves for the endogeneity. We decided to follow their approach, which is further explained in section 3.3. Hence, we will compute the effects of the model's variables in both migration flows and the bilateral foreign aid decisions. For this reason, we will also explain our model's predictions regarding the allocation of aid.

Firstly, from an unconventional perspective, our model corroborates the literature in that aid fosters migration flows as described earlier. Now, the reverse might not be true according to proposition 4 where aid is lower when migration flows are positive, given that the foreign power perceives migration as a cost.<sup>30</sup> Now, development in the home country should decrease aid, while crime should have a positive impact. Finally, border control should move in the same direction than aid also through their effect on migration, i.e. tighter border control decreases migration, allowing the foreign power to spend more in aid, so despite the trade-off they represent in the budget, they should move in the same direction.

<sup>&</sup>lt;sup>30</sup>It is worth mentioning that this prediction is not supported in the literature nor in the data, for which our empirical specification will deal with alternative explanations.
#### 3.2.5 Extension: Aid for development

Our results from proposition 4 rely on the hypothesis that foreign aid is used to decrease organized crime. We briefly discuss what would happen in our model if instead we argued that organized crime was a decreasing function of development in the home country, having aid entering the domestic government's budget equation.

Such a change would not affect the migrant's optimal decision, so we firstly analyze the domestic government's problem, which would be written as follows:

$$\max_{D} P$$
s.t.  $B(n_m) + A = P + D$ 

$$n_m = N \left(1 - F\left(v^*\left(\gamma, C, G\right), D\right)\right)$$
(19)

Given that A is not a variable of choice for the domestic government, it would not change its optimal decision of  $D^*$  given by proposition 3, rather it would be as if the government absorbs it for the pet projects P. Therefore, if D does not change with A, C would be the same regardless of the level of A. Thus, the foreign power would optimally choose a level of aid equal to zero.

In order to have positive amounts of aid, one would need to introduce aid conditioning, where the foreign power would choose the level of  $C^*$  that maximizes its utility, and only to give  $A^*$  if the domestic government commits to a the level of D that meets the chosen  $C^*$ . For there to be a contract between the governments then,  $A^*$  should equal the cost of providing such level of D, while the gains of reducing the externality of crime for the foreign power should equal the cost induced by the increase in migrants plus the cost of aid itself. Hence, these results coincide with our initial findings.

## 3.3 Empirical Strategy

From our theoretical background, we are interested in studying the effect of foreign aid, organized crime and development on migration flows. However, it is noted by Berthélemy, Beuran, and Maurel (2009) that migration and foreign aid have simultaneous effects on each other. Hence, the estimation of a migration equation only would provide biased results if this simultaneity is not accounted for. Indeed, foreign aid funds may increase development in the country of origin of migrants, decreasing migration flows. On the other hand, a higher proportion of migrants in the donor country may advocate for a higher donation to their home countries. For this reason, a simultaneous equations model will be employed, using a migration gravity equation and an aid equation that will both be explained below.

Now, the assumptions and intuitions of our theoretical model are based on the Mexico-US illegal migration scenario. Ideally, we would like to use dis-aggregated data of the US foreign aid allocation throughout Mexico, together with same level of illegal migration, crime, and other variables. However, foreign aid data is only available at the country-level for which a Mexico-US analysis would not be feasible. For this reason, we decided to follow the literature on foreign aid and to use all available information on the OECD countries aid commitments and disbursements. For this purpose, we have data on 32 countries and their bilateral donations to 139 countries over the period of 1995 to 2013.

Unfortunately, illegal international migration patterns are not easily accounted for. As a consequence, we will look at overall migration to these 32 countries instead. Adding all other available variables that will be described below reduces the non-missing sample drastically. For this reason, we decided to take 5-year averages, which allows us to reduce the number of missing observations in our data. Hence, we have a dataset on 32x139 country-pairs, for the periods 1995-1999, 2000-2004, 2005-2009 and 2010-2013. Following, we will describe the equations to be estimated in our simultaneous equation empirical strategy.

### **Migration Gravity Equation**

Following our theoretical model, the migration decision is determined by  $m_i^*$  =  $m_i^*(\gamma, v_i, D, C, A, G)$ . To be consistent with the literature on migration gravity models, and taking into account data availability, we use the migrant-sending country's GDP per capita as the development level D; for  $v_i$  we use the destination country's GDP per capita and incorporate common language and historical colonial ties dummies to account for other characteristics in the receiving country that account for the value of migrating, apart from higher wages and we use simple distance to account for migration costs  $\gamma$ . These variables were found from Mayer and Zignago (2011) in the CEPII research center's website. The destination country's openness to migration, measured through a migration policy variable, will be used as a proxy for border control using the DEMIG (2015) database. We use two dummies, one for positive, pro-migration policies, and one for negative, anti-migration policies. The first one, has a value of 1 if in a given year the country has done more positive policies, taking into account the previous years, and zero if there are none or more negative policies regarding migration. The opposite is done for the second policy variable. For the case of the migration equation, we use bilateral Official Development Aid (ODA) as the foreign aid A variable, which determines C in our model, which is in turn proxied here by the homicide rate in the migrant-sending country. Given the fact that this variable may probably represent a push effect in migration, and not completely the fact that migrants might decide not to migrate due to fear of being caught by crime organizations, we incorporate the average homicides-rate in the neighboring countries considering it a proxy for the trajectory risk. As per the assumptions of a gravity equation, all variables with the exception of dummies are expressed in log terms, and incorporate both countries' population as control X to account for variables that are not expressed in per capita terms. Hence, our migration equation is expressed as:

$$m_{ijt} = \beta_0 + \beta_1 A_{ijt} + \beta_2 D_{it} + \beta_3 C_{it} + \beta_4 G_{jt} + \beta_5 v_{it} + \beta_6 \gamma_{it} + \beta_7 X_{ijt} + u_{ijt}$$
(20)

### Foreign Aid Equation

For the dependent variable in our aid equation we use bilateral aid commitments instead of the given ODA due to the fact that this variable better reflects donor's allocation decisions while the actual disbursements might be subject to conditions to be complied by recipient countries. We adapt the aid equation in Berthélemy (2006) to our theoretical model and hence include organized crime as in the migration equation, proxied by homicide rates in the recipient country. In our model, foreign aid is motivated by the fact that organized crime represents a negative externality for the donor, such that can be fought through aid. This externality will be represented by the simple distance between the countries, assuming that the closer the country is, the more crime represents a negative externality for the donor. Furthermore, due to organized crime, migration is reduced in our model through the fear of being kidnapped, and immigration represents a further cost for the donor. Hence, we include migrant inflows lagged by one period, to account for the fact that these past arrivals impact aid allocation decisions. We include the recipient's GDP per capita for D, and the same migration policy dummies from the migration equation as a proxy for G.

It is important to mention that our theoretical model does not provide a complete background on the decision to give aid, as it only incorporates variables from the destination country in its aid decision. Although this suffices as to the scope of this paper and regarding the model's aim, following the literature the econometric analysis requires further control variables in the aid equation. For this reason, we introduce additional variables following the literature and in particular Berthélemy (2006), and upon availability for our periods of interest.

We incorporate donor's total given ODA as a measure of the donor's available aid budget. To measure the proximity in relations between the countries we introduce the colonial ties dummy as well as trade intensity between the countries, measured by exports to donor as a ratio of the recipient's GDP. We additionally control for both of the countries population size. Therefore, the aid equation we will estimate is written

$$A_{ijt} = \alpha_0 + \alpha_1 m_{ijt-1} + \alpha_2 D_{it} + \alpha_3 C_{it} + \alpha_4 G_{jt} + \boldsymbol{\alpha}_5 \boldsymbol{X}_{ijt} + u_{ijt}$$
(21)

## 3.4 Empirical Results

We present results of our simultaneous equation pooled model in table 11. Our results remain relatively similar throughout our different specifications in which we add variables to test further hypothesis and for robustness checks.

Firstly, in line with our model's findings, we observe bilateral aid having a positive impact on migration. While this result is also in line with the previous literature, total aid does not appear to have an effect as had been found by Berthélemy, Beuran, and Maurel (2009), arguing that aid relaxes budget and allows for more migration. Hence, the data probably show that aid no longer reaches those potential migrants.

Turning to our development variables, we observe that per capita GDP in the home country has a positive effect on migration flows, which is not in line with our model. However, GDP per capita is not necessarily the best proxy for development. For this reason, we included another variable in specifications 2 and 3, that we believe better measures development in the home country, that is, infant mortality. Still, the results show a negative effect suggesting that the lower the infant mortality rate, meaning a higher development level, the higher migration flows are. To further test our development finding, we included the square of the GDP per capita in specification 3. The negative and significant sign shows a U-shaped relation that would validate our model's hypothesis for the richer segment of our sample. Thus, it would appear that development can only reduce migration flows after a certain welfare level has been reached, while it would not have an effect for the poorest countries. In other words, in order for the domestic government to be able to have an impact, the development level to be provided needs to be rather large.

In the first column we further observe that organized crime in the home country does not have the expected, positive push effect on migration, which is no the case in specifications 2 and 3, where we introduced a trajectory risk<sup>31</sup> variable instead. Indeed, it appears as though our homicides variable absorbed the large and negative effect of the trajectory risk variable, which, when introduced in our estimations is significantly negative, while the sign of homicide rates turns positive. Hence, we are able to disentangle through both of our organized crime variables, the two effects proposed earlier in this paper. As crime increases in the home country, there is indeed a positive push effect. However, the fact that the trajectory gets more dangerous, decreases international migration flows.

Regarding border control, we included both open and closed migration policy<sup>32</sup> changes in all our specifications, yet only one of them, closed migration policies, appears negative and significant. Hence, border control from our model does appear as an effective policy to halt migration flows, in line with most of the literature (Espenshade, 1994; Hanson and Spilimbergo, 1996; Angelucci, 2012b) as well as our model.

Most of the migration literature focuses on wage differentials as the main factor attracting migrants. Nevertheless, when including this variable in our empirical specifications we find no significant effect. Rather, when we include other variables to proxy for the value of migration, such as colonial ties and common language, we find large and significant positive effects. Hence, it appears as though the value of migration is related more to the probability of finding a job, which is related to higher social networks from a colonial past and speaking the same language, than to pure economic factors. This suggests that the economic advantages of migration should not only be measured in monetary terms. Lastly, from the migration equation, our measure of the cost of migrating, the distance, appears negative and significant in all specifications as expected.

Turning to the aid equation results, we find a positive effect of migration flows as found in the literature. Our model suggested a joint effect of organized crime and migration, that we test using homicide rate and its interaction to migration flows in column 1. Our results are

 $<sup>^{31}</sup>$ Calculated as the average homicide rate in neighboring countries minus own country rate.

 $<sup>^{32}{\</sup>rm These}$  variables take the value of 1 if a positive/negative change in their immigration policy took place during the period, zero otherwise.

not statistically significant. Additionally, we find a positive impact of distance, which would be counter-intuitive if we think that the externality is stronger the closer the countries are. However, the effect is dissipated in our other specifications when we substitute homicides for our trajectory risk variable. The results of this variable go indeed in line with our model, as we observe a positive effect of the trajectory risk variable, while the interaction term is negative. Thus, higher migration decreases the positive effect of the crime externality, when measured as trajectory risk, and hence reduces aid. We further tested in specification 3 a measure of externality, given by the interaction of homicides and distance, yet no effect was found.

Open migration policy is found negative in all specifications, while anti-migrant policies are positive as expected. Indeed, results suggest a complementary effect of both policies in that the higher border control is, the more the donor is able to give aid, despite that it increases migration.

|   | (1)   | (2)   | (3)                               |
|---|---|---|-----------------------------------|
| Migration Gravity Equation  | 0.041***  | 0.400***  | 0 401***                          |
| Bilateral aid disbursements   | (34.54)   | (22.53)   | (22.35)                           |
| Total ODA received  |   | -0.0220<br>(-0.81)                                      | -0.0450<br>(-1.65)                |
| Home country GDP per capita   | $0.616^{***}$   | 0.229***  | 1.483***                          |
| Home country Infant Mortality                                       | (23.40)   | -0.701***   | -0.709***                         |
| Home country GDP squared  |   | (-12.81)  | (-12.99)<br>$-0.0841^{**}$        |
| Homicide rate   | -0.0970***  | 0.0889*   | (-4.32)<br>$0.0867^*$             |
| Trajectory risk   | (-3.29)   | (2.40)<br>-0.213***                                     | (2.30)<br>-0.221***               |
| Open Migration Policy   | 0.0144  | (-5.36)<br>0.0505                                       | (-5.56)<br>0.0559                 |
| Closed Migration Policy   | (0.14)<br>-0.717***                                   | (0.48)<br>-0.517***                                     | (0.54)<br>- $0.513^{**}$          |
| Destination country GDP per capita                                  | (-7.04)<br>-0.0856                                    | (-5.10)<br>0.101  | (-5.08)<br>0.110                  |
| Colonial ties   | (-1.24)   | (1.47)<br>$0.462^{***}$                                 | (1.61)<br>$0.478^{***}$           |
| Common language   |   | (3.73)<br>1.171***                                      | (3.87)<br>1.178***                |
| Simple distance   | -0.867***   | (15.02)<br>-0.822***                                    | (15.16)<br>- $0.805^{**}$         |
|   | (-21.87)  | (-19.78)  | (-19.33)                          |
| Aid equation<br>Lagged Migration flows                              | 0.339***  | 0.382***  | 0.366***                          |
| Homicide rate   | (16.89)<br>0.0537                                     | (16.77)   | (15.69)<br>0.00244                |
| Trajectory risk   | (1.28)  | 0.257***  | (0.01)<br>$0.262^{***}$           |
| Migration*Trajectory Risk   |   | (5.49)<br>-0.0277**                                     | (5.08)<br>-0.0225*                |
| Simple distance   | 0.0906**  | (-3.07)<br>0.0153                                       | (-2.38)<br>0.0307                 |
| Migration*Homicides   | (2.83)<br>0.00453<br>(0.57)                           | (0.40)  | (0.39)                            |
| Externality(Homicides*Distance)                                     | (0.57)  |   | -0.00596                          |
| Open Migration Policy   | -0.420***   | -0.402***   | (-0.14)<br>$-0.399^{**}$          |
| Closed Migration Policy   | (-5.20)<br>$0.265^{***}$                              | (-4.46)<br>$0.242^{**}$                                 | (-4.44)<br>$0.236^{**}$           |
| Home country GDP per capita   | (3.41)<br>-0.531***                                   | (2.76)<br>-0.417***                                     | $(2.70) \\ 0.380$                 |
| Home country GDP squared  | (-29.52)  | (-14.29)  | (1.49)<br>-0.0522**               |
| Home country Infant Mortality                                       |   | 0.202***  | (-3.11)<br>$0.207^{***}$          |
| Total ODA given   | 0.420***  | (4.38)<br>$0.465^{***}$                                 | (4.39)<br>$0.466^{***}$           |
| Trade Intensity   | (23.90)<br>$0.661^{***}$                              | (24.46)<br>$0.523^{***}$                                | (24.59)<br>$0.502^{***}$          |
| Colonial ties   | (10.04)<br>$0.946^{***}$<br>(11.34)                   | (7.23)<br>$0.823^{***}$<br>(8.37)                       | (6.93)<br>$0.841^{***}$<br>(8.53) |
| Controls  | YES   | YES   | YES                               |
| Time FE   | $\begin{array}{c} {\rm YES} \\ {\rm YES} \end{array}$ | $\begin{array}{c} \text{YES} \\ \text{YES} \end{array}$ | YES<br>YES                        |
| $\begin{array}{c} \text{Observations} \\ R^2 Migration \end{array}$ | 3860<br>0.62  | 3223<br>0.69  | $3223 \\ 0.70$                    |

## Table 11 – Empirical specification results

0.53

0.55

0.55

 $R^2 A i d$ 

### 3.5 Concluding remarks

This paper provides a simple framework relating organized crime, foreign aid and illegal migration. To our knowledge, it is the first attempt at analyzing this three-sided relationship in the literature. We further provide empirical support for our model's hypothesis and findings with cross-country data.

Through a simple game-theoretic framework, we modeled a population of potential migrants who observe development levels, border control and organized crime in their country and then migrate if their expected utility is superior to the outside option of staying home. The heterogeneity of individuals allows for a proportion of migrants that decreases if development outcomes improve or if more border guards or organized crime is observed.

The domestic government spends in development to limit migration flows, yet given other variables decrease migration, it is able to deviate some resources to pet projects as well. Given the fact that reducing the organized crime through foreign aid will have a positive impact on migration, the foreign country opts for a stronger border control policy and lower foreign aid, which translates into higher organized crime than the optimum.

We provide an empirical strategy to test for our model's hypothesis and findings through a simultaneous equation estimation model of a migration gravity equation and an aid equation. Most of our empirical results go in line with our model, suggesting a positive effect of aid on migration, a negative effect of organized crime on migration and most importantly, organized crime and high migration flows yield lower aid. Hence, we are able to support our model's finding that the donor allows for a higher level of organized crime as another way of reducing migration flows.

Thus, we observe from both model and evidence, that the migration decision largely depends on the domestic government development plans. Empirically, our results suggest only broad development increments can deter migration flows. In addition, our results corroborate a hidden agenda in aid towards the reduction of migration flows, as aid appears to be lower when other mechanisms, such as organized crime are in place reducing migration. Our statistically significant results on the organized crime variables suggest a new angle for future research. Moreover, the fact that our cross-country comparison approach yielded such results demonstrates it might not be an exclusive issue from the Mexican scenario.

Nevertheless, future extensions should also seek to apply this empirical strategy to a one country context. Although not yet available, a compilation of more dis-aggregated foreign aid data would thus provide a large set of interesting extensions to the current framework.

# 3.A Appendix

### 3.A.1 Proof of Proposition 1

We can rewrite the first order condition as follows:

$$h'(m_i^*(\gamma, v_i, C, G))q(C, G)v_i = \gamma$$
(22)

Differentiating 22 with respect to  $\gamma$ ,  $\nu_i$ , C and G, we obtain:

$$\begin{split} \frac{\partial m_i^*}{\partial \gamma} &= \frac{1}{h''(m_i^*)q(C,G)v_i} < 0\\ \frac{\partial m_i^*}{\partial C} &= -\frac{\frac{\partial q(C,G)}{\partial C}h'(m_i^*)}{h''(m_i^*)q(C,G)} < 0\\ \frac{\partial m_i^*}{\partial G} &= -\frac{\frac{\partial q(C,G)}{\partial G}h'(m_i^*)}{h''(m_i^*)q(C,G)} < 0\\ \frac{\partial m_i^*}{\partial v_i} &= -\frac{h'(m_i^*)}{h''(m_i^*)} > 0 \end{split}$$

### 3.A.2 Proof of Proposition 2

Let us call the marginal migrant whose migration value is given by  $v^*$  as i = m, hence his expected utility is noted as  $E(u_m)$ , and his optimal migration investment is  $m_m^*$ . Taking the total derivative of the expected utility function of i = m

$$E(u_m) = y - \gamma m_m^* + h(m_m^*)q(C,G)v^* = \bar{u}$$

The 'migration decision condition' defines the idiosyncratic value for migration of the marginal migrant as an implicit function of the exogenous parameters of the model  $v_m(\gamma, C, G)$ . Differentiating (X) with respect to  $\gamma$ , <sup>C</sup> and G, it follows that:

$$\frac{\partial v^*}{\partial \gamma} = \frac{m_m^*}{h(m_m^*)q(C,G)} > 0$$

$$\frac{\partial v^*}{\partial C} = -\frac{v^* h(m_m^*) \frac{\partial q(C,G)}{\partial C}}{h(m_m^*) q(C,G)} > 0$$

$$\frac{\partial v^*}{\partial G} = -\frac{v^* h(m_m^*) \frac{\partial q(C,G)}{\partial G}}{h(m_m^*) q(C,G)} > 0$$

The number of migrants is defined as  $n_m = N [1 - F(v^*(\gamma, C, G), D)]$ . Hence,  $n_m^*$  is decreasing in  $\gamma$ , C, and G; and as  $\frac{\partial F}{\partial D} > 0$  the number of migrants is also decreasing in D.

## 3.A.3 Proof of Proposition 3

Taking the total derivative of equations 12 and 13:

$$B'(\widetilde{n_m})\frac{\partial F}{\partial \widetilde{D}}dN + NB''(\widetilde{n_m})\frac{\partial F}{\partial \widetilde{D}}d\widetilde{n_m} + NB'(\widetilde{n_m})\frac{\partial^2 F}{\partial \widetilde{D}\partial v^*}dv^* + NB'(\widetilde{n_m})\frac{\partial^2 F}{\partial \widetilde{D}^2}d\widetilde{D} = 0$$
(23)

$$d\widetilde{n_m} = (1 - F)dN - N\frac{\partial F}{\partial v^*}dv^* - N\frac{\partial F}{\partial \widetilde{D}}d\widetilde{D}$$
(24)

Substituting equation 24 in 23 and rearranging terms,

$$\begin{split} \left[B'(\widetilde{n_m})\frac{\partial F}{\partial \widetilde{D}} + NB''(\widetilde{n_m})(1-F)\frac{\partial F}{\partial \widetilde{D}}\right]dN + \left[NB'(\widetilde{n_m})\frac{\partial^2 F}{\partial \widetilde{D}\partial v^*} - N^2B''(\widetilde{n_m})\frac{\partial F}{\partial \widetilde{D}}\frac{\partial F}{\partial v^*}\right]dv^* \\ + \left[NB'(\widetilde{n_m})\frac{\partial^2 F}{\partial \widetilde{D}^2} - N^2B''(\widetilde{n_m})\left(\frac{\partial F}{\partial \widetilde{D}}\right)^2\right]d\widetilde{D} = 0 \end{split}$$

From which we can derive the following relations,

$$\begin{split} \frac{\partial \widetilde{D}}{\partial N} &= -\frac{\left[ B'(\widetilde{n_m}) \frac{\partial F}{\partial \widetilde{D}} + NB''(\widetilde{n_m})(1-F) \frac{\partial F}{\partial \widetilde{D}} \right]}{\left[ Nx'(\widetilde{n_m}) \frac{\partial^2 F}{\partial \widetilde{D}^2} - N^2 B''(\widetilde{n_m}) \left( \frac{\partial F}{\partial \widetilde{D}} \right)^2 \right]} > 0 \ if \ \frac{NB''(\widetilde{n_m})}{B'(\widetilde{n_m})} < -\frac{1}{(1-F)} \\ \xrightarrow{>0} \\ \frac{>0}{\left[ NB'(\widetilde{n_m}) \frac{\partial^2 F}{\partial \widetilde{D} \partial v^*} - N^2 B''(\widetilde{n_m}) \frac{\partial F}{\partial \widetilde{D}} \frac{\partial F}{\partial v^*} \right]}{\left[ NB'(\widetilde{n_m}) \frac{\partial^2 F}{\partial \widetilde{D}^2} - N^2 B''(\widetilde{n_m}) \left( \frac{\partial F}{\partial \widetilde{D}} \right)^2 \right]} < 0 \ if \ \frac{\partial^2 F}{\partial \widetilde{D} \partial v^*} \ge 0 \end{split}$$

Hence, from proposition 2, we find  $\widetilde{D}$  decreasing in  $\gamma$ , C and G, if some additional assumptions are made. Additionally, it is straightforward from equation 24 that  $\widetilde{n_m}$  is also decreasing in  $v^*$  for which  $\widetilde{n_m}$  is also decreasing in  $\gamma$ , C and G.

# 4 Chapter 3

The fall of mobility when moving: A study of social mobility of Mexican migrants to the US

### Abstract

This paper intends to infer the causal impact of US migration on educational mobility in Mexico. We provide the literature with a unique study of the effects of migration on the social mobility of the left behinds. Through an instrumental variable strategy we are able to identify a large negative impact on educational mobility using correlation coefficients of parents-child's years of education. Thus, although attractive in the short-term, migration seems to be detrimental to equality of opportunities in the long-run.

Keywords: Social mobility, Educational attainment, International Migration

JEL Classification I21, J61, J62

## 4.1 Introduction

Since the works of Rawls (1958, 1971) equality of opportunity has risen as a means for social justice, replacing the ideal of equality of welfare which had failed to incorporate the individuality of people into what is ethically fair. The concept gained popularity with Sen (1980, 1985, 1992) and ever since, equality of opportunity has been incorporated as a target in public policy. Inter-generational social mobility helps measuring a society's standing towards equality of opportunity, that is, the degree in which individuals' possibilities to get ahead in life are independent from their ascribed characteristics such as race, social position or gender, and rather a result of their own decision making. Public schooling, social welfare, as well as social protection programs, are evidence of governments' efforts towards this objective. Indeed, fighting poverty goes in hand with providing all society members with the same set of alternatives. Still, despite it being an objective, equality of opportunities is rarely present in less developed countries such as Mexico, ranking first from the OECD countries in terms of inequality as measured by the Gini coefficient, and 25 from a list of 149 countries in the world.<sup>33</sup> When the government's efforts are shorthanded, and opportunities are lacking, individuals take matters into their hands to expand their set of opportunities through other means, including migration.

This is the case of millions of Mexicans, migrants who travel and live in rough conditions after reaching their destination, having left their families behind, all in hopes of providing a better life for their loved ones. As found in the literature, migration may have a direct impact alleviating current poverty through remittances (Adams and Page, 2005; Adams, Lopez-Feldman, Mora, and Taylor, 2008; Acosta, Fajnzylber, and Lopez, 2007; Acosta, Calderon, Fajnzylber, and Lopez, 2008). The large amount of remittances sent back home reached as much as 2.6% of Mexico's GDP in 2016<sup>34</sup> representing a major source of household and national income. Nevertheless, it is worth asking whether there is a long-lasting effect of a

 $<sup>^{33}\</sup>mathrm{From}$  2015 OECD data and The CIA World Factbook

<sup>&</sup>lt;sup>34</sup>From Mexico's Central Bank data.

migrant parent's efforts on their offspring's development in life. In other words, are Mexican migrants' efforts paying off in the long-run? The purpose of this paper is to answer this question by studying the impact of parental migration on intergenerational educational mobility.

There is no consensus in the literature about the evolution of social mobility in Mexico mostly because there does not seem to be a constant trend over time. Indeed, Binder and Woodruff (2002) show differences in patterns of educational mobility by gender and across different birth cohorts. Although overall the authors find an increase in mobility, some of the latest cohorts analyzed showed slight decreases. As will be shown in section 4.2, our data also picture differences among cohorts and coincide with finding higher mobility for women. The opposite was highlighted, however, by Behrman, Gaviria, Székely, Birdsall, and Galiani (2001), who found higher mobility of men. Nevertheless, the authors used a sample comprising only Mexican urban population, which could be a potential explanation. De Hoyos, Martínez de la Calle, and Székely (2010) on the other hand, find overall higher educational mobility in the recent decades, which is also translated into higher household income. For a detailed description of Latin American trends in social mobility, one can refer to Azevedo and Bouillon (2009), who provide extensive evidence of Mexico's social mobility and its standing with respect to other Latinamerican countries. The authors show Mexico having higher mobility than most Latinamerican countries, despite the fact that it also has one of the highest inequality levels. Through their review, the authors also show no overall change in mobility in Mexico through time, which can be due to the downturn in mobility during the 1980s as shown by Binder and Woodruff (2002).

Although social mobility can be also studied from a wealth and an occupational perspective, we focus on education for several reasons. Firstly, it is more straightforward to interpret more schooling years as positive mobility than it is so while comparing occupational choices. Many studies have analyzed occupational mobility looking at the odds of an offspring of agricultural parents to work in non-farming activities (Emran and Shilpi, 2011; Emran and Sun, 2015). Even though rural families are usually poorer and less educated, it is difficult to take as positive mobility a low-skilled, poorly-paid job, even when compared to farming. In terms of income mobility, relevant studies have used permanent earnings to analyze wealth mobility (Zimmerman, 1992; Dustmann, 2008). Nevertheless, one would require extensive data on wages of both fathers and sons for such an analysis, data which we do not believe exist in the Mexican context. On top of these reasons, given the fact that education determines both occupation and income to a great extent, we consider that educational mobility should be the first to be looked at in a social mobility framework.

There are different approaches to infer the causal impact of parental education on intergenerational transmission of education. Upon data availability, researchers have exploited differences between twins educational levels and that of their children, arguing ability should not play a role as both should have been equally endowed with (Behrman and Taubman, 1985; Behrman, Rosenzweig, et al., 2002). Other studies have used data on adoptees instead, relying on the reasonable assumption that ability is only transferred genetically, for which it should not play a role when studying effects of adoptive parental education on that of their children (Plug and Vijverberg, 2003; Plug, 2004; Björklund, Lindahl, and Plug, 2006; Sacerdote, 2007). In addition, other studies have exploited schooling reforms as natural experiments for identification (Chevalier, 2004; Chevalier, Harmon, O'Sullivan, and Walker, 2013; Black, Devereux, and Salvanes, 2005; Lundborg, Nilsson, and Rooth, 2014; Dickson, Gregg, and Robinson, 2016). Despite the substantial evidence pointing to the endogeneity of parental schooling in determining a child's educational attainment, our work does not focus on providing causal estimates in this regard. Indeed, our interest does not rely on the identification of correlation coefficients between parents and children's education, but rather on the extent to which migration alters the coefficients *per se*, regardless of whether intergenerational transmission of education comes from inherited ability or actual educational level. In other words, we are interested on quantifying the causal impact of migration on educational mobility rather than to explain all of its components.

With this regard, despite the large literature on social mobility, only few studies are found analyzing the links between migration and social mobility. Moreover, most authors have analyzed the intergenerational social mobility of immigrants, while in a few cases a comparison to mobility of native populations is also provided. This is the case of Bauer and Riphahn (2007), who studied the different patterns of intergenerational education transmission among second-generation immigrants and natives in Switzerland, finding that mobility is higher for immigrants than for natives. Contrary to these results, Dustmann (2008) incorporates data on probability of permanent migration which appears to have a positive association to educational investment, and finds a lower social income mobility for immigrants than for natives in Germany. While studying immigrants in the US from a diverse set of countries of origin, Borjas (1985, 1992, 1993) formulated a theory on ethnic capital. The author argues and provides extensive evidence that the average skill level of the generation of a child's ethnic group, has a positive impact on educational outcomes. Indeed, by studying US immigrant populations he finds a positive effect of ethnic capital, meaning individuals belonging to ethnic groups with higher education on average, are likely to have higher schooling levels themselves. More recently, Postepska (2017) reviewed Borja's theory finding a significantly lower impact of ethnic capital once genetic ability has been accounted for, as opposed to previous studies. The author's work, which follows Farré, Klein, and Vella (2012)'s approach, evinces the importance of controlling for the intergenerational transmission of ability from parents to children, as it appears to upwardly bias coefficients of parental education's impact on children's schooling.

In addition to finding a scarce literature studying migration and social mobility, we believe this paper is one of the only studies assessing the causal relationship of these variables. Furthermore, our paper contributes to the even smaller literature of social mobility of migrants from a home-country perspective as indeed, all studies mentioned above focus on immigrant populations settled in developed countries.

This paper is structured as follows. We present the data used for our analysis in Sec-

tion 4.2, incorporating some descriptive statistics about social mobility in Mexico. Section 4.3 describes our empirical strategy while results are presented in Section 4.4. Section 4.5 concludes.

## 4.2 Data

The Mexican Social Mobility Survey (EMOVI) was created by the Espinosa Yglesias Studies Center (CEEY) in 2006 with the specific objective of studying social mobility in Mexico. Hence, the survey was administered to head of households between the age of 25 and 64, who were living in Mexico at the time of the interview. Besides asking individuals about their present situation, retrospective information about their life at the age of 14 regarding their parental background was requested too. The EMOVI is nationally representative on both demographic and socioeconomic levels, and has a sample size of 8,520 households. We present the summary statistics of our sample<sup>35</sup> in Table 12 where the first column presents data of the entire sample while columns 2 and 3 show subsamples on whether the surveyed individuals' parents migrated. In the last column we present the results of a difference in means test. The descriptive statistics show the average age of the respondents is nearly 45 and generally men. The average age of their fathers is 74 and the same across groups. The average years of education for respondents is nearly 8, while parents have less than half of this number. This suggests significant improvements in Mexican schooling over time. The wealth deciles were computed through a wealth index<sup>36</sup> on assets and suggest individuals of migrant parents were and still are slightly wealthier. The average number of siblings is near 6 and higher for the migrant parent subsample, in which 4% more individuals used to live in rural areas at age 14. Finally, our ability variable, described in detail later in this paper,

<sup>&</sup>lt;sup>35</sup>Note that the sample is reduced in about 30% due to missing observations on a few important variables of our empirical specifications. In particular, 15% where lost from missing observations of the EMOVI variables, and another 15% from incorporating the instrumental variables. We tested whether the remaining sample differed from the observations that were dropped and found small, yet statistically significant results, showing less educated and poorer individuals in the dropped observations. The fact that our sample would be slightly better off, shows that our results could even be higher if no observations were dropped.

<sup>&</sup>lt;sup>36</sup>Refer to the Appendix 4.A.1 for an explanation on the computation of the wealth index.

appears slightly higher for children of migrants. Despite the fact that the difference in means test yielded some statistically significant results, the magnitude of such differences remains quite narrow for which no significant differences can be argued.

|                             | All        | Non-Migrants Parents | Migrant Parents | p-value |
|-----------------------------|------------|----------------------|-----------------|---------|
| HoH Years of Education      | 7.76       | 7.74                 | 7.90            | NO      |
|                             | (4.63)     | (4.65)               | (4.55)          |         |
| Father's Years of Education | $3.58^{'}$ | 3.59                 | 3.54            | NO      |
|                             | (3.91)     | (4.00)               | (3.39)          |         |
| Mother's Years of Education | 3.09       | 3.05                 | 3.32            | **      |
|                             | (3.53)     | (3.55)               | (3.40)          |         |
| HoH gender                  | 0.14       | 0.14                 | 0.13            | NO      |
|                             | (0.34)     | (0.34)               | (0.33)          |         |
| HoH age                     | 44.80      | 44.82                | 44.68           | NO      |
|                             | (11.91)    | (11.98)              | (11.50)         |         |
| Father's age                | 74.35      | 74.32                | 74.56           | NO      |
|                             | (14.29)    | (14.46)              | (13.27)         |         |
| HoH Decile                  | 5.63       | 5.57                 | 5.99            | ***     |
|                             | (2.86)     | (2.88)               | (2.73)          |         |
| Parents' Decile             | 5.60       | 5.56                 | 5.85            | ***     |
|                             | (2.97)     | (2.97)               | (2.95)          |         |
| Number of siblings          | 5.90       | 5.85                 | 6.21            | **      |
|                             | (3.51)     | (3.52)               | (3.41)          |         |
| Rural area at age 14        | 0.57       | 0.56                 | 0.60            | **      |
|                             | (0.50)     | (0.50)               | (0.49)          |         |
| Ability                     | 2.72       | 2.69                 | 2.86            | ***     |
|                             | (1.31)     | (1.32)               | (1.25)          |         |
| Observations                | 5803       | 4936                 | 867             | 5803    |

Table 12 – Mean characteristics of the sample by parental migration

*Note:* Summary statistics of our sample by parental migration and difference in means test results in the last column with NO p > 0.1, \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

Although the retrospective questions were specifically designed to study social mobility, it was not so to study migration. Hence, the migration data is of less depth and important aspects such as the legality of migration, as well as migration length were not documented. Additionally, most of the retrospective questions were administered to both the head of the household and its partner, which would yield a relatively well balanced database in terms of gender. However, retrospective migration information is only available for the main respondent, i.e. the head of the household. Therefore, the main empirical strategy described in section 4.3 only considers head of households which are usually male. Nevertheless, we provide an illustration of social mobility in Mexico from a gender perspective in Table 13. Overall, we find lower mobility for men than for women, as measured by the father-child correlation coefficients. Furthermore, male's mobility appears increasing in time, while female's decreases. In the second column of each gender category, we observe that for the case of exceeding a father's years of schooling, females begin at a clear disadvantage, yet they catch up to males in the latest cohorts. The gender differences found in our data might be explained by yet another gender-specific effect. As found in Emran and Shilpi (2011), females could have higher correlations to their mothers' educational level than to their fathers'. However, we are not able to test this hypothesis given that the mothers' educational questions are only available for the head of the household, and not for the partner.

Table 13 – Educational Mobility in Mexico by Time and Gender

|                        | Ma  | le    | Fem  | ale   |
|------------------------|---|-------|--|-------|
|                        | Corr.   | Prop. | Corr.  | Prop. |
| All observations       | 0.56<br>(6,639)                               | 0.77  | 0.52<br>(6,640)                                | 0.72  |
| Birth Cohort 1940-1950 | $\begin{array}{c} 0.55 \ (1,739) \end{array}$ | 0.69  | 0.44<br>(1,472)                                | 0.56  |
| Birth Cohort 1950-1960 | $0.54 \\ (1,452)$                             | 0.77  | $\begin{array}{c} 0.53 \\ (1,580) \end{array}$ | 0.74  |
| Birth Cohort 1960-1970 | $0.50 \\ (1,698)$                             | 0.83  | 0.47<br>(1,750)                                | 0.78  |
| Birth Cohort 1970-1980 | $0.51 \\ (1,515)$                             | 0.82  | 0.47<br>(1,381)                                | 0.79  |

*Note:* Father-child correlation coefficients and proportion of children exceeding father in schooling years by child's gender and selected birth-cohorts. Number of observations in parenthesis.

Table 14 shows the probabilities of the respondents achieving different schooling levels

conditioned on their parents' education and US migration. Note that in the Mexican schooling system primary school is achieved after 6 years, our third educational level of 7-11 years corresponds to uncompleted secondary school, and the last comprises both individuals with high school degrees as well as those with higher education. In general, we find that children of uneducated migrants have slightly larger probabilities of higher education. On the other hand, higher education of mothers appears to have a higher impact on non-migrants than on migrant families, while the reverse is observed for the case of the father's education.

Table 14 – Probabilities of Child's Education by Parent's Educational Level

|                    |      | Non-Migrants |         |      |      | Migr | ants |      |
|--------------------|------|--------------|---------|------|------|------|------|------|
| Father's Education | None | 1-6          | 7-11    | 12+  | None | 1-6  | 7-11 | 12 + |
|                    |      |              |         |      |      |      |      |      |
| None               | 0.18 | 0.03         | 0.01    | 0.00 | 0.15 | 0.03 |      |      |
| Primary            | 0.56 | 0.38         | 0.09    | 0.03 | 0.53 | 0.40 | 0.08 | 0.03 |
| Secondary          | 0.20 | 0.35         | 0.41    | 0.10 | 0.22 | 0.34 | 0.45 | 0.06 |
| University         | 0.06 | 0.24         | 0.50    | 0.86 | 0.10 | 0.23 | 0.47 | 0.91 |
| Observations       | 1771 | 2532         | 352     | 281  | 225  | 558  | 51   | 33   |
|                    |      |              |         |      |      |      |      |      |
|                    |      | Non-M        | igrants |      |      | Migr | ants |      |
| Mother's Education | None | 1-6          | 7-11    | 12+  | None | 1-6  | 7-11 | 12 + |
|                    |      |              |         |      |      |      |      |      |
| None               | 0.16 | 0.02         | 0.01    |      | 0.15 | 0.02 |      |      |
| Primary            | 0.56 | 0.34         | 0.08    | 0.02 | 0.52 | 0.38 | 0.06 | 0.13 |
| Secondary          | 0.20 | 0.38         | 0.33    | 0.14 | 0.23 | 0.36 | 0.35 | 0.13 |
| University         | 0.08 | 0.26         | 0.58    | 0.84 | 0.09 | 0.24 | 0.59 | 0.75 |
| Observations       | 2064 | 2351         | 345     | 176  | 286  | 498  | 51   | 32   |

*Note:* Probabilities are conditional proportions over the child's educational level, by educational levels and migration status of parents.

Alternatively, Table 15 presents proportions of individuals succeeding each educational level according to their parents' education and migration status. Similarly, we find a higher proportion of children of uneducated migrant parents to have completed each schooling level. For low to medium educational level of parents, children of non-migrant show higher proportions of completing secondary school levels. For the case of highly educated parents, children of non-migrants fare better at obtaining a university degree, while a higher proportion of children of migrant parents complete upper secondary school.

|                    | Non-Migrant |      |      | Migrant |      |      |      |      |
|--------------------|-------------|------|------|---------|------|------|------|------|
| Father's Education | None        | 1-6  | 7-11 | 12 +    | None | 1-6  | 7-11 | 12 + |
| Primary            | 0.49        | 0.84 | 0.95 | 0.99    | 0.52 | 0.79 | 0.96 | 1.00 |
| Lower Secondary    | 0.23        | 0.54 | 0.87 | 0.96    | 0.26 | 0.51 | 0.88 | 0.94 |
| Upper Secondary    | 0.06        | 0.24 | 0.50 | 0.86    | 0.10 | 0.22 | 0.47 | 0.91 |
| University         | 0.02        | 0.08 | 0.20 | 0.50    | 0.03 | 0.09 | 0.16 | 0.45 |
| Observations       | 1771        | 2532 | 352  | 281     | 225  | 558  | 51   | 33   |

Table 15 – Individuals School Levels Completion

*Note:* Proportions of surveyed individuals having completed each educational level according to parent's education and migration.

The data presented so far yields a mixed picture of the relationship between migration and educational mobility. On the one hand, offspring of uneducated migrant parents appear to achieve higher education while the opposite is true for children of both high and low educated non-migrant parents. Nevertheless, these results do not account for other factors such as income, among others, nor do they account for the structural differences between migrant and non-migrant parents. The following section depicts our identification strategy in order for causal inference to be drawn.

## 4.3 Empirical Strategy

Although our study focuses on educational mobility, we first look at the determinants of educational attainment, which is determined by factors other than parental educational transmission. Becker's theory of human capital suggests that parents' educational investment in their offspring is determined by a rational decision that takes into account expected costs and benefits of schooling (Becker, 1994). In addition to direct costs of schooling, indirect costs such as the number of siblings should be considered, as per Becker and Lewis (1973)'s theory on the quantity-quality trade-off, which may impact educational investment decisions of parents. Incorporating educational mobility, our educational attainment equation would yield,

$$Y_i^{HH} = \alpha + \beta Y_i^P + \gamma X_i + \epsilon_i \tag{25}$$

where Y denotes the number of years of education,<sup>37</sup> with HH identifying the head of the household surveyed by the EMOVI and P for his/her parents. Vector X contains costs, benefits and a household composition variable. Therefore, our coefficient of interest in equation 25 is  $\beta$ , which measures the correlation between parental and the child's education. The higher the correlation, the more a child's education depends on that of his parents' and thus, the lower the educational mobility.

As noted in the literature, educational mobility is itself determined by genetics, parental behavior and other environmental factors. We will hence adopt an approach similar to Bauer and Riphahn (2007), in which the impact of environmental factors on educational mobility is analyzed. However, instead of focusing on genetics or environmental factors, while controlling for them<sup>38</sup>, we study parental behavior instead: i.e. parents' migration to the US. Therefore, we rewrite equation 25 as follows,

$$Y_i^{HH} = \alpha + \beta Y_i^P + \psi M_i^P + \delta (Y_i^P \cdot M_i^P) + \gamma X_i + \epsilon_i$$
(26)

where  $M_i^P$  represents a dummy variable indicating whether either parent ever migrated to the US for work for at least one month. Thus, by interacting the migration dummy with the parents' education, the impact of migration on educational mobility would be given by  $\delta$ , and the sum of  $\beta + \delta$  gives the total educational mobility.

<sup>&</sup>lt;sup>37</sup>Years of education are incorporated in log terms in our regressions, given that the distribution of this variable is not smooth, having picks at zero and at completion of primary schooling (six years).

 $<sup>^{38}</sup>$ As will be described further down, an ability proxy is introduced, and in some specifications we additionally control for a state-level development variable.

There are, however, two potential issues with our empirical strategy. Firstly, and as discussed in section 4.1, evidence suggests that the impact of parental education can be upwardly biased when parental ability cannot be accounted for. Although our objective is not to provide a causal estimate of parental education on child's education, we decided to incorporate data of the self-assessment of the head of the household regarding his own school performance in the past as a proxy for inherited ability.<sup>39</sup> Self assessment data is available for individuals at age of 14. In the case they were no longer at school at this age, self assessment of schooling as a child was used. Nevertheless, nearly 10% of individuals never attended school and for them, both of these variables were missing. In order not to exclude them from the analysis, their ability was set to zero. As a robustness check of this arbitrary value, we tested giving these individuals the minimum value in the data, 1. The results of this test show no significant changes in the coefficients of interest and can be found in Table 22 in the Appendix.

Although this variable might not directly reflect parental ability, it is the closest our data provides. Moreover, given the purpose of our study, a failure to fully capture the effect of inherited ability does not pose a threat in determining the impact of migration.

The second potential issue in our specification is the fact that migration as a decision can be related to unobservable characteristics that might themselves be correlated to educational decisions, leading to endogeneity problems. To address this, we apply an instrumental variable strategy using state-level historical migration rates dating to the 1920s, following the works of Woodruff and Zenteno (2001, 2007); Hanson and Woodruff (2003); McKenzie and Rapoport (2007), among others. Given that historical migration rates are only available at the state-level, we further include the distance from the municipality to the closest train station plus that to the US border by train as an instrument, using data of the railroad network in Mexico during the 1920s, following López Córdova (2006) and Demirgüç-Kunt,

<sup>&</sup>lt;sup>39</sup>This variable was taken from a question asking individuals to argue how good they were in school at age 14 and could take values 1 to 5, from one of the worst, to one of the best. In the case the individual was no longer at school by age 14, a similar question was asked regarding his performance in school as a child, with the same values.

Córdova, Peria, and Woodruff (2011). As mentioned by the previous authors, this strategy helps avoiding having only an instrument that varies at the state level, while only incorporating municipal distance variables would not yield a sufficiently strong instrument. Railroad networks determined migration to a large extent as US employers came looking for migrants in cities neighboring train stations (McKenzie and Rapoport, 2007). Both of these variables then describe migrant networks with roots since the 1920s, networks that allowed future migrants to incur lower costs and hence determine migration rates in the years to come.

The exogeneity assumption of these instruments will be met as long as these variables do not determine educational attainment for individuals in our sample. It is true that the existence of a railroad station, and thus migration rates, might have a direct impact on the development of the cities nearby, which may in turn affect education decisions. However, the migration literature exploits the fact that the direct effect of historical variables should have dissipated in time, leaving only an indirect effect through migration itself. We believe this is the case in our study, as we deal with parental migration of individuals born after the 1940s, which gives at least two decades of breach. Moreover, the fact that our historical variables are contemporaneous to some of the parents in our sample only strengthens our instrumentation by having a higher weight determining migration. To further show the exogeneity condition, we examined correlations of the historical instruments with respect to a set of 1930 and 1950 development outcomes following McKenzie and Rapoport (2007). The results, presented in Table 16 below, indicate significantly low correlations, corroborating the exogeneity condition of our instruments.

|                      | 193       | 0s      | 1950s     |         |  |
|----------------------|-----------|---------|-----------|---------|--|
|                      | Migration | Railway | Migration | Railway |  |
| Schools per students | 0.25      | 0.02    | -0.05     | 0.22    |  |
| Infant mortality     | -0.19     | -0.22   | -0.03     | -0.20   |  |
| Rural landholdings   | -0.19     | -0.05   |           |         |  |

Table 16 – Correlation of IVs and Development Outcomes

*Note:* Table reports pairwise correlations of instruments and different state-level development outcomes for 1930 and 1950. Most coefficients are significant at 1%. Development data are from the Statistics Yearbooks of the former National Statistics Department, digitized by the author. Instrumental variables for migration are taken from Woodruff and Zenteno (2007) and Demirgüç-Kunt, Córdova, Peria, and Woodruff (2011), and accessed through C. Woodruff's website. Rural landhold-ings for the states of Baja California Norte and Baja California Sur were not separated in 1930's data.

We now describe the variables included in vector X that will serve as controls to better isolate educational mobility in Equation 26. Firstly, we use a dummy variable for rural areas as a proxy for the cost of schooling. As the literature suggests, this variable reflects the fact that rural areas lack of schools and hence, individuals need to travel longer distances in order to attend one (Binder and Woodruff, 2002). Additionally, in order to account for the effect of parental wealth and not to overestimate the effect of parental education (Corak, Lipps, and Zhao, 2004), we use wealth deciles, calculated through an index on a number of assets the individual mentioned his parents had during his youth. We also incorporate the number of siblings to account for Becker and Lewis (1973)'s quantity-quality theory, which suggests the number of siblings should have a negative impact on school attainment. As mentioned before, we also include a variable of self-assessment as a proxy for the individual's inherited ability. Finally, we add the individual's age to account for differences in time, while the father's age is added only as an instrument for the parental migration decision.

### 4.4 Empirical Results

We present the results of our empirical strategy in Table 17. For the case of parental education, we test different specifications either using the average education of the parents (columns 1, 2 and 6), both mother's and father's education separately (columns 3 and 4); and together (column 5). We present OLS results of our model in column one, using our preferred parental education specification that we believe incorporates the effects of both parent's education without multicolinearity due to assortative mating which could be present in column 5. We can appreciate that comparing the first columns, higher correlation coefficients when incorporating migration compared to the simple OLS model in which migration and its interaction to parental education are not significant. Thus, the total social mobility indicator of our IV strategy reaches as much as  $0.38^{40}$ , compared to the 0.14 in the OLS. This could be explained by the endogeneity of the migration variable, which is not solved for through an OLS estimation rendering the migration and its interaction coefficients non significant, while the rest of coefficients remain relatively the same accross specifications.

The interaction terms are always positive and significant, except in the case of the mother's education interaction term in specification 5, thus showing that the impact of migration is higher through father-child correlations, also suggested by the higher correlation coefficient in model 3 than model 4. Given that most of our sample are male heads of household, this result would go in line with Emran and Shilpi (2011) who show a gender relationship in mobility coefficients in the sense that the predominant effects are men-father and women-mother relations.

In all, our results suggests migration increases the parent-child correlation coefficients, signaling a decrease in social mobility for migrants. Notwithstanding, these findings also suggest that having highly educated parents decreases the negative impact of migration on educational attainment, which we subsequently test in table 18. We include a control for the state-level development as in 1950, measured by infant mortality rate in column 6 using

<sup>&</sup>lt;sup>40</sup>Correlation coefficient ( $\beta$ ) plus interaction term coefficient ( $\delta$ ).

our preferred specification. Although the historical development control's coefficient is found significant, the coefficients of our variables of interest remain seemingly similar confirming the quality of our instruments, with a parents-child total coefficient of 0.36 instead than 0.38 as in our second column.

|                                       | (1)      | (2)          | (3)          | (4)          | (5)          | (6)          |
|---------------------------------------|----------|--------------|--------------|--------------|--------------|--------------|
|                                       | OLS      | IV           | IV           | IV           | IV           | IV           |
| Parents Average Years of Education    | 0.14***  | 0.09***      |              |              |              | 0.10***      |
| 0                                     | (18.13)  | (5.03)       |              |              |              | (5.28)       |
| Average Education $\times$ Migration  | -0.01    | 0.29**       |              |              |              | $0.26^{*}$   |
| 0                                     | (-0.43)  | (2.18)       |              |              |              | (1.92)       |
| Father's Years of Education           | ~ /      | ( )          | $0.06^{***}$ |              | 0.04**       | × ,          |
|                                       |          |              | (3.75)       |              | (2.22)       |              |
| Father's Education $\times$ Migration |          |              | $0.21^{*}$   |              | 0.20**       |              |
| Č.                                    |          |              | (1.95)       |              | (1.98)       |              |
| Mother's Years of Education           |          |              | ( )          | 0.07***      | 0.06***      |              |
|                                       |          |              |              | (4.07)       | (3.22)       |              |
| Mother's Education $\times$ Migration |          |              |              | $0.17^{*}$   | 0.05         |              |
| 0                                     |          |              |              | (1.70)       | (0.53)       |              |
| Either Parent's Migration             | -0.02    | -0.47*       | -0.32        | -0.40        | -0.37        | -0.55**      |
| 0                                     | (-0.44)  | (-1.74)      | (-1.19)      | (-1.21)      | (-1.06)      | (-2.03)      |
| Number of siblings                    | -0.00    | -0.01*       | -0.01**      | -0.01*       | -0.01        | -0.01        |
| -                                     | (-0.30)  | (-1.68)      | (-1.98)      | (-1.66)      | (-1.49)      | (-1.52)      |
| Living in rural area at age 14        | -0.15*** | -0.13***     | -0.14***     | -0.14***     | -0.12***     | -0.13***     |
|                                       | (-3.98)  | (-2.92)      | (-3.23)      | (-3.17)      | (-2.78)      | (-3.05)      |
| Age                                   | -0.02*** | -0.02***     | -0.02***     | -0.02***     | -0.02***     | -0.02***     |
|                                       | (-14.16) | (-12.05)     | (-12.76)     | (-12.96)     | (-11.80)     | (-12.00)     |
| Ability (self-assessment)             | 0.80***  | $0.74^{***}$ | $0.74^{***}$ | $0.76^{***}$ | $0.74^{***}$ | $0.74^{***}$ |
|                                       | (61.75)  | (51.61)      | (52.62)      | (55.54)      | (51.57)      | (51.66)      |
| Child mortality rate 1950             |          |              |              |              |              | -0.00***     |
|                                       |          |              |              |              |              | (-3.37)      |
| Observations                          | 7,092    | 5,803        | 5,987        | 6,387        | 5,803        | 5,803        |
| $Adj. R^2$                            | 0.53     | 0.48         | 0.47         | 0.47         | 0.47         | 0.48         |
| Unc. $R^2$                            |          | 0.68         | 0.68         | 0.68         | 0.68         | 0.68         |
|                                       |          |              |              |              |              |              |

| Table 17 – Instrumental | Variable Estimation | of Parent's Migration | on Educational Mobility |
|-------------------------|---------------------|-----------------------|-------------------------|
|                         |                     |                       |                         |

 $^{\ast}p < 0.1,^{\ast\ast}p < 0.05,^{\ast\ast\ast}p < 0.01.$ t-statistics in parentheses.

In our descriptive analysis in Section 4.2, we found different education patterns of children

*Note:* Table reports OLS and IV estimates of the effects of migration on educational mobility. Years of education expressed in log. Instrumental variables include historical migration rates at the state level, distance from municipality to closest train station plus the distance to the US border by train, and father's age, and the first two interacted with the parent's education variable. Migration dummy for either parent's US migration. All models include nine dummy variables for each parents' wealth decile with the first one as a reference, and a constant term.

according to their parent's educational levels. Hence, we further apply our empirical strategy on different subgroups of our sample in Table 18. We include our preferred specification, and the historical development control in the first column, and analyze a subsample according to the educational level of the parents in columns 2 and 3. We observe that results are rather similar for low educated parents, while the interaction term becomes insignificant for highly educated parents. Moreover, the parent-child correlation becomes a lot higher for the later. These results suggest migration only has an effect when parents have zero to primary education, both through the interaction term and through the migration term alone. Moreover, it shows less mobility for highly educated parents and children, however, in the case of parents with higher education, is not necessarily undesirable, as it would simply mean their children become just as educated. Note however that less statistically significant results are found in the subsample in column 3, which could be due to a smaller number of observations.

In the last two columns we analyze geographical effects by dividing the sample in those who lived in rural or urban areas at age 14. We can observe that the coefficient of parental education is larger for the urban sample, while their educational mobility effect is erased by parental migration. On the other hand, the rural sample presents the highest interaction coefficient, rendering the educational mobility coefficient higher than our base model in column 1 from 0.36 to 0.52.

Thus, our results suggest that migration has a negative impact on educational mobility overall, an effect which appears to be driven by low educated parents or having lived in rural areas during childhood. We had shown in Table 12 in Section 4.2 that both children of migrants and non-migrants had similar means of years of education. Therefore, our results suggest a difference in educational mobility despite the convergence found in years of education.

|                                      | (1)<br>IV | (2)Edu<= 6 | (3)Edu> 6 | (4)<br>Rural | (5)<br>Urban |
|--------------------------------------|-----------|------------|-----------|--------------|--------------|
| Parents Average Years of Education   | 0.10***   | 0.09***    | 1.25**    | 0.07***      | 0.28***      |
|                                      | (5.28)    | (4.82)     | (2.14)    | (2.96)       | (5.07)       |
| Average Education $\times$ Migration | 0.26*     | $0.26^{*}$ | -8.09     | 0.45***      | -1.50***     |
|                                      | (1.92)    | (1.96)     | (-1.62)   | (3.12)       | (-3.08)      |
| Either Parent's Migration            | -0.55**   | -0.50*     | 17.24     | -0.19        | -0.07        |
|                                      | (-2.03)   | (-1.86)    | (1.63)    | (-0.59)      | (-0.12)      |
| Number of siblings                   | -0.01     | -0.01**    | 0.02      | -0.00        | -0.03***     |
|                                      | (-1.52)   | (-2.00)    | (0.92)    | (-0.52)      | (-3.19)      |
| Living in rural area at age 14       | -0.13***  | -0.14***   | -0.19     | . ,          | . ,          |
|                                      | (-3.05)   | (-2.93)    | (-1.42)   |              |              |
| Age                                  | -0.02***  | -0.02***   | -0.00     | -0.03***     | -0.00        |
|                                      | (-12.00)  | (-11.80)   | (-0.27)   | (-11.58)     | (-1.08)      |
| Ability (self-assessment)            | 0.74***   | 0.79***    | 0.14***   | 0.92***      | 0.41***      |
|                                      | (51.66)   | (50.30)    | (3.25)    | (45.53)      | (15.78)      |
| Child mortality rate 1950            | -0.00***  | -0.00***   | 0.00      | -0.00***     | -0.00***     |
|                                      | (-3.37)   | (-3.28)    | (0.60)    | (-2.76)      | (-2.89)      |
| Observations                         | 5,803     | 5,010      | 793       | 3,296        | 2,507        |
| Unc. $R^2$                           | 0.68      | 0.64       | 0.88      | 0.60         | 0.62         |

Table 18 – Subgroup IV estimation of Educational Mobility Estimates

p < 0.1, p < 0.05, p < 0.01. t-statistics in parentheses.

*Note:* Table reports OLS and IV estimates of the effects of migration on educational mobility. Refer to notes in table 17 for details on instrumental variables.

As suggested in the literature, ability is an important variable to incorporate in social mobility models. Without the variable the parent-child correlations could be biased as a result of absorbing the effect of genetic transmission of ability. Recent works have solved this issue through a control function methodology based on estimating residuals of the parent-child correlation coefficients that then serve as control for the transmission of unobserved ability. Compared to simple OLS that does not account for ability, Farré, Klein, and Vella (2012) find a reduction in the the correlation coefficients of more than half for the mother, from 0.21 to 0.10, while that of the father becomes statistically insignificant. Likewise, Postepska (2017) finds important reductions in the parental capital coefficients within different cohorts. The author's results suggest a variation of the coefficient of as much as a quarter, from 0.23 to 0.17, once incorporating ability. We further test this using our ability variable by comparing both OLS and IV results of our preferred specification with and without our ability variable. We include such results in Table 23 in the Appendix. We find that by incorporating ability, the parent-child correlation coefficients are reduced to nearly half through both OLS and IV, from 0.22 to 0.14, and 0.17 to 0.09, respectively. Thus, our findings coincide with Farré, Klein, and Vella (2012) and Postepska (2017), despite our simpler ability variable.

### Mechanisms

After having provided substantial evidence of the effect of migration on educational mobility, we try to explain the possible mechanisms behind these results. One explanation is the fact that the type of work migrants do in the US does not require substantial schooling, being mostly located in the unskilled labor sector. This could impact a child's educational attainment if they would be more prone to migrate when having migrant parents. Hence, children of low educated migrants would attain lower schooling levels than children of low educated non-migrants. Table 19 shows indeed at least 50% higher proportions of head of households having migrated if their parents were US migrants, low educated or lived in rural areas.

Table 19 – Migration proportions by categories

|                                      | Non-Migrant | Migrant | Low Edu | High Edu | Urban | Rural |
|--------------------------------------|-------------|---------|---------|----------|-------|-------|
| Child's Migration<br>No US migration | 0.89        | 0.69    | 0.85    | 0.90     | 0.90  | 0.84  |
| US migration                         | 0.11        | 0.31    | 0.15    | 0.10     | 0.10  | 0.16  |
| Observations                         | 7470        | 1100    | 6397    | 2399     | 3759  | 4891  |

*Note:* Table reports proportions of head of households that have migrated by their parents migration status, educational level and whether lived in rural or urban areas at age 14.

Another explanation is suggested by Borjas' theory of ethnic capital (Borjas, 1992). The author suggests that migrants educational decisions are based on the average level of education of their parent's generation from their same ethnic community. In our case we are not dealing with immigrants from different countries but rather Mexican emigrants. We test this theory nevertheless, and analyze the relationship between average years of education of the parent's generation in their localities. Our difference in means test in Table 20 shows no significant difference of this ethnic capital variable for children of migrants and children of non-migrants.

Table 20 – IV Results with Ethnic capital

|                         | Non-Migrant Parents | Migrant Parents | p-value |
|-------------------------|---------------------|-----------------|---------|
| Average local education | $3.34 \\ (1.68)$    | 3.27<br>(1.53)  | 0.24    |
| Observations            | 4936                | 867             | 5803    |

*Note:* Table reports mean average education in locality of the parent's generation by parental status and a difference in means test of these two. Ethnic capital specified as the average local education level of the parent's generation.

We incorporate our ethnic capital variable in our empirical strategy and find a significant coefficient which is shown in Table 21. These results suggest that by controlling for the ethnic capital, the educational mobility is even lower, yet the contribution of the parental education is decreased by the addition of our ethnic capital variable, suggesting another mechanism in explaining educational mobility in the Mexican context.

|                                      | (1)<br>IV | (2)<br>IV    |
|--------------------------------------|-----------|--------------|
| Parents Average Vears of Education   | 0 00***   | 0.05**       |
| Tarents Tiverage Tears of Education  | (5.03)    | (2.23)       |
| Average Education $\times$ Migration | 0.29**    | 0.55***      |
|                                      | (2.18)    | (3.86)       |
| Either Parent's Migration            | -0.47*    | -0.73***     |
|                                      | (-1.74)   | (-2.62)      |
| Ethnic capital                       |           | $0.24^{***}$ |
|                                      |           | (8.90)       |
| Observations                         | $5,\!803$ | $5,\!803$    |
| Unc. $R^2$                           | 0.68      | 0.66         |

Table 21 – IV Estimation with Ethnic capital - Average Local Education

*Note:* Table reports IV estimation results including an ethnic capital control. Refer to Table 17 for information on instrumental variables.

## 4.5 Concluding remarks

The objective of this paper is to contribute to the migration and social mobility literature by providing estimates of the causal impact of migration on educational mobility. Although most of this literature focuses on the immigrant population, here we focus on the effect of migration on the left behinds, an approach which has not been previously followed to the best of our knowledge.

We use an instrumental variable strategy exploiting historical migration and railroad networks data from the 1920's in Mexico. Although many Mexican migration studies have used these variables, we provide further evidence of the validity of the instruments, especially since our sample of parents is partially contemporaneous to the historical data.

Our results suggest a relevant effect of migration on social mobility, which increases the correlation coefficients to more than twice than that of a simple OLS framework. This means that children of migrants are significantly less mobile than those of non-migrant parents. In addition, the fact that our interaction term is positive also suggests that the negative effects of

migration on educational attainment are greatly decreased by parents with higher education.

We provide possible explanations of our results and suggest that educational mobility of migrants is specially low when parents have zero to low schooling or come from rural backgrounds. Furthermore, we show that ethnic capital is also of relevance in the migrant sending country.

Thus, although migration may help migrant families withstand short-term poverty, there appears to be a detrimental long-term effect with respect to social mobility as measured through education.

# 4.A Appendix

### 4.A.1 Wealth Index Computation

Given the fact that retrospective income and expenditure data can be inaccurate, especially when asking adults about their teenage years, no income related questions were asked in the EMOVI. Instead, the survey incorporated questions regarding certain assets that allow for us to withdraw the relative wealth level of an interviewee's parents. For this, we applied the principal components analysis (PCA) approach using all available asset ownership in the data which comprise:

- Access to services: water pipe system, electricity, hot water, housekeeping service, bathroom inside the house;
- Home assets: gas or electric stove, washing machine, telephone, TV, cars;
- Land ownership: shop, land, vacation house, additional property to rent;
- Financial system access: own shares or bonds, savings in savings account, own bank account;
- Agricultural goods: cattle, farm equipment.

When constructing an index, it is important to consider the variation of the variables in the sample as those without variation would not significantly contribute the index (Vyas and Kumaranayake, 2006). Analyzing the summary statistics of these assets for the EMOVI sample, we found the lowest standard deviations for the variables: owning a vacation house, additional property to rent and owning shares or bonds. Nevertheless, we include these variables as we believe they provide further potential variation among households so that they may capture inequality between them.

After calculating the index with the predicted scores from the PCA, deciles were created, which were used in the analysis.

Present wealth index were also calculated following the same strategy, based on current asset ownership of the interviewees.
#### 4.A.2 Additional Tables

|                                      | (1)<br>IV    | (2)<br>IV    |
|--------------------------------------|--------------|--------------|
|                                      | 1 V          | 1 V          |
| Parents Average Years of Education   | $0.09^{***}$ | $0.09^{***}$ |
|                                      | (5.03)       | (4.94)       |
| Average Education $\times$ Migration | 0.29**       | 0.28**       |
|                                      | (2.18)       | (2.14)       |
| Either Parent's Migration            | -0.47*       | -0.48*       |
|                                      | (-1.74)      | (-1.78)      |
| Number of siblings                   | -0.01*       | -0.01*       |
|                                      | (-1.68)      | (-1.76)      |
| Living in rural area at age 14       | -0.13***     | -0.12***     |
|                                      | (-2.92)      | (-2.84)      |
| Age                                  | -0.02***     | -0.02***     |
|                                      | (-12.05)     | (-12.18)     |
| Ability (self-assessment)            | 0.74***      | · · · ·      |
|                                      | (51.61)      |              |
| Ability - Test                       | . ,          | $0.77^{***}$ |
| ~                                    |              | (53.52)      |
| Observations                         | 5,803        | 5,803        |
| Unc. $R^2$                           | 0.68         | 0.69         |

Table 22 – IV Results using different ability specifications

 $p^* > 0.1, p^* < 0.05, p^* < 0.01$ . t-statistics in parentheses.

*Note:* Table reports IV estimates of the effects of migration on educational mobility. Refer to Table 17 for details on instrumental variables. Ability - Test is the specification where missing self-assessment data is replaced by the minimal selfassessment value.

|                                      | (1)     | (2)     | (3)        | (4)          |
|--------------------------------------|---------|---------|------------|--------------|
|                                      | OLS     | OLS     | IV         | IV           |
| Parents Average Years of Education   | 0.22*** | 0.14*** | 0.17***    | 0.09***      |
|                                      | (24.22) | (18.13) | (7.79)     | (5.03)       |
| Average Education $\times$ Migration | -0.03   | -0.01   | $0.28^{*}$ | $0.29^{**}$  |
|                                      | (-1.16) | (-0.43) | (1.76)     | (2.18)       |
| Either Parent's Migration            | 0.05    | -0.02   | -0.73**    | -0.47*       |
|                                      | (0.81)  | (-0.44) | (-2.21)    | (-1.74)      |
| Ability (self-assessment)            |         | 0.80*** |            | $0.74^{***}$ |
|                                      |         | (61.75) |            | (51.61)      |
| Observations                         | 7,111   | 7,092   | 5,817      | 5,803        |
| $Adj. R^2$                           | 0.27    | 0.53    | 0.22       | 0.48         |
| Unc. $R^2$                           |         |         | 0.53       | 0.68         |

Table 23 – OLS and IV estimation results including and excluding ability

 $^{\ast}p < 0.1,^{\ast\ast}p < 0.05,^{\ast\ast\ast}p < 0.01.$ t-statistics in parentheses.

*Note:* Table reports OLS and IV estimates of the effects of migration on educational mobility. Refer to Table 17 for details on instrumental variables.

# 5 General Conclusion

This dissertation is composed of three research articles analyzing Mexican migration to the United States from multiple perspectives. The aim of this work was to study this large phenomenon from different angles with the ultimate objective of contextualizing and guiding the policy-maker with respect to the current, rather controversial, situation.

We firstly focused on the domestic side of the question as opposed to the large literature focusing on the recipient country, and we find that local governments have a sizable power to influence the migration decision. We then incorporate both the domestic and foreign countries in the second chapter, investigating the foreign aid - migration relationship, aiming at providing policy implications for coping with migration flows from a holistic perspective. Lastly, our third chapter focuses rather on the migrant itself, studying whether it is desirable for migration flows to be coped with.

While our first two chapters inquire on ways for both domestic and foreign countries, to reduce migrations flows, the third chapter motivates the first two by providing evidence of the adverse effect of migration on the left behinds in the long-term. Nevertheless, this research does not directly imply that migration should be entirely stopped. Rather, our point is to make awareness of the relevant costs of migration and to motivate governments to provide better ways in which migration can bring about benefits for both governments, and more specifically for migrant families.

As Mexican migration has become more dangerous than ever, the first two chapters also incorporated an increasingly relevant aspect of the current Mexican context: organized crime. Through our empirical specifications, we were able to differentiate between the negative externality of having high crime levels at home, which increases the migration probability; and the negative effect on migration due to higher risks in the migrant's trajectory due to organized crime. These results suggest a new relevant line of research in the migration literature that has not been greatly accounted for so far.

Data limitations did not allow us to restrict our analysis to the Mexican context in the

empirical strategy of our second chapter. Thus, future research would be desired to test our model's hypothesis and findings to the scenario the model itself was based on. Nevertheless, the results suggest that our model might not be solely reflecting the Mexican migration context but rather that it could be applied to several other cases.

An additional limitation is the fact that in our third chapter we analyzed long-term effects of migration by studying social mobility of migrants, yet we overlooked other shortterm effects that might make migration attractive. In the presence of intertemporal inconsistency, short-term effects are actually what individuals would base themselves in the decision-making. Thus, future extensions could involve the analysis of both long-term and short-term effects as a means of discerning the overall effect of migration on the left behinds.

As a general conclusion of this dissertation, we have found that migration has been an important aspect of the Mexico-US relationship and that it is not likely to change without the common work of all agents involved in the individual migration decision, that is, both Mexico and US governments, as well as the individuals themselves. Mexican migration as it is today has not made things all better for the migrant families and thus, conditions that make migration risky today and that limit the opportunities for the left-behinds need to change in order for it to be desirable for all.

# 6 Résumé

## Introduction Général

L'introduction général a abordé plusieurs sujets qui ont façonné la migration mexicaine vers les États-Unis d'aujourd'hui. D'un point de vue historique, nous avons suggéré des déterminants précoces du phénomène, qui ont eu un impact sur les modèles de migration actuels grâce aux réseaux sociaux.

Bien qu'un ensemble diversifié d'estimations aient été élaborées pour tenir compte à la fois des populations d'immigrants légaux et illégaux aux États-Unis, il y a encore des incertitudes quant aux chiffres réels. Cependant, les Mexicains aux États-Unis représentent la part la plus importante de la population non autorisée et environ un tiers de la population totale née à l'étranger. Cette grande quantité d'immigrants mexicains a donné des lois et des politiques de plus en plus restrictives, aboutissant à la proposition controversée de Trump de construire un mur le long de la frontière entre les États-Unis et le Mexique.

En s'ajoutant aux politiques d'immigration restrictives des Etats-Unis, une nouvelle menace pour les migrants a gagné en force ces dernières années. Avec la guerre des drogues du Mexique depuis 2006, les organisations criminelles ont trouvé un nouveau potentiel financier dans l'enlèvement et l'extorsion de migrants interceptés sur la longue trajectoire à travers le Mexique. Ainsi, en évitant d'être appréhendés par les autorités américaines à la frontière, les migrants craignent maintenant l'action des organisations criminelles en cours de route, les voies de migration typiques étant un point de risque pour l'enlèvement.

Avec l'augmentation de la violence au Mexique, de nouvelles tendances dans la politique d'aide étrangère des États-Unis ont également émergé. En effet, si l'aide économique a été réduite, elle a été remplacée par une aide militaire dans le but de lutter contre la criminalité.

Avec tous ces faits stylisés à l'esprit, dans l'ensemble, cette thèse tente de fournir d'autres preuves sur la décision de migration et de mettre en évidence les effets nuisibles potentiels de la migration sur le long terme. Ainsi, grâce à cette recherche, j'ai l'intention de fournir des implications politiques pour contribuer au bien-être des migrants mexicains.

#### Chapitre 1

# Le développement local et la décision de migrer: migration mexicaine vers les États-Unis

Cet article fournit un cadre théorique simple pour illustrer l'effet des investisments en développement local sur la décision de migrer illégalement. Cela montre que les politiques gouvernementales qui augmentent le développement local peuvent freiner les migrations, tout comme les coûts de migration et le crime organisé.

En utilisant des données sur la migration en provenance du Mexique, nous testons davantage les prévisions du modèle et estimons la probabilité de décider de migrer vers les États-Unis en utilisant l'expression de désir de migrer dans le future, disponible dans nos données pour contrôler les caractéristiques non observables des migrants. L'estimation par un modèle logit binomiale fournit des résultats favorables au modèle théorique proposé. Pourtant, il se pourrait aussi que l'effet soit différent entre les migrants légaux et les migrants illégaux. En effectuant le logit multinomial sur la spécification de base, les résultats suggèrent que le cadre théorique est valable pour les migrants illégaux alors qu'aucun résultat n'est trouvé pour soutenir le modèle pour le groupe des migrants légaux. Les résultats sont consolidés avec l'ajout de la richesse de la municipalité et des envois de fonds comme sources potentielles d'endogénéité.

Nos résultats empiriques montrent que les résultats du développement ont un effet négatif sur la probabilité de migration illégale, mesurée par un indice de développement calculé par la méthode d'analyse des composants principaux, ou par une mesure de la qualité du système de soins de santé. Un proxy pour l'infrastructure de transport a été utilisé pour étudier l'effet des coûts de migration, les résultats empiriques se trouvent également en ligne avec le modèle, suggérant un effet positif et statistiquement significatif sur la probabilité de migration pour les deux types de migrants. Enfin, le crime organisé, appliqué par le taux d'homicides de la municipalité, donne un coefficient positif pour la migration illégale. Dans le cadre théorique, cette variable a été trouvée non concluante parce que les individus pourraient craindre d'être capturés par les organisations criminelles pendant le voyage et migrer moins, alors que le crime fonctionne aussi comme une externalité négative poussant les individus à migrer. Notre variable sur les homicides ne contient que des données sur le taux de criminalité dans la municipalité de résidence au Mexique et ne peut donc pas prendre en compte l'effet sur le voyage du migrant. La comptabilisation de la distance et du taux de criminalité dans les états frontaliers a réussi à incorporer cet aspect et a eu un impact négatif sur la décision de migration illégale.

Les résultats trouvés dans cet article éclairent l'effet des politiques du gouvernement mexicain sur les tendances migratoires au niveau local. En dépit de constater que les caractéristiques individuelles et familiales continuent de jouer un rôle important dans une telle décision, nous avons constaté des données probantes suggérant que l'augmentation des facteurs de développement à l'échelle locale peut empêcher les individus de subir une activité aussi dangereuse. En outre, nos résultats suggérent aussi que les programmes de transferts sociaux pourraient augmenter les taux de migration illégale à court terme, conformément à la littérature, car elle augmente les revenus actuels. Pourtant, l'effet à long terme pourrait être le contraire, compte tenu de l'effet négatif de l'éducation sur la migration illégale.

Ni les variables de développement ni la criminalité organisée ne semblent avoir d'impact sur les migrants documentés. Seuls les coûts de migration semblent avoir un impact négatif, de même que certaines caractéristiques individuelles. Cela peut s'expliquer par une plus grande hétérogénéité dans le groupe légal, étant donné qu'il pourrait s'agir des migrants qui dépassent la validité légal de leur séjour autant que des migrants autorisés, aspect que nous ne pouvons pas discerner dans nos données.

Mots clés: Migration internationale; Développement local; Politique publique. JEL Classification: D720, J610, O200.

#### Chapitre 2

#### Aide internationale, migration illégale et criminalité organisée

Cet article ajoute une nouvel aspect aux résultats trouvés dans le premier chapitre. L'article fournit un cadre simple reliant le crime organisé, l'aide étrangère et l'immigration clandestine. À notre connaissance, c'est la première tentative d'analyse de cette relation tripartite dans la littérature. Nous fournissons également un soutien empirique pour l'hypothèse et les résultats de notre modèle avec des données de plusieurs pays, étant donné que l'analyse d'un point de vue exclusivement du Mexique est impossible sans des données désagrégées.

Grâce à un cadre théorique simple, nous avons modelé une population de migrants potentiels qui observent les niveaux de développement, le contrôle des frontières et le crime organisé dans leur pays, puis migrent si leur utilité attendue est supérieure à celle de rester chez eux. L'hétérogénéité des individus permet établir un individu marginal qui aide à mesurer la proportion de migrants. Le modèle nous permetre observer que cette proportion de migrants diminue si les résultats du développement s'améliorent ou si plus de gardes-frontières ou de crime organisé sont observés.

Le gouvernement domestique dépense dans le développement pour limiter les flux migratoires, mais compte tenu que d'autres variables diminuent la migration, elle peut dévier certaines ressources pour les projets. Étant donné que la réduction du crime organisé par l'aide internationale au développement aura un impact positif sur les migrations, le pays étranger opte pour une politique de contrôle des frontières plus forte et un niveau d'aide plus faible, ce qui se traduit par une criminalité organisée supérieure à l'optimum.

Nous fournissons une stratégie empirique pour tester l'hypothèse et les résultats de notre modèle à travers d'un modèle d'équation simultané utilisant des données de plusieurs pays maillés: d'un coté, des pays qui recoivent l'aide internationale et envoient des migrants, et des l'autre des pays qui accueillent des migrants et donne de l'aide internationale au développment. Les équations estimées sont derivées du modèle théorique et comprennent une équation de gravité de migration et une équation d'aide international au développement. La plupart de nos résultats empiriques correspondent à notre modèle, ce qui suggère un effet positif de l'aide aux migrations, un effet négatif de la criminalité organisée sur les migrations et, surtout, la criminalité organisée et les flux migratoires élevés entraînent une aide plus faible. Par conséquent, nous sommes en mesure d'appuyer la constatation de notre modèle théorique selon laquelle le donateur permet un niveau supérieur de criminalité organisée dans le pays qui envoie des migrants comme autre moyen de réduire les flux migratoires.

Mots clés: Migration illégale; L'aide internationale; Développement; Crime organisé.JEL Classification: F22, F35.

#### Chapitre 3

La chute de la mobilité lors du déplacement: une étude sur la mobilité sociale des migrants mexicains vers les États-Unis

Bien que les chapitres précédents se concentrent sur les déterminants de la migration, ce chapitre vise à étudier l'impact de la migration parentale sur leurs enfants. Concrêtement, L'objectif de cet article est de contribuer à la migration et à la mobilité sociale en fournissant des estimations de l'impact causal de la migration sur la mobilité éducative. Bien que la plupart de cette littérature se concentre sur la population immigrante, nous nous concentrons ici sur l'effet de la migration sur la famille des migrants, une approche qui n'a pas été précédemment suivie au mieux de nos connaissances.

Nous utilisons une stratégie de variables instrumentales qui exploite les données historiques sur les migrations et les réseaux ferroviaires des années 1920 au Mexique. Bien que de nombreuses études migratoires mexicaines aient utilisé ces variables, nous fournissons des preuves supplémentaires de la validité des instruments, d'autant plus que notre échantillon de parents est partiellement contemporain des données historiques.

Nos résultats suggèrent un effet pertinent de la migration sur la mobilité sociale, ce qui augmente les coefficients de corrélation à plus de deux fois par rapport à celui d'un cadre OLS simple. Cela signifie que les enfants des migrants sont nettement moins mobiles que ceux des parents non migrants. En outre, le fait que notre terme d'interaction soit positif suggère également que les parents ayant des diplômes supérieures diminuent considérablement les effets négatifs de la migration sur le niveau de scolarité.

Nous fournissons des explications possibles de nos résultats et suggérons que la mobilité éducative des migrants est particulièrement faible lorsque les parents ont une scolarité nulle ou faible ou proviennent de milieux ruraux. En outre, nous montrons que le capital ethnique est également pertinent dans le pays d'origine des migrants.

Ainsi, bien que la migration puisse aider les familles migrantes à résister à une pauvreté

à court terme, il semble y avoir un effet préjudiciable à long terme en ce qui concerne la mobilité sociale, mesurée par l'éducation.

Mots clés: Mobilité sociale, Education, Migration internationale.

JEL Classification I21, J61, J62.

# 7 Summary

## Chapter 1

# Local Development and the Decision to Migrate: Evidence from Mexican Migration to the US

Mexican migration to the United States is one of the largest migration phenomena and subject to a wide range of studies having reached more than 11 million of Mexican immigrants in the US, which accounts for nearly a tenth of Mexico's population and a third of all US foreign-born population. Despite having been widely studied, this paper contributes the scarce literature of the supply-side perspective. Indeed, most of the literature has focused on the demand-side aspects, studying the mechanisms behind immigration policies and suggesting alternatives to cope with immigration from the US viewpoint. The paper is comprised by a simple game theoretic model which aims at illustrating the relationship between development outcomes and the decision to migrate and hence to motivate and provide a framework for the empirical analysis. Furthermore, the model incorporates a factor that has been recently shown to play a part on the migration decision: organized crime. Recent kidnapping of migrants suggest a new risk affecting trajectories, while a more violent environment may contribute to push migrants away from their homes. We test the model's findings empirically using household survey data and propose different effects for legal and illegal migrants, as defined by the type of documents used to enter the US. The results from the illegal migrant subsample are in line with our theoretical framework and support the importance of local development variables as a determinant of migration. Thus, our results suggest that the domestic government should not be disregarded when studying migration patterns. Furthermore, we were able to discern the dual channels of impact of organized crime in our data, finding significant evidence for both effects.

Keywords: International Migration; Local Development; Public Policy.

JEL Classification: D720, J610, O200.

#### Chapter 2

#### Foreign Aid, Illegal Migration and Organized Crime

Through this chapter, the link between foreign aid, illegal migration and development is studied in a game-theoretic framework. We model a sequential game of a foreign government that decides its border control and foreign aid policies, which are known to source country government deciding on the level of investment in domestic development. In this particular framework, aid is used to fight crime organizations in the source country, as it represents a negative externality for the donor. Potential migrants then make their migration decisions after observing both government's expenditure decisions, which have an impact on the probability of success. The model suggests migration flows are reduced by development expenditure and that the existence of organized crime, reduces the optimal level of aid allocated as crime works as an additional tool for reducing illegal migration. The model is then tested empirically through a simultaneous equation model using cross-country data on migrant sending countries to developed donor countries. Most model predictions are supported by our empirical specification, suggesting indeed a reduction in aid allocation when migration and crime are high.

Keywords: Illegal Migration; Foreign Aid; Development; Organized Crime.

JEL Classification: F22, F35.

# Chapter 3

# The fall of mobility when moving: A study of social mobility of Mexican migrants to the US

While the previous chapters focus on the determinants of migration, this chapter aims to study the impact of parental migration on their children. In concrete, we intend to infer the causal impact of US migration on the intergenerational transmission of education in Mexico. Social mobility and migration had only been analyzed comparing immigrants an natives in the destination country. Thus, targeting the migrant population from the sourcecountry perspective, our paper contributes the literature with a unique study of the effects of migration on the educational mobility of the left behinds. Using a household survey data, we look at the educational attainment of a representative sample of head of households living in Mexico in 2006, using information on the migration of their parents during their childhood. We exploit historical data to solve for the endogeneity of the decision to migrate through an instrumental variables approach, which allows us to draw causal inference of our results. We identify a large negative impact of migrant parents on educational mobility using correlation coefficients of parents-child's years of education. Thus, although attractive on the short-term through the alleviation of current poverty, our evidence suggest migration may be detrimental to the equality of opportunities on the long-run.

Keywords: Social mobility, Educational attainment, International Migration JEL Classification: I21, J61, J62.

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