Synthetic Measures of Illegal Immigration and implications for Policy: the case of Guatemala[1]

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ABSTRACT

The phenomenon of irregular migration analyzed in this report is of particular relevance to Guatemala's foreign policy and its social and economic relationships with the United States. Migration is not a recent event, but rather has evolved during the past 20 years, but at a much faster rate in the past five years.

Therefore, the initial task of the analysis is to construct a robust department and municipal level database. From this, the determinants of migration in Guatemala can be described not only at the country level, but at the municipal level where conditions may vary significantly. This research is the first effort that seeks to identify the fundamental causes of migration from publicly available data at the municipality level. The analysis identifies the "revealed" determinants of migration, rather than impressionistic responses to survey questions or case studies. With this level of information, it is also possible to apply more sophisticated statistical and econometric techniques. In addition, using official, publicly available data provides for the possibility of replication or further analysis without the need to incur considerable costs of collecting first-hand information. An additional benefit of explaining the phenomenon of migration from official information, is that there is a more direct, clearer link between the determinants of migration, potential solutions and the measurable impact of public policies on specific determinants.

We construct a data set of 31 variables that may influence immigration for 340 municipalities. Then with this municipality level data we use principal components to construct a measure of illegal immigration and then regression analysis to identify key determinants. We find key measures of economic opportunity, in particular municipal level income, are clearly negatively associated with illegal immigration. Other variables related to climate, violence and population characteristics have little if any effect. As a result, policies should focus on job creation and income growth, nuanced by sector and region. Improved health and investment in human capital increases employability, productivity and incomes, thus reducing migration. Other factors, like violence and personal security, should be addressed by other public efforts to reduce crime and conflict.

INTRODUCTION

Immigration from the Northern Triangle of Central America - El Salvador, Guatemala and Honduras - to the US has grown about 8.1% per year since 1980, significantly more than the overall immigration rate. In 1980 there were about 200,000 immigrants in the US, whereas by 2015 there were about 2.8 million immigrants from these countries.[2] But only recently has illegal (undocumented or informal) immigration skyrocketed. Reasons for migrating are clear and may be found in the originating country, "push factors," and in the destination countries, "pull factors". Lack of economic opportunity (simply measured as cross-country income differentials[3]), poverty, crime or threats to personal security (such as robbery, blackmail and assault), and political oppression have long been identified as "push factors," or drivers of immigration. To these may be added civil war and natural disasters.[4] Conditions in destination countries, such as changes in labor demand and migration policies, and the development of family connections and migration networks may be considered "pull factors."[5] Individuals from these countries, especially Guatemalans, face all of these and the incentives to immigrate, at any cost, have dramatically increased in recent history. It is difficult to say which is the primary motive. In this paper we focus on six Departments of Guatemala known to be a primary source of immigrants, to construct a proxy for illegal migration, identify the main determinants of migration, and provide policy recommendations to reduce illegal immigration.

In general, creating economic opportunities and alleviating poverty will, *ceteris paribus*, make immigration less appealing. It is a given that resources, including labor, driven by market forces, flow to their highest valued use. And indeed, we find that measures of economic distress are a major push factor of Guatemalan illegal immigration. Regulations, political borders and transportation costs drive up the costs of this flow, but do not prevent it. A clear policy implication is that improving economic opportunities in Guatemala will reduce the flow of illegal immigration because it is also well understood that the trade of goods and services, and the trade of factor resources, capital and labor, are also substitutes for one another in the context of international trade and resource flows. This suggests that increased trade in goods and services will serve to dampen flows of labor, or migration, out of Guatemala, to the extent that local production of exportables and incomes associated with that activity are increased. Further, a flow of capital into Guatemala also creates domestic employment opportunities. To the extent that unemployment is reduced, and income increases from any activity, the incentives to immigrate are reduced. Further, a movement from the informal to formal economy improves tax collections and enhances government revenues.

There has been extensive academic and scholarly research, journalistic reports, surveys, editorials and opinion columns on migration from the Northern Triangle of Central America northwards through Mexico. Most research has been based on national level aggregate data or national or international level surveys. They identify several common determinants and uniformly argue that the decision to migrate is complex and evolves over time. Nevertheless, it is common that conclusions are often highly qualified by the lack of high-quality data. Case studies may not be uniformly applicable, and surveys are a temporally irregular snapshot, often quickly out of date. Anecdotal evidence is often added to support their conclusions.

This research is the first effort that seeks to identify the fundamental causes of migration from publicly available data at the municipality level. The analysis identifies the "revealed" determinants of migration, rather than impressionistic responses to survey questions or case studies. With this level of information, it is also possible to

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[2] Del Carmen and Sousa (2018). These numbers reflect those with legal status in the US.

[3] Roughly measured by differences in GDP per capita, or wage distributions of the originating country vis-à-vis destination country.

[4] But note IOM (2016) reports Guatemalan immigration up to 2016 due to these factors is minimal. Currently the drought may be an exception.

[5] Del Carmen and Sousa (2018).

apply more sophisticated statistical and econometric techniques. In addition, using official, publicly available data provides for the possibility of replication or further analysis without the need to incur considerable costs of collecting first-hand information. At the end, the analysis demonstrates that migrations from Guatemala will decrease as improvements in economic opportunities and income increases, thereby changing the benefit-cost ratio. Thus, interventions that emphasizes job creation, increasing local income and wealth, moving individuals into the formal sector of the economy and improving financial literacy, are most appropriate.

In the sections that follow we provide the context and magnitude of illegal immigration from Central America, and Guatemala in particular, the analytical problem in measuring unobservable illegal immigration, an innovative methodology for solving the problem and identifying determinants of illegal immigration and conclude with clear policy recommendations.
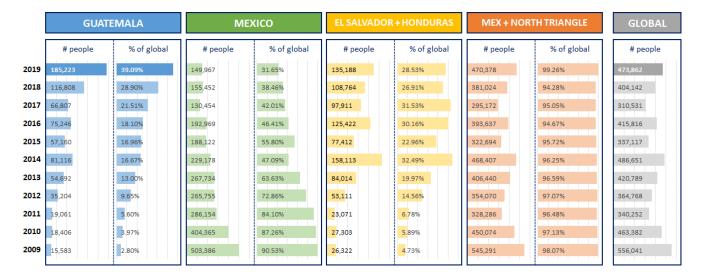
1. GUATEMALA IN CONTEXT

While illegal migration to the United States from Mexico and Central America has been a long-standing issue, in the last five years or so the home country composition of the potential illegal migrants has changed rather dramatically. We assume that "pull factors," i.e. conditions in the US that makes migration attractive, are constant across home country groups. If border enforcement efforts are assumed to be independent of country of origin of those apprehended, then apprehensions provide a clear indication of how the composition has changed. Table 1 below illustrates the changes. From 2009 to 2018 total apprehensions from Mexico and the Northern Triangle (NT) fell from 545,290 to 381,024, or about 30%. Apprehensions from Mexico fell much more: from 503,386 to 155,452, or about 69%. On the other hand, apprehensions from Guatemala have skyrocketed from 2009 to 2018: increasing from 15,583 to 116,808, or 650%.[6] In 2019, apprehensions were 185,223, representing 39.09% of the global apprehensions at the southwest border of US.

Note that early Rand Corporation studies suggested that only one in three border crossing attempts were successful, and this implies that for 2009 there were 23,374 attempts, 15,583 apprehensions and 7,791 successful crossings. Using the same likelihood of success in 2018 there would be 175,212 attempts with 116,808 apprehensions and 58,404 successes. This later calculation is not quite appropriate though since with greater border security the success rate might be lower and many more attempts to migrate are amnesty applications and not between ports of entry attempted illegal crossings. The relationship between the actual number of illegal crossings may not be stable.

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[6] Note Table 1A of Additional Data Appendix provides data for Honduras and El Salvador as well. Apprehensions from Mexico and the Northern Triangle combined have fallen dramatically from 863,045 in 2007 to 381,024 in 2018, with all of that from Mexico, for which apprehensions fell from 808,688 in 2007 to 155,452 in 2018. However, the growth in apprehensions from the northern triangle alone is startling. As indicated in Table 1A, apprehensions from El Salvador doubled, from Honduras tripled and from Guatemala almost seven times from 2007 to 2018. https://www.cbp.gov/document/stats/us-border-patrol-nationwide-apprehensions-citizenship-and-sector-fy-2007-fy-2018

Table 1: Border Apprehensions

	GUATEMALA		MEXICO		EL SALVADOR + HONDURAS		MEX + NORTH TRIANGLE		GLOBAL
	# people	% of global	# people	% of global	# people	% of global	# people	% of global	# people
2019	185,223	39.09%	149,967	31.65%	135,188	28.53%	470,378	99.26%	473,862
2018	116,808	28.90%	155,452	38.46%	108,764	26.91%	381,024	94.28%	404,142
2017	66,807	21.51%	130,454	42.01%	97,911	31.53%	295,172	95.05%	310,531
2016	75,246	18.10%	192,969	46.41%	125,422	30.16%	393,637	94.67%	415,816
2015	57,160	16.96%	188,122	55.80%	77,412	22.96%	322,694	95.72%	337,117
2014	81,116	16.67%	229,178	47.09%	158,113	32.49%	468,407	96.25%	486,651
2013	54,692	13.00%	267,734	63.63%	84,014	19.97%	406,440	96.59%	420,789
2012	35,204	9.65%	265,755	72.86%	53,111	14.56%	354,070	97.07%	364,768
2011	19,061	5.60%	286,154	84.10%	23,071	6.78%	328,286	96.48%	340,252
2010	18,406	3.97%	404,365	87.26%	27,303	5.89%	450,074	97.13%	463,382
2009	15,583	2.80%	503,386	90.53%	26,322	4.73%	545,291	98.07%	556,041

2. THE MAGNITUDE OF IMMIGRATION

Estimating migration flows begins with examining "hard data" on immigrant visas issued, plus an estimate of visa overstays. To this is added estimates of undocumented cross border entry to get total migration. The latter is typically estimated based on data on apprehensions and deportations at the US border and indirectly from remittance flows and survey methods. (Apprehensions at the Guatamala-Mexico border may also be used as an indicator).[7] Ultimately these flows should be correlated with actual US Census data on immigrants with legal status.

While estimating the magnitude of undocumented immigration is difficult, we may assume though that there is high correlation between the actual flow and the number of apprehensions and detentions at the border and also remittances flowing back to Guatemala.[8] *US Customs and Border Patrol* reports provide basic information on detentions at all ports of entry, by country. They do not provide information on Department or municipality of origin of the immigrants, only country of origin.

Apprehensions may vary for many reasons, including greater or lesser outflows from the host countries, and resources devoted to border security. There is no reason to believe that resources devoted to apprehensions would vary by country of origin, so one may conclude that there are greater outflows from the country of origin in 2018, e.g., Guatemala, relative to 2007, and less outflows from Mexico, relative to 2007. Further there is no reason to believe that the proportion of apprehensions relative to original departures would vary by country of origin. Because pull factors from the US as a destination country likely have not varied by country, i.e., immigration policies haven't varied by country and US GDP per capita or wage structure is also constant across origination countries, this suggests that factors in the originating country are driving a corresponding proportional increase in migration outflows. The push factors mentioned above, relative economic opportunity, poverty, crime, natural disasters, and so forth, must have worsened in Guatemala (and other NT countries) vis-

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[7] See for example, Orozco (2017), Table 3 for Central American migration patterns for 2009/2010-2016.
[8] This relationship is unclear and may not be stable over time, however. The *Atlas on Migration for the NCA* reports that there were 880,000 migrants from Guatemala in 2015 and this is more than 15 times the 57,160 apprehensions reported by the USBP above for the same year.

à-vis Mexico. The question then is what are these specific factors and why are they so prevalent in Guatemala in particular? While this source of data is too aggregated for our analysis, it suggests changes, in the "push" factors in Guatemala, that deserve further attention. Even so, the extraordinary surge in apprehensions of Guatemalans in 2018 remains practically inexplicable, based on most of the push factors above, thus calling for more in-depth analysis.

After extensive fieldwork in those departments and municipalities in Guatemala from which most migrants originate, researchers focused on the cost-benefit analysis subconsciously made by individuals when they decide to migrate. This decision-making process involves the rough quantification of costs (e.g., loss of home property, distance from family, actual transportation and smuggling costs and expected insecurity at the place of arrival) and benefits (e.g., opportunities for more education, or potential acquisition of new competencies, substantial increment in income associated with more job opportunities, and overall improvement in living conditions).

When expected benefits exceed expected costs, migration is undertaken, usually from rural and very impoverished areas to more urban and developed areas. This process does not stop when people migrate to major cities in Guatemala. Instead, the decision-making process is repeated, considering a broader set of opportunities including those outside the country, and not surprisingly, they consider the US as a feasible option. The analysis below demonstrates that migrations from Guatemala will decrease as improvements in economic opportunities, i.e., income, increases, thereby changing the benefit-cost ratio. Thus, policy interventions emphasizing job creation, increasing local income and wealth, moving individuals into the formal sector of the economy and improving financial literacy are most appropriate.

3. DETERMINANTS OF IMMIGRATION: PUSH FACTORS

4.1. Economic Opportunity, poverty, nutrition and demographics

Guatemala is the largest economy in Central America and is currently one of the strongest growing economies in Latin America with GDP growth of 2.8% in 2017, 3.0% in 2018 and 3.85% in 2019. Concurrently, it has one of the highest income inequality rates, very high levels of poverty (68% overall and 77% rural[9]), malnutrition and maternal-child mortality rates in the region. Contrary to this, note that the rate of employment in the US for Guatemalan migrants is very high, and Guatemala accounts for the largest proportion of NCA returnees (46% in 2016-2018) to their home country.[10] Also suggesting that economic factors weigh heavily in the decision to migrate.[11]

A well-known measure of economic opportunity is from the individual components of the UNDP Human Development Index for Guatemala. While the index and the individual components are reported for the country as a whole, each of the components is constructed from multiple official government statistics which are available at the department level.[12]

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[9] Atlas of Migration in NCA.

[10] Atas of Migration in NCA.

[11] This suggests that an expanded formal guest worker-type program may be a reasonable policy. Also note the policy recommendations from "Opportunities for my Community" project of the Inter-American Dialogue: (1) Financial education programs, (2) Access to credit for knowledge economy, tied to remittance flows, 3. Diaspora outreach for education funding (they have children in Guatemala), (3) After school programs in areas of high emigration.
https://www.thedialogue.org/programs/programs/opportunities-for-my-community/

[12] See UNDP Human Development Index at http://hdr.undp.org/en/countries/profiles/GTM

Feed the Future reports provide extensive summaries of the status of health, education and nutrition of the population of the Western Highlands zone of influence. The *Guatemala Feed the Future, Baseline Report* (2014) focuses on 27 "priority" municipalities (including five of the six Departments in this study, Guatemala, Huehuetenango, Totonicapan, San Marcos and Quiche, but excludes Quetzaltenango). For this group poverty is extreme and education is very limited. 76% of the population lives below the poverty line (27.7Quetzales per capita, per day, about US$3.50) and 27% live below the extreme poverty line, (13.18 Quetzales per capita, per day, or about US$ 1.75). 80% of females and 70% of males did not complete primary education.

Children suffer from malnutrition (chronic, acute and overall) at alarming rates. 67.4% of children under five years old in these municipalities suffer from moderate to severe chronic malnutrition, higher than the 49.8% reported nationally and 58.6% nationally in rural areas as reported by the ENSMI.[13] Interestingly, chronic malnutrition of children co-exists with over nutrition during adulthood of women. Food insecurity is formally measured by a Household Hunger Scale[14] with moderate or severe hunger affecting 13.7% of households.

Certainly, in the dry corridor of Guatemala, food insecurity is higher, and this coupled with high unemployment and limited seasonal labor demand encourages migration. A recent research report by International Organization for Migration (IOM), et al, (2017)[15] for the Northern Triangle indicates that the propensity to migrate from food insecure regions is higher for younger and more vulnerable populations. Therefore, demographic characteristics of the 6 Departments being analyzed is also considered below.

4.2. Weather, drought and climate

The on-going drought and resulting harvest failures is a determinant of well documented food insecurity and nutrition issues. The World Bank Climate Knowledge Portal[16] provides historical monthly average temperature and rainfall country level data. Guatemalan meteorological data by municipality and Department are available for examining the drought and deviations from trend or normal weather patterns, which may be a determinant of food insecurity and incentives to migrate.

4.3. Violence and political insecurity

The Northern Triangle is considered a region with very high levels of violence associated with transnational organized crime, particularly drug trafficking and smuggling.[17] In the last decade, Guatemala has experienced a considerable reduction in the homicides rate, passing from 46.9 by 100,000 people to less than 15 by 100,000 people in the most recent year. However, the other side of the phenomenon is the increase in the number of people extorted by criminals, reaching more than 80 judicial complaints by 100,000 people. Studies in developing countries clearly indicate that low levels of social support and low income are associated with high levels of violence. Dinesen, et al (2013) in a World Health Organization (WHO) funded project demonstrate that low levels of social support is also a predictor of gang membership in Guatemala. They also note that social support, or capital, may take two forms: 1) community resources, social organizations and formal networks based on trust and cohesion, and 2) invisible, informal elements of trust, altruism and charity exhibited by individuals in the community. They find that social capital and violence are inversely related and, importantly, that it exerts this

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[13] *Encuesta Nacional de Salud Materno Infantil* (National Maternal and Child Health Survey).

[14] See *Guatemala Feed the Future, Baseline Report* July 2014 for details.

[15] IOM, et al (2017). https://docs.wfp.org/api/documents/WFP-0000019629/download/

[16] https://climateknowledgeportal.worldbank.org/country/guatemala/climate-data-historical and the data is documented in https://climateknowledgeportal.worldbank.org/themes/custom/wb_cckp/resources/data/Metadata.pdf

[17] Orozco (2017).

influence at the community level, rather than the individual level. We also consider the role of social capital, at the community rather than individual level, and the potential dampening effect on migration.[18]

Various studies by WHO document the level of health, violence, etc. in Guatemala, *inter alia,* but no studies directly link these factors to migration. The Atlas on Migration in the NCA also provides excellent descriptive analysis on these issues.[19] We employ department/municipality level official government statistics available for crime and violence.

4.4. Migration networks and remittances

Migration networks, a loose collection of friends and family members in the US or along the way from Guatemala to the US have developed slowly over time. Today 82% of migrants from the Northern Triangle countries report having relatives in the US.[20] While a network is difficult to quantify, remittances, returnees and relatives in the US are indirect measures. The International Organization on Migration of the UN has an on-going survey-based project addressing these as well as unaccompanied children. [21]

An indirect measure of the strength of immigration networks is the magnitude of flows of remittances. The IOM *Survey on International Migration of Guatemalan People and Remittances* 2016 (published February 2017, henceforth referred to as *IOM Survey 2016*), and annexes provide very detailed information on migration and remittances.[22] The main results of the survey are reported in Table 2 below. Most of these remittances come from irregular (without family) migrants located in the United States. According to the This survey reports US$7.273 billion in remittances back to Guatemala in 2016 (which is consistent with World Bank estimates of US$6.523 billion in remittances in 2015, 7.47 billion in 2016 and 8.449 billion in 2017[23]), as compared to US$4.49 in 2010. These were received by about 1.69 million persons in the amount of US$379 per month from about 1.86 million senders of remittances.[24] According to the survey the beneficiary population of the remittances increased nearly 38% from 2010 to 2016, from 4.5 million to 6.2 million persons in 2016.[25] It is interesting that younger recipients of remittances attend school at rates higher than the national average, perhaps because remittances allow them to attend school rather than seek employment.

Table 2: The main results of the IOM survey for 2016

INDICATOR	QUANTITY / %
Volume of Remittances	7,273,365,826
• In cash	7,164,908,055 (98.5%)
• In kind	108,457,771 (1.5%)
Monthly average of remittances received by a person	US $ 379.00
People receiving remittances	1,667,699
• Men	58.4%

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[18] Such as membership in community organizations, voter registration, church attendance, etc.

[19] Also see Ceron and Weisner (2018) and ECLAC, *Atlas on Migration.*

[20] ECLAC, *Atlas on Migration in the NCA.*

[21] https://mic.iom.int/webntmi/guatemala/ Summary PPT presentations may be found in various tabs and several summary reports are available. The survey on returnees is approximately annual. Others are less frequent. Original data may be available, but given the irregular intervals it is difficult to match the frequency of other data sources.

[22] A previous survey was done in 2010.

[23] https://data.worldbank.org/indicator/BX.TRF.PWKR.CD.DT?locations=GT

[24] Note that data often differ by source, as here on remittances, and even vary by the same source depending on differences in definition and collection and compilation methods; and often with no explanation

[25] *IOM Survey 2016*, p. 19.

• Women	41.6%
Senders of remittances	1,860,287
• Men	73.0%
• Women	27.0%
Population beneficiary of remittances	6,212,099
• Men	45.0%
• Women	55.0%
Girls, boys and adolescents who are beneficiaries of remittances	2,117,832
• Men	50.9%
• Women	49.1%
Returned population of the beneficiary of remittances	123,213
• Men	68.4%
• Women	31.6%
Perspective of international migration in the next 12 months of the beneficiary population	181,070 (3.3%)
• Men	48.9%
• Women	51.1%

The study does not duplicate information from the surveys made by the National Institute of Statistics (INE) since it is specifically designed to measure migration and remittances.

Of recipients age 7 or greater, 5.53 million persons total, 3.3%, or 182,510, of them intend to migrate within the next 12 months of the survey, with 92.1% of those, or 168,092, having the US as their destination. California, New York, Florida and Texas are the most common destinations. There are several reasons for migration considered in the survey, but by far the dominant response (91.1%) was economic reasons: employment (56.8%), improve income (32.9%), acquire a house (1.2%) or start a business (0.1%).[26] These results are essentially the same as the 2010 Survey. Given the low level of education of the overall labor force (uneducated (28%), unskilled (33%), underpaid and informal (at least 50%))[27] international migration is an employment strategy. Simply put, migrants seek a job. While violence is often mentioned in other sources, this survey found that it was a very distant, minor factor with 0.3% citing violence as a factor, 0.2% citing extortion and 0.2% problems with gangs.

The destination of remittances by Department is also reported in the survey. For the six Departments in this analysis remittances were substantial: Guatemala: US$1,395.2 million; Huehuetenango: US$917.4 million; Quiche: US$532.4 million; San Marcos: US$909.3 million; Quetzalttenango: US$737.1 million; and Totonicapan: US$214.1 million.[28] The use of the remittances is straightforward as well. 49.8% of survey participants report that remittances are used for investment and savings, and of those 37.9% is used for housing construction, 32.2% for purchase of real estate, 24.2% for house repairs and 5.5% for savings. 35.0% report that remittances are used for consumption, or basic needs like clothing footwear, transportation and so forth, with the largest, 25%, being for food. When compared to the 2010 survey the amounts reported for consumption are ten percentage points lower. Also, of interest is that the percent of respondents reporting a formal bank relationship is relatively small. 17.3% report saving, 18.7% have a bank account and 18.6% have a bank debit or credit card, and 7.8% took some form of credit, usually to establish a business, pay for health expenses, or house construction.[29]

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[26] *IOM Survey 2016*, p. 50.
[27] *Atlas on Migration in the NCA.*
[28] *Bank of Guatemala. Remittances by Department, data updated by 2019.*
[29] *IOM Survey 2016*, p. 64.

While these surveys are insightful, they do not provide regular reporting of consistent time series. The Annexes to this report and other IOM documents provide some data, but again, typically a cross section for the particular survey year.

4.5. Summary and Conclusions regarding Determinants of Migration

From the review above, economic opportunity coupled with high levels of poverty clearly drive migration from Guatemala. This driver of migration may be moderated by remittances from the US to family members in Guatemala, which are used to improve individual standards of living and small business investments, increasing the quality of life overall. On the other hand, a more developed migration network lowers the cost and dangers associated with migration. Violence and crime are mentioned as drivers of immigration and are serious, but they appear relatively less important as a determinant in much of the IOM survey literature, which focuses at the national or regional level.[30] Migration due to armed conflict and natural disasters like the earthquake and hurricanes in the past do not now appear to be important push factors for migration in the 2016 IOM follow-up survey, but drought today may be.[31] The regional level survey findings on violence is interesting because the Northern triangle, identified as having more crime and violence, also has the highest number of US bound immigrants and may be an important exception to these findings. While all of these are drivers of migration, they do not appear to explain the recent surge in migration; with the possible exception of drought. Analysis provided in IOM, et al. (2017, p 70.) indicates that being from the drought corridor of Central America increases the probability of migration by 1.5%; a modest amount. It is higher for the drought-stricken areas of Guatemala.

We now focus on the analysis of the specific Departments of the USAID CEO project by collecting more detailed less aggregated, regular higher frequency data to the extent possible. In the next section the basic modelling approach and data needs are presented.

4. DATA OVERVIEW

Total immigration from a source country into the United States may be divided into two components. Legal migration, that which is recorded via issuance of visas and temporary and permanent resident status and amnesty applications, and that which is illegal, visa overstays, which is measurable, and illegal, between ports of entry, border crossings, which is not clearly measured or observable. The primary difficulty then is that the dependent variable of interest contains a large component that is not observable, neither at the national level, nor at the department/municipality level. The best estimates for illegal immigration are for the country level and are not contemporary. Thus, we need a reasonable proxy for municipal level migration for the most recent time period available. As mentioned above Orozco (2018) has recent estimates using survey data and the characteristics of migrants from many countries. We construct a proxy using principal components analysis as discussed below in the Methodology section.

The data base consists of 31 variables associated with migration determinants for 22 Departments and 340 municipalities. While observations are annual, they are not available consistently for all variables for all years. These variables are defined and documented in Appendix 1. Tables 2 and 3 display relevant categories of

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[30] Across Central America the Northern triangle, El Salvador, Guatemala and Honduras, identified as being more subject to violence and crime, have the largest number of migrants bound for the US. Whereas the Southern triangle, Nicaragua, Costa Rica and Panama tends to be intra-regional migration.

[31] IOM (2016), Migration Follow-up Guatemala.

available national and municipal level data and the potential links to variables we wish to determine, essentially measures of irregular migration or relevant proxies, and interventions that may reduce migration.

The major problem we face is simply that irregular migration is very difficult, if not impossible, to measure accurately. The best analyses are by the Department of Homeland Security Office of Immigration Statistics, Pew Research Center and the Center for Migration Studies. However, while the methodologies are rigorous and based on well documented more reliable US data, these estimates are for countries as a whole, not departments, and the latest estimates are for 2015, prior to the recent surge from Central America. Estimates by other researchers of migration by department may be useful, but the underlying assumptions made to construct the estimates limit their usefulness and they are not yet published. Rather than estimate migrants directly, we employ roughly the same available data on remittances and returnees, which are highly correlated with migrants, to construct an alternative measure using factor analysis, or principal components. This is then the proxy for the unobserved irregular migration variable that we analyze. As a robustness check, we also perform the same analysis for estimates of this unobserved migration using Orozco's (2018) estimates.

Further demographic variables that may be helpful may be available upon completion and publication of the current census. As a result, the data we employ is one cross section, for 2018 or the latest available year, for 31 variables across 22 departments and 340 municipalities. Table 3 and 4 present national and municipal level factors which may influence migraton and Table 5 presents the variables available at the municipality level that we employ. Appendix 1 provides more detailed descriptions and sources of each variable.

5. METHODOLOGY

We proceed in two steps. First, we construct a proxy for migration and then use this proxy as the dependent variable in standard regression models. We know that remittances and returnees are highly correlated with migrants in the US. We have good measures of these variables at the municipality level and can use these to construct a department level proxy for migrants. Then we construct the proxy, a synthetic variable, the first principal component of remittances and returnees. Technical details are available upon request, but the intuition is straightforward. Typical regression models relate a well-measured dependent variable to several well-measured independent variables, or correlates. We know the values of each of these variables and estimate the coefficients of each, typically in a linear regression model. If values of the dependent variable are unobservable, regression models cannot be employed. However, principal components analysis finds a linear combination of the independent variables, a composite variable, which by itself explains the maximum share of the total variation of that set of variables.[32] This new variable, a linear combination of all or selected key correlates, may be interpreted as a new dependent variable or proxy for migration, which can then be used as the dependent variable in a new set of regressions.

We have two variables, remittances and returnees, which are highly correlated with migrants and we may calculate two principal components (the maximum number is the number of variables available). The first principal component is an equally weighted (.707) linear combination of remittances and returnees and it alone explains 79% of the variation. The second principal component is a linear combination orthogonal to the first and it explains the remainder of the variation. We use the first principal component as a proxy for migration. Details are provided separately in the technical Appendix.

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[32] See, e.g., Kennedy (2006), Chpt. 12.

Table 3: Guatemala factors – National Level

PUSH FACTORS (migrants to US)	National Level Conditions	

MEASURES OF MIGRATION	Observed Data	
	• Visas Issued • Visa Overstays • Apprehensions • Remittances • Returnees	

Synthetic Measure of Migration to US	Observed Data	Unobserved and Unknown
	• Regular Migration • Illegal Migration • Visa Overstays	• Illegal Migrants

Table 4: Guatemala factors – Municipal Level

MEASURES OF MIGRATION	Observed Data	
	• Remittances • Returnees	

Synthetic Measure of Migration to US	First principal component as proxy for observed migrants	

MUNICIPAL LEVEL CONDITIONS	Observed or Proxies	
	• Econ opportunity Income • Econ opportunity Wealth • Health Status • Violence • Civic Engagement	• Drought • Population characteristics (urban, high school grads) • Migration network • 6 Departments of CEO

Table 5: Potential Determinants of Migration (list of Variables)

DETERMINANTS OF MIGRATION	PUSH FACTORS – 7 groups of variables

Economic Opportunity - INCOME	• Municipal Income per capita • Poverty Rate • Labor Force • Secondary School Graduates • Cellphone Users

Economic Opportunity - WEALTH	• Deposit accounts: number of accounts • Deposit accounts: value of accounts • Savings accounts: number of accounts

- Savings accounts: value of accounts
- Housing: Quantitative deficit
- Housing: Qualitative deficit
- Electrification Rate

Health Status	
	• Social Security Affiliates
	• Public Expenditure on Health
	• Chronic Malnutrition
	• Water access (households)
	• Sanitation access (households)

Violence	
	• Homicides per 100,000 people
	• Extortions per 100,000 people
	• Intra-family violence against Female
	• Intra-family violence against Male

Civil Engagement	
	• Agro-related Protests and Conflicts
	• Voters registration

Drought	
	• Deviation from long-run average Precipitation
	• Deviation from long-run average Temperature

Population Characteristics	
	• Urban Population
	• Population Density
	• Secondary School Graduates

CEO Project (fixed effects)		CEO Project Components
	• Guatemala	
	• Quetzaltenango	• Promote Trade and Investment
	• Totonicapan	• Upgrade Productive Infrastructure
	• San Marcos	• Mobilize Financial Resources
	• Huehuetenango	• Increase Businesses Competitiveness
	• Quiche	

6. RESULTS AND FINDINGS

Four specifications of the regression model are presented in Table 6. The dependent variable is as described above. Independent variables in the final specifications are described in Table 6 below, with further detail and sources provided in Table 1 of the Appendix. In each specification, coefficient estimates, and p-values are reported and those that are statistically significant at the five percent and one percent level are indicated by ** and * respectively. The first two specifications use our proxy for migration and CEO Department dummy variables, in which the dummy for a particular department is assigned a value of 1 if the municipality is in the department, and 0 otherwise. (DGC = Guatemala, DQUET = Quetzaltenango, DHUE = Huehuetenango, DQUI = Quiche, DSAN = San Marcos, DTOT = Totonicapán). These dummy variables account for fixed effects or department level idiosyncrasies that affect migration that are not accounted for by the other variables. For all departments except Guatemala, there are unique features of the department that contribute to migration other

than that of the other departments in Guatemala. The third specification presents a similar model using Orozco's (2018) estimate of migration, without department dummy variables, due to multi-collinearity. Notably, the basic results are similar. The fourth specification is for a sample of only the 6 CEO departments (and therefore no dummy variables). The results are similar, except for the health care expenditures anomaly, which likely reflects poor economic conditions rather than health status.

With regard to the individual variables, we find that our measures of drought CL_PC1[33] the first principal component of climate variables or DR_PRECIPDEV, the deviation of department level rainfall from the national average relative to the national average) and health status/malnutrition (HS_EXPHEALTH18 or HSTATPC1) have little if any effect on migration. Population characteristics (POP_PC1, the first principal component of urban population and population density) are not significant.

Importantly, several measures of economic opportunity (income and wealth measures) have the expected relationships and are statistically significant. Economic opportunity, as measured by municipal income per capita (ECOI_GDPPERCAPITA17) has a negative effect on migration for every specification, indicating that higher levels of municipal income is associated with lower levels of immigration. While the quantitative economic meaning of the coefficient for specifications with the dependent variable based on principal components is unclear, the qualitative impact is clear: increasing municipal income pe capita is associated with lower levels of migration. Specifications using Orozco's (2018) estimates provides the same general conclusion, but from the coefficient we can calculate the elasticity of emigrants with respect to municipal income per capita. Specification 3 in Table 5 uses Orozco's estimates as the dependent variable. Using the municipal income coefficient estimate, we calculate the cross sectional elasticity (over municipalities in 2018) of emigrants with respect to income for the country as a whole to be -0.9. Thus, a 1% increase in municipal income per capita from one municipality to the next is associated with 0.9% fewer emigrants in the US. We may calculate the changes in municipality-to-municipality levels of migrants starting from the country averages (average municipal income per capita of $4,211.77 and average number of emigrants per municipality of 2,878.16) for 2018. If we assume that the responsiveness to municipal income changes over time is the same as the responsiveness across municipalities in 2018, then we could infer how changes in municipal income per capita affect migration if we had current annual migration flows by municipality. These results though clearly infer that in the past, higher cumulative migration flows were associated with lower levels of municipal income per capita and there is no reason to believe that relationship has or will change.

We also find that the first principal component of variables relating to wealth, ECOW_PC1 is negatively related to migration in specification 3 using Orozco's migration estimate as the dependent variable. Thus, all indicators of wealth or income are negatively associated with immigration.[34]

These results are robust across specifications and when other potential determinants of immigration are in the regression specifications. Some of these are significant as well. Violence (VIOLENCE_PC1) has a positive effect on migration. Civic engagement is also. Our measure of civic engagement consists of voter registration and agricultural protests (CIC_AGROCONFLICTS17) and CIVIC_PC1 is the first principal component of these and is dominated by the agricultural protest variable. In regions with high levels of agricultural protests, migration is higher. We also constructed a measure of the strength of the family migration network. This variable is simply the difference between the number of returnees in a particular department and the median level for all

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[33] Here and below PC1 refers to the first principal component of the set of variables of that group of determinants.

[34] The number of cell phone accounts in the municipality, ECOI_CELLPHONES17, was included because it is often mentioned as an indicator of economic wellbeing, either in terms of income or wealth, likely to dampen migration, or alternatively as a tool that makes migration easier. Thus it may be negatively of positively associated with immigration. In some specifications, it is associated with an increase in migration, but in the sample limited to only CEO departments, it is negatively related to migration.

departments, relative to the median number of returnees. We argue the larger this variable the stronger the migration network in a municipality. It is positive and statistically significant in specifications 2 and 3. However, it must be noted that this variable is based on returnees, which is a major component of the dependent variable, migration, regardless of how it is constructed. As a result, this may be a mathematical rather than behavioral relationship and other measures of the strength of family migration network may be considered.

Table 6: Regression Results (Dependent Variable MIGRATION_PC1 or MO_MIGRANT_18F)

Variable	Coefficient P value			
Dependent variable	Spec. 1: eqnA3	Spec. 2: eqnA4	Spec. 3: eqnB1	Spec. 4: eqnC1
	Migrat_PC1	Migrat_PC1	MO_MIG_18F	Migrat_PC1 CEO Depts Only
C			4685.992	0.762312
			0.0000*	0.0011*
CEOINCLUDED			-321.7301	
			0.2974	
DGC	-0.82797	0.481587		
	0.7275	0.0001*		
DQUET	0.506743	0.042801		
	0.0022*	0.5586		
DHUE	0.747487	-0.368768		
	0.0000*	0.0000*		
DTOT	0.5039359	-0.184184		
	0.0611	0.1241		
DSAN	0.923388	-0.125308		
	0.0000*	0.0837		
DQUI	0.398673	-0.334013		
	0.0206**	0.0000*		
ECOI_CELLPHONES17	1.03E-06	2.98E-06	0.027511	-1.29E-06
	0.1275	0.0000*	0.000*	0.0110*
ECOI_GDPPERCAPITA17	-5.50E-05	-8.07E-05	-0.599844	-0.000165
	0.0000*	0.0000*	0.0000*	0.0010*
ECOW1			-627.7010	
			0.0045*	
HS_EXPHEALTH18	-2.87E-10			4.44E-09
	0.5997			0.0416**
HSTAT1			3172.938	
			0.0000*	
VIOLENCE_PC1	0.338325	0.100807	1247.066	0.667357
	0.0000*	0.0000*	0.0045*	0.0000*
CIVIC_PC1	0.447676	0.209019		0.360782
	0.0000*	0.0000*		0.0000*
CIC_AGROCONFLICTS17			17.16720	
			0.1076	
DR_PRECIPDEV	-0.55548			0.129033
	0.4754			0.2758
CL_PC1		-0.031726	193.1587	
		0.0859	0.1263	
POP_PC1	-0.073914			0.062705

Variable	Coefficient P value			
Dependent variable	Spec. 1: eqnA3	Spec. 2: eqnA4	Spec 3: eqnB1	Spec. 4: eqnC1
	Migrat_PC1	Migrat_PC1	MO_MIG_18F	Migrat_PC1 CEO Depts Only
FAM_MIG_NET_Median	0.0843	0.362733 0.0000*	520.0116 0.0000*	0.4738
N	333	333	333	131
Adjusted R-squared	0.651860	0.931750	0.925320	0.683793

NOTE: * statistically significant at the 1% level and ** at the 5% level.

Table 7: Definitions of Independent Variables included in Table 5 Regressions

VARIABLE	DESCRIPTION
CEOINCLUDED	1 if municipality is in a CEO Department, 0 otherwise
DGC	1 if municipality is in Guatemala, 0 otherwise
DQUET	1 if municipality is in Quetzaltenenago, 0 otherwise
DHUE	1 if municipality is in Huehuetenanago, 0 otherwise
DTOT	1 if municipality is in Totonicapan, 0 otherwise
DSAN	1 if municipality is in San Marcos, 0 otherwise
DQUI	1 if municipality is in Quiche, 0 otherwise
ECOI_CELLPHONES17	Number of cell phone users, 2017
ECOI_GDPPERCAPITA17	Municipal income per capita, US dollars, 2017
ECOWI	First principal component of seven variables associated with wealth. Category EconOppWealth in Table 1 of the appendix.
HS_EXPHEALTH18	Expenditures on public health as reported in national budget, 2018
HSTAT1	First principal component of five variables associated with health status, Category HealthStatus in Table 1 of the appendix.
VIOLENCE_PC1	First principal component of four measures of violence, Category Violence in Table 1 of the appendix.
CIVIC_PC1	First principal component of two measures of civic involvement, Category CivilInvolvement in Table 1 of the appendix.

CIC_AGROCONFLICTS17	Number of conflicts registered related to agricultural issues, 2017
DR_PRECIPDEV	Difference in current precipitation from long term average relative to long term average
CL_PC1	First principal component of relative deviation from long-term average precipitation and temperature. Calculated as above.
POP_PC1	First principal component of share of total population in urban area and population density (number of inhabitants per square kilometer).
FAM_MIG_NET_Median	Difference in returnees from the national median number of returnees relative to national median (returnees as reported by IOM)

7. POLICY IMPLICATIONS OF THE KEY FINDINGS

Given the data set, methodology, statistical significance of the results and their robustness across specifications, there are several key findings of importance. First, because pull factors in the United States are essentially given, policies to reduce illegal immigration must address the push factors to address the root causes of migration. The most significant determinant directly related to migration is **municipal income per capita**, or simply individual income. We calculate the elasticity of emigrants with respect to income for the country as a whole to be -0.9. However, this relationship may not be linear since some threshold level of income is necessary to migrate abroad, which is much higher than the level of income required to migrate internally. Internal migration from areas of high levels of poverty to within-country areas of higher economic opportunity may be a better option than migration abroad because the costs of doing so are lower. If urban conditions are unsatisfactory, however, higher levels of income and wealth may then lead to migration abroad. Then, to keep potential immigrants in place new levels of income must be higher than this second threshold to provide sufficient economic well-being to develop local community attachment and deter migration abroad. Exact threshold effects cannot be identified with data currently in hand, but census data on municipal level income strata may be employed to do so and may be explored later.

Second, indirect methods and policies to increasing income and quality of life are also important. Migration is sensitive to changes in income and increases in labor productivity are a key determinant of income growth. Improving health status and human capital increases labor productivity, but means of doing so will vary depending on the initial level in the municipality and the particular economic activity or sector. Migration may be reduced by creating jobs in the formal sector, promoting financial education and bankability (savings such as wealth accumulation) and access to credit (the possibility of improving productive activity).

Interventions must be carefully tailored to meet sectoral differences, in particular agriculture/rural vs. manufacturing and services/ urban.[35]

Third, other factors indirectly related to income and wealth are also important. Increases in the number of agricultural conflicts is related to (rural) migration. This may also simply reflect poor economic conditions in rural areas. Additionally, the quality of housing deficit is positively related to migration and hence may lead to direct migration to the US from urban areas and rural areas as well (rather than first to urban areas with higher economic opportunity). Or, there may be a threshold effect, as mentioned above, that once in an urban area

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[35] Measuring productivity changes in agriculture is particularly difficult because much of production takes place in the informal economy.

migration may be undertaken after accumulation of wealth sufficient to migrate, but not sufficient to afford quality housing.

Fourth, although recent literature refers to the effects of climate change in rural areas on migration, our measures of drought (variations in temperature or rainfall across departments in one given year), were generally not significant *per se*, when income measures were included in the model. The effects of drought were captured indirectly by changes in income. The effect of personal security conditions was also important. However, for domestic violence, homicides and extortion, only extortion showed a consistent effect on migration, presumably from urban areas since rural areas generally have low levels of violence and criminality. In general, we find that health conditions, climate/weather and population characteristics are less important in our regressions. Variation in municipality level data and municipal income per capita indirectly captures the effects of these determinants.

An important caveat is these findings are based upon one annual cross section of municipality level data and reveal the differences in determinants of migration across departments and municipalities at a particular point in time. As a result, it is clear that interventions should be tailored to the varying conditions of individual municipalities. National level policies may have significant impacts, but it may be much more effective to address problems at a more specific, targeted municipal level. Interventions should be aimed at the most important determinants of migration: increasing incomes via foreign and domestic investment, leading to export driven growth, training and educational programs to increase labor productivity, creating jobs in the formal sector, and enhancing the banking system and financial education. Investment and job creation activities may be focused on public sector productive infrastructure, as well as private sector jobs. In addition, to the extent that individuals enter formal sector jobs, accumulate modest amounts of savings and have access to credit, more opportunities for creation of small businesses arise. Attachment to neighborhood and community then increase and incentives to migrate are reduced.

Improved health and investment in human capital also improves employability, increases productivity, increase incomes and reduces migration. Other determinants, like violence, should be addressed by public efforts to address issues of insecurity, with success measured by a reduction in all measures of violence, but in particular extortion in urban areas and conflict in rural areas.

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APPENDIX I: DATA DESCRIPTION

Description of the variables used for this report:

CATEGORY	LABEL	VARIABLE	METRICS	DESCRIPTION	YEARS	SOURCE
CONTROL	CEOAttended	CEO Attended	binary	Dummy: 1 = Attended, 0 = Not Attended	2019	CEO Project
SyntheticMIGRANTS	Returnees18	Returnees	people	Number of returnees documented by IOM	2018	International Organization for Migration
SyntheticMIGRANTS	Remittances18	Remittances	US dollars	Amount of Remittances registered by the Bank of Guatemala	2018	Bank of Guatemala
EconOppIncome	GDPperCapita17	GDP per capita	US dollars	GDP per capita, calculated as US dollars a year (PPP, 2012 numbers)	2017	FUNDESA
EconOppIncome	Poverty14	Poverty Rate	percentage	Share of population living under the National Poverty line	2014	National Institute for Statistics
EconOppIncome	LaborForce18	Labor Force	people	Number of working population in the age range from 15 to 64	2018	National Institute for Statistics
EconOppIncome	Graduates18	Graduates	percentage	Secondary Level Graduates as share of the Population in Secondary Level Age	2018	Ministry of Education
EconOppIncome	CellPhones18	Cell Phone Users	units	Number of active Cell Phone Users	2017	Superintendence of Telecomunications
EconOppWealth	DepositsAcc18	Deposits Accounts	units	Number of deposits accounts reported by the SIB	2018	Superintendence of Banks
EconOppWealth	DepositsAm18	Depostis Ammount	US dollars (thousands)	Amount of money reported as Deposits by the SIB	2018	Superintendence of Banks
EconOppWealth	SavingsAcc18	Savings Accounts	units	Number of savings accounts reported by the SIB	2018	Superintendence of Banks
EconOppWealth	SavingsAm18	Savings Ammount	US dollars (thousands)	Amount of money reported as Savings by the SIB	2018	Superintendence of Banks
EconOppWealth	QuantiHousing18	Housing Quantitative Deficit	percentage	Number of Households with Quantitative Deficit as share of Total Households	2018	National Institute for Statistics
EconOppWealth	QualiHousing18	Housing Qualitative Deficit	percentage	Number of Households with Qualitative Deficit as share of Total Households	2018	National Institute for Statistics
EconOppWealth	Electrific18	Electrification	percentage	Number of Households with Electificaton Connection as share of Total Households	2016	Ministry of Energy
HealthStatus	SSAffiliates17	Social Security Affiliates	people	Number of workers that contribute to Social Security	2017	Guatemalan Institute for Social Security
HealthStatus	ExpHealth18	Public Expenditure in Health	GT Quetzales	Amount of Money registered in the Nation´s Budget as Public Expenditure in Health	2018	Ministry of Finance

CATEGORY	LABEL	VARIABLE	METRICS	DESCRIPTION	YEARS	SOURCE
HealthStatus	ChronicMal15	Chronic Malnutrition	percentage	Share of children under 5 years old that not meet potential Height for the actual Age	2015	Ministry of Health
HealthStatus	Water14	Water Coverage	percentage	Number of Households with access to Water as share of Total Households	2014	National Institute for Statistics
HealthStatus	Sanitation14	Sanitation Coverage	percentage	Number of Households with access to Sanitation as share of Total Households	2014	National Institute for Statistics
Violence	Homicides18	Homicides	units	Number of homicides reported by the National Police Force	2018	National Police Force
Violence	Extortions18	Extortions	units	Number of extortions reported by the National Police Force	2018	National Police Force
Violence	InFamVioMale17	Intrafamiliar Violence Male	people	Number of intrafamiliar violence cases reported, Male victim	2017	National Institute for Statistics
Violence	InFamVioFem17	Intrafamiliar Violence Female	people	Number of intrafamiliar violence cases reported, Female victim	2017	National Institute for Statistics
CivilInvolvement	AgroConflicts17	Agro Conflicts	units	Number of conflicts registered that are related with Agricultural issues	2017	Agricultre Affairs Secretary
CivilInvolvement	Voters18	Voters	people	Number of people registered to vote	2018	Electoral Supreme Tribunal
Climate	PreciptAvg	Average Precipitation	milimeters	Precipitation accumulated during the year, average 2010 to 2018	2018	INSIVUMEH
Climate	Precipt18	Precipitation	milimeters	Precipitation accumulated during the year, 2018	2018	INSIVUMEH
Climate	TempAvg	Average Temperature	Celsius degrees	Average Temperature registered during the year, average 2010 to 2018	2018	INSIVUMEH
Climate	Temp18	Temperature	Celsius degrees	Average Temperature registered during the year, 2018	2018	INSIVUMEH
Climate	UrbanPop18	Urban Population	percentage	Share of total population living in urban areas	2018	National Institute for Statistics
Climate	PopDensity18	Population Density	habitants per km2	Number of Habitants per square kilometer of surface	2018	National Institute for Statistics