Migration, Remittances and the Well-Being of Left-Behind Children: A National-Level Quantitative Assessment of Guatemala

Abstract

Historically, Guatemalans have suffered high rates of poverty and malnutrition while nearly ten percent of their population resides abroad. This investigation uses multilevel modeling to quantify associations among Guatemalan fathers' and mothers' migration, remittances and left-behind children's well-being. Based on national-level data collected in 2000, the investigation's major findings include: for every month a father was away from the household the previous year, a left-behind child aged <3 was 26.3 and 26.6 percent more likely to be stunted or severely stunted, respectively, while a left-behind child aged <5 was 16.2 percent more likely to be underweight. In contrast, the receipt of remittance income did not have a countervailing beneficial association with measures of stunting, severe stunting, or being underweight.

Introduction

Poverty and malnutrition, two diabolical conditions that often go hand in hand, remain rampant throughout much of the developing world. Historically, one of the worst performers in reducing poverty and malnutrition in the Western Hemisphere was Guatemala. In 1989, 55.6% of its population lived in poverty (World Bank, 2010), while the World Health Organization (WHO) reports that 62.1 % of all Guatemalan children under the age of five were stunted and 27.8% were underweight (WHO, 2012). However, in recent years Guatemala has witnessed a sharp reduction in its poverty rate (26.3% in 2006) (World Bank, 2010), while stunting and underweight conditions in children under five have dropped to 48% and 13%, respectively, by 2009 (WHO, 2012). What are the factors that explain this decline in poverty and malnutrition in Guatemala

over the last decade? Adams (2006) argues that economic migration, principally the remittances that were generated, was the single most important factor for reducing poverty at the beginning of the century.

Economic migration and the concomitant remittances that are generated can be an integral part of a household's livelihood strategy for alleviating poverty in places such as Guatemala. To put economic migration and the magnitude of remittance flows to Guatemala into perspective, the International Organization for Migration (2002, 2009) estimates that about 10% of Guatemala's population lived abroad in the first decade of the 21st century. The World Bank (2011) reported a six-fold jump in remittance inflows to Guatemala from 596 million in 2000 to over 4 billion U.S. dollars by 2009—representing 10.8% of Guatemala's GDP for that year. Adams (2006) discusses the importance of remittances in effecting poverty reduction in Guatemala at the beginning of this century (2006). While his study did not find remittances to have an overwhelming ameliorative effect on poverty in Guatemala in 2000—only 1.6% of poor households were moved out of poverty due to remittances—the severity of poverty in Guatemala was reduced by 12.6%. This was due to the fact that remittances received by the 'poorest of the poor' households in Guatemala account for a disproportionate amount of their overall incomes (60%).

Prima facie, one can envision that the flow of remittance income to migrant-sending households would lead to improvements in left-behind children's well-being. For instance, remittance-receiving households can invest these payments in prenatal and general health care and/or improvements in basic household infrastructure (electricity, clean water and sewage systems). Furthermore, remittances might be used to decrease the risk of malnutrition should a household face a negative income shock such as a meager harvest or severe climatic event. Unfortunately, studies have shown that the disruptive consequences of parental absences, especially in the first few years of migration, can neutralize the positive benefits of remittances to

human capital formation. The very act of migration can lead to short-term losses in income, including the need to repay debt incurred to fund a migration trip, and can fracture the nuclear family through infidelity and/or the migrant's abandonment of his/her family (Frank and Wildsmith, 2005) leading to the long-term loss of household income. The temporary or long-term loss of a household breadwinner has contributed to poor children's health outcomes, including higher rates of infant mortality (Kanaiaupuni and Donato, 1999; Hamilton *et al.*, 2009) and childhood illnesses (Schmeer, 2009) in migrant-sending households. This investigation quantifies the overall influence of economic migration—teasing out the beneficial income effects of remittances from the disruptive effects of father's absences—on left-behind children's well-being as measured by international growth standards including: stunting (an indicator of chronic undernourishment and/or infections due to poverty), wasting (an indicator of acute starvation or disease), and underweight (an indicator of both stunting and wasting) (Gross *et al.*, 2000; UNICEF, 2007).

Background

Research on the health effects of migration and remittances on the left-behind family is still in its infancy. One of the first studies on this subject was published in 1999 by Kanaiaupuni and Donato (1999) who found, based on Mexican Migration Project data from five Mexican states, that the short-term absence of the household head was correlated with higher incidences of infant mortality. However, they also noted that higher infant mortality was ameliorated when the household received remittances and/or occurred in communities with well established migration networks. These findings were largely bolstered at the national level in Mexico by Hildebrandt and McKenzie (2005) and Hamilton *et al.* (2009) who also found positive associations between remittance income and infant survival, especially in rural communities. The former study also

found higher birth weights in migrant households while the latter found negative associations between recent out-migration by a family member and infant survival. Further work in rural Mexican households found the absence of a father to be associated with increased odds of a child being ill and 51-79% higher odds of a child experiencing diarrhea (Schmeer, 2009).

Another line of inquiry that is more pertinent to this investigation compares children's growth standards to changes in household migration and remittance receipts. A national-level study using two waves (2002 and 2005) of the Mexican Family Life Survey found a strongly detrimental effect of migration, defined to include both parental absence and remittances, on the height for age Z-scores (HAZ)—an indicator of stunting—of children aged 3-6 years (Nobles, 2007). The migration effect translated into a 3.9 and 4.0 centimeter decrease in the height of the average 3-year old girl and boy, respectively. Anton's (2010) investigation in Ecuador, while not looking at the effect of parental absences, identified a statistically positive association between a rise in remittances received and rising Z-scores for both height for weight (HWZ)—an indicator of wasting—and weight for age (WAZ)—an indicator of being underweight—while not finding a significant difference in HAZ. Specifically, children aged <5 living in households that receive the average amount of remittances for the studied population had HWZ and WAZ values that were 0.74 and 0.06 standard deviations higher than non-remittance receiving households. In another study focusing on the impact of remittances on poverty and human capital, Acosta *et al.* (2007) began to look at the influence of remittances on the HAZ and WAZ scores for children aged 1-5 years in Guatemala and Nicaragua. They use 2000 and 2001 Living Standards Measurement Survey (LSMS) data for their respective countries. Their initial findings suggest a positive association between a rise in remittances and WAZ and HAZ—the only statistically significant result being the rise in WAZ in Guatemala. However, this portion of their study failed to thoroughly control for several key variables that may influence tested measures of children's

growth including: length of parental migration, child's ethnicity and gender and the household's relative wealth level. Their investigation also used the Centers for Disease Control's Growth Charts for the U.S.'s child population as a reference rather than the WHO's Child Growth Standards that would be more applicable to a developing country setting.

The closest investigation to the present study is one by Carletto *et al.* (2011) based on self-collected data in the Western Highlands of Guatemala in 2008. They found that HAZ scores in children aged 0-6 years from migrant-sending households to be about one half a standard deviation higher and children to be 6% less likely to be stunted than those from non-migrant households. The present investigation differs from Carletto *et al.* (2011) in two substantial ways: (1) Carletto *et al.* (2011) lumped remittances within the overall migration effect, while this study disentangles the income effects of remittances from the sociological effects of parental absences, namely the length of the father's and mother's migration; and (2) this study uses national level instead of regional level data to investigate stunting, wasting, and underweight conditions in left-behind children from Guatemalan migrant-sending households.

Research Question and Theory

How do fathers' and mothers' migration and the resultant remittances influence child well-being in migrant-sending households? Specifically, how does the migration/remittance phenomenon influence growth rates in "left-behind" children in Guatemala? I hypothesize that incidences of stunting, severe stunting, wasting, severe wasting, underweight, or severely underweight in left-behind children will be positively associated (more likely) with increasing father's and mother's migration length but negatively associated (less likely) with rising remittances received by the household. Corresponding theories that bolster the research

hypotheses, separating the sociological effects associated with parental absences from the income effect of remittances, are described below.

Sociological Effects The disruption hypothesis argues that during the act of migration and the intervening time required to settle in a new location, the normal functioning of the household is disrupted (Goldstein and Goldstein, 1983; Stephen and Bean, 1992). There are numerous obstacles that migrants face in achieving their ultimate goal of securing gainful employment and remitting earned income to their families. These obstacles include obtaining sufficient capital to make the migration journey. This may entail obtaining a loan from family or friends—with the amount increasing if a *coyote* (human smuggler) is hired to facilitate the migration event. For undocumented Guatemalans migrating to the U.S., once two international borders have been successfully crossed, the migrant must find stable and secure employment. These varying obstacles take time. Some migrations are not successful, and often households must incur significant debt to make the migration journey without the financial benefit of remittances from a successful migration. These factors have direct and indirect negative repercussions for left-behind children and have been found to contribute to higher infant mortality rates (Kanaiaupuni and Donato, 1999; Hamilton *et al.,* 2009), increased disease prevalence (Schmeer, 2009) and decreased growth rates (Nobles, 2007).

Income Effects Becker and Lewis (1973) and Becker and Tomas (1976) argue that under a quantity/quality tradeoff scenario, as household income rises (e.g. remittances), parents invest more in their children's human capital, through education and health expenditures. Parents who receive a salary increase often must balance increased personal consumption with increased investments in child quality and quantity. When parents invest more of the net salary increase in

their children's human capital, these children become more expensive and thus take away from parent's personal consumption. Therefore, under a quantity/quality tradeoff, parents choose to have fewer but higher quality children. Human capital investments in children thus bolster child well-being. Indications of this include low incidences of neonatal and infant mortality, low birth weight and underweight young children. Findings by Hamilton *et al.* (2009) in Mexico support this when a migrant is well established in the migration destination.

Methods

To answer the study's research questions, nationally representative, cross-sectional data from Guatemala's 2000 Encuesta Nacional de Condiciones de Vida (ENCOVI) were used. Guatemala's ENCOVI provides a rich source of individual, household and municipal-level data that cover 7,276 households (3,852 rural) and over 37,000 individuals (6,074 children aged <5). The cross-sectional data were collected using a stratified probabilistic sampling design to capture a proportional number of households from each of Guatemala's 22 departments. The dataset contains information on remittances received and months away for each household member during the prior 12-month period. Several health variables, including measures of height and weight of all members of the household are available, as well as information on several control variables including each household member's age, education, ethnicity, and gender were also available in the survey. The ENCOVI also provides household-specific information including indicators of wealth (e.g. building materials and consumer durable assets), whether the household was rural or urban, and the regional location of the household. The survey was implemented by the Guatemalan National Statistics Institute (INE), with technical guidance from the World Bank's LSMS team.

Six growth measures (stunting, severe stunting, wasting, severe wasting, underweight, and severely underweight)—as defined in Table 1—representing the study's dependent variables, were tested to determine their relationship with changes in father's and mother's domestic and international migration length and household remittance receipts during the prior 12-month period. WHO Macro Packages for STATA were used to calculate Z-scores for the corresponding growth measures described in Table 1 (WHO, 2007a, 2007b). A breakdown of each growth measure by migration and remittance-receiving household category can be found in Table 2.

{Table 1 about here}

{Table 2 about here}

Independent variables used in the analysis are listed in Table 3. With the exception of yearly remittances, father's and mother's body mass index (BMI) and household wealth index, all independent variables were taken directly from the ENCOVI dataset. Yearly household remittances were calculated by adding all reported remittances, from both international and domestic sources, received over the prior 12-month period by each household member. ENCOVI reported remittances in quetzals. These figures were transformed into $100 U.S. dollar values by dividing by 100*7.7632—the exchange rate of quetzals to dollars in 2000. Father's and mother's BMIs were calculated with the formula weight (kg)/height(m)^2.

The household wealth index is a measure that attempts to control for the relative wealth of the household prior to the year 2000—the year of the survey. Instead of income, which can be highly variable, a measure of relative wealth based on household assets and infrastructure can provide a better measure of relative wealth, which can influence both migration decision-making and the ability of parents to adequately feed their children. Following the methodology described

in Filmer and Pritchett (2001) and McKenzie (2005), principal components analysis was used to create a household wealth index. Specifically, 39 variables representing three broad categories, household size and construction materials (e.g. number of rooms, roof, wall and floor construction materials), access to utilities and infrastructure (e.g. electricity, sewage, telephone service), and ownership of durable goods (e.g. automobile, cell phone, computer, oven, refrigerator, stove, and television) were used in the creation of this index.

The key independent variables included in the analysis are yearly remittances received by the household and father's and mother's domestic and international migration lengths. Domestic migration was separated from international migration due to the fact that the two phenomena are vastly different. While domestic migration is relatively inexpensive, quick, safe, and may allow for the periodic return of the migrant to his/her household, international migration—especially if the migrant does not have legal papers to reside in the migration destination—can pose a fundamentally different migration risk and experience. Guatemalan international migrants may incur large debts in order to hire a human smuggler, take a much longer time to travel and establish oneself into the new community, face substantial dangers (robbery, violence, and death while crossing international borders), and are unlikely to return to their native households frequently.

The analysis takes into account several child-specific (child's age, age^2, ethnicity, and gender), household-specific (size and whether it is rural or urban), and parent-specific (age, education level, height, and BMI) variables. The child and household-specific variables were included because national-level surveys show girls, ethnic Mayan children (compared with Ladino) and children residing in rural communities face substantial poverty and discrimination-related barriers to education and health (World Bank, 2003; Hallman *et al.*, 2007). Additionally, household size was incorporated into the analysis based on research showing a linkage between

decreased child quality and larger families (Baez, 2008). The parent-specific variables control for relative differences due to parent's age and education (older and better educated parents may be better able to feed their children) and height and BMI (accounting for possible genetic and environmental confounders). Lastly, regional-level dummy variables are included to control for geographic differences relative to poverty.

{Table 3 about here}

Statistical Analysis

Statistical analyses of stunting and severe stunting were performed with children aged <3 to address the fact that stunting is unlikely to occur after a child has reached the age of 3 (Beaton *et al.*, 1990; Martorell *et al.*, 1995). Additionally, measures of wasting, severe wasting, underweight, and severe underweight were analyzed with children aged <5, conforming to the WHO's international growth standards (WHO, 2006; de Onis *et al.*, 2007). A two-level logistic model was used for these analyses. The two levels include 'child' at the first level and 'household' at the second level. The household was found to be an appropriate second level of analysis because more than half of all households had two or more children in both the <3 and <5 year age groups.

Multilevel models were used due to their advantage over basic logistic regression models in their ability to parse out random error at the various levels of the analysis. For instance, in this endeavor where increased migration length by the father and/or mother or increased receipt of remittances by the household can lead to changes in the odds that a left-behind child will be malnourished, random error between children within the same household can be separated from random error among children from different households.

Two-level Logistic Random Intercept Model: To demonstrate the basic multilevel model structure, an example is given for one of the proposed research questions – odds of stunting under differing migration and remittance receiving scenarios. The example will be a two-level (individual and household) logistic random intercept model. Following specification by Rabe-Hesketh and Skrondal (2008), y_{ij} denotes the i^{th} child of the j^{th} household. Letting ζ_j represent the household-specific random effects, the baseline-category multilevel model is written:

$$\text{logit}\ \{\Pr(\ y_{ij}\ =1 \mid x_{ij}, \zeta_j)\} = \beta_1 + \beta_2 x_{2ij} + \beta_3 x_{3j} + \zeta_j$$

Here $x_{\mathbf{ij}} \equiv (x_{2ij}, x_{3j})'$ is a vector containing all covariates. y_{ij} is the stunting hazard for the i^{th} child in the j^{th} household; $x_{2'ij}$ are individual-specific characteristics of the i^{th} child in the j^{th} household; $x_{3'j}$ are household-specific characteristics. The $\zeta_j \sim N(0, \psi)$ term is a random intercept of households.

Results

Stunting and Severe Stunting

This investigation tests whether there are associations among increasing length of father's and mother's domestic and international migration in addition to the receipt of remittances over the last year with changes in left-behind children's propensity for being stunted or severely stunted. For children aged <3, increases in father's absences from the household due to international migration were significantly correlated with both stunting and severe stunting but not with measures of father's domestic migration length, any measures of mother's migration length or remittances received by the household (Table 4). Specifically, for every one month

increase in the length of a father's international migration absence, the odds of a left-behind child being stunted increased by 26.3%. To put this into perspective, if a father was away from the household for the entire previous year (12 months), the odds that a left-behind child from that household aged <3 was stunted is (26.3*12 months) 315.6% higher or 3.156 times more likely than for a similar child living in a non-migrant household. The association between father's migration and the propensity of a left-behind child being severely stunted is even more dramatic. Specifically, for every month that a father was away from the household, the odds that a left-behind child was severely stunted increased by 26.6% (319.2% or 3.192 times more likely if the father was away for 12 months).

Wasting, Severe Wasting, Underweight, and Severe Underweight

While no relationships were found among remittance receipts, migration length and wasting or severe wasting, a positive (more likely) correlation was found between father's migration length and the propensity to be underweight while a negative correlation between remittance receipts and the likelihood of being severely underweight existed (Table 4). Specifically, for every month a father was abroad, the likelihood that his child aged <5 was underweight increased by 16.2%. While, every $100 received by the household was correlated with a 12.9% decline in the likelihood of a left behind child being severely underweight. The study found no significant influence of mother's absences due to domestic or international migration on their children's growth outcomes.

Regarding domestic migration, the findings were consistently insignificant for all malnutrition measures for children of both father and mother migrants even though nearly 6 and 3% of the fathers and mothers, respectively, experienced some domestic migration last year. However, the lack of women's international migration in 2000 is likely responsible for the non-

significant finding for malnutrition given that less than 0.5% of study's mothers migrated internationally in 2000. This result may be different today as international migration by Guatemalan women has more than doubled from under 200,000 in 1999 to 403,000 in 2009 (IOM 2009).

Control variable results are as expected in most instances (Table 4). Specifically, the odds of a left-behind child being malnourished increases when the child is Mayan (Table 4). Furthermore, children with better educated, taller and larger (BMI) parents were less likely to exhibit signs of malnourishment. However, children from more rural areas and in households with lower levels of material wealth were more likely to show signs of malnourishment. The one control variable that did not act as expected was gender. Results from this investigation found no significant difference in nutrition outcomes between boys and girls. While conventional thinking argues that girls are often more neglected and poorly nourished than their male siblings, Latin American-specific studies have found girls to show signs of malnutrition less frequently than boys (Alves and Belluzo, 2004; Anton, 2010).

{Table 4 about here}

Discussion

The key findings in this investigation are the moderate to strongly positive correlations among short-term fathers' absences due to international migration and their left-behind children suffering from stunting, severe stunting and being underweight. The long-term importance of stunting and severe stunting, in particular, cannot be overstated. In comparison to wasting and being underweight, children who are chronically malnourished before the age of 3 express

negative health and social development outcomes in later life related to stature, human capital formation and productivity. The development of stunting during infancy leads to permanent reductions in stature which can cause lower body functional limitations (LBFL) with concomitant reductions in physical strength in adulthood (Dewey and Begum, 2011; Huang et al., 2011). Furthermore, studies have shown strong associations between stunting and impaired intellectual development, school achievement and decreased economic productivity in adulthood (Milman *et al.*, 2005). Stunting that develops in early childhood can pose a host of risks for childbearing in adult women. Pregnancies in stunted women are more likely to result in perinatal death (stillbirth) or children born with lower birth weight than children born to non-stunted women (Dewey and Begum, 2011). Ozaltin *et al.* (2010) also found that children born to stunted mothers were at higher risk of death compared with children born to mothers of normal weight.

The study highlights additional important findings pertaining to the increased likelihood of left-behind children being underweight as father's absences due to international migration rise and the decreased likelihood of left-behind children being severely underweight as more remittances are received by the household. Unlike stunting, being underweight is more an indication of acute starvation rather that a chronic indicator of malnutrition. The primary concern with underweight children is they are at higher risk of general mortality that varies by the severity of undernutrition (Pelletier et al., 1993, 1994). More recent studies have also shown that specific causes of death (diarrhea, malaria, measles, and pneumonia) were elevated when children suffer from malnutrition (Caulfield et al., 2004).

Another compelling finding from this investigation is the lack of significant correlations between remittance receipts and all measures of childhood malnutrition with the exception of severe underweight. A likely explanation for these outcomes relate to the fact that new economic migrants—especially those who travel abroad—must overcome a number of hurdles before they

can return meaningful amounts of income to their households. Such obstacles include successfully traveling to their intended destination, finding stable and gainful employment and avoiding detection by migration authorities in cases where they do not possess legal documents to reside in the destination. Many of these factors can be mitigated to some extent by the presence of strong migration networks connecting a migrant's community of origin with locations abroad. Social networks can provide assistance with making the migration journey and aiding the migrant with locating a place to live and potential employment opportunities, all of which reduce the amount of time and expense required to become established in the migrant destination. Despite the beneficial effects of these social networks, positive income flow from migrants to left-behind family members can be hampered by the fact that many economic migrants from Guatemala have taken out loans to pay the substantial fees demanded by *coyotes* to get them across both the Mexican and U.S. borders. Such loans often require repayment to begin immediately, which substantially reduces the amount that can be returned to migrant-sending families. A review of the data provides evidence for this. In the 476 households that sent a father or mother abroad, the amounts of remittances received ranged between $0 and $2,061 with an average of $349. Just considering the high end of the range of remittance transfers, $2,061 is substantially less than the amount the average Guatemalan laborer ($3,770) would have earned in 2000 had he not left (World Bank 2002). Furthermore, while migrants are busily establishing themselves elsewhere, the household does not have an important laborer that at a minimum could help produce subsistence food for the household. Therefore, left-behind mothers are likely bearing the burden of both agricultural as well as household chores, including caring for children. And, as this study corroborates, fathers of infant children are unlikely to make sufficient foreign income during the critical three year period of child development to reduce the likelihood that their left-behind children will be stunted, severely stunted or underweight.

This study contradicts Carletto *et al.*'s (2011) findings for northwestern Guatemala. They found a negative (beneficial) effect of international migration on stunting in left-behind children. However, where their study differs from this one is they did not separate out the potential harms of parental absences from the benefits of remittances on left-behind children's nutritional status. A great strength of the present study is it shows that when remittances are decoupled from the overall migration effect, that father's absences have an overwhelmingly harmful association with the likelihood of left-behind children being stunting or severely stunted.

The results in this investigation also diverge from those reported by Acosta *et al.* (2007). While using the same dataset, they found a statistically significant beneficial association of remittances on WHZ but no association with HAZ. As described above, the remittance and health portion of the Acosta *et al.* (2007) study differs from this investigation by not controlling for key characteristics of the child (ethnicity and gender), parents (domestic and international migration length, age, education level, height and BMI), and regional-level differences. Additionally, they used ordinary least squares (OLS) regression to look at differences in Z-scores for height and weight measures that were calculated based on the CDCs growth standards for the U.S. population. This study, in contrast, used Guatemalan children's heights and weights to calculate Z-scores based on the WHO's international growth standards, converted those scores to the presence or absence of each of the growth measures listed in Table 2 and then analyzed them with multilevel logistic regression to determine if they were associated with migration and remittances separately. Such methodological differences are likely responsible for the divergent results between the two studies.

Shortcomings of this investigation pertain to both selection effects of migrant-sending households, causality and data limitations. Left-behind children in migrant-sending households may be fundamentally different from children in non-migrant households. Migration can be

forced by crop failure or other income shocks that may correspond with poorly nourished children. Or, children from migrant-sending households may be better off than their non-migrant sending household counterparts. The fact that migrant households can afford to send a member abroad indicates that they may be relatively more affluent. Two factors lessen the concern for selection effects and causality. First, results from other studies on children's mortality in Mexico came to the same fundamental conclusion that parental absences are harmful to children (Kanaiaupuni and Donato, 1999; Hildebrandt and McKinzie, 2005; Hamilton *et al.,* 2009; Schmeer, 2009). Additionally, indications of selectivity were controlled for with the inclusion of the household wealth index variable. This measure provides an indication of household wealth prior to a possible migration event. Therefore, if a household was forced to send a member abroad due to an income shock, then it was likely that they were identified has having low household wealth while just the opposite would be the case for a more affluent household. While selection effects and causality were not fully ameliorated by the inclusion of the household wealth index variable, its inclusion along with the consistency of findings with other similar studies in Guatemala and Mexico provide some assurances that this study's findings are reliable.

A final drawback of this investigation is that the ENCOVI data do not provide meaningful migration data beyond the year prior to the survey. Therefore, it is likely that remittances in this study both provide an indication of income flows back to the household and partially reflect the level of establishment of the migrant at the migration destination. However, because the remittances received variable was not statistically significant for any of the malnutrition variables other than severe underweight, the practical implications of this drawback are likely not substantial.

Conclusion

For many, migration is an integral part of a household's livelihood strategy. The concomitant remittances have the power to supplement basic household expenditures (food, clothing, medicine) and improve human capital development for many left-behind children. However, migration—especially when parents leave children behind—can be very disruptive, endangering the provision of sufficient nutrition and lowering health care expenditures, possibly leading to a decline in child well-being. This investigation quantified at the national level, within a multilevel statistical model that disaggregated household differences, the association of migration and remittances on left-behind child well-being in Guatemala. Major findings show that while father's migration length in the previous year is positively associated (more likely) with the odds that young left-behind children were either stunted, severely stunted or underweight, that the receipt of remittances during the same time period does not have a significant counterbalancing negative association for some children.

The importance of this research relates to parental goals for enhancing the well-being of their children and the lack of information for best achieving these goals. In particular, many parents use international economic migration as a means to improve the livelihoods of their children. However, as the results from this study show, these altruistic actions may have an ultimate and permanent negative impact on their children's well-being if the timing of international economic migration coincides with the critical, first three years of a child's life. It behooves Guatemalan government and non-governmental organizations interested in migrant health, from both a human welfare as well as a national productivity stand point, to inform their constituents about the risks of migration on the development of left-behind children. Furthermore, these organizations should urge families with young children to put off the migration of fathers until the three-year development period for all children has been surpassed and when possible

provide temporary nutritional assistance for migrant households with young children until migrants can successfully establish themselves abroad.

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TABLE 1

Definitions of Growth Measures* (Dependent Variables).

Variable	Definition
Stunting	<-2 standard deviations of height (or length) for age
Severe Stunting	<-3 standard deviations of height (or length) for age
Wasting	<-2 standard deviations of height for weight
Severe Wasting	<-3 standard deviations of height for weight
Underweight	<-2 standard deviations of weight for age
Severely Underweight	<-3 standard deviations of weight for age

* Based on the World Health Organization's (WHO) median international reference values for children of similar age.

TABLE 2

Percentage and Number of Children Aged <5 Years by Growth Measure Category and Household Type[a].

	Non-migrant, non-remittance-receiving (%)	Non-migrant, remittance-receiving (%)	Migrant, non-remittance-receiving (%)	Migrant, remittance-receiving (%)
Stunting	51.11	45.06	66.58	45.83
Severe Stunting	27.37	24.43	44.47	33.33
Wasting	3.42	3.62	3.39	2.08
Severe Wasting	1.44	1.86	1.31	0
Underweight	16.61	16.61	28.53	16.67
Severe Underweight	4.76	4.53	7.97	2.08
N	4245	912	383	48

Source: 2000 Encuesta Nacional de Condiciones de Vida, Guatemala.

[a] A migrant household means a child's father or mother has migrated domestically or internationally in 2000 while a remittance-receiving household means the household has received remittances from any member of the household in 2000.

TABLE 3
Definitions and Means of Independent Variables.

Variable	Unit	Mean	Definition
Key Variables			
Yearly remittances	$1US	658	Remittances received in 2000 by all household remittance recipients
Father's domestic migration	months	5.10	Months away in 2000 by domestic migrant fathers
Father's international migration	months	4.38	Months abroad in 2000 by international migrant fathers
Mother's domestic migration	months	5.42	Months away in 2000 by domestic migrant mothers
Mother's international migration	months	3.67	Months abroad in 2000 by international migrant mothers
Child-specific			
Age	years	1.96	Child's age at time of height and weight measures
Age^2	years	5.88	Child's age squared at time of height and weight measures
Ladino	no/yes	0.52	Mayan or Ladino
Girl	no/yes	0.49	Boy or Girl
Parent-specific			
Father's age	years	32.8	Father's age in 2000
Father's education level	0/1/2/3	0.91	None/Primary/Secondary/Higher
Father's height	meters	1.59	Father's height in meters in 2000
Father's BMI	BMI	24.0	Father's BMI (weight(kg)/height(m)^2) in 2000
Mother's age	Years	28.4	Mother's age in 2000
Mother's education level	0/1/2/3	0.75	None/Primary/Secondary/Higher
Mother's height	Meters	1.47	Mother's height in meters in 2000
Mother's BMI	BMI	24.9	Mother's BMI (weight(kg)/height(m)^2) in 2000
Household-specific			
Household size	#	6.70	Number of individuals living in the household
Household wealth index	#	0.77	See Methods Section
Rural	no/yes	0.63	Urban (areas include cities, towns, pueblos, and colonies) or Rural (areas include villages, hamlets, and farms)
Regional			
Metropolitan	%	8.26	Percentage of children residing in the Metropolitan region
North	%	12.50	Percentage of children residing in the North region
Northeast	%	6.12	Percentage of children residing in the Northeast region
Southeast	%	10.22	Percentage of children residing in the Southeast region
Central	%	17.12	Percentage of children residing in the Central region
Southwest	%	15.87	Percentage of children residing in the Southwest region
Northwest	%	20.14	Percentage of children residing in the Northwest region
Peten	%	9.76	Percentage of children residing in the Peten region

Source: 2000 Encuesta Nacional de Condiciones de Vida, Guatemala.

TABLE 4

Three-Level Random Intercept, Logistic, Odds of Experiencing Malnutrition for Guatemalan Children, ENCOVI 2000.

	Children Aged <3				Children Aged <5							
	Stunting		Severe Stunting		Wasting		Severe Wasting		Underweight		Severe Underweight	
Odds Ratios = exp(β)	OR	(SE)	OR	(SE)	OR	(SE)	OR	(SE)	OR	(SE)	OR	(SE)
Independent variables												
Household remittances (100 U.S. dollars)	0.976	(0.025)	1.011	(0.026)	0.987	(0.044)	1.045	0.044	0.964	(0.027)	0.871^{+}	(0.064)
Father's domestic migration length (months)	1.049	(0.063)	1.033	(0.061)	1.002	(0.107)	0.942	0.138	1.019	(0.055)	0.920	(0.089)
Father's international migration length (months)	1.263*	(0.129)	1.266**	(0115)	0.789	(0.199)	0.629	0.300	1.162*	(0.083)	1.029	(0.116)
Mother's domestic migration length (months)	0.939	(0.078)	0.905	(0.082)	0.885	(0.171)	--	--	0.934	(0.080)	1.101	(0.136)
Mother's international migration length (months)	0.960	(0.239)	1.102	(0.286)	1.413	(0.329)	1.115	0.371	0.855	(0.232)	1.071	(0.298)
Individual controls												
Age (days)	1.007***	(0.001)	1.007***	(0.001)	0.998**	(0.001)	0.998	0.001	1.002***	(0.000)	1.002**	(0.001)
Age^2	1.000***	(0.000)	1.000***	(0.000)	1.000	(0.000)	1.000	0.000	1.000***	(0.000)	1.000**	(0.000)
Female	0.921	(0.097)	0.855	(0.097)	0.783	(0.152)	0.920	0.260	1.120	(0.109)	1.027	(0.160)
Ladino	0.616***	(0.086)	0.900	(0.129)	1.252	(0.316)	1.247	0.449	1.239^{+}	(0.159)	0.919	(0.190)
Father's age	0.999	(0.010)	0.981^{+}	(0.010)	0.978	(0.019)	0.975	0.028	1.005	(0.010)	0.991	(0.016)
Father's level of education	0.809^{+}	(0.090)	0.900	(0.106)	0.958	(0.192)	0.699	0.204	1.061	(0.111)	0.831	(0.136)
Father's height	0.949***	(0.009)	0.956***	(0.009)	1.008	(0.016)	0.989	0.022	0.955***	(0.008)	0.968*	(0.013)
Father's BMI	1.008	(0.018)	0.973	(0.018)	1.015	(0.031)	1.021	0.043	0.953**	(0.016)	0.952^{+}	(0.026)
Mother's age	0.994	(0.013)	1.009	(0.014)	1.028	(0.024)	1.007	0.034	1.002	(0.012)	1.007	(0.019)
Mother's level of education	0.839^{+}	(0.090)	0.666***	(0.080)	0.728	(0.146)	0.617^{+}	0.179	0.839^{+}	(0.089)	0.783	(0.136)
Mother's height	0.946***	(0.009)	0.940***	(0.010)	1.002	(0.017)	1.008	0.025	0.942***	(0.008)	0.952***	(0.014)
Mother's BMI	0.948***	(0.013)	0.942***	(0.014)	0.938*	(0.025)	0.943	0.037	0.925***	(0.012)	0.882***	(0.022)
Household controls												
Household size	1.053*	(0.026)	1.079**	(0.028)	1.105*	(0.047)	1.046	0.062	1.085***	(0.025)	1.131***	(0.037)
Household wealth index	0.907*	(0.044)	0.919	(0.053)	1.087	(0.058)	1.135	0.084	0.877*	(0.053)	0.928	(0.091)
Rural	1.168	(0.163)	1.308^{+}	(0.202)	1.298	(0.343)	1.811	0.741	1.515**	(0.213)	1.651*	(0.398)
Geographic controls												
Metropolitan	1^{R}		1^{R}		1^{R}		1^{R}		1^{R}		1^{R}	

North	0.513*	(0.145)	0.503*	(0.164)	1.772	(0.928)	0.670	0.533	1.334	(0.444)	1.519	(1.014)
Northeast	0.871	(0.272)	0.577	(0.219)	2.045	(1.130)	2.073	1.530	1.322	(0.497)	2.199	(1.561)
Southeast	1.493	(0.417)	1.017	(0.323)	1.357	(0.719)	0.478	0.409	1.069	(0.364)	1.471	(1.002)
Central	1.118	(0.281)	1.061	(0.308)	0.970	(0.484)	0.483	0.361	1.471	(0.464)	1.250	(0.820)
Southwest	1.563^{+}	(0.423)	1.486	(0.452)	2.202	(1.082)	2.260	1.509	2.453**	(0.779)	2.760	(1.784)
Northwest	1.455	(0.384)	1.263	(0.376)	1.183	(0.605)	0.753	0.549	1.822^{+}	(0.581)	1.832	(1.192)
Peten	0.778	(0.215)	0.514*	(0.169)	1.012	(0.560)	1.350	0.985	0.669	(0.236)	0.550	(0.404)
$\Psi^{(2)}$	0.794	(0.419)	0.661	(0.479)	1.492	(0.799)	0.881	1.114	0.761	(0.240)	0.514	(0.386)
Log likelihood	-1406.302		-1223.283		-561.320		-268.362		-1671.562		-710.818	
Number of Children (Level 1)	2539		2539		4071		4073		4131		4131	
Number of Households (Level 2)	2072		2072		2602		2603		2624		2624	

$^{+}$significant at p<0.10, *significant at p<0.05, **significant at p<0.01, ***significant at p<0.001

1^{R} designates the reference group that results for categorical and ordinal independent variables that are compared against. The reference has a value of 1.