Published in final edited form as:
Land use policy. 2014 January ; 38: . doi:10.1016/j.landusepol.2013.09.001.

Migration, remittances and smallholder decision-making: implications for land use and livelihood change in Central America

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1. Introduction

In contrast to the 1960s, 1970s and 1980s when numerous armed conflicts pushed scores of Central Americans northward, recent emigration has swelled as people struggle to reconcile deficiencies in wealth, social status, personal security, and poverty (Adams and Cuecuecha, 2010; Hecht et al., 2006; Massey et al., 1993). While a substantial number of migrants may have no intention of returning to their native communities, for those who do return, the experiences while abroad combined with a boost in capital savings can have profound effects on migrant-sending household livelihoods. One understudied area of potential livelihood change is household agriculture. New Economics of Labor Migration (NELM), further explained below, models how labor losses, capital accumulations, the potential adoption of new lifestyle ideals, and different methods of practicing agriculture may influence how smallholders continue to manage their land. The considerable prevalence of migration and remittance transfers among Central American agricultural households provides a ripe opportunity to test the applicability of NELM theory to remittance-induced land use change. The primary aim of this investigation is to determine the extent to which NELM theory explains recent Central American migrant-sending household remittance investments in land.

According to the 2007/2008 Human Development Report, the percentage of Central Americans who were primarily employed in agriculture ranged from 15% in Costa Rica to 39% in Guatemala and Honduras (Watkins, 2007). For many Central American farmers, access to agricultural land is fundamental to their livelihoods. According to George Lovell, Mayans equate land with life (Lovell, 2010). The following comment from a Guatemalan Highland migrant reflects this view, "…*si no tienes más tierra, no tienes nada. La tierra es lo más importante*." (… if you do not have more land, you have nothing. Land is the most important thing.) (House and Lovell, 2001). Unfortunately, inadequate access to land is a major, perhaps the largest, contributor to rural poverty in Central America (De Janvry and Sadoulet, 2000; Krznaric, 2006; Merlet and Pommier, 2000). To cope with pervasive rural poverty, coupled with a desire to alleviate relative deprivation (Massey et al., 1993; Stark and Bloom, 1985), many smallholders have invested in international economic migration

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(Adams Jr, 2004; Adams Jr and Page, 2005; Adams and Cuecuecha, 2010; Durand et al., 1996; Taylor and Wyatt, 1996).

Between 2000 and 2010, Central American migration to the U.S. increased by nearly 50% (from 2.03 to 3.01 million) (Patten, 2012). And, while workers have crossed international boundaries for centuries in search of better economic opportunities, the scale of international monetary flow in the form of remittances has also grown dramatically in recent decades. Global remittances more than tripled from $132 to $440 billion between 2000 and 2010 (WorldBankGroup, 2010). In 2010, remittances constituted more than 10% of the GDPs of 24 developing nations including several in Central America (El Salvador—15.7%, Guatemala— 10.2%, Honduras—15.0%, and Nicaragua—11.7%). Given the pervasiveness of agricultural employment in Central America, the adoption of a profound lifestyle change —e.g., sending a household member abroad to earn remittance income—can have a major influence on the extent and manner to which agriculture continues to be practiced (or not).

Agricultural households from the four countries of interest to this investigation, Costa Rica, El Salvador, Guatemala, and Nicaragua, demonstrate a range of economic migration dynamics (Table 1). El Salvador supports the highest percentage of migrant (26.1%) and remittance receiving households (44.9%). In contrast, Nicaragua has the lowest percentage of migrant households (12.4%), while Costa Rica has the lowest percentage of remittance receiving households (13.4%). Furthermore, 60–90% of all migrants captured by the study have returned to their native communities. The significant prevalence of migration and remittance sending practices, in addition to the high number of migrants that return to their native households, suggest that Central American farming households might use economic migration as an investment strategy vis-à-vis their agricultural pursuits as predicted by NELM. Relevant work by Sana and Massey (2005) that applied NELM theory to remittance-sending strategies primarily in Mexico and the Dominican Republic, also addressed the potential applicability of the theory to Costa Rica and Nicaragua. Their findings suggest that Mexicans used economic migration as a risk aversion strategy as predicted by NELM while Dominican Republicans did not—the Costa Rica and Nicaraguan results fell in between the two extremes. Similar in many respects to the work by Sana and Massey (2005), our investigation aims to model NELM theory for Latin American countries but differs by focusing on Central American farming households in El Salvador, Guatemala, Costa Rica, and Nicaragua.

Central America's colonial history led to the concentration of its most valuable land in the hands of a few rich landowners. According to Brockett (1990), in the 1970s, the largest 4.0% of land holders held 64% of all land in El Salvador; 2.5% of the land holders held 65.5% of the land in Guatemala; 4.2% of the largest land holders in Nicaragua held 56% of the land; and 9.1% of the largest land holders held 67.2% of the land in Costa Rica. However, the numerous civil conflicts in the region substantially altered the land distribution equation. In Guatemala, civil war further skewed land ownership toward richer landowners —fewer than 1% of landowners controlled 75% of Guatemala's most productive agricultural land following the end of Guatemala's civil war in 1996 (Wittman and Saldivar, 2007). However, the resolution of civil conflicts in El Salvador and Nicaragua led to land redistribution efforts, albeit imperfect, that decreased land inequity (Bandiera, 2007; Vargas, 2003).

In addition to poverty and inadequate access to land, another reason to theorize that remittance income could have a profound effect on smallholder land use is the current lack of access to credit by rural farmers, which inhibits them from fully entering the agricultural marketplace. According to the World Bank (1998), less than 12% of El Salvadoran rural households received a loan in 1995, while 13% of rural Guatemalan farmers received credit

(half from informal institutions) in 2000 (Krznaric, 2006). In the case of Guatemalan farmers in Petén, only those who owned cattle and fenced pastureland were extended credit (Gould, 2006). However, unlike El Salvador's and Guatemala's failed civil uprisings, Nicaragua's largely successful revolution led to some land redistribution among pro-Sandinista peasants and limited credit increases in the 1980 and 1990s (Cupples, 1992; Deininger et al., 2003). Sanchez (2001) reports that approximately 20% of rural Nicaraguan farmers received a loan in 1998. In contrast to El Salvador, Guatemala and Nicaragua's more recent violent uprisings, Costa Rica sustained a relatively tranquil development trajectory in the last half of the 20th Century. Numerous government sponsored agricultural support programs were implemented to provide credit and price supports to farmers (Segura, 2006). Unfortunately, most of these programs largely benefited larger landowners (Cartin and Piszk, 1980).

How might international migrant remittances and returned savings influence land use in Central America? This paper begins by describing and relating the NELM theory to potential smallholder responses to migration and remittances. This is followed by an empirical descriptive analysis of the phenomenon with data collected by the Latin American Migration Project (LAMP). We then analyze several agricultural outcomes related to NELM with a combination of logistic, Poisson and beta regression models. Finally, we discuss the impact of international migration and remittance flows on the current state of Central America's smallholder agricultural practices and access the relevance of NELM to model these effects and implications for related processes globally.

2. New economics of labor migration

Numerous scientists have proffered theories of smallholder agricultural change in Latin America following the advent of large-scale international migration that precipitates both labor losses and remittance transfers (Basok, 2000; Gray, 2009; Jokisch, 2002; Klooster, 2003; Klooster, 2005; Oberai and Singh, 1980). The NELM as described by Stark and Bloom (1985) argues that the choice to migrate is rational and made at the household level. A household seeks to maximize its economic condition through various means in light of the fact that capital institutions do not exist to provide insurance or investment loans (Massey et al., 1993; Taylor, 1999; Wouterse and Taylor, 2008). However, NELM may not aptly model agricultural change in Central America due to unforeseen remittance-related land effects, including land inflation that may minimize agricultural investment profitability. In the case of a smallholder household, income streams are often diversified by planting a range of subsistence and cash crops and devoting some family members to local wage labor and others to internal and international migration to earn higher wages. The household uses these diversification strategies as a hedge against potential negative outcomes including a lost or devalued harvest or an injured family member. Given the risk-diminishing and revenue generating potential that remittances provide, households sometimes use economic migration as a means to enter capital markets (Massey et al., 1993) such as starting a business or making a major change in how agriculture is practiced (i.e., transition from largely subsistence cropping to capital intensive cash cropping or cattle ranching). Additionally, households may use international economic migration as a means to respond to feelings of relative deprivation within the community. When households perceive that their economic standing has diminished compared to others in their community, they may send members abroad to earn income toward the purchase of items that boost their social status including new homes, automobiles or, critical to this investigation, more agricultural land.

Given that migrant-sending smallholder households exist in economies virtually devoid of formal loaning institutions and insurance markets and where governments are unlikely to

step in to repair a human or nature-induced calamity, households may rely upon international migration to fulfill these purposes to enhance agricultural production. However, smallholders must first decide whether the value added from leveraging remittances to lift these credit and insurance barriers is worth the risks associated with migration compared to other less risky investment strategies (e.g., rural-urban migration). And, should they decide international migration is a worthwhile undertaking, is agricultural investment the best economic use of remittances compared with other potential investments (e.g., launching a small business)? In this context, if smallholder farmers decide that agriculture is a central, long-term investment strategy, then they may earmark remitted income for changing agricultural investments with the ultimate goal of enhancing profitability. Such changes may take the form of farmland expansion, intensification, or a transition into livestock ranching. Extensification, another potential agricultural transition, was not investigated due to lack of data on land conversion. The following section details the conditions under which these changes might occur:

2.1 Expansion of land ownership

When smallholders decide that agricultural improvement could be a relatively profitable undertaking facilitated by remittances, the first option they are likely to consider is increasing their landholdings if cheap land is available and labor remains relatively unconstrained, as characterizes some less market-oriented rural regions (Figure 1). This option allows farmers to continue to practice agriculture in traditional ways and enables households to fully maximize labor assets (again assuming excess labor is available).

While some smallholders may invest remittances to expand the size of their agricultural plots, they may also use remittances to transition to larger commercial farming or cattle ranching operations (further discussed below). Or, for the poorest of economic migrants, the purchase of agricultural land may be the ultimate goal toward achieving self-sufficiency once family maintenance needs have been satisfied, a new home constructed, and investments in children's education have been met (Davis, 2010b; House, 1999; House and Lovell, 2001). However, the reasons that underlie a household's strategy to increase land holdings are not always straightforward nor do they necessarily stem from a desire to own sufficient land to ensure economic viability.

Feelings of relative deprivation may also motivate a migration event (Massey et al., 1993; Stark and Bloom, 1985). Relative deprivation exists when some households within a community express higher living standards in the form of larger, modernized houses and more landholdings. Wealth inequity can create feelings of inadequacy thus providing a strong impetus to invest in international migration and the sending of remittances as a means to equalize living standard imbalances. When international migration is used to alleviate relative deprivation, remittance moneys may be likely allocated to the purchase of agricultural land. However, an increase in farm size may negatively correspond with the percentage of farmland placed in agricultural production. While land purchases may be made in response to a relative deprivation effect, households may also realize that it is better to continue to invest household labor in the international labor market (i.e., labor migration) rather than in local farming, thus leading to declines in per acre land use (Durand and Massey, 1992; Mines and De Janvry, 1982).

2.2 Intensification

The next likely agricultural improvement option that smallholders may consider after expansion of land ownership is agricultural intensification. The decision to intensify may respond to one or a combination of the following factors: prohibitive land costs, labor constraints, and knowledge gained while abroad (Figure 1). The use of agricultural inputs

such as chemical fertilizers and pesticides can allow farmers to plant greater varieties of cash crops and to increase crop yields, further diversifying a household's livelihood portfolio.

2.3 Transition to cattle ranching

A final agricultural transition strategy that smallholders may pursue in response to an infusion of remittances is livestock (nearly always cattle) ranching (Figure 1). A major constraint to entering large-scale cattle ranching is the availability of cheap forage land. Should this barrier be overcome then ranching can become a valuable smallholder livelihood strategy. Cattle ranching, in contrast to row crop agriculture, ameliorates labor shortages associated with migration as only a few laborers are needed to raise and monitor large numbers of cattle (Loker, 1993; Roebeling and Hendrix, 2010).

3. Material and methods

To investigate the aforementioned avenues of smallholder agricultural change as predicted by NELM-informed land use theory, LAMP longitudinal and cross-sectional data were combined for four Central American nations, Costa Rica – 2002, El Salvador – 2007, Guatemala – 2004, and Nicaragua – 2002 (Figure 2). These data were collected by the LAMP (Durand et al., 2005) between 2000 and 2007. These four countries are suitable study sites because they represent a broad range of Central American agricultural conditions. From a productivity standpoint, Guatemala holds the highest abundance of productive agricultural land in Central America while Costa Rica supports the fewest hectares. Nicaragua, the largest of the Central American countries (11% larger in land area than Guatemala), supports 13% fewer hectares of arable land in crops than Guatemala (FAO_Stats_Division, 2010).

As shown in Table 2 and further described below, longitudinal data that cover the 1990 to 2007 time period were analyzed to address questions related to land and pasture purchases and sales. However, only cross-sectional data for the year of the survey (this varies by individual country from 2000 to 2007) were available concerning data on the proportion of land in cultivation, chemical use, hired labor, and the ownership of mechanized equipment and livestock. The LAMP administered questionnaires to the head of household (HOH) and the spouse of the HOH (SHOH) to collect information on household characteristics. Selected communities span the range of urbanization levels, from rural to metropolitan. Once representative communities were selected, a survey protocol was administered to a random sample of households, averaging 200 households per community, to ensure that a substantial number of migrant-sending households would be captured by the survey and to maintain statistical representativeness at the community level. These interviews entailed a retrospective accounting of annual events since the HOH's and SHOH's years of birth. Retrospective surveys have one major defect, namely the accuracy of recall information. For this endeavor, interviewees may mistakenly report the dates of migration events and the buying and selling of agricultural land. The LAMP takes steps to mitigate these potential data deficiencies by interviewing family units as a whole rather than just the HOH and to cross-reference dated events such as timing of migrations with land purchases and sales (Durand et al., 2005).

Starting from a base of 4,112 households, we pared the combined 4-country dataset to only reflect households who have ever practiced agriculture. The paring exercise has naturally excluded nearly all urban households with the exception of a few that reside on the outskirts of smaller towns. We removed years of civil strife from the analysis to control for the confounding impact of forced migration events. Thus, person-years before peace accords were implemented in each respective country were excluded: 1992 for El Salvador, 1996 for

Guatemala, and 1990 for Nicaragua. For Costa Rica a country that did not suffer from a recent history of civil conflict, we did not include person-years before 1990 in order to retain consistent comparisons among countries. Thus, for the longitudinal analyses of land and pasture purchases and land sales, 547 households contributed 6,420 person-years from 1990 to 2004. This investigation was conducted under the assumption that all households, even the poorest subsistence farmers were open to changing their farming practices via land expansion, intensification and/or transition to cattle ranching if sufficient remittance income was conveyed from abroad. Furthermore, only years when the HOH was 18 years or older were included. The LAMP team identified a variety of U.S. citizenship statuses, including legal residents, citizens, temporary workers, and undocumented migrants during their surveys. Since this study investigates changes in sending-household agricultural practices, legal residents and U.S. citizens were excluded to prevent potential bias that might exist within these households since there is a high probability that they have no intention of returning to their countries of birth.

3.1 Statistical models

This investigation employed a variety of statistical models to represent the various phenomena of interest. Because the data represented both cross-sectional and longitudinal data and binary responses, counts, and proportions, three types of models were used: multivariate logistic regression, Poisson regression, and beta regression (see Table 2 for a summary of the models used for each statistical outcome). Numerous studies have employed logistic and Poisson regression models to analyze agricultural change specifically and land cover change more generally (Dendoncker et al., 2007; Jaraíz et al., 2012; Ramirez and Shultz, 2000; Serra et al., 2008). While we are not aware of any applications of beta regression for these types of applications, as further described below, we believe it appropriately models differences in proportions of land in cultivation.

Multilevel models were also tested for each agricultural change phenomenon and enhanced explanatory power for the cross-sectional analyses of chemical use, labor hired and cows owned. A series of diagnostics and robustness checks were performed for each model used. Following the recommendations specified in Chen *et. al* (2003) and Rabe-Hesketh and Skrondal (2008), we searched for non-compliance of independence and normality, overdispersion, specification errors, goodness-of-fit, multicollinearity, and influential observations. To limit the influence of outliers, the right-skewed and heteroscedastic remittance and migration length variables were transformed by $\ln(y + 0.001)$. Adding a small amount (0.001) to a y value of zero ensures that these values are not lost when log-transforming the data.

3.2 Dependent variables

We evaluated several measures of agricultural land ownership and use to determine if Central American smallholders conform to the responses predicted by NELM. The first measures evaluated were the current state of land ownership, i.e., were smallholders increasing, decreasing or maintaining land ownership levels. We developed logistic regression models to evaluate the odds that a household would buy land in relation to the length of time household members spent in the U.S. and the amount of remittances transferred back to the household. Following NELM, we might expect that as remitted income increased over time (a function of both time spent away and annual amount remitted by the HOH and/or SHOH) receiving households would increase their land holdings.

We might also anticipate following a NELM relative deprivation effect, that as land holdings increased, the proportion of one's holdings in agricultural production would decline. To investigate this secondary response, we used a beta regression model to evaluate

the proportion of land maintained in crops versus total land (cropped and fallowed) in relation to household migration lengths and remittance receipts. Beta regression is an appropriate model for this type of analysis because the beta distribution can handle discrete proportion data that exist between 0 and 1 (Kieschnick and McCullough, 2003; Smithson and Verkuilen, 2006). Furthermore, it is a robust method for modeling abnormal skewness and heteroskedacity at both ends of the distribution (i.e., many 0 and 1s) that violate linear regression normal distribution assumptions (Cribari-Neto and Zeileis, 2009). In our sample, approximately one third of land holders fallowed nearly all their land while half of farmers had all of their land in production thus making beta regression an appropriate technique.

We also evaluated the likelihood that households would adopt agricultural intensification measures and/or transition to cattle ranching as predicted by NELM. Specifically, we evaluated the likelihood that increased migration length and remittance receipts would lead to changes in the application of fertilizers and insecticides, hired labor, and mechanized equipment usage and/or an increased likelihood that they would invest in pastureland and cattle. These dynamics were analyzed with logistic and Poisson regression models.

3.3 Independent variables

Two predictor variables and up to seven control variables were included in each model to best determine the influence of international migration and remittance receipts on the dependent variables listed above (Table 3). The predictor variables aimed to capture the combined effects of migration, remittances and savings returned (i.e., economic migration) on land use changes. For our analyses, to independently test whether remittances might be used differently from savings in shaping land use decisions, we created two predictor variables: 1) combined months of migration with average amounts remitted per month and 2) total savings returned to the migrant sending household. For the longitudinal analyses, the migration/remittance and savings returned predictor variables were only included in years prior to an event of interest, e.g., land purchase or sale. The combined migration and remittance variable was calculated following Massey and Parrado (1994) and Kanaiaupuni and Donato (1999) by multiplying HOH or SHOH's total months abroad by the average amount of remittances received per month in the last year of migration. Both predictor variables were log transformed to correct for their right-skewed and heteroscedastic structure.

There are some problems and clarifications with these methods that are worth noting. First, our measures of economic migration do not represent an exact measure of international migration. While the values of migration length and savings returned to migrant-sending households are exact, the cumulative remittances sent to date are not. The remittance portion of this value is extrapolated based on the average amount of remitted income reported during the survey. This method is constrained by yearly income volatility. However, we assume that across migrants the magnitude difference in average income remitted does not change substantially over time.

A second issue to consider is the following: As migrants gain experience in the receiving community, their earning potential will increase along with their ability to remit more income. Second, and countervailing the first caveat, studies have demonstrated that remittance transmissions are sporadic depending upon job availability (Amuedo-Dorantes and Pozo, 2006) and can decline over time as migrants lose their connection with their sending household (Menjfvar et al., 1998); this trend is less typical with spouses (the subjects of this study) and more prevalent with children and non-nuclear family members (Amuedo-Dorantes and Pozo, 2006). Because the LAMP gathered remittance-sending information from husbands and wives, we assume that remittance transfers do not significantly decline over time

This last point necessitates some clarification regarding the NELM and LAMP data availability. Under the NELM framework, a household will send members abroad to diversify income streams. This assumes that a parent or a child or, in rare circumstances, a non-nuclear family member who is considered a member of the household unit can assume this role. The LAMP only accounts for monthly remittance amounts sent from the HOH or the SHOH, so other potentially remitting family members are excluded from the analysis. However, we do not believe this is a major concern. As noted above, Amuedo-Dorantes and Pozo (2006) found spouses to be the most likely to regularly remit income and to return to the household. Remittances sent by children are erratic because they often have non-household goals to consider including the saving of money toward the establishment of their own independent family.

Control variables were also selected to capture demographic effects, including age (HOH's Age), period (Year) and country level (Country) effects. Additionally, an "Owns Land" variable was included to control for the increased likelihood that a household that owns land would be better able, and perhaps more inclined, to purchase additional land than a non-land owner. Specific to the livestock ownership analysis, we included an "Owns Pasture" variable under a similar assumption that pasture owners remain more likely to invest in cattle. We included two migration status variables, "In US" and "Years Since Returning from the U.S.", to control for the use or not of remittance income to compensate for the inevitability that a primary laborer may be unavailable to assist on the household farm and to control for a likely erosion over time in the use of remittance income for making agricultural changes once the migrant has permanently returned home. Several additional control variables were initially included but later excised because they remained consistently insignificant and did not increase the strength of the various models. These include dummy variables for the member of the household who migrated (husband, wife or both), HOH education, number of family members, number of day laborers, number of hectares owned, and land tenure (owned, leased, communal).

4. Results

4.1 Agricultural land expansion

Interestingly, the saving returned portion of economic migration was (modestly) correlated with an increase in the odds that the household would purchase additional agricultural land while the combined migration length/remittance variable was not significant (Table 4). This finding is consistent with the idea that periodic remittances transfers are more likely to be channeled to household maintenance activities such as food, clothing, and school supplies (Reichert, 1981; Rubenstein, 1992), while larger infusions of income in the form of returned savings are more likely to be invested in more substantial purchases including land. The average plot of land purchased by receivers was 0.93 hectares versus 1.58 hectares purchased by non-receivers of foreign savings (the significance is further discussed below).

Regarding agricultural production, we found no correlation between economic migration and the proportion of land farmed. This latter finding is inconsistent with NELM relative deprivation theory. A positive relative deprivation finding would have revealed a decline in the proportion of hectares farmed as the absolute number of hectares increased; households may accumulate land to increase their social status but household labor is better invested in the international marketplace rather than farming landholdings (Massey et al., 1993).

Several control variable outcomes facilitate model interpretation. First, as the age of the HOH increased, the odds of that households purchasing agricultural land decreased. This is consistent with Chayanov's theory of agricultural land distribution that contends that land accumulation wanes in households with older heads as land is bequeathed to adult children

(Chayanov, 1966). Presumably parents are waiting for their migrant children to return to claim land purchased with remittances. Regarding period effects, households were more likely to purchase land in more recent years as reflected by the Year results. Additionally, the Owns Land control variable was highly negatively correlated with the odds of purchasing additional land. This is consistent with the smaller plot sizes purchased by receivers of U.S. savings versus non-receivers and supports the findings of Davis and Lopez-Carr (2010) for rural Guatemala where landless households—often newly formed—were predominately engaging in economic migration to purchase their first plot of land.

4.2 Agricultural intensification

Counter to NELM, increased economic migration did not lead to dramatic changes in the propensity to use chemical soil amendments, hire labor or to purchase mechanized agricultural equipment (Table 5). While the totality of these economic migration/intensification findings are inconsistent with NELM, they are largely supported by the bulk of research on this subject, including work performed in El Salvador, Oaxaca and Highland Ecuador, that argue that economic migration is not primarily used as a means of increasing smallholder agricultural production. A recent study in El Salvador found no evidence that having a household member abroad the previous year or receiving larger amounts of remittance income increased the use of chemical inputs (Damon, 2010). In eleven randomly selected Oaxacan villages, only 1.6% of remittances were used to further agricultural interests (Cohen, 2004; Cohen and Rodriguez, 2005). A study of Ecuadorian highland communities by Jokisch (2002) also failed to find any major agricultural changes between remittance-receiving and nonremittance-receiving households. His study concluded that poor quality soils made agricultural intensification unprofitable. However, contradictory to our findings is Gray's (2009) study in Highland Ecuador that found smallholder farmers increasing labor hires and using more chemical inputs as remittances received from abroad increased. Interestingly, while we did not find an increase in chemical use when the HOH or SHOH was in the U.S., some Nicaraguan and Guatemalan land owners were hiring labor without U.S. remittances to presumably compensate for labor shortages.

A limitation of the fertilizer and insecticide data is they are reported in a yes/no binomial fashion instead of quantities of use per hectare. Therefore, we cannot know if households increased their use of these inputs in response to a rise in remittances. However, we can reasonably surmise that economic migration is not inducing the bulk of smallholder farmers to adopt them.

4.3 Agricultural transition to cattle ranching

Similar to our land purchase results, we find that an increase in saving returned was significantly and positively correlated with the purchase of pasture land while remittances had no effect (Table 6). We also found that the number of cattle owned was positively correlated with an increase in economic migration. However, this livestock ownership result becomes attenuated when we employ robust standard errors to correct for overdispersion of the Poisson model's variance. Little has been written on this topic but these results are consistent with recent research conducted in Albania and Burkina Faso but largely inconsistent with recent findings in El Salvador regarding the impact of migration and remittances on livestock production. Studies in Albania and Burkina Faso report that international migration is positively associated with increased investment in livestock (Miluka, 2007; Wouterse and Taylor, 2008) and pasture and away from staple cereal production (McCarthy et al., 2006). Damon's (2010) results in El Salvador found migration length to have an insignificant influence on livestock value and land dedicated to pasture when fixed effects are included. However, she did find that an increase in remittances received corresponded with an increase in livestock value in all her models but a decrease in

land dedicated to pasture in two of her three models. The use of remittances to purchase livestock follows from the literature on cattle as a logical investment when labor is reduced. It also follows from the literature on the culture of cattle whereby poor rural smallholders look to cattle ranchers as successful role models and aim to invest additional capital in striving to become ranchers themselves (Carr et al., 2005; Downing et al., 1992; Hoelle, 2011; Loker, 1993).

4.4 Country-level differences

Statistical differences between the country-level variables are noteworthy. For example, farmers in El Salvador and Guatemala were more likely to have significantly higher proportions of their land in cultivation (Guatemalan especially) and less likely to purchase land than farmers from Nicaragua, the country of reference. Regarding land sales, Costa Rican farmers were over nine times more inclined to sell their land compared with Nicaraguan farmers (Table 4). For intensification methods, Costa Rican farmers were less likely to hire additional labor or to own mechanized equipment than Nicaraguan farmers; El Salvadorans were much less likely to hire labor than Nicaraguans; while Guatemalans were nearly four times more like to use chemical soil amendments than Nicaraguan farmers. Concerning cattle ranching, Costa Ricans were ten times more likely to purchase pasture land than Nicaraguans while Guatemalans were 85% less likely to own cattle; the mean size of Nicaragua's cattle ranches was over 100 times larger than Guatemala's (70 hectares versus 0.50 hectares).

Country-level differences follow divergent histories of rural poverty and violence. More intense histories of inequity perpetuated higher concentrations of rural impoverishment in El Salvador and Guatemala (Southgate and Basterrechea, 1992), compared to their Central American neighbors. Such poverty makes land purchases difficult and forces subsistence farmers to use most of their land for crop production. Farming large proportions of land in Guatemala is consistent with their nation having the highest percentage of subsistence farmers of any Central American nation and with it having the highest percentage of indigenous. The latter may retain subsistence plots even when unnecessary due to cultural and religious ties to corn and their land (Carr, 2004). El Salvador, Guatemala and Nicaragua share similar neocolonial development trajectories, a recent history of internal civil conflict, and high rates of rural poverty (De Janvry and Sadoulet, 2000; Corral and Reardon, 2001; Delgato and Salgado, 2009). However, El Salvador's and Guatemala's higher rural population densities combined with their government's violent repression of popular uprisings in the rural countryside in recent decades (Haggerty, 1990a, b; Morrison, 1993) and Guatemala's enduring legacy of ethnic discrimination (Manz, 2005), have contributed to a lack of affordable agricultural land, 1996 population densities were 498, 458 and 69 individuals per square kilometer of arable land in El Salvador, Guatemala and Nicaragua, respectively (Mundial, 1999). This contrasts with a partially successful popular revolution in Nicaragua, which led to large-scale land reform that, although constrained by export agricultural and foreign interests, continues today (Merrill, 1993).

Costa Rica's substantially higher odds of pasture purchases compared with Nicaragua also follows distinct rural development arcs. During the latter half of the 20th century, Costa Rica's agricultural economy increasingly shifted from row crop agriculture to livestock production while in Nicaragua, the proportion of land devoted to each practice increased equally. Carr et al. (2009) discuss how, between 1961 to 2001, emboldened by greater access to capital than their Central American neighbors, Costa Rican farmers invested vigorously in cattle production while the percentage of Costa Rican pasture as a portion of total land more than doubled from 18 to 46% while the percentage of row crop agriculture remained nearly unchanged from 9 to 10%. Conversely, in Nicaragua, the percentage of

pasture as a portion of total land increased from 32 to 40% from 1961 to 2001 while the portion of land in row crop agriculture climbed from 10 to 18%.

5. Discussion

This investigation examined the impact of international economic migration on land use by Central American smallholders. A conceptual model based on NELM theory was developed and applied to smallholder agriculture, international migration and remittances. Perhaps the most striking finding from this investigation is that while migrant-sending Central American households do not radically change most of their subsistence-related agricultural practices they do increase their landholdings. There are no indications that households who send temporary economic migrants to the U.S. either curtail their agricultural practices or enter into more economically productive farming operations such as intensive row crop agriculture or large scale cattle ranching. These findings, as a whole, are unsupportive of NELM theory. Of the seven outcomes that reflect economic migration investments in agriculture, only land and pasture purchases evinced significant increases consistent with NELM theory. However, increases in landownership alone, without investments to improve productivity by intensifying row crop agriculture or transitioning to cattle ranching, suggest that Central American farmers use international migration as a means to expand without necessarily (at least in the short term) intensifying (through additional chemical, mechanical, or labor inputs per unit land) or extensifying (through pasture conversion) agricultural operations.

Ethnographic and quantitative fieldwork carried out by the authors over the last two decades provide further evidence that land prices in migrant-sending communities in Central America are rising rapidly, thus creating a barrier to agricultural expansion (Davis, 2010a; Davis and Lopez-Carr, 2010). The influx of remitted income has led to more land purchases for housing to the detriment of agriculture by both removing productive land from cultivation and by increasing the opportunity cost for its continued use for farming in lieu of its sale for new home construction. Under such circumstances, investments in land uses consistent with decreasing labor and land productivity, such as pasture, make economic sense (Loker, 1993; Roebeling and Hendrix, 2010). As explained above, it also is consistent with Central and broader Latin American “cattle culture” described in detail by Latinamericanist anthropologists (Grandia, 2009; Hoelle, 2011). Cattle may be a safe, risk-averse, investment, albeit with limited upside for human, economic, and ecological development indices. The finding augurs poorly for conservation interests in Central America as pasture requires several times more land for the equivalent amount of protein and calories as crops (Barona et al., 2010; Fearnside, 2005).

Furthermore, and contrary to NELM, smallholders in our sample do not appear to be utilizing economic migration as a means to address feelings of relative deprivation. These outcomes, although not without precedent, are interesting because they suggest that while loath to abandon farming, rural households generally, and smallholders specifically, may not consider row crop agriculture as a priority future economic strategy. International migration may thus be accelerating rural farm abandonment.

A contributing factor to this viewpoint pertains to economies of scale and governmental incentives. Smallholder farmers are naturally risk averse for good reason: economies of scale severely limit their ability to compete in the market with larger landowners and they often do not have the resources to survive income shocks due to short or long-term climatic conditions or volatility in commodity prices. Compared with smallholders, larger farmers pay less on a production quantity basis for agricultural inputs and the cost of transportation to market (Carter and Barham, 1996). Larger farmers also have better access to credit and

insurance than smaller farmers thus providing a hedge against income shocks (Carter et al., 1996) such as the large reductions in grain prices (Cuéllar et al., 2002) or highly volatile cash crops—especially coffee (Eakin et al., 2006; Hecht, 2010; Hecht et al., 2006). Furthermore, and unlike the pre-neoliberal reform era of Mexico, Central American governments never actively invested in the smallholder economy (Davis and Eakin, 2013). The lack of a governmental safety net for the smallholder agriculturalist represents an additional deterrent for allocating remittance income toward risky small-scale agricultural activities.

Alternatively, if smallholders are considering a transition away from traditional agriculture over the longer term, they are apparently not jumping on the transition bandwagon immediately. Evidence for this includes the fact that production methods are not changing. Considering the many uncertainties that life in rural Central America presents—government corruption, wars, difficulties entering and surviving in the agricultural market, poor education, and the scarcity of jobs—land does provide some foundation from which smallholder farmers can base their economic security and retain important cultural identities, thus making them loath to abandon it completely. Smallholders in general and Central American smallholders in particular have always diversified their income streams through migration, nonfarm employment, and the sale of excess food to weather income shocks attributable to health issues or extreme climatic events (Eakin, 2006; Ellis, 2000; Frank et al., 2011; House, 1999). However, without a base of economic security that land provides—namely the ability to grow one's own crops and thus subsidize non-farm wage employment (Eakin, 2005)—many rural inhabitants would quickly find themselves living in severe poverty, one shock away from ruin and wholesale migration to urban or international destinations (Laferriere, 1992). Land also provides smallholder farmers a sense of empowerment and autonomy by allowing them to provide for their families and mitigates the need to seek out other methods of income diversification including annual migrations to coastal plantations, major cities or internationally (Lovell, 1995).

5.1 Conclusion

With access to a new source of capital (remittances and returned savings), combined with exposure to a different culture and perhaps new ways of practicing agriculture, NELM would argue for notable changes in the operation of smallholder agriculture among remittance receiving rural households. Instead we observed investment in land expansion among our sample of Central American respondents. Given the limited number of farming households captured by this investigation (547), results cannot be extrapolated beyond the regional level and should only be considered under a NELM framework. However, while evidence suggests that some smallholders are increasing their land ownership, for the majority it appears that farming will continue to be practiced in the traditional ways for the foreseeable future, regardless of remittance income. It also appears that cattle ranching may be an increasingly popular investment due to its complementarily with farming systems characterized by decreasing labor and land degradation. This may represent an economically rational and risk-averse strategy. But given the outsized land demands of supporting cattle and the land degradation cattle precipitate, the trend does not bode well for the sustainability of rural systems increasingly altered by international remittances. Appropriate policies to champion coupled human-land system sustainability in Central America might usefully consider viable land use alternatives to remittance investments into cattle and pasture expansion. It may be that substitute land uses that provide similar revenues are not enough. Farmers may remain loathe to invest in alternatives to pasture that fail to provide a similar level of risk aversion and cultural cache.

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Highlights

- We test new economics of labour migration (NELM) for Central America farmers
- We determine how migration and remittances alter smallholder farming practices
- Economic migration correlates with an increase in land and pasture purchases
- Economic migration does not produce changes in agricultural intensification methods
- NELM does not aptly model smallholder agricultural investment in Central America

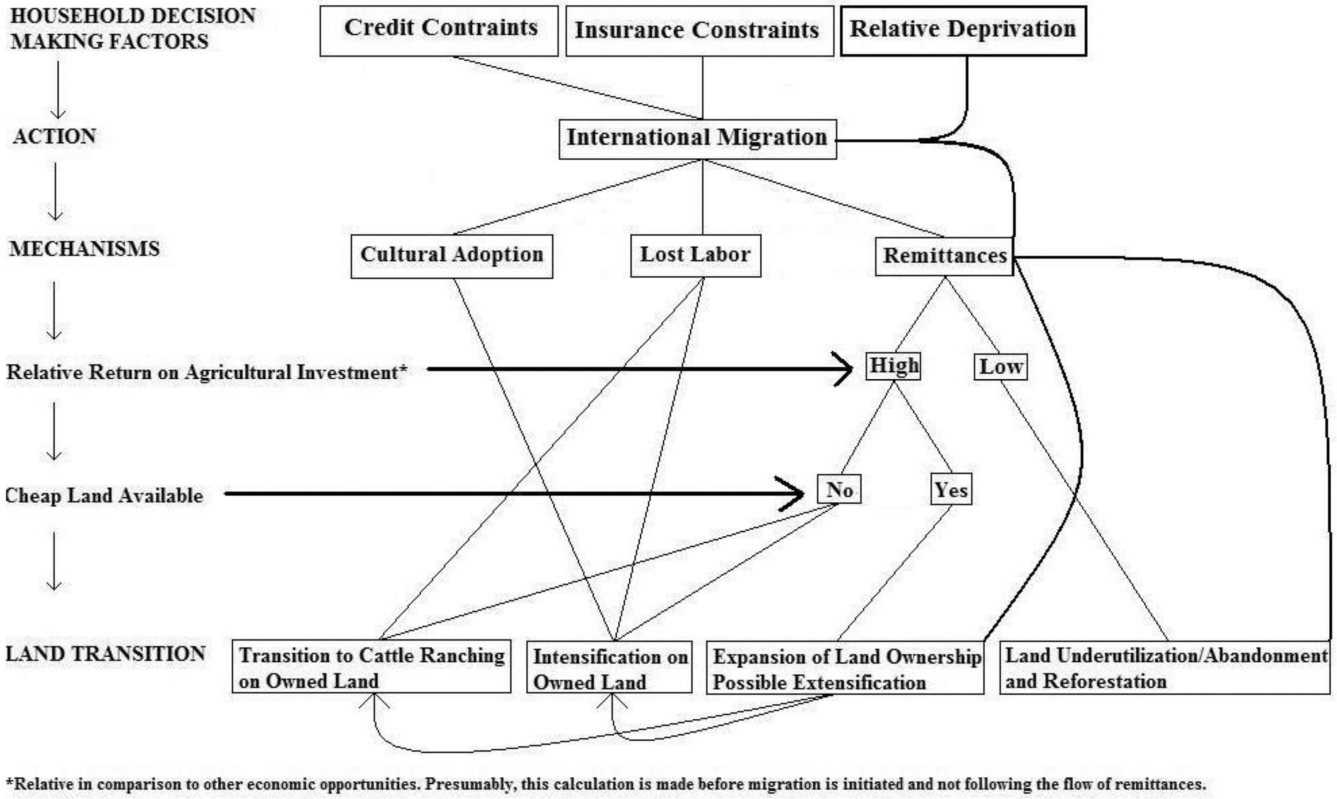

Figure 1.
New Economics of Labor Migration applied to international migration and smallholder land use decision-making

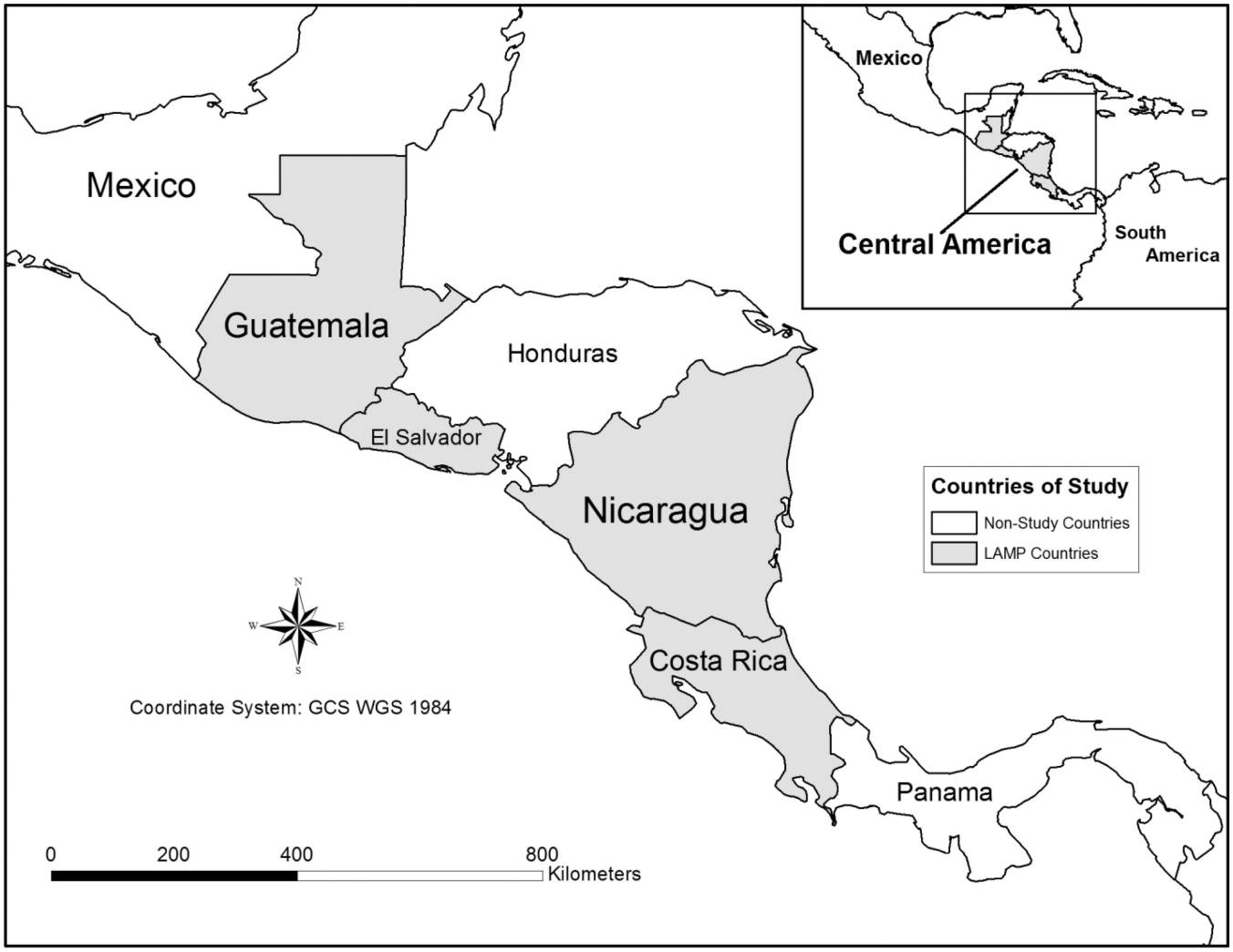

Figure 2.
Central American countries represented in the Latin American Migration Project

Table 1

Agricultural household migration characteristics within four Central American countries

Country	Costa Rica	El Salvador	Guatemala	Nicaragua
% of households with migrants	23.1	26.1	16.4	12.4
% of households with return migrants	14.3	23.2	11.5	8.1
% of households receiving remittances	13.4	44.9	20.0	20.6
% households with repatriated U.S. savings	7.1	11.1	7.6	3.2
Number of agricultural households	212	69	140	161

Source: Latin American Migration Project 2000–2010

Table 2

Dependent variable summary statistics, models used and definitions

Variable	Unit	N	Mean (Household)	Model	Definition of Outcome
Longitudinal Analysis					
Land Purchased	Plots	261	1.30	Logistic Regression	Odds of land purchase during year
Pasture Purchased	Plots	91	0.45	Logistic Regression	Odds of pasture purchase during year
Land Sold	Plots	33	0.16	Logistic Regression	Odds of land sale during year
Cross-sectional Analysis					
Proportion Cultivated Land (Cultivated/Owned)	Hectares	322/549	59/100	Beta Regression	Proportion of land cultivated (not fallowed) of owned land
Chemicals Used	Yes	385	0.67	2-Level Logistic Regression	Odds of fertilizer use
Day Laborers	#	876	1.52	2-Level Poisson Regression	Number of day laborers employed
Mechanized Equipment	Yes	70	0.12	Logistic Regression	Odds of owning mechanized equipment (tractors, etc.)
Cow Owned	#	3,471	5.99	2-Level Poisson Regression	Number of cows owned

Source: Latin American Migration Project 2000–2010

Table 3

Definitions of independent model variables and units

Variable	Units	Mean/Median	Definition
Ln(Migration/Remittances)	$US	4057[a] /0[a]	Ln(Remittances*Years of Migration)[b]
Ln(Savings Returned)	$US	357[a] /0[a]	Ln(Savings Returned)[b]
Control Variables			
HOH's Age	Years	44/43	HOH's age in current year
Year	Year	1996/1996	Year
Country	1/2/3/4	2.16/2	Nicaragua(reference), Costa Rica, Guatemala, El Salvador
Owns Land	0/1	0.95/yes	Owns land during year (no/yes)
Owns Pasture	0/1	0.27/yes	Owns pasture during year (no/yes)
Years Since Returning from US	Years	2.79/0	Number of years since returning from last migration trip to US
In US	0/1	0.06/no	Currently in US (no/yes)

Source: Latin American Migration Project 2000–2010

[a] Value before Ln transformation

[b] Transformed by Ln(y+0.001)

Table 4

Statistical analyses of agricultural land expansion or contraction

AGRICULTURAL CHANGE TYPE		Proportion Land Cultivated		Land Purchased		Land Sold	
MODEL		Beta Regression		Logistic Regression		Logistic Regression	
		Odds Ratios	(SE)	Odds Ratios	(SE)	Odds Ratios	(SE)
Ln(Migration/Remittances)		1.01	(0.02)	1.03	(0.02)	0.99	(0.05)
Ln(Savings)		0.98	(0.02)	1.05^{+}	(0.03)	1.06	(0.07)
Control Variables							
HOH's Age		1.00	(0.004)	0.98***	(0.01)	0.97	(0.02)
Country[a]	Costa Rica	1.24	(0.19)	1.29	(0.21)	9.46**	(7.03)
	Guatemala	3.15***	(0.52)	0.57*	(0.14)	0.00	(0.00)
	El Salvador	1.59*	(0.37)	0.05***	(0.02)	0.00	(0.00)
Year		NA		1.20***	(0.03)	1.01	(0.06)
Owns Land		0.83	(0.16)	0.04***	(0.01)	1.34	(0.71)
Years Since Returning from US		1.00	(0.02)	0.97	(0.05)	0.95	(0.15)
In US		1.08	(0.42)	0.67	(0.26)	0.66	(0.83)
N		517		6085		6066	
Log Likelihood		1246.80		−722.08		−140.44	

Source: Latin American Migration Project 2000–2010

Notes:

$^{+}$p<0.10;

*p<0.05;

**p<0.01;

***p<0.001

[a](Nicaragua) Country of reference

Table 5

Statistical analysis of agricultural intensification

AGRICULTURAL CHANGE TYPE		Chemicals Used		Day Laborers		Mechanized Equipment Owned	
MODEL		2-Level Logistic Regression		2-Level Poisson Regression		Logistic Regression	
		Odds Ratios	(SE)	Odds Ratios	(SE)	Odds Ratios	(SE)
Ln(Migration/Remittances)		0.99	(0.03)	1.01	(0.02)	0.96	(0.06)
Ln(Savings)		0.98	(0.04)	1.00	(0.03)	0.94	(0.08)
Control Variables							
HOH's Age		0.99	(0.01)	1.01	(0.01)	1.00	(0.01)
Country[a]	Costa Rica	0.73	(0.30)	0.47*	(0.18)	0.39**	(0.13)
	Guatemala	3.90**	(2.33)	1.18	(0.37)	0.61	(0.21)
	El Salvador	1.31	(0.73)	0.23*	(0.15)	0.88	(0.41)
Owns Land		1.62+	(0.45)	1.24	(0.41)	1.56	(0.66)
Years Since Returning from US		0.97	(0.04)	0.98	(0.02)	0.99	(0.07)
In US		1.44	(1.02)	1.95*	(0.55)	2.27	(2.18)
N		545		543		544	
Log Likelihood		−319.05		−1207.01		−193.83	

Source: Latin American Migration Project 2000–2010

Notes:

+ p<0.10;

* p<0.05;

** p<0.01

[a] (Nicaragua) Country of reference

Table 6

Statistical analysis of agricultural transition to cattle ranching

AGRICULTURAL CHANGE TYPE		Pasture Purchased		Cows Owned	
MODEL		Logistic Regression		2-Level Poisson Regression	
		Odds Ratios	(SE)	Odds Ratios	(SE)
Ln(Migration/Remittances)		1.01	(0.03)	1.00	(0.03)
Ln(Savings)		1.06***	(0.05)	1.03	(0.05)
Control Variables					
HOH's Age		0.97**	(0.01)	0.99	(0.01)
Country[a]	Costa Rica	10.25***	(4.46)	0.47	(0.36)
	Guatemala	0.77	(0.57)	0.15***	(0.08)
	El Salvador	0.00	(0.00)	1.31	(0.71)
Year		1.08+	(0.04)	NA	
Owns Land		0.14***	(0.04)	1.25	(0.47)
Owns Pasture		NA		1.59	(0.93)
Years Since Returning from US		0.45+	(0.20)	0.97	(0.05)
In US		1.66	(0.98)	1.14	(0.54)
N		6420		547	
Log Likelihood		−301.14		−5291.96	

Source: Latin American Migration Project 2000–2010

Notes:

+ p<0.10;

** p<0.01;

*** p<0.001

[a](Nicaragua) Country of reference