Abstract  Relying upon new economics of labor migration (NELM), we model Central American migrant-sending household agricultural practices given labor losses and the concomitant infusion of remittances. Under the NELM framework, we hypothesize that smallholders use remittance income to make capital improvements to their land either to increase crop production or to transition to cattle ranching. Using Latin American Migration Project data, agricultural land use change was compared among migrant and non-migrant households for Costa Rica, El Salvador, Guatemala, and Nicaragua. Results show that a rise in months spent abroad and remittances returned do not translate into a higher percentage of farm sales, intensification or transition to cattle ranching. However, evidence indicates that remittances are used to increase agricultural land holdings and to hire labor when household members are abroad.

Keywords: Migration, Remittances, Agriculture, New Economics of Labor Migration, Smallholders, Land use

Introduction

Migration has swelled to unprecedented numbers as people struggle to reconcile deficiencies in wealth, social status, personal security, and poverty (Massey et al. 1993; Adams 2004; Hecht et al. 2006). While a substantial number of migrants may have no intention of returning to their native communities—nearly 50% of Mexican migrants did not return in the 1990s (Vernez and Ronfeldt 1991; Lindstrom 1996)—for those who do return, the experiences while abroad combined with a boost in capital savings can have profound effects on migrant-sending household lifestyles. One understudied area of potential lifestyle change pertains to smallholder agriculture. In particular, how labor losses, capital accumulations and the adoption of new lifestyle ideals, and perhaps different methods of practicing agriculture, may influence how smallholders continue to manage their land. A combination of these factors may prompt shifts in agricultural land-use practices in the form of a decline in or expansion of land ownership, land intensification, a transition from row crop to livestock agriculture (or the reverse), or a combination of these.

According to the 2007/2008 Human Development Report, the percentage of Central Americans who were primarily employed in agriculture ranged from a high of 39% in Guatemala and Honduras to a low of 15% in Costa Rica in 2005 (UN 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 1995). 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 1999). Unfortunately, inadequate access to land is a major—perhaps
the largest—contributor to rural poverty in Central America (Brockett 1988; de Janvry and Sadoulet 2000; Merlet and Pommier 2000; Krvnaric 2004). To cope with the pervasive existence of rural poverty, coupled with a desire to alleviate feelings of relative deprivation (Stark and Bloom 1985; Massey et al. 1993), many smallholders have resorted to international economic migration (Durand et al. 1996; Taylor and Wyatt 1996; Taylor 1999; Adams 2004, 2005; Adams and Page 2005). In addition to poverty amelioration and as a means to reduce population pressures, rural households use economic migration to diversify income streams and to equalize perceived disparities in social status (Massey et al. 1993).

Central American migration to the U.S. increased by over 25% (from 2.0 to 2.7 million) from 2000 to 2007 (Pew Hispanic Center 2009). 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 substantially in recent decades (Durand et al. 1996; Orozco 2001). Global remittance flows more than doubled from $132 to $337 billion between 2000 and 2007 (IMF 2008). In 2006, remittances also constituted more than 10% of the GDPs of 24 developing nations including several in Central America (El Salvador—18.6%, Guatemala—10.3%, Honduras—26.6%, and Nicaragua—12.4%). Given the pervasiveness of agricultural employment in Central America, the adoption of a profound lifestyle change—sending a household member abroad to earn remittance income—could have a major influence on the extent and manner that agriculture continues to be practiced.

This investigation uses data supplied by the Latin American Migration Project (LAMP) to assess changes in agricultural practices under varying migration and remittance scenarios for four Central American countries (Costa Rica, El Salvador, Guatemala and Nicaragua). These four countries were chosen as suitable study sites because they represent the 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 (Brockett 1988). Nicaragua, the largest of the Central American countries (11% larger in land area than Guatemala), supported 13% fewer hectares of arable land in crops than Guatemala in 2007 (FAO Stats Division 2010). Central America’s colonial history and recent civil unrest have contributed to the concentration of its most valuable land in the hands of a few rich landowners. According to Brockett (1988) in the 1970s, the largest 4.0% of land holders 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. These factors combined with high population growth have resulted in the grossest inequities in land distribution in Guatemala and El Salvador, followed by Honduras, Nicaragua and Costa Rica (Brockett 1988).

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 in Central America, preventing them from 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

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1 This study uses data collected by the Latin American Migration Project (LAMP: lamp.opr.princeton.edu) in Costa Rica, Guatemala, and Nicaragua. The surveys in Nicaragua and Costa Rica were conducted in association with the Central American Population Center of the University of Costa Rica (CCP: http://ccp.ucr.ac.cr), with support from the Mellon Foundation. The LAMP is funded by the National Institute of Child Health and Human Development (NICHD).
(half from informal institutions) in 2000 (Krznaric 2004). However, unlike El Salvador and Guatemala’s failed civil uprisings, Nicaragua’s largely successful revolution led to some land redistribution in the hands of 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 more tranquil development in the last half of the 20th Century. Numerous government sponsored agricultural support programs were implemented over that time period to provide credit and price supports to farmers (Saenz-Segura 2006). Unfortunately, most of these programs largely benefited the larger landowners to the detriment of medium to smaller landholders (Cartin and Piszk 1980).

Data and Methods

To investigate the aforementioned avenues of smallholder agricultural change as predicted by NELM-informed land use theory, longitudinal and cross-sectional data collected by the LAMP between 2000 and 2007 were combined for four Central American nations (Costa Rica, El Salvador, Guatemala, and Nicaragua) and quantitatively analyzed. 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—from rural to metropolitan—but also support some level of international migration. 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 exact 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. Approximately 589 households contributed 6,256 person-years from 1990 to 2004. This investigation was conducted under the assumption that all households, even the poorest subsistence farmers are open to changing their farming practices via land expansion, intensification and/or transition to cattle ranching if sufficient remittance income is conveyed from abroad. Longitudinal data before 1986 were excluded from the analysis to control for forced migration events attributable to civil strife in El Salvador, Guatemala and Nicaragua. 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, U.S. citizens and permanent residents 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.
Remittance income reported by the LAMP comes in response to the question, “¿Cuánto mandaba al mes a su familia en…?” (How much money did you send each month to your family in…?). These reported amounts were extrapolated to the annual level and imputed for previous years when migrants were abroad. Under this method, remittance results reflect a relative difference—not an exact difference—in received remittances among households.

There are some problems and clarifications with these methods that are worth noting. First, as migrants gain experience in the receiving community, their earning potential will increase along with their ability to remit more income. Second, and counter to the first caveat, studies have shown that remittance transitions are sporadic depending upon job availability (Amuedo-Dorantes and Pozo 2006) and can drop off over time as migrants lose their connection with their sending household (Menjivar 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). Following upon the work of Massey and Parrado (1994) and Kanaiaupuni and Donato (1999) who used similar methods, we assume that remittance transfers do not decline in time because the LAMP only gathered remittance-sending information from husbands and wives.

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 their 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 think this is a major concern because, 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.

**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 including multivariate logistic regression, Poisson regression, and beta regression (see Table 1 for a summary of the models used for each statistical outcome).

| Statistical models used and definitions of dependent variables |
Multilevel models were originally tested but abandoned when found to be no more powerful than simpler single-level models. To limit the influence of outliers, the right-skewed and heteroscedastic remittance and migration length variables were transformed\(^2\) by \(\ln(y + 0.001)\).

Table 2  Definitions of independent model variables and units

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Mean/Median</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(Migration/Remittances/Savings)</td>
<td>US</td>
<td>0/5075</td>
<td>(\ln(\text{Remittances} \times \text{Years of Migration}) + \text{Savings Returned})(^a)</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOH's Age</td>
<td>years</td>
<td>49/50</td>
<td>HOH's age in current year</td>
</tr>
<tr>
<td>Year</td>
<td>year</td>
<td>2002/2003</td>
<td>Year</td>
</tr>
<tr>
<td>Country</td>
<td>0/1/2/3</td>
<td>1/1.3</td>
<td>Nicaragua (reference), Costa Rica, El Salvador, Guatemala</td>
</tr>
<tr>
<td>Owns Land</td>
<td>0/1</td>
<td>no/no</td>
<td>Currently owns land (no/yes)</td>
</tr>
</tbody>
</table>

\(^a\) Transformed by \(\ln(y + 0.001)\)

Results

Agricultural Land Expansion

As expected, a rise in remittances received by the household over time was (weakly) correlated with an increase in the odds that the household would purchase more agricultural land (Table 3). However, there was no correlation between remittances and the proportion of land farmed. This latter finding is inconsistent with a relative deprivation scenario that often accompanies NELM theory. A positive relative deprivation finding would have revealed a decline in the proportion of hectares farmed as the number of hectares increased—theory holds that households accumulate land to increase their social status but the household’s labor is best utilized in the international marketplace rather than farming landholdings (Massey et al. 1993). To further support the lack of a relative deprivation finding, we looked at one additional indicator of this effect—the improvement of one’s home\(^3\). This outcome also contradicted theory; a comparison of house types (construction materials, floor type and number of rooms) and household amenities (sewage, water, electricity, stove, refrigerator, television, and a telephone) between owners of

\(^2\) Adding a small amount (0.001) to a \(y\) value of zero ensures that these values are not lost when log-transforming the data.

\(^3\) Model results not shown but are available upon request.
land purchased with and without remittances did not show a statistically significant difference\(^4\). In combination, these indicators suggest that economic migrants did not invest remittance capital appreciably to boost social status vis-à-vis land expansion.

An additional outcome worthy of mention is the lack of a statistically significant relationship among increased remittance transfers and the odds of selling land. This indicates that farmers are reluctant to leave agriculture even when they receive large amounts of remittance income.

A few outcomes relative to the control variables are worthy of mention. Firstly, as the age of the HOH increased, the odds of that households purchasing agricultural land decreased, while households in El Salvador and Guatemala are much less likely (80 and 33 percent, respectively) to purchase land as remittance transfers increase than Nicaraguan households. The Own Land control variable was found to be highly correlated with the odds of purchasing additional land. This is consistent with findings reported by Oberai and Singh (1980) in rural Punjab, India, where only households who maintained farming operations prior to sending a family member abroad used remittances for agricultural changes; remittances did not bring newcomers to the agricultural marketplace.

### Table 3  Statistical analyses of agricultural land expansion or contraction

<table>
<thead>
<tr>
<th>AGRICULTURAL CHANGE TYPE</th>
<th>Proportion Land Cultivated</th>
<th>Land Purchased</th>
<th>Land Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta Regression (Odds Ratios)</td>
<td>Logistic Regression (Odds Ratios)</td>
<td>Logistic Regression (Odds Ratios)</td>
</tr>
<tr>
<td>Ln(Migration/Remittances/Savings)</td>
<td>1.00</td>
<td>1.02(^*)</td>
<td>1.00</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOH's Age</td>
<td>1.00</td>
<td>0.96(^***)</td>
<td>1.00</td>
</tr>
<tr>
<td>Country(^a)</td>
<td>Costa Rica: 1.17(^<em>), El Salvador: 1.61(^</em>), Guatemala: 3.08(^***)</td>
<td>0.81</td>
<td>4.25(^***)</td>
</tr>
<tr>
<td>Owns Land</td>
<td>NA</td>
<td>0.20(^***)</td>
<td>NA</td>
</tr>
<tr>
<td>N</td>
<td>537</td>
<td>2.05(^**)</td>
<td>NA</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>1269.91</td>
<td>-1278.09</td>
<td>-414.89</td>
</tr>
</tbody>
</table>

\(^*\) p<0.05; \(^**\) p<0.01; \(^***\) p<0.001  
\(^a\) (Nicaragua) Country of Reference  
\(^b\) Results not included due to collinearity

### Agricultural Intensification

Counter to expectations, increased remittance transfers did not lead to dramatic changes in the propensity to use chemical soil amendments or to own mechanized agricultural equipment (Table 4). However, a rise in remittances received was correlated with a rise in hired labor. The totality of these economic migration/intensification findings largely support the bulk of research on this subject including work performed in El Salvador, Oaxaca and Highland Ecuador. A recent study in El Salvador found no evidence that having a household member abroad the previous year or

\(^4\) None of the ten variables included in the logistic regression model for this comparison were found to be significant.
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 Rodriquez 2005). While, 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, partially supportive and partially contradictory to our findings, Gray’s (2009) study in Highland Ecuador found smallholder farmers to increase labor hires and to use more chemical inputs as remittances received from abroad increased.

A drawback 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 do not know if households increased their use of these inputs in response to a rise in remittances. However, we can reasonably conclude that economic migration is not inducing the bulk of smallholder farmers to adopt their use.

**Table 4** Statistical analysis of agricultural intensification

<table>
<thead>
<tr>
<th>AGRICULTURAL CHANGE TYPE</th>
<th>Chemicals Used</th>
<th>Day Laborers</th>
<th>Mechanized Equipment Owned</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Logistic Regression (Odds Ratios)</td>
<td>Poisson Regression (Odds Ratios)</td>
<td>Logistic Regression (Odds Ratios)</td>
</tr>
<tr>
<td>Ln(Migration/Remittances/Savings)</td>
<td>1.00</td>
<td>1.03*</td>
<td>0.95</td>
</tr>
<tr>
<td>Control Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOH’s Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costa Rica</td>
<td>0.99</td>
<td>1.01</td>
<td>1.00</td>
</tr>
<tr>
<td>El Salvador</td>
<td>1.16</td>
<td>0.33***</td>
<td>0.39**</td>
</tr>
<tr>
<td>Guatemala</td>
<td>3.78***</td>
<td>0.29***</td>
<td>0.66</td>
</tr>
<tr>
<td>N</td>
<td>562</td>
<td>563</td>
<td>563</td>
</tr>
</tbody>
</table>

Log Likelihood: -344.41 -862.63 -201.67

** a (Nicaragua) Country of Reference

** p<0.01; *** p<0.001

Agricultural Transition to Cattle Ranching

Also counter to expectations, an increase in remittance transfers was not found to be significantly correlated with pasture purchases or cattle ownership (Table 5). These results are inconsistent with recent research conducted in Albania but largely consistent with recent findings in El Salvador regarding the impact of migration and remittances on livestock production. Two studies in Albania report that international migration is positively associated with increased investment in livestock (Miluka et al. 2007) 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.

**Table 5** Statistical analysis of agricultural transition to cattle ranching
Country-level Differences

The great disparity in correlations between the country-level variables and the numerous dependent variables are noteworthy. Keeping in mind that Nicaragua was the country of reference from which the following comparisons pertain, farmers in Costa Rica, El Salvador and Guatemala were more likely to have a higher proportion of their land in cultivation (Guatemalan especially) and less likely to purchase land with a rise in remitted income (El Salvador and Guatemala results significant). Regarding land sales, Costa Rican farmers were much more inclined to sell their land while El Salvadorans and Guatemalans were less likely to sell their land compared with Nicaraguan farmers. For specific intensification methods, El Salvadorans were much more likely to use chemical soil amendments but less likely to hire labor than Nicaraguans while Costa Rican farmers were also less likely to hire additional labor or to own mechanized equipment than Nicaraguan farmers. Lastly, Costa Ricans were more likely to purchase pasture land than Nicaraguans but less likely to own cattle while El Salvadorans and Guatemalans were less likely to own cattle compared with Nicaraguans.

These country variable differences are likely due to a long and disparate history of rural poverty and violence that can be attributed to gross inequities in income and land apportionment amongst Central American countries. The fact that El Salvadorans and Guatemalans are less likely to purchase or sell farmland but farm a greater proportion of the land they own, when compared with Nicaraguans, is consistent with their historically high rates of inequity compared with other Central America countries (Brockett 1988; Southgate and Basterrechea 1992). El Salvador, Guatemala and Nicaragua do share similar neocolonial development histories, a recent

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5 Land sale results were not included for El Salvadoran households due to collinearity—the LAMP reported no agricultural land sales by El Salvadoran households.
history of internal civil conflict and high rates of rural poverty\textsuperscript{6}. However, El Salvador and Guatemala’s higher rural population densities\textsuperscript{7} combined with their government’s violent repression of popular uprisings in the rural countryside in recent decades (Haggarty 1988; Morrison 1993) and Guatemala’s enduring legacy of ethnic discrimination (Manz 2004), have contributed to a paucity of affordable agricultural land. 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 high rate of pasture purchases but fewer cows owned compared with Nicaragua are worthy of mention. According to Carr et al. (2009), between 1961 to 1981, the percentage of Costa Rican pasture as a portion of total land more than doubled from 18 to 41%—primarily a forest to pasture phenomenon. Such a substantial loss of primary forest land in a relatively short period of time was a major contributing factor to Costa Rica’s decision to place large proportions of its remaining forests in protected status—national parks and protected areas—starting in the 1980s. Since that time, pasture conversions have crept upward, primarily resulting from a decline in farmland rather than forestland.

Why do Costa Rican farmers own fewer cattle on average than Nicaraguan farmers considering that they have a higher probability of purchasing pasture and a high percentage of Costa Rica’s total land area is devoted to pasture (46% in 2001 according to Carr et al. 2009)? The probable reason is that the median size of Nicaragua’s cattle ranches captured by the LAMP survey is 17 times larger than Costa Rica’s, 32 hectares versus 2 hectares. Another contributing factor is that Nicaragua has had a much longer history of widespread pasture ownership. In 1961, 32% of Nicaragua’s relatively vast land area was in pasture compared with only 18% of Costa Rica’s land area (Carr et al. 2009). Furthermore, between 1961 and 2001, Nicaragua also had a jump in land conversion to pasture equaling Costa Rica’s 41% of total land devoted to pasture in 1981 but dropping to 40% by 2001.

\textsuperscript{6} El Salvador 60% (Delgado and Salgado 2009), Guatemala 75% (de Janvry and Sadoulet 2000) and Nicaragua 76% (Corral and Reardon 2001)

\textsuperscript{7} 498, 458 and 69 individuals per square kilometer of arable land in El Salvador, Guatemala and Nicaragua respectively in 1996 (World Bank 1999).
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