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ABSTRACT

Who Remits? The Case of Nicaragua

In this paper I use a unique data set from Nicaragua to assess the behavior of persons who send money back home. I estimate a heteroskedastic Tobit with a known form of variance to estimate the correlation of the remitting decisions of migrants. Working, residing in a developed country and belonging to the nuclear family positively affect remittances. The labor status and the level of education of the head of the household both affect remittances. The decision to participate in the remitting process appears to be positively related across migrants within the same receiving household.

JEL Classification: F22, J61, O15

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INTRODUCTION AND MOTIVATION

International estimates of official remittances flows suggest that total remittances averaged around US\$ 59 billion per year during the 1990s¹ (World Bank). Figure 1 ranks the first 20 developing country recipients of workers' remittances by size of remittances received in 2001.

Out of the first 20 developing countries receiving remittances six are from Central and South America with a total of US\$ 18.5 billion. In some countries remittances constitute a significant share of gross domestic product (GDP). Figure 2 ranks the first 20 developing country recipients of workers' remittances by percentage of their GDP.

Remittances constitute more than 10% of the GDP in twelve developing countries. In Nicaragua, the poorest country in the Western Hemisphere (World Bank Website www.worldbank.org/ni), remittances constitute around 16% of its GDP, the fifth highest percentage among the developing country recipients of workers' remittances in 2001.

The growing importance of these transfers of money has produced a number of studies to explore their dimensions, determinants, effects and the government policies designed to influence them. Migrant remittances affect the performance of the economy. Glytsos (2002) shows that remittances have the potential to substitute for foreign aid. Chami *et al.* (2003) find that remitting takes place under asymmetric information and imply that remittances have a negative impact on economic growth. Amuedo-Dorantes and Pozo (2004) find that workers' remittances can reduce the international competitiveness of the receiving countries' export sector by appreciating the real exchange rate in the receiving economies. Remittances also impact the behavior at the household level. Funkhouser (1992) finds opposite effects of remittances inflows on the Nicaraguan and Salvadorian labor markets. Edwards and Ureta (2003) find that remittances have a large effect on school retention. All these studies stress on better understanding the remittance behavior in order to develop economic policies that take full advantage of these flows.

In this study I use a unique data set from Nicaragua to assess the characteristics of the individuals who remit. I have information on the sender and the receiver from the same source. I estimate a heteroskedastic Tobit with a known form of heteroskedasticity which allows me to examine the correlation

¹ Most estimates of remittances are based on the balance of payments statistics reported to the International Monetary Fund (IMF). Note that these numbers are generally an underestimate of the actual remittances since they only include the official flows of this money into the receiving countries.

of the remitting decisions of migrants in the same original receiving household². The main contribution of this paper is the ability to quantify the correlation of the remitting decisions between migrants who belong to the same receiving household. The ability to measure this relationship is crucial since it allows further understanding of how intra-family decisions are made regarding the allocation of resources across households that are separated by migration. The knowledge of the mechanism of intra-family remitting decisions shed light on the indirect outcomes of remittance policies. I believe this is the first paper to address this issue. This paper also adds to the remittance literature in computing changes in both the likelihood of remitting and the amount remitted.

Gender, labor force status, and destination of the migrant all have significant effects on remittances. The relationship of the migrant to the head of the household also affects the remitting behavior. The labor status and the level of education of the head of the receiving household influence the migrant's decision to participate in the remitting behavior. Evidence suggests that there is a positive correlation between migrants' remitting decisions among migrants belonging to the same receiving household.

The section below provides an overview of the existing literature. The following section consists of a theoretical model. I then describe the data and the methodology followed by the results. The last section summarizes and concludes.

LITERATURE REVIEW

Lucas and Stark (1985) discuss several hypotheses for motivations to remit. The authors present three reasons for remitting ranging from pure altruism to pure self-interest spanning a more tempered point of view combining these two extremes. Lucas and Stark explore these concepts using data from the National Migration Study of Botswana. Remittances are determined partly by the earnings of the migrant and partly by his years of schooling. Lucas and Stark also note a positive trend between these flows of money and per capita income of the household.

Oberai and Singh (1980) using a household survey in the Ludhiana district of the Indian Punjab report a positive relation between low income migrant and the probability of remittances and a negative

² In this paper the receiving household is the original household in Nicaragua which reported at least one migrant living abroad.

correlation between the number of household members working and this same likelihood. In addition, the authors find that the level of education does not affect the decision whether or not to remit.

Based on a nationwide survey of households in Kenya, Knowles and Anker (1981) present empirical evidence on issues related to remittances. The authors first stress that remittances are primarily limited to members of the nuclear family. Moreover they conclude that migrant's income of the sending unit, education level, sex, ownership of a house back home and the fact of a spouse residing away all positively affect the probability to remit. Knowles and Anker add that the length of time a migrant has resided away negatively affect these chances. Also migrant's schooling and income negatively influence the level of remittances.

Funkhouser (1995) uses data from El Salvador and Nicaragua to investigate and compare the determinants of remittances in both countries. Funkhouser applies a separable utility function that values both absentee's utility and the household utility. The author also follows a linear functional form in estimating remittances. Funkhouser presents fairly similar findings for El Salvador and Nicaragua. In both countries education is negatively related to the probability of remittances while it is positively associated to the level of these money transfers. Using the Salvadoran data Funkhouser notes that age and gender do not affect the likelihood and the level of remittances. In Nicaragua, age is adversely correlated with both the probability and the amount of remittances. Furthermore, Funkhouser examines familial relationship and the period of time spent abroad and their effects on remittances.

Rodriguez (1996) uses a data set from the Philippines to note a positive connection between the age of the migrant, time since migration and the chance of remitting. However, equally to Knowles and Anker this incidence decreases for long absences. Rodriguez also remarks that being a member of the nuclear family increases the probability of remitting. Similarly to Oberai and Singh, Rodriguez does not find a clear association relating education to remittances.

Lianos (1997) focuses on the remittances to Greece from Germany for a period of 30 years. Lianos tests the significance of a set of factors in terms of their effects on remittances. The author finds that the level of migrant's income has a positive and major effect on remittances to Greece. Lianos also calculates the elasticity of remittances with respect to income. This elasticity is greater than one suggesting a large

response of remittances for any small change in income. Furthermore, Lianos finds that household income in the country of origin does not significantly influence the level of remittances.

Clearly, the empirical evidence on the determinants of remittances is inconclusive. I summarize these findings in table 1.

Both Oberai and Singh (1980) and Rodriguez (1996) find that education and remittances are not related. Lucas and Stark (1985) along with Knowles and Anker (1981) find a relationship between these two even though they do not agree on its direction. In addition, Lianos (1997) finds that household income is uncorrelated with remittances while Lucas and Stark (1985) document a positive correlation. These results support a need for more empirical studies on the determinants of remittances. The following section outlines a theoretical model of remittance behavior.

MODEL

This paper builds on the model in Funkhouser (1995). A model of remittance behavior considers an emigrant's utility that is a function of his own utility and that of the receiving household in the home country. I assume a separable utility function given by:

$$U(U_{ij}; U_j) = U_{ij}(C_{ij}) + V\{U_j(C_j), Z_j\} \quad (1)$$

where $U'_{ij} > 0; U'_j > 0; U''_{ij} < 0$ and $U''_j < 0$; i refers to a particular migrant and j refers to a specific receiving household, U_{ij} is emigrant i own utility which depends on consumption C_{ij} , U_j refers to the receiving household j utility which depends on its consumption C_j and Z_j defines a vector that includes the receiving household characteristics.

The emigrant maximizes a separable lifetime utility function such as:

$$\text{Max}_{R_{ijt}} U = \sum_t U_{ij} \{C_{ijt}\} (1/(1+\sigma_u)^t) + V\{U_j(Y_{jt} + R_{ijt} + N_{jt}\bar{R}_t), Z_j\} (1/(1+\sigma_v)^t) \quad (2)$$

subject to

$$C_{ijt} + R_{ijt} = I_{ijt} \quad (3a)$$

$$I_{ijt} = \beta_0 + X_{ijt}\beta_1 + \varepsilon_{ijt} \quad (3b)$$

where C_{ijt} is emigrant's consumption at time t , Y_{jt} is household income earned by receiving household j in the native country at time t , R_{ijt} refers to remittances received by the receiving household j from migrant i at time t , N_{jt} identifies the number of other household emigrants at time t , $\bar{R}_{jt}$ quantifies the average remittances per other emigrant at time t , I_{ijt} is the income of the emigrant i at time t , X_{ijt} describes a vector of emigrant's characteristics at time t , $(1/(1+\sigma_u)^t)$ is a discount rate applied to emigrant utility function, and $(1/(1+\sigma_v)^t)$ is a discount rate applied to the receiving household utility function.

Solving this maximization problem leads to the first order condition for a positive level of remittances at time t :

$$-(U'_{ij})[1/(1+\sigma_u)]^t dR + \partial V / \partial U_j (U'_j)[1/(1+\sigma_v)]^t dR = 0 \quad (4)$$

Solving for the level of remittances yields an implicit remittance equation

$$R_{ijt}^* = R(\sigma_u, \sigma_v, X_{ijt}, Y_{jt}, N_{jt}, \bar{R}_{jt}) \quad (5)$$

In a censored regression model equation (5) determines both the probability of remitting and the level of remittances. I use a linear functional form given by:

$$R^* = \alpha + \beta X + \pi Z + u \quad (6)$$

in which X is a vector that includes emigrants' characteristics, Z is a vector that consists of household characteristics in the recipient country; and u is a normally distributed error term $u \sim N(0, \sigma^2)$. The objective of exploring the determinants of remittances lies in estimating equation (6). The domain of the dependent variable is censored since the observed remittances are never negative. Remittances are zero for a large number of observations. I rewrite equation (6) to explicitly illustrate this:

$$R_{ij} = \begin{cases} \alpha + \beta X_{ij} + \pi Z_j + u_{ij} & \text{if and only if } \alpha + \beta X_{ij} + \pi Z_j + u_{ij} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (7)$$

such that $i = 1, \dots, k_j$; $j = 1, \dots, J$ and k_j is the total number of migrants in household j and J is the total number of receiving households.

In a nutshell, to explore the determinants of remittances I need to estimate equation (6).

Ordinary least squares (OLS) yield biased estimates because of the nature of the dependent variable. Two alternative approaches are usually adopted to estimate equation (6). The first one is a Heckman (1979) two-step procedure. This method requires that the decision to remit is a two-step decision: the likelihood of remitting and the level of remittances. The second approach is a censored Tobit model. This model assumes that the decision to remit is a one-step decision and therefore requires that all determinants have the same sign effect on the likelihood and the level of remittances. In this paper the second approach is dictated by equation (5) since it determines both the probability of remitting and the level of remittances.

DATA AND ESTIMATION METHOD

Data

The data set is from the 2001 Nicaraguan Encuesta Nacional de Hogares sobre Medición de Niveles de Vida (EMNV). This is a nationally representative survey that was administered by the Nicaraguan Institute for Statistics and Census. The national living standards measurement survey (LSMS) was established by the World Bank in 1980. The LSMS collects data on many dimensions of the household well-being including consumption, income, employment, education and migration. The data set contains 4001 households including 22,810 household members. The survey was administered in 2001. Receiving household members were asked about their age, education, property, income, occupation, businesses and any agricultural activities. This survey includes a remittances model where a knowledgeable member of the receiving household was asked about other household members who do not live in the household. All the information about emigrants is extracted from their primary receiving household. I have information on their destination, labor force status, age, education, their relationship to the head of the main household and also their year of migration. The remittances module documents 897 migrants in total.

I have information on the sender and the recipient from the same source, the original receiving household. One contribution of this paper is that I am able to track information on both sides of the remittance behavior from the same source. This ability to identify each individual allows me to further understand how intra-family decisions are made regarding the allocation of resources across households that are separated by the migration of some of its members (Menjívar, 1995).

However even with this data set I can only precisely recognize the decision to remit of migrants. I cannot identify the exact amount of remittances sent by each migrant³. This lack of information causes a problem since I cannot identify the exact amount remitted by each migrant. To avoid this problem I separate migrants into three categories based on their decision to participate in the remitting process. The first category includes migrants who do not remit such that their remittances are zero. The second category has migrants who remit but also who belong to households with only one migrant remitting ($s_j = 1$ where s_j is the number of remitting migrants in household j). Again I know the exact amount that these migrants are sending. The third category consists of migrants who remit and who belong to multiple remitting migrants' households ($s_j > 1$). In this last category I do not observe the exact amount of remittances for each migrant remitting. I average the total amount of remittances received by the original household on all the migrants who remit. The following subsection explains in details the estimation method.

Estimation Method

I re-write equation (6) as the following:

$$R_{ij} = \alpha + \beta X_{ij} + \pi Z_j + u_{ij} \quad (8)$$

I take the average of equation (8) by summing over migrants who are remitting within each receiving household with multiple migrants remitting and then dividing by s_j . This leads to equation (9) which, hereafter, I refer to as the average model:

$$\frac{1}{s_j} \sum_{i=1}^{s_j} R_{ij} = \frac{1}{s_j} R_j = \alpha + \frac{1}{s_j} \beta \sum_{i=1}^{s_j} X_{ij} + \pi Z_j + \frac{1}{s_j} \sum_{i=1}^{s_j} u_{ij} \quad (9)$$

where R_j is the total amount of remittances received by household j from all remitting migrants belonging to household j and s_j is the number of migrants who remit in household j . If the number of remitting migrants s_j is either zero or one then the model follows equation (8). Otherwise the model is

³ A knowledgeable member of the receiving household was asked whether migrant i remits or not. The same member was also asked about the monetary value of remittances that the household received in the last 12 months.

defined by equation (9). Also, since $u_{ij} \sim N(0, \sigma^2)$ then the new error term $e_j = \frac{1}{s_j} \sum_{i=1}^{s_j} u_{ij}$ is not homoskedastic with $e_j \sim N(0, \sigma_j^2)$. Therefore, equation (9) defines a heteroskedastic Tobit with a known form of heteroskedasticity. In fact:

$$Var(e_j) = Var\left(\frac{1}{s_j} \sum_{i=1}^{s_j} u_{ij}\right) = Var\left(\frac{1}{s_j} (u_{1j} + u_{2j} + u_{3j} + \dots + u_{s_j j})\right) \quad (10)$$

Equation (10) holds for all households and can be rewritten as:

$$Var(e_j) = \frac{1}{s_j} (\text{cov}(u_{ij}; u_{ij})) + \frac{1}{s_j} (s_j - 1) (\text{cov}(u_{ij}; u_{sj})) = \frac{1}{s_j} \sigma^2 (1 + (s_j - 1)\rho) = \sigma_j^2 \quad (11)$$

where s is a migrant other than migrant i in household j , $\text{cov}(u_{ij}; u_{ij}) = Var(u_{ij}) = \sigma^2$,

$\text{cov}(u_{ij}; u_{sj}) = \sigma_j$ and $\text{corr}(u_{ij}; u_{sj}) = \frac{\text{cov}(u_{ij}; u_{sj})}{std(u_{ij}) * std(u_{sj})} = \rho$. The variance of the new error term is a

function of the variance of the original model in equation (8), the number of remitting migrants within a household and the correlation of the error terms of different remitting migrants who belong to the same receiving household.

The correlation coefficient ρ measures the correlation between u_{ij} and u_{sj} ⁴. A positive ρ suggests that if migrant i remits then migrant s also remits and both remittances amounts move in the same direction. This suggests some competition between migrants within the same receiving household. A less aggressive hypothesis proposes that migrants coming from the same receiving household share the same background and behave in a similar manner. If migrant i sees a need to remit then migrant s sees the same need and also remits and the latter is conditional on their abilities to remit. A negative ρ implies a negative relationship between the error terms of the remitting migrants in the same household. This indirect connection defines a crowding out effect. The fact that migrant i is remitting discourages other migrants in the same receiving household from remitting. This negative relationship might also represent an

⁴ The following condition $\rho > \frac{-1}{s_j - 1}$ applies for $s_j \geq 2$ to insure a positive variance.

ex-ante agreement on the remitting behavior between all migrants within the same receiving household⁵. Both of these cases indicate that remitting decisions among migrants belonging to the same receiving household are interdependent. Finally, if ρ is equal to zero then migrants' decisions to participate in the remitting process are independent.

The coefficients in equations (8) and (9) α , β and π , are the same as the coefficients in equation (6) which insure the same interpretation of the results. I estimate the average model using maximum

likelihood estimation. The likelihood function $L_j = \sum_{i=1}^{k_j} \ln L_{ij}$ for the average model is the following:

$$\ln L_{ij} = \ln[1 - \Phi(X' \gamma)] = \ln[1 - \Phi(X' \beta * \theta)] \quad \text{if } s_j = 0 \quad (12)$$

$$\ln L_{ij} = 0.5 * \left[\ln(\theta^2) - (\theta R_{ij} - X' \gamma)^2 \right] \quad \text{if } s_j = 1 \quad (13)$$

$$\ln L_{ij} = 0.5 * \left[\ln \left(\frac{\theta^2}{h_j + \rho(1 - h_j)} \right) - \frac{1}{h_j + \rho(1 - h_j)} (\theta R_{ij} - X' \gamma)^2 \right] \quad \text{if } s_j > 1 \quad (14)$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function and $\gamma = \frac{\beta}{\sigma}$; $\theta = \frac{1}{\sigma}$ ⁶. I maximize

L_j with respect to γ ; θ and ρ . In the following subsection I describe the data.

Descriptive Statistics

Table 2 presents a comparison of characteristics between emigrants and native population. Migrant are twice likely to be in their 20s relative to native population. Emigrants tend to be male and more educated and the households they left behind are more likely to reside in urban areas⁷.

The average number of years since migration is roughly six years. The proportion of migrants remitting is 54% and the mean remittance is around US\$ 40 per month⁸. The average amount of remittances is similar in magnitude to what Funkhouser (1995) found.

⁵ A positive correlation coefficient can also signal an ex-ante agreement where migrants have agreed on a remitting schedule.

⁶ The likelihood function for the third case ($s_j > 1$) is derived from the likelihood function of the second case ($s_j = 1$) with

$$\gamma_j = \frac{\beta}{\sigma_j}; \theta_j = \frac{1}{\sigma_j}; \sigma_j = \sigma(h_j + \rho(1 - h_j))^{0.5} \text{ and } h_j = \frac{1}{s_j}.$$

⁷ There is no significant difference in the years of education between different migrants who belong to the same receiving household.

⁸ I use 13.44 Nicaraguan Cordobas for one 2001 US\$ as an exchange rate from the Banco Central de Nicaragua.

Table 3 presents characteristics of emigrants by destination. The main two destinations for Nicaraguan migrants are Costa Rica and The United States. Costa Rica accounts for 58% share of the Nicaraguan emigrants. The United States accounts for 28%. In table 3 I define two main subsets of destinations and include all the developing countries under developing and all the developed countries under developed⁹. Nicaraguan emigrants' characteristics in developing countries are different from those in developed countries for gender composition. Emigrants in developing countries come from different regions, are less educated and tend to be more in their 20s compared to those in developed countries. The highest proportion of remitting is by emigrants in developed countries with a 68%. The proportion of emigrants remitting in developing countries is less than 50%. As expected, the average amount remitted per month is higher for migrants living in developed countries. This figure is also higher than the mean of the total sample. This is hardly surprising because in general developed countries offer higher standards of living, higher wages and stronger currency denominations than any other developing country. Living in the U.S. or Canada for example gives emigrants a stronger remitting power which translates into higher levels of remittances.

I also stress on the significant difference between the mean years since migration. One plausible explanation is that countries like the U.S. and Canada signal long term migration intentions due to availability of opportunities and more stable economies¹⁰.

In the following I restrict the sample size to emigrants older than 13¹¹. Table 4 describes the proportion of migrants remitting by relationship to the head of the receiving household and by groups of migrants. A large portion of emigrants are the offspring of the head of the household. Only about 5.2% of the emigrants are spouses of the head of the household. Siblings to the head of the household form approximately 10% of the total number of emigrants. These groups are ranked by the closeness of the relationship between the migrant and the head of the household from closest to farthest. This ranking also coincides with the ranking of the fraction of emigrants remitting except for the last group, not related,

⁹ For a complete list of countries please refer to table 3.

¹⁰ Migrants who belong to the same multiple migrant household seem to share the same destination country since 80 percent of receiving households report all their migrants living in the same country.

¹¹ I limit the sample of emigrants in the household to those emigrants older than 13 because the minimum age for employment in the two most popular destinations for Nicaraguan emigrants is 15 in Costa Rica (The Costa Rican Constitution and The Labor Code) and 14 in the United States (Fair Labor Standards Act).

where I note a surprising 58% remitting. I suppose either a strong friendship or some investment opportunities behind this high proportion.

Table 4 also separates the emigrant population into four subgroups. Approximately 80% of emigrants have a job. Around 64% of the working emigrants send money back home. As expected the proportion of students remitting is 30% much smaller than those migrants working.

In table 5 I discuss the characteristics of the receiving households by number of remitting emigrants per household. Out of 495 households that have at least one migrant living abroad, 41% have at least one migrant remitting. It seems that there is a negative relationship between the number of remitting migrants and the percentage of working head of households. The next section presents the results.

RESULTS

In this section I discuss the set of independent variables that form X and Z in equation (6). At the remitting decision stage a migrant's individual characteristics play a major role. I include migrants' age, gender, level of schooling, employment status, destination, years living abroad and the relationship to the head of the receiving household. Likewise I expect the receiving household's attributes to have an effect on the migrant's remitting decisions. I include the receiving household area of residence, the labor status and the years of education of the head of the household.

Table 6 outline three model specifications with different subset of independent variables for the average model presented in section 4. Column (1) shows the maximum likelihood estimates of a heteroskedastic Tobit on both emigrant and receiving household characteristics. Column (2) includes a set of emigrant's characteristics while column (3) includes the receiving household's characteristics¹². Migrant's gender, the labor force status, destination and the relationship to the head of the receiving household all significantly affect the remitting behavior. The education level and the labor status of the head of the household also affect the remitting process¹³.

¹² A list of definitions and descriptive statistics of the variables is in appendix B. All the independent variables are in discrete form. The dependent variable is the logarithm of monthly remittances measured in 2001 U.S. dollars.

¹³ The variables of migrant education and years since migration are defined around their median which is four years. The variable of head of household education is defined around four for comparison purpose with the migrant education variable (the median is three for this variable).

One of the contributions of this paper is quantifying the results. Table 7 decomposes the heteroskedastic Tobit coefficients into two effects: a change in the probability of remitting and a percentage change in the amount remitted.

Male migrants are less likely to remit. The probability of remitting decreases by around 7% for male migrants. These findings strengthen the belief of gender differences in the remitting behavior. Migrants who have a job are 32% more likely to remit than those who are not working. Also the percentage change in the level of remittances is a large increase of 77% for working migrants. Living in the U.S. or Canada increases both the probability (18%) and the percentage change in the amount of remittances (44%). The labor status and the destination of the migrant seem to have a significant role in the remitting behavior for Nicaraguans. Together they shape the remitting ability of migrants.

The probability and amount of remittances increase for migrants belonging to the nuclear family. The increase in the probability and the amount is the largest for the migrants who are the spouse or the parent (29% to 22% for the probability and 71% to 54% for the change in the amount) compared to migrants who are the child of the head of the household (12% to 30%). The difference in these magnitudes is most likely explained by the responsibility that spouses and parents share toward the receiving household. Spouses and parents share the responsibility of providing for the receiving household while this responsibility is not that evident for child migrants. Also the large difference of the percent change in the amount between a migrant spouse and a migrant parent strengthens this hypothesis since it also illustrates the difference between the roles of parents and spouses (Menjivar *et al.*, 1998:104).

From the household characteristics, the likelihood of remitting and the percentage change in the amount remitted decrease for migrants belonging to a receiving household with a head of household who reports less than four years of education (10% and 25% respectively). The same results apply for receiving households with a working head (14% and 33% respectively). A working head of the receiving household signals a stable source of income and possibly less need for financial help.

The main contribution of the paper is quantifying the interaction among remitters within the same receiving household. Social interactions and decision making are topics of huge interests for economists. In fact, the literature on the interaction among members of the same household is extensive (see, for example, Becker, 1974; Bergstorm, 1989). However, no paper has extended this literature into the theory of migrant

remittance behavior. I measure the remittance behavior between migrants belonging to the same household. The correlation coefficient ρ is positive for all three regressions. This coefficient is significantly different from zero at the 5% significance level and is around 0.39 for two of the three regressions. In order to measure ρ with more precision I re-estimate the average model with fewer controls. Table 8 present six different specifications. For instance, column A includes the labor status of the migrant while column B represents the average model controlling for migrant's destination.

The correlation coefficient is significant at the 1 percent significance level for five of the six cases and in all these cases the estimates of ρ are greater than the ones presented in table 6. Column F includes no controls and estimates ρ to be around 0.47. I refer to this value as the benchmark value¹⁴.

The remitting decision of migrant i seems to be directly related to the remitting decision of migrant s taken into consideration that both migrants belong to the same receiving household¹⁵. One can say that migrants within the same receiving households compete through remittances. If migrant i remit then migrant s remits and remits more. Migrants compete to get the attention of the receiving household.

Another hypothesis proposes that migrants belonging to the same receiving household share the same background and therefore behave in the same manner. For instance, if migrant i sees a need to remit then s sees the same need and also remits. Also one can think of an ex-ante agreement hypothesis between migrants. Migrants agree on a predetermined schedule of remitting.

The relationship of the migrant to the head of the receiving household is not necessarily the same for all migrants. The difference in the relationship to the head of the household can define a different association with the receiving household and therefore a different approach towards remitting. I test this suggestion by pooling on all migrants who are children of the head of the household. Migrants who are children of the head of the household represent the largest group of emigrants.

¹⁴ Note that this model allows me to calculate the homoskedastic variance of the original model. From table 8 column F I find that θ is equal to 0.322 which means that σ^2 is around 9.64.

¹⁵ Moreover, tables C.1 through C.3 in the appendix provide the normal form for a supposed game between migrants within the same receiving household. Again evidence suggests that there is a positive relationship between the migrants remitting decisions in the same receiving household. Close to 80% of migrants who belong to two migrants' receiving households share the same strategy concerning remitting. For households with three and four migrants this number goes down to 46.4% and 55.5% but is still the dominant habit.

Table 9 illustrates four equations with different sub-samples and no controls¹⁶. The first column includes migrants who are the children of the head of the household. The other columns add more restrictions on the children sample by labor status and destination. The correlation coefficient estimates do not differ much from the benchmark value except for the migrants who are children and living in Costa Rica. The estimate of ρ captures the highest correlation (0.70) in the remitting decisions among migrants living in Costa Rica and who are siblings. The high correlation estimate might be explained by the fact that many Nicaraguans migrate to Costa Rica to work in the coffee harvest and share the same remitting behavior.

CONCLUSION

In recent years remittances have gained international spotlight. Migrant remittances can affect the performance of the economy as a whole and can also impact the behavior at the household level. One way to develop economic policies that take full advantage of these money flows is to understand the remitting behavior.

This paper examines the remitting behavior of Nicaraguans. It presents three main contributions: using a rich data set, quantifying the correlation of the remitting decisions and calculating the changes in the likelihood and amount of remittances. I use a rich data set where I have information on the sender and the receiver from the same source. I estimate a heteroskedastic Tobit with a known form of heteroskedasticity to capture both the probability of remitting and the levels of remittances. Gender, labor force status and destination of the migrant along with the nuclear family all have significant effects on the remitting behavior. The labor force status and the education level of the head of the receiving household influence the migrant's decision to participate in the remitting behavior.

From policy perspective, it seems that foreign migration policies are likely to have significant effects on remittances to Nicaragua since these policies are likely to affect the destination of Nicaraguan migrants. Also any economic shocks in the destination countries affect the remittance process in Nicaragua by affecting the labor status of the Nicaraguan migrant. On the other hand, domestic policies that affect the composition of the emigrant pool through gender, receiving household characteristics and even the

¹⁶ An attempt was made to classify the relationships between migrants themselves based on the relationship to the head of the receiving household. This attempt leads to inaccurate classifications since I cannot exactly observe the link between multiple migrants.

relationship of the migrant to the head of the household are also likely to affect the amount of remittances sent back to Nicaragua.

In addition, migrants belonging to the same receiving household seem to make decisions concerning remittances in accordance with other migrants in the same household. I find evidence supporting a positive correlation between migrants' remitting decisions. For policy makers this is of great significance. Remittance policies that directly target particular migrants are also expected to affect the remittance decisions of other migrants belonging to the same receiving household. The full effect of such policies can be separated into direct effect through the main policy objective and an indirect effect through the significant correlation between the remitting decisions.

Also, this direct correlation introduces a set of hypotheses on the remitting decisions. Migrants within the same receiving household might be competing, behaving in the same manner based on their shared background or simply implementing an ex-ante agreement. It is not very clear from the results in this paper which model of household behavior is supported (collective versus unitary) (Browning and Chiappori, 1998). Also it is not obvious whether the remitting decisions of migrants belonging to the same receiving household should be modeled as a cooperative process (ex-ante agreement). More evidence from other data sets is needed in order to investigate this set of hypotheses. This approach forms the next step in this line of research.

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Figure 1. Top 20 Developing-Country Recipients of Workers' Remittances by Size of Remittances

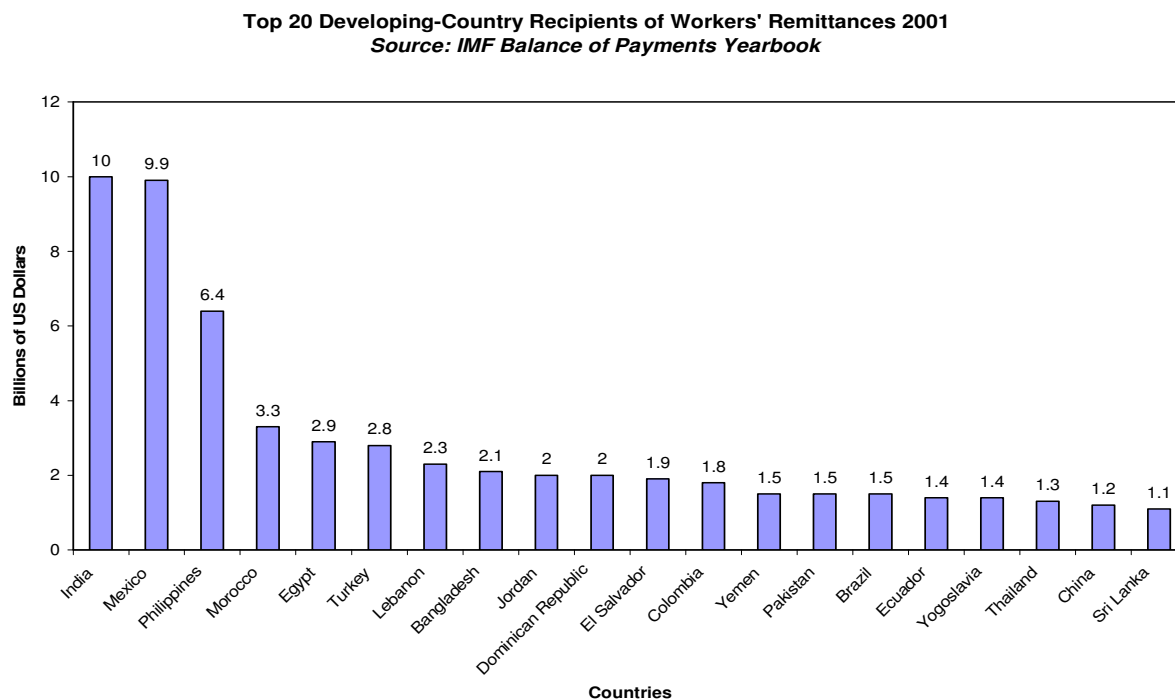


Figure 2. Top 20 Developing-Country Recipients of Workers' Remittances by Percentage of GDP

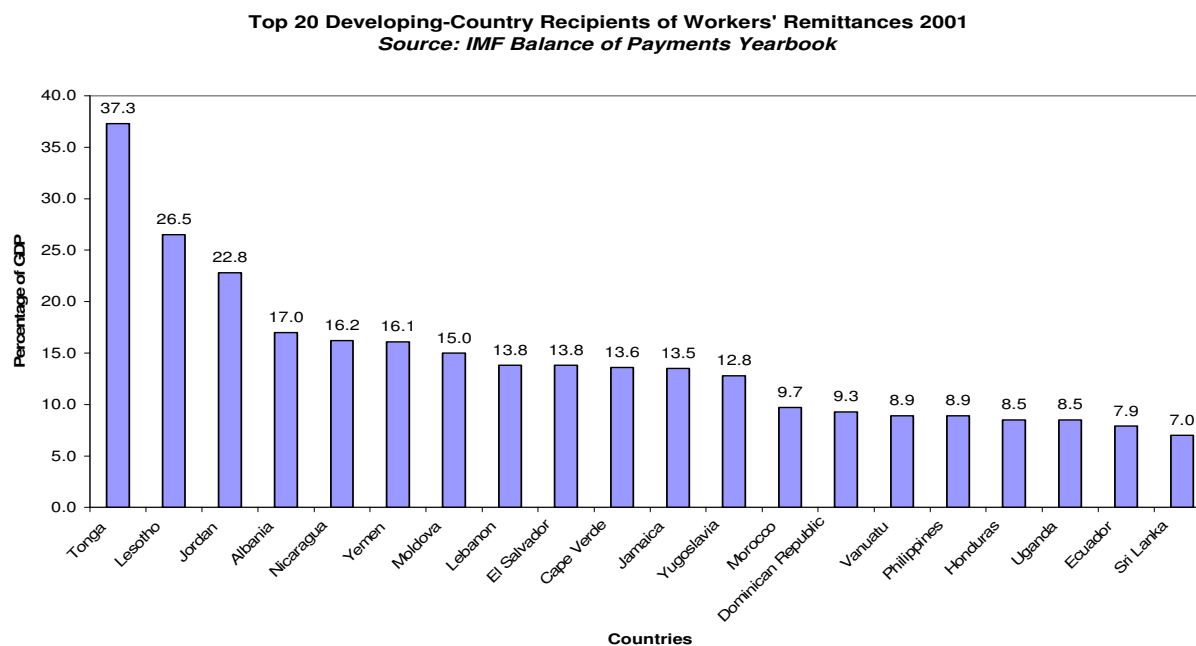


TABLE 1
SUMMARY OF THE LITERATURE FINDINGS

Authors	Data	Findings
Oberai and Singh (1980)	Rural Household Survey ¹⁷ in the Ludhiana District of the Indian Punjab (March – April 1977)	Years of schooling do not affect both the prob. and the level of remittances. Migrant's income has a positive effect on the probability of remittances. The number of HH ¹⁸ members working negatively affects this likelihood.
Knowles and Anker (1981)	Household Survey ¹⁹ in Kenya (December 1974)	Male gender and years of schooling have a positive effect on the probability of remitting. Migrant's income and receiving household's income have a negative effect on this likelihood.
Lucas and Stark (1985)	Household Survey ²⁰ of Migration in Botswana (1978 – 1979)	Years of schooling, migrant's income and the receiving household's income all positively affect the level of remittances.
Funkhouser (1995)	<i>El Salvador</i> : Survey ²¹ conducted by Segundo Montes (1987) <i>Nicaragua</i> : Household Survey ²² in Managua (December 1989)	<i>El Salvador</i> : Age and gender have no effect on both the probability and the level of remittances while years of schooling have an adverse effect on the likelihood of remitting and a positive effect on the level of remittances. <i>Nicaragua</i> : Age negatively affects the prob. and the level of remittances. Gender has no significant effect on remittances. Years of schooling have an adverse effect on the likelihood of remitting and a positive effect on the level of remittances.
Rodriguez (1996)	Survey ²³ of Overseas Philippians workers (SOW – 1991)	Age, years since migration, relationship to HH positively affect the probability of remitting. Age and years since migration negatively affect the level of remittances. Years of schooling have no effect on the level of remittances.
Lianos (1997)	Statistical Data come from diverse sources ²⁴	Migrant's income positively affects the level of remittances. The receiving household's income has no effect on the level of remittances.

¹⁷ Source: International Labour Office (ILO)

¹⁸ HH refers to the receiving household

¹⁹ Sources: ILO / University of Nairobi

²⁰ Source: National Migration Study of Botswana (NMS)

²¹ Source: Central American University in El Salvador

²² Source: Nicaraguan Institute of Statistics and Census (INEC)

²³ Source: National Statistics Office (NSO)

²⁴ Sources: Bank of Greece, International Financial Statistics, Yearbook of Labour Statistics, Monthly Statistical Bulletin of the Bank of Greece and Trends in International Migration

TABLE 2
CHARACTERISTICS OF NATIVE AND EMIGRANT POPULATION(PERCENTAGES)

	Nicaragua 2001	
	Native	Emigrants
Age		
Between 21 and 30	15.2	33.8
Region		
Urban	52.9	71.8
Gender		
Male	49.4	53.2
Education		
Less than 4 Years	63.3	47.6
Proportion Remitting	—	53.6
Mean Years Since Migration	—	5.9
Mean Remittances per Month (U.S. dollars)	—	40.2
Total Sample Size	22,810	897

TABLE 3
CHARACTERISTICS OF EMIGRANTS BY DESTINATION (PERCENTAGES)

	Destination	
	Developing	Developed
Age		
Between 21 and 30	37.6	25.7
Region		
Urban	64.7	86.8
Gender		
Male	53.5	52.4
Education		
Less than 4 Years	60.9	19.4
Proportion Remitting	47.6	68.0
Mean Years Since Migration	4.8	8.4
Mean Remittances per Month (U.S. dollars)	29.4	50.4
Total Sample Size	609	288

Notes: 1- The destination developing includes the following: Algeria, Argentina, Brazil, China, Colombia, Costa Rica, Cuba, El Salvador, Guatemala, Guinea, Haiti, Honduras, Mexico, Panama and Tunisia. Costa Rica constitutes 86% of this sample. 2- The destination developed includes Canada, Greece, Sweden and the United States.

TABLE 4
EMIGRANT POPULATION AGED 14 AND UP: PROPORTION REMITTING BY
RELATIONSHIP TO THE HEAD OF THE RECEIVING HOUSEHOLD AND BY
GROUP (PERCENTAGES)

		Proportion Remitting
Relationship to the Head of the Receiving Household		
If Spouse of the Head of the Household	5.22	72.09
If Child of the Head of the Household	61.97	62.35
If Parent of the Head of the Household	3.04	60.00
If Child in law of the Head of the Household	4.01	51.52
If Sibling of the Head of the Household	10.45	46.51
If Grandchild of the Head of the Household	7.65	39.68
If Other Relationship to the Head of the Household	3.89	34.38
If Not Related to the Head of the Household	3.77	58.06
	100.00	
Emigrant Population by Groups		
Working	80.68	63.55
Student	8.87	30.14
Stay at-Home Wife	7.53	45.16
Other	2.93	12.50
	100.00	
Sample Size		823

TABLE 5
DISTRIBUTION OF RECEIVING HOUSEHOLDS AND THEIR CHARACTERISTICS BY NUMBER OF
SENDING EMIGRANTS AGED 14 AND UP (PERCENTAGES)

Number of Sending Emigrants per Household	Percentage of Households	Mean Years of Education of the Head of the Household	Percentage Residing in Urban Areas	Percentage Working Head of Household
0	36.77	2.67	73.63	74.73
1	41.82	2.91	75.36	61.35
2	14.55	2.98	61.11	55.56
3	4.24	2.19	76.19	47.62
4 or more	2.62	3.15	76.92	46.15
All Households	100.00	2.81	72.73	64.44
Sample Size of Receiving Households				495

TABLE 6
MAXIMUM LIKELIHOOD ESTIMATES FOR A HETEROSKEDASTIC TOBIT AVERAGE MODEL OF
THE AMOUNT REMITTED BY EMIGRANTS AGED 14 AND UP

Variables	Amount Remitted		
	(1)	(2)	(3)
Intercept	-0.551 (0.648)	-2.18*** (0.533)	1.993*** (0.424)
Emigrant Characteristics			
1 if Age between 21 and 30	0.387 (0.269)	0.259 (0.271)	-
1 if Male	-0.462* (0.265)	-0.523** (0.268)	-
1 if Education less than 4 Years	-0.327 (0.291)	-0.426 (0.283)	-
1 if Years since Migration less than 4	-0.318 (0.255)	-0.279 (0.258)	-
1 if Working	2.200*** (0.357)	2.251*** (0.364)	-
1 if Emigrant Resides in a Dev. Country	1.273*** (0.294)	1.327*** (0.294)	-
1 if Spouse of the Head of the Household	2.032*** (0.515)	2.032*** (0.539)	-
1 if Parent of the Head of the Household	1.549** (0.654)	1.830*** (0.688)	-
1 if Child of the Head of the Household	0.866*** (0.294)	0.905*** (0.297)	-
Household Characteristics			
1 if Urban Residence	-0.690** (0.284)	-	-0.305 (0.286)
1 if Education of HHH less than 4	-0.702** (0.282)	-	-1.103*** (0.286)
1 if Head of the Household Working	-0.938*** (0.239)	-	-1.129*** (1.129)
Log Likelihood	-675.07	-686.14	-725.71
Theta = θ	0.361*** (0.013)	0.355*** (0.012)	0.331*** (0.009)
Rho = ρ	0.314* (0.168)	0.392** (0.180)	0.392** (0.172)
Sample	661	661	661

Notes: 1- The dependent variable is logarithm of remittances defined as $\log(1 + \frac{1}{s_j} R_j)$ 2- Robust standard errors are in parentheses 3- *** means significant at the 1 percent level; ** at the 5 percent level; * at the 10 percent level. 4- Dev. Country refers to developed country. 5-HHH means Head of the receiving Household.

TABLE 7
SUMMARY OF THE CHANGE IN AMOUNT OF REMITTANCES AND CHANGE IN PROBABILITY
OF REMITTING RESULTS OF MODEL (1) IN TABLE 6

Variables	Average Model	
	Percentage Change in Probability	Percentage Change in Amount
Intercept	-7.93	-19.2
Emigrant Characteristics		
1 if Age between 21 and 30	5.57	13.5
1 if Male	-6.64	-16.1
1 if Education less than 4 Years	-4.71	-11.4
1 if Years since Migration less than 4	-4.58	-11.1
1 if Working	31.6	76.8
1 if Emigrant Resides in a Developed Country	18.3	44.4
1 if Spouse of the Head of the Household	29.2	70.9
1 if Parent of the Head of the Household	22.2	54.1
1 if Child of the Head of the Household	12.4	30.2
Household Characteristics		
1 if Urban Residence	-9.93	-24.1
1 if Education of Head of Household less than 3	-10.1	-24.5
1 if Head of the Household Working	-13.5	-32.7

TABLE 8
MAXIMUM LIKELIHOOD ESTIMATES FOR A HETEROSKEDASTIC TOBIT AVERAGE MODEL OF THE
AMOUNT REMITTED BY EMIGRANTS AGED 14 AND UP: FEWER CONTROLS

	A	B	C	D	E	F
Variable	-1.673***	-0.204	0.161	0.056	0.297	0.190
Intercept	(0.380)	(0.218)	(0.202)	(0.206)	(0.198)	(0.200)
1 if Working	2.327***					
	(0.369)					
1 if in Dev. Country		1.483***				
		(0.260)				
1 if Parent of HHH			0.942			
			(0.796)			
1 if Spouse of HHH				1.810***		
				(0.532)		
1 if Sibling of HHH					-1.158**	
					(0.468)	
Theta = θ	0.333***	0.329***	0.323***	0.330***	0.325***	0.322***
	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Rho = ρ	0.438***	0.338**	0.475***	0.593***	0.505***	0.470***
	(0.160)	(0.162)	(0.169)	(0.196)	(0.175)	(0.170)
Log Likelihood	-718.41	-725.80	-740.08	-735.53	-738.97	-740.90
Sample	661	661	661	661	661	661

Notes: 1- *** means significant at the 1 percent level; ** at the 5 percent level; * at the 10 percent level. 2- HHH means head of the receiving household 3-Dev. Country refers to developed country.

TABLE 9
MIGRANT REMITTING DECISIONS AMONG DIFFERENT SAMPLES: RELATIONSHIP OF
THE MIGRANT TO THE HEAD OF THE HOUSEHOLD, LABOR STATUS AND
DESTINATION

Variable	Child	Child and Working	Child and living in Costa Rica	Child and living in U.S. or Canada
Intercept	0.445** (0.234)	0.946*** (0.227)	0.161 (0.301)	0.829** (0.334)
Theta = θ	0.349*** (0.012)	0.355*** (0.014)	0.360*** (0.017)	0.317*** (0.017)
Rho = ρ	0.514** (0.224)	0.254 (0.164)	0.701** (0.355)	0.459* (0.264)
Log Likelihood	-459.94	-395.62	-291.67	-235.54
Sample	408	341	269	191

Notes: *** means significant at the 1 percent level; ** at the 5 percent level; * at the 10 percent level.

Appendix
A.

TABLE A
VARIANCE OF THE ERROR TERM FROM THE AVERAGE MODEL

Number of Remitting Migrants s_j	Average Model $Var_{AM}(e_j) = \frac{1}{s_j} \sigma^2 (1 + (s_j - 1)\rho)$
0	σ^2
1	σ^2
2	$\frac{1}{2} \sigma^2 (1 + \rho)$
3	$\frac{1}{3} \sigma^2 (1 + 2\rho)$
4	$\frac{1}{4} \sigma^2 (1 + 3\rho)$
:	:
:	:
7	$\frac{1}{7} \sigma^2 (1 + 6\rho)$

B.

TABLE B
VARIABLES DESCRIPTIVE STATISTICS: AVERAGE MODEL WITH SAMPLE SIZE EQUAL TO 661

Variable	Description	Mean	Std. Dev.	Min.	Max.
Remittances	Logarithm of Monthly Remittances measured in 2001 U.S. Dollars	1.29	1.61	0	6.22
1 if Age between 21 and 30	Age of the Migrant, equal to 1 if migrant is between 21 and 30 years old.	0.36	0.46	0	1
1 if Male	Gender of the Migrant, equal to 1 if migrant is a male.	0.52	0.47	0	1
1 if Education less than 4 Years	Education of the Migrant, equal to 1 if migrant's education is less than 4 years.	0.47	0.48	0	1
1 if Working	Labor Status, equal to 1 if migrant is working	0.78	0.40	0	1
1 if Emigrant Resides in D.C.	Destination of the migrant, equal to 1 if migrants live in developed countries.	0.30	0.45	0	1
1 if Years since Migration less than 4	Number of Years the migrant has been living out of Nicaragua, equal to 1 if the number of years is less than 4 years.	0.52	0.48	0	1
1 if Spouse of the Head of the Household	Relationship of the migrant to the head of the household, equal to 1 if the migrant is the spouse of the head of the household.	0.05	0.22	0	1
1 if Parent of the Head of the Household	Relationship of the migrant to the head of the household, equal to 1 if the migrant is the parent of the head of the household.	0.03	0.17	0	1
1 if Child of the Head of the Household	Relationship of the migrant to the head of the household, equal to 1 if the migrant is the child of the head of the household.	0.59	0.48	0	1
1 if Urban Residence	Resident of the migrant's Receiving Household, equal to 1 if it resides in an urban area	0.72	0.44	0	1
1 if Education of the Head of Household is less than 4 Years	Education of the Head of the Household, equal to 1 if Head of the Household's education is less than 4 years.	0.75	0.43	0	1
1 if Head of the Household Working	Status of the head of the Household, equal to 1 if head of the household working.	0.63	0.48	0	1

C.

**TABLE C.1
MIGRANTS' STRATEGIES
FOR TWO HOUSEHOLDS
MIGRANTS**

		Migrant 2	
		Remit	Not Remit
Migrant 1	Remit	58.0 %	12.0 %
	Not Remit	7.0 %	23.0 %
Note: The sample consists of 200 migrants who belong to two migrants' households which is around 24 percent of the total migrants' population and 36 percent of the total multiple households' migrants' population. The numbers in the table consist of the number of incidence.			

**TABLE C.2
MIGRANTS' STRATEGIES FOR
THREE HOUSEHOLDS
MIGRANTS**

		Migrant 3			
		Remit		Not Remit	
		Migrant 2		Migrant 2	
		Remit	Not Remit	Remit	Not Remit
Migrant 1	Remit	36.6 %	4.9 %	14.6 %	12.2 %
	Not Remit	7.3 %	7.3 %	7.3 %	9.8 %
Note: The sample consists of 123 migrants who belong to three migrants' households which is around 15 percent of the total migrants' population and 24 percent of the total multiple households' migrants' population. The numbers in the table consist of the number of incidence.					

**TABLE C.3
MIGRANTS' STRATEGIES
FOR FOUR
HOUSEHOLDS
MIGRANTS**

TABLE C.3 MIGRANTS' STRATEGIES FOR FOUR HOUSEHOLDS MIGRANTS		Migrant 4							
		Remit				Not Remit			
		Migrant 3				Migrant 3			
		Remit		Not Remit		Remit		Not Remit	
		Migrant 2				Migrant 2			
		R	NR	R	NR	R	NR	R	NR
Migrant 1	Remit	22.2 %	0.0 %	5.6 %	0.0 %	5.6 %	0.0 %	0.0 %	11.1 %
	Not Remit	11.1 %	5.6 %	0.0 %	0.0 %	0.0 %	5.5 %	0.0 %	33.3 %
Note: The sample consists of 72 migrants who belong to four migrants' households which is around 9 percent of the total migrants' population and 14 percent of the total multiple households' migrants' population. The numbers in the table consist of the number of incidence. R = Remit; NR = Not Remit.									