

**AN INTEGRATED ANALYSIS OF MIGRATION AND REMITTANCES:
MODELING MIGRATION AS A MECHANISM FOR SELECTION***

September 2007

-DRAFT-

Do not quote or cite without the authors' permission

Filiz Garip

Department of Sociology

Harvard University

fgarip@wjh.harvard.edu

* Direct all correspondence to Filiz Garip, Department of Sociology, 33 Kirkland St., Cambridge, MA 02138 (fgarip@wjh.harvard.edu). This research was funded by research grants from Program in Urbanization and Migration at Princeton University and NSF (#SES-0525942). I am grateful to Sara Curran, Paul DiMaggio, and Doug Massey for helpful discussions and suggestions. I thank the research team from the Carolina Population Center at the University of North Carolina and the Institute for Population and Social Research at Mahidol University for their data collection efforts and the villagers of Nang Rong district, Buriram province, Thailand for their cooperation. Responsibility for the contents is exclusively mine.

Abstract

Prior work models individuals' migration and remittance behavior separately, and finds mixed empirical support for altruistic or contractual theories of remittances. This inconsistency may result from selection bias. This study controls for this bias statistically, and treats migration as a mechanism for selection in a censored probit model of remittances. Using longitudinal and multi-level data from Thai internal migration, the study reports three findings: First, altruism and insurance seeking influence both migration and remittance probability. Second, bargaining, inheritance seeking and investment opportunities decrease probability of migrating, but increase probability of remitting. Third, these results are considerably different than those obtained by conventional approach of modeling remittances separately. The study concludes that migration and remittances are related processes, and it is crucial for an analysis of remittances to control for the selectivity of migration.

An Integrated Analysis of Migration and Remittances: Modeling Migration as a Mechanism for Selection

Scholarly interest in remittances, funds and goods sent by migrants to their origin families and communities, has grown dramatically in recent years due to the significant increase in the amount and perceived developmental potential of these flows (Taylor 1999; Taylor et al. 1996). Recent estimates indicate that international remittances to developing countries have reached US\$126 billion annually, becoming the second largest source of external finance for these countries after foreign direct investment (World Bank 2004). Remittances from international or rural-to-urban migrants serve the vital purpose of relaxing budget and credit constraints of origin households, and creating opportunities for investment and income redistribution within origin communities (Durand et al. 1996; Durand, Parrado, and Massey 1996; Rapaport and Docquier 2003; Rempel and Lobdell 1978; Russel 1992; Taylor 1999). A first step to evaluating these consequences of remittance flows is understanding the mechanisms that account for individuals' decisions to migrate and send remittances.

Research to date has yielded inconsistencies in attributing migrants' remittance behavior to either altruistic or contractual mechanisms. Altruism suggests that migrants seek to improve their households' welfare by remitting, while contractual behavior implies that migrants remit to repay past loans or to assure future gains. This paper argues that the mixed support for altruistic or contractual patterns in the literature may result from a selection effect. Specifically, prior research typically models migration and remittance behavior separately, treating them as independent processes. However, individuals do not become migrants randomly, and unless we

first understand individuals' reasons for becoming migrants, we cannot evaluate the determinants of their remittance behavior. Empirically, insofar as similar factors influence both migration and remittance patterns, it is important to specify an integrated model that unifies explanations for these outcomes. Statistical models that account only for individuals' remittance behavior, while omitting individuals' selection process into migration, are likely to produce biased estimates. Theoretically, explanations for remittances entail implicit assumptions about individuals' reasons for migrating, and similarly, theories of migration posit expectations about prospective remittance behavior. Conceptualizing migration and remittances as interdependent processes helps us sharpen and unify theories of migration and remittances.

To provide a unified explanation for migration and remittance behavior, in this paper, I draw upon prior work on selection effects (e.g., in the context of conflict onset and escalation by Reed 2002, Senese and Vasquez 2003; contingent valuation by Eklof and Karlsson 1999; credit scoring by Greene 1992), and employ a censored bivariate probit model that treats migration as a mechanism for selection in estimating remittance outcomes. Using a unique multi-level and longitudinal data set on Thai internal migration, I find that an integrated model of migration and remittances statistically manages selection bias and significantly alters our empirical conclusions about causes of remittance behavior.

In what follows, I begin by reviewing the theoretical literature on migration and remittances, and demonstrate the links among different arguments. Then I present an empirical strategy for jointly modeling migration and remittance outcomes. In the subsequent section, I describe the Thai setting, data and operational variables. After presenting the results from the empirical estimation,

I conclude with a discussion of the implications of my findings for research on migration and remittances.

Background and Hypotheses

The conventional approach to explaining migration and remittances is to treat these outcomes separately. Students of migration theorize about individual or household level factors that foster migration, disregarding the implications for subsequent remittance behavior. Similarly, studies of remittances identify altruistic or contractual mechanisms as explanations for why some migrants remit while others do not, without considering the connections to migration. In empirical work from both strands of the literature, similar set of relevant variables are employed to measure these mechanisms in an ad-hoc manner. Specifically, survey data cannot adequately measure individuals reasons or motivations for migrating or sending remittances, hence observed characteristics such as income, education, wealth, or macroeconomic indicators are taken as proxies. Insofar as the unobserved factors that influence individuals' decision to migrate also affect remittance behavior, modeling remittances separately leads to biased estimates. In this study, I address these issues by providing an integrated model of migration and remittances, where a similar set of variables can affect both outcomes. The integrated setting allows to combine the established explanations of migration and remittance behavior in the literature, and to understand how these explanations relate to each other. Below, I first review the determinants of migration in the literature, selectively focusing on those that might also affect remittance outcomes. (In that sense the review is not exhaustive, yet the factors excluded from the review, such as migrant networks, that influence migration behavior are controlled for in the empirical model.) Then, I provide a comprehensive review of explanations for remittances from both

sociology and economics, and integrate these explanations within a common analytic framework to achieve a systematic comparison of theories.

Determinants of Migration

The economics literature identifies a number of explanations for migration at the individual or household level. Neoclassical micro-economics defines migration as an individual strategy for income maximization. Given their differential earnings potentials (which are typically proxied by human capital), individuals migrate when the expected gain from migrating to a destination is greater than that from staying in the origin (Todaro 1969). Similar models conceptualizing migration as an individual decision to maximize income are provided by Hay (1980), Kalzuny (1975), Nakosteen and Zimmer (1980), Navratil and Doyle (1977), Yezer and Thurston (1976). This individualistic view of migration behavior has been challenged by household theories of migration, which suggest that migration is a household strategy for income maximization. This so-called New Economics of Labor Migration (NELM) suggests that households send migrants to improve income in absolute terms, as well as to increase their relative income, and to reduce their relative deprivation with respect to some reference group, like the community. (Stark, Taylor, and Yitzhaki 1986; Stark and Taylor 1989; Stark 1991; Stark and Bloom 1985).

As one moves from individual to household theories of migration, the issue of remittances arises naturally. Explicitly, if individuals migrate to increase their own income, as neoclassical microeconomics suggests, then they are not expected to send remittances. If, on the other hand, individuals migrate to improve household position as the NELM theory suggests, then they are expected to maintain their linkages and send at least part of their earnings as remittances to their

households. Consequently, the hypotheses of NELM theory regarding migration also carry implications about subsequent remittance behavior. Taking these implications into account, I expect:

H1: The lower the household's income (or wealth), the higher the likelihood of sending a migrant, and the higher the likelihood of receiving remittances, *ceteris paribus*. (*Maximizing household income hypothesis*)

H2: The lower the household's income (or wealth) relative to other households in the community, the higher the likelihood of sending a migrant, and the higher the likelihood of receiving remittances, *ceteris paribus*. (*Minimizing household's relative deprivation hypothesis*)

These hypotheses draw on the economic theories of migration, however they are different in one important respect: They recognize and make explicit these economic theories' claims about migrant remittances, making it possible to subject these claims to empirical scrutiny.

Determinants of Remittances

As is the case with the literature on migration, the studies of migrant remittances selectively focus on a single phase of the migration-remittance process. While these studies try to provide explanations for individuals' remittance behavior, they leave out the factors that cause individuals to become migrants in the first place. Table 1 lists references to the theories of remittances most commonly cited in the literature. The two principal competing explanations view remittances as either altruistic or contractual behavior. Models of remittances as altruistic behavior, presented in the works of Banerjee (1984) and Johnson and Whitelaw (1974), simply embed the utility of other household members in the migrant's utility function, and suggest that

migrants remit to improve their household's welfare. In that sense, these models are akin to household-level explanations of migration presented above. Models of contractual behavior, on the other hand, view remittances as part of a self-enforcing, cooperative contract between the migrant and household that serves, for instance, the purpose of risk sharing, as suggested by Stark (1991) and Stark and Levhari (1982). Agarwal and Horowitz (2002) assess the significance of the risk sharing hypothesis in explaining the remittance patterns of Guyanese international migrants. They argue that if this hypothesis holds, then migrants' remittances should serve as a premium for their future insurance against unemployment and low wages. Accordingly, they hypothesize that the amount remitted by the migrants should be positively correlated with these risks to their income in destinations. Following a similar strategy, I formally define the risk sharing hypothesis as follows:

H3: The higher the risks to a migrant's income in the destination location, the higher the likelihood of sending remittances to the origin household, *ceteris paribus*. (*Insurance/Risk sharing hypothesis*)

Conversely, if remittances are related to altruistic behavior, defined restrictively as migrants equating their own welfare with their household's welfare, then I expect poorer or more relatively deprived households to receive higher remittances, as suggested in H1-H2. Moreover, I expect altruistic remittances to be positively correlated with the risks to origin household's income. More formally:

H4: The higher the risks to a household's income in the place of origin, the higher the migrant's likelihood of sending remittances, *ceteris paribus*. (*Altruism hypothesis*)

-- Table 1. Overview of the Explanations for Remittances in the Literature--

In addition to altruism or risk sharing hypotheses, remittances may also be part of current or future exchanges of favors in a household. Following from the bargaining theory of intra-household transfers (Lee, Parish and Willis 1994), migrants may send remittances in exchange for non-monetary help from other household members, for example, in the form of household chores or child-care. Therefore, a migrant sending household's composition, dependency and domestic structure influence the amount of remittances received (Goldring 2003; Kanaiapuni and Donato 1999). More formally, one may expect that:

H5: The higher the number of migrant's dependents residing in the household, the higher the likelihood of sending remittances to the origin household, *ceteris paribus*. (*Bargaining hypothesis*)

Remittances may also constitute an advance payment to favors expected from household members in the future. As an offset of the bargaining hypothesis, research shows that remittances may be related to an inheritance-seeking behavior of migrants. Namely, migrant sons or daughters may send remittances to maximize their probability of inheriting, or the amount inherited. Evidence for this hypothesis is provided by de la Briere et al. (2002), who show that remittances to Dominican Republic from migrants in the U.S. reflect an investment in future inheritance. They find that child-to-parent remittances are positively correlated with parental inheritable assets, and negatively correlated with the amount of brothers they would have to share their inheritance with. A similar finding by Hoddinott (1994) suggests that remittances from a migrant reflect the ability of the household members (the parents in particular) to offer rewards in the form of land bequests. Drawing on these arguments and empirical findings, I hypothesize that:

H6: The higher the prospects for future inheritance from household members, the higher the likelihood of a migrant's sending remittances, *ceteris paribus*. (*Inheritance seeking hypothesis*)

Other than altruistic, insurance or inheritance seeking behavior of migrants, remittances may represent a mechanism for migrants to invest in the origin households or communities.

Conceptualized as such, the amount of remittances received depends on the investing conditions in the households or communities of origin. For example, there is evidence that remittances from international migration are sensitive to interest rate differentials between sending and host community (Foster 1995). Similarly, the remittances from Mexicans living in the U.S. are sensitive to investment conditions in the sending communities, including available infrastructure, inflation rate, and access to land (Durand et al. 1996). Adding to this line of arguments, I suggest that household members may provide the security of investments (for example, protecting the land or the house) in the origin community, and therefore migrants may be more likely to send remittances. I expect that:

H7: The more favorable the investing conditions in the origin household or community, the higher the amount of remittances from migrants, *ceteris paribus*. (*Investment hypothesis*)

Durand et al. (1996) argue that remittances also reflect migrants' family ties in their country of origin, or how assimilated they are in their receiving country. Empirical evidence provided by numerous other studies confirms this hypothesis. For example, Blue's (2004) research in Cuba shows that remittances depend on the strength of the ties between migrants and the receiving households. Length of stay in the U.S. decreases the amount remitted, while visits to Cuba

increases remittances. Similarly, Brown (1997) and Ahlburg and Brown (1998) find that the intentions of return migration plays an important role in migrants' remittances. Moreover, qualitative research on transnational migration shows that remittances provide international migrants a way of maintaining their linkages to and influence in their communities of origin. In the case of Mexican migration to the U.S., for example, migrants' remittances and governments' incentives to sustain the flow of remittances have given migrants additional influence on the political and public spending decisions of their communities of origin (Roberts, Frank, and Lozano-Ascencio 1999). Given this evidence, I expect that:

H8: The stronger a migrant's intention to return or links to the community, the higher the likelihood of sending remittances, *ceteris paribus*. (*Maintaining linkages / intentions to return hypotheses*)

As a final explanation, remittances may be considered as a way for migrants to pay back their household's past investments in them (e.g., covering education or migration costs). The literature provides mixed empirical evidence for migrants' remittances responding to past parental investments in the form of education. While the probability of remitting increase with migrants' education in the case of Mexicans living in the U.S. (Durand et al. 1996) and of Nepalese rural migrants to the cities (Regmi and Tisdell 2002), the education level of the migrant does not affect the remittances among rural-to-urban migrants in China (Cai 2003), and among Samoan and Tongans migrants in Australia (Ahlburg and Brown 1998). In addition to being a repayment of education investments in the migrant, Durand et al. (1996) find that remittances may also be in return for the loans to cover the smuggling fees to destination. To test these ideas, I hypothesize that:

H9: The higher the investments of the household in the migrant (in the form of education or loans), the higher the likelihood of migrant's sending remittances, *ceteris paribus*.

(Repayment of past loans)

Several studies to date have juxtaposed the different explanations for remittances outlined in H1-H9 in different settings. Comparing altruistic and contractual explanations for remittances, Agarwal and Horowitz (2002) found evidence for the former, while de la Briere et al. (2002), Hoddinott (1994), Regmi and Tisdell (2002) reported evidence for latter. Recently, in Thai internal migration setting, Vanwey (2004) identified gender differences in altruistic and contractual remittance behavior. In this study, I also attempt to combine different hypotheses about remittances within a common analytic framework and provide a comparison of theories' empirical performance. In doing so, in contrast to prior work, I consider how the selectivity of migration affects remittance outcomes and how acknowledging that selectivity alters our conclusions regarding the relative explanatory power of different theories.

Empirical Strategy: An Integrated Analysis of Migration and Remittances

Despite the theoretical linkages between explanations for migration and remittances, few studies to date have considered individuals' migration decision and their respective remittance behavior as possibly interrelated phenomena (e.g., Hoddinott 1994; Taylor, Rozelle, and de Brauw 2003). The conventional approach in the literature is to model migration and remittances separately. Given migration and remittance outcomes that are observed discretely, the following model structure is typically used. Let migration and remittance decisions by an individual be represented by two binary dependent variables y_1 and y_2 . Assuming that each of these equations

is generated by a probit equation, if the errors from these two equations are independent, our model is:

$$y_1^* = x_1\beta_1 + \varepsilon_1 \quad (1)$$

$$y_2^* = x_2\beta_2 + \varepsilon_2 \quad (2)$$

where y_j^* are unobserved latent variables, related to our binary dependent variables as follows:

$$y_j = \begin{cases} 1 & \text{if } y_j^* > 0 \\ 0 & \text{if } y_j^* \leq 0 \end{cases} \quad j = 1, 2$$

If we assume that the error terms ε_1 and ε_2 are independent and identically distributed (i.i.d.) standard normal, the probability π_j of observing a positive outcome is:

$$\pi_j = \Phi(x_j\beta_j)$$

where Φ is the standard normal cumulative distribution function. The inverse transformation of the above equation, which gives the linear predictor as a function of the probability, gives rise to two probit models (for $j=1,2$).

A weakness of this approach with separate probit models is that it assumes a priori that the error terms from migration and remittance equations are uncorrelated. Yet, this assumption may be untenable if the unobserved factors that influence migration behavior are also related to the remittance outcome. As reviewed in the background section, explanations for migration rely on motivations (e.g., individual gain, or improving household's status) that are not readily observable or adequately measurable. Moreover, it is reasonable to assume that these

unobservable motivations also influence remittance behavior. (For example, migrants with individualistic motives may not be as likely to remit as those who have moved to improve their household's economic status.) If that is the case, the migration process generates a non-random sample of individuals for observing remittance outcomes, and consequently, standard estimation of remittances on this sample (e.g., using a univariate probit model as in (2)) leads to biased results.

Joint modeling of migration and remittance outcomes, where migration is treated as a mechanism for selection, manages the source of bias. Namely, we take into account the fact that remittance decision, y_2 , is observed if and only if a person migrates ($y_1 = 1$). Then, if $y_1 = 0$, we have no information on y_2 . This leads to a specification where the first probit equation for migration is completely observed, but for the second equation of remitting, we have a selected sample. As Meng and Schmidt (1985) argue, in the case of a non-zero correlation (ρ) between the error terms $(\varepsilon_1, \varepsilon_2)$, separately estimating the migration and remittance equations will lead to selectivity bias in the estimates of the latter. We can account for the sample selection bias by employing a variant of Heckman's (1979) two-step selection model. Because in our case both the selection and outcome equations have binary dependent variables, we end up with a censored bivariate probit specification which has previously been used by Boyes, Hoffman and Low (1989), Reed (2000), and van de Ven and van Pragg (1981). Note that if the two equations are indeed correlated, this specification corrects for sample selection bias in the remittance equation. Conversely, if there is no correlation, then this procedure is identical to estimating the two equations separately. By observing the magnitude and significance of the correlation term, ρ , we can determine whether sample selection indeed biases our results.

The censored bivariate probit model employs the same structure displayed in (1)-(2), but recognizes that y_2 is observed only if $y_1 = 1$, and that error terms $(\varepsilon_1, \varepsilon_2)$ may have a non-zero correlation (ρ). This specification leads to the following log-likelihood function for sample of N observations (Meng and Schmidt 1985; van de Ven and van Praag 1981):

$$\ln L = \sum_{i=1}^N \{y_{i1}y_{i2} \ln \Phi_2(z_{i1}, z_{i2}, \rho) + y_{i1}(1 - y_{i2}) \ln [\Phi(z_{i1}) - \Phi_2(z_{i1}, z_{i2}, \rho)] + (1 - y_{i1}) \ln [1 - \Phi(z_{i1})]\}$$

where Φ_2 is the standard bivariate normal distribution function, Φ is the standard normal distribution function and $z_{ij} = x_{ij}\beta_j$. Note that the first and second terms on the right-hand side relate to migrants that remit and do not remit respectively. The third term relates to the censored individuals that do not become migrants. It is important to recognize that, in a censored probit model, a change in a variable x_k (that is part of both migration and remittance equations) has two effects on the latent remittance outcome, y_2^* : It affects the conditional mean of y_2^* in the positive part of the distribution (direct effect), and it affects the probability that the observation will fall in that part of the distribution (indirect effect) (Greene 1992, 2003). In evaluating the overall effect of a variable on the binary remittance outcome, we need to evaluate both the direct and indirect effects.

To summarize, this paper employs two empirical specifications to model migration and remittance behavior: (1) the univariate probit model of remittances on the sample of migrants (conventional approach) and (2) the censored bivariate probit model of migration and remittances on the entire sample. The hypotheses presented in the preceding section postulate

that migration and remittance decisions are affected by a common set of individual, household and village characteristics, which are included in both models. In addition to these common factors, migration is a function of migrant networks, and resources of information or help provided villagers who have previously migrated. These ties and resources may reduce the costs and risks of migrating for potential migrants (Massey and Zenteno 1999), yet they should not affect the level of household-specific remittances (Taylor, Rozelle and De Brauw 2003). These variables, which affect migration but not remittances, ensure that the censored probit model is identified.

The Thai Setting and Data

To evaluate the theoretical elaboration outlined above, this study analyzes rural-urban migration and remittance patterns in Thailand following a period of dramatic economic change and growth from 1984 to 2000. During the first decade of this period, Thailand led the world in economic growth, averaging nine percent each year (Jansen 1997). In the same period, the country's economic base shifted from agriculture to exports (Bello, Cunningham, and Poh 1998; Phongpaichit and Baker 1996, 1998; Suksiriserekul 2000; Warr and Nidhiprabha 1996), fueling an increase in demand for labor in industrial centers like Bangkok and its provinces, and Eastern Seaboard (Tambunlertchai 1990). Much of this labor was provided by rural migrants from the Northeastern part of the country, where 40 percent of the population lived in poverty (Hafner 2000). The data for this study come from the three waves (1984, 1994, 2000) of a longitudinal survey of twenty-two villages in Nang Rong, a district in this historically poor region of Thailand.¹ The 1984 data collection wave is a census of twenty-two villages and includes information on individual demographic data, household assets and village characteristics. The

1994 data collection not only replicates the 1984 survey, including a census of all households and information about former 1984 village members, but also includes a 10-year retrospective life history about education, work, and migration, as well as key social and demographic events, information about siblings and their current residence, and a special survey of migrants.

Similarly, 2000 data collection wave replicates the 1994 survey and additionally collects a 6-year retrospective life history covering the period from 1994 to 2000.

Unlike other migration data available to researchers, these data are not collected from a random sample of respondents. Instead, the data contain demographic information on all the individuals in the survey villages as well as individual life histories for those between the ages of 13 to 35.

Because 16-year retrospective life histories are combined with cross-sectional censuses in three time periods (1984, 1994, 2000), the data also allow us to observe migration prospectively.

Furthermore, the surveys follow migrants up in their destinations, and therefore attrition bias that commonly plagues migration data is minimized. Despite these advantages, the data set also has some weaknesses. While migration is observed at the individual level longitudinally for a period of 16 years, data on migrant-household remittance flows is only available for two cross-sections (1994, 2000). For the analyses at hand, I use the household and village surveys from 1994 and 2000 cross-sections in combination with the longitudinal life history data from 1984 to 2000.

More explicitly, the 1994 and 2000 household questionnaires asked each household member if they have migrated and/or sent remittances in the past 12 months. The dependent variables for the analyses in this paper are based on these questions. On the other hand, several explanatory variables (such as accumulated migration experience at the individual, household and village level, distribution of migration experience in the community) are based on the 16-year

retrospective life history data. (Unfortunately, the life history survey only asked about migration, education and work histories, and did not inquire about remittance patterns, which restricts us to cross-sectional analyses.)

These individual and household level data are combined with village-level surveys in 1994 and 2000, and several measures of village development level are added to the set of explanatory variables. Finally, the survey data are further supplemented by macroeconomic indicators at migrants' destinations, such as unemployment rates by education and occupation, obtained from the Thai National Statistics Office.

Operational Measures

Dependent variables are two binary indicators of migrating and remitting based on the following questions in 1994 and 2000 household questionnaires: "Has this person migrated (for more than two months) in the past 12 months?" and "Has this migrant sent any goods or money in the past 12 months?" Table 2 summarizes all the independent variables along with the hypotheses they are designed to test. As a rule, the independent variables related to the remittance outcome are also included in the migration equation, unless they perfectly predict migration outcomes. (For instance, occupation is a near perfect predictor of migrant status, as almost all non-migrants are farmers, therefore any variable related to occupation is not included in the migration model. Similarly, the indicator of household-to-migrant remittances is a perfect indicator of migrant status and is excluded from the migration model.) This strategy allows us to evaluate how each variable affects remittance outcome directly as well as indirectly through its effect on the probability of migrating.

In order to assess the effect of a household's economic standing on migration-remittance behavior of its members, I use an indicator of household's debt along with measures of land and durables² owned by the household. The land and durables measures are lagged to prevent endogeneity with the migration or remittance outcome (i.e., the 1994 values for land and durables come from the 1984 household survey, and the 2000 values come from the 1994 household survey). To evaluate the importance of a household's relative economic position, I employ the relative deprivation index suggested by Stark and Taylor (1986). For each household, the relative deprivation of the household in land (or durables) owned is equivalent to the product of two terms: the share of households with more land (or durables), and the average difference between the land owned by the index household and the higher levels of household land (or durables). Note that as the amount of land (or durables) a household owns increases compared with others in the village, both terms decrease, so that the household with the highest number of land (or durables) in the village is the lowest in this index. For sake of comparability, I standardize both relative deprivation indices to have a mean of 0 and standard deviation of 1.

-- Table 2. Summary of Expected Direction of Regression Coefficients by Hypothesis --

To test the hypothesis that remittances increase with increasing risks to migrants' income, I use regional unemployment rates in a migrant's education and occupation category as independent variables. (Unemployment rate by occupation category is not included in the migration equation as occupation perfectly predicts migrant status. Unemployment rate by education category, on the other hand, is not related to migrant status, and thus is included in both migration and remittance equations.) As most households are involved in farming, months of water shortage in

the year provides a good proxy for risks to origin household's income, and is included as a predictor of both migration and remittance outcomes.

As household demographic indicators, I include the number of dependents (aged 65 or more), number of children (aged 14 or less), and number of migrants (excluding the index individual) in the household. Given the hypothesis that remittances increase with increasing dependency of household members, I expect the number of dependents and children to both increase a migrants' remittance probability. Conversely, having other migrants in the household should decrease the remittance propensity, as it implies a diffusion of responsibility for dependents' care among migrants. To test whether prospects for future inheritance affect remitting behavior, I include a binary indicator for the youngest daughter in the household (the most likely heir) which is anticipated to have a positive effect on the remittance propensity. An indicator for other daughters and sons, who can potentially inherit, similarly is expected to positively influence the remittance outcome. (Although the inheritance norm is bilateral in Thailand, sons usually abdicate their land inheritance to their sisters or brothers-in-law since they will be moving to their wife's household and receive, instead, some other form of inheritance.)

The number of economic activities in which the household is involved (silk weaving, silk worm raising, other cloth weaving, charcoal making) is used as a measure of investment opportunities for the migrants in their origin households, and is expected to affect positively the remittance probability. Similarly, remoteness of village to urban centers³ (an indicator of low development of village) and years since village is electrified (an indicator of high development of village) measure potential for investment opportunities for migrants in origin villages, and are expected

to have negative and positive effects on remittances, respectively. Proportion of households receiving remittances in the village captures how remittance behavior is affected by migrants' links to their community, and their compliance with the remittance norms within the community. An indicator of remittances sent by the household to the migrant, along with migrant's education, are variables which test whether migrants are repaying past or current loans to their families by remitting.

Several indicators of migration experience, accumulated over a 16-year period, are added as identifying variables to the migration equation in the censored probit specification (i.e., these variables affect migration, but not remittances). Accumulated number of individual migration trips is included to capture the effect of prior migration experience on an individual's re-migration probability. Household and village level migration experience (measured by accumulated number of migration trips by household and village members, respectively) are also included, along with measures of the distribution of migration experience (measured by the Theil index of accumulated village migration trips⁴) and destination diversity of migration experience (measured by Shannon's entropy of village trips to different destinations⁵). The underlying idea, based on Garip (2006), is that prior migration experience in the household or village reduces the costs of migrating for potential migrants (through information and direct help provided by prior migrants). Moreover, the village-level experience is more accessible and useful to individuals if it is more uniformly distributed among village members (i.e., has a lower Theil index) and if it is more diverse in terms of opportunities it provides (i.e., more diverse across different destinations). Note that all the accumulated experience indicators are lagged by one year to

prevent endogeneity; diversity and inequality indices are standardized to have mean of 0 and standard deviation of 1 for the sake of comparability.

At the individual and household level, socio-demographic indicators, such as age, sex, marital status, and household size, are included in both migration and remittance models. To control for differences in origin village characteristics, two binary variables indicating the presence of a school and a temple, respectively, are added. Also included are measures of land and durables inequality (measured by the Theil index) in the village. Other control variables are occupation and destination indicators for migrants, which proxy their income levels. Typically, factory workers have the highest earnings, followed by service and construction workers. Farmers, which are the reference category, earn the least. Compared with the reference region of the Northeast, the income levels are higher in the Central region and highest in the Bangkok region. These indicators, then, should have proportionate effects on remittance propensities.

I include descriptive statistics for all the independent variables as an appendix in Table A1. To discard the possibility of multicollinearity, I computed Variance Inflation Factors (VIFs), which are a scaled version of the multiple correlation coefficient between a given variable and the remaining independent variables. Common practice is to look at the largest VIF value, and as a rule of thumb a value greater than 10 is an indication of potential multicollinearity problems (Neter, Wasserman, and Kunter 1990). In our case, the largest VIF value is 3.19, while the mean VIF is 1.85. I also examined alternative specifications where the variables that were even remotely correlated with a variable of interest were excluded. The results were robust through all the alternative specifications. To account for the potential correlation among observations in the

data, the standard errors in all models were corrected for year clusters (1994 and 2000 cross-sections).

Results

Table 3 displays the estimates from two statistical models predicting whether migrants send remittances to their households in the 22 study villages in Nang Rong. The first column of Table 3 reports the results from the univariate probit model of remittances, which is the conventional empirical strategy in the literature. Note that this approach does not statistically control the effect of migration, and constitutes our baseline model. The second and third columns in the table report the results from an integrated model of migration and remittances, where migration is the selection equation in a censored bivariate probit specification. (A univariate probit model for migration is not presented, as migration is by definition prior to remittance decision, and hence the estimates from the univariate model are very similar to those obtained from the selection part of the censored probit model.)

-- Table 3. Effects of Socio-Economic Characteristics on Remittances --

I begin with the third column of the table, which reports coefficients of the migration equation. The findings show that women and married individuals living with their spouses are less likely to migrate. Conversely, individuals from larger households are more likely to migrate, possibly due to their smaller chance of claim to household assets, or to the higher potential of such households for allocating labor to migration. Status within the household is another important determinant of

migrating; household heads are the most likely to migrate, while youngest daughters are least likely to do so. This reflects the division of labor in Thai households, where the household head is the main provider, and the youngest daughter has a major responsibility for care work (in return for which she receives a higher inheritance). Existence of temple, which may represent a setting for individuals to get together and share experiences, positively influences migration.

Consistent with earlier findings in the literature, prior migration experience at the individual level positively affects migration. Surprisingly, accumulated migration experience of household and village members appear to diminish the probability of migrating. This result may reflect a saturation effect in households and villages with already high levels of migration, whereby each additional trip adds little or no value to the existing information stock about migration.

Regardless of the level of the accumulated trips in the village, their diversity by destination still increases migration propensities.

Moving on to the economic explanations for migration, individuals from poorer and more relatively deprived households are more likely to migrate, as are individuals from households that are in debt. The regional unemployment rate at the individual's education level appears to be an important determinant of migration, as a minute increase in its level causes a spike in migration propensities. Structure of the household also influences migration; probability of migrating decreases with the number of elderly and increases with the number of children in the household. This interesting result may be due to higher needs of the elderly for care deterring migration versus the higher need for future investment in children's education fostering migration. In terms of village characteristics, the proportion of households receiving remittances

has the highest positive effect on migration, suggesting a strong effect of village norms.

Remoteness of the village to urban centers, which reflects low level of development in the village, also increases migration propensities.

Next, I move on to the estimates of the remittance equation from the univariate probit specification presented in the first column. The coefficients from the integrated model, which corrects for selection into migration, are presented in the adjacent column 2 for comparison.

Without controlling the effect of migration, I find that migrants are more likely to send remittances if their household is poor, or if there are risks to household's income (measured by months of water shortage in village). Surprisingly, migrants are less likely to remit if their household is in debt. These results provide partial support for the view that migrants may be sending remittances to improve the household's economic standing (i.e., the altruistic explanation).

The results also provide evidence that insurance seeking and inheritance expectations may factor into migrant's remittance choices. The unemployment rate in the migrant's occupation category, proxying potential risks to the migrant's income, positively influences remittance probability. Similarly, migrants who have prospects for inheritances (such as youngest daughters, and other daughters or sons⁶) are more likely to send remittances. The number of economic activities the household is involved in, signifying the investment opportunities for the migrant within the household, has the expected positive effect on the probability of remitting. Investment opportunities in origin villages measured by village electrification and remoteness of the village, development indicators with opposite anticipated effects, have positive and negative effects on

remittances respectively, confirming the expectation. Village remittance norms reflected in the measure of proportion of households receiving remittances positively influence remittance propensity. Similarly, strength of the link between migrant and the household, captured through an indicator of whether household sends remittances to the migrant, increases of migrant's chances of reciprocating the act.

I continue with the estimates from the remittance equation of the integrated model presented in the second column of Table 3. A comparison of these estimates with those from the separate model of remittances (summarized above) leads us to the conclusion that migration and remittance outcomes are related. The significance and magnitude of rho (ρ), the correlation between the errors of the migration and remittance equations, indicate whether and how these two outcomes are related, respectively. Recall that in the separate model of remittances, presented in column 1, ρ is assumed to be zero. In the integrated model, by contrast, ρ is found to be negative (-0.27) and statistically significant ($p=0.000$). This result statistically demonstrates that migration and remittance equations are correlated, and that ignoring this correlation (as in the univariate model of remittances) may lead to biased parameter estimates.

Substantively, the negative sign suggests that the unobserved factors that affect migration behavior actually diminish the prospects for remitting. Among these unobserved factors, one may have individuals' self-interested motives to improve their income, or their altruistic motives to improve their household's income, both of which should positively influence migration probability. These motives, although central to explanations of migration, are not readily

observable in these (or other) data, but instead are proxied through individual or household economic status indicators. The estimate of the correlation coefficient, ρ , from the integrated model gives an opportunity to speculate on the relative importance of these unobserved (self-interested or altruistic) motives for influencing migration. Namely, if the unobserved factors influencing migration are mostly related to individuals' self-interested motives, these factors should negatively affect remittances. Then, the correlation between migration and remittance equations, ρ , should be negative. Conversely, if the unobserved factors reflect individuals' altruistic motives to help the household that we cannot adequately capture through the regressors, then we expect them to positively affect remittances, in which case ρ should be positive. In our case, because ρ is negative, the former explanation appears to be more plausible.

The estimates of the integrated model for remittances are different from those of the separate model, although the differences are not striking. About a third of the coefficients that are of substantive interest have changed by at least 10 percent in magnitude from the separate to the integrated model (shown in boldface in table). Only one coefficient, for the unemployment rate in individual's education group, has lost significance once selectivity of migration is taken into account. Two other coefficients, those of education and relative deprivation index, have changed in sign, yet remain insignificant in either case.

Given that the coefficient estimates remain more or less intact, should we conclude that selection bias exists, but it does not significantly alter our conclusions? The answer is no, and owes to a fact that is often neglected in empirical studies using censored regression models. Namely, a lack

of change in the coefficient estimates signifies that the unobserved factors influencing migration do not significantly alter the effect of the observed factors (i.e., regressors) on remittances. Moreover, in a censored model, the coefficient estimates capture only the direct effect of regressors on remittances, and thus, they can be misleading. Specifically in our case, because the same set of variables influence migration and remittance outcomes, each variable affects remittances directly as well as indirectly through its influence on migration. To assess the overall impact of a given variable, then, we need to consider how a change in its value alters the joint probability of migrating and remitting. As Greene (1998) notes, whether the effects of variables on the conditional probability of remitting or on the joint probability of migrating and remitting are of interest reflect the intended inferences of the study. Most empirical studies in the literature confine their analyses to migrants only, and evaluate the effects of regressors on the conditional probability of remitting. Because in this study I intend to provide a unified explanation for migration and remittances and extend the analyses to the entire population (migrants and non-migrants), the effects of regressors on the joint probability of migrating and remitting are of interest.

Coefficients may also be misleading because of the nonlinearity of the probit specification, yielding a distorted picture of the response of the outcome to a change in the explanatory variables (Greene 2003). Instead of coefficients, it is more useful to analyze marginal effects, that is, change in the probability of outcome in response to a change in the variable of interest while holding the other continuous variables at their means and discrete variables at their modes.⁷ In order to capture the variation in each variable and better assess its relative influence,

below, I compute the marginal effect on the probability of outcome when the variable of interest moves from its minimum to maximum value.

Marginal Effects

In respective columns, Table 4 displays changes in (1) the conditional probability of remitting from the univariate model, (2) the conditional probability of remitting, and (3) the joint probability of migrating and remitting from the censored bivariate model when the variable of interest moves from its minimum to maximum value. Comparing the first and second columns, we observe similar trends to those suggested by the coefficient estimates. This is expected as both columns report direct effects of variables on remittance outcomes, without and with selection respectively. Yet, when we assess the overall effect of variables (sum of their direct effect and indirect effect through migration) presented in the third column, the picture changes dramatically. Compared with the univariate model, the partial effects of several variables, shown in boxes in the table, changes in direction and/or significance. Coefficients of most of the remaining variables, shown in boldface, change in magnitude by at least 10 percent.

-- Table 4. Change in the (1) Univariate, (2) Bivariate Conditional Probability of Remitting, and (3) Joint Probability of Migrating and Remitting When a Variable Changes from its Minimum to Maximum Value --

In individual characteristics, for instance, education has no effect on the probability of remitting in the univariate model. But, because it positively affects migration, it has an indirect positive effect on remittances. When both the direct and indirect effects are taken into account in the integrated model, education becomes one of the most important determinants of migration-

remittance behavior. Moving from no education to advanced education increases the probability of migrating and remitting by 44 percent. Note that education signifies both an individual's earning potential in destination, and household's past investment in his or her education. Either way, it is anticipated to have a direct positive effect on remittances. The fact that the effects are only indirect in our case suggests that more educated individuals are more likely to migrate due to either their higher earning potential, or higher past loans from the household; but once they migrate, they are equally likely to send remittances as their less educated counterparts. Note that the lack of any direct effects of education on remittances may be due to the inclusion of migrant's earnings, proxied by their occupations in destination, in the remittances equation.

In economic explanations of remittances, the negative effect of household land becomes stronger when selectivity of migration is taken into account. In the univariate model, the probability of remitting for the richest household members is 16 percent less than that for the poorest household members. The same estimate in the integrated model for the joint probability of migrating and remitting is 27 percent. Similarly, household debt appears to influence migrant's remittance probabilities negatively in the univariate model. This unexpected finding disappears when the selectivity of migration is taken into account. Namely, household debt has no direct effect on remittances, but because it positively affects migration propensities, it also has an indirect positive effect on remittances which is only captured in the integrated model. These results, coupled with the stronger effect of household land, provides unequivocal support to the hypotheses suggesting remittances are a strategy to improve household income (altruistic explanation), as opposed to the only partial support provided by the univariate model.

Continuing with the insurance explanations of remittances, the univariate model estimates a higher frequency of remittances when risks to migrants' incomes, measured by education- and occupation-specific unemployment rates in destination, are higher. This finding is robust to selection bias, as the marginal effects in the univariate model are identical to those estimated by the integrated model in column 2. Both results reflect the direct effects of these variables on remittance probability estimated on a sample of migrants. If individuals anticipate risks to their future income, and become less likely to migrate as a result, then the effects estimated on a sample of migrants are underestimates of the true effects. Indeed, when the joint probability of migrating and remitting is considered, the effect of the education-specific unemployment rate more than doubles. Therefore, considering the joint probability of migrating and remitting, instead of the conditional probability of remitting, we find stronger support for the insurance explanations. (Interestingly, the effect of the occupation-specific unemployment rate loses significance, as it is not included in the migration equation. Because almost all non-migrants are farmers, any occupation related indicator is a perfect predictor of migration. To prevent issues of endogeneity, such variables are not included in the migration equation. Consequently, the effect of occupation-specific unemployment rate becomes diluted in the whole sample, appearing to lose significance.)

Finally, using a sample of migrants only, we find that the number of dependents in the household has no direct effect on the probability of remitting. This estimate does not reflect the fact that individuals with children are in fact more likely to migrate. When we take into account this fact, which indirectly influences remittances by determining the sample of migrants, we find that having children significantly improves the chances of migrating and remitting. Similarly, when

only migrants are considered, investment opportunities in the village, captured through development indicators such as the remoteness of the village, seem to positively influence remittance outcomes (the marginal effect is negative since remoteness is an indicator of lack of development). But there is less migration out of developed villages, as shown by the positive coefficient of remoteness in the migration equation of Table 4. This indirect effect is reflected in the insignificant marginal effect of this variable on the joint migration-remittance outcome. Then, considering the whole sample, there is less support for the investment opportunities hypothesis of remittances. (Note that the effect of investment opportunities in the household, measured by the number of economic activities, remains the same across samples.)

In sum, our conclusions on the whole sample including migrants and non-migrants are considerably different than those on a sample of migrants only. While for migrants, we find ambiguous support for altruistic explanations and only moderate support for insurance explanations of remittances, in the whole sample we find unequivocal support for altruism, and stronger support for insurance motives. Similarly, dependency in household, which has no effect on migrants' remittance behavior, gains significance once its effect on migration is taken into account. Conversely, investment opportunities in the village which seem to positively affect remittances among migrants, become insignificant once its negative effect on migration is controlled for. These results justify substantively what this paper has shown statistically, namely, that remittance behavior is strongly related to the determinants of migration.

Conclusion

Most empirical work in the literature models migration and remittances separately, treating them as independent processes. Because remittances are observed for a non-random sample of the population (i.e., migrants), and unobserved characteristics related to being a migrant are likely to also affect remittance behavior, empirical estimates from prior studies may be subject to selection bias. To address this problem, this study employs a censored bivariate specification, a variant of the standard Heckman procedure, identifying migration as a mechanism for selection. This approach integrates analyses of migration and remittances, allowing extension of the inferences to the whole sample including migrants and non-migrants. The main finding is that migration and remittance processes are related. The integrated model of migration and remittance behavior demonstrates this empirically in the case of Thai rural to urban migration and suggests that similar social, economic and demographic factors influence both outcomes. Furthermore, the estimates from the integrated model of migration and remittances (estimated on the whole sample) lead to distinctively different conclusions than those implied by the separate model of remittances (estimated on migrants). Specifically, considering the selectivity of migration, (1) the support for altruistic explanations for remitting, captured by low economic status of household, moves from ambiguous to unequivocal, (2) the evidence for contractual explanations, measured by risks to income in destination and number of migrants' dependents in origin, becomes stronger, (3) inheritance seeking hypothesis, measured by indicators of heir status, become less influential, (4) the effect of investment opportunities, proxied by economic opportunities in household or village, decreases, and (5) the idea that migrants remit to maintain linkages, captured by proportion of remittance receiving households, gains more support.

In conclusion, the results from the integrated model suggest that it is crucial for researchers interested in the remittance behavior of migrants to first consider how and why individuals become migrants. Conceptually and empirically, migration and remittance decisions are found to be related processes. These results also suggest a need for a theoretical framework which links explanations for migrating and remitting. Specifically, future work should attempt at deriving hypotheses that incorporate selectivity of migration as an endogenous explanation for remittances.

Appendix

-- Table A1. Descriptive Statistics for Variables --

Endnotes

- 1 The Nang Rong surveys are conducted by University of North Carolina and Mahidol University in Thailand. The data and information about the surveys are available at <http://www.cpc.unc.edu/projects/nangrong/>.
- 2 Land owned is measured in rai (1 rai=1600m²). Durables are measured by counting the number of household assets (television, vcr, refrigerator, sewing machine, truck, car or motorcycle).
- 3 A village is considered remotely located if there are three or more obstacles to traveling to the district town. The obstacles are the presence of a portion of the route to the district town that is a cart path (unpaved, rutted, and narrow), the lack of public transportation to the district town, travel to the district town takes an hour or more, that during the year there are four or months of difficult travel to leave the village, and it is 20 or more kilometers to the district town.
- 4 Inequality is measured using the Theil index as follows:

$$Inequality = \sum_{i=1}^n \left(\frac{x_i}{\sum_{j=1}^n x_j} \ln \frac{x_i}{\bar{x}} \right)$$

where x_i is the number of trips by i -th individual, \bar{x} is the mean number of trips in village, and n is the number of individuals.

5 Diversity, measured by Shannon's entropy index, is computed as follows:

$$Diversity = \frac{-\sum_{i=1}^n p_i \times \log(p_i)}{\log(n)}$$

where n is the number of possible destinations and p_i is the proportion of trips to destination i . Minimum diversity occurs when all trips are concentrated in one destination and the index equals zero. Maximum diversity occurs when each destination contains the same proportion of trips, yielding an index of 1. In the Thai context, I identify ten possible categories that exhaust all possible destinations for Nang Rong residents: Buriram, Korat, any other provinces in the North Eastern region, Chon Buri, Rayon, Eastern Seaboard, Bangkok, Bangkok Metropolitan Area, Other and International.

6 The excluded category includes household members who are not heirs, such as, the mother, the father, the grandparents or other relatives who live in the household.

7 As Greene (2000) notes, the sign and statistical significance of the marginal effect can be different from those of the estimated coefficient. In our case, the significance changes in two variables in the univariate model (months of water shortage and years since village electrification), and three variables in the censored bivariate model (married with spouse living in the house, unemployment rate in migrant's education group, years since village electrification) when marginal effect, instead of the coefficient, is analyzed.

References

- Agarwal, R. and A. W. Horowitz. 2002. "Are international remittances altruism or insurance? Evidence from Guyana using multiple-migrant households." *World Development* 30(11): 2033-2044.
- Ahlburg, D. A. and R. P. C. Brown. 1998. "Migrants' intentions to return home and capital transfers: A study of Tongans and Samoans in Australia." *Journal of Development Studies* 35(2): 125-151.
- Banerjee, B. 1984. "The probability, size, and uses of remittances from urban to rural areas in India." *Journal of Development Economics* 16: 293–311.
- Blue, S. A. 2004. "State policy, economic crisis, gender, and family ties: Determinants of family remittances to Cuba." *Economic Geography* 80(1): 63-82.
- Boyes, William J., Dennis L. Hoffman and Stuart A. Low. 1989. "An Econometric Analysis of the Bank Credit Scoring Problem." *Journal of Econometrics* 40: 3-14.
- Brown, R. P. C. 1997. "Estimating remittance functions for Pacific Island Migrants." *World Development* 25(4): 613-626.
- Cai, Q. 2003. "Migrant remittances and family ties: a case study in China." *International Journal of Population Geography* 9(6): 471-483.

- Curran, S., F. Garip, C. Chung, and K. Tangchonlatip. 2005. "Gendered Migrant Social Capital: Evidence from Thailand." *Social Forces* 84(1): 225-255.
- De la Briere, B., E. Sadoulet, A. de Janvry, S. Lambert. 2002. "The roles of destination, gender, and household composition in explaining remittances: an analysis for the Dominican Sierra." *Journal of Development Economics* 68(2): 309-328.
- Durand, J., W. Kandel, E. A. Parrado, and D. S. Massey. 1996a. "International Migration and Development in Mexican Communities." *Demography* 33(2): 249-64.
- Durand, J., E.A. Parrado, and D.S. Massey. 1996b. "Migradollars and Development: Reconsideration of the Mexican Case." *International Migration Review* 30: 423-44.
- Eklof, Jan A. and Sune Karlsson. 1999. "Testing and Correcting for Sample Selection Bias in Discrete Choice Contingent Valuation Studies." *Technical Report 171, EFI Working Paper Series in Economics and Finance, Stockholm School of Economics.*
- Foster, J. 1995. "The relationship between remittances and savings in small Pacific Island states: some econometric evidence." *Asian and Pacific Migration Journal* 4(1): 117-138.

Funkhouser, E. 1992. "Migration from Nicaragua: Some recent evidence." *World Development* 20(8): 1209–1218.

Garip, F. 2006. "Social Capital and Migration: How Do Similar Resources Lead to Divergent Outcomes?" *Center for Migration and Development Working Paper*, Princeton University.

Goldring, L. 2003. "Rethinking Remittances: Social and Political Dimensions of Individual and Collective Remittances." *CERLAC Working Paper*.

Greene, W. 2003. *Econometric Analysis*. Prentice Hall, 5th Edition.

Greene, W. 1999. "Marginal Effects in the Censored Regression Model." *Economic Letters* 64(1): 43-50.

Greene, W. 1998. "Gender Economics Courses in Liberal Arts Colleges: Further Results." *Journal of Economic Education* 29(4): 291-300.

Greene, W. 1992. "A Statistical Model for Credit Scoring." *NYU Stern/Economics Working Paper* 92-29.

Hay, M. J. 1980. "A structural equations model of migration in Tunisia" *Economic Development and Cultural Change* 28: 345–358.

- Heckman, James. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47: 153-162.
- Hoddinott, J. 1994. "A model of migration and remittances applied to western Kenya." *Oxford Economic Papers* 46: 459-476.
- Johnson, G. E. and W. E. Whitelaw. 1974. "Urban-rural income transfers in Kenya: an estimated-remittances function." *Economic Development and Cultural Change* 22: 473-479.
- Kalzuny, R. L. 1975. "Determinants of household migration: a comparative study by race and poverty level." *Review of Economics and Statistics* 57: 269-274.
- Lee, Y., W. Parish and R. Willis. 1994. "Sons, Daughters, and Intergenerational Support in Taiwan." *American Journal of Sociology* 99(4): 1010-1041.
- Massey, D. and R. Zenteno. 1999. "The Dynamics of Mass Migration." *Proceedings of the National Academy of Sciences*: 5328-35.
- Meng, Chun-Lo and Peter Schmidt. 1985. "On the Cost of Partial Observability in the Bivariate Probit Model." *International Economic Review* 26(1): 71-85.

- Nakosteen, R. A. and M. 1980. "Migration and Income: the Question of Self-selection." *Southern Economic Journal* 46: 84–85.
- Navratil, F. J. and J. Doyle. 1977. "The Socio-economic Determinants of Migration and the Level of Aggregation." *Southern Economic Journal* 43(4): 1547–1559.
- Neter, J., W. Wasserman, and M. Kunter. 1990. *Applied Linear Statistical Models*, 3rd ed. Irwin, Homewood.
- Reed, W. 2000. "A Unified Statistical Model of Conflict Onset and Escalation." *American Journal of Political Science* 44(1): 84-93.
- Rempel, H. and R. A. Lobdell. 1978. "The Role of Urban-to-Rural Remittances in Rural Development." *Journal of Development Studies* 14(3): 324-341.
- Roberts, B., R. Frank, and F. Lozano-Ascencio. 1999. "Transnational Migrant Communities and Mexican Migration to the U.S." *Ethnic and Racial Studies* 22 (2): 238-66.
- Stark, O. 1991. "Migration in LDCs: Risk, Remittances, and the Family." *Finance and Development* 28(4): 39–41.
- Stark, O. and D. Bloom. 1985. "The New Economics of Labor Migration." *American Economic Review* 75(2):173-78.

Stark, O. and D. Levhari. 1982. "On Migration and Risk in LDCs." *Economic Development and Cultural Change* 31: 191–196.

Stark, O. and E. Taylor. 1989. "Relative Deprivation and International Migration." *Demography* 26: 1-14.

Stark, O., J. E. Taylor, and S. Yitzhaki. 1986. "Remittances and Inequality." *Economic Journal* 96:722-41.

Taylor, E. J. 1999. "The New Economics of Labour Migration and the Role of Remittances in the Migration Process." *International Migration* 37(1):63-88.

Taylor, E. J., J. Arango, G. Hugo, A. Kouaouci, D. S. Massey, and A. Pellegrino. 1996. "International Migration and National Development." *Population Index* 62(2):181-212.

Taylor, J. Edward, Scott Rozelle and Alan de Brauw. 2003. "Migration and Incomes in Source Communities: A New Economics of Migration Perspective from China." *Economic Development and Cultural Change* 52: 75-101.

Todaro, M. P. 1969. "A Model of Labor Migration and Urban Unemployment in Less Developed Countries." *American Economic Review* 59(1):138-48.

Van de Ven, Wynand P. and Bernard M. Van Praag. 1981. "The Demand for Deductibles in Private Health Insurance: A Probit Model with Sample Selection." *Journal of Econometrics* 17: 229-252.

Vanwey, L. K. 2004. "Altruistic and Contractual Remittances Between Male and Female Migrants and Households in Rural Thailand." *Demography* 41(4): 739-756.

World Bank Report. 2004. Remittances (by Sole Martinez Peria and Asli Demirguc-Kunt.)
<http://econ.worldbank.org> (accesses on July 25, 2006)

Table 1. Overview of the Explanations for Remittances in the Literature

Mechanism	Reference
<i>Altruistic</i>	Agarwal and Horowitz (2002) Benarjee (1984) Johnson and Whitelaw (1974) Vanwey (2004)
<i>Contractual</i> Risk sharing / Insurance	Lucas and Stark (1985) Rosenzweig and Stark (1989) Stark (1991) Stark and Levhari (1982) Stark and Lucas (1988) Vanwey (2004)
Bargaining / Inheritance seeking	De la Briere et al. (2002) Regmi and Tisdell (2002)
Investment	Blue (2004) Durand, Kandel et al. (1996) Foster (1995) Hoddinott (1994)
Maintain linkages / Intentions to return	Ahlburg and Brown (1998) Brown (1997) Guarnizo (2003) Regmi and Tisdell (2002) Roberts, Frank et al. (1999) Roberts and Morris (2003)
Repayment of past loans	Durand et al. (1996)

Table 2. Summary of Expected Direction of Regression Coefficients by Hypotheses

Proposed Operational Variables	Expected effect on		By Hypothesis
	Migration	Remittances	
Altruism			
Land owned by the household (lagged)	-	-	H1 The lower the household's income/ wealth, the higher the propensity to migrate and remit.
Durables owned by the household (lagged)	-	-	
Household has debt?	+	+	
Relative Deprivation Index of hh in land	+	+	H2 The lower the household's relative income/ wealth, the higher the propensity to migrate and remit.
Relative Deprivation Index of hh in durables	+	+	
Months of water shortage in year	+/-	+	H4 The higher the risks to a household's income in origin, the higher the propensity to remit.
Risk Sharing / Insurance			
Unemployment rate in migrants' education category	+/-	+	H3 The higher the risks to a migrant's income in destination, the higher the propensity to remit.
Unemployment rate in migrants' occupation category		+	
Bargaining			
Number of dependents in hh (age>64)	+/-	+	H5 The higher the number of dependents in the household, the higher the propensity to remit.
Number of children in hh (age<15)	+/-	+	
Number of other migs in hh	+/-	-	
Inheritance Seeking			
Is individual the youngest daughter? (most likely heir)	+/-	+	H6 The higher the prospects for inheritance, the higher the propensity to remit.
Is individual a potential heir?	+/-	+	
Investment			
No of economic activities hh is involved in (0-4)	+/-	+	H7 The better the investing conditions in origin, the higher the propensity to remit.
Remoteness of village to urban centers	+/-	-	
Years since village is electrified	+/-	+	
Maintaining Linkages			
Proportion of hhs receiving remittances in village	+/-	+	H8 The stronger a migrant's links to the community, the higher the propensity to remit.
Repaying Past Loans			
Hh sends remittances to migrant?		+	H9 The higher the past investment of the household in the migrant, the higher the propensity to remit.
Migrant's education	+/-	+	

Table 3. Effects of Socio-Economic Characteristics on Remittances - Models with and without Sample Selection Correction

	UNIVARIATE PROBIT		CENSORED BIVARIATE PROBIT			
	Remit	(se)	Remit	(se)	Migrate	(se)
Controls						
<i>Individual characteristics</i>						
Age	0.037	(0.002) ***	0.031	(0.006) ***	-0.015	(0.016)
Sex (Male=1)	-0.394	(0.028) ***	-0.366	(0.026) ***	-0.319	(0.055) ***
Married and spouse lives in the house	-0.153	(0.075) **	-0.064	(0.104)	-0.864	(0.361) **
Married and spouse does not live in the house	-0.260	(0.207)	-0.273	(0.209)	-0.034	(0.054)
Is individual hh head?	0.877	(0.163) ***	0.887	(0.186) ***	0.630	(0.022) ***
<i>Household characteristics</i>						
Household size	-0.003	(0.036)	-0.011	(0.038)	0.093	(0.025) ***
Parents live in hh?	-0.101	(0.123)	-0.081	(0.123)	-0.167	(0.039) ***
<i>Village characteristics</i>						
Is there a school in the village?	-0.119	(0.045) ***	-0.116	(0.038) ***	-0.050	(0.036)
Is there a temple in village?	-0.040	(0.066)	-0.056	(0.071)	0.199	(0.004) ***
Inequality of owned land in village (lagged) ^a	0.068	(0.015) ***	0.070	(0.015) ***	-0.006	(0.008)
Inequality of durables in village (lagged) ^a	-0.126	(0.003) ***	-0.129	(0.003) ***	0.097	(0.031) ***
<i>Migrants' characteristics</i>						
Factory worker	0.338	(0.126) ***	0.340	(0.129) ***		
Construction worker	-0.134	(0.129)	-0.117	(0.129)		
Service worker	0.239	(0.076) ***	0.233	(0.077) ***		
Migrant is in Bangkok?	0.502	(0.178) ***	0.495	(0.170) ***		
Migrant is in Central Region?	0.463	(0.133) ***	0.455	(0.128) ***		
<i>Prior migration experience</i>						
Migration trips by individual					0.216	(0.020) ***
Migration trips by household members					-0.013	(0.006) **
Migration trips by village members					-0.066	(0.011) ***
Destination diversity of trips by villagers ^a					0.090	(0.017) ***
Inequality of trips in village ^a					0.034	(0.021)

Table 3 (cont'd). Effects of Socio-Economic Characteristics on Remittances - Models with and without Sample Selection Correction

	UNIVARIATE PROBIT		CENSORED BIVARIATE PROBIT			
	Remit	(se)	Remit	(se)	Migrate	(se)
Altruism						
Land owned by the household (lagged) ^b	-0.015	(0.005) ***	-0.013	(0.006) **	-0.021	(0.003) ***
Durables owned by the household (lagged) ^b	0.026	(0.039)	0.028	(0.038)	-0.010	(0.027)
Household has debt?	-0.065	(0.028) **	-0.069	(0.029) **	0.103	(0.020) ***
Relative Deprivation Index of hh in land ^a	0.002	(0.063)	0.000	(0.063)	0.021	(0.005) ***
Relative Deprivation Index of hh in durables ^a	-0.030	(0.045)	-0.028	(0.045)	-0.026	(0.021)
Months of water shortage in year	0.253	(0.155) *	0.227	(0.129) *	0.056	(0.111)
Risk Sharing/Insurance						
Unemployment rate in migrants' education category	0.611	(0.288) **	0.435	(0.287)	1.345	(0.122) ***
Unemployment rate in migrants' occupation category	0.037	(0.015) **	0.033	(0.017) **		
Bargaining						
Number of dependents in hh (age>64)	0.037	(0.038)	0.041	(0.040)	-0.024	(0.008) ***
Number of children in hh (age<15)	0.035	(0.034)	0.024	(0.031)	0.106	(0.035) ***
Number of other migs in hh	-0.044	(0.031)	-0.043	(0.031)	-0.011	(0.006) *
Inheritance Seeking						
Is individual the youngest daughter? (most likely heir)	0.717	(0.009) ***	0.726	(0.006) ***	-0.084	(0.022) ***
Is individual a potential heir?	0.632	(0.186) ***	0.634	(0.191) ***	-0.006	(0.037)
Investment						
No of economic activities hh is involved in (0-4)	0.056	(0.006) ***	0.052	(0.009) ***	0.023	(0.036)
Remoteness of village to urban centers ^a	-0.095	(0.006) ***	-0.096	(0.010) ***	0.040	(0.022) *
Years since village is electrified	0.013	(0.007) *	0.013	(0.007) *	0.000	(0.004)
Maintaining Linkages						
Proportion of hhs receiving remittances in village	1.467	(0.025) ***	1.322	(0.035) ***	1.040	(0.199) ***
Repaying Past Loans						
Hh sends remittances to migrant?	0.372	(0.049) ***	0.368	(0.050) ***		
Years of education	0.003	(0.020)	-0.009	(0.018)	0.117	(0.013) ***
Year 2000	-0.811	(0.095) ***	-0.870	(0.027) ***	1.042	(1.233)
Intercept	-1.814	(0.035) ***	-1.297	(0.166) ***	-1.999	(0.455) ***
ρ			-0.267	(0.046) ***		
N	2793		2793		3823	
Pseudo-R2	0.1324					

***p<0.01, **p<0.05, *p<0.10 Standard errors given in parentheses are adjusted for year-level clusters. Bold indicates that the coefficient changes by at least 10% from univariate to the bivariate model.

^a Variable is standardized to have mean 0 and standard deviation 1.

^b For the lagged variables, the 1994 value comes from the 1984 survey wave, and 2000 value comes from the 1994 wave.

Table 4. Change in the (1) Univariate, (2) Bivariate Conditional Probability of Remitting, and (3) Joint Probability of Migrating and Remitting When a Variable Changes from Its Minimum to Maximum Value(Continuous variables are kept at their mean, and binary variables are kept at their mode)

	UNIVARIATE PROBIT	CENSORED BIVARIATE PROBIT	
	(1) $\Delta P(\text{Remit} \text{Migrate})$	(2) $\Delta P(\text{Remit} \text{Migrate})$	(3) $\Delta P(\text{Migrate}\&\text{Remit})$
(Controls Included)			
Altruism			
Land owned by the household (lagged) ^b	-0.156 **	-0.160 *	-0.267 ***
Durables owned by the household (lagged) ^b	0.056	0.063	0.033
Household has debt?	-0.020 ***	-0.019 **	0.009
Relative Deprivation Index of hh in land ^a	0.004	0.004	0.030
Relative Deprivation Index of hh in durables ^a	-0.060	-0.066	-0.086
Months of water shortage in year	0.040	0.039 *	0.037 ***
Risk Sharing/Insurance			
Unemployment rate in migrants' education category	0.119 ***	0.120 ***	0.271 ***
Unemployment rate in migrants' occupation category	0.033 ***	0.031 **	0.025
Bargaining			
Number of dependents in hh (age>64)	0.095	0.103	0.039
Number of children in hh (age<15)	0.056	0.061	0.161 ***
Number of other migs in hh	-0.181	-0.195	-0.182
Inheritance Seeking			
Is individual the youngest daughter? (most likely heir)	0.168 ***	0.181 ***	0.118 **
Is individual a potential heir?	0.233 ***	0.243 ***	0.189 *
Investment			
No of economic activities hh is involved in (0-4)	0.080 ***	0.083 ***	0.087 ***
Remoteness of village to urban centers ^a	-0.112 ***	-0.114 ***	-0.058
Years since village is electrified	0.073	0.076	0.058
Maintaining Linkages			
Proportion of hhs receiving remittances in village	0.288 ***	0.299 ***	0.371 ***
Repaying Past Loans			
Years of education	0.015	0.021	0.443 **
Hh sends remittances to migrant?	0.102 ***	0.124 ***	0.097 ***

***p<0.01, **p<0.05, *p<0.10. Bold indicates that the coefficient changes by at least 10% from univariate to bivariate model.

indicates the significance or the direction of the partial effect changes from univariate to bivariate model.

^a Variable is standardized to have mean 0 and standard deviation 1.

^b For the lagged variables, the 1994 value comes from the 1984 survey wave, and 2000 value comes from the 1994 wave.

Table A1. Descriptive Statistics for Variables

	Mean	Standard Deviation	Minimum	Maximum
Dependent Variables				
Person migrated in the last 12 months?	0.73	0.44	0.00	1.00
Person remitted in the last 12 months? (Whole sample)	0.52	0.50	0.00	1.00
Person remitted in the last 12 months? (Among migrants)	0.71	0.50	0.00	1.00
Controls				
<i>Individual characteristics</i>				
Age	24.37	6.37	13.00	41.00
Sex (Male=1)	0.47	0.50	0.00	1.00
Married and spouse lives in the house	0.06	0.24	0.00	1.00
Married and spouse does not live in the house	0.39	0.49	0.00	1.00
Is individual hh head?	0.01	0.08	0.00	1.00
<i>Household characteristics</i>				
Household size	4.10	1.95	1.00	13.00
Parents live in hh?	0.94	0.23	0.00	1.00
<i>Village characteristics</i>				
Is there a school in the village?	0.59	0.49	0.00	1.00
Is there a temple in village?	0.74	0.44	0.00	1.00
Inequality of owned land in village (lagged)	0.39	0.15	0.11	0.91
Inequality of durables in village (lagged)	0.29	0.12	0.09	0.62
<i>Migrants' characteristics</i>				
Factory worker	0.35	0.48	0.00	1.00
Construction worker	0.04	0.19	0.00	1.00
Service worker	0.14	0.35	0.00	1.00
Migrant is in Bangkok?	0.32	0.47	0.00	1.00
Migrant is in Central Region?	0.31	0.46	0.00	1.00
<i>Prior migration experience</i>				
Migration trips by individual	5.42	5.16	0.00	28.00
Migration trips by household members	5.22	5.48	0.00	52.00
Migration trips by village members	4.11	1.75	1.30	7.91
Destination diversity of trips by villagers	0.71	0.05	0.60	0.81
Inequality of trips in village (Theil index)	1.24	0.43	0.60	2.73

Table A1 (cont'd). Descriptive Statistics for Variables

	Mean	Standard Deviation	Minimum	Maximum
Altruism				
Land owned by the household (lagged)	3.85	3.48	0.00	32.08
Durables owned by the household (lagged)	0.98	1.17	0.00	8.00
Household has debt?	0.65	0.48	0.00	1.00
Relative Deprivation Index of hh in land	9.12	7.27	0.00	43.00
Relative Deprivation Index of hh in durables	0.68	0.69	0.00	4.26
Months of water shortage in year	0.12	0.14	0.00	0.50
Risk Sharing/Insurance				
Unemployment rate in migrants' education category	0.41	0.21	0.03	0.64
Unemployment rate in migrants' occupation category	1.85	0.98	0.71	3.51
Bargaining				
Number of dependents in hh (age>64)	0.69	0.98	0.00	8.00
Number of children in hh (age<15)	0.09	0.46	0.00	5.00
Number of other migs in hh	2.38	1.89	0.00	13.00
Inheritance Seeking				
Is individual the youngest daughter? (most likely heir)	0.20	0.40	0.00	1.00
Is individual a potential heir?	0.67	0.47	0.00	1.00
Investment				
No of economic activities hh is involved in (0-4)	0.25	0.65	0.00	3.00
Remoteness of village to urban centers	1.72	1.08	0.00	4.00
Years since village is electrified	10.82	4.41	3.00	21.00
Maintaining Linkages				
Proportion of hhs receiving remittances in village	0.56	0.13	0.22	0.84
Repaying Past Loans				
Hh sends remittances to migrant?	0.27	0.44	0.00	1.00
Years of education	7.14	2.96	0.00	17.00