The Effects of Social Networks at the Village of Origin on Migrant Remittance: Evidence from Nang Rong, Thailand

Abstract

The literature on the effect of social networks on migrant remittance has focused on networks at the destination community. This paper contributes to existing literature by using multilevel statistical modeling and social survey data from Nang Rong, Thailand to examine how remittances between migrants and households in rural origin villages are related to social networks and social capital at the community of origin. Using data from two different social networks, results suggest that networks can have different, even opposite effects. Moreover, results also show that network effects may be overstated, as individual-level measures of kin ties to the origin household, the migrant's gender and marital status, and human capital measures were found to have the strongest and most consistent effects on remittance.

Introduction

Past research on migration and development has shown that migrant remittances, or money and goods sent by migrants to their home households, can have substantial impacts on origin households and communities. Durand, Parrado, and Massey (1996) find that monetary remittance, or "migradollars," sent home from Mexican migrants working in the United States have substantial multiplier effects at both the national and community level. Transfers of cash from migrants ease household budget constraints enabling the purchase of products that would otherwise be difficult to acquire.

From the perspective of the household, the gain from remittance is obvious. However, it is less clear what the migrant gains from such an arrangement. To better understand this, researchers (see for example Hoddinot, 1994; Lucas and Stark, 1985; Massey and Basem, 1992; Stark and Lucas, 1988) have modeled the determinants of remittance by incorporating information on both parties involved the remittance exchange: migrants and their origin households. Recently, the literature has progressed beyond the simple dyadic relationship between households and migrants, by including aspects of social networks (see Massey and Basem, 1992; Roberts and Morris, 2004 for example).

Work by Massey and Basem (1992), and Roberts and Morris (2004) have found that migrant social networks at destination and such networks between destination and origin communities encourage greater remittances to origin villages. However, while the focus of this research has been on social networks and social capital at the destination community and between the destination and origin community, no research has considered its implications solely at the origin community. Up until now, there was been

no empirical inquiry into whether the origin household's embeddedness in a social network can also encourage remittance.

In this paper I fill a gap in the existing literature by using actual social network measures from complete networks of several communities in Nang Rong, a rural, agricultural district located Thailand's Northeast region, to examine how social networks at the village of origin influence migrant remittance. I draw on insights from the microeconomics of remittance literature, as well as ideas from economic sociology. In what follows I outline the microeconomic model of remittance, and I show how empirical research and theory have altered that model to incorporate the effect of social networks at destination and networks spanning destination and origin communities. I proceed to argue that the model must also include measures of networks at the origin community, which I use as a basis for testing an empirical model of remittance.

The Microeconomic Model of Remittance

The microeconomic model of remittance, as developed by Lucas and Stark, views remittance as part of a mutually-beneficial, inter-temporal, self-enforcing, implicit contract between a migrant and a household (Lucas and Stark, 1985; Stark and Lucas, 1988). This contract is motivated by a mixture of altruism and self-interest, whereby the migrant and household use remittance to better each other's welfare in addition to using remittance instrumentally to pursue personal gains.

Instrumental motivations are of three varieties: investment, insurance, and promise of bequest. Investment, the first type of instrumental motive, occurs, for instance, when a household invests in the education of the migrant in anticipation of future returns from accruements to the migrant's human capital endowments. The second

type of instrumental motive, coinsurance, occurs when a household and migrant take turns insuring each other from market fluctuations and risky ventures, such as when the household provides a safety net to insure the migrant against involuntary unemployment, or when the migrant sends remittance to allow a household to invest in a relatively risky new production technology, such as a high-yield crop variety (Stark and Lucas, 1988). A final instrumental motive is the promise of bequest, whereby migrants send remittance in anticipation of future inheritance of land or others assets (Hoddinot, 1994).

The difficulty with such a model has to do with adherence to this contract or avoidance of malfeasance. Such a contract, which is likely made between family members, is cost efficient relative to alternative contractual arrangements since both the migrant and family are endowed with a highly specific asset: mutual altruism. Mutual altruism creates an effect similar to trust or loyalty, which assists both parties in solving problems that emerge when legally enforceable contracts are not available. From a more sociological viewpoint, mutual altruism may represent what Granovetter (1973) calls "strong ties," where the strength of a tie is a combination of the amount of time, emotional intensity, intimacy (mutual confiding), and the reciprocal services which characterize the tie.

The value of mutual altruism is lost if both parties – the migrant or the household – were to enter into an exchange relation with any third party. The addition of a third party could change the dynamics of exchange between the two original parties, making them less reliant on each other, and more reliant on exchange with that third party.

The theory further suggests that the migrant and the household agree on the particulars of their contractual understanding through bargaining, whereby each party

pushes for the arrangement that best suits its interest, be it motivated by altruistic or instrumental ends. Bargaining power is determined by human capital or financial capital, such that attributes enhancing the bargaining power of the household vis-à-vis the migrant will positively influence the migrant to remit, and attributes enhancing the bargaining power of the migrant will influence migrant remittance negatively (Lucas and Stark, 1988).

Social Networks and Refinements of the Microeconomic Model

One problem with this model is that social relations are abstracted to an atomized exchange between two entities – in this case the migrant and the household – hence, decision-making is forced to occur at the level of the dyad, which excludes the influence of a broader set of social relations that may be involved. Not only is this a problem conceptually, but also empirically, in light of Massey and Basem's (1992) finding that in the cross-section, Mexico immigrants living in the United States were more likely to send remittance to their households living in Mexico as the number of family members of the migrant living at the destination community increased. Massey and Basem interpret this to mean that social capital, defined as a productive value inherent in the structure of relations between persons that facilitates action, improved access to employment and provided more secure channels within which remittances and savings could travel back and forth between sending and receiving countries. This result was found even when controlling for measures of human capital (such as education), which were found to have weaker effects.

Roberts and Morris (2004) argue that this finding is contrary to predictions of the existing microeconomic model, particularly with respect to the insurance motive.

Stronger networks at destination should reduce the need for insurance, which should *lower* remittance as a payment for insurance from the household to the migrant. Why would a migrant continue to maintain ties to the home community when networks are so strong at destination?

Roberts and Morris proposed another motivation for migrants to remit: the option motivation. According to the option motive, migrant networks, or networks of former and current migrants that connect sending and receiving communities, enter into a given migrant's cost-benefit analysis, which is used in deciding to send remittance. Through such costs as visits home, gifts, remittances, or contributions to community projects, migrants affirm membership in the community in which migrant networks are based. The benefit of such membership is that networks provide migrants with employment options through the influence of, or information from, other migrants in the network. Since migrant networks are anchored in the home community, and the majority of migrant spending flows to and from the family in the place of origin (Roberts and Morris, 2004), migrants must remit to gain the benefits of network membership. Were a migrant to renege on obligations to kin living at the origin household, that migrant would suffer a loss of reputation, not only in the village, but also in the destination, since the frequent circulation of migrants means that people in one locale are aware of actions taken by individuals in another locale. Such loss of reputation could eventually hurt the migrant's chance of using the network to gain employment.

Embeddedness of Social Action

Thus the classic microeconomic model of remittance has several shortcomings, which can be illustrated in Figure 1. Figure 1 shows three different circumstances of

what Granovetter (1985) calls embeddedness, or concrete configurations of social ties that make up an actors social network. As Massey and Basem point out, migrants are embedded in a network of social relations at the destination community (see Panel A, Figure 1), which mediate migrant remittance. Roberts and Morris add that embeddedness in networks spanning destination and origin communities, characterized by the constant movement of migrants (see Panel B, figure 1) can also influence migrant remittances, as migrants send remittance in anticipation of employment options.

[Figure 1 about here]

What has not received any empirical focus is the embeddedness of origin households in a network of social ties (see Panel C, figure 1). In this paper I examine how the household's social network configuration at the community of origin can influence a migrant's decision to send remittance. There are a number of ways in which networks can affect such a decision; in what follows I outline several possible scenarios.

One possibility is that migrant's decision to remit has to do with what Coleman (1988) calls the "closure" of a social network. Closure operates through collective sanctioning, made possible by the density of social ties. Figure 2 illustrates two networks with varying degrees of closure. Network (a) is said to have a lower level of closure relative to (b), because in (a) obligations between actors can only be monitored by individuals having direct ties to one another. More specifically, *A* has separate ties to *B* and to *C*, so both *B* and *C* can only impose negative externalities on *A* independently. In contrast, in network (b), *B* and *C* share ties with one another, which enables them to combine their efforts against *A*. Thus collective sanctioning, created by the density of

social ties is the mechanism that creates social pressure and reduces the possibility of reneging on obligations.

[Figure 2 about here]

The migrant may be motivated to remit for fear of losing social relations emanating from a close-knit community, or because of the sanctioning capacity of that community. Therefore greater network density at the origin community should lead to a higher propensity for migrants to remit.

Another possibility is that the migrant's decision is not affected by closure or the density of ties, but rather the number of ties that the household shares with other households. On the one hand, if the household at the origin community is a network isolate, or is excluded from participation in social networks at the origin community, it may not matter that a migrant did not send remittance – the migrant's reputation would not change because no one would hear about the migrant's failure to send remittance. It may even be favorable to the migrant to not send remittance, if other households in that community purposely shun the household. On the other hand, if the household has many ties to other households in the village, regardless of the density of those ties, almost certainly people in the origin would find out about the migrant's unwillingness to fulfill obligations to the household. This could result in the migrant's loss of reputation among several people at both the origin and destination community, and in turn means a loss of employment options or insurance from other migrants. Thus remittance should increase with the number of social ties that a household has to other households in the origin community.

Alternatively, the number of network ties that a household possesses may also indicate the availability of alternative sources of aid, which could influence the migrant's decision to remit. Migrants may be aware that the origin household is well connected to other households in the community, who could effectively act as third parties that reduce the household's dependency on the migrant. Hence, remittance should decrease with the number of social ties that a household has to other households in the origin community.

Hypotheses

Given the above arguments, this paper examines three hypotheses about the effect of a household's network at origin on remittance. First, given Coleman's (1988) closure argument, all else equal, greater network density at the origin community should lead to a higher propensity for migrants to remit. Migrants who want to maintain a connection to a community may be influenced by both the degree to which the community is a tight-knit community, or possibly the sanctioning capacity of that community.

Second, *ceteris paribus*, the number of direct ties that a household shares with other households in the origin village will be directly proportional to the migrant's propensity to send remittance. Therefore, households that are isolates, who have no ties to other households in the village, should receive less remittance, because the migrant should have less fear of losing reputation, and less possibility of losing employment options at destination. Moreover, households having a large number of ties to other households in village should have a higher propensity for getting remittance, because more individuals would potentially know if the migrant did not send remittance, which could hurt the migrant's job options.

Third, in contrast to the second hypothesis, all else equal, the number of direct ties that a household shares with other households in the origin village will be inversely proportional to the migrant's propensity to send remittance. It may be that having more connections means that a household has more support from within the village, and has less need for remittance.

Having described my major hypotheses, I now proceed to describe the setting for this research, followed by a description of social networks, data, operationalization of various measures, analytical approach, results, and the discussion.

Setting

Nang Rong is a relatively poor, rural, agrarian district located in Northeast Thailand. The district was a frontier region until the 1970s, when road construction, electrification, telecommunications, and migration substantially changed the way that people lived. Most people in Nang Rong are rice farmers, and rain-fed lowland paddy rice cultivation is the primary source of subsistence, although increasingly farmers are growing rice and upland cash crops like cassava to sell on the market.

Many young people in Nang Rong migrate to urban areas in search of wage labor. Migration in Nang Rong tends to be either rural-to-rural, which is largely attributable to marriage, or rural-to-urban, as villagers migrated to Bangkok and surrounding areas. Often migration is only temporary, and typically it is seasonal or cyclical. During the agricultural seasons when demand for agricultural labor is low, migrants often flock to Bangkok in search of work, with flows being particularly heavy during the dry season.

Social Networks in Thailand

Because the effect of social networks at the origin community on remittance is central to this study, I describe the significance of using the network measures that are included in this study. I use ties from two different networks: a sibling network and a rice harvest help network. This is a departure from many social network studies, which only uses network data from a single social network (see for example: White and Watkins, 2000; Boulay and Valente, 1999). With only two network generators it may be difficult to ascertain a true network effect, especially given the enormous number of dimensions across which network ties can exist. Nonetheless, I argue that these networks represent two important aspects of life in Nang Rong, thus an effect should be discernable form this data. Further, past research has indicated substantial variation in the network patterns of both of these networks across villages, with surprising little overlap in their configurations within villages **(**Entwisle et al., 2004**)**.

Thailand underwent a demographic transition in the two decades prior to the early 1980s, whereby a mortality decline was followed by a fertility decline. The mortality decline was greatest for the youngest age groups, especially for infants (Knodel, et al., 1987). These changes in the population structure have resulted in sizeable families, and young adult Thais tend to have substantial numbers of siblings. Moreover, rice harvesting is central to Nang Rong's subsistence economy, and the vast majority of Nang Rong households grow rice in order to meet their subsistence needs. The sibling network represents family influence, which I expect to be more important than the effect of the rice harvest network. The rice harvest network characterizes the influence of unrelated individuals, most of who provide unpaid labor to other households within villages.

Data

Data come from the 1984 and 1994 waves of a longitudinal panel study of social change in Nang Rong, Thailand. In 1984, data from household surveys of all members of village households were collected in 51 villages in Nang Rong district, Buriram province in Northeast Thailand. A second wave of data collection occurred in 1994, at which time a complete census was conducted of each of the 51 villages that had been included in the first wave. The 1994 survey includes social and demographic information regarding household composition, migration, land use, and other subjects. It also includes data on complete social networks of rice harvest help and sibling connections across households.

Operationalization of Key Measures

Migrants are those individuals who lived in the household in 1984 or were temporarily absent, who were not in the village in 1994. My sample of migrants is restricted in two ways. First, migrants are limited to those persons for whom at least one member of the 1984 household was in the village in 1994. In the event that an entire household moved, the individuals within that household are not considered in the present analysis. This is appropriate, because if an entire household moved there would be no opportunity for remittance.

Second, I limit the age range of migrants to ages 18 – 35, because these are the years in which migrants at the greatest risk of exposure to sending remittance. In addition, I limit the sample to migrants who have been away from the village for at least one year. This ensures that migrants have had sufficient time to establish themselves, so that they may be in a position to remit[1].

In this research, there is also a particular definition of households. I define the household at origin as a group of people who share common residence. However, in

some circumstances, migrants can be considered functional members of a household. For instance, a migrant may move temporarily to an urban area in search of work, with the intention of providing for his or her family and moving back shortly thereafter. In such a case, that individual would still be considered a member of the household. Therefore, being a part of a household can depend on both common residence in a dwelling unit, or self-identification as a member of a household.

Remittance is defined as money or goods sent from a migrant to the origin household. I create a series of dummy variables measuring whether the migrant sent monetary remittance or goods-in-kind remittance (1 = yes)[2]. Having data on multiple types of remittances is interesting, because it can inform us about the intention behind sending remittance. For instance, while monetary remittance can be used for any number of things, such as capital for investment in agricultural production, in-kind remittance, which consists of household items and other durables, is likely to be used mainly for consumption. Albeit, it is also possible that receiving in-kind remittance allows the household to productively invest money that they would have otherwise spent on consumer durables.

Data on remittance of money is derived from the following item: "During the last 12 months has this household received any money from this person [the migrant]." Goods-in-kind remittance is derived from a similar survey item, which is followed by a set of responses that are specific to particular goods, such as: clothes, food, household items, and electrical appliances. From Table 1, which shows frequency distributions for the dependent variables, it can be seen that over half of the migrants (55%) sent monetary

remittance, while slightly less goods-in-kind remittance was sent (41% of migrants sent goods-in-kind).

[Table 1 about here]

I now turn to social network measures, the main independent variables of interest. Network connections are measured as ties between households, rather than individuals. In the analysis I use non-directional ties from within the village, which exclude ties outside the village. Variables for the sibling network were constructed from survey items in which respondents age 18 – 35 who reside in a household (henceforth referred to as the ego household) were asked to provide the name and address of living siblings residing in other households in the village (henceforth alter households)[3].

The rice harvest network variables were constructed from answers to survey items in which respondents were asked to include the names of any households who participated in rice harvesting activities. Survey items used to construct these data were like the following question. Did anyone from this village come to help this household harvest rice in the last year? Again, ties are considered without respect to direction and are limited to network ties within villages.

At the village-level, both the sibling network and the rice harvest help network tend to be sparsely connected. Because closure can only operate among households who share ties with one another, I measure closure, or density, within a network component. A component is a portion of a network in which networks actors share ties with each other, but exclude ties with other actors in the network. For the purposes of this analysis, components are households who share ties with one another, but with no other households in the network. Therefore, a component is an intermediate level of analysis

between the household-level and the village-level. Network density is measured as the proportion of possible ties to those that are actually present in a given network, with 0 indicating a complete lack of ties, and 1 indicating the maximum possible number of ties[4] (Wasserman and Faust, 1994).

I measure number of direct ties that a household shares with other households in the origin village by using a simple count of non-directional ties between households. I also construct an indicator variable measuring whether or not a household was an isolate, which can be thought of as a household with no direct path lengths, or a household in a component of size one.

Table 2 shows summary statistics for the network variables as well as control variables. With regard to the network variables, it can be seen that a little over half of migrants (55%) come from households that are isolates in the rice harvest network. Moreover, direct ties to other households in the sibling network range from 0 connections to as many as 10 households, while on average, migrants come from households that have just under 1 network tie. In terms of network density, it can be seen that migrants tend to come from households whose network components are relatively sparsely connected. The rice harvest network components, on average, have a density of about 13, on a scale of 0 to 100. The sibling network is a bit more densely connected with a density of 19. Both component densities have rather large standard deviations, (26.49 and 32.61 respectively), suggesting a great deal of variation in these variables.

[Table 2 about here]

Operationalization of Control Variables

In this section, I describe the control variables. Since many of these variables have been studied in past research, my description will be brief. Among my control variables are variables measuring characteristics of migrants, including demographic variables, human capital variables, and measures of spatially separated ties to kin. In addition, there are characteristics of the household, including measures of household economy, and household composition.

Demographic measures include age, gender, number of years since migration, and marital status. Past research has argued that the migrant's duration of absence contributes to less remittance to the origin community as the migrant develops stronger ties in the destination community (Menjivar et al., 1998). To test this I include a measure the duration (in years) that a migrant has been gone, as well as a measure of the migrant's age in order to isolate the effect of the latter from the former. I also include a measure of the migrant's marital status, indicating whether the migrant is currently married, post-married, or never married. I expect married migrants to be the least likely to remit, as their obligations to their own household may supersede their obligations to their origin household[5].

Past research on remittance and gender has demonstrated that women remit more than men not only in Thailand (Curran, 1995; Osaki, 2002; VanWey, 2002), but also around the world (Chiang Huang, 1984; Radcliffe, 1990). This may be linked to Thai norms about parental support, whereby the youngest daughter is expected to care for her age parents. Otherwise, it may suggest something more basic about the organization of families and households, and their expectations regarding support from sons and daughters (VanWey, 2002).

Human capital characteristics include measures of education and occupation. In terms of education, I construct indicator variables distinguishing between migrants who have more than a primary school education, less than a primary school education, or only a primary a school education. I also construct separate dummy variables for five occupations, including: agriculture, laborer, commerce, government, and student/unemployed. Those in agriculture tend to be predominantly paddy rice farmers, while laborers are mainly factory workers, construction workers, auto or furniture repair employees, and general unskilled laborers. Those in commerce are usually either salespeople or small shopkeepers, while government employees tend to be split between police officers, soldiers, teachers and employees in government or state enterprises.

According to expectations from option theory and the coinsurance argument, migrants in stable, good paying jobs should be less likely to remit, whereas migrants employed in less stable poorer paying jobs should be more likely to do so. However, I expect that migrants working in government or commerce are more likely to remit than are migrants employed in agriculture or migrants who are students/employed, because of their greater ability to remit. The option and coinsurance logic may also hold for education, with more educated migrants remitting the least and less educated migrants remitting the most. It is also possible that the migrant uses remittance as a way of paying back a household's investment in his or her education.

I control for the existence of ties to relatives in the origin household. These variables can also be thought of as indicators of networks connections, however, they do not measure the embeddedness of a household in a web of social relations at origin, and thus they are not central to the focus of this research. However, they do measure kin ties

that span spatially separated communities, and may indicate something about Granovetter's (1973) notion of the strength of ties between individuals as a motivation for remittance. Therefore, their effect can be important to understanding how social networks affect remittance.

Table 2 shows that neither parent lives in the origin household in only 12% of cases. Therefore, overwhelmingly, migrants are potentially remitting back to their natal households. In Thailand, parental support can be understood by considering Thai Buddhist practices related to parental obligation, perhaps best captured in the notion of *Bunkhum*, the Thai word used to describe a debt between children and their parents. Such a debt is characterized by a child's repayment to parents in gratitude for giving them birth and for raising them. This debt is repaid differently depending on one's gender. Males pay off their *bunkhum* by becoming monks, while females pay off their *bunkhum* by helping parents with household labor and caring for them in their old age (Chamratrithirong, Morgan, and Rindfuss, 1988).

I also control for the presence of the migrant's children in the home household. As rural villagers migrate to Bangkok and other urban areas in search of jobs, it is common to leave children behind, under the care of extended family members (Richter, 1996). It could be that remittance is being sent to provide for the welfare of these children.

At the household level, I control for measures of household economy and household composition. With respect to the former, I control for household wealth, whether or not the household grows rice, and the amount of land owned[6]. As for the

latter, I control for the size of the household and the number of migrants from the household.

Following work by Filmer and Pritchett (2001), I operationalize household wealth as a series of dummy variables. I use principal components analysis to make an index of wealth for each household, using a number of household assets and characteristics of the household's dwelling unit. Based on its index score, each household is be grouped into one of the three categories. Specifically, households in the bottom 33 percentile will be considered "poor," those in the 34^{th} to 79^{th} percentiles will be considered "middle," and the top fifth will be considered "rich," or relatively rich for Nang Rong (see Appendix 1 for details).

With the exception of the measure of whether the household grows rice, measures of household economy should be inversely related to the migrant's propensity to remit, because these households have less need for insurance. However, migrants who remit to these households may be following a bequest motive, and thus their propensity to remit should be directly proportional to the amount of land owned or greater household wealth. Households who grow rice are actively engaging in an agricultural economy and are expected to be reliant on migrant remittance as a form of insurance against absences of, or fluctuations in, rural markets.

Turning to measures of household composition, the altruism motive suggests that the propensity to remit is directly proportional to household size, as the migrant's utility increases with the utility of greater numbers of household members. Option theory would suggest that, all else equal, more migrants in a household would lead to more remittance, since remittance is the cost that migrants pay to maintain good standing in the

origin community, which increases the migrant's employment options, through the support of other migrants at the destination community.

Analytical Approach: Multi-Level Modeling

I use a series of regression models to determine the independent effects of network characteristics on the various remittance behaviors. Because the dependent variable for each model is dichotomous, a binary logit model is used. The data are organized into three hierarchically nested levels: migrants are nested in households, which are nested in villages. Because of this, each observation contributes less information than it is assumed to if the observation were independently sampled, which artificially lowers standard errors associated with coefficients, thereby overestimating *t*-statistics and overstating the significance of estimates. Thus the assumption of independence between observations would be violated in the event that such data clustering is ignored. I correct for this using a multilevel model, which corrects estimates of standard errors (see Bryk and Raudenbush, 1992; Snijders and Bosker, 1999 for details).

For all of the models, the dependent variable is a transformation of the binary response that individual migrant *i,* who is a member of household *j,* in village *k* will send remittance (1 = migrant sent remittance, 0 = otherwise). The probability that the response is equal to 1 is defined as $p_{ijk} = Pr(y_{ijk} = 1)$, where I use the standard assumption that y_{ijk} has a Bernoulli distribution. The combined three-level model takes the following form:

$$\ln\left[\frac{p_{ijk}}{1-p_{ijk}}\right] = \gamma_0 + \sum_{h=1}^{p} g_{h00} x_{hijk} + \sum_{g=1}^{q} g_{g0} w_{gjk} + \sum_{f=1}^{r} g_{f} z_{fk} + U_{0k} + V_0 \qquad (1)$$

Where:

γ are regression coefficients

p is the number of x migrant variables

q is the number of w household variables

r is the number of z village variables

V_0 and U_{0k} are random effects, accounting for variation at the village level and household levels respectively. I use the standard assumption that both have an expected value of zero, while V_0 has a variance equal to φ^2 and U_{0k} has a variance of τ^2. Estimating separate variance components for each hierarchical levels of analysis can help us better understand the degree to which individual decisions to remit are influenced by households and villages. For instance, a finding that most of the variance in remittance occurs at the individual level would suggest that households and villages do not play a large role in a migrant's decision to remit.

The SAS GLIMMIX macro is used to estimate fixed[7] and random effects. The tables below present the fixed and random effects separately, even though they are estimated as part of a single model. Random effects are calculated through empirical Bayes estimation, which calculates random coefficients by using data from the group level of analysis to which the effect is ascribed, and the fact that the error term is a normally distributed random variable with a mean of zero (Mason, Wong, and Entwisle, 1983; Bryk and Raudenbush, 1992; Snijders and Bosker, 1999).

Results of Regression Analysis

Turning to empirical results from the multilevel models, I estimate separate models for monetary remittance and goods-in-kind remittance. For both dependent

variables, I estimate an individual-level model, followed by a model that adds household-level measures. Finally, to avoid collinearity, I estimate two separate models for the social network effects. Tables 3 and 4 show results for the fixed effects portion of the model predicting the log-odds of sending remittance. Results for the random effects portion of all models are shown in Tables 5 and 6, and will be discussed after the fixed effects portions.

[Table 3 about here]

Starting with the social network fixed effects, Table 3 shows that rice harvest network isolates have a lower propensity to receive monetary remittances, compared to non-isolates. Further, the magnitude of the effect is reasonably large: the odds of the migrant sending money to a rice harvest isolate are about 17% lower than the odds of the migrant sending money to a non-isolate.

[Table 4 about here]

A similar and stronger effect of rice harvest isolates is found in the in-kind remittance fixed effects results. Model 3 in Table 4 shows that the odds of the migrant sending goods to a rice harvest isolate are about 28% lower than the odds of the migrant sending goods to a non-isolate origin household. This finding lends support to the second hypothesis that, all else equal, the number of direct ties that a household shares with other households in the origin village will be directly proportional to the migrant's propensity to send remittance.

[Figure 3 about here]

Model 4 in Table 4 shows another rice harvest effect for in-kind remittance. Lending support to the first hypothesis, or Coleman's closure argument, the density of the

rice harvest component has a significant positive effect on the migrant's propensity to send in-kind remittance. The odds of the migrant sending goods in-kind remittance increase by less than half-a-percent (.4%) for a unit increase in component density. While a unit increase this variable is rather weak, this variable ranges from 0 to 100, thus in figure 3, I show odds ratios for a number of values for this covariate. From figure 3, it can be seen that 25-point increase in density, which is approximately equal to the mean, increases the odds of remitting goods by 10%. Further, an increase of 40-points in density, which is roughly equal to the mean plus one standard deviation, increases the odds by 17%. Finally, a 100-point increase in density, the full range of the variable, increases the odds by 49%.

[Figure 4 about here]

The effects of the sibling network confirm the third hypothesis that, all else equal, the number of direct ties that a household shares with other households in the origin village will be inversely proportional to the migrant's propensity to send remittance. The baseline models that included only the number of direct ties that a household shares with other households in the origin village showed that this effect was consistent for all types of remittance (results not shown). But once individual and household variables are controlled, only the monetary remittance variable is significant. The effect for a unit increase in this variable tends to be weak: the odds of the migrant sending monetary remittance decreases by about 6% for a unit increase in the number of alter households that share a direct sibling tie with the ego household. However, this variable ranges from 0 to a possible 10, so I show odds ratios for a number of values for this variable. An increase of 2 sibling connections, which is approximately equal to the mean and one

standard deviation, decreases the odds of sending money by 13%. The odds of sending such remittance decrease by 29% and 49% respectively for an increase of 5 and 10 sibling connections.

Turning to fixed effects for individual-level covariates, results for monetary remittance (Table 3) and in-kind remittance (Table 4) show many similarities. In all models, males are found to remit less than females; the magnitude of the effect is considerable. Across the in-kind equations, the odds of males remitting are 70% lower than the odds of females remitting. Across the monetary remittance equations, the odds of males remitting are 55% lower than the odds of females remitting.

Marriage also has very similar effects across the different types of remittance. In all of the models, currently married and post-married migrants are less likely to remit relative to never-married migrants. For monetary remittance, the odds of currently married migrants sending remittance are about 74% lower than the odds of never-married migrants sending remittance. The corresponding percentage for in-kind remittance is about 46% lower. For post-married migrants, the odds of sending monetary remittance are about 60% lower than the odds of never-married migrants sending such remittance, and the corresponding percentage for in-kind remittance is about 49% lower. This result suggests that remittance is generally coming from unmarried migrants, who likely have not yet married or started their own families.

Results for education are also similar, at least for migrants who have less than a primary school education. For both in-kind and monetary remittance, the odds of a migrant with less than a primary school education sending remittance are a little over 35% lower than the odds of a migrant with only a primary school education sending such

remittance. The lower propensity for less-educated migrants to send remittance probably has to do with the migrant's ability to send money and goods. Less-educated migrants may not be in a position to use their human capital to acquire better paying and more stable jobs. Furthermore, this finding does not support either the insurance motive or option theory, because these migrants should be highly dependent on both their origin household for insurance, and migrant networks for jobs.

It is also interesting to note that migrants with more than a primary school education have a lower propensity to send in-kind remittance relative to migrants with only a primary school education. This effect was not found for monetary remittance, except in the individual-level model, which suggests that this effect is mediated by household variables. The odds of a migrant with more than a primary school education sending in-kind remittance are about 24% lower than the odds of a migrant with only a primary school education sending such remittance.

This effect is in agreement with both option theory and the insurance motive. Since these migrants can probably use their human capital assets to find higher paying, more stable jobs, so they are less dependent on their origin household for insurance, and migrant networks for employment options. This effect also provides evidence against the investment motive. The differences between the various types of remittance may have to do with the migrant's reason for migration: perhaps better-educated migrants are migrating to seek urban employment in order to earn money, and they are less interested in acquiring goods-in-kind, which are used for consumption.

There are a few parallels in the occupational effects on remittance. For both types of remittance, agricultural workers and students / unemployed migrants send less

remittance relative to laborers. Moreover, the effects are of considerable magnitude: the odds of a migrant employed in agriculture sending money are 70% lower than the odds of a migrant employed as a laborer sending money. The corresponding percentage for in-kind remittance is about 63%. Also, the odds of student and unemployed migrants sending money or goods in-kind are 93% lower and 88% lower respectively, compared the odds of migrants who are employed as laborers sending either type of remittance. This most certainly has to do with the ability of these types of migrants to send remittance. It is likely that laborers employed in such places as factories and construction sites have a steadier stream of income relative to agricultural workers, and compared to those who have no income, such as the unemployed and students. Thus, they can afford to send remittance back to their origin household.

Also of interest are the effects of commerce and government occupations, which are significant for monetary remittance but not in-kind remittance. Relative to laborers, migrants employed in commerce and government are less inclined to send monetary remittance. The odds of migrants employed in commerce or in government sending money are each a little under approximately 35% lower than the odds of laborers sending money. This is probably not due to an ability to send money; rather, it seems to be more consistent with the insurance or options motive. Laborers, who likely have less stable, and poorer paying jobs are probably remitting more in anticipation of insurance from their origin household or job options from migrant networks.

Relations to kin living in the origin household are also important determinants of both types of remittance. Migrants are much more inclined to send remittance when their children live in the origin household. For migrants whose children live in the home

household, the odds of sending monetary remittance are over 2.6 times (260%) higher relative to migrants whose children do not live in the origin household. The corresponding magnitude of effect for in-kind remittance is 76% higher. It is likely that migrants are using extended family in rural areas to help care for dependent children, and they send remittance back to help with their children's welfare.

Compared to households in which both of the migrant's parents live in the household, if neither parent lives in the household, migrants have a lower propensity of sending remittance. In such cases, the odds of migrants sending money are 84% lower, and the odds of migrants sending goods are about 72% lower compared to the odds of sending remittance to households with no parents. This finding suggests that migrants are sending remittance to care for their parents. Interestingly, the results for in-kind remittance show that relative to households in which both parents are present, migrants from households containing only the migrant's mother are less disposed to send remittance, a rather inexplicable finding.

[Figure 5 about here]

Another interesting finding is the effect of age, which is found for in-kind remittance, but not monetary remittance. Keeping in mind the restricted age range of 18 to 35, the results show that aging increases the propensity of in-kind remittance. The odds of sending in-kind remittance increases by about 4% for a year increase in age. Although the effect of a unit increase is somewhat weak, Figure 5 shows odds ratios for the effect of age across a range of years. A 5-year increase in age increases the odds of sending money by 19%, while the corresponding percentage is 42% for a 10-year increase, and 81% for the entire age range (17 years). This may suggest that as migrants

age they become more aware of the consumption needs of their households, and in turn, they remit various goods.

Although individual-level effects show the strongest results, there are a few differences in the effects of household-level fixed effects that are worth mentioning. Results for monetary remittance show that the propensity to send monetary remittance decreases as the number of people living in the origin household increases. However, this is a weak effect, as the odds of sending money are only 6% lower for a unit increase in household size. Most likely, larger households are relatively self-sufficient and do not need as much remittance.

Before turning to a discussion of the random effects, I briefly describe other model specifications that were tried (results not shown). Using Model 3 in Tables 3 and 4 as my point of departure, first, I added measures of the total number of migrants in the sibling and rice harvest network component. Option theory suggests that these measures would have positive effects on remittance, because migrants use remittance to gain access to employment options from migrant networks. The results showed that only one of these variables was statistically significant, and the magnitude of the effect is very small. The propensity to remit was negatively related to the total number of migrants in a sibling network, the opposite of what was expected. Therefore, more migrants from a sibling network component actually meant less remittance for the home household. The odds ratio was equal to one, indicating no change in the effect of the covariate for a unit increase in this variable.

For the second specification, I included interaction terms between the number of migrants in the household and the network variables. My expectation was that

households with large networks and a large number of migrants would be the most likely to get remittance. This is reasonable because migrants would be worried about losing two sources of employment options or insurance. The first is from migrants associated with the origin household, and the second would be among migrants from other households who share ties with the origin household, who also affect employment options. However, none of these interactions were statistically significant.

I also conducted a sensitivity analysis for several covariates that may endogenous. Allison (1999) states that reverse causality, one aspect of endogeneity, can bias all coefficients in the model. I run separate models in which the covariate is included, and I compare this to a model in which the covariate is excluded, to determine if the other coefficients in the model change drastically. I examine three variables: the number of years that a migrant has been gone, the measure of household wealth, and the amount of land owned by the household. In no case did the exclusion of any these variables drastically alter the other coefficients in the model.

Tables 5 and 6 include estimates of the random effect portion of these models. Results show the amount of variance in the dependent variable that occurs at each hierarchical level of analysis. With the logit model, level one variance is a constant, equal to $\pi^2 / 3$ ($\cong 3.29$), the variance of the standard logistic distribution (Guo and Zhao, 2000, Snijders and Bosker, 1999). From this information, one can calculate the intraclass correlation coefficient (ρ_i or ICC), which is the proportion of variance that is accounted for by each level. This is done by dividing each individual variance component by the sum of the other variance components (Snijders and Bosker, 1999). To see the basic partitioning of the variability in the data between the three levels of analysis, I include

estimates of the unconditional model, a model in which the dependent variable is a function of only the intercept at level one, level two, and level three.

[Table 5 about here]

With respect to monetary remittance, results show that close to 33% of the variability in monetary remittance occurs at the household level, and only 0.3% occurs at the village level. Adding explanatory variables at the individual-level results in a new partitioning of the variance, in which 13% of the residual variance occurs at the village level, about 33% at the household level. This can be understood to mean that the added explanatory variables, while diminishing the variability in monetary remittance at the individual level, increases variability at the village level. The results suggest that most of the variance in remittance behavior occurs at the individual level, although a fair bit of it occurs within households, and only very little occurs at the village level. Model 2, which adds explanatory variables at the household level, shows little change in the partitioning of the residual variance, as do Models 3 and 4, which add network variables. This would seem to suggest that the decision to send remittance is mainly made by the migrant, although it can be affected by the characteristics of the household. The village does not seem to play a substantial role in the decision to remit.

[Table 6 about here]

From Table 6, which shows estimates for random effects, it can be seen that the variance in goods-in-kind remittance is quite similar to the variance in monetary remittance. In the unconditional model, variance is high at the household level (almost 45% of the variance occurs here), and is lowest at the village level, in which about 5% of the variance occurs. The results of Model 1, show the residual intraclass correlation

coefficient, which is conditional on explanatory variables from the individual-level of analysis. The model shows that individual-level variance decreased while village-level variance increased to about 14%. As can be observed from Model 2 through Model 4, the inclusion of household-level and network variables seems to have had very little impact on the partitioning of the variance.

Discussion

In this paper, I evaluated the role of social networks at origin on a migrant's propensity to remit. The results showed that a household's embeddedness in a web or social relations at the origin community influences migrant remittances. The results show that networks can have very different, and even opposite, effects. In the sibling network more network connections reduce the propensity to receive remittances. This suggests a lower need for remittance, stemming from the availability of care from family members living in proximity to the origin household.

Results for the rice harvest network, in contrast, show that the household's isolation diminishes the propensity to remit, which may have to do with the fact that these ties are typically not between family members, who may be less willing to help the household. It is likely that migrants are less concerned about sending remittances to households that are not well connected in their community, because they lack the fear of a loss of reputation, or perhaps they do not anticipate a gain in employment options from doing so. There was also some empirical support for a density effect with the rice harvest. However, this effect was less consistent, and the overriding effect seems to be the effect of being an isolate.

Therefore the difference between the rice harvest and sibling networks is probably related to differences between family or kin ties and ties among unrelated individuals. Migrants may be more concerned about their reputation among non-kin, while their relationship with family members allows them to trust that social support to the origin household is more certain, and loss of reputation is less pertinent.

The sibling network effect may also have to do with the household's stage in the life cycle. It may be that households with more sibling connections are "old households," whose members have moved out in order to start separate "new households". Old households, in contrast to new households, have been extant for some time. They are likely to be extended households, which contain three or more generations. A new household is one that is more recently established; it is likely to contain only a nuclear family, including a husband, wife, and children. Old households may receive less remittance from migrants because new households with whom the old household shares ties may contain more help from in-laws, such as the siblings of spouses, which in turn leads migrants to perceive that their fellow household members have less need for their help in the form of remittances.

It is also interesting that network effects were generally not as strong as individual-level effects. Throughout the analysis, individual-level measures such as kin ties to the origin household, the migrant's marital status, the migrant's gender, and various human capital measures were found to have the strongest and most consistent effects. This may suggest that networks effects are not as important as the literature would lead us to believe. As the random effects results demonstrate, most of the remittance decision is determined by individual-level and household-level characteristics.

It seems that less of an effect is attributable to the embeddedness of the origin household in a web of social networks.

There is general support that Thai norms about parental support are operating on migrant's decisions to remit. First, female migrants are more likely to remit compared to males. Second, much of the potential remittance is to natal households, and the presence of parents is an important determinant of remittance. Nonetheless, given the strong effect of the presence of children, this may be linked to childcare arrangements, as migrant parents often leave their children behind to live with extended family members. This may indicate that the strength of ties, or obligations to those with whom the migrant has a deep personal connection, is a more important determinant of remittance than the embeddedness of a household in a web of social ties.

Another consistent finding has to due with the migrant's marital status. Married or formerly married migrants tend to be less likely to send remittance relative to single migrants. This may be related to the embeddedness of the migrant in a web of obligations in the destination community. Married migrants are likely to have obligations to their own households, which may interfere with their ability to care for their origin household. Perhaps they no longer consider themselves to be a part of that household. This highlights a common finding in the literature that those members who continue to be regarded as members of their origin household are robust remitters (Stark and Lucas, 1988; Menjivar et al, 1998). Arguably, this too argues for the importance of the strength of ties, because maybe the migrant's commitment to the spouses or children at destination diverts funds that would be otherwise sent as remittance.

Human capital variables, which include education and occupation, typically provide evidence that migrant remittance is contingent on the ability to send money. In terms of education, a consistent finding is that migrants with less than a primary school education are less inclined to send remittance than migrants with only a primary school education. Less educated migrants may not be in a position to use their human capital to acquire better paying and more stable jobs, so perhaps they cannot afford to send remittance. In terms of occupation, migrants employed in agriculture, students, and the unemployed are found to be less inclined to send remittance compared to migrants who are employed as laborers. This too probably has to due with the ability to send remittance, as laborers employed in factories or on construction sites may have a more stable stream of income that they can use for remittance.

It is also interesting that there is a difference in the effect of age for in-kind remittance, and not for monetary remittance. It may be that as migrants get older, they become more aware of the consumption needs of their households, which prompts them to send more goods in-kin. Perhaps these migrants are heads of the household, or spouses of the head, who migrate temporarily, but who plan to return to live in the origin household.

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[1] I also limit my sample by using listwise deletion (i.e. complete case analysis) to deal with missing data This procedure diminished my sample from a total of 6019 cases, down to 5800 cases, a decrease of about 4%.

[2] I also created a measure of whether the migrant sent any kind of remittance (money and/or goods-in-kind). However, empirical results showed different networks effects on goods-in-kind versus monetary remittances, and models that included all remittance did not yield any theoretically interesting results

[3] The presence of a sibling tie from ego household to alter household guarantees the presence of the reverse tie, except in cases in which one of the siblings is outside of the age range 18 – 35. Thus although directionality of ties in this network is meaningless in most cases, using non-directional ties ensures greater coverage than would be possible if in-degree or out-degree ties would be considered separately.

[4] The calculation of density for isolates yields an undefined value, thus the density of isolates was set to zero. For the analysis, density is scaled to range from 0 to 100, because logit coefficients are highly sensitive to the underlying metric of the data

[5] This may depend on the location of the migrants spouse. Preliminary analysis indicated that out of 3284 married migrants, only 28 had a spouse living in the origin household. Because of this lack of variation with respect to this covariate, a distinction was not made with respect to spouses' location. The effect of "currently married" should therefore be interpreted as largely including cases in which the spouse did not live in the origin household

[6] The amount of land owned is measured in square wa, the Thai measure of size. One square wa is equal to 4 square meters

[7] Fixed effect simply refers to the main effect of a covariate in the model

Figure 1. Remittance and Social Networks

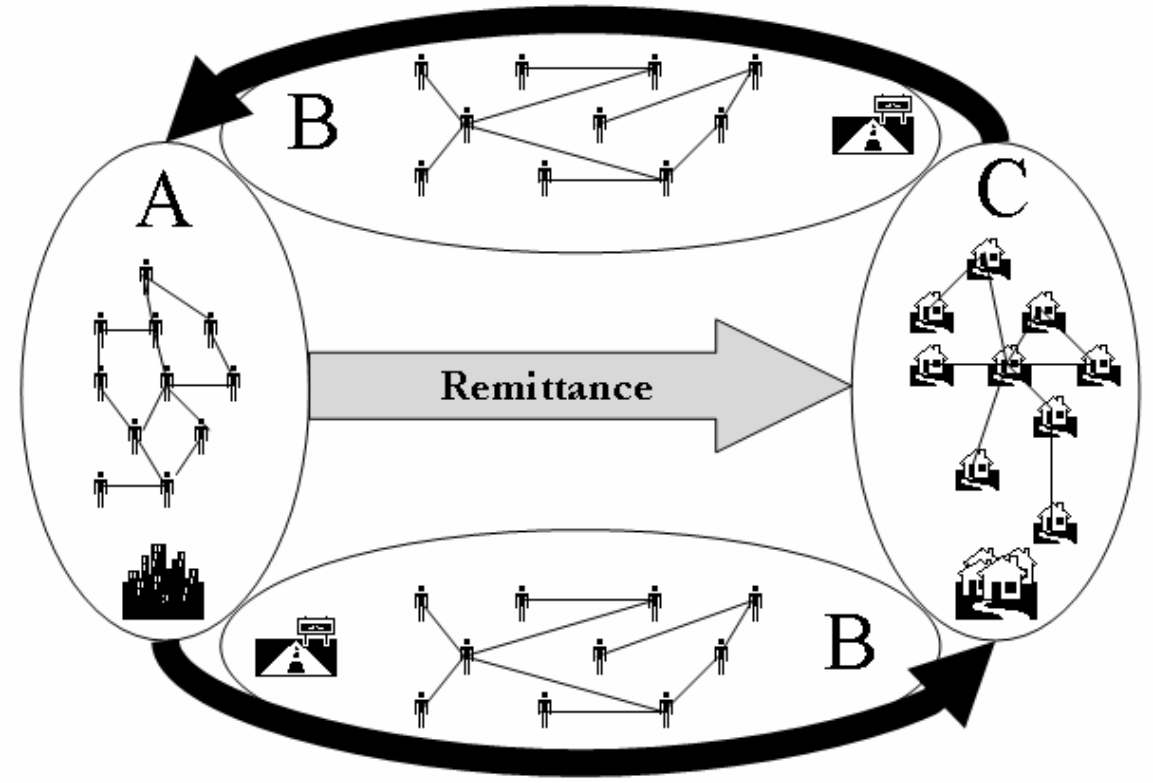

Figure 2. Closure of a Social Network

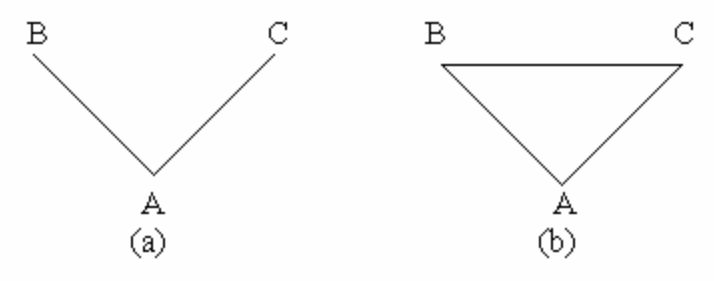

Figure 3. Odds Ratios for the Effect of Rice Harvest Help Component Density on In-Kind Remittance

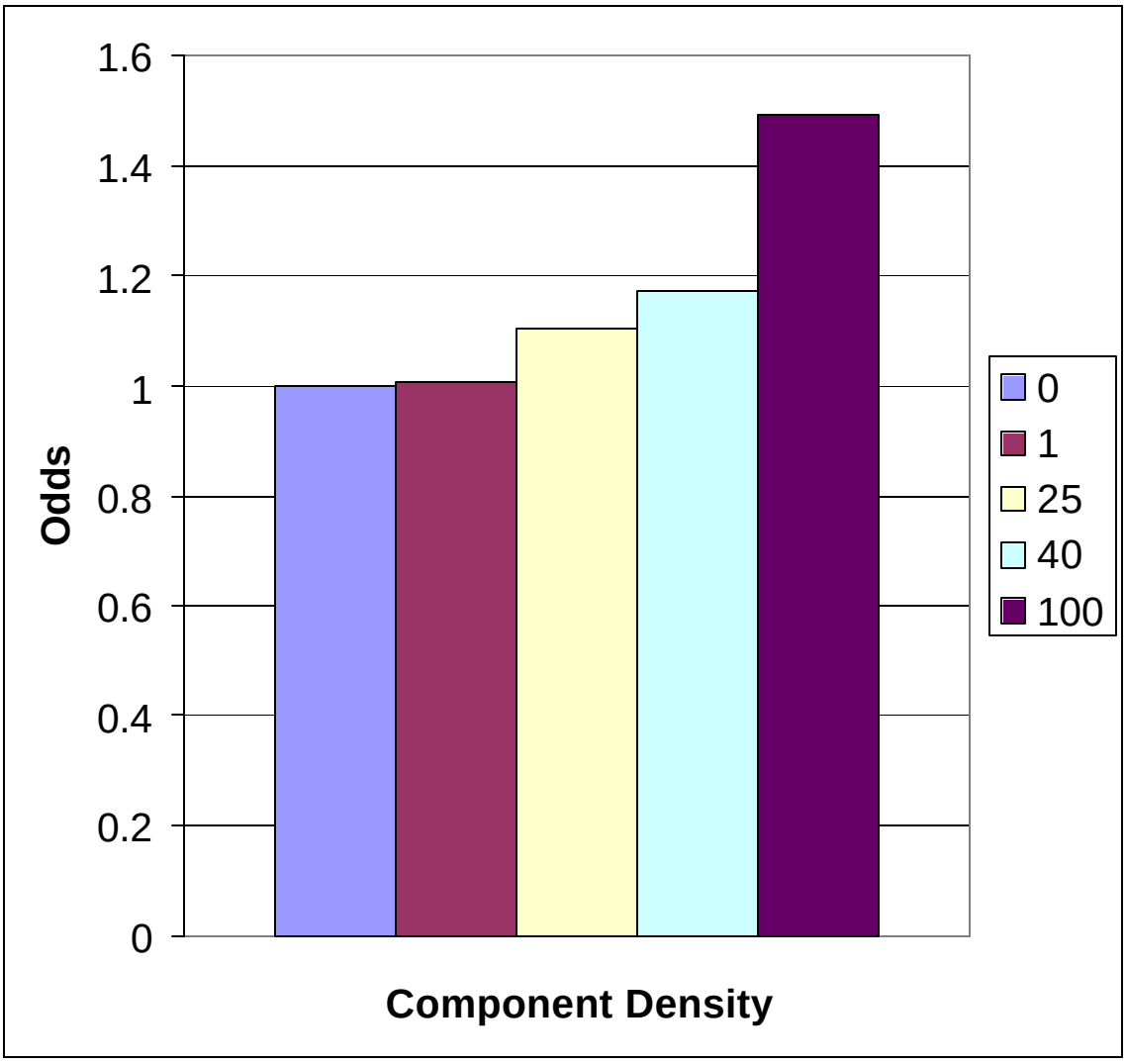

Figure 4. Odds Ratios for the Effect of the Number of Alter Households with a Direct Sibling Tie to Ego Household on Monetary Remittance

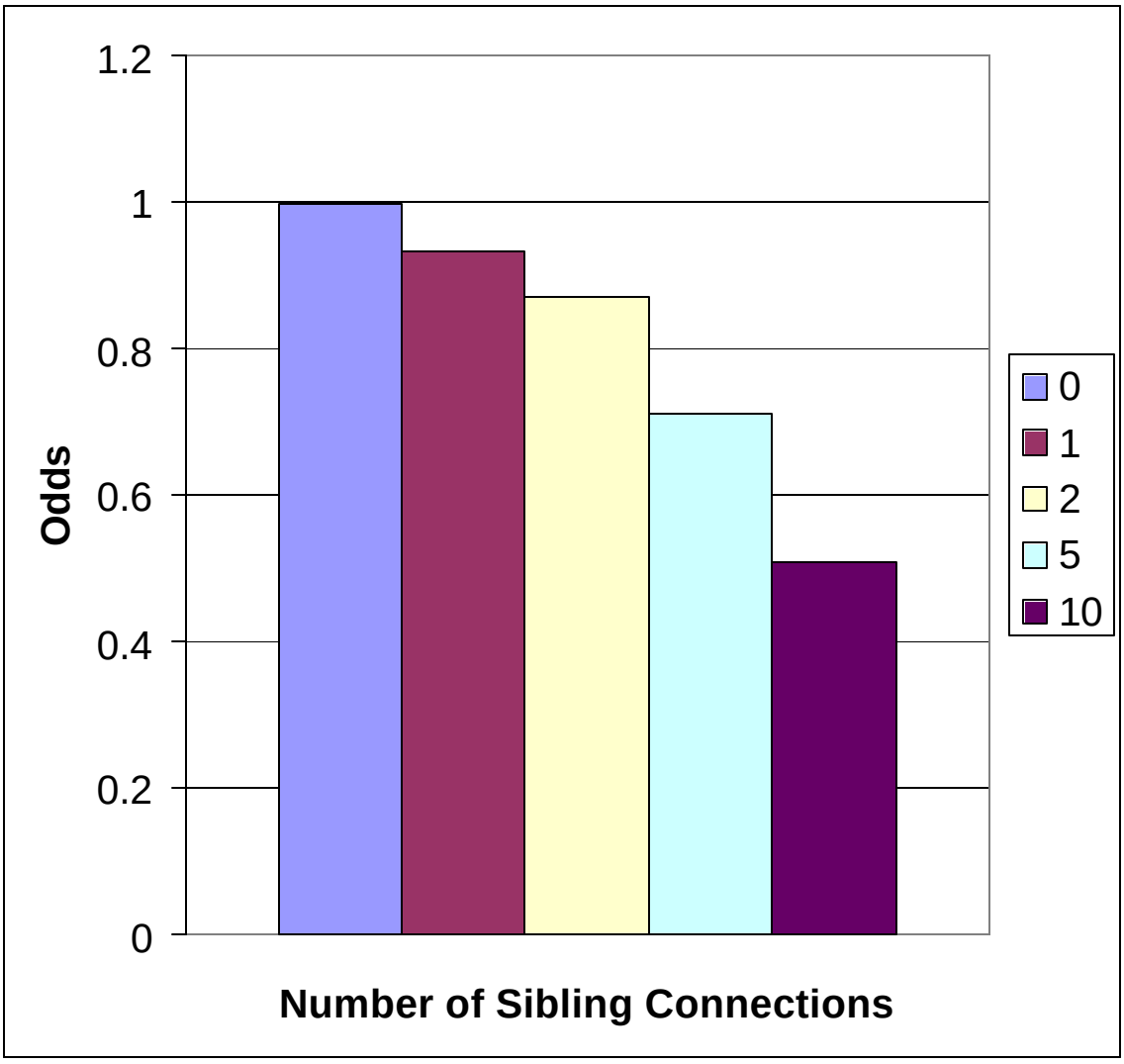

Figure 5. Odds Ratios for the Effect of Migrant's Age on In-Kind Remittance

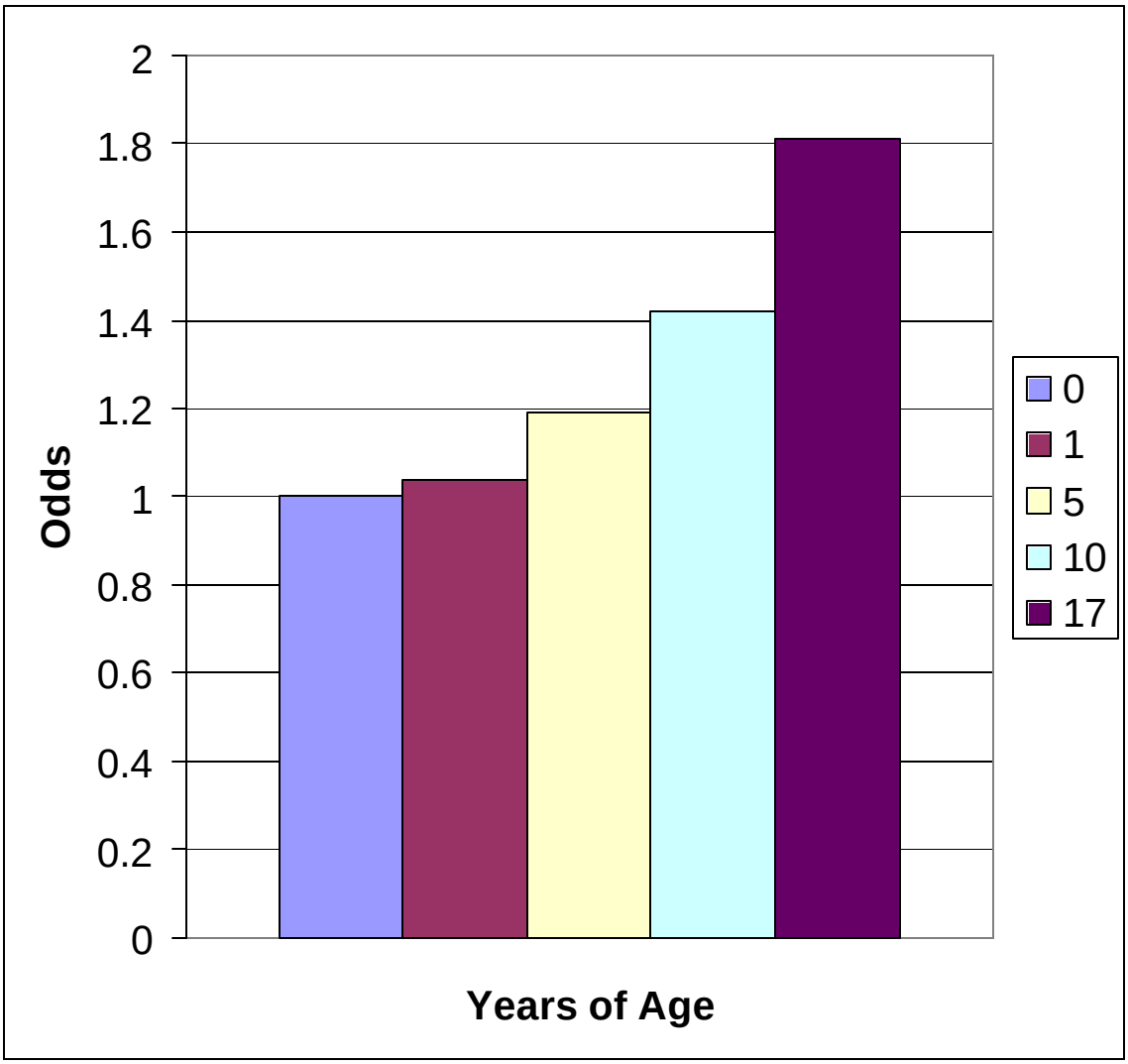

Table 1. Frequency Distributions of Dependent Variables for Nang Rong Migrants Age 18 - 35 in 1994

Monetary Remittances:

	Frequency	Percent
No	2625	45.26
Yes	3175	54.74
Total	5800	100

Goods-in-Kind Remittances:

	Frequency	Percent
No	3436	59.24
Yes	2364	40.76
Total	5800	100

Table 2. Descriptive Statistics of Select Independent Variables for Nang Rong Migrants Age 18 - 35 in 1994

Variable	Min	Max	Mean	Std Dev
Level One (Individual)				
Demographic				
Age	18	35	25.36	4.64
Male	0	1	0.55	0.50
Number of Years Gone	1	13	4.10	2.66
Currently Married	0	1	0.57	0.50
Post Married	0	1	0.02	0.13
Never Married	0	1	0.42	0.49
Human Capital				
Greater Than Primary School Education	0	1	0.19	0.39
Less Than Primary School	0	1	0.33	0.47
Primary School Only	0	1	0.48	0.50
Agriculture	0	1	0.35	0.48
Commerce	0	1	0.03	0.17
Government	0	1	0.06	0.23
Student and Unemployed	0	1	0.02	0.15
Laborer	0	1	0.51	0.50
Household Kin Ties				
Ego's Children live in Household	0	1	0.06	0.24
Only Father Lives in Household	0	1	0.06	0.23
Only Mother Lives in Household	0	1	0.20	0.40
Neither Parent Lives in Household	0	1	0.12	0.33
Both Parents Live in Household	0	1	0.63	0.48
Level Two (Household)				
Household Economy				
Top 20% of Wealth Distribution	0	1	0.24	0.43
Bottom 33% of Wealth Distribution	0	1	0.24	0.43
Middle 34 - 79 Percentile of Wealth Distribution	0	1	0.53	0.50
Household Grows Rice	0	1	0.79	0.40
Land Owned by Household (in 1,000 Wa^2)	0	100	9.73	10.05
Household Composition				
Number of People Living in Household	1	15	4.17	1.82
Number of Migrants from Household	1	11	3.56	1.79
Social Network				
Rice Network Isolate	0	1	0.55	0.50
Number of Alter Households with a Direct Tie to Ego Household in Sibling Network	0	10	0.87	1.30
Rice Harvest Network Component Density	0	100	13.08	26.49
Sibling Network Component Density	0	100	19.41	32.61

Table 3. Multilevel Logit Fixed Effects Coefficient Estimates For Monetary Remittance Against Independent Variables

	Model 1			Model 2			Model 3			Model 4		
Fixed Effects	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio
Intercept	2.207	(0.226)	-	2.297	(0.278)	-	2.486	(0.287)	-	2.748	(0.313)	-
Level One (Individual)												
Demographic												
Age	0.009	(0.011)	1.009	0.013	(0.011)	1.013	0.012	(0.011)	1.012	0.012	(0.011)	1.013
Male	-0.799***	(0.066)	0.450	-0.805***	(0.067)	0.447	-0.805***	(0.067)	0.447	-0.806***	(0.067)	0.446
(Female)												
Number of Years Gone	-0.016	(0.014)	0.984	-0.016	(0.014)	0.984	-0.016	(0.014)	0.984	-0.016	(0.014)	0.984
Currently Married	-1.342***	(0.080)	0.261	-1.35***	(0.080)	0.259	-1.345***	(0.080)	0.260	-1.347***	(0.080)	0.260
Post Married	-0.942***	(0.273)	0.390	-0.932***	(0.273)	0.394	-0.92***	(0.273)	0.398	-0.925***	(0.273)	0.397
(Never Married)												
Human Capital												
Greater Than Primary School Education	-0.220*	(0.106)	0.802	-0.167	(0.109)	0.846	-0.164	(0.109)	0.849	-0.170	(0.109)	0.844
Less Than Primary School	-0.480***	(0.095)	0.619	-0.49***	(0.096)	0.613	-0.484***	(0.096)	0.617	-0.49***	(0.096)	0.613
(Primary School Only)												
Agriculture	-1.203***	(0.082)	0.300	-1.205***	(0.083)	0.300	-1.2***	(0.083)	0.301	-1.204***	(0.083)	0.300
Commerce	-0.404*	(0.187)	0.668	-0.391*	(0.187)	0.677	-0.378*	(0.187)	0.685	-0.388*	(0.187)	0.679
Government	-0.431**	(0.149)	0.650	-0.417**	(0.150)	0.659	-0.416**	(0.150)	0.660	-0.419**	(0.150)	0.658
Student and Unemployed	-2.711***	(0.229)	0.066	-2.685***	(0.230)	0.068	-2.688***	(0.230)	0.068	-2.686***	(0.230)	0.068
(Laborer)												
Household Kin Ties												
Ego's Children live in Household	1.271***	(0.145)	3.566	1.303***	(0.146)	3.679	1.294***	(0.146)	3.647	1.301***	(0.146)	3.674
(Ego's Children do not live in Household)												
Only Father Lives in Household	-0.261	(0.183)	0.771	-0.297	(0.185)	0.743	-0.287	(0.185)	0.751	-0.292	(0.185)	0.746
Only Mother Lives in Household	-0.046	(0.109)	0.955	-0.057	(0.112)	0.944	-0.040	(0.112)	0.960	-0.057	(0.112)	0.945
Neither Parent Lives in Household	-1.809***	(0.128)	0.164	-1.831***	(0.130)	0.160	-1.81***	(0.130)	0.164	-1.829***	(0.130)	0.160
(Both Parents Live in Household)												
Level Two (Household)												
Household Economy												
Top 20% of Wealth Distribution	-	-	-	-0.083	(0.117)	0.920	-0.094	(0.117)	0.910	-0.112	(0.118)	0.894
Bottom 33% of Wealth Distribution	-	-	-	0.077	(0.109)	1.080	0.079	(0.109)	1.083	-0.012	(0.105)	0.988
(Middle 34 - 79 Percentile of Wealth Distribution)	-	-	-									
Household Grows Rice	-	-	-	0.230	(0.118)	1.259	0.208	(0.120)	1.232	-0.218	(0.119)	0.804
Land Owned by Household (in 1,000 Wa^2)	-	-	-	-0.007	(0.005)	0.993	-0.007	(0.005)	0.993	-0.007	(0.005)	0.993
Household Composition												
Number of People Living in Household	-	-	-	-0.06*	(0.026)	0.942	-0.056*	(0.026)	0.946	-0.057*	(0.026)	0.945
Number of Migrants from Household	-	-	-	-0.010	(0.027)	0.990	-0.018	(0.027)	0.982	-0.009	(0.027)	0.991
Social Network												
Rice Network Isolate	-	-	-	-	-	-	-0.193*	(0.091)	0.825	-	-	-
(Not an Isolate in Rice Harvest)												
Number of Alter Households with a Direct Tie to Ego Household in Sibling Network	-	-	-	-	-	-	-0.068*	(0.034)	0.934	-	-	-
Rice Harvest Network Component Density	-	-	-	-	-	-	-	-	-	0.002	(0.002)	1.002
Sibling Network Component Density	-	-	-	-	-	-	-	-	-	-0.0005	(0.001)	1.000
N		5800			5800			5800			5800	
-2 Log Likelihood		28019.837			28076.313			28094.554			28100.192	
BIC		28043.700			28100.200			28118.400			28124.100	
AIC		28025.800			28082.300			28100.600			28106.200	

* p < .05 ** p < .01 *** p < .001 (Two-Tailed Test)

Table 4. Multilevel Logit Fixed Effects Coefficient Estimates For In-Kind Remittance Against Independent Variables

	Model 1			Model 2			Model 3			Model 4		
Fixed Effects	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio	Coefficient	Std. Error	Odds Ratio
Intercept	0.341	(0.236)	-	0.157	(0.300)	-	0.442	(0.310)	-	0.827	(0.338)	-
Level One (Individual)												
Demographic												
Age	0.037***	(0.011)	1.038	0.035**	(0.011)	1.036	0.035**	(0.011)	1.036	0.035**	(0.011)	1.035
Male	-1.233***	(0.068)	0.291	-1.235***	(0.068)	0.291	-1.236***	(0.068)	0.290	-1.237***	(0.068)	0.290
(Female)												
Number of Years Gone	-0.002	(0.014)	0.998	-0.001	(0.014)	0.999	-0.002	(0.014)	0.998	-0.002	(0.014)	0.998
Currently Married	-0.637***	(0.082)	0.529	-0.62***	(0.083)	0.538	-0.615***	(0.083)	0.541	-0.614***	(0.083)	0.541
Post Married	-0.700*	(0.274)	0.497	-0.682*	(0.275)	0.506	-0.666*	(0.275)	0.514	-0.667*	(0.275)	0.513
(Never Married)												
Human Capital												
Greater Than Primary School Education	-0.242*	(0.110)	0.785	-0.271*	(0.113)	0.762	-0.268*	(0.113)	0.765	-0.279*	(0.113)	0.757
Less Than Primary School	-0.486***	(0.101)	0.615	-0.468***	(0.101)	0.626	-0.462***	(0.101)	0.630	-0.469***	(0.101)	0.626
(Primary School Only)												
Agriculture	-0.970***	(0.088)	0.379	-0.984***	(0.089)	0.374	-0.98***	(0.089)	0.375	-0.986***	(0.089)	0.373
Commerce	-0.047	(0.190)	0.954	-0.055	(0.190)	0.946	-0.045	(0.190)	0.956	-0.050	(0.190)	0.952
Government	-0.209	(0.160)	0.811	-0.210	(0.160)	0.811	-0.212	(0.160)	0.809	-0.215	(0.160)	0.806
Student and Unemployed	-2.098***	(0.239)	0.123	-2.114***	(0.240)	0.121	-2.114***	(0.240)	0.121	-2.117***	(0.240)	0.120
(Laborer)												
Household Kin Ties												
Ego's Children live in Household	0.570***	(0.147)	1.767	0.571***	(0.147)	1.769	0.565***	(0.147)	1.759	0.566***	(0.147)	1.762
(Ego's Children do not live in Household)												
Only Father Lives in Household	-0.314	(0.203)	0.731	-0.300	(0.204)	0.741	-0.281	(0.204)	0.755	-0.292	(0.204)	0.746
Only Mother Lives in Household	-0.379**	(0.121)	0.685	-0.319*	(0.124)	0.727	-0.302*	(0.125)	0.739	-0.323**	(0.125)	0.724
Neither Parent Lives in Household	-1.31***	(0.138)	0.270	-1.268***	(0.139)	0.281	-1.247***	(0.139)	0.287	-1.269***	(0.139)	0.281
(Both Parents Live in Household)												
Level Two (Household)												
Household Economy												
Top 20% of Wealth Distribution	-	-	-	0.230	(0.130)	1.258	0.223	(0.130)	1.249	0.187	(0.131)	1.205
Bottom 33% of Wealth Distribution	-	-	-	-0.044	(0.122)	0.957	-0.043	(0.122)	0.958	-0.160	(0.118)	0.853
(Middle 34 - 79 Percentile of Wealth Distribution)												
Household Grows Rice	-	-	-	0.356**	(0.134)	1.427	0.299*	(0.136)	1.348	-0.322*	(0.135)	0.724
Land Owned by Household (in 1,000 Wa^2)	-	-	-	0.0004	(0.005)	1.000	0.001	(0.005)	1.001	-0.0001	(0.005)	1.000
Household Composition												
Number of People Living in Household	-	-	-	-0.012	(0.029)	0.988	-0.010	(0.029)	0.991	-0.009	(0.029)	0.991
Number of Migrants from Household	-	-	-	-0.025	(0.030)	0.976	-0.032	(0.031)	0.968	-0.024	(0.030)	0.976
Social Network												
Rice Network Isolate	-	-	-	-	-	-	-0.332**	(0.101)	0.718	-	-	-
(Not an Isolate in Rice Harvest)												
Number of Alter Households with a Direct Tie to Ego Household in Sibling Network	-	-	-	-	-	-	-0.060	(0.039)	0.942	-	-	-
Rice Harvest Network Component Density	-	-	-	-	-	-	-	-	-	0.004*	(0.002)	1.004
Sibling Network Component Density	-	-	-	-	-	-	-	-	-	-0.0004	(0.002)	1.000
N		5800			5800			5800			5800	
-2 Log Likelihood		28676.717			28724.712			28752.349			28756.897	
BIC		28700.600			28748.600			28776.200			28780.800	
AIC		28682.700			28730.700			28758.300			28762.900	

* p < .05 ** p < .01 *** p < .001 (Two-Tailed Test)

Table 5. Random Effects Parameter Estimates for Monetary Remittance at Individual, Household, and Village Level

	Unconditional Model			Model 1			Model 2			Model 3			Model 4		
Random Effects	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC
Level-one random effects															
$var(R_{ij}) = \pi^2/3$	3.290	-		3.290	-		3.290	-		3.290	-		3.290	-	
Level-two random effects															
$var(U_{0j}) = \tau^2$	1.607	0.114	0.328	2.031	0.170	0.329	2.039	0.171	0.330	2.035	0.171	0.329	2.040	0.171	0.330
Level-three random effects															
$var(V_{0j}) = \varphi^2$	0.013	0.0003	0.003	0.846	0.0220	0.137	0.856	0.0222	0.138	0.862	0.022	0.139	0.856	0.022	0.138

Note: ICC refers to the Intraclass Correlation Coefficient; Models 1, 2, 3, 4 correspond to models 1, 2, 3, 4 in table 3

Table 6. Random Effects Parameter Estimates for In-Kind Remittance at Individual, Household, and Village Level

	Unconditional Model			Model 1			Model 2			Model 3			Model 4		
Random Effects	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC	Variance Component	Std. Error	ICC
Level-one random effects															
$var(R_{ij}) = \pi^2/3$	3.290	-		3.290	-		3.290	-		3.290	-		3.290	-	
Level-two random effects															
$var(U_{0j}) = \tau^2$	2.636	0.160	0.445	3.070	0.212	0.414	3.071	0.213	0.414	3.067	0.213	0.413	3.074	0.213	0.414
Level-three random effects															
$var(V_{0j}) = \varphi^2$	0.299	0.008	0.051	1.052	0.028	0.142	1.066	0.028	0.143	1.075	0.028	0.145	1.068	0.028	0.144

Note: ICC refers to the Intraclass Correlation Coefficient; Models 1, 2, 3, 4 correspond to models 1, 2, 3, 4 in table 4

Appendix 1. Creating a Wealth Index from Household Assets Using Principal Components Analysis.

While the Nang Rong data do not contain information on individual income or household consumption expenditures, data was collected about household ownership of various consumer durables or assets. These variables can be used to create an index of assets that is a proxy for household wealth. In creating such an index, choosing an appropriate weight to attribute to each asset maybe difficult. To calculate these weights, I use principal components analysis (PCA), a well-known technique for reducing the dimensionality of a data set.

PCA is a technique that extracts a few uncorrelated linear combinations of an original set of variables that captures most of the information in the original variables (Dunteman 1989). Suppose we had a set of p variables, representing the ownership of assets by each household. PCA transforms these p wealth indicator variables, which can be characterized as a p dimensional random vector $\mathbf{x}$ (x_1, x_2, … x_p) into a one-dimensional wealth index z, using the following equation:

$$z = u_1x_1 + u_2x_2 + \ldots + u_px_p \qquad (1)$$

The weights (u_1, u_2, … u_p) are determined mathematically by maximizing the variation of the linear composite. Furthermore, the principal components are ordered with respect to their variation so that the first principal component accounts for the most variation in the original variables, and each subsequent principal component accounts for less and less of the remaining variation.

The first principal component is the line of closest fit to the j observations in the p dimensional variable space defined by the asset variables. It minimizes the squared distance (defined in a direction perpendicular to the line) of the j observations from the

line in the variable space representing the first principal component. The p principal components can be expressed in equation form:

$$z_1 = u_{11}x_1 + u_{12}x_2 + \ldots + u_{1p}x_p$$

$$z_2 = u_{21}x_1 + u_{22}x_2 + \ldots + u_{2p}x_p$$

...

$$z_p = u_{p1}x_1 + u_{p2}x_2 + \ldots + u_{pp}x_p \qquad (2)$$

or in matrix form:

$$\mathbf{z}_i = \mathbf{u}_i'\mathbf{x}$$

where $\mathbf{u}_i$ is a weight vector $(u_{i1}, u_{i2}, \ldots, u_{ip})$ associated with the ith principal component, which can be calculated separately for every household j. Also, $\mathbf{x}$ is a $p \times 1$ vector of original variables. The main statistics resulting from PCA are the variable weight vector $\mathbf{u}_i$ associated with each principal component, and its corresponding variance, λ_i (Dunteman 1989).

PCA finds a weight matrix $\mathbf{U}$ that maximizes $\mathbf{U}'\mathbf{R}\mathbf{U}$, given the constraint that $\mathbf{U}'\mathbf{U} = \mathbf{I}$, the identity function. This method is based on a result from matrix algebra involving a $p \times p$ symmetric, nonsingular matrix $\mathbf{R}$, a correlation matrix of asset variables. Because the units in which the original variables are measured are often arbitrary, and variables with large variances automatically get large weights in the principal component, a correlation matrix is often preferred to a covariance matrix (Dunteman 1989).

As detailed in Jackson (1991), the matrix λ, can be calculated by premultiplying and postmultiplying $\mathbf{R}$ by a weight vector $\mathbf{U}$ such that:

$$\mathbf{U}'\mathbf{R}\mathbf{U} = \lambda \qquad (3)$$

The diagonal elements of $\mathbf{l}$, (l_1, l_2, … l_p) are called *characteristic roots* or *eigenvalues*, and they are equal to the variance of each respective principal component. The off-diagonals of $\mathbf{l}$ are all equal to zero. The columns of $\mathbf{U}$, $\mathbf{u}_1$, $\mathbf{u}_2$, … $\mathbf{u}_p$ are called *characteristic vectors* or *eigenvectors* of $\mathbf{R}$. Eigenvalues can be obtained by solving for l in the *characteristic equation*:

$$| \mathbf{R} - l\mathbf{I} | = 0 \tag{4}$$

where $\mathbf{I}$ is the identity matrix. After solving for l, one can obtain eigenvectors by finding the solution of the equations:

$$[\mathbf{R} - l\mathbf{I}]\mathbf{t_i} = 0 \tag{5}$$

and

$$\mathbf{u_i} = \frac{t_i}{\sqrt{t_i' t_i}} \tag{6}$$

for $i = 1,2, \ldots, p$.

Upon solving for these eigenvectors, one can make up the matrix $\mathbf{U}$, with the ith row corresponding to the elements of the eigenvector associated with the ith eigenvalue:

$$\mathbf{U} = [\mathbf{u}_1 \,|\, \mathbf{u}_2 \,|\, \ldots \,|\, \mathbf{u}_p]. \tag{7}$$

This can be used to express the functional relationship between principal components, the weight vector, and the original variables more succinctly as:

$$\mathbf{z} = \mathbf{U}'\mathbf{x} \tag{8}$$

where $\mathbf{z}$ is a $p \times p$ matrix of principal components, $\mathbf{U}'$ is a $p \times p$ matrix of eigenvectors and $\mathbf{x}$ is a p column vector of original variables (Jackson 1991). While there are p principal components of the original p variables, it is the first principal component that captures the most variation. Thus, following work by Filmer and

Pritchett (2001), I use only the eigenvectors from the first principal component as weights in creating a wealth index for each household *j*, which can be expressed as:

$$z_{11} = u_{11}x_{1j} + u_{12}x_{2j} + \ldots + u_{1p}x_{pj}$$

$$\ldots \qquad\qquad j = 1,\ldots,J$$

$$z_{1j} = u_{11}x_{1j} + u_{12}x_{2j} + \ldots + u_{1p}x_{pj}$$

The critical assumption is that household wealth is what causes the most common variation in asset variables Filmer and Pritchett (2001).

Works Cited

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