# HOUSEHOLD-LEVEL RELATIONSHIPS BETWEEN OUT-MIGRATION AND MONETIZATION OF RICE HARVEST LABOR IN NANG RONG DISTRICT, THAILAND

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ABSTRACT

JAMES R. HULL: Household-Level Relationships between Out-Migration and Monetization of Rice Harvest Labor in Nang Rong District, Thailand
(Under the direction of Ronald R. Rindfuss)

There is an ongoing paucity of attention from researchers to the consequences of migration for households in villages of origin. The relationship between migration and remittance behavior on the one hand and the monetization of rice harvest labor on the other are explored in the context of Nang Rong District, Northeast Thailand. Theoretical linkages between migration and use of paid labor are explored.

Results demonstrate that the prevalence of wage labor use during the rice harvest doubled between 1994 and 2000 across the region, while reliance solely upon unpaid household labor fell substantially. Despite differences in growing conditions, macroeconomic conditions, household demographics and other phenomenon, a relationship between remittance behavior and use of paid labor was found in both time periods. Migration behavior by itself was related to paid labor use only when labor was scarce.

DEDICATION

To Jane and Bill, for your steady encouragement.

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## A. The Consequences of Migration

In recent years, there have been many advances in understanding the causes of internal and international migration, and in describing the effects of these processes on receiving areas, particularly urban centers (see reviews in Massey *et al.* 1993; Hammar 1997; Alba and Nee 1997). Research into both the causes of migration and its impacts on destinations is motivated, in part, by an underlying concern for the transformative potential of large migrant populations. Results of investigations into migration's causes are of interest to those policy-makers who debate whether the volume, direction, and composition of migrant flows can and should be altered. The results of destination impact studies are often used to support political claims that migrants are either reducing or improving the quality of life for native populations (Borjas 1999; Bouvier 1992; Brimelow 1995). These contemporary debates do reflect a more critical assessment of migrant impacts than those of twenty years ago, when the question was only how best to keep rural-urban migrants, in Rhoda's (1983) memorable phrase, "down on the farm." However, at the same time scholars of migration and development have noted that there continues to be a paucity of empirical investigation into the many important consequences of migration in the place of *origin* (Taylor, Rozelle, and deBrauw 2003: 75; Rigg 2003: 306). These researchers argue that a full understanding of the migration process will require us to move toward theoretical models that recognize migration's role as both a cause and a consequence of the many processes of change occurring in areas of origin.

Contemporary calls for attention to the interrelationships between migration and processes like rural development, agricultural productivity, and labor loss echo appeals to researchers made in the 1980s (Hugo 1982; Simmons 1982; Limanonda & Tirasawat 1987). During this earlier period, researchers delved into the subject from a theoretical standpoint, identifying broad areas of potential impact in places of origin and destination for future study. In one such list, Hugo (1982) includes 11 separate domains that are suspected to be linked to the phenomenon of migration. He describes the domains as only a 'select' list (194). The aspects of life in origin areas that are potentially impacted by migration range from production, employment, and housing, to health, fertility, and traditional family roles. They span multiple contextual levels. But from these rich, detailed roadmaps for research, only a small number of paths have been followed to date. It is almost exclusively the economic and social effects of migration on urban destinations that have received attention (For a review of the effects in the American context see Hirschman 2005; International Migration Review 1997). What is missing is attentiveness to the many and considerable consequences of migration for the individuals, households, and origin communities with whom migrants frequently maintain social and economic ties after migrating.

The present study documents relationships between migration and transformations occurring in the migrants' communities and households of origin. I examine a phenomenon that is central to the economic prosperity of most households in developing country contexts: the monetization of agricultural labor, and the corresponding decline in the prevalence of traditional labor practices. The custom of paying workers cash wages in exchange for labor is reported to have increased rapidly across Northeastern Thailand in recent years (Phongphit and Hewison 2001; Curran and Sawangdee 1998; Rigg 2003). Early indications of this trend

were documented in the 1980s by a United Nations-International Labor Organization Report (UN-ILO 1982), but in recent years, the pace of monetization has accelerated. Simultaneously, traditional strategies for providing rice harvest labor, including participation in labor-sharing networks and non-wage labor are in decline. Throughout the region and elsewhere, it is suspected that some households are abandoning rice agriculture entirely in favor of other livelihoods. These phenomena are interconnected, and together imply fundamental changes in the lives and livelihoods of households. The onset of these and other economic changes coincides with increases in population mobility, and particularly labor migration (Pejaranonda, Sanitipaporn, and Guest 1995). The simultaneity of the phenomena suggests that they may be causally related, but does not indicate the specific nature of the relationship (Simmons 1982).

I begin by laying out the case for why a relationship should be expected between migration and the monetization of paid labor, outlining theoretical linkages that may exist. In the analysis, I demonstrate an increase in the practice of households relying on agricultural wage-labor over the period 1994-2000 in Northeast Thailand and decreases in other practices. I provide evidence that two key linkages – the loss of labor through out-migration and the influence of remittances exchanged between migrants and households – operate to increase the likelihood of a household compensating its laborers monetarily for harvest work. Despite many broad shifts in contextual conditions between 1994 and 2000, a relationship between migration and agricultural practices persists in both time periods.

## B. Potential Relationships between Migration and Wage Labor

### 1.) Migration as a Causal Force

Migration and agricultural practices such as wage labor are suspected to be interrelated, although the exact nature of the relationship is not well-understood (Taylor, Rozelle, & deBrauw 2003; Rigg 2003). The anticipated linkages between migration and agricultural labor monetization are summarized in Figure 1. Hugo suggests two ways that migrants can affect conditions in their place of origin: through their absence and through the transmission of goods, ideas, attitudes, and innovations back from their destination (1979: 204). He labels these two channels *passive* and *active* impacts of rural out-migration on the origin household (1979: 205). These terms were originally used to characterize village-level effects, but they apply equally well to the household. Turner has argued that a reduction in the availability of labor in a region often results in changes in the extent of farming or the ways in which farming tasks are accomplished (1999: 268). In a similar vein, Rigg contends that virtually all ongoing transformations in agricultural practice in Southeast Asia are in part adaptations to the loss of labor (2003: 281). Adapting these theories about the *passive* impacts from the community to the household level is straightforward: as households are the principal unit of production in SE Asia, the absence of working-age individuals from an agricultural household translates into a loss of potential labor for that household (Rozelle, Taylor, and deBrauw 1999; Taylor, Rozelle, and deBrauw 2003).

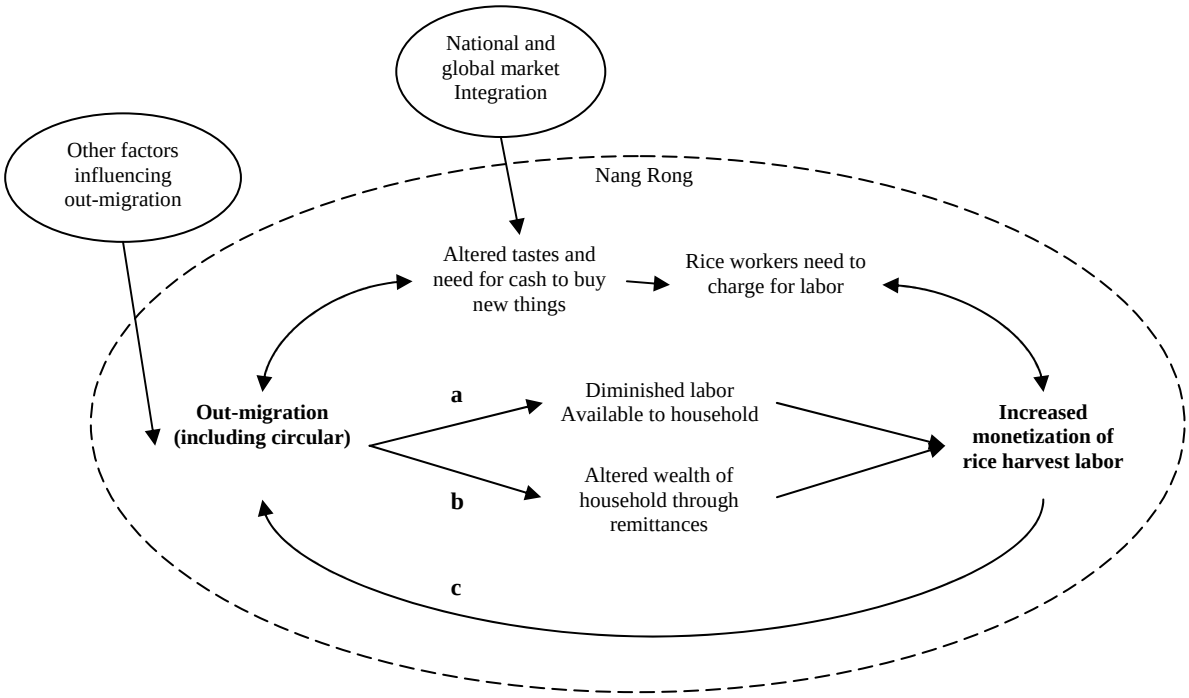
Among the most important *active* impacts that may transpire at the household level is the remitting of assets between migrants and households.[1] Migrants in Northeast Thailand and

[1] The transmission of ideas, attitudes, and innovations is a more problematic concept, at least with regards to measurement. But while it is true that migrants bring information into their households that could give those households an economic advantage over others, there is little evidence that such information is kept private in the Thai context. Ideas, attitudes, and innovations, unlike remittances of money or goods, are likely to be transmitted among households in the villages. Rapid diffusion of information and innovation through social networks in rural Thai villages has been documented in Northeast Thailand. Entwisle *et al.* demonstrated this regarding knowledge of contraceptive techniques among women in rural villages (1996), while Phongphit and Hewison (2001) note the easy flow of information between and within villages. For this reason, no attempt is made to operationalize and measure the ideational impact of migrants at the household level.

many other developing regions are typically expected to remit some portion of their wages and to send or bring goods back to their household (Stark and Lucas 1988; VanWey 2004; Piotrowski Forthcoming). Remittances of all types bring wealth into households, and cash remittances bring currency into circulation in the local economy. Taylor (1999) has explored the secondary effects of remittance behavior, noting that the effects of remittances for households in the sending area are poorly understood and theorized. Remittance studies in developing country settings suggest that cash gifts are typically spent by the family on basic needs (including family health, housing, and debt repayment) and on conspicuous consumption, as opposed to being invested in capital development efforts with long-term benefits (Durand and Massey 1992; Fuller *et al.* 1983: 16-17). A key question for this analysis is: do remittances to the household increase the ability of the household to pay laborers? There are at minimum two possible ways that they could. First, cash remittances may be spent directly on labor to replace the loss of the migrant. Second, gifts of goods might offset the cost of other expenditures, freeing up resources to be spent on laborers. Supporting these claims with two case studies from Peru, Jokisch finds households with migrants enjoy the 'luxury' of being able to hire laborers during periods of high labor demand (2002: 544). Although much less is known about remittances from the household to the migrant, they are expected to have the opposite effect of reducing cash available for use in paying wages to workers, all other factors being equal. To summarize, the active and passive channels of influence are represented by the paths labeled A and B in Figure 1.

Figure 1:

Potential Links between Migration and Monetization of Rice Harvest Labor



## 2.) Monetization as a Causal Force

Some migration occurs as a response to changing agricultural practices. An important interrelated process in tracing this linkage is the monetization of the rural economy resulting in part from rural-urban integration. Rigg notes that as far back as the middle of the nineteenth century rural Thais required cash income for the purpose of paying taxes (1994: 127). He also indicates that a broad process of monetization was underway as early as the mid-twentieth century in some Southeast Asian contexts (128). Keyes (1976), in contrast, notes that while head taxes imposed on rural Thais were calculated in money, villagers often paid these taxes in kind, mostly with rice (52). More important than the historic presence or absence of money in the rural economy, however, is the scope of the present change (Rigg 2003). Not only are households in Northeast Thailand and elsewhere increasingly seeking cash in order to purchase manufactured goods, but other types of social exchange which presently have suitable non-cash bases are coming to be mediated monetarily.

The monetization of local economies has been described at different times in contexts ranging from India, Indonesia, and Kiribati to Peru and Ecuador (Ghosh 1964; Bardhan 1988; Pinchón 1997; Heinrich 1997; Asian Development Bank 2002; Schrader 1997). A broad process of change has been documented in Northeast Thailand as well, in which money increasingly is viewed as an *essential* part of village life (Phongphit and Hewison 2001: 103). Chantana Banpasirichote (1993) conducted a case study of a Central Thai village where residents went from viewing pickup trucks as 'status symbols' to considering them 'necessities' over the span of just five years (described in Rigg 2003). For many households and villages in the region, integration into national and global markets has proceeded rapidly, due to improvements in transportation networks, increases in personal mobility, access to

mass media, and the penetration of formal markets into rural economies. Market integration brings with it rising material and social aspirations (Parnwell 1988: 205). The desire to obtain modern manufactured goods, ranging from televisions to tillers, leads many households in developing contexts to actively engage in practices that generate cash income (Heinrich 1997: 321).

It is argued that monetization depersonalizes transactions and dehumanizes relationships that once involved a high degree of mutual dependence and required high levels of social solidarity (Asian Development Bank 2002). Labor that was once exchanged directly is increasingly exchanged through the intermediate medium of money (Schrader 1997: 46). Among those households seeking cash income, those that perform agricultural work for other households in the village on an exchange basis may begin to view their labor as an unexploited source of cash income. The situation is complicated by the observation that many households in the region are both labor consumers and labor producers. Under these conditions, a feedback loop may ensue in which laborer's requests to be paid in cash may place the household they work for in a bind: in an attempt to meet these requests, households that also provide labor to others may begin to demand cash wages in order to pay off their debts. In similar fashion, an increase in material aspirations among participants in the local economy may lead to a monetization of other traditional barter transactions, forcing even reluctant households to increase their cash income in order to continue participating in the local economy. Both of these processes resemble the arguments made by economists about the role of relative deprivation in driving migration (Stark and Taylor 1991; Stark, Taylor, and Yitzhaki 1986).

In the absence of significant sources of cash income from within the local economy these feedback processes are not sustainable unless some households obtain cash from outside sources. Without the infusion of outside money, increasing demands for cash wages and monetary transactions would be futile because households would never acquire any surplus cash to be spent on things like labor. It is thus reasonable to expect some households to send members elsewhere in order to acquire additional cash and material wealth. The implication of such a feedback mechanism is that out-migration rates will accelerate most rapidly in areas where they are initially the greatest. This theoretical argument is consistent with the cumulative causation arguments made by demographers that villages in which pioneer migrants are successful over time build up the economic institutions and social support networks necessary to facilitate even higher levels of migration (Massey *et al.* 1993). Over time, the fundamental character of some villages becomes geared toward migration. In this case, however, the hypothesized change is not one *enabling* migration, but one that actually *encourages* migration. This path represented by arrow C running from monetization of rice harvest labor back to out-migration in Figure 1. Because of the longer time-scale over which these changes are thought to occur, only the first two links (lines A and B in Figure 1) representing labor loss and remittances, are examined in the present analysis. These are thought to operate at a more immediate scale, impacting household decisions almost instantaneously, as opposed to being spread over months or years.

## C. The Labor Squeeze

### 1.) The Continuing High Labor Demands of Rice Agriculture

Wetland rice agriculture plays a central role in the lives of the people of Northeast Thailand (Phongphit and Hewison 2001; Keyes 1976). Seeking to understand the changing nature of rice cultivation is therefore an important concern in its own right. But as noted above, there are reasons to believe that changes in agricultural practice are tied to migration. Any explanation of such changes must consider the impact that migration has on the availability and demand for labor in households and villages. For this reason, I focus specifically on the rice harvest, the phase of rice production with the highest labor demand.[2]

There is a strong pressure on households to harvest rice quickly once it matures. Mature rice left standing in the fields is at risk of lodging, or falling over from the weight of the mature heads, especially if a late-season rain occurs. Lodging makes harvesting considerably more difficult, as the stalks tend to fall randomly in all directions. The result is a tangled mess, and often a reduced yield. There is an ever-present risk of crop loss due to insect and animal pests, which increases once the crop is mature. Finally, there is also the risk of the rice becoming too dry while still in the field, which increases loss due to shattering during later phases of processing. With each day mature rice remains standing in the fields, it becomes drier and more brittle.

The rice harvest coincides with the beginning of the hot season in Thailand's monsoonal climate. When the sun is directly overhead at midday, work is extremely hot and difficult, and is usually avoided as a matter of course. This limits the number of hours for harvesting in a day. On some days the heat rising from the fields is visible, and work is typically planned to minimize sun exposure (Rajadhon 1955: 12, 31-32). Grünbühel *et al.* (2003) estimate that

[2] There are several times during the agricultural season when labor demand rises dramatically for a short duration. These periods correspond to the preparation of rice nursery beds (among those farmers using the transplant method of rice cultivation), plowing, transplanting, and harvesting. At one time, threshing the rice was also a collective labor activity (Rajadhon 1955: 33-41), but over time, the use of mechanical rice mills has largely displaced the ceremonial and communal events that accompanied threshing (Edmeades 2000).

between 15 and 25 workers are required to harvest the average family's fields in two days time (62). In an earlier report, the United Nations International Labor Organization placed the estimate slightly lower at approximately 2 days for 10 persons to harvest 5 rai, the average holdings of a household at the time (UN-ILO 1982: 88).

A vital question is why households do not simply invest in labor saving strategies that would enable those with shrinking labor pools to continue cultivating rice. Their primary means of reducing labor would be to mechanize aspects of the process, enabling more work to be done by fewer people. In point of fact, throughout the Northeast, mechanization has already been employed to the extent possible in most cases. Its overall contribution is modest, leaving much labor to be performed manually. Plows are of no use during the harvest, and mechanical reapers are equally impractical for most lands used in Nang Rong. Plots are typically small and surrounded by raised earthen dikes called *bunds* that are vital to regulating water levels in the rice paddy, but also make mechanization troublesome. Moreover, mechanized reaping does not remove the need to gather up the cut stalks and panicles, bundle them, and transport these bundles to the rice mill or threshing ground. Based upon evidence from the Philippines, Hayami, Marciano, and Bando (1988) conclude that the successful introduction of machines into the process of smallholder rice cultivation had little impact on the labor requirements of the harvest.

One other option available to farmers in the region is to alter the method of sowing rice, which may impact the labor requirements of harvesting it. Broadcasting, or tossing handfuls of seed rice over freshly tilled earth, has lower labor requirements early on, and higher labor requirements at harvest time due to the random pattern of growth. In contrast, transplanting rice places high demands on labor initially, but produces greater yields with less labor at

harvest time. Households experiencing labor shortages could in theory turn to one or the other strategy in order to better manage their labor supply. However, Curran and Sawangdee's qualitative interviews find that for Nang Rong farmers, having access to labor does not seem to be a determining factor in method of sowing (Curran and Sawangdee, 1998: 4). Rigg (2003) notes that when wages for agricultural workers exceed 100 baht/day (about twice the average in Nang Rong in 1994 with no correction for inflation, and approximately the typical average wage in 2000 based on responses to the community surveys), households may transition from transplanting to broadcast planting (284). Taken together, these findings suggest that method of sowing is likely to have little impact on labor demands in Nang Rong.

The spatial patterning of the landscape at the local scale also contributes to preventing large-scale mechanization and other labor-saving improvements. The Northeast occupies part of the Khorat Plateau, a geological formation that undulates between 100 and 200 meters above sea level, rising occasionally to over 300 meters (Parnwell 1988: 202). The Khorat Plateau exhibits considerable variation in local elevations and environmental conditions that agriculturalists have described as mini-watersheds (KKU-Ford Cropping Systems Project 1982). A mini-watershed may cover a very small area of land, some less than a hectare in extent. It is subject to local conditions, such as flooding potential, that are not shared by its immediate neighbors. Water from the rains will flow into the lowest areas of each mini-watershed, gradually flooding higher and higher areas. A difference in elevation of a few feet or meters may result in very different suitability for agriculture and influences the choice of crops and crop varieties. [3] Scarcely perceptible to outside observers, these variations in

[3] Farmers in the Northeast commonly describe land as either upland, upper paddy (middle terrace), or lower paddy (low terrace) (Rigg 1985; Polthanee and Marten 1986: 104). Uplands are unsuitable for rice and are commonly planted in cassava or kenaf. Upper paddy can be used for rice in years with sufficient rains, especially when low paddy is flooded, or can be planted in other crops. Lower paddy is typically suitable only

elevation impact every aspect of rice agriculture and are responsible to a considerable degree for preventing economies of scale in the harvesting of rice.

The biophysical constraints in the Northeast are compounded by the highest levels of poverty and lowest per capita income of any region in Thailand (Dohrs 1988: 12-13; Parnwell 1988). Grünbühel *et al.* go so far as to describing the Northeast as "unarguably" the most disadvantaged region in Thailand (2003: 60). The continuing high rates of poverty throughout the region make investments in labor-saving technologies all the more impossible for local farmers. It seems realistic on these grounds to conclude that high labor demands will characterize the rice harvest in the Northeast for some time to come (Rigg 1985; Grandstaff 1992). In the face of such consistently high labor demands, the supply of available labor through traditional means has become increasingly scarce. I now turn to these developments in the supply of labor.

### 2.) The Decline of Traditional Labor Supplies Available to Households

*The Demise of Labor-sharing networks.* Historically, Thai villagers adapted to the particular labor demands imposed by rice agriculture in their region by banding together in short-term labor-sharing networks among households (DeYoung 1955; Phongphit and Hewison 2001: 103). In Thai, these networks are called *long khaek* (Phongphit & Hewison 2001; Rigg 1994). Such networks took many forms, from pairs of households pooling their labor to harvest each other's rice crop, to extensive networks of many households, sometimes across several villages. The labor pool would successively help each household harvest its rice crop once mature.

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for rice cultivation, but is often usable even in years of low rainfall (Polthanee and Marten 1986). Thus, farmers working higher areas of a mini-watershed will not follow the same practices as those in the lowlands: they must adapt to the peculiarities of their parcels.

A key to the success of this strategy is that each household's crops traditionally matured at slightly different times, greatly enhancing the effectiveness of the *long khaek*. The temporal dispersal of labor demand across households occurs for several reasons. First, cultural practice once dictated that each household choose the date of planting based upon a set of factors, including the dates of Buddhist Holy Days, the year of birth of the household head, and the particular day, month, and year in relation to the lunar calendar. Because of the complexity of the decision, farmers frequently consulted with books of astrology or village monks to determine the best day for planting to ensure a good harvest (Phongphit and Hewison, 2001; Rajadhon 1955: 7-8). These traditions are disappearing in Northeast Thailand, but the norm of independence in the choice of planting dates appears to continue (Curran and Sawangdee, 1998: 3). Second, farmers often choose to plant their crop earlier or later than their neighbors based upon particular biophysical characteristics of their fields such as elevation, drainage, soil fertility, and the method of irrigation, if present. These conditions will in turn affect the speed at which the rice grows and matures (Curran and Sawangdee: 5). Finally, farmers select varieties of rice to suit the particular micro-environmental conditions of their particular land parcels, sometimes planting a number of varieties, each in a different area of their parcels. This serves primarily as an insurance policy against the variability in the timing and amount of rainfall (Grandstaff 1992: 136). The result of this variation in planting dates, physical conditions, and rice varieties, is that not all rice paddies in a given locality mature at the same time, alleviating the burden that would be felt if all lands in a village territory required harvesting at approximately the same time.

But in the 1980s, the International Labor Organization of the United Nations and other researchers noted that labor exchange groups were declining in the Northeast (UN-ILO 1982:

70; Polthanee and Marten 1986: 115). Two decades later Phongphit and Hewison observed that the *long khaek* strategy had virtually disappeared from the Northeastern villages they studied, and had been replaced by reliance on household and paid labor (2001: 103). These existing reports are based on small-scale studies of one or a few villages, however, and there is little systematic reporting on collective farming behavior from Northeast Thailand and other developing regions. Moreover, in nearly every case, these study villages were recipients of development aid and assistance that may have accelerated the transition away from the *long khaek* strategy. An important additional contribution of the present study is thus to confirm qualitative reports of the decline of unpaid labor arrangements for a large sample of rural Thai households.

*Demographic changes decreasing household labor.* Another traditional source of labor was the household itself. The average household size in Nang Rong declined from 4.0 to 3.8 in the six-year interval from 1994 to 2000, but this modest decline is the continuation of a decline in mean household size in Northeast Thailand from 5.5 in 1984. Prior to 1984, there is little reliable information on demographic trends in the Northeast, but families as large as 7 or 8 would be consistent with fertility patterns in pre-transition Thailand (Hirschman, Tan, Chamratrithirong, and Guest 1994). The problem of finding enough labor to complete the rice harvest in a timely fashion is exacerbated by the shrinking size of families under lower fertility conditions. Further, growth in the number of households has occurred in many Nang Rong villages even while the population declined somewhat (Entwisle *et al*. 2004). The fragmentation of households may reflect trends toward increasing affluence throughout the region. Higher levels of affluence permit wealthier households to make the shift from living in complex multi-generational family units to smaller, nuclear families who, although often

living in close proximity, enjoy greater levels of privacy than were previously possible. These two trends together have, over the long term, reduced the amount of labor directly available to households.

*Disarticulation between Circulation and Peak Labor Demand.* The dominant pattern of migration from Nang Rong, and from other parts of the Northeast, can be characterized as circular (Fuller, Kamnuansilpa, and Lightfoot, 1990: 535; 1985: 565; Chamratrithirong *et al*. 1995; Richter *et al*. 1997). Under such a mobility regime, migrants travel to Bangkok and other urban areas, many of them finding employment in the large informal sector that exists in the metropolis (Hackenberg 1980). During this time, it is common for the migrant to maintain contact with his or her household back in the village in expectation of eventually returning to the village and taking up residence again. The pattern may be repeated many times. This behavior has been described as a strategy for maximizing household income, while simultaneously limiting the expense and unpleasantness of living in a highly urbanized area (Fan and Stretton, 1985: 343-345). The New Economics of Labor Migration theory also describes this type of migration behavior as a form of coinsurance – by living in areas with different risk profiles, a household is able to minimize its chance of experiencing catastrophic loss (Lucas and Stark 1985).

Due to the seasonal variation in labor demands in many agricultural contexts, the assumption has long been made that many circular migrants time their absences to coincide with the agricultural calendar – giving rise to the term seasonal migration. In fact, considerable disarticulation has been shown to exist between periods of high agricultural labor demand and periods when seasonal migrants are present, reducing the likelihood that migrants are able to assist households with harvests and other tasks (Collins 1988). Fuller *et*

*al.* observed, in a study of six rural villages in Atsamat District, Roi-Et Province, Northeast Thailand that, "Circular urban migration, while ostensibly seasonal and geared to the demands of labor for farming, involves substantial rates of absence from the villages during seasons of peak labor demand" (1983: 201). Elsewhere, this same research group reported that only 9 percent of its sample of 442 circular migrants during the period from 1976-1979 fit the predicted pattern of absence from the village during non-farming seasons and return during times of planting and harvest (Lightfoot, Fuller, and Kamnuansilpa, 1983: 33). These authors concluded that patterns of movement were far more complex than previously thought, and that the term "seasonal" migration is too simplistic to be widely applicable in the Thai context. Banpasirichote (1993) and Piotrowski (Forthcoming) have both identified a similar disarticulation between return spells and periods of peak agricultural labor demand, for Klong Pan Pho village in Central Thailand and Nang Rong district, respectively. These findings together suggest that far from being the norm, articulation between the agricultural calendar and migration spells is one of many patterns.

To summarize, there are numerous processes that may potentially contribute to the ongoing high labor demands in the study area. These include characteristics particular to wetland rice agriculture, specific sociocultural practices of rice-growing, aspects of the biophysical environment and cropping system, and a lack of capital and institutional support for investment in the small range of labor-saving improvements available to Nang Rong farmers. Equally important is the increasing potential for household-level labor 'shortages.' Factors working to reduce the labor available to households through traditional means include the deterioration of the *long khaek* labor-sharing system, the reduction in both fertility and average size of household, and the planned or unplanned failure of migrants to

return from abroad to assist during periods of peak labor demand. These forces interact to create a set of circumstances that leave many households with few options for continuing to farm. Among these, I argue that paying laborers to assist with the harvest, and other tasks, is prominent.

## D. ANALYSIS

### 1.) Nang Rong Data

The data for this study come from a longitudinal study that began in 1984 as the Community-Based Integrated Rural Development (C-BIRD) Evaluation Project.[4] In this analysis, I use information collected from the Nang Rong household and community surveys in the 1994 and 2000 waves. In 1994, there were 7,331 households in the sample villages. By 2000, this number had grown to 8,638. In using the household rosters from the previous survey to inquire about migrants, the study obtains complete records of all persons leaving their villages. In 1994 and 2000, two types of households are identified. Old households are identified first, using a rule of household succession to match households found in the village in the current wave to those at the preceding wave[5]. If a household matched to a household from a previous wave, it is classified as 'old'. If no match is made, it is classified as 'new.' For the old households in the study the interviewer inquired about the current whereabouts of all members listed on the household roster at the last wave. Thus, for all old households an

[4] A detailed description of the Nang Rong Project data is available at https://www.cpc.unc.edu/projects/nangrong/.

[5] The household succession rule is as follows: the interviewer was instructed to locate the oldest female member listed on a household roster from the previous wave. If such an individual could not be located in the village, or was identified as being deceased, or a migrant, the interviewer then asked about the oldest male member of the household. If this individual was also no longer present, the interviewer then asked about the second-oldest female member of the household, then about the second-oldest male member, and so on until a household match was made. If none of the members listed on a household roster from the previous wave could be located during the present wave, the entire household was classified as 'lost to follow-up.'

attempt was made to determine the current whereabouts of all members present during the last interview, whether presently in the village, dead, or migrated outside the village. I am able to take advantage of this research design to collect prospective information about migrants from old households. Out of 7,331 households in 1994, 5,191 of them were classified as old, and of 8,638 households in 2000, 6,958 of them were old. These constitute the sample used in this analysis.

## 2.) Unit of Analysis

There are several of reasons to expect that the household is the level of social arrangement at which an association between migration and the monetization of the rice harvest will be most clearly detectable. Households take many diverse forms in Northeast Thailand, including multi-generational and multi-family units, but in most cases they are the decision-making units in agricultural matters (Capistrano and Marten 1986). It is households themselves, as the basic unit of production, that enter into *long khaek* arrangements and wage labor contracts in order to harvest rice for the benefit of all members (Lightfoot, Fuller, and Kamnuansilpa 1983; Taylor, Rozelle, and deBrauw 2003). Moreover, because of the subsistence character of much rice agriculture in the region, the impacts of agricultural decisions by any member are commonly spread across the entire household (Phongphit and Hewison 2001).

The central argument of this paper is that the migration behavior is related to agricultural practice. This makes relevant the question of whether the migration decision is made by the household collectively, individuals acting independently, or some combination of the two. This paper takes the stance articulated in New Economics of Labor Migration that decisions

about migration are largely collective household decisions (Stark and Bloom 1985; Taylor 1999; Taylor, Rozelle, and DeBrauw 2003). Guest (1991) remarks that treating migration as a household decision does not imply that all household members are involved, only that the decision is not made by the individual in a vacuum (233). Within the predominantly Buddhist Thai cultural context, individualism is often viewed as a negative, even dangerous trait (Mulder 1996). Young Thais are taught to place a high value on group cohesion, and to subvert personal desires to the wishes of their parents and family. Thus, to treat migrants as independent decision-makers acting without consultation with other household members does not reflect what is known about the Thai cultural context (DeJong 2000).

### 3.) Dependent Variable

The few studies that have examined the impacts of migration on agricultural practice among villages and households have focused on agricultural production and cultivation as the outcome of interest (Hugo 1982; Taylor, Rozelle, and DeBrauw 2003; Jokisch 2002). These studies find consistently that the reduction in labor throughout a village has no effect on yield and various measures of agricultural production, while the effect at the household level is to decrease the agricultural output for that household through loss of labor. Researchers that examine the impact of remittances suggest that their effect is to increase household income obtained through cropping (Taylor, Rozelle, and DeBrauw 2003: 93). However, the important question of how migration might affect agricultural *practice*, that is, the *ways* in which yields and household incomes are maintained has yet to be addressed (Rigg 2003).

A categorical outcome variable is constructed using a series of questions that appeared on the 1994 and 2000 questionnaires. Four mutually exclusive and exhaustive outcomes are

created: The first is households that grew no rice. The second consists of households that grew rice and relied only on their own members. This category is labeled 'household labor only'. The third and fourth categories consist of households that relied on labor in addition to their household members. This labor could have been provided by former and returning household members, fellow villagers, or workers from another village. [6] For each of the sources a household used, it was asked about the nature of the work, whether for wages, for free, or labor exchange.[7] The third category consists of households that used some extra labor but paid none of their workers and is labeled 'unpaid extra labor'. The fourth category contains all households that paid some or all of their workers and is labeled 'paid extra labor'.

## 4.) Independent Variables

For the purposes of this analysis a migrant is defined as a household member who left their Nang Rong village prior to the last rice harvest, irrespective of purpose or destination. To

[6] Former and returning household members are persons who were present (living in the household or temporarily absent) during the previous interview but now live elsewhere. These are individuals who have moved into another household in the same village (former members), and those who have migrated elsewhere (returning members).

[7] The level of detail of this information implies a minimum of nine different categories can be created in addition to the two already made. Each of these categories would have numbers too small to enable reliable estimation of a model. Descriptive analyses were used in combination with a classification rule of the type "if any, then…" to consolidate and reduce categories. Only 3 percent of those households relying on former and returning members compensated any of them monetarily in either year. All households relying only on these types of laborers were coded 3 – 'used unpaid extra labor'. Households primarily relied upon a single source of labor: returning and former members, workers from the same village, or workers from another village. Mixing of two sources was fairly uncommon, and mixing of all three was quite rare. Mixing of both paid and unpaid laborers was also uncommon. Households that relied on some exchange and free labor from the same or another village, but did not pay any workers were added to category 3 – unpaid extra labor. These two strategies combined are representative of "traditional" approaches to meeting labor demand: households relying on the *long khaek* or counting on returning members. Among those households that paid some or all of their laborers, I collapsed the distinction between labor from the same village and another village into category 4 – used paid extra labor. My aim is to determine the characteristics of those households that paid *any* workers in contrast with other households, not where the workers were from, how many there were, or what proportion of them was paid. Future analyses may be able to further explore these more fine-grained questions.

determine this, the timing of the annual harvest must be established. I used questions from 1994 about the month that each household harvested its rice during the preceding year, corroborated by other studies on the timing of the harvest (Fukui 1993) to set this date. These sources indicate that the harvest for a given household typically takes place between October and January.[8] To be conservative, I define a migrant as a member who has been absent from the household since at least the beginning of October of the preceding year. [9]

Two other independent variables are constructed. The first measures the total number of migrants from each household that remitted wages or goods to the household during the 12 months prior to the interview. The second is a measure of the total number of migrants receiving money or goods from the household during the 12 months prior to the interview. [10]

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[8] In 1994, approximately 24 percent of households who harvested rice did so only during the month of December. If the window is enlarged to one month on either side of December, the number who completed their harvest during that window rises to 84 percent. Finally, if a window is used that spans from October to January, a full 95 percent of rice-growing households are included. Further, of 5,478 rice-growing households in 1994, only one reported any harvest activities in the month of September.

[9] The household interviews were conducted during the months of April, May, and June, and the exact day of each interview is recorded for each household. At the time of the interview, the households were asked about absent members, their destination, and the length of their absence. Using the interview date, I define as migrants those individuals who have been gone a minimum number of months: six for households interviewed in April, seven for households interviewed in May, and eight for households interviewed in June. In this way, I increase the likelihood that for each household the migrants were in fact absent during the previous harvest season. I also reduce uncertainty due to the variable timing of interviews. The definition of migrant used in this analysis does not rule out the possibility that a given individual returns for short visits. If the migrant was involved with the rice harvest, however, she or he will be counted among the returning and former members of the household, and the household is coded 3 on the dependent variable. The upper end of the time interval that defines a migrant must also be specified. Between the 1984 wave of interviews and the 1994 wave, a span of approximately 10 years passed, while the interval between the 1994 and 2000 waves is only six years. In the analysis of household rice harvest strategies for 1994, I exclude migrants from the household who have been gone longer than six years. This shortens the window from 1984-1994 to 1988-1994. The result is that I have two six-year windows that are parallel and comparable.

[10] Although the window for both forms of remittance is 12 months prior to the interview, all migrants that have been gone since before the last harvest, regardless of duration, are eligible to remit and receive assets. The data can thus be thought of as a one-year sample of ongoing remittance behaviors over longer periods of time. The stability of remittance behaviors over time suggest that this is a valid measurement procedure (results not shown). A second issue is the lack of specificity about when during the 12 months the money or goods were sent and whether in one lump sum or many small transfers. For this reason, it may be best to interpret the remittance variable as representing an overall predisposition to remit or not to remit on the part of each migrant.

Although the information on remittances and money sent to migrants includes estimates of the total amount and the types of goods sent or received, this detailed information is not used in the present analysis. Estimates of the total amount were intentionally recorded as an ordinal variable in order to avoid artificial precision on this recall item, and are measured in unequal increments (e.g. 0, 1-1000 baht, 1001-3000 baht, and so on). In this format, the data cannot be aggregated easily, and doing so would necessarily introduce uncertainty into the measurement of the variables. For this reason, I use the simpler measures of the number of remitters and migrants receiving money for each household. Although not perfect substitutes for the actual amounts of remittance, both measures establish a general pattern of asset flows between migrants and households. In discussing these two measures in this paper, I shorten the variable descriptions to 'remitters' and 'migrants receiving money'. This is done for convenience, but the reader should be aware that these descriptions are always intended to include both material goods and cash payments. No distinction is made between transfers of money and goods because of the high degree of substitutability between the two in the context of Nang Rong. In general, gifts of goods sent and received free the household or the migrant from the need to purchase such goods using cash on hand.

## 5.) Changes in Agricultural Practice

Before examining shifts in agricultural practice at the household level, I note the shifts occurring at the village level in order to provide a sense of the larger context of change occurring in Nang Rong. A great many villages saw dramatic increases in the percentage of households using paid extra labor and corresponding decreases in the percentage relying on household labor only. Figures 2a and 2b were generated by calculating the percentage of

Figure 2a:

Change in Proportion of Households Using 'Paid Extra Laborers'
among Villages, sorted by Magnitude of Change

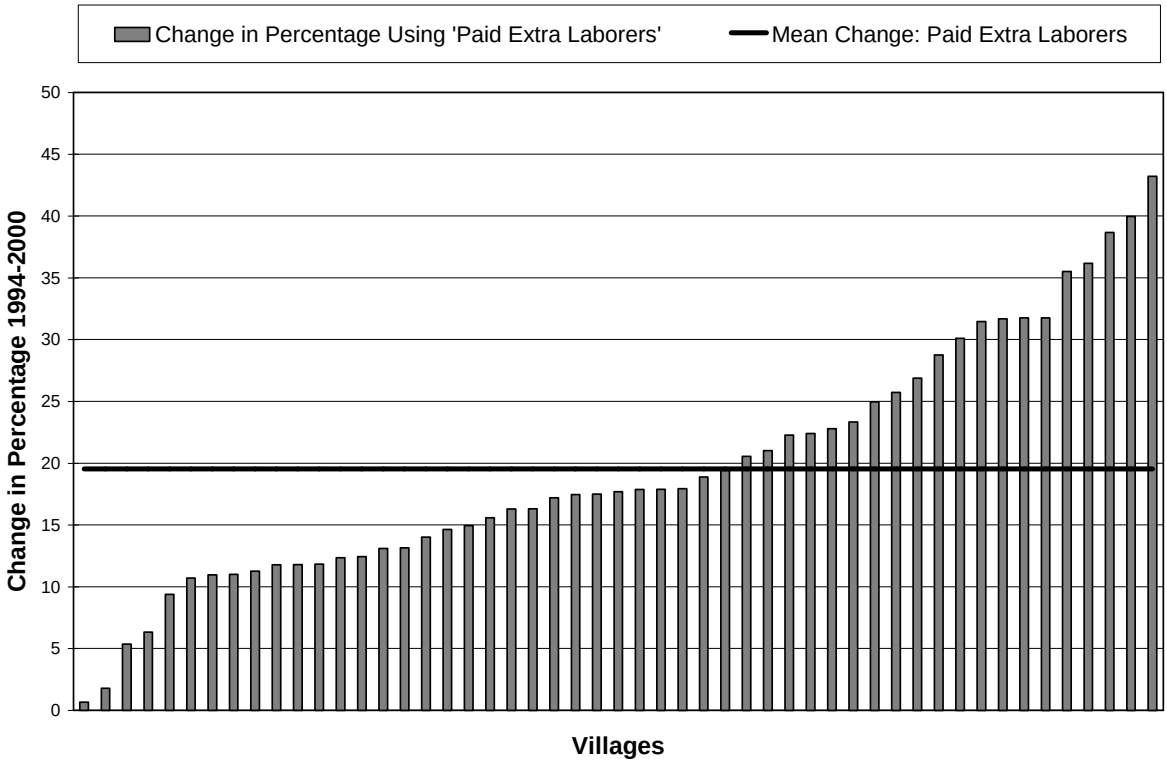
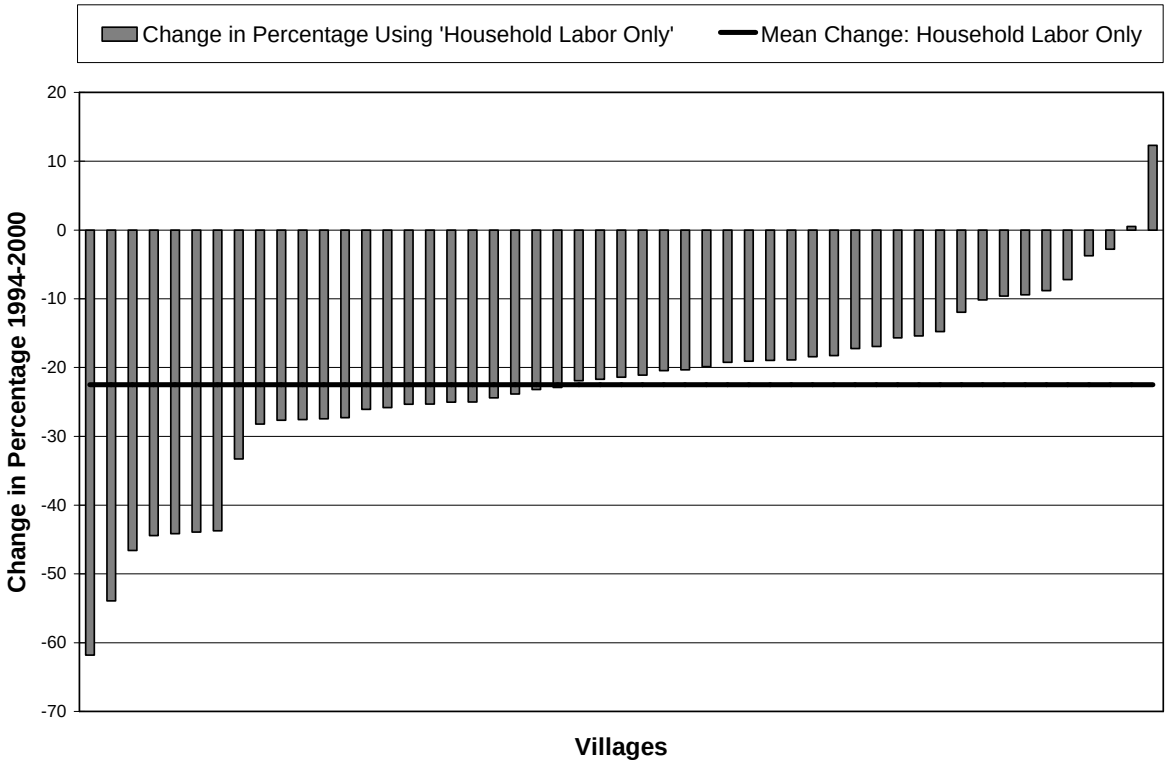


Figure 2b:

Change in Proportion of Households Using 'Household Labor Only'
among Villages, sorted by Magnitude of Change



households in each village using 'paid extra laborers' and 'household labor only' respectively in 1994 and 2000. A village's 1994 value is subtracted from its 2000 value to determine the change in percentage reported in the figures. These calculations include only 'old' households. Figure 2a indicates that between 1994 and 2000, in every single village in the sample, the percentage of households relying on paid extra labor to harvest their rice increased, and that in 46 of the 51 villages, the increase was at least 10 percentage points. The mean change across all villages was nearly 22 percentage points. Although all villages experienced increases, there was considerable variation in the prevalence of the shift across villages. Also worth noting is the corresponding decline at the village-level in the percentage of households growing rice and using household labor only for the harvest. From Figure 2b, decreases of at least 10 percentage points can be seen in 42 of 51 study villages. In 7 villages the decline was greater than 40 percentage points. On average, villages saw a decrease in the prevalence of this practice among households of greater than 20 percent.

These same trends are observed at the household level. In Table 1, I present a classification of the outcomes for households in 1994 versus those in 2000. From 1994 to 2000, the percentage of households relying on paid extra labor increased from 24 to 44 percent, with a nearly equivalent decrease in the percentage relying on household labor only. The percentage of households using unpaid extra labor stayed fairly constant at between 10 and 13 percent of the sample, while the percentage of households growing no rice increased from 18 to 24. Table 2 gives a more detailed account of the shifts occurring by taking advantage of the longitudinal quality of the data.[11] The marginal counts indicate the overall

[11] The combined sample used to generate this table does not correspond exactly to the two cross-sectional samples used in the rest of the analysis. In order to assess the transitions between outcomes for specific households I must examine the data longitudinally, which requires the imposition of several selectivities. These include the removal of households from the sample that were not located in 2000 and of those that were new in

prevalence of each practice among households in both years. Among those households relying on unpaid extra labor or household labor only in 1994, 46 percent shifted to reliance on some paid extra labor by 2000. Also of note is that the two categories with the most 'staying' power – those categories that retained the highest percentage of households between 1994 and 2000 are the two least traditional practices – growing no rice and paid extra labor. Three-fifths of those households that paid laborers in 1994 did so again in 2000, and were joined by an almost equal number of households from the other three categories.

It is clear that the overall incidence of paid labor usage in Nang Rong Thailand increased substantially between 1994 and 2000, but it is difficult to discriminate among explanations for the increase. One important factor that is not constant between the two years is the overall amount of rainfall in the region (see Figure 3). 1994 was considered a 'dry' year, well below the 32-year average, while 2000 was a fairly 'wet' year, with above-average rainfall. These data are taken from a single rain gauge near the center of the District, and for this reason should be treated with caution in light of the earlier discussion about the variation across the region. As an indicator of the overall pattern of rainfall, however, the data suggest that a partial explanation for the increase in paid labor use between 1994 and 2000 could be a dramatic rise in the total amount of labor needed at harvest time. While this may contribute to the observed shift, the magnitude and pervasiveness of the shifts in agricultural practice suggest that they are more than a response to year-to-year fluctuations. So too, does the observation that households did not rely more on all forms of labor in 2000, but only paid

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2000. The result of matching the 1994 and 2000 household data was a file containing 4,960 cases, compared with 5,191 for 1994 and 6,958 for 2000. There were 231 old households in 1994 for which no members were located in 2000, and 1866 old households in 2000 that were new households in 1994. There were an additional 132 cases that did not match between 1994 and 2000. This lack of exact correspondence is due to household merges and splits. Imposing these selectivities had no effect on the overall percentages for any outcome. For paid extra labor, the true cross-sectional percentages were 23.62 percent in 1994 and 43.86 percent in 2000, compared with 23.92 percent in 1994 and 44.66 percent in 2000 for the longitudinal analysis presented here.

Table 1:

Harvest Strategies in 1994 and 2000

| | **1994** | **2000** |
|---|---|---|
| Grew No Rice | 18% | 24% |
| Household Labor Only | 46% | 23% |
| Unpaid Extra Laborers | 13% | 10% |
| Paid Extra Laborers | 24% | 44% |
| TOTAL | 100% | 100% |
| N | 5191 | 6958 |

NOTE: Totals may not sum to 100 due to rounding error.

Table 2:

Cross-Tabulation of Harvest Strategy in 1994 vs. 2000, n=4,960 households

| | Dependent Variable 2000: | | | | | |
|---|---|---|---|---|---|---|
| Dependent Variable 1994: | Grew No Rice | Household Labor Only | Unpaid Extra Labor | Paid Extra Labor | PercentTotal | **Counts** |
| Grew No Rice | 65% | 11% | 5% | 19% | 100% | **860** |
| Household Labor Only | 14% | 28% | 11% | 46% | 100% | **2,242** |
| Unpaid Extra Labor | 13% | 24% | 17% | 46% | 100% | **670** |
| Paid Extra Labor | 16% | 16% | 9% | 60% | 100% | **1,186** |
| Percent Total | 23% | 22% | 10% | 45% | 100% | |
| **Counts** | **1,153** | **1,078** | **513** | **2,214** | **4,958** | |

Row percentages (2000)

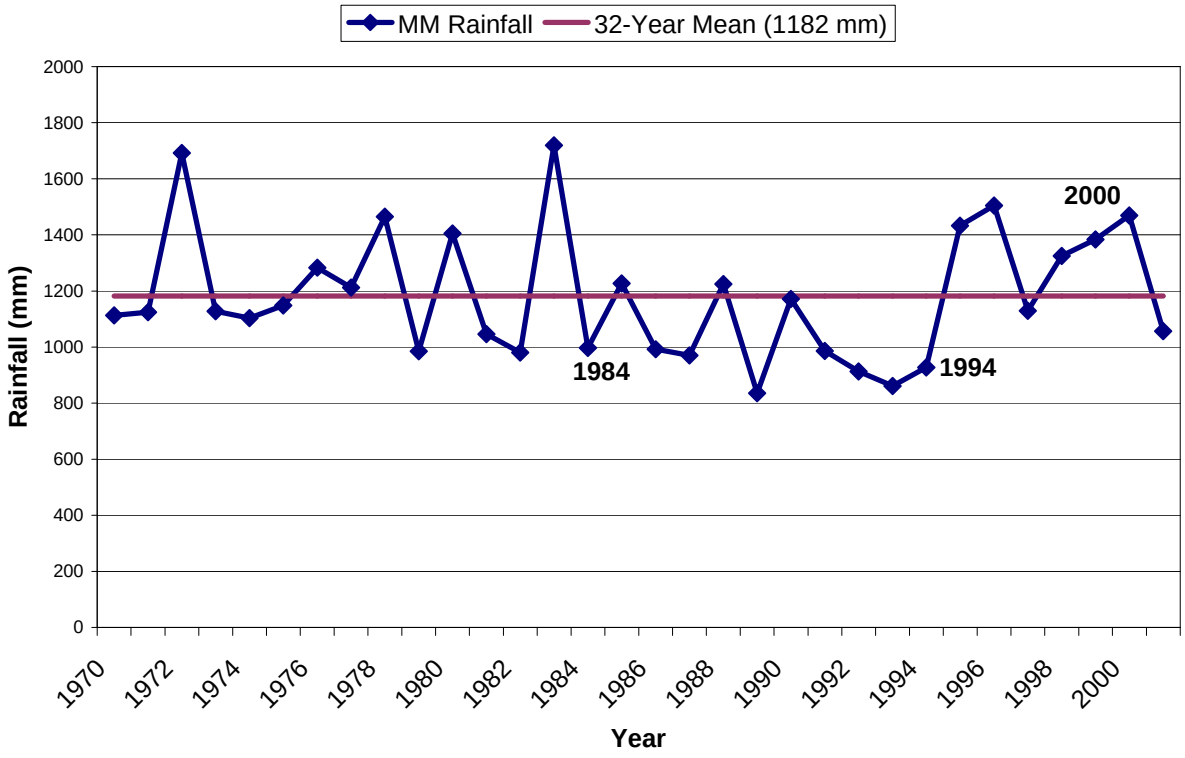
NOTE: row percentages may not sum to 100 due to rounding

labor. They made *less* use of unpaid labor in 2000, contrary to what would be expected if all forms of labor were in greater demand. Lastly, if 2000 were simply a better year for rice-growing, one would expect households that were unable to grow rice in 1994 would take advantage of the improved conditions, but we find just the opposite: as can be seen from Tables 1 and 2 the percentage and raw number of households not growing any rice increased between 1994 and 2000, contrary to expectations if a simple improvement of conditions was at work.

These notable differences in rainfall between the two years may strengthen the support for a relationship between migration and paid labor usage if one is found in both years. It would suggest that, irrespective of highly variable factors such as rainfall, a relationship is consistently present between migration and paid labor usage at the household level. Along these lines, another factor that should be noted is the 1997 Southeast Asian financial crisis, which occurred in the middle of the six year interval. Exposure to the effects of this crisis is thought to be fairly evenly distributed across a region like Nang Rong, in which most households were insulated from the worst of its effects by their involvement in numerous non-market economic activities. However, an event with such broad implications for people throughout Southeast Asia may have permanently changed conditions in Nang Rong following the economic crisis. Thus, the finding that a relationship appears both in the years prior to and immediately after an event of major import such as this would again suggest that the relationship is robust to these environmental and economic changes. A third and final trend affecting the entire region, and described elsewhere in this paper, is the rise in wage labor rates from 1994 to 2000. Over this six-year period, mean wages across all villages more than doubled, from about 50 baht/day to over 100 baht/day per worker. A finding that the

Figure 3:

Annual Rainfall (mm) Plotted Against 32-year Mean



relationship between migration and paid labor persists despite such changes in average wage rates would again speak to the persistent nature of the association.

## 6.) Multinomial Logistic Model

A Multinomial logistic model (MNLM) is used to produce two models in which the dependent variable is the household's agricultural practice (Long 1997; Long 2001). The Huber-White robust standard error procedure is used to ensure unbiased estimation of standard errors despite the multi-level structure of the data.[12] In this analysis, all of the standard errors reported and used in calculations are the robust standard errors corrected for correlation of errors at the village level. The three independent variables cannot be included in the same model because of a structural relationship among them. If a household does not have any migrants, it is automatically excluded from having any remitters and from sending gifts of goods and money to a migrant. To get around this problem, I estimate three separate models with the same dependent variable: one for each of the key independent variables. The same control variables are included in each model and show almost perfect consistency

[12] It is possible that households within the same village may show more similarity on measured characteristics than households from different villages. That is, if we know something about a household in village A, we may be able to predict something about a second household in village A. This violates an important assumption in maximum likelihood regression that the errors between any two observations be uncorrelated. If such a violation should occur because standard techniques are applied to hierarchically structured data, the coefficient estimates will remain unbiased, but the associated standard errors are likely to be underestimates. The standard errors are used in a variety of tests of statistical significance, including the common Wald test for the significance of parameters, making their correct estimation an important concern. The problem of overestimating the information content of observations clustered in a hierarchy are well-known in statistics, and a number of methodologies have been developed for dealing with this issue. If one is concerned only with estimating the coefficients, and not in analyzing the error structure, or random effects, of the model, Huber-White robust standard error estimation has been shown to be sufficient (Raudenbush and Bryk 2002). The primary requirement to use Huber-White correction instead of more complicated multi-level models is that the number of level-2, or group, variables not be too small. There is no strict standard in such matters, but 30 is generally considered the minimum number of level-2 groups required for the method to produce reliable estimates. One can verify the appropriateness of this method by estimating an unconditional means (intercept-only) mixed model and calculating the Intra-Class Coefficient (ICC) at the village level. Based on other work in Nang Rong District, the ICC for the study villages is typically moderate when working with agricultural variables (ranging from roughly 0.04 to 0.08), suggesting that the Huber-White method is sufficient for dealing with the effects of clustering.

across the models.[13] Each set of three models is estimated using the 1994 and 2000 wave of data for a total of six models. A standard check against collinearity was conducted on each model and no evidence was found for collinearity when the three key independent variables are treated separately.[14] Standard procedures were used to test the assumption of independence of irrelevant alternatives (IIA), and suggest that this assumption is not violated.[15]

When using a MNLM, it is common practice for researchers to report only those contrasts that involve their outcome of interest as the reference category. Other contrasts can be mathematically derived from a model with a single reference category. However, given the dearth of information on social and economic transformations taking place in developing

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[13] Control variables were stable across these three models in both 1994 and 2000. In 1994, 44 out of 46 control variable beta coefficients significant at the p<=0.05 level in one model were also significant in the same direction in the other two models. In 2000, it was 49 out of 50. Differences in magnitude were extremely small.

[14] The highest variance inflation factor in 1994 was 2.38, and in 2000 was 2.24, well below the suggested threshold of 10 or higher (Neter, Kutner, Nachtsheim, and Wasserman 1996).

[15] As Long notes, statistical tests of the IIA often yield contradictory results and none of them provides conclusive evidence that assumption has been either met or violated. The present analysis is no exception. The Hausman test option (McFadden 1973) available in STATA urges acceptance of the null hypothesis that the four-category specification of the dependent variable does *not* violate the IIA assumption in any of the models or years. The alternative Small-Hsiao test, also available in STATA, provides mixed results – in each year, the removal of some categories results in a rejection of the same null hypothesis, but the results are not consistent across models. The inconsistency cannot be interpreted as evidence for or against the null hypothesis, however, because the Small-Hsiao test relies upon re-sampling to compute the test statistics, and may produce different results based upon the randomly chosen seed. Long suggests that rather than relying on these tests alone, users of the MNLM take care to specify dissimilar and distinct outcomes that are not substitutes for one another (2001: 191). Among the four outcomes in the present model, I have reason to believe that they are substitutable in the eyes of the decision-maker. The choice of whether a household grows rice and how it obtains the labor needed to harvest it is made under a wide variety of constraints: the degree to which the household needs the rice, the availability of different types of laborers, the availability of cash to pay laborers, the number of former who are willing and able to return to help. I argue that for most households these and other factors limit the available choices. Even in cases where a household might have more than one option, it is unlikely that these choices come with equal advantages and disadvantages. As an additional check against the possibility of IIA violation, I estimated a comparable multinomial probit model. The probit class of models is not subject to the IIA assumption. Results for the key independent variables were entirely consistent with regard to the statistical significance and magnitude of coefficients. Results of the probit analysis are available from the author upon request.

contexts like Nang Rong, the relationships between other outcomes are of considerable value in understanding the changes taking place. For this reason, all six unique contrasts are reported directly, removing the need for readers to calculate the missing three contrasts. With six models and six contrasts for each variable in the model, I present and interpret only select results. Tables containing the full set of coefficients and standard errors may be found in the Appendix. Due to the large volume of information generated, I also rely on predicted probabilities to aid in summarizing and interpreting the results.

### 7.) Control Variables

The controls may be grouped broadly into measures of household composition, household economic diversification and income generation, household economic position, and village characteristics.

When a household member leaves and forms a new household through marriage that member often settles within the village or their spouse's village. A similar situation could arise through other processes, marital separation, for example. Such individuals are no longer counted among the members of the household, but they are included in another household in the village. Strong ties frequently persist between the existing and the newly formed households. In particular, due to their close proximity, these ties may increase the likelihood of households exchanging labor. A count of the number of such individuals living in the same village is included. The number of working age males and females in each household are measured and entered separately to control for the labor available to the household.[16] A

[16] A working-age individual for the purposes of this analysis is defined quite broadly as any person between the ages of 13 and 65. The age of 13 coincides roughly with the end of primary education in Thailand. Age 65 was chosen somewhat arbitrarily. It is known that older household members in Thailand continue to contribute what they can to the household into old age (Knodel & Saengtienchai 1996: 99), but no studies exist that quantify the

count of the number of children and elderly in each household, defined as those persons outside the 13-65 range, is included in the model as a single variable. The mean age of the household is included to account for age-compositional differences in the makeup of households. With all of the household composition variables, there is a small lag between the harvest date and the date of the interview, but this span of time is not sufficient to alter the values of these variables significantly.

Another major set of influences that must be controlled are the many potential sources of cash income for the household. Most households in the Northeast manage a "diverse portfolio" of activities, agricultural and otherwise, as a safeguard against failure in any one domain (Grandstaff 1992: 142). Among the cash crops grown in the region, cassava is the only one that is cultivated widely. A simple dichotomous variable for whether cassava was grown by the household at the time of the survey is used. Cassava has a fairly long startup and maturation time, making it unnecessary to correct for the small difference in time between the harvest and the interview. A composite variable indicates a household's involvement in one or more cottage industries: silk weaving, raising silk worms, and cloth weaving. Charcoal making is included as a separate control variable because, unlike the other three cottage industries which declined in popularity between 1994 and 2000, it became more widespread. Variables indicating whether the household raised cattle or pigs are also included because of the potential for these animals to be sold for cash. The variable measuring pigs is dichotomous, the variable measuring the number of cattle is trichotomous – based upon a natural break in the distribution of ownership in both years. The number of water buffalo is not included because of the decreased popularity of water buffalo as

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age at which these contributions cease to matter in the household calculus, if ever. Age 65 also represents the last of several natural breaks in the age distribution of migrants and non-migrants in Nang Rong – after this age the number of migrants is exceptionally small.

livestock and its traditional function a traction animal. It is worth noting in regard to the above discussion that in semi-subsistence economies such as that in Nang Rong, income and wealth are not always clearly delineated concepts.

The data contain no direct measures of household income or expenditures, but information was obtained about a number of household assets ranging from appliances to automobiles. This information has elsewhere been used to create an index of wealth for Nang Rong households based on these assets (Edmeades 2006; Piotrowski 2004). This is accomplished using principal components analysis (PCA), a well-known technique for reducing the dimensionality of a set of indicator variables. The result is a single index of wealth that captures a high degree of the information from the original variables. Three indicator variables are produced that further simplify the data, and are included. [17]

Villages with more land or a smaller potential labor force may experience greater competition for laborers. The number of working age males and females present in the village provides controls for variation in size of the available labor force. The total amount of rice paddy used to cultivate rice during the previous year in the village is a rough measure of the potential demand for laborers. All area measures in the Nang Rong study were recorded or converted to the *rai*, a local unit 1,600 square meters in size.[18]

It is also important to note those factors that are thought, a priori, to be related to agricultural practice but cannot be included in the model for one reason or another. At the

[17] The specific assets included in this analysis are: black and white television, color television, VCR, refrigerator, Itan (multi-purpose farm engine), automobile, motorcycle, sewing machine, cooking fuel type, windows in house (a measure of dwelling unit quality), and electricity in the home. For reasons noted elsewhere, a variable measuring land cultivated was removed from the PCA. The first eigenvector from this analysis is used to generate a wealth index that can then be used to rank households. Households at or below the 33rd percentile are coded 'lowest', those from 34 to 79 are coded 'middle', and those ranking at higher than the 80th percentile are coded 'highest'.

[18] For comparison, there are 6.25 *rai* in one hectare, and approximately 2.53 *rai* in one acre.

village level, the average local wage rate should be related to the likelihood of households in that village adopting paid labor. But in reality, there is so little variation on this variable that for the purposes of this analysis it can be considered a constant factor in each year.[19] At the household level, a key variable that is excluded from the analysis is a measure of the labor demands of each household. This could be operationalized as the amount of land planted to rice, in rai or as the actual rice yield. Both of these measures share the same problem of being structurally related to the dependent variable. Households that grew no rice would automatically have a value of zero for both measures. The measure of rice yield is also quite likely a proxy for a number of factors, including elevation, soil fertility, and drainage. Spatially explicit measures of these concepts are not available at the fine scale of the household parcel, and these concepts would have little relevance if measured at the village level due to the micro-environmental variation discussed earlier.

## E. RESULTS

In both 1994 and 2000, roughly half of households have no migrants, with about a fourth having one migrant and another fourth having two or more[20]. The same constancy is observable at the level of the individual, where approximately 26 percent of all individuals living in 'old' households were absent in 1994 and 26 percent again in 2000. This observation stands in contrast to the shifts in agricultural practice documented in the previous

[19] In 1994 reported wages during periods of high labor demand ranged from 50 to 75 baht per day for male workers and from 40 to 60 for female workers. The mean for both men and women was close to 50 baht/day with standard deviations of less than 10. In 2000, these numbers ranged from 100 to 130 for both males and females during periods of high labor demand. The means and standard deviations for both sexes in 2000 were 104 baht/day and 7.6.

[20] Recall that for this analysis, "migrants" are defined as persons gone since before the last harvest, but not longer than six years. If all possible migrants are included, the number of households with no migrants falls to about a quarter, a number consistent with other reports.

section. The implication is that migration is a fairly enduring force in Nang Rong, while large-scale shifts in agricultural practice are more recent occurrences. As noted previously, this situation provides a strong test of the association between the variables: if a relationship is consistently found, it suggests that these processes are linked, independently of other contextual shifts. Examining the bivariate relationships, chi-square tests performed on the cross-tabulations of the independent variables and the dependent variable for 1994 and 2000 all reject the null hypothesis of statistical independence (see Table 3). Table 4 presents means and standard deviations for the independent and control variables for 1994 and 2000. A key difference to note is the reduction in the average sizes of households – reflecting the trend towards smaller households noted earlier. This shift is also evident in the decrease in the mean number of migrants per household; while the percentage of total individuals who migrated stayed constant, the mean number of households increased, resulting in the apparent decrease in migrant prevalence at the household level. Also, the proportion of households engaged in a wide variety of economic activities fell from 1994 to 2000. A likely explanation for this is the dramatic variation in rainfall conditions. In a year when rainfall is good and profits from agriculture are sufficient, households may feel less pressure to participate in alternative income-generating activities in order to supplement income from agriculture.

Table 5 presents fit statistics and general information about the six models estimated. This table also introduces the system of naming the models that will aid in interpretation. Selected results of models I-VI, examining the outcomes in 1994 (1993 harvest season) and 2000 (1999 harvest season) are presented in Table 6. By exponentiating the coefficients shown in Table 6, we obtain odds ratios, which, although not shown, will be used to enhance

Table 3:

Chi-Square Test on Dependent Variables and Key Independent Variables

| | 1994 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | Pearson Chi-Square | Probability | Degrees of Freedom | Pearson Chi-Square | Probability | Degrees of Freedom |
| # of household migrants | 29.89 | 0.000 | 9 | 47.40 | 0.000 | 9 |
| # of household migrants remitting | 40.5 | 0.000 | 9 | 40.11 | 0.000 | 9 |
| # of household migrants receiving | 28.63 | 0.001 | 9 | 70.71 | 0.000 | 9 |

Table 4:

Descriptive Statistics for Independent Variablesand Controls, 1994 and 2000

| | 1994 | | 2000 | |
|---|---|---|---|---|
| Variable Description | Mean | Std. Dev. | Mean | Std. Dev. |
| # of household migrants | 1.08 | 1.33 | 0.88 | 1.2 |
| # of household migrants remitting | 0.61 | 0.98 | 0.43 | 0.77 |
| # of household migrants receiving | 0.12 | 0.44 | 0.2 | 0.53 |
| # of former members living in same village | 0.5 | 1.05 | 0.37 | 0.92 |
| # working-age males in household | 1.45 | 0.98 | 1.36 | 0.92 |
| # working-age females in household | 1.61 | 0.87 | 1.48 | 0.83 |
| # non-working age individuals in household | 1.34 | 1.2 | 1.29 | 1.12 |
| mean age of household | 33.8 | 12.2 | 34.8 | 13 |
| household cultivates cassava | 0.13 | 0.33 | 0.08 | 0.27 |
| household participates in a cottage industry | 0.19 | 0.4 | 0.08 | 0.27 |
| household raises pigs | 0.16 | 0.36 | 0.08 | 0.28 |
| household raises no cows | 0.82 | 0.38 | 0.83 | 0.38 |
| household raises 1-6 cows | 0.11 | 0.32 | 0.12 | 0.33 |
| household raises more than 7 cows | 0.07 | 0.25 | 0.05 | 0.21 |
| household makes charcoal | 0.59 | 0.49 | 0.72 | 0.45 |
| household is in the lowest PCA group | 0.43 | 0.5 | 0.32 | 0.47 |
| household is in the middle PCA group | 0.39 | 0.49 | 0.47 | 0.5 |
| household is in the highest PCA group | 0.18 | 0.38 | 0.21 | 0.41 |
| # of working age individuals in village | 473 | 153 | 534 | 176 |
| # of rai of paddy used by village last year | 1822 | 707 | 1931 | 852 |

interpretation. Finally, Table 7 presents microsimulated predicted probabilities for the dependent variable across values of each of the three key independent variables from 0 to 4.[21]

Tables 6 and 7 tell the same story in slightly different ways. Looking first at 1994, an increase in any of the three independent variables decreases the odds of a household relying only on its own members over using paid laborers (Models I-III). Likewise, an increase from 0 to 4 on each independent variable decreases the predicted probability of households relying on only their own members by a minimum of 5 percent and increases the predicted probability of paying laborers by at least 2 percent, and as much as 17 percent. The relationships involving the number of migrants and the number of remitters are in the direction anticipated (Model I and II). They support the assertion that both 'passive' and 'active' channels of influence are operating, through reduction in labor and the provision of assets by migrants to households. The relationship between the number of migrants receiving money and paid labor usage is the opposite of expectations, however (Model III). This strong effect likely reflects that households with sufficient wealth to support one or more migrants financially also have enough cash on hand to pay laborers. This finding suggests, as one might expect, that some households in Nang Rong have additional sources of wealth and income beyond the wide variety of controls already in the model.

[21] To generate the predicted probabilities, I use a microsimulation method in which the actual values for each household are introduced into the predicted model, producing a probability for each outcome for each case. The resulting values are averaged across all cases to obtain the predicted probability for each outcome overall. A major strength of generating predicted probabilities in this way is that it avoids the necessity of selecting a single value for every variable that may not reflect the variation in the data. Using this method, one can assign all households in the model a particular value on a given variable in order to determine the 'effect' of that variable, keeping others at their actual values. I computed microsimulated predicted probabilities with the three key independent variables set equal to 0, 1, 2, 3, and 4 for all cases. Values greater than four were not considered, due to the increasingly small number of cases in the sample having values that high and the decreasing realism of the simulation. This process was replicated separately for each of the three models that were estimated.

Table 5:

Basic Information and Fit Statistics for all Models Estimated

| | Model I | Model II | Model III | Model IV | Model V | Model VI |
|---|---|---|---|---|---|---|
| Data | 1994 | 1994 | 1994 | 2000 | 2000 | 2000 |
| Key Ind. Var. | # migrants | # remitters | # receivers | # migrants | # remitters | # receivers |
| Controls | all controls | all controls | all controls | all controls | all controls | all controls |
| Cases (n) | 5178 | 5178 | 5178 | 6932 | 6932 | 6932 |
| Wald $\chi 2$ | 2212.34 | 2375.51 | 2283.15 | 5434.57 | 5750.71 | 4815.03 |
| Prob > $\chi 2$ | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Table 6:

Multinomial Logistic Regression of Agricultural Practices on
Selected Independent Variables, 1994 and 2000

| | | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Laborers | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1994:** | **Variable:** | **B** | **SE[a]** | **B** | **SE** | **B** | **SE** | **B** | **SE** | **B** | **SE** | **B** | **SE** |
| Model I | # of household migrants | 0.02 | 0.03 | **-0.05** | **0.03** | -0.01 | 0.03 | 0.03 | 0.04 | -0.04 | 0.03 | **0.08** | **0.03** |
| Model II | # of household migrants remitting | -0.06 | 0.06 | **-0.13** | **0.04** | -0.02 | 0.05 | -0.04 | 0.05 | **-0.11** | **0.04** | 0.06 | 0.05 |
| Model III | # of household migrants receiving | -0.15 | 0.11 | **-0.23** | **0.08** | **-0.29** | **0.12** | 0.14 | 0.14 | 0.07 | 0.12 | 0.08 | 0.11 |
| **2000:** | **Variable:** | **B** | **SE[a]** | **B** | **SE** | **B** | **SE** | **B** | **SE** | **B** | **SE** | **B** | **SE** |
| Model IV | # of household migrants | 0.03 | 0.03 | -0.05 | 0.03 | **0.09** | **0.03** | -0.06 | 0.04 | **-0.13** | **0.03** | **0.07** | **0.03** |
| Model V | # of household migrants remitting | -0.08 | 0.06 | **-0.17** | **0.04** | **0.10** | **0.05** | **-0.18** | **0.06** | **-0.27** | **0.06** | 0.08 | 0.06 |
| Model VI | # of household migrants receiving | **-0.25** | **0.08** | **-0.25** | **0.07** | 0.15 | 0.08 | **-0.40** | **0.10** | **-0.40** | **0.10** | 0.00 | 0.09 |

a - Huber-White Robust standard errors are reported throughout
coefficients in bold are significant at the p <= 0.05 level

Table 7:

Microsimulation Predicted Probabilities for Key Independent Variables, 1994 and 2000

| | 1994 | | | | 2000 | | | |
|---|---|---|---|---|---|---|---|---|
| | *1 - Grew No Rice* | *2 - Household Labor Only* | *3 - Unpaid Extra Laborers* | *4 - Paid Extra Laborers* | *1 - Grew No Rice* | *2 - Household Labor Only* | *3 - Unpaid Extra Laborers* | *4 - Paid Extra Laborers* |
| # Mig's = 0 | 0.18 | 0.46 | 0.13 | 0.23 | 0.23 | 0.24 | 0.09 | 0.44 |
| # Mig's = 1 | 0.18 | 0.44 | 0.13 | 0.24 | 0.24 | 0.22 | 0.10 | 0.44 |
| # Mig's = 2 | 0.19 | 0.43 | 0.14 | 0.24 | 0.24 | 0.21 | 0.10 | 0.43 |
| # Mig's = 3 | 0.20 | 0.42 | 0.14 | 0.25 | 0.24 | 0.20 | 0.11 | 0.43 |
| # Mig's = 4 | 0.20 | 0.41 | 0.14 | 0.25 | 0.25 | 0.19 | 0.12 | 0.43 |
| **Percent Change 0 to 4** | **0.03** | **-0.05** | **0.00** | **0.02** | **0.01** | **-0.04** | **0.03** | **-0.01** |
| # Mig's Remitting = 0 | 0.18 | 0.46 | 0.13 | 0.23 | 0.24 | 0.24 | 0.09 | 0.43 |
| # Mig's Remitting = 1 | 0.18 | 0.43 | 0.14 | 0.24 | 0.23 | 0.21 | 0.10 | 0.45 |
| # Mig's Remitting = 2 | 0.18 | 0.41 | 0.14 | 0.26 | 0.22 | 0.19 | 0.12 | 0.46 |
| # Mig's Remitting = 3 | 0.18 | 0.38 | 0.15 | 0.28 | 0.22 | 0.16 | 0.13 | 0.48 |
| # Mig's Remitting = 4 | 0.18 | 0.36 | 0.16 | 0.29 | 0.21 | 0.14 | 0.15 | 0.49 |
| **Percent Change 0 to 4** | **0.00** | **-0.10** | **0.03** | **0.07** | **-0.03** | **-0.09** | **0.06** | **0.06** |
| # Mig's Receiving = 0 | 0.18 | 0.45 | 0.13 | 0.23 | 0.24 | 0.23 | 0.09 | 0.43 |
| # Mig's Receiving = 1 | 0.19 | 0.42 | 0.12 | 0.27 | 0.21 | 0.20 | 0.11 | 0.47 |
| # Mig's Receiving = 2 | 0.19 | 0.39 | 0.10 | 0.31 | 0.19 | 0.17 | 0.14 | 0.50 |
| # Mig's Receiving = 3 | 0.19 | 0.36 | 0.09 | 0.36 | 0.16 | 0.14 | 0.17 | 0.52 |
| # Mig's Receiving = 4 | 0.18 | 0.33 | 0.08 | 0.40 | 0.13 | 0.11 | 0.21 | 0.54 |
| **Percent Change 0 to 4** | **0.00** | **-0.12** | **-0.06** | **0.17** | **-0.11** | **-0.12** | **0.12** | **0.11** |

Note: values in table may differ slightly from those reported in paper exactly due to rounding

Turning to 2000, the positive relationship between the simple number of migrants and a household's use of paid extra labor is no longer apparent in Table 6 (Models IV-VI). In place of a significant positive relationship, we find that each additional migrant actually decreases the odds of a household using paid extra labor over unpaid extra labor (Model IV). The relationship is substantively unimportant because the impact on the predicted probability of a shift from 0 to 4 migrants is trivial – less than 1 percent. In this model, we again see a negative relationship between additional remitters and a households using household labor only over paid labor. The contrast between household labor only and paid labor use is stronger in 2000 than in 1994 for the number of remitters (Model V), while the change in predicted probabilities from 0 to 4 for these two outcomes are roughly equivalent in 1994 and 2000.

The positive relationships between number of migrants and remitters and the use of unpaid laborers over paid laborers are admittedly a surprise. The existing theory summarized at the outset of this analysis does not really make a strong prediction about this contrast. Although unpaid labor was initially conceptualized as a 'traditional' practice, it might be better thought of as a continuing successful alternative to paid labor for the small proportion of farmers using it. For these farmers, lost household labor may compel them to call in labor obligations from neighbors, while increased remittances may enable these households to maintain higher levels of social standing in the village. If such were the case, it would suggest that in 2000 the relationship between migration and remittances on the one hand and agricultural practice on the other does not favor paid labor exclusively. Rather, it would appear that the real losers in the 'labor squeeze' are households with neither the money to pay laborers nor the social relationships necessary to obtain free or exchange workers. Predicted probabilities indicate

that paid and unpaid labor increase in equal measure as the number of remitters shifts from 0 to 4, while households relying only on their own members decline substantially. The relationship with remittances may additionally represent a potential unmeasured characteristic: the strength of the ties linking migrants and households. These ties could influence both the likelihood of migrants remitting and returning to help with the rice harvest. Thus, the apparent positive relationship between these variables and unpaid labor might be spurious. The operationalization of a concept like the quality or strength of relationship stands as an important, but challenging task for future research. As in 1994, additional migrants receiving remittances make a household more likely to use paid labor rather than relying on household labor or not growing rice at all (Model VI).

Before concluding, it is instructive to examine the predicted probabilities in Table 6 from the standpoint of the magnitude of changes. The two outcomes that are most responsive to changes in the value of the key independent variables are household labor only and paid extra labor. Overall, however, the cross-sectional differences caused by varying the independent variables are smaller than the longitudinal differences observed. Returning to Table 1, we see that one of the largest changes impacting the lives of households and their members in Nang Rong over the period 1994-2000 was a doubling of the proportion of households relying on paid labor and a halving of the number relying on only their own members. But, the impact of changing the number of migrants, remitters, and receivers from 0 to 4 is generally in the range of a quarter to a half of the size of the these over-time shifts. Thus, while noting that increases in the number of migrants, remitters, and migrants receiving money from the household are associated with an increased probability of using paid extra labor, with the exception of the number of migrants in 2000, it is important to keep the larger perspective

that migration is just one of a potentially large number of forces implicated in the broad-scale changes taking place.

## F. Conclusions and Future Directions

The foregoing analysis provides support for three major conclusions. First, paid labor was used to a considerably greater extent in 2000 over 1994. The magnitude and prevalence of the increase, combined with no observed increases in the use of other forms of labor suggest that the trend reflects more than an increase in labor demands between the two years. These findings confirm reports from the field that a broad process of monetization has been occurring and continues in many regions of the developing world. That such change has penetrated a core social institution like agricultural production hints at the many cascading impacts on social roles and relationships, traditional communal activities, culture, and the attitudes and values of individuals and households that are almost certainly taking place but are only poorly understood and documented at present. Returning to the broader arguments of the introduction, a major challenge for researchers in coming years will be to increasingly extend what is known about migration's role in the process to improve understandings of these dramatic shifts in the lives and livelihoods of millions of people living in rural developing contexts like Nang Rong. As Taylor (1999) makes clear, it is increasingly impossible to discuss either the determinants or the consequences of migration in isolation from other processes occurring, especially in origins. This analysis implies that monetization of agricultural practices and other forms of social exchange is an important component of social change, possibly as cause and consequence, and one that merits further investigation.

Second, the results of this analysis begin to paint a picture of the potential relationships between migration and wage labor that is more complex than existing theory would suggest. Migration is associated with the practice of households paying extra laborers to help harvest their rice Northeast Thailand in both 1994 and 2000. The nature of this relationship is similar, but not identical in the two years. In 1994, increases the number of migrants, remitters, and migrants sending money all improve the odds of households paying laborers over using no additional labor. In 2000, only the relationships involving number of remitters and migrants receiving remittances persist. These findings add to the growing consensus that both labor and remittances play a role in mediating the relationship between migration and agricultural monetization, though not under all conditions. This analysis demonstrates the usefulness of simple descriptive analyses combined with modeling techniques to demonstrate the existence of a statistical relationship between two variables thought to be causally related. I acknowledge, however, that while plausible mechanisms exist that may link these two processes, and the association is apparent, considerable further analysis will be required before one would be justified in concluding that the variables are likely causally related. It is worth noting, as well, that without ongoing attention to issues of operationalizing and measuring important theoretical concepts like monetization, these more complex models and methodologies will be unlikely to provide more information than their simpler counterparts.

Third, as noted in the introduction, the general practice of studying potential outcomes of migration presents considerable challenges for our existing theories, methodologies, and data sources. There are three major reasons for the lack of attention to origin impacts. The first is that the methodology of choice in most contemporary studies of migration is some form of regression analysis. Although this collection of techniques provides powerful tools for

isolating the impacts of multiple factors on a single outcome, they are poorly suited to tracing multiple consequences of a single phenomenon or variable. That is, when examining migration as a dependent variable, one can introduce a wide range of relevant factors as variables in an explanatory model, controlling for potential spurious relationships, and introducing interactions, higher-order terms, and so forth. But, if one seeks to determine the many processes that are affected by migration behavior, each one of these concepts must be treated as an outcome variable and modeled separately with migration as a predictor under traditional regression analysis – a cumbersome way to proceed. Simultaneous equation modeling can ease some of this burden, but may quickly become exceedingly complex when attempting to model the numerous outcomes thought to be associated with migration. Another alternative would be to take advantage of more detailed data regarding migration and agricultural practices that exist through detailed, highly contextualized, descriptive analyses. Secondly, examining the impacts of migration on origin requires data that simply are not available. In order to be of value in answering these questions, such data must be collected simultaneously on multiple contextual levels and should permit the examination of both long-term and short-term effects. Quantitative longitudinal studies recording information on both migration and the potential impact domains across multiple levels are still uncommon in developing contexts. Only a handful of studies possess the characteristics that would make such an investigation feasible. The third obstacle is the great potential for mutual determination, endogeneity, and feedbacks among the theorized causal linkages. Although these topics were initially discussed almost exclusively in the literature of economics, from which were derived a number of approaches to dealing with the problem, they have in recent years garnered increasing attention from those outside that discipline

(Moffitt 2005). Taken together, these and other barriers present a formidable challenge to researchers wishing to make headway into understanding the consequences of migration, but one that must be met with innovative solutions if we are to move beyond present destination-centered view of migration impacts.

APPENDIX

Model I:

Multinomial Logistic Regression of Agricultural Practices on Number of Migrants and All Controls, 199

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants | 0.02 | 0.03 | **-0.05** | **0.03** | -0.01 | 0.03 | 0.03 | 0.04 | -0.04 | 0.03 | **0.08** | **0.03** |
| # of former members living in same village | **-0.11** | **0.05** | -0.02 | 0.04 | 0.03 | 0.04 | **-0.14** | **0.05** | -0.05 | 0.04 | **-0.09** | **0.04** |
| # working-age males in household | **-0.56** | **0.07** | **0.10** | **0.04** | -0.04 | 0.06 | **-0.52** | **0.09** | **0.14** | **0.07** | **-0.66** | **0.06** |
| # working-age females in household | **-0.30** | **0.07** | **0.10** | **0.04** | -0.04 | 0.07 | **-0.26** | **0.09** | **0.14** | **0.06** | **-0.40** | **0.06** |
| # non-working age individuals in household | -0.03 | 0.04 | 0.03 | 0.03 | **-0.10** | **0.05** | 0.06 | 0.05 | **0.13** | **0.04** | -0.07 | 0.03 |
| mean age of household (b) | **0.16** | **0.05** | -0.04 | 0.04 | 0.09 | 0.05 | 0.07 | 0.05 | **-0.13** | **0.05** | **0.20** | **0.04** |
| household cultivates cassava | **-1.19** | **0.28** | -0.25 | 0.20 | **-0.54** | **0.17** | **-0.65** | **0.28** | 0.30 | 0.20 | **-0.94** | **0.25** |
| household participates in a cottage industry | **-1.10** | **0.16** | **-0.43** | **0.14** | -0.07 | 0.15 | **-1.04** | **0.19** | **-0.37** | **0.16** | **-0.67** | **0.16** |
| household raises pigs | **-0.52** | **0.15** | **-0.64** | **0.12** | **-0.64** | **0.16** | 0.12 | 0.20 | 0.00 | 0.16 | 0.12 | 0.14 |
| household raises 1-6 cows | **-0.80** | **0.19** | -0.15 | 0.14 | -0.05 | 0.17 | **-0.75** | **0.24** | -0.10 | 0.18 | **-0.65** | **0.17** |
| household raises more than 7 cows | **-0.65** | **0.22** | **-0.46** | **0.18** | -0.37 | 0.20 | -0.29 | 0.23 | -0.10 | 0.21 | -0.19 | 0.23 |
| household makes charcoal | **-0.83** | **0.12** | **0.20** | **0.09** | 0.03 | 0.12 | **-0.86** | **0.14** | 0.17 | 0.12 | **-1.04** | **0.10** |
| household is in the middle asset group | -0.16 | 0.11 | -0.16 | 0.10 | 0.09 | 0.12 | -0.25 | 0.13 | **-0.25** | **0.10** | 0.00 | 0.10 |
| household is in the highest asset group | **-0.34** | **0.15** | **-0.36** | **0.09** | **-0.27** | **0.13** | -0.07 | 0.15 | -0.10 | 0.12 | 0.02 | 0.13 |
| # of working age individuals in village (c) | 0.06 | 0.09 | **-0.16** | **0.07** | 0.01 | 0.06 | 0.04 | 0.11 | -0.17 | 0.09 | **0.21** | **0.08** |
| # of rai of paddy used by village last year (c) | -0.02 | 0.02 | 0.02 | 0.02 | -0.02 | 0.01 | 0.00 | 0.03 | 0.04 | 0.02 | -0.04 | 0.02 |
| Constant | **1.52** | **0.38** | **1.16** | **0.30** | 0.00 | 0.39 | **1.60** | **0.48** | **1.23** | **0.39** | 0.36 | 0.34 |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

Model II:

Multinomial Logistic Regression of Agricultural Practices on Number of Remitters and All Controls, 1994

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants remitting | -0.06 | 0.06 | **-0.13** | **0.04** | -0.02 | 0.05 | -0.04 | 0.05 | **-0.11** | **0.04** | 0.06 | 0.05 |
| # of former members living in same village | **-0.11** | **0.05** | -0.02 | 0.04 | 0.03 | 0.04 | -0.14 | 0.05 | -0.05 | 0.04 | **-0.09** | **0.04** |
| # working-age males in household | **-0.56** | **0.07** | **0.10** | **0.04** | -0.04 | 0.06 | **-0.52** | **0.09** | **0.14** | **0.07** | **-0.66** | **0.06** |
| # working-age females in household | **-0.30** | **0.07** | **0.10** | **0.04** | -0.04 | 0.07 | **-0.26** | **0.09** | **0.14** | **0.06** | **-0.40** | **0.06** |
| # non-working age individuals in household | -0.04 | 0.04 | 0.03 | 0.03 | **-0.10** | **0.05** | 0.06 | 0.05 | **0.13** | **0.04** | **-0.07** | **0.03** |
| mean age of household (b) | **0.16** | **0.05** | -0.04 | 0.04 | 0.09 | 0.05 | 0.07 | 0.05 | **-0.12** | **0.05** | **0.20** | **0.04** |
| household cultivates cassava | **-1.20** | **0.28** | -0.25 | 0.20 | **-0.54** | **0.17** | **-0.66** | **0.28** | 0.30 | 0.20 | **-0.95** | **0.25** |
| household participates in a cottage industry | **-1.09** | **0.16** | **-0.42** | **0.14** | -0.06 | 0.15 | **-1.02** | **0.19** | **-0.36** | **0.16** | **-0.66** | **0.16** |
| household raises pigs | **-0.53** | **0.15** | **-0.64** | **0.12** | **-0.64** | **0.16** | 0.12 | 0.20 | 0.00 | 0.16 | 0.12 | 0.14 |
| household raises 1-6 cows | **-0.80** | **0.19** | -0.15 | 0.14 | -0.05 | 0.17 | **-0.75** | **0.24** | -0.10 | 0.18 | **-0.65** | **0.17** |
| household raises more than 7 cows | **-0.65** | **0.22** | **-0.47** | **0.18** | -0.37 | 0.20 | -0.28 | 0.23 | -0.10 | 0.21 | -0.18 | 0.23 |
| household makes charcoal | **-0.83** | **0.12** | **0.21** | **0.09** | 0.03 | 0.12 | **-0.86** | **0.14** | 0.18 | 0.12 | **-1.04** | **0.10** |
| household is in the middle asset group | -0.16 | 0.11 | -0.16 | 0.10 | 0.09 | 0.12 | -0.25 | 0.13 | **-0.25** | **0.10** | 0.00 | 0.10 |
| household is in the highest asset group | **-0.34** | **0.14** | **-0.36** | **0.09** | **-0.27** | **0.13** | -0.08 | 0.15 | -0.10 | 0.12 | 0.02 | 0.13 |
| # of working age individuals in village (c) | 0.05 | 0.08 | **-0.16** | **0.07** | 0.01 | 0.06 | 0.04 | 0.11 | -0.17 | 0.09 | **0.21** | **0.08** |
| # of rai of paddy used by village last year (c) | -0.02 | 0.02 | 0.02 | 0.02 | -0.02 | 0.01 | 0.00 | 0.02 | 0.04 | 0.02 | -0.04 | 0.02 |
| Constant | **1.61** | **0.38** | **1.19** | **0.30** | -0.08 | 0.39 | **1.68** | **0.48** | **1.26** | **0.39** | 0.42 | 0.35 |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

Model III:

Multinomial Logistic Regression of Agricultural Practices on Number of Receivers and All Controls, 1994

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants receiving | -0.15 | 0.11 | **-0.23** | **0.08** | **-0.29** | **0.12** | 0.14 | 0.14 | 0.07 | 0.12 | 0.08 | 0.11 |
| # of former members living in same village | **-0.11** | **0.05** | -0.02 | 0.04 | 0.02 | 0.04 | -0.14 | 0.05 | -0.05 | 0.04 | **-0.09** | **0.04** |
| # working-age males in household | **-0.56** | **0.07** | **0.11** | **0.04** | -0.03 | 0.06 | **-0.53** | **0.09** | **0.14** | **0.07** | **-0.67** | **0.06** |
| # working-age females in household | **-0.30** | **0.07** | **0.10** | **0.04** | -0.04 | 0.07 | **-0.26** | **0.09** | **0.14** | **0.06** | **-0.40** | **0.06** |
| # non-working age individuals in household | -0.04 | 0.04 | 0.03 | 0.03 | **-0.10** | **0.05** | 0.06 | 0.05 | **0.13** | **0.04** | **-0.07** | **0.03** |
| mean age of household (b) | **0.16** | **0.05** | -0.05 | 0.04 | 0.09 | 0.05 | 0.07 | 0.05 | **-0.13** | **0.05** | **0.20** | **0.04** |
| household cultivates cassava | **-1.19** | **0.28** | -0.23 | 0.20 | **-0.54** | **0.17** | **-0.65** | **0.28** | 0.30 | 0.19 | **-0.96** | **0.25** |
| household participates in a cottage industry | **-1.09** | **0.16** | **-0.44** | **0.14** | -0.06 | 0.15 | **-1.03** | **0.19** | **-0.38** | **0.16** | **-0.66** | **0.16** |
| household raises pigs | **-0.52** | **0.15** | **-0.64** | **0.12** | **-0.64** | **0.16** | 0.12 | 0.20 | 0.00 | 0.16 | 0.12 | 0.14 |
| household raises 1-6 cows | **-0.80** | **0.19** | -0.15 | 0.14 | -0.04 | 0.17 | **-0.76** | **0.24** | -0.10 | 0.18 | **-0.65** | **0.17** |
| household raises more than 7 cows | **-0.64** | **0.22** | **-0.46** | **0.18** | -0.36 | 0.20 | -0.28 | 0.23 | -0.10 | 0.21 | -0.19 | 0.23 |
| household makes charcoal | **-0.83** | **0.12** | **0.20** | **0.09** | 0.03 | 0.12 | **-0.86** | **0.14** | 0.17 | 0.12 | **-1.04** | **0.10** |
| household is in the middle asset group | -0.15 | 0.11 | -0.15 | 0.10 | 0.10 | 0.12 | -0.25 | 0.13 | **-0.25** | **0.10** | 0.00 | 0.10 |
| household is in the highest asset group | **-0.34** | **0.14** | **-0.36** | **0.09** | **-0.26** | **0.13** | -0.08 | 0.15 | -0.10 | 0.12 | 0.02 | 0.13 |
| # of working age individuals in village (c) | 0.05 | 0.09 | **-0.15** | **0.07** | 0.01 | 0.06 | 0.04 | 0.11 | -0.17 | 0.09 | **0.21** | **0.08** |
| # of rai of paddy used by village last year (c) | -0.02 | 0.02 | 0.02 | 0.02 | -0.02 | 0.01 | 0.00 | 0.03 | 0.04 | 0.02 | -0.04 | 0.02 |
| Constant | **1.58** | **0.38** | **1.13** | **0.30** | -0.06 | 0.39 | **1.64** | **0.48** | 1.19 | 0.39 | 0.45 | 0.34 |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

Model IV:

Multinomial Logistic Regression of Agricultural Practices on Number of Migrants and All Controls, 2000

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants | 0.03 | 0.03 | -0.05 | 0.03 | **0.09** | **0.03** | -0.06 | 0.04 | **-0.13** | **0.03** | **0.07** | **0.03** |
| # of former members living in same village | 0.07 | 0.04 | -0.04 | 0.04 | **0.22** | **0.04** | **-0.16** | **0.04** | **-0.26** | **0.05** | **0.10** | **0.05** |
| # working-age males in household | **-0.59** | **0.06** | **0.20** | **0.03** | 0.01 | 0.05 | **-0.60** | **0.07** | **0.18** | **0.05** | **-0.79** | **0.06** |
| # working-age females in household | **-0.45** | **0.06** | **0.18** | **0.04** | 0.04 | 0.06 | **-0.49** | **0.08** | **0.13** | **0.07** | **-0.63** | **0.07** |
| # non-working age individuals in household | -0.02 | 0.04 | **0.07** | **0.03** | 0.00 | 0.04 | -0.02 | 0.04 | 0.07 | 0.04 | **-0.09** | **0.04** |
| mean age of household (b) | **0.14** | **0.03** | -0.04 | 0.04 | 0.04 | 0.04 | **0.10** | **0.04** | **-0.09** | **0.04** | **0.19** | **0.04** |
| household cultivates cassava | **-1.76** | **0.39** | **-0.55** | **0.13** | -0.27 | 0.20 | **-1.49** | **0.42** | -0.28 | 0.20 | **-1.21** | **0.37** |
| household participates in a cottage industry | **-0.87** | **0.19** | -0.09 | 0.13 | -0.48 | 0.25 | -0.40 | 0.32 | 0.39 | 0.21 | **-0.78** | **0.21** |
| household raises pigs | -0.22 | 0.16 | **-0.45** | **0.13** | -0.27 | 0.19 | 0.06 | 0.24 | -0.18 | 0.18 | 0.23 | 0.20 |
| household raises 1-6 cows | **-0.98** | **0.16** | **-0.38** | **0.10** | -0.23 | 0.14 | **-0.75** | **0.19** | -0.15 | 0.16 | **-0.60** | **0.15** |
| household raises more than 7 cows | **-0.57** | **0.18** | **-0.79** | **0.17** | -0.23 | 0.18 | -0.34 | 0.22 | **-0.56** | **0.22** | 0.22 | 0.22 |
| household makes charcoal | **-1.22** | **0.08** | -0.04 | 0.10 | 0.02 | 0.14 | **-1.24** | **0.17** | -0.06 | 0.17 | **-1.18** | **0.09** |
| household is in the middle asset group | **-0.71** | **0.09** | **-0.78** | **0.08** | **-0.65** | **0.11** | -0.06 | 0.12 | -0.13 | 0.11 | 0.07 | 0.10 |
| household is in the highest asset group | -0.19 | 0.13 | **-1.67** | **0.12** | **-1.35** | **0.17** | **1.15** | **0.18** | -0.32 | 0.20 | **1.47** | **0.16** |
| # of working age individuals in village (c) | **0.15** | **0.05** | 0.04 | 0.04 | **0.17** | **0.06** | -0.02 | 0.08 | **-0.13** | **0.07** | 0.12 | 0.07 |
| # of rai of paddy used by village last year (c) | **-0.04** | **0.01** | -0.01 | 0.01 | **-0.05** | **0.01** | 0.01 | 0.02 | **0.04** | **0.01** | -0.03 | 0.02 |
| Constant | **1.45** | **0.25** | -0.27 | 0.24 | **-1.24** | **0.33** | **2.70** | **0.37** | **0.97** | **0.37** | **1.73** | **0.33** |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

Model V:

Multinomial Logistic Regression of Agricultural Practices on Number of Remitters and All Controls, 2000

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants remitting | -0.08 | 0.06 | **-0.17** | **0.04** | **0.10** | **0.05** | **-0.18** | **0.06** | **-0.27** | **0.06** | 0.08 | 0.06 |
| # of former members living in same village | 0.07 | 0.04 | -0.04 | 0.04 | **0.22** | **0.04** | **-0.16** | **0.04** | **-0.26** | **0.05** | **0.10** | **0.05** |
| # working-age males in household | **-0.59** | **0.06** | **0.20** | **0.03** | 0.02 | 0.05 | **-0.61** | **0.07** | **0.18** | **0.05** | **-0.79** | **0.06** |
| # working-age females in household | **-0.45** | **0.06** | **0.18** | **0.04** | 0.04 | 0.06 | **-0.49** | **0.08** | **0.14** | **0.07** | **-0.63** | **0.07** |
| # non-working age individuals in household | -0.02 | 0.04 | **0.07** | **0.03** | 0.00 | 0.04 | -0.02 | 0.04 | 0.07 | 0.04 | **-0.09** | **0.04** |
| mean age of household (b) | **0.15** | **0.03** | -0.04 | 0.04 | 0.05 | 0.04 | **0.11** | **0.04** | **-0.08** | **0.04** | **0.19** | **0.04** |
| household cultivates cassava | **-1.77** | **0.39** | **-0.56** | **0.13** | -0.27 | 0.20 | **-1.50** | **0.42** | -0.29 | 0.21 | **-1.21** | **0.37** |
| household participates in a cottage industry | **-0.87** | **0.19** | -0.09 | 0.13 | -0.47 | 0.25 | -0.40 | 0.32 | 0.38 | 0.21 | **-0.78** | **0.21** |
| household raises pigs | -0.22 | 0.16 | **-0.45** | **0.13** | -0.28 | 0.20 | 0.06 | 0.24 | -0.17 | 0.18 | 0.23 | 0.20 |
| household raises 1-6 cows | **-0.99** | **0.16** | **-0.38** | **0.10** | -0.24 | 0.14 | **-0.75** | **0.19** | -0.14 | 0.16 | **-0.61** | **0.15** |
| household raises more than 7 cows | **-0.57** | **0.18** | **-0.79** | **0.17** | -0.25 | 0.18 | -0.33 | 0.23 | **-0.55** | **0.23** | 0.22 | 0.22 |
| household makes charcoal | **-1.22** | **0.08** | -0.03 | 0.10 | 0.02 | 0.14 | **-1.24** | **0.17** | -0.06 | 0.17 | **-1.18** | **0.09** |
| household is in the middle asset group | **-0.70** | **0.09** | **-0.77** | **0.08** | **-0.65** | **0.11** | -0.04 | 0.12 | -0.12 | 0.11 | 0.07 | 0.10 |
| household is in the highest asset group | -0.19 | 0.13 | **-1.66** | **0.12** | **-1.35** | **0.17** | **1.16** | **0.18** | -0.31 | 0.20 | **1.47** | **0.16** |
| # of working age individuals in village (c) | **0.15** | **0.05** | 0.04 | 0.04 | **0.17** | **0.06** | -0.02 | 0.08 | **-0.14** | **0.07** | 0.12 | 0.07 |
| # of rai of paddy used by village last year (c) | **-0.04** | **0.01** | -0.01 | 0.01 | **-0.05** | **0.01** | 0.01 | 0.02 | **0.04** | **0.01** | -0.03 | 0.02 |
| Constant | **1.48** | **0.25** | -0.27 | 0.23 | **-1.23** | **0.33** | **2.71** | **0.37** | **0.95** | **0.37** | **1.76** | **0.33** |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

Model VI:

Multinomial Logistic Regression of Agricultural Practices on Number of Receivers and All Controls, 2000

| | Grew No Rice vs. Paid Extra Laborers | | Household Labor Only vs. Paid Extra Laborers | | Unpaid Extra Labor vs. Paid Extra Labor | | Grew No Rice vs. Unpaid Extra Laborers | | Household Labor Only vs. Unpaid Extra Laborers | | Grew No Rice vs. Household Labor Only | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables:** | B | SE[a] | B | SE | B | SE | B | SE | B | SE | B | SE |
| # of household migrants receiving | **-0.25** | **0.08** | **-0.25** | **0.07** | 0.15 | 0.08 | **-0.40** | **0.10** | **-0.40** | **0.10** | 0.00 | 0.09 |
| # of former members living in same village | 0.06 | 0.04 | -0.04 | 0.04 | **0.23** | **0.04** | **-0.16** | **0.05** | **-0.27** | **0.05** | **0.11** | **0.05** |
| # working-age males in household | **-0.59** | **0.06** | **0.19** | **0.03** | 0.02 | 0.05 | **-0.61** | **0.07** | **0.18** | **0.05** | **-0.79** | **0.06** |
| # working-age females in household | **-0.45** | **0.06** | **0.18** | **0.04** | 0.04 | 0.06 | **-0.49** | **0.08** | **0.14** | **0.07** | **-0.63** | **0.07** |
| # non-working age individuals in household | -0.04 | 0.04 | 0.05 | 0.03 | 0.01 | 0.04 | -0.04 | 0.04 | 0.05 | 0.04 | **-0.09** | **0.04** |
| mean age of household (b) | **0.15** | **0.03** | -0.04 | 0.04 | 0.05 | 0.04 | **0.10** | **0.04** | **-0.09** | **0.04** | **0.20** | **0.04** |
| household cultivates cassava | **-1.77** | **0.39** | **-0.55** | **0.13** | -0.27 | 0.20 | **-1.49** | **0.42** | -0.28 | 0.20 | **-1.22** | **0.37** |
| household participates in a cottage industry | **-0.86** | **0.20** | -0.09 | 0.13 | -0.47 | 0.25 | -0.39 | 0.32 | 0.37 | 0.21 | **-0.77** | **0.21** |
| household raises pigs | -0.21 | 0.16 | **-0.44** | **0.13** | -0.28 | 0.20 | 0.07 | 0.24 | -0.16 | 0.19 | 0.24 | 0.20 |
| household raises 1-6 cows | **-0.99** | **0.16** | **-0.37** | **0.10** | -0.24 | 0.14 | **-0.75** | **0.19** | -0.13 | 0.16 | **-0.62** | **0.15** |
| household raises more than 7 cows | **-0.57** | **0.18** | **-0.78** | **0.17** | -0.25 | 0.18 | -0.32 | 0.22 | **-0.53** | **0.22** | 0.21 | 0.22 |
| household makes charcoal | **-1.21** | **0.08** | -0.03 | 0.10 | 0.02 | 0.14 | **-1.24** | **0.16** | -0.05 | 0.17 | **-1.18** | **0.09** |
| household is in the middle asset group | **-0.68** | **0.09** | **-0.76** | **0.08** | **-0.66** | **0.11** | -0.02 | 0.12 | -0.10 | 0.11 | 0.08 | 0.10 |
| household is in the highest asset group | -0.15 | 0.13 | **-1.63** | **0.12** | **-1.37** | **0.17** | **1.22** | **0.18** | -0.26 | 0.20 | **1.48** | **0.16** |
| # of working age individuals in village (c) | **0.15** | **0.05** | 0.04 | 0.04 | **0.17** | **0.06** | -0.02 | 0.07 | **-0.13** | **0.06** | 0.12 | 0.07 |
| # of rai of paddy used by village last year (c) | **-0.04** | **0.01** | -0.01 | 0.01 | **-0.05** | **0.01** | 0.01 | 0.02 | **0.04** | **0.01** | -0.03 | 0.02 |
| Constant | **1.48** | **0.25** | -0.27 | 0.24 | **-1.23** | **0.33** | **2.71** | **0.37** | **0.96** | **0.37** | **1.76** | **0.33** |

a - Huber-White Robust standard errors are reported throughout

b - denotes coefficient multiplied by 10

c - denotes coefficient multiplied by 100

coefficients in **bold** are significant at the p <= 0.05 level

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