Seasonal Migration and Micro-credit in the Lean Period: Evidence from Northwest Bangladesh

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Abstract

Temporary seasonal migration is an issue which is largely ignored in the standard rural-urban migration literature. Seasonal migration due to agricultural downturns is a common phenomenon in developing countries. Using primary data from a cross-sectional household survey from the northwest part of Bangladesh, this study quantifies the factors that influence such migration decisions. Among other results, we find that network effects play a significant role influencing the migration decision. Seasonal migration is a natural choice for individual suffering periodic hardship, however the strict weekly loan repayment rules of Micro-credit can have adverse effect on this process, reducing the ability of borrowers to react to a shock. Our result suggest that poor individuals prefer the option of not accessing the the Micro-credit and opt for temporal seasonal migration during the lean period. The results have numerous potential policy implications, including the design of typical micro-credit schemes.

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1. Introduction

In the standard rural-urban migration literature, scholars primarily focus on permanent internal migration and its economic, social and demographic significance. Very few studies have discussed temporary internal migration, which is

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variously known as 'seasonal migration', 'circular migration', or 'oscillatory migration'. Evidence of this phenomenon exists in many regions and particularly in the developing countries.[2] People move from rural areas to nearby cities or towns for a short period of time during lean periods in an attempt to survive and maintain their family in such difficult times. Lean periods can occur as a result of agriculture downturn and temporary migration is an important livelihood strategy for a large number of poor rural people in developing countries.

In the case of seasonal downturns, a person may prefer a temporary move to a permanent one because such a decision offers an opportunity to combine village based existence with urban opportunities. Faced with highly seasonal labor demand, villagers may see temporary migration to urban areas as a relatively practical and rational strategy to cope with seasonal downturns. The most important factor, resulting in a temporary move rather than a permanent one, however is the reversal of the urban-rural wage differential that occurs during the peak labor demand season in the agricultural sector.

Evidence from different countries suggests that the temporary mobilization of labor from rural to urban areas has important socio-economic implications. Migration reduces the inequality in the rural area due to the flow of remittances from the migration destinations. This flow, which is quite regular, is unlikely to occur with permanent rural to urban migration, and such a flow has a large impact on rural families who through this money can afford the necessities of life. Return migrants may also diffuse ideas, information and knowledge which might play a vital role in the rural development process.

Temporary migrants, however, cause congestion and other social problems in urban areas and policy makers have insufficient information about the number of people migrating temporarily to tackle these problems. Seasonal migrants are very difficult to detect and the definition is not a clear one; hence, they are typically excluded from national surveys. As a result, it is difficult to implement effective policies to accommodate seasonal migrants.

Seasonal migration, which is mainly caused due to the seasonal hardship, is quite common among the agri-based people of Northwest Bangladesh. Rural life of Bangladesh very much revolves around the agricultural cycle. As a consequence of this cycle, two major seasonal deficits occur, one in late September to early November and the other in late March to early May. With the widespread

[2]For Africa see (Elkan 1959, 1967; Guilmoto 1998), for Asia (Hugo 1982; Stretton 1983; Deshingkar and Start 2003; Rogaly et al. 2002; Rogaly and Coppard 2003) and for South America see (Deutsch et al. 2003).

expansion of Boro cultivation, the incidence of the early summer lean period has significantly declined. However, the autumn lean season coming after the plantation of the Aman crop still affects almost all parts of the country, and especially the northwest part of Bangladesh. There is barely any alternative agricultural activity persists in that period, and the non-firm sector is not sufficient enough to absorb the seasonal unemployed labor. In local terms, this lean season is called *Monga* or *Mora Karthik* (Rahman and Hossain 1991). During the lean season, such lack of income and alternative means for earnings limit the purchasing power of the people, which cannot be subdued with minuscule amount of assets and savings of the poor households. Despite the widespread safety net programs in Bangladesh, the seasonal hardship is still quite robust which seems to indicate that such safety net programs are not sufficient to tackle situation like Monga.[3] Access to credit is another problem that could also amplify the problem of seasonal hardship in this region. As (Khandker et al. 2010) points out, most of the northwest region does not have functional credit market and people are sometimes exposed to informal credit market arrangement which is locally known as "dadan" where one has to make advance sell of labor and crops for immediate access of food and money.

Micro-credit could be another option where poor could access the micro-credit programs to have non-firm activities and will not suffer from the seasonality of the agricultural sector. But such option is not adequate for many ultra-poor households mostly due to two reasons, firstly the non-firm sector in northern Bangladesh is much dependent on the agricultural sector which is subject to seasonality and secondly, the micro-credit provided by the Micro-finance Institutes (MFIs) mostly have inflexible contract, high interest rates and strict loan repayment rules (such as, weekly payment that starts after one week of loan disbursement and weekly meeting schedules). In situations like lean period shocks, where migration is a natural response, the strict weekly loan repayment rules of MFIs can have adverse effect on this process, reducing the ability of borrowers to react to a shock.

To address the factors influencing the seasonal migration decision and the impact micro-credit on seasonal migration, this paper used a primary dataset collected from the northern part of Bangladesh. This random cross-section household survey was conducted in January 2006 by Abu Shonchoy, Abu Z. Shahriar, Sakiba Zeba and Shaila Parveen as part of a project undertaken by the Economics and Social Sciences Research Group (ESSRG) of BRAC University, Bangladesh. The study team chose the Kurigram district of northern Bangladesh because of

[3]Safety net programs that are quite regular in Bangladesh are mainly food-for-work, cash transfer, old-age benefit, food coupons, vulnerable group feeding and public work program.

some distinctive features. Kurigram is mainly an agri-based, severely poverty-stricken area and has micro-credit coverage provided by MFIs. Due to the agricultural cycle, farmers have very little work to do on the farms after the plantation of the Aman in September-October.[4] As a result, a large number of agricultural workers become jobless every year and decide to migrate temporarily. Such migrants tend to get work in the urban informal sector and work mainly as day laborers or street vendors. Although the urban standard of living is typically a bare minimum for these migrants, they prefer this option to staying in the village with no income at all.

Pioneering work on seasonal migration in Bangladesh has been conducted by Shahriar et al. (2006). Unfortunately, the study did not produce efficient and consistent estimates due to the use of an incomplete dataset. However, by using an updated version of the data, the present study has improved on the model of Shahriar et al. and is able to provide efficient estimates and additional insights; hence, this study provides a significant advance in the understanding of the drivers of seasonal migration and the impact of micro-credit on seasonal migration during lean seasons.

2. Background

2.1. Seasonal Migration

Seasonal migration could be seen as an effective strategy for consumption-smoothing (Rosenzweig and Stark 1989), risk diversification (Stark and Levhari 1982; Katz and Stark 1986) or as a means to overcome credit constraints for source households (Lucas 1987; Stark 1991). In the model of Todaro (1969), individuals migrate if their expected earning from migration is higher than staying, however such decision is dependent on individuals human capital which could influence their earning and probability of getting a job in the migration destinations. Modern labor market literature argues that migration could be a family decision where having a family member migrating elsewhere is a useful strategy to manage uncertainty, relieve liquidity constraint and diversify the income portfolio (Stark 1991) whereas a notable number of papers conceive migration as an individual decision to maximize income (Navratil and Doyle 1977; Nakosteen and Zimmer 1980, to name a few).

[4] In more than 80% of the farms in the study area, only one (Aman paddy) or two crops (Aman and Boro paddy) are produced annually.

The terminology of seasonal migration probably first appeared in the seminal paper by Walter Elkan in which he observed circular migration patterns of labor in East Africa and explained it 'Combined with the familiar pattern of migration, all in one direction, there is another and important movement back to the countryside' (Elkan 1967, pg. 581). However, according to Deshingkar and Start (2003), the formal definition of seasonal migration was put forward in the 1970s by Nelson (1976) who discussed such labor as 'sojourners' (page 721). This work raised interest in the causes and consequences of temporary city-ward migration in developing countries. According to Nelson, a major proportion of rural to urban migration in Africa and of Asia is temporary in nature, and Zelinsky (1971) defined seasonal migration as 'short-term, repetitive or cyclic in nature' (page 226).

The seasonal migration of labor has been studied in many disciplines other than Economics. Demography, Anthropology and Sociology have discussed such movements of labor long before it appeared in Economics. Consequently, the terminology used to describe this phenomenon varies considerably; for example, seasonal migration has also been referred to as 'return migration', 'wage-labor migration', 'transhumance' to name a few. In addition, geographers noticed this observable fact of labor movement even in the early 1920s. As mentioned in (Chapman and Prothero 1983, pg. 599):

> 'The concept of circulation as the beneficial integration of distinct places or communities dates from the 1920s mainly characterizes the work of human geographers and originated with the French led by Vidal de la Blache (1845-1918). Among French geographers, circulation refers to the reciprocal flow not only of people but also of ideas, goods, services and sociocultural influences (de la Blache, 1926: 349-445; Sorre, 1961: Part IV)'.

Chapman and Prothero (1983) provide a comprehensive study of this literature, while Nelson (1976) discusses in detail the causes and consequences of such migration.

2.2. Reasons for Seasonal Migration

Other than social issues such as family structures, social customs and religious beliefs, economic factors are the most influential reasons for migration in the lean period. Elkan (1959, pg 192) refers to these non-economic factors as 'most unlikely to be the whole story, and...it can never be the most important part of the story.' On the contrary, Elkan denoted the economic factors as 'largely a rationalization of simple economic motives'. In this section we primarily focus on the economic

factors that lead to migration (rural to urban) and reverse migration (urban to rural).

2.2.1. Reasons causing rural to urban migration

During the lean period, the temporary mobility of labor provides some means of livelihood in urban areas. There are four main reasons why families take such decisions in the lean period. Firstly, it is always easier and cheaper to survive in the rural environment than in urban areas, as the prices of food grains and other household essentials are relatively cheaper. In most cases, it is the head or the most capable members of the household, who are mainly men, migrate to urban areas. Moving away from the household, a single person can cope better with urban life and typically survives on a bare minimum in order to send remittances back to the family.

Secondly, seasonal unemployment in agriculture causes an excess supply of unskilled or semi-skilled workers in rural areas. In combination with this, food grains and other necessary commodities become relatively expensive during this period as the affluent in these regions hoard a large amount of crops in good times to sell in the lean period at a high price; hence, the increase in price reduces the real wage of workers. It becomes almost impossible for an ordinary agricultural worker to maintain general living standards during the lean period in a village and thus they choose to migrate.

In recent years, much public and private investment has been concentrated in urban areas in developing countries. Little or no effort has gone into creating effective non-agricultural sectors in rural areas and there exists only a few alternative means of earning in rural areas other than agriculture and agri-based industries. This pattern of temporary labor movement is nothing but a pure response to the lack of alternatives in rural areas (Hugo 1982).

Finally, the cost of the journey to migration destinations is usually very small and unimportant for migrants. As mentioned in Hugo (1982, pg. 73) 'travel costs, time taken, and distance traversed between origin and destination generally constitute a minor element in a mover's overall calculus in deciding whether or not to migrate and where'. The recent improvement in communication in third world countries has also significantly reduced the cost of movement (Afsar 1999). Moreover, access to an informal credit market (through micro-credit schemes operated by NGOs) gives migrants the option of borrowing which can reduce their immediate relocation and travel costs. Although NGOs do not run specific programs to provide credit for migration, however, it is possible to use a loan taken by other members of the family and to repay the loan once work has been found in the

migration destination.

2.2.2. Reasons causing reverse migration

There are some interesting facts which influence migrants to return to the village, causing reverse migration. Once a move to urban areas has taken place, there are some off-setting factors such as forgone skills and income in the normal season, which are quite important for the reverse migration (Mendola 2008). Poverty and resource constraints, make it extremely difficult for a migrant to devote resources to building or to invest in the skills that are required for formal urban job markets; hence, seasonal migrants end up seeking jobs in the urban informal sector where the wage is typically at a minimum and working conditions are not pleasant. The informal sector is primarily low-skilled and usually involves manual labor (such as the job of rickshaw puller, street vendor or day laborer). The wages are inadequate to support a single man, let alone a family. These people live in the slums or on the pavements of the large train stations or sometimes by the side of street; such living conditions are worse than they have in villages. Lack of job security, ineffective labor unions and illness-related insecurity also play a role in reverse migration. Seasonal migrants are generally not protected against accidents and do not have provision for retirement benefit (Elkan 1959). If a migrant becomes ill or requires money, they can seek help in the village which provides some sort of social security through the widespread network of social relations, which provides an incentive for migrants to go back (Hugo 1982).

In the lean period, large numbers of people may leave the village to seek jobs in the urban sector leading to an excess supply of labor. Employers usually exploit this by decreasing the wage rate below the standard market rate. Moreover, employers know that migrants are temporary workers, hence there is no incentive for them to provide training or invest in this short-term labor force. The lack of formal or skill-based education ensures that most migrant workers remain unskilled, making it extremely difficult for them to seek jobs in the formal urban labor market.

The most important economic factor leading to reverse migration is the reversal of the rural-urban wage difference. For a temporary migrant, the income in the rural sector during the normal time is typically more than the the urban sector. As a result, there is an obvious incentive for migrants to return to rural areas in the normal period after the shock.

2.3. Factors Influencing the Migration Decision

A number of studies have analyzed the internal migration pattern in Bangladesh which are mostly qualitative analysis.[5] We also find some studies on circular migration such as Breman (1978), Hugo (1982), Stretton (1983), Chapman and Prothero (1983), Rogaly et al. (2002); Rogaly and Coppard (2003), Deshingkar and Start (2003), andDeutsch et al. (2003). Broadly, these studies focus on issues such as the scale and pattern of migration, the characteristics or selectivity of the migrants, causes of migration, the impacts of internal migration on urbanization and the pattern of resource transfer followed by rural-urban migration. As we could not find sufficient studies on the factors influencing the seasonal migration decision, we have used the generally used variables which are found to be significant for internal rural to urban migration studies.

Sir John Hicks argued in *The Theory of Wages* (1963, pg. 76) that the main cause of migration is the wage differential. Classic migration literature and theories (Harris and Todaro 1970, e.g.), whether internal or international, employ wage differentials as the core mechanism that leads to migration.

Interestingly, the relationship between land holding and the migration decision in empirical studies is inconclusive and ambiguous. For example, Kuhn (2005) argues that the land-holdings of households is a key determinant of rural-urban migration and the tendency to migrate will be greater for those who hold less land. Similarly, the recent work of Mendola (2008) finds a negative and significant relationship between land holding and migration decisions for temporary migrants in Bangladesh. Hossain (2001), in contrast, finds that the tendency to migrate is higher for households with some sort of land holding compared to the landless. Hence, it will be interesting to explore the role of asset holding (in the form of land) in determining the seasonal migration decision of the poor in lean period.

The literature shows that internal migration is most common among the younger population (Borjas 2000; Mendola 2008). Demographically, the internal migrants of Bangladesh are mostly young adults (Chowdhury 1978) and temporary migrants are even younger than permanent ones (Afsar 2002) which is perhaps not surprising since the demographic pattern of the population of Bangladesh is quite young in comparison with western countries. (Hugo 1982) argued that men have a significantly greater tendency for seasonal migration than women. Due to lim-

[5]For reference, see Chowdhury (1978), Khan (1982), Huq-Hussain (1996), Begum (1999), Islam (2003), Hossain (2001), Barkat and Akhter (2003), Afsar (1999, 2003, 2005), Kuhn (2001, 2005), to name a few.

ited employment opportunities, family responsibilities and for religious reasons, female members of a family are less likely to migrate than adult male members. Previous empirical works on migration suggested that household size positively influences an individual's migration decision (Deshingkar and Start 2003; Mendola 2008). Hence, a positive influence of household size on migration decision has been hypothesized.

The importance of a strong support network is crucial for the immigrants (Munshi 2003; McKenzie and Rapoport 2007) as well as for the migrants (Afsar 2002; Brauw and Harigaya 2007). Social networks offer support in the provision of accommodation, relocation, learning new skills, better bargaining power and protection against harassment, assault and uncertainties. Afsar (2003) found that 60 percent of the internal migrants who have kinsmen at the place of destination, managed employment within a week of arrival in Dhaka city. Hence, the presence of kinship at the place of destination is expected to have a higher influence on the seasonal migration tendency.

3. Micro-credit and Seasonal Migration

An important determinant of seasonal migration could be the role of micro-credit in influencing the decision regarding migration. Micro-credit provided by micro-finance institutions (MFIs) is a recent policy development in developing countries in relation to poverty alleviation. It is argued that if given access to relatively small credits, entrepreneurs from poor households will find opportunities to engage in viable income-generating activities, often secondary to their primary occupation, and thus alleviate their poverty by themselves. Micro-credit is accessible in rural areas through MFIs that have expanded quite rapidly in recent years. According to the Micro-credit Summit Campaign, Micro-finance institutions had 154,825,825 clients as of December 2007, of which more than 100 million were women. In 2006, Mohammad Yunus and the Grameen Bank were awarded the Nobel Prize for Peace for their contribution to the reduction of poverty, especially in Bangladesh. However, among academics there is so far no consensus on the impact of micro-credit on income improvement and poverty reduction (Banerjee et al. 2009).

Typically, MFIs provide small loans to poor people who are deprived of access to credit offered by regular banks. Through the introduction of 'social collateral', MFIs give individual loans to villagers in groups and hold the group jointly liable for repayment. If any group member defaults, the entire group is punished by being denied future loan applications. This group mechanism creates peer pressure

and solidarity, which is reported to work well in societies where social networks and bonding are of vital importance. The repayment success rate of MFIs is quite high and in Bangladesh, for example such repayment rate has never dropped below 90 percent (Develtere and Huybrechts 2005).

Though there were no specific micro-credit program targeted only to tackle the seasonal hardship during the Monga period, individuals could always take micro-credit or access micro-credit during the normal season through their family members, if they could fulfil the eligibility criteria. Hence, individuals can use micro-credit during the productive part of the year and use the increased income to address their consumption and income shortfalls during the lean season. However, the major drawback of the micro-credit framework is the rigid loan repayment rule where nearly all contracts are fixed in their repayment schedules, which entails constant equal weekly payments with a high interest rate (usually 20%). The members of MFIs are poor rural people who frequently have uncertain income, which makes it very difficult for them to maintain such rigid weekly loan repayments. In a lean period especially when there is no job availability in the rural agricultural sector, it is extremely difficult for the poor to generate income, let alone comply with their loan repayment scheme. Such strict repayment schedules prevent people with prior access to micro-credit from migrating, thus making it very hard for them to repay their weekly installments and survive. Families, however, may bypass such strict loan repayment rule by combining both migration and micro-credit where the credit is received by the female member of the household but is used by the male member who migrates to the urban areas during the lean season and sends remittances to repay the loan. However, not everybody in the population has capable family members to take the loan and there exist a sizable number of female headed households, elderly people and disable people who will be restricted to migrate if taken credit and may not like to access micro-credit. Moreover, the amount of loan available through micro-credit is also very limited which is based on the borrowers ability to repay in their worst week (Karlan and Mullainathan 2009). Therefore, the impact of having prior access to micro-credit on seasonal migration has important policy implication for the poor people who are affected with the seasonality in the agricultural sector.

4. Data Description

The empirical analysis of this study is based on the primary household survey of 290 households from 17 villages in four selected thanas[6] of the Kurigram district: Chilmari, Ulipur, Rajarhaat and Kurigram. The survey team collected the primary data of this study from Kurigram where approximately 46% of the total labor force is involved in agriculture (they work in their own firm); another 30% are agricultural day laborers (Banglapedia 2006). The survey covered 17 villages from the four thanas: four from Chilmari, three from Rajarhat, four from Ulipur and six from the Sadar thana. Although the villages from each thana were selected randomly, the four thanas were selected to capture heterogeneity in income, communication, infrastructure facilities, catastrophic and other sociocultural factors.

The survey showed that people living in Ulipur and Chilmari were relatively poor compared to those living in Rajarhaat. The survey team observed that Kurigram Sadar and Rajarhat had better transportation systems compared to Chilmari and Ulipur, so the ability to move is relatively higher in this area. A char[7] area was also surveyed in the Kurigram Sadar to capture the special characteristics of char livelihood in relation to the migration decision in the lean period. Among the four thanas, the history of these areas suggests that Rajarhaat suffers the least during natural disasters. In contrast, Chilmari is the worst affected by both flood and river erosion. River erosion is quite rare in Ulipur, although annual floods ravage the area. The char area is affected by river erosion and floods quite regularly: the Kurigram town is also affected by river erosion.

According to the Banglapedia (2006) the population of Kurigram district is 1,782,277, of which 49.62% are male and 50.93% are female. The majority of the population are Muslim; as a result, only minor religious and cultural heterogeneity exists in the survey area and is negligible. The people of this region are largely illiterate, with an average literacy rate of around 22.3%. The survey area consists of 37.02% of the total population of the district.

The survey was conducted among 290 random individuals who are the heads of their representative households. The survey questionnaire was trialed on 30 respondents in Chilmari and Ulipur before being used for the main survey. The final questionnaire consisted of 12 sections and was designed to collect individual information on the migration decision and factors influencing this decision. The

[6] A thana is a unit of police administration. In Bangladesh, 64 districts are divided into 496 thanas. There are ten thanas in the Kurigram district.

[7] A char is a small river island created by silt deposits and estuaries.

survey sought general information like age, occupation, average income and the number of dependents. The questionnaire also addressed issues of land usage, occupation at destination if migrated, micro-credit membership and land ownership. The questionnaire collected information on the nature and extent of starvation throughout the year, information on natural disasters, death of earning family members and sudden damage of crop or livestock.

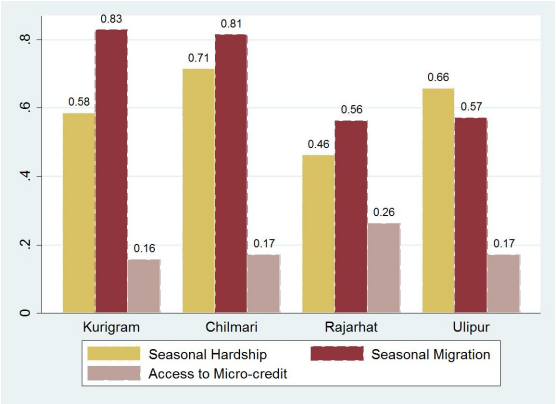

FIGURE 1: Average district specific distribution of seasonal hardship, migration, access to micro-credit (in percentage)

We collected the data at the beginning of the normal period when all the migrants have just came back from urban areas. Of the 290 respondents, 68 percent were identified as seasonal migrants. The variables were categorized into three groups: representing economic factors, ecological vulnerabilities and personal characteristics. The survey team asked each individual about their income in both periods. Hence the measure of income in the lean period in this study is the individual earnings if the respondent stays in the village or the individual earnings if the respondent migrates. We do not have the counterfactuals for this information in the dataset.

We were not confident that individuals could predict future plans for seasonal migration and we therefore asked respondents about their immediate past migration behavior and income. To capture the seasonal migration behavior of the respondents, we used a dummy variable, which has a value of one if the respondent migrated in the last lean period and zero otherwise.

With 1200 micro-credit institutions and 19.3 million members, the micro-credit sector of Bangladesh is one of the largest in the world. According to the Credit and Development Forum Bangladesh (Credit and Development Forum 2006), approximately 37% of all households in Bangladesh have access to micro-credit. Credit does not require any collateral and is given to both individuals and groups. The major types of loans include general loans, program loans and housing loans. However, at the time of the survey there was no micro-credit program that solely designed to tackle the seasonality due to Monga. Furthermore, the Micro-finance Institutes (MFIs) have only moderate coverage in the survey area even though the Northern part of Bangladesh is known for its grievous incidence of extreme poverty as well as acute seasonality of agricultural downturn. We measured the access to micro-credit through MFIs by a dummy variable, which is coded as one for having access to micro-credit (both directly if the respondent took the credit and indirectly in case other family members have taken the credit through MFIs) and zero otherwise. In the survey, only 19% of the respondent have access to micro-credit.

The variable that has been used to capture the seasonal starvation during the lean period is termed as seasonal hardship which is a dummy variable that equals one if the individual has one meal or less on a typical day in the lean period. In the sample, 60 percent of the respondents reported that they had one or less than one meal during the lean period which shows the severity of the seasonal starvation in the survey area. Fig. 1 reports the average seasonal hardship, access to micro-credit and migration by survey thanas.[8] It is evident from the figure that seasonal hardship is higher in the Chilmari and Ulipur district compared with other two districts. On the contrary, people from Kurigram sadar and Chilmari have more incidents of seasonal migration among all thanas. However, access to micro-credit is the highest in Rajarhat while the other thanas have almost equal level of response.

[Table A.1 about here]

More males than females were interviewed (89 percent versus 11 percent). Patriarchal village societies account for such a small female response rate. Some 70 percent of the respondents reported being married at the time of the survey, which is quite a high number. A simple dummy variable is used to indicate land ownership. An respondent is assigned a value of one if his/her family owns any

[8] In the figure 1 Kurigram is used instead of Kurigram Sadar for simplicity

amount of cultivable land, irrespective of the size. Otherwise, he/she is assigned a value of zero. 43 percent of the respondents reported that they were landless.

The occupation variable was divided into two broad categories of agricultural and non-agricultural, because we were interested in testing the hypothesis that agricultural workers are the group that migrates in the lean period. Consequently, farmers were assigned a value of one and zero otherwise. The occupational composition of the respondents is as follows: 47 percent of the respondents are involved in agriculture, while the remainder are non-farm workers such as fishermen, potters, petty traders, land leasers, garment workers, rickshaw-pullers or petty village musicians.

A dummy variable was also used to capture information on education. An individual having some reading ability was given a value of one and zero otherwise. In the present sample, 42 percent of the respondents have at least some education. Interestingly, 63 percent of the respondents reported having some prior migration experience, and 52 percent of the respondents had kinsmen at the urban centers at the time of survey.

5. Econometric Models

In this section a detail discussion about the estimation techniques has been introduced. The first subsection discusses about the econometric techniques employed to estimate the determinant of seasonal migration. As mentioned in Harris-Todaro model, the key determinant of migration is the difference of the wage differential between the origin and migration destination. However, using income differential where those incomes are subject to selection bias could create inefficient and biased estimation. Hence, in our empirical model, to correct for such selection bias we have used the "Roy" model suggested in Lee (1983). In our estimation on the determinant of seasonal migration, prior access to micro-credit plays a pivotal role. However, adequate caution has been taken in estimating the impact of such variable on migration since prior access to micro-credit could be endogenous in nature. In such case, to model the effect of micro-credit on migration, we used a bivariate probit model with endogenous dummy variable (otherwise known as recursive bivariate probit or bivariate endogenous treatment model).

5.1. Self- selection Model of Migration

5.1.1. Econometric Modeling of Seasonal Migration and Self-Selection

We follow Nakosteen and Zimmer (1980), and Robinson and Tomes (1982) models of migration in which switching regression models with endogenous switching are used, as characterized by Maddala and Nelson (1975). Let us assume that

during the lean period, individual i elects to migrate if the percent gain in moving exceeds the associated total costs. Thus a person chooses to migrate if

$$(Y_{mi} - Y_{ni})/Y_{ni} > C_i \tag{1}$$

where C_i represents the direct and indirect costs of moving from area n to area m, by individual i as a proportion of income. Let us assume that the cost of moving is represented by economic factors, ecological vulnerabilities and personal characteristics (X) with a random disturbance term.

$$C_i = g(X_i) + e_i \tag{2}$$

Expression 1 and 2 suggest, as a general proposition, that the migrant selectivity criterion is a function of gains in earnings along with other attributes. Here, the criterion is modeled as a linear combination of these variables which explain an individual's propensity to migrate. Formally, an individual i chooses to migrate if $I_i^* > 0$ and does not migrate if $I_i^* \leqq 0$ where

$$I_i^* = \alpha_0 + \alpha_1[(Y_{mi} - Y_{ni})/Y_{ni}] - \alpha_2 X_i - e_i \tag{3}$$

Since $(Y_{mi} - Y_{ni})/Y_{ni}$ is approximated by $\log Y_{mi} - \log Y_{ni}$, then plugging this into the above equation, the decision equation becomes

$$I_i^* = \alpha_0 + \alpha_1(\log Y_{mi} - \log Y_{ni}) - \alpha_2 X_i - e_i \tag{4}$$

and

$$\log Y_{mi} = \theta_{m0} + \theta_{m1} X_i + \varepsilon_{mi} \tag{5}$$

$$\log Y_{ni} = \theta_{n0} + \theta_{n1} X_i + \varepsilon_{ni} \tag{6}$$

where

$$\begin{aligned} X_i &= \{\text{Factors influencing the income}\}_i (observable) \\ \varepsilon_{mi} &= \{\text{General ability, attitude towards risk and preference, specific to } m\}_i \\ &\quad (unobservable) \\ \varepsilon_{ni} &= \{\text{General ability, attitude towards risk and preference, specific to } n\}_i \\ &\quad (unobservable). \end{aligned}$$

Expression 4 - 6 comprises the basic structure of the migration model. The en-

dogenous variables are I_i^*, $\log Y_{mi}$ and $\log Y_{ni}$, but in reality we do not observe I_i^*, instead we observe $I_i = 1$ if $I_i^* > 0$ and $I_i = 0$ if $I_i^* \leqq 0$. In addition, since only part of the population moves and part of them stays, we observe $\log Y = \log Y_{mi}$ when $I_i = 1$ and $\log Y = \log Y_{ni}$ when $I_i = 0$. However, for the income equations, OLS estimations will be inappropriate due to the presence of self-selection in migration. Migration is a decision chosen by each individual i, which tends to be non-randomly distributed within the population. As a consequence, there is inherent 'selectivity bias' with the OLS estimations of income equations 5 and 6 since such estimations fail to reflect the presence of self-selection. More formally,

$$E(\varepsilon_{mi}|I_i = 1) = \sigma_{m\varepsilon^*}[-f(\psi_i)/F(\psi_i)] \tag{7}$$

$$E(\varepsilon_{ni}|I_i = 0) = \sigma_{n\varepsilon^*}[-f(\psi_i)/1 - F(\psi_i)] \tag{8}$$

where, $f(.)$ and $F(.)$ are the standard normal density and distribution functions based on the conditional formulae for the truncated normal distribution.

To correct for selectivity bias and to estimate consistent parameters, we need to follow the procedures developed by Lee (1983) described as follows. Substituting 5 and 6 into 4 provides the reduced form decision equation. If we assume the error terms of the reduced form equation is normally distributed with unit variance, then such a model could be a estimated by probit model. Hence the reduced form decision equation will become

$$\psi = \beta_0 + \beta_1 X_i' - e_i' \tag{9}$$

Probit estimations of the above model yield the fitted values of $\hat{\psi}_i$ which then will be used to construct the following variables

$$u_{mi} = [-f(\hat{\psi}_i)/F(\hat{\psi}_i)]$$

and

$$u_{ni} = [-f(\hat{\psi}_i)/1 - F(\hat{\psi}_i)].$$

In stage two, the correct income equation which could be estimated by OLS is stated below.

$$\log Y_{mi} = \theta_{m0} + \theta_{m1} X_{mi} + \theta_{m2} u_{mi} + \eta_{mi} \tag{10}$$

and

$$\log Y_{ni} = \theta_{n0} + \theta_{n1} X_{ni} + \theta_{n2} u_{ni} + \eta_{ni} \tag{11}$$

where,

$$E(\eta_{mi}|I_i = 1) = 0$$

and

$$E(\eta_{ni}|I_i = 0) = 0.$$

The estimates obtained by this procedure are known to be consistent Lee (1983). In the final stage we need to estimate the fitted values of log earnings from equation 10 and 11, which together with appropriate exogenous variables are then switched back into the structural decision equation 4. Further discussion of such estimation procedures appears in Lee (1983).

5.1.2. Estimation

We first estimated the reduce form equation like the one stated in equation 9. Probit estimates of such equation are presented in Table A.2. In the next step, fitted values of the reduced form maximum likelihood model are used to construct selectivity variables. Here we create two variables, one for the migrants and the other for the non-migrants, according to equation 7 and 8. These selectivity variables are then used for estimating the earning equations 10 and 11 by OLS (Nakosteen and Zimmer 1980). Estimates of the earning equation are not reported here but are documented separately and could be available upon request. If the combined effect of these two selectivity variables on unconditional earnings is positive then we can confirm that the process of self-selection of the migration decision serves to improve unconditional expected earnings.[9] From our results, the combined effect of self-selection on expected earnings is $\hat{\theta}_{n2} - \hat{\theta}_{m2} = 0.26$ which is positive. The final stage in the estimation entails probit estimation of the structural form equation as expressed in equation 4. The resulting maximum likelihood estimations are reported in Table A.2. We have results from three sets of Probit estimations in Table A.2 with coefficients and marginal effects. Here the reported marginal effects are the average values of the explanatory variables. In the first model, we have the log of migration income variable as an independent

[9]Note: Unconditional expected earnings for individual i could be written as

$$E(Y_i) = E(Y_i|I_i = 1).P(I_i = 1) + E(Y_i|I_i = 0).P(I_i = 0).$$

So, if we plug all the exogenous variables in the above equation then the expression becomes

$$E(Y_i) = (\theta'_{m1}X_{m1}).F(\Psi_i) + (\theta'_{n1}X_{n1}).[1 - F(\Psi_i)] + (\theta_{n2} - \theta_{m2}).f(\Psi_i).$$

variable, which shows that as the income at the migration destination increases, people will be more inclined to seasonally migrate during the lean season. Such an estimation is highly statistically significant. In the second model, we have the log of non-migration income as the dependent variable which is also significant but shows a negative sign. This estimates reveals that as non-migration income opportunity increases in rural areas, people will be less interested in seasonally migrating during the lean season, holding all things constant. In model three, we implemented the most crucial migration determinants factor; migration and non-migration income differential. As expected, the effect of anticipated monetary gain due to migration significantly increases the probability of migration, confirming the classic Harris-Todaro theory of migration.

The probit estimates of the structural form equation show that seasonal hardship in the lean period and individual characteristics like sex, age, size of the family, farm occupation, prior experience and kinship at the place of destination and education have a significant association with the migration decision. The marginal effect of a unit change in the explanatory variables on the decision to migrate has also been calculated. It is evident that expected income difference is the most decisive among the economic factors in determining the probability of migration. Among the non-economic factors, previous migration experience has the highest magnitude in explaining the migration decision.

[Table A.2 about here]

Another economic factor, land ownership; was found to be significant and negative, which shows that people who have ownership of land are not greatly affected by the lean period shocks and are less inclined to migrate. Land ownership could be used as a proxy of the wealth status of an individual showing that relatively wealthy population in lean affected areas are not particularly vulnerable as a result of seasonal shocks, because they can save sufficiently during the normal period to cover their expenditures during the lean seasons.

The role of education in the migration decision has been widely discussed in the literature and several studies have shown that migrants are usually more educated than non-migrants in the same locality (Chowdhury 1978; Kuhn 2005). Educated people are more likely to migrate, as job opportunities for them are higher in the urban centers than in the rural areas. However, in our present study, we find education has significant negative impact on seasonal migration. Such result is not surprising since seasonal migration is temporary in nature and, as a result, individuals who have relatively better education will tend to choose permanent over temporary migration. Temporary seasonal migrants tend to seek jobs in the

urban informal sector which does not require any formal education. Moreover, individuals with better education who live in the villages mostly work in the non-agricultural sector hence less likely to be affected with the seasonality.

Prior migration experience has the strongest positive impact among all the factors influencing the migration decision. Migration experience and kinship at the place of destination reduces the cost of migration by minimizing the time for job searching. Both of these variables were found to be significant at less than the 1% level, which is a crucial finding of our study.

The results also show that migration propensity is significantly higher among males. Workers in the 20-40 age group have a significantly higher intention to move in the lean period. The size of family is found to be significant and positively influences the probability of migrating as expected. This indicates that for a large family, the chief earner is more likely to migrate as the migration income in the lean period is very important for the survival of a bigger family.

An important finding of our study is that farm occupation significantly modifies the migration decision. Since the seasonal hardship results from seasonal unemployment in agriculture, it is logical that farmers would be keen to seek an alternative livelihood strategy, preferably in the cities. The probit model suggests that the probability of migration is significantly higher among the farmers. Agricultural workers are more vulnerable to seasonal unemployment in the lean period. As a result, a large number of agricultural workers choose to migrate in the lean period and the present study has found a significant and positive impact on agricultural professionals to opt for seasonal migration. Such evidence contradicts the literature on permanent internal migration. Studying migration in Costa Rica, Carvajal and Geithman (1974), found that income elasticities of in-migration rates are higher for professionals, managers, white-collar and industrial workers. This is quite natural, as higher wages for these jobs attract migrants to cities. It provides evidence that lean period migration is basically a shock driven migration where farm laborers are the most-affected. Thus they constitute the vast majority of the population to choose temporary internal migration.

An interesting relationship between household land ownership and predicted probabilities of migration is shown in Figure A.2. Here, we have created a graph of a representative individual as a base case. The individual is a male, married, with mean income, family size of 5, who has no migration experience, no kinship at the destination of migration, no education, no social security and aged 35. The figure reflects that migration propensity is higher for the farmers with low levels of wealth (land holdings) when compared with the non-farmers during the lean season. However, such phenomenon drastically decreases for the farmers with

assets and marginal increase in land-holding decreases the probability to seasonal migration. This demonstrates the vulnerability of the asset poor farmers during the lean period who opt for temporary migration for survival.

5.2. Simultaneity of Migration and Micro-credit

5.2.1. Econometric Model of Migration and access to Micro-credit

To model the effect of micro-credit on migration, the issue of endogeneity becomes relevant since individual's decision to take micro-credit is endogenous to the migration decision. The problem lies in the fact that the individuals who have access to micro-credit (treatment) are self selected individuals which is influenced by idiosyncratic and unobserved individual characteristics. Moreover, such unobserved individual characteristics (for example individual's ability or level of risk aversion) may drive both the treatment variable and the outcome (migration decision). Furthermore, there might have unobserved preference which could affect individuals decision to take micro-credit and simultaneously their decision to migrate. To estimate such endogenous model, we could use the Instrumental Variable (IV) approach which is usually implemented ia a two-step procedure (two stage least square, 2SLS). However, when dealing with a dichotomous output (migration decision) with binary treatment variable (access o micro-credit), the 2SLS or the two stage estimator procedure has been proved to be inconsistent (Foster 1997; Bhattacharya et al. 2006). An alternative approach is to implement a structural approach in which we will specify a joint model combining both treatment where output equation includes the treatment variable as an endogenous regressor. This can be estimated by full information maximum likelihood (FIML) estimation procedure. Since, in our case both the outcome and endogenous variables are binary, we can use a bivariate probit model with endogenous dummy variable (otherwise known as recursive bivariate probit or bivariate endogenous treatment model, for example see Maddala (1983) and Greene (2002)). Such a model belongs to the family of the simultaneous equation model with endogenous variable (both discrete and continuous) first introduced by Heckman (1978) and further developed by Maddala (1983). As mentioned in Jones (2007), according to the framework defined in Blundell and Smith (1993), such kind of model is termed as type II model which is in our case the household's prior access to micro-credit assumed to influence individual's migration decision during the lean period. [10]

[10]Chronology of these events means that current migration decision cannot have a direct feedback effect on the access to micro-credit in the previous year, since micro-credit is mostly taken by females whereas migration is mostly done by the males, hence rules out the simultaneity bias.

However, the coherency condition of type II model may only be consistent if the endogeneity of the access to micro-credit based on the unobserved heterogeneity bias rather than a direct effect of the micro-credit on migration. Since, in our study, we are more interested in identifying the impact of household's prior access to micro-credit on migration rather than the impact of the propensity to have access to micro-credit, hence such endogenous recursive model seems more appropriate. In our model, the access to micro-credit, which is a dummy variable appears as a regressor in the migration equation. The unobserved heterogeneity that could have influence over an individual's prior decision to have access to micro-credit and the decision to migrate can be estimated by using a bivariate probit specification.

Formally, let us denote two simultaneous equations; one for the access to micro-credit and the other for the migration, with correlated disturbances, which can then be estimated with an endogenous treatment model using FIML methods. Following Greene (2002), the general specification for a two equation model where y_{1i} is the dummy for micro-credit and y_{2i} is the dummy for migration is as follows,

$$y_1^* = x_1'\beta_1 + \varepsilon_1,\ y_1 = 1\ if\ y_1^* > 0, 0\ otherwise, \tag{12}$$

$$y_2^* = x_2'\beta_2 + y_1\gamma + \varepsilon_2,\ y_2 = 1\ if\ y_2^* > 0, 0\ otherwise, \tag{13}$$

$$E[\varepsilon_1|x_{1,}x_2] = E[\varepsilon_2|x_{1,}x_2] = 0,$$
$$Var[\varepsilon_1|x_{1,}x_2] = Var[\varepsilon_2|x_{1,}x_2] = 1,$$
$$Cov[\varepsilon_{1,}\varepsilon_2|x_{1,}x_2] = \rho,$$

where the first dependent variable (the dummy variable which is coded one to represent the access to micro-credit) appears as an independent variable in the second equation, which is a recursive, simultaneous equation model. Our identification strategy depend on the fact that Here, the coefficient of interest is γ and if we find evidence that γ is statistically significant then we can conclude that the people who choose to have access to micro-credit have a systematically different pattern of migration decision in the lean period. Similarly, unless we find evidence that $\rho = 0$, the probit analysis without considering this above-mentioned endogeneity will give inconsistent parameter estimates since ρ measures the unobserved heterogeneity which implies that the error term shares a common component between these two equations and can be expected to be correlated with each other.

5.3. Estimations

To avoid the identification problems in recursive bivariate probit settings, it is only necessary to have variation in the set of the exogenous regressors and exclusion restrictions are no necessary: which is often described as "identification by functional form (IFF)" (Wilde 2000; Jones 2007). In such case, only one additional variable in the endogenous regression which is not included in the base equation should be sufficient. In other words, the set of variables in x_1 in the access to micro-credit equation is partly common in the to the sets of regressors in x_2 but not identical. In our case, in the first equation we include a dummy variable to denote the access to social security which takes a value of one if an individual is currently receiving any transfer payment through safety net programs from the government and zero otherwise. Receiving such payment by an individual provides evidence of individual's economic vulnerability and could be considered as an instrument since such variable is expected to be associated with the probability of seeking access to micro-credit but not with migration decision (Khandker et al. 2010).[11] However, this identification could be week as it depends predominantly on the assumption of the bivariate normality of the error terms and it is a common practise in applied econometrics to include exclusion restrictions to improve identification. Following Pitt and Khandker (1998) we used landholding based exclusion restrictions where households having more than 50 decimal of land are precluded from joining any MFI's micro-credit lending program. This exclusion restriction is used to create discontinuous household's program choice variable which is then interacted with the household's observable characteristics to instrument for the participation in the micro-credit program. Such model has been termed as "identification by exclusion restriction (IER)" in our estimation.

Table A.3 and A.4 presents the main findings of the recursive bivariate probit models. The first table has the results of the IFF estimation where the latter has the estimations of the IER. To estimate the FIML estimations, we used STATA 11 'biprobit' command which is applicable for the recursive bivariate probit framework when one of the dependent dichotomous variable appears as a regressor for the main probit equation (Fabbri and Monfardini 2008; Park 2009). Both the estimations are checked for robustness.

Table A.3 reports that the model fits the data well ($\chi^2 = 129.77, p < 0.000$) and all the parameters are statistically significant and coherent with the results of Table A.2. Here the access to micro-credit and migration decision have been

[11] For the purpose of regression authenticity, we tested for the validity of such instrument and it passes the orthogonality requirement.

jointly determined in which the correlation coefficient of the error terms ρ is statistically different from zero, where the estimate of ρ is -0.78 with a standard error of 0.13. The Wald statistics for the test of the hypothesis that $\rho = 0$ is 10.2. For a single restriction, the chi-squared critical value is 3.84, so the hypothesis that $\rho = 0$ is soundly rejected. Table A.4 also shows similar estimations where the $\rho = -0.76$ and highly statistically significant and the Wald test rejects the null hypothesis. The likelihood ratio test for the same hypothesis leads to a similar conclusion. Which implies that the error terms of the equations jointly estimated varies together hence the bivariate endogenous dummy model appears to be the appropriate setting for drawing some consistent inference on the impact of access to micro-credit on migration. Moreover, the sign of the ρ is negative which indicates that it is more likely for the individuals to consider the option of not accessing the the micro-credit and to opt for temporal seasonal migration during the lean period after the influence in the included factors is accounted for. In the recursive bivariate probit model, the conditional marginal effects is more intuitive than the typical marginal effects. Using the IFF model, the predicted probability that a person seasonally migrates given that (s)he already have prior access to micro-credit is 87.04 percent at the reference point. STATA estimation of marginal effects are the summation of the direct and the indirect effects of the regressors. Combining direct and indirect effects, an additional increase in the size of the family from 5 persons, the conditional predicted probability of migration increases by 6.5 percent, holding all other variables constant at their reference points.

Now, focusing on the main coefficient of interest γ which is found to be positive and highly significant in both of the estimations. The estimation of γ is positive which implies that, net of observable and unobservable confoundings, people with prior access to micro-credit is more likely to migrate seasonally during the lean period. Given the framework of the existing micro-credit contracts, such finding makes perfect sense. If the head of the household has already accessed micro-credit through other member of the family during the productive time of the year, the other family member is still liable for repaying the weekly installments even in the lean season when the chief bread-earner is in jobless status. Hence in such case, the best option for that head of the household is to migrate in the lean season and send remittances back home to repay the loan. However, due to such rigid loan repayment rule of MFIs with constant equal weekly payments with a high interest rate, the consequence of accessing micro-credit during the non lean period becomes a serious problem in the lean period. During the lean period, it is extremely difficult for the poor to generate income, let alone comply with their loan repayment scheme. Hence, such an option becomes less attractive

and the negative and significant ρ confirms that not accessing micro-credit and migrating temporarily during the lean period is the more preferable strategy for the poor households, which also explains why the take up of micro-credit is so low in this region.

6. Concluding Remarks

One important caveat of this research is the use of the small sample size due to the availability of limited funding during the time of the study. However, using a much larger dataset, a recent article by Khandker et al. (2010) confirms that most of our findings align with their report which also demonstrates the robustness of our study. We found that economic and individual characteristics all play an important role in migration decisions. Among the economic factors, seasonal unemployment and wage difference have significant effects. Personal characteristics such as sex, age, farm occupation, the role of networks and previous migration experience, are all significant at less than the 5% level of significance.

This study has found systemic differences between seasonal migration and permanent internal migration. To the author's knowledge, existing empirical studies on permanent internal migration have found significant positive impacts of education on migration. In this study, we find a reverse relationship. Seasonal migration is temporary in nature and, as a result, individuals who have relatively better education will tend to choose permanent over temporary migration.

This study has found evidence that temporary internal migration in the lean period is an efficient coping strategy that individuals in rural areas use to overcome income shock in the lean period. However, seasonal migration is not an efficient long-term sustainable solution to the seasonal downturn and natural shocks suffered in the agriculture sector vis-à-vis village level poverty. Temporary migration can provide short-time economic benefits to migrants, their families and their villages but such movements may not be possible over the years.

Micro-credit schemes have increased opportunities for rural people to have access to the informal credit market. One could reasonably assume that individuals who have direct or indirect access to micro-credit (through family members) could be involved both firm and non-firm activities and less likely to suffer from seasonality hence less likely to migrate during the lean period. However, our result suggest that people with prior access to micro-credit is more likely to migrate seasonally during the lean period. Furthermore, we found that individuals prefer the option of not accessing the the micro-credit and opt for temporal seasonal migration during the lean period. The main reason for such finding is deep rooted

in the micro-credit framework. MFIs have a very strict policy of loan repayments and usually collect repayment on a weekly basis. As a result, if the male member of the household takes credit during the lean period, he will lose his mobility and cannot undertake migration due to the strict repayment rules. In many cases, the credit is received by the female member of the household but is used by the male member who migrates to the urban areas during the lean season and sends remittances to repay the loan. However, we have to consider that not all borrowers of micro-credit is capable enough to use this strategy and there exists a sizable number of female headed households, elderly and disable people who will be restricted to migrate if taken credit. Thus MFIs should consider relaxing the loan repayment scheme during the lean period, as this would help to increase rural incomes and the ability to repay loans. Moreover, the results suggest that MFIs and governments should provide more support on adult education and the development of diverse skills (both non-agricultural and agricultural) as well as support in providing job related information and credit facilities which will help poor migrants during lean seasons and thus alleviate the social problems associated with seasonal migration in a sustainable way.

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Appendix A. Appendix

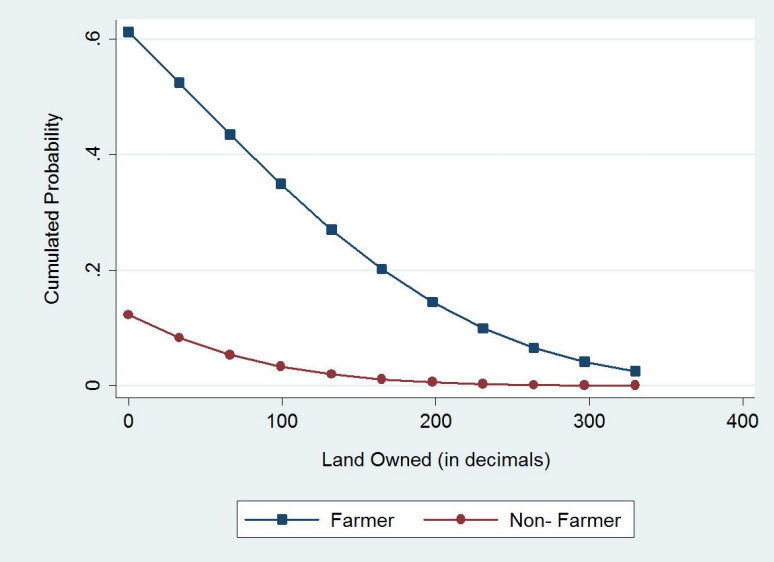

FIGURE A.2: Cumulative predicted probabilities based on household land ownership

TABLE A.1: Descriptive statistics

	Migration decision (Migdec = 0)		Migration decision (Migdec = 1)		Full sample	
Variable	Mean	SD	Mean	SD	Mean	SD
Previous migration experience (d)	0.078	0.269	0.885	0.320	0.634	0.482
Kinship at the migration destination (d)	0.056	0.230	0.730	0.445	0.521	0.500
Sex (1 if male)	0.767	0.425	0.955	0.208	0.897	0.305
Occupation Dummy (1 if farm occupation)	0.256	0.439	0.570	0.496	0.472	0.500
Access to Micro-credit (d)	0.233	0.425	0.175	0.381	0.193	0.395
Social security (d)	0.100	0.302	0.145	0.353	0.131	0.338
Total amount land (in decimals)	26.839	50.301	15.600	29.719	19.088	37.610
Education (zero if no education)	0.600	0.493	0.350	0.478	0.428	0.496
Seasonal hardship (d)	0.556	0.500	0.620	0.487	0.600	0.491
Age (in years)	37.567	12.028	40.540	12.672	39.617	12.531
Marital Status (d)	0.722	0.450	0.690	0.464	0.700	0.459
Income in the normal period (in taka, per week)	73.689	45.042	64.175	28.096	67.128	34.464
Income in the lean period (in taka, per week)	50.944	45.548	61.850	40.871	58.466	42.599
Observation	90		200		290	

Note: (d) stands for dummy variable

TABLE A.2: Univariate probit model

	Reduced form equation		Structural form equation					
Dependent variable			Model 1		Model 2		Model 3	
Migration decision	Coefficients	Marginal effects	Coefficients	Marginal effects	Coefficients	Marginal effects	Coefficients	Marginal effects
Land ownership (d)	-0.448	-0.033	-0.419	-0.024	-1.556***	-0.045	-0.991**	-0.025
	(0.321)	(0.033)	(0.335)	(0.025)	(0.549)	(0.035)	(0.409)	(0.023)
Size of household	0.246**	0.017	0.245**	0.013	0.276**	0.004	0.273**	0.005
	(0.100)	(0.010)	(0.112)	(0.009)	(0.133)	(0.004)	(0.137)	(0.005)
Seasonal hardship (d)	1.036***	0.094**	1.127***	0.084*	2.234***	0.109*	1.849***	0.083*
	(0.354)	(0.046)	(0.377)	(0.043)	(0.602)	(0.057)	(0.499)	(0.050)
Age dummy (d)	0.438	0.037	0.717**	0.057	0.377	0.007	0.837**	0.028
	(0.339)	(0.036)	(0.355)	(0.044)	(0.397)	(0.011)	(0.408)	(0.028)
Sex (d)	1.763***	0.364**	1.668***	0.289	4.006***	0.845***	2.763***	0.492*
	(0.483)	(0.178)	(0.572)	(0.194)	(0.980)	(0.163)	(0.835)	(0.274)
Farm occupation (d)	1.157***	0.085**	1.377***	0.084**	1.693***	0.038	1.658***	0.044
	(0.364)	(0.040)	(0.392)	(0.042)	(0.458)	(0.031)	(0.422)	(0.035)
Education (d)	-0.829***	-0.067*	-0.705**	-0.044	-0.717**	-0.013	-0.628*	-0.014
	(0.312)	(0.039)	(0.317)	(0.028)	(0.336)	(0.014)	(0.331)	(0.015)
Migration experience (d)	3.351***	0.597***	3.661***	0.623***	4.233***	0.547***	4.256***	0.583***
	(0.418)	(0.081)	(0.492)	(0.082)	(0.643)	(0.110)	(0.646)	(0.101)
Kinsmen (d)	2.374***	0.259***	2.568***	0.250***	3.448***	0.220***	3.325***	0.224***
	(0.417)	(0.061)	(0.435)	(0.068)	(0.713)	(0.068)	(0.640)	(0.074)
$\log(Y_m)$			2.336***	0.124*				
			(0.611)	(0.068)				
$\log(Y_n)$					-5.922***	-0.087		
					(1.572)	(0.087)		
$\Delta \log \hat{Y}$							3.028***	0.054
							(0.726)	(0.053)
Constant	-5.231***		-8.691***		-1.086		-7.719***	
	(0.890)		(1.396)		(1.569)		(1.590)	
No. of Observations	290	290	290	290	290	290	290	290
Pseudo R2	0.78		0.81		0.84		0.84	
Wald χ^2	90.32		72.15		48.55		50.17	
Log likelihood	-39.554	-39.554	-34.552	-34.552	-28.385	-28.385	-27.712	-27.712
AIC	99.107	99.107	91.105	91.105	78.769	78.769	77.424	77.424
BIC	135.806	135.806	131.473	131.473	119.138	119.138	117.793	117.793

Note: Values in the parentheses are the reported standard errors of the estimates. (d) stands for discrete change of dummy variable from 0 to 1. Marginal effects have been calculated at the mean. Significance code: ***1%, ** 5%, * 10%.

TABLE A.3: Endogenous Bivariate probit with identification by functional form

Migration Equation	Bivariate Probit		Marginal effect		
	Coefficient	S.E.	Coefficient	S.E.	$\overline{X}$
$\Delta \log \hat{Y}$	3.050***	(0.683)	0.873	(0.604)	0.042
Land ownership (d)	-0.883***	(0.342)	-0.321**	(0.137)	0
Size of household	0.281**	(0.120)	0.065	(0.052)	5
Seasonal hardship (d)	1.826***	(0.414)	0.760***	(0.133)	1
Age dummy (d)	0.596*	(0.355)	0.430*	(0.221)	1
Sex (d)	2.220***	(0.827)	0.869***	(0.135)	1
Farm occupation (d)	1.593***	(0.390)	0.664***	(0.149)	1
Education (d)	-0.499*	(0.299)	-0.185	(0.138)	0
Migration experience (d)	3.927***	(0.578)	0.130	(0.137)	0
Kinsmen (d)	2.830***	(0.559)	0.130	(0.137)	0
Access to Micro-credit (d)	1.725***	(0.444)	0.783***	(0.166)	1
Constant	-7.341***	(1.476)			
Access to Micro-credit Equation					
Land ownership (d)	0.255	(0.189)	-0.321**	(0.137)	0
Size of household	-0.090	(0.067)	0.065	(0.052)	5
Seasonal hardship (d)	-0.272	(0.196)	0.760***	(0.133)	1
Age dummy (d)	0.463*	(0.244)	0.430*	(0.221)	1
Sex (d)	0.731**	(0.298)	0.869***	(0.135)	1
Farm occupation (d)	-0.337*	(0.190)	0.664***	(0.149)	1
Education (d)	0.049	(0.196)	-0.185	(0.138)	0
Migration experience (d)	-0.310	(0.210)	0.130	(0.137)	0
Kinsmen (d)	0.091	(0.218)	0.130	(0.137)	0
Social Secuirity (d)	1.406***	(0.224)	0.101	(0.103)	0
Constant	-1.397***	(0.519)			
Error terms correlation $\widehat{\rho}$	-0.783***	(0.128)			

No. of Observation = 290

Log-Likelihood: $-144.458, \chi^2(21) = 129.77, P > \chi^2 = 0.000$

Wald test for $\widehat{\rho} = 0, \chi^2(1) = 10.2, P > \chi^2 = 0.001$

Note: (d) stands for discrete change of dummy variable from 0 to 1. Significance code: ***1%, **5%, *10%.

TABLE A.4: Endogenous Bivariate probit with identification by exclusion restriction

Migration Equation	Bivariate Probit		Marginal effect		
	Coefficient	S.E.	Coefficient	S.E.	$\overline{X}$
$\Delta \log \hat{Y}$	3.041***	(0.693)	0.881	(0.669)	0.042
Land ownership (d)	-0.757**	(0.346)	-0.336**	(0.146)	0
Size of household	0.279**	(0.121)	0.081	(0.066)	5
Seasonal hardship (d)	1.769***	(0.420)	0.778***	(0.132)	1
Age dummy (d)	0.611*	(0.361)	0.257	(0.209)	1
Sex (d)	2.225***	(0.823)	0.842***	(0.154)	1
Farm occupation (d)	1.565***	(0.389)	0.722***	(0.144)	1
Education (d)	-0.530*	(0.299)	-0.215	(0.149)	0
Migration experience (d)	3.931***	(0.620)	0.137	(0.164)	0
Kinsmen (d)	2.801***	(0.581)	0.137	(0.164)	0
Access to Micro-credit (d)	1.670***	(0.529)	0.753***	(0.226)	1
Constant	-7.335***	(1.471)			
Access to Micro-credit Equation					
ER X Total land	-0.002	(0.006)	-0.000	(0.001)	6.46
ER X Age	0.304	(0.242)	0.061	(0.072)	1
ER X Size of household	-0.103*	(0.061)	-0.017	(0.019)	5
ER X Level of Education	0.266	(0.200)	0.038	(0.045)	0
ER X Seasonal Hardship	-0.169	(0.200)	-0.025	(0.034)	1
ER X Sex	0.729**	(0.292)	0.182	(0.155)	1
ER X Firm Occupation	-0.313	(0.208)	-0.043	(0.050)	1
ER X Migration experience	-0.307	(0.220)	-0.061	(0.074)	0
ER X Kinsmen	0.031	(0.225)	0.005	(0.037)	0
ER X Social Security	1.566***	(0.253)	0.106	(0.121)	0
ER X Flood	-0.123	(0.230)	-0.022	(0.045)	0
ER X River erosion	-0.059	(0.249)	-0.010	(0.044)	0
Constant	-1.148***	(0.247)			
Error terms correlation $\widehat{\rho}$	-0.763***	(0.172)			

No. of Observation = 290

Log-Likelihood: $-142.248, \chi^2(23) = 132.62, P > \chi^2 = 0.000$

Wald test for $\widehat{\rho} = 0, \chi^2(1) = 5.93, P > \chi^2 = 0.015$

Note: ER stands for Exclusion Restriction. (d) stands for discrete change of dummy variable from 0 to 1. Significance code: ***1%, **5%, *10%.