

**Migration and household decision on occupational choice and investment:
Evidence from Bangladesh**

Marup Hossain ^{a,b}, Gülcan Önel^a and Conner Mullally^a

^a Food and Resource Economics Department, University of Florida, Gainesville, FL 32611

^b Corresponding author (maruphossain@ufl.edu)

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Migration and household decision on occupational choice and investment: Evidence from Bangladesh*

Marup Hossain, Gulcan Onel, Conner Mullally†

Abstract

We study the roles of migration and remittances along with other income sources on investment decisions in rural Bangladesh. We estimate households' investment equations conditional on their participation in and income from alternative (farm and non-farm) activities in the context of household's current endowments and existing market structures. Using a true household-level panel data from rural Bangladesh covering 2000, 2004, and 2008 with 1223 sample points, we estimate the effects of migration and remittances on household's investment in own cultivated land, land rent out to other households, livestock and non-farm business capital. Results show that remittances decrease household own cultivated land and also decrease land rent out to other households. We explain this result by controlling households labor endowments, education status and existing market imperfections. Our results also show that female headed households overall invest less in self-employment activities when they receive remittances. We find that remittances have little investment effects in general which is expected result given the overall low productive investment rate of remittance receiving households in Bangladesh.

JEL classification: D43, E22, F22, F24, O12.

Keywords: Migration, remittances, market imperfection, investment.

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† Hossain [Food and Resource Economics Department, University of Florida: maruphossain@ufl.edu]; Onel [Food and Resource Economics Department, University of Florida: gulcan.onel@ufl.edu]; Mullally [Food and Resource Economics Department, University of Florida: connerm@ufl.edu].

1. Introduction

International migration is an important source of employment and remittances for many developing countries. Currently, more than 3.4 percent of the world population lives outside of their birth countries. Total remittances received by developing countries reached to \$432 billion in 2015 (World Bank 2016). Although a large number of studies focus on the effects of migration and remittances on household consumption, poverty and inequality, there are only a few studies that focus on household occupational choice and investment decisions. While some studies find positive investment effects of migration and remittances on household investment (e.g., Dustmann and Kirchkamp 2001; Woodruff and Zenteno 2007 and Yung 2008), others find no impact (Durand et al. 1996; Taylor et al. 1996; De Brauw, Rozelle 2008; and Castelhana et al. 2015). Additionally, existing studies on investment choices do little to explore the mechanisms through which migration and remittances can affect household occupational choice as well as investment decisions

Migration and remittances will change household investment and sectoral choice decisions if labor markets or financial markets are imperfect. In the presence of imperfect or missing labor market, migration may lead to reduced self-employment activities by household members because of an inability to use hired labor in place of household labor. In addition, remittances may loosen liquidity constraints and enable greater investment in productive activities. Lastly, remittances can serve as insurance for household members remaining in the origin country, flowing back to the household when shocks occur. In contrast, if markets are perfect and separability of household consumption and production decisions holds, migration and remittances will only affect household labor allocations and consumption decisions.

We study the effect of migration and remittances on household investment decisions given their occupational choices in rural Bangladesh. It covered 62 villages from 57 districts out of 64 total districts in Bangladesh. Our study is based on 1,223 households for which we have information for all three rounds. We consider four investment options for the household based on the data we have: cultivating own land, renting out land, investing in livestock capital and investing in business capital. We estimate effects of income from different activities –namely, agricultural work, non-agricultural, wage labor and remittances (predicted) on investment choices. We account for sample selection problem in both income and investment equations and the endogeneity of migration decisions.

Existing studies show that migration and remittances in Bangladesh have significant positive effects on poverty reduction, food expenditure and agricultural inputs and technologies adoption in Bangladesh (Mendola 2008; Raihan et al. 2009; Sharma and Zaman 2009). However, our study has several advantages over existing studies. First, we study the role of migration and remittances on investment choices in Bangladesh using a unique panel data set. Second, we attempt to link the investment choices with sectoral shift in Bangladesh economy where role of the farming sector is declining and role of non-farming sector is growing over time. Third, we use different market imperfection characteristics to explain migration and remittances effects. An important aspect of migration in Bangladesh is that predominantly male members of the households engage in international migration, which in turn raises the proportion of female members in the origin households. The average number of female members in a household that sends international migrant(s) is 2.93 compared to 2.53 male members. This observation brings another dimension to household's decision making process. Along with incomplete markets mentioned earlier, changed managerial capacity due to migration may play an important role in household's decisions on investment and how to utilize remittances received from migrant members. If household's managerial capacity changes because remaining female members lack managerial skills or supervisory capacity, then we can expect an additional channel through which migration alters investment decisions at home. In the context of Bangladesh, typically female members who are left in the origin households cannot move freely to supervise farming or business activities outside of homestead area, mostly because of the social norms (Jaim and Hossain 2008). As a result, households with female headship or less male members may alter their investment decisions.

Our findings show that remittances affect household's own land cultivation. We also find that remittances are complementary to investment loans and help households with limited access to credit increase their farm investments. Female headed households with remittances income seem to invest less in non-farm self-employment activities.

2. Migration, investment and sectoral choices

Impacts of migration and remittances on household's investment decisions and sectoral choices, if any, depend on whether the separable agricultural household model³ (Singh, Squire and Strauss 1986) assumption hold or not. In other word, migration and remittances will alter the investment

³ Migration will increase household use of hired labor and remittance will affect consumption. It implies that the production and investment decisions will remain unchanged.

and sectoral choice decisions if the prediction of the new economics of labor migration (NELM) holds. NELM states that migration and remittances will affect the activity choices and production decisions in incomplete market environments. Several types of incomplete market environments such as labor, credit and insurance markets can affect household's investment and sectoral choice decisions. Household self-employment activities both in farming and non-farming sectors can fall in the presence of imperfect or missing labor market. Self-employment activities can fall because household's may not be able to substitute the lost migrant labor by hired labor either because of unavailability of labor or the hired labor is not perfect substitute of the forgone migrant labor. In case of imperfect credit market, on the other hand, remittances can relax household's credit constraint and can increase investment in different sectors. In such case sectoral choice will depend on returns from alternative sectors and also on other markets structures. Finally, in case of missing insurance market, remittances can insure households in the event of shock and can induce households to diversify the investment decisions and to take riskier investments.

Household labor usage status in the pre-migration period can affect the investment decisions. Migration and remittance's effects will be stronger for those households who were self-sufficient with family labor compare to the households who used to employ both family and hired labor and those who used to employ only hired labor in pre-migration period. We can also check whether the existing credit market is adequate for household investment purposes. If we see that remittances increase household investment for those who already have loan from institutional sources, it will imply that the existing credit supply is not commensurate to the credit demand. Household's market participation status can also affect post migration investment choices. For example, households those produce only for subsistence consumption are more self-insured to price and other shocks relative to the households who sell produced goods in markets. Household that sell goods in markets have volatile income depending on the output market structures. These different self-insured status effect household investment and sectoral choices after receiving remittances.

In addition to the above markets imperfections, there are some other channels that can affect household's investment decisions in the post migration periods. First, household's residual members and their knowledge level about different activities can affect post migration investment choices. If the origin household left with no or few members who can operate farming and non-

farming activities or they have less knowledge and supervision capabilities, we would expect investments in certain kinds of activities to decrease. In the context of Bangladesh, usually the female members are left in the origin households who cannot move freely to supervise farming or business activities outside of homestead area because of the social norms (Jaim and Hossain 2008). As a result, household with female headship or less male members can change their investment decisions as well.

The existing literatures support NELM predictions that migration and remittances affect household production, investment decisions and sectoral choices. For example, migration affects crop production (Rozelle et al. 1999), stimulate crop and possibly self-employment activities (Taylor et al. 2003) and increase non-farm income generating activities (Arslan and Taylor 2012). They can also effect investment decisions as we mention in the introduction. Different mechanisms through which migration may affect household investment decisions are not typically explored in these studies. We aim to fill this gap with a comprehensive analysis of linkages through which migration affects origin household's investment decisions.

3. Data

We use a three-round panel data on rural households in Bangladesh. Data set is representative of the rural Bangladesh and the same households were tracked over years to study the dynamics of rural livelihoods in Bangladesh. The earliest round of the survey that was conducted in 1988 is skipped in this study due to very low count of migrant-sending households in that year. We use the three rounds of the survey conducted in 2000, 2004 and 2008. A multi-stage random sampling approach was adopted to assure that the sample represented the population of the rural Bangladesh. At the first stage, 62 villages were randomly selected from 57 districts of Bangladesh. A village level census was carried out to get information about land holdings and land tenancy status of all households. Later, all households were classified into four land groups and two tenancy groups. Final sample was determined by using a stratified random sampling technique from all groups. Number of households included in the survey was 1,888 in 2000, 1,927 in 2004 and 2,010 in 2008. Some households were lost over the years and a large number of households were broken into new households over time. We use 1,223 households that we could trace through then end of the third round with no missing data.

Around 66 percent of the total population of Bangladesh lives in rural areas (World Bank, 2015) where agriculture is the main source of employment and income generation (Garrett and Chowdhury, 2004). Non-farm sector has been emerging over time and currently accounts for more than 40 percent of all rural employment and more than 50 percent of total rural income (World Bank, 2004). Unlike other developing countries, the non-farm sector in Bangladesh owes its growth to pull factors, such as productivity growth and higher non-farm wage rates, rather than the push factors⁴ (World Bank, 2004). International migration has become an important source of employment and remittances from abroad have become an integral part of total income in Bangladesh. Since official starting of overseas employment from 1976, out-migration and remittances have been both steadily increasing in Bangladesh and contributing to the sectoral transformation in rural areas.

Table 1 shows summary statistics by households' migratory status. About 11 percent of the households had at least one international migrant member in 2008. This ratio was 8 percent in 2004 and 7 percent in 2000. Households who have migrant members abroad are more female headed compared to the households with no migrant members. This change in the gender decomposition of the household may influence occupation and investment choices at home.

[Insert table 1 here]

Table 1 also shows that households who send out migrant are, on average, better off in terms of income levels and asset holdings. They have significantly higher income from farm and non-farm work but their income from wage employment is lower. Wage labor is not a permanent and high returning income source; it is also not seen as a lucrative profession in terms of social status in Bangladesh. These it is expected that migrant household will have lower wage labor income compare to non-migrant households. Table 1 also reveals that households with migrant members hold significantly higher amount of land; they both cultivate and rent out higher amount of lands. There may be different reasons for the origin households to rent out more to other households. It may be that remaining household members switch to non-farm activities. In addition, households sending migrants seem to be on average more educated and larger in size than households that do not have migrant members.

⁴ Pull factors are those attract the individual or group to shift from the current activities and push factors are those force the individual or group to move from the current activities.

4. Empirical methodology

We consider three alternatives investments for rural Bangladeshi households including land, livestock and non-farm business investment. Household's land allocation, which they can use to cultivate themselves or rent out to the other households, represents their farming activities. Any change in the land allocation potentially reflects a sectoral shift away from the farm sector onto non-farm sector. We use land holdings instead of actual farm investment because Bangladeshi households spend a large portion of remittances for home construction and land purchase after food and non-food expenditures. Bangladesh Bureau of statistics (BBS) (2013) show the details expenditure patterns of remittances and it shows that actual input expenditure in farming activities is very low. We instead consider land holding amount (hectare), livestock capital value (BDT) and business capital value (BDT) in our study. We use a household model proposed by de Janvry and Sadoulet (2008) that consider multiple market failures in household decision-making process. The basic model is as follows,

$$\max_{c_t, q_t, m_t, s_t} E \sum_t \beta^t u(c_t; z_c) \quad (1)$$

Outcome variables are the consumption vector c_t , the production vector q_t , the input vector x_t , the vector of marketed surpluses m_t (they are negative in case of a purchase), and the vector of savings s_t (they are negative in case of borrowing), for each year t . Equation 1 shows that household's objective is to maximize the expected utility which is a function of consumption (c) and household characteristics (z_c) subject to the following constraint.

$$\sum_i^n [((p_{it}^m - t_{pit}^v) \delta_{it}^v + (p_{it}^m + t_{pit}^a) \delta_{it}^a) m_{it} - t_{fit}^v \delta_{it}^v - t_{fit}^a \delta_{it}^a] + T_t + s_t = 0, \quad \forall t, \quad (2)$$

Equation (2) shows that household's marketable surplus net of transaction costs, other incomes (T) which consist of remittances (R), wages (W) and any other income earnings, and savings (S) sum to zero. The effective sale price is market price (p^m) net of variable transaction cost (t_p^v) and effective purchase price is market price (p^m) plus the variable transaction cost (t_p^a) paid. Households also need to bear a fixed transaction cost, t_f^v or t_f^a , to participate into market. For each of the N good or factor i , sales are defined by $\delta^v = 1$ and $\delta^a = 0$, and purchases are defined

by $\delta^v = 0$ and $\delta^a = 1$. In our case both farming and off-farm business income will come from marketed surplus portion of the constraint.

$$q_{it} + x_{it} + E_{it} - m_{it} - c_{it=0}, \quad i = 1 \dots N, \quad \forall t, \quad (3)$$

$$m_{kt} \leq \bar{M}_{kt}, \quad k \in K, \quad \forall t, \quad (4)$$

$$G(q_t, x_t; z_{qt}) = 0, \quad \forall t, \quad (5)$$

$$A_{t+1} = (1 + r_t)(A_t + s_t), \quad \forall t, \quad (6)$$

$$A_t \geq A_{\min}, \quad \forall t, \quad (7)$$

$$c_{it}, q_{it}, x_{it} \geq 0, \quad i = 1 \dots N, \quad \forall t. \quad (8)$$

Equation (3) specifies the equilibrium between supply and utilization of each of these products or factors adjusting the initial endowment (E). Market participation constraint is shown in equation 4 where \bar{M}_{kt} is the value of constraints from good k . Equation (5) is production function relating output, input and fixed production factors (z_{qt}). Equation (6) shows the law of motion of the (unproductive) asset A which depends on the yield r_t and annual savings s_t . Equation (7) show the constraint on the level of indebtedness. Finally, equation (8) is the non-negativity constraints. The model presented here boils down to separable household model if the there are no risk averseness (equation 1), transaction cost (equation 2), participation constraint (equation 4), and credit constraint (equation 7).

If any of the constraints are true, then household production and consumption decisions are not separable. Hence migration and remittances will affect household's investment decisions and can also induce households to change the sectors. On the other hand, if none of the constraints given in equations (3) to (8) are true, remittances will work like an alternative source of income and will be uncorrelated with other income sources. As a result, its only impact will be on household's consumption and not on production or investment decisions. Given household participation in different investment activities j based on vector X characteristics, we can present a reduced form equation to show the determinants of alternative investments.

$$I_{jt} = \gamma_o + \sum_{k=1}^{n-1} \gamma_k Y_{kt} + \gamma_n R_t + \gamma_{n+1} X + \varepsilon_{jt} \quad (9)$$

Where I is the investment in sector j where $j = 1 \dots n$, Y is household income from sectors k with $k = 1 \dots n-1$, R is remittances and X is the vector of household and market characteristics. The

hypothesis $\gamma_n = 0$ will help us testing whether the separable household model or NELM prediction hold.

We find in Table 1 that households with migrant members are significantly better off in most of the outcome variables. It implies that only a selective group of households decide to go for migration and as a result only a selective group of household receive remittances. These estimating equation (9) by ordinary least square (OLS) method will cause bias in parameter estimates if selectivity problem is not addressed. We use the following approaches to get unbiased estimations, in the first stage, we estimate household income equations with sample selection correction. Selectivity correction is needed because not all households participate in all income generating activities. In the second stage, we estimate investment equations controlling for the selectivity corrected incomes (predicted) estimate in the first stage. Selectivity correction is needed in the second stage as well because not all households invest in every investment option. We can define the latent income participation decision as,

$$\begin{aligned} S_{it} &= \mathbf{1}, \text{ if } I_{it} = \theta X + \epsilon \geq 0 \\ &\mathbf{0}, \text{ if } I_{it} = \theta X + \epsilon \leq 0 \end{aligned} \quad (10)$$

$$\begin{aligned} Y_{it} &= Y_{it}, \quad \text{if } I_{it} = 1 \\ &= 0, \quad \text{if } I_{it} = 0 \end{aligned} \quad (11)$$

where S_{it} is indicator for household's participation status. Household participation in an income activity depends on vector of X characteristics. Y_{it} is the income earned from a particular income generating activity which is realized only if the participation condition in equation (10) holds. We estimate equation (10) by a fixed effect probit model. We estimate inverse mills ratio (IMR) coefficients from the probit regressions for each outcome variable equations, such that

$$IMR_{it} = \frac{-\phi(\theta X)}{\Phi(\theta X)} \quad (12)$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ denote the normal probability density and cumulative distribution functions, respectively. The selectivity corrected regression model for income determination is as follows,

$$Y_{it} = \beta X_{it} + \alpha_i + IMR_{it} + \epsilon_{it} \quad (13)$$

where Y_{ij} is the income level from each activity j at time t in household i . X is a vector of household level characteristics. α_i is the household level fixed effects and IMR_{ij} is selectivity correction term for each activity. In equation (11), we control for the number of migrant members in the family as one of the independent variables since it is a main determinant of remittances and may also affect income earned from other activities. This raises an endogeneity issue because there can be some unobservable characteristics in ε_{it} that affect both migration and household income. We use a fixed effect two stage least square (2SLS) method using village level migration network as an instrument for household migration to solve the endogeneity problem.

The last step of the empirical analysis is to estimate investment equations. For investment decisions, we follow a similar econometric approach. We first estimate the selection equations for different types of investment choices (same as equation 10), and obtain inverse mills ratios (same as equation 12). Then we estimate the following investment equations,

$$I_{ij} = \beta_j \widehat{Y}_{ij} + \delta X_{it} + \alpha_i + IMR_{ij} + \varepsilon_{it} \quad (14)$$

where I_{ij} is the investment level in choice j at time t in household i . X is a vector of household level characteristics. α_i is the household level fixed effects and IMR_{ij} is selectivity correction term for each activity. \widehat{Y}_{ij} is the predicted income each activity obtained from equation (13).

5. Empirical results

5.1 Determinants of alternative income-generating activities and resulting incomes

Table 2 shows determinants of household participation in different income generating activities. income choices. Distance from nearest business or administrative center which reflects the remoteness of where household live, decrease the probabilities of participating (non-farm) self-employment and international migration but increases wage labor participation. A household that lives near to a business center may have more opportunities for participating in non-farming activities and more access to information about migration. The higher the numbers of household members who are at working age, the higher the probability of participation in farming or migration. Agricultural work is historically done by family labor in Bangladesh, therefore, we expect that household with more labor will involve more in farming. Having a female household head is associated with a higher probability of sending member(s) abroad for work and with a

lower probability of participation in wage employment. Household head's education level positively affects chances of household participating in farming and non-farm self-employment activities but decreases probability of involving in wage employment. Table 2 also reveals that households with lower access to loan are more likely to participate in non-farm self-employment and wage employment activities.

[Insert table 2 here]

Table 3 gives the results of income equations in equation (13). As expected, households with more migrant members earn more remittances and less wage labor. It has two implications, first, it may imply that migrant members were involved in wage labor activities before migration and hence, after the migration remittances increased but wage labor income decreased. Second, it may imply that household engage more in self-employment activities in the post-migration period and leave wage labor jobs. We find that female headed households have significantly lower income levels from all types of employment activities. Household head's education has significant positive effect on non-farm self-employment income. The more the amount of land the household has, the more that household earns farm and non-farm income and remittances. Having more land at the margin also decreases income from wage employment. We use predicted income computed from estimation results in table 3 to explain household's investment patterns in the next parts.

[Insert table 3 here]

5.2 Alternative investment options

Table 4 shows factors determining household's investment options (owned-land, rented-out land, livestock capital, and business capital). We find that predicted agricultural income significantly increases the probabilities of owning more land for cultivation by themselves, renting out to other households and investing in livestock capital. Land allocation among own-land cultivation and partially renting out is more likely for households that have to incur high supervision cost if they were to cultivate all land. Instead, household can rent out a plot that is far from their homestead and increase the total returns to land. Household earning more non-agricultural income are more likely to rent their land out to other households. We find that an increase in remittances only affects the probability of renting land out more to other households.

[Insert table 4 here]

Table 4 also shows that the village characteristics relevant to farming activities such as, the percentage of irrigated land in the village, significantly increase the probability of participating in own land cultivation and decreases the probability of land rented out. The land elevation status reduces the probability of renting the land out and instead increases the probability of investing in livestock capital. As expected, the more remote the village, the more is the higher the probability that households will invest in livestock capital and lower the probability of renting the land out. An increase in the number of farming family members, not surprisingly, significantly increases the probability of cultivating own land and decrease the probability of renting out land to other households. On the other hand, an increase in the number of non-farming members in the household increases the probability of that household investing in business capital. Household members' education level is not a significant factor in determining participation in any investment alternatives, except that education of non-farming members increases the probability of investing in business capital. We find that female headed household are less likely to be involved in own land cultivation. Access to loan from institutional sources increases the probability of own land cultivation, livestock and business capital and decreases the probability of renting out land to other households. Finally, we find that foreign migration network significantly decreases the probabilities of both renting out land and also investing in livestock capital.

5.3 Resulting investments

After estimating the participation in different investment options and correcting for the selection bias, we estimate the determinants of the levels of investment in each type. Table 5 presents the estimated coefficients of investment equations. We estimate 3 alternative sets of independent variables and introduce them in regression model in step wise method. We follow a step wise method to see effect of different sets of variables those reflect different hypothesis. At first, we only control time effect and predicted income variables (column 1-4). In second step, we control household member, education level, access to loan and headship information (column 5-8). Finally, we control a set of interaction variables all with all previous variables (column 9-12).

In step 1, we find that an increase in (predicted) level of agricultural income significantly increases the amount of land cultivated by the households and investment both in livestock capital and business capital. It also increases the amount of land rented out to other households. This finding implies that increased agricultural income earned by the households facilitates household's

ability to diversify investment among several alternatives, including non-agricultural investment. We also see that income earned from non-farm self-employment activities encourages the household to rent land out to the other households implying that those households may be drifting away from agricultural work as they earn more non-agricultural income. An increase in wage income decreases the amount of land rented out. This may be an indication of the association between low-income status of households and their propensity to cultivate land by themselves. Finally, we find that an increase in remittances received by the households leads to an increase in the amount of land rented out but it has no statistically significant effect on the levels of other investments.

[Insert table 5 here]

When we control additional set of variables related to household's endowments in step 2, we find that effect of all the income variables remain more or less same as before. However, non-agricultural income increases land rent out and migration income now has no significant effect on own land cultivation. Our result show that an access to institutional loans significantly increases livestock and business capital and significantly decreases land rented out. The implication here is that access to institutional loan enable households to be more self-employed. Number of working members has a positive and significant effect on investment; number of farming members increases the amount of cultivated land by the household and decreases land rented out. An increase in the number of non-farming household member increases investment in business capital. Education of non-farming members has a positive significant impact on the level of investment in business capital while the education level of wage labor in the households is associate with an increase in the amount of land they keep for worn cultivation. If we compare migration and remittances effects on household's investments in step 1 and 2, we find that in step 1, they have significant effects but after controlling household endowments and some market related variables (access to loan) in step 2, there is no significant effects on own cultivated land. It implies that migration and remittances effects household investment decision conditioned on other characteristics.

Effect of different income variables remain same like step 2 when we control additional interaction variables in step 3. We find that female headed households who also receive remittances rent out more land compared to other households. It may be an indication that female

headed households divert from self-employment activities when receiving remittances from the migrant member. Those households who already have access to credit and also receive remittances increase the amount of own cultivated land and rent out less land. Same households, on the other hand, will invest less in business capital. Household who used to only utilize family labor for farming activities and now receive remittances, will rent out more land and also decrease the amount of own cultivated land and business investment. Households who cultivate only for subsistence consumption and receive remittances increase cultivation on their own land.

6. Discussion and conclusion

We find that international migration has negative effect on farming activities. However, when we control endowments and other market related variables, we find no significant effects. It implies that migration and remittances effect household investment behavior through other household and market related characteristics. Thus our result supports the prediction of NELM that migration effect household investment.

Our results indicate that female headship has no significant implication by itself on household investment decisions. However, female headed household who also receive remittances start renting out more land to other households instead of cultivating by themselves. These origin households with female headship are also less likely to involve in self-employment activities. Some studies back this finding up, stating that female headed households exhibit less yield rate due to reasons such as lack of access to extension, lack of experiences (Tiruneh et al. 2001; Horrell and Krishnan 2007). Historically women's involvement in self-employment activities is low in Bangladesh because of traditional Muslim society norms. Jaim and Hossain (2008) show that women's participation in work force us typically limited to livestock and poultry sectors where they spend only 0.91 hour per day. They also find that women's participation in crop farming is only 3.85 percent compared to the 53 percent participation rate for males. Therefore, we expect that a female headed household who receives remittances may be further reducing their involvement in self-employment activities due to positive income effect.

Another important finding for the sectoral reallocation and investment decisions in rural Bangladesh is that access to institutional credit services has significant effect on households' investment decisions. Access to credit positively affects farming, livestock, and business capital

investments. This is not surprising since these credits are designed for productive purposes. We introduce an interaction term to observe the joint effect of both credit access and remittances receipt. If the coefficient on this interaction term turns out to be positive and significant, it may signal the incompleteness of credit markets in rural Bangladesh. Result show that joint effect of credit access and remittances is positive on amount of own cultivated land, and negative for land rented out and business capital investment. Therefore, remittances seem to be complementary to institutional loans for farming activities; however, remittances likely substitute institutional credits for those households who want to invest in business capital.

One important finding is that agricultural income is invested in all types of investment, including own land, rented out land, livestock, and business capital. Agricultural sector has been the main driver of the economy of Bangladesh over long years, but its share in gross domestic product (GDP) is 16.1 percent (World Bank 2015) for the period 2011-2015. There is a tendency for Bangladeshi farm households to diversify their income generating activities and use farming as a means to switch to non-agricultural activities and investment (Sarker, Mandal and Kleinke 2013; World Bank 2008; Khandker and Samad 2014). Households diversify their economic activities to manage risk, cope with income shocks and perhaps to gradually exist from farming.

Overall, we conclude that remittances have some effects on households' participation in alternative income-generating activities and their investment decisions in rural Bangladesh. The likely reasons for this are market imperfections, risk averseness, and efficiency of female headed households. To get an idea on how receiving households spend their remittances income, we look at Survey on use of remittances (SUR, 2013) by Bangladesh Bureau of Statistics. Survey shows that only 25 percent of household receiving remittances engage in any type of investment, and 75 percent of these investments are for constructing a house for dwelling purposes. It also shows that only 33 percent of the total remittances are invested in non-agricultural options. This implies that rural households use most of their remittances income for consumption rather than investment.

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Findings:

Table 1 Summary statistics

VARIABLES	2000			2004			2008		
	Migrant household	Non-Migrant household	Mean Difference	Migrant household	Non-Migrant household	Mean Difference	Migrant household	Non-Migrant household	Mean Difference
Sex of Household head (Female=1)	0.29	0.03	0.253***	0.34	0.04	0.293***	0.31	0.09	0.224***
Farming members	0.94	0.81	0.130	0.60	0.59	0.007	0.67	0.62	0.052
Non-farming members	0.01	0.03	-0.022	0.25	0.18	0.073	0.11	0.19	-0.077*
Wage labor members	2.73	2.10	0.629***	0.01	0.15	-0.144***	0.01	0.18	-0.161***
Working member (farming+non-farmi+labor)	3.81	3.11	0.699***	2.48	2.07	0.412***	2.09	2.12	-0.028
Education of household head (years)	5.30	3.92	1.379***	4.62	3.83	0.794*	4.53	4.00	0.526
Average education of farming members	3.70	2.86	0.847*	2.19	1.90	0.296	2.73	2.04	0.691**
Average education of non-farming members	0.05	0.13	-0.085	1.39	0.78	0.609**	0.51	0.86	-0.345
Average education of wage labor members	2.13	1.46	0.668***	0.03	0.11	-0.087	0.03	0.14	-0.110**
Livestock capital (BDT)	8,078	6,228	1,850*	8,597	7,636	961	17,758	16,753	1,004
Business capital (BDT)	16,356	13,788	2,568	22,293	11,591	10,702	37,992	20,703	17,289
Rent out land(Hectare)	0.48	0.14	0.347***	0.36	0.14	0.219***	0.30	0.16	0.142***
Own cultivated land(Hectare)	0.36	0.35	0.010	0.45	0.33	0.110*	0.39	0.32	0.069
Agricultural Income(BDT/Yearly)	30,326	19,602	10,723**	36,738	25,560	11,177***	43,556	37,016	6,540
Wage Income(BDT/Yearly)	761	6,057	-5,296***	2,044	7,844	-5,799***	3,917	15,026	-11,108***
Non-agricultural Income(BDT/Yearly)	25,944	21,92	4,023	44,928	23,362	21,566***	27,407	28,546	-1,139
Foreign remittances (BDT/Yearly)	73,890	0.00	73,890***	73,840	0.00	73,840***	146,963	0.00	146,963***
Have an institutional loan (Percentage)	0.14	0.28	-0.138***	0.11	0.34	-0.230***	0.15	0.43	-0.275***
N	80	1,143		95	1,128		137	1,086	

Table 2 Household's activity participation

VARIABLES		Agriculture	Non-agriculture	Wages	Remittance (foreign)
	2004	0.469*** (0.140)	0.124* (0.0637)	0.582*** (0.0712)	0.365** (0.168)
	2008	0.745*** (0.162)	0.113* (0.0640)	0.555*** (0.0717)	0.855*** (0.167)
Irrigated land in the village(percent)		-0.00219 (0.00240)	-0.00167 (0.00116)	0.00110 (0.00142)	-0.00194 (0.00295)
High land in the village(percent)		-5.97e-05 (0.00226)	-0.00334*** (0.00113)	0.00150 (0.00140)	-0.000412 (0.00314)
Clay land in the village(percent)		-6.62e-05 (0.00283)	-0.00121 (0.00131)	-0.000374 (0.00162)	0.00233 (0.00347)
Distance from nearest sub-district (Miles)		0.0291 (0.0182)	-0.0266*** (0.00832)	0.0235** (0.0102)	-0.0410* (0.0233)
Working members in the family		0.466*** (0.0697)	-0.00672 (0.0213)	-0.0259 (0.0241)	0.206*** (0.0491)
Sex of household head (Female=1)		-0.0452 (0.216)	-0.132 (0.117)	-0.785*** (0.140)	2.298*** (0.266)
Education of household head (years)		0.112*** (0.0232)	0.0992*** (0.00819)	-0.125*** (0.00956)	0.0297 (0.0199)
Amount of loan (BDT)		0.0632 (0.145)	0.371*** (0.0638)	0.169** (0.0706)	-0.737*** (0.190)
Foreign migration network		0.787 (3.147)	-3.409** (1.454)	-8.545*** (1.820)	34.68*** (3.541)
Constant		0.890*** (0.325)	0.304* (0.156)	-0.169 (0.186)	-4.685*** (0.501)
Insig2u		-0.314 (0.349)	-0.337*** (0.119)	0.249** (0.110)	1.065*** (0.222)
Observations		3,612	3,612	3,612	3,612

Table 3 Determinants of alternative incomes

VARIABLES		Agriculture	Non-agriculture	Wages	Remittance (foreign)
	2004	8,793*** (1,556)	8,749*** (2,983)	6,840** (2,939)	1,288 (2,571)
	2008	15,828*** (1,832)	10,580*** (3,539)	14,763*** (3,327)	10,485*** (3,557)
Working aged members in the family		871.3 (643.8)	-367.9 (720.6)	690.8** (314.8)	960.0 (1,300)
Sex of household head (Female=1)		-9,443** (4,464)	-11,016* (6,040)	-6,888*** (2,606)	-6,976 (8,364)
Education of household head (years)		369.6	5,122***	-754.4	-587.3

	(346.4)	(1,788)	(596.9)	(552.5)
Amount of loan (BDT)	199.6	21,462***	398.9	-11,066***
	(1,658)	(6,401)	(912.7)	(3,781)
Own land (hectare)	36,325***	4,414*	-2,391***	5,997**
	(1,835)	(2,469)	(897.1)	(2,988)
Foreign migration	9,946	11,598	-38,462*	255,588***
	(21,464)	(36,832)	(20,429)	(48,214)
IMR	48,566**	90,645***	9,638	12,795***
	(22,400)	(33,291)	(7,024)	(4,766)
Constant	-44.82	-63,564**	-1,908	-63,707**
	(3,631)	(28,521)	(5,025)	(25,185)
Observations	3,612	3,612	3,612	3,612
R-squared	0.224	0.036	0.117	0.064

Table 4 Participation in alternative investment options

VARIABLES	Own land	Rent out land	livestock capital	Business capital
Predicted agricultural income	0.0202***	0.0265***	0.0117***	0.00527
	(0.00353)	(0.00311)	(0.00287)	(0.00335)
Predicted non-agricultural income	-0.0128	0.0356***	-0.00312	0.000938
	(0.00983)	(0.00896)	(0.00891)	(0.0110)
Predicted wage income	-0.0129	-0.0846	0.0597	0.00263
	(0.0582)	(0.0520)	(0.0504)	(0.0654)
Predicted foreign remittance	-0.00217	-0.0141*	0.00829	-0.000868
	(0.00858)	(0.00767)	(0.00741)	(0.00965)
2004	0.688***	-0.0126	0.353*	-0.806***
	(0.243)	(0.214)	(0.213)	(0.274)
2008	0.404	0.261	0.00882	-1.240
	(0.742)	(0.655)	(0.643)	(0.836)
Irrigated land in the village(percent)	0.00741***	-0.00367**	0.00448***	-0.00128
	(0.00169)	(0.00150)	(0.00151)	(0.00180)
High land in the village(percent)	0.00199	-0.00780***	0.00399**	-0.00541**
	(0.00222)	(0.00202)	(0.00200)	(0.00246)
Clay land in the village(percent)	-0.00132	0.00123	-0.00617***	-0.00471**
	(0.00182)	(0.00160)	(0.00163)	(0.00199)
Distance from nearest sub-district	0.0203	-0.0430***	0.0493***	-0.0276
	(0.0166)	(0.0150)	(0.0150)	(0.0182)
Farming members	1.365***	-0.302***	0.523***	-0.170**
	(0.0874)	(0.0727)	(0.0699)	(0.0833)
Wage labor members	-0.0141	-0.00458	0.0259	0.00407
	(0.0556)	(0.0501)	(0.0492)	(0.0583)
Non-farming member	-0.194	-0.253*	-0.0634	2.398***
	(0.124)	(0.148)	(0.118)	(0.211)
Average education of farming members	-0.0108	0.0166	-0.0108	0.000392
	(0.0131)	(0.0116)	(0.0116)	(0.0140)
Average education of wage labor members	0.0439	0.0763**	0.158***	0.0388
	(0.0344)	(0.0316)	(0.0321)	(0.0350)
Average education of non-farming members	0.0143	0.0292	-0.00222	0.137***

Sex of household head (Female=1)	(0.0517) -1.123**	(0.0507) 0.274	(0.0514) 0.0733	(0.0645) -0.422
	(0.452)	(0.397)	(0.393)	(0.507)
Amount of loan (BDT)	0.348***	-0.425***	0.298***	0.452***
	(0.101)	(0.0966)	(0.0886)	(0.114)
Foreign migration network	-1.829	-8.640***	-4.212*	-2.546
	(2.678)	(2.440)	(2.382)	(2.961)
Constant	-1.353***	-0.618	-1.632***	-0.630
	(0.437)	(0.392)	(0.376)	(0.485)
Insig2u	0.287**	-0.0628	0.120	0.249
	(0.124)	(0.131)	(0.114)	(0.158)
Observations	3,612	3,612	3,612	3,612

Table 5 Investment Equations

VARIABLES	Own land	Rent out land	Livestock capital	Business capital	Own land	Rent out land	Livestock capital	Business capital	Own land	Rent out land	Livestock capital	Business capital
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2004	-0.083*** (0.014)	-0.022* (0.012)	-299.48 (616.79)	4,460.62 (3,827.16)	-0.081* (0.048)	0.057 (0.037)	1,790.33 (2,227.21)	-42,062*** (12,225.49)	-0.084* (0.048)	0.061 (0.037)	1,241.48 (2,250.76)	-41,820*** (12,313)
2008	-0.173*** (0.044)	0.065* (0.034)	5,703*** (1,761.89)	15,822.63 (10,172.44)	-0.358** (0.144)	0.352*** (0.115)	7,596.39 (6,251.48)	-82,379** (35,999.45)	-0.386*** (0.145)	0.375*** (0.116)	5,773.00 (6,323.50)	-79,923** (36,342.64)
Predicted agricultural income	0.012*** (0.001)	0.012*** (0.000)	131.46*** (23.21)	371.81*** (126.79)	0.013*** (0.001)	0.015*** (0.001)	170.65*** (30.68)	701.48*** (167.36)	0.013*** (0.001)	0.015*** (0.001)	170.98*** (30.81)	714.86*** (167.78)
Predicted non-agricultural income	-0.002 (0.002)	-0.003** (0.001)	89.62 (71.02)	14.94 (415.63)	-0.000 (0.002)	0.013*** (0.002)	-18.54 (101.29)	-14.49 (581.243)	-0.000 (0.002)	0.013*** (0.002)	-17.02 (101.33)	42.39 (580.77)
Predicted wage income	-0.004 (0.004)	-0.026*** (0.003)	128.63 (171.79)	93.72 (882.41)	0.013 (0.011)	-0.062*** (0.009)	307.42 (485.96)	4,263.15 (2,772.58)	0.015 (0.011)	-0.063*** (0.009)	431.08 (490.40)	4,221.78 (2,797.02)
Predicted foreign remittance	-0.001** (0.001)	-0.003*** (0.001)	6.28 (26.25)	52.24 (139.62)	0.001 (0.002)	-0.009*** (0.001)	35.40 (69.79)	609.85 (398.28)	0.002 (0.002)	-0.009*** (0.001)	55.58 (70.67)	638.13 (403.22)
Household head (Female=1)					0.098 (0.096)	-0.016 (0.072)	-3,280.98 (3,900.55)	20,672.44 (22,330.85)	0.104 (0.109)	-0.078 (0.083)	92.58 (4,526.17)	31,388.15 (25,775.32)
Have any institutional loan					0.039** (0.020)	-0.217*** (0.020)	2,984*** (952.94)	15,206*** (5,680.31)	0.022 (0.021)	-0.204*** (0.021)	2,622*** (1,004.25)	18,722*** (5,864.73)
Foreign migration network					-1.002 (0.669)	-3.520*** (0.589)	-25,178.92 (30,726.91)	123,980.68 (165,230)	-1.298* (0.681)	-3.335*** (0.602)	-25,141.08 (31,274.08)	218,002.89 (168,629)
Household man power												
Farming					0.119*** (0.020)	-0.136*** (0.014)	3,414*** (1,011.61)	-4,341.62 (3,776.06)	0.119*** (0.020)	-0.132*** (0.014)	3,240*** (1,019.09)	-4,481.12 (3,783.90)
Wage labor					-0.014 (0.010)	0.023*** (0.008)	-428.55 (444.42)	-880.47 (2,472.08)	-0.014 (0.010)	0.023*** (0.008)	-508.79 (448.56)	-962.95 (2,486.27)
Non-farming					-0.016 (0.026)	-0.059*** (0.022)	-1,452.91 (1,116.94)	51,368*** (9,545.61)	-0.016 (0.026)	-0.055** (0.022)	-1,514.91 (1,117.29)	50,275*** (9,537.24)
Average education level of man power												
Farming					-0.000 (0.003)	0.003 (0.002)	52.46 (108.19)	-1,013.85 (622.36)	-0.000 (0.003)	0.003 (0.002)	42.73 (108.41)	-968.05 (622.72)

Wage labor					0.017***	0.030***	843.21**	-750.87	0.017***	0.029***	802.05**	-943.98
					(0.006)	(0.005)	(392.99)	(1,500.11)	(0.006)	(0.005)	(394.56)	(1,499.25)
Non-farming					0.005	0.007*	56.85	6,600***	0.006	0.006*	63.34	6,457***
					(0.005)	(0.004)	(194.74)	(1,349.61)	(0.005)	(0.004)	(194.72)	(1,348.77)
Female* Remittance									-0.000	0.000	-0.099	-0.37
									(0.000)	(0.000)	(0.072)	(0.41)
Loan * Remittance									0.000***	-0.000*	0.062	-0.57**
									(0.000)	(0.000)	(0.045)	(0.25)
Family labor* Remittance									-0.181***	0.182***	-3,103.94	-30,981**
									(0.061)	(0.049)	(2,653.39)	(15,170.37)
Consumption only* Remittance									0.113**	-0.136***	1,304.19	-22,429.29
									(0.057)	(0.046)	(2,485.12)	(14,183.09)
IMR	-0.087***	0.117***	-3,766***	-21,469***	0.070**	0.530***	7,723**	25,554***	0.070**	0.513***	7,236.27**	24,564.***
	(0.018)	(0.023)	(1,428.468)	(2,521.671)	(0.032)	(0.037)	(3,493.300)	(7,304.214)	(0.032)	(0.038)	(3,510.76)	(7,305.76)
Constant	0.254***	-0.034	3,675.87	38,104***	-0.130	-0.742***	-7,664.80	-66,025***	-0.130	-0.703***	-7,733.94	-67,278***
	(0.051)	(0.046)	(2,454.62)	(12,031.07)	(0.088)	(0.092)	(5,551.00)	(23,750.13)	(0.088)	(0.092)	(5,568.85)	(23,895.5)
Observations	3,612	3,612	3,612	3,612	3,612	3,612	3,612	3,612	3,612	3,612	3,612	3,612
R-squared	0.236	0.266	0.203	0.044	0.258	0.333	0.214	0.073	0.265	0.342	0.216	0.077