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How Does Contract Design Affect the Uptake of Microcredit among the Ultrapoor? Experimental Evidence from River Islands of Northern Bangladesh[*]

Kazushi Takahashi [a], Abu Shonchoy [a], Seiro Ito [a], Takashi Kurosaki [b]

[a] *Institute of Developing Economies-Japan External Trade Organization (IDE-JETRO)*

[b] *Institute of Economic Research, Hitotsubashi University*

Abstract:

Despite the professed claims of microcredit for poverty alleviation, little is known about what kind of credit contract is suitable for extremely poor households or the ultrapoor. To fulfil this knowledge gap, we initiated a field experiment in river islands of northern Bangladesh, where a substantial portion of dwellers belong to the ultrapoor due to cyclic floods. We randomly offered four types of loans to such dwellers: regular small loans in cash with one-year maturity, large cash loans with three-year maturity with and without a one year grace period, and in-kind livestock loans with three-year maturity with a one year grace period. We compared their uptake rates as well as the determinants of uptake and found that the uptake rate is lowest in the regular contract, followed by the in-kind contract. Contrary to prior belief, we also found that the microcredit demand of the ultrapoor is not necessarily small and in particular the ultrapoor are significantly more likely to join the program if a grace period with longer maturity is attached with a relatively large amount of credit, irrespective of whether the credit is provided in cash or kind. This paper provides evidence that a typical microcredit with one-year maturity without a grace period is not attractive for the ultrapoor. Microfinance institutions may need to think of longer maturity loans with convenient grace periods, without compromising the loan repayment schedules, to

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fulfill the need of the ultrapoor.

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1. Introduction

It is widely recognized that the lack of access to the formal financial market is among the major impediments for poor households in developing countries to improve their livelihoods (Kono and Takahashi, 2010). One of the recent innovations for poverty alleviation has been the emergence of microcredit, which provides a small amount of collateral-free loans to low-income households, who have been deemed to be unbankable. Based on the success of high repayment rates worldwide, the number of microfinance institutions (MFIs) has increased rapidly, and as of 2010, they attracted more than 205 million clients in the world (Maes and Reed, 2012). In 2006, a microcredit front-runner, the Grameen Bank, and its founder, Professor Yunus, were awarded the Nobel Prize for Peace for their contribution to the reduction of poverty.

Despite the growing enthusiasm, however, recent rigorous empirical studies have shown that microcredit is not the silver bullet for poverty reduction (Karlan and Zinman, 2011; Banerjee et al., 2013; Creon et al., 2013; Roodman and Morduch, 2014). In particular, many existing studies point out that the poorest of the poor, or the ultrapoor, have been excluded from microcredit services (Morduch, 1999; Navajas et al., 2000; Duong and Izumida, 2002; Copestake et al., 2005; Cuong 2008). For example, Copestake et al. (2005) find that microcredit programs in Zambia are not reaching the extremely poor, but are targeting mainly households at the upper margins of poverty or even households above the poverty line. Similarly, Navajas et al. (2000) conclude that five MFIs in Bolivia work with households just above and just below the poverty line, but not with the extremely poor.

One mooted cause of the limited microcredit access among the ultrapoor is the heterogeneity in returns. While the existing studies show high average returns to capital

in self-employed- or micro-enterprises on which most microcredits are placed (Udry and Anagol, 2006; de Mel et al., 2008; Fafchamps et al., 2014), de Mel et al. (2008) find that returns are significantly different with client's entrepreneurial ability and their household wealth. Banerjee et al. (2013) also argue that not every client can benefit from microcredit and that impacts on income are positive only for households with an existing business or those who manage to start business. Targeting exclusively the ultrapoor in India, Morduch et al. (2013) find that the ultrapoor microcredit programs result in neither significantly greater total income nor asset accumulation of its clients. These together imply that the expected returns to credit could be lower for the ultrapoor, who are characterized by less experience or less willingness to participate in self-employed activities due to risk aversion as well as a lack of entrepreneurial ability. As a result, microcredit may not be an attractive tool for the ultrapoor and they may exclude themselves. These are demand-side constraints in participation.

Another potential reason is the existence of a flypaper effect, whereby "capital coming directly into the business sticks there, but cash does not" (Fafchamps et al., 2014). The case of Ghana shows that returns to credit are significantly higher if it is provided by in-kind rather than in cash (Fafchamps et al., 2014). This implies that the credit is partly used for outside of microenterprises because money is fungible, even though MFIs often require clients to use their loans only for business purposes (Karlan and Zinman, 2012). If that is the case, the default risk of the ultrapoor, who would demand cash more for making daily ends meet rather than for productive investment to expand business, may be substantially greater, which prevents MFIs from providing the credit to the ultrapoor. Moral hazard may be also severer for the ultrapoor if they are more mobile than the moderately poor and non-poor because of their lack of immobile

assets. With these supply- and demand-side constraints, the ultrapoor have long been excluded from microcredit services despite the professed goal of microcredit to improve the welfare of the poor.

Given the limited access to microcredit, the ultrapoor mostly rely on informal money lenders or social networks in time of need. Therefore, surprisingly litte is known as to how the ultrapoor demand microcredit. According to Field et al. (2013), more risk-averse clients benefit more if there is a grace period in the repalyment schedule. Hulme (1999) discusses that the poorer clients are more likely to drop-out from microcredit sevices if a large amount of loans is offered. Do these observations imply that a microcredit contract with a smaller amount and/or with a grace period induces a higher probability of paricipation among the ultrapoor? Alternatively, do the ultrapoor demand large scale loans from the beginning if there is non-convexity in technology and they need to have a lumpy investment at the beginning of the project to move them out of poverty traps (Galor and Zeira, 1993; Lybbert and Barrett, 2010)?

Although there exist some studies that explore how microcredit contract designs affect repalyment rates and returns to credit (de Mel et al., 2008; Fields and Pande, 2008; McKenzie and Woodruff, 2008; Field et al., 2013; Fafchamps et al., 2014; Gine and Karlan, 2014; Shonchoy and Kurosaki, 2014), there is little work that has examined the differential participation rates by the microcredit design, especially among the ultrapoor. The existing studies, if any, only show possible covariates with drop-out without clearly distinguishing dropouts, defaulters and graduates (Hulme, 1999; Siliki, 2012). Unlike the previous studies, our study focuses on whether or not the respondents accept to participate in the study and microcredit services before actual loan distribution. This effectively excludes the possiblity that those who reject our offer are the ones who

fail to repay loans and thereby are forced to leave or the ones who graduate from microcredit with success, enabling us to focus only on the attractiveness of the credit designs. To explore this issue in detail, this paper employs microdata generated from our randomized controlled trial in river island areas in northern Bangladesh, where periodic floods and land erosion severely affect the livelihood of its dwellers, making the majority of the population vulnerable and poor.

More specifically, we introduced the following four treatment arms. The first treatment arm is the regular microcredit program with a small loan amount, which requires clients to start repayment two weeks after receiving the loan within a usual maturity of one year. The second treatment arm provides a loan amount of three times the regular program with a loan maturity of three years. The third treatment arm adjusts the second one, giving borrowers a grace period of one year before they start repaying but with the same maturity period of three years (effectively repaying in two years). The last treatment arm is the in-kind loan with necessary services to implement a microenterprise project using the investment. This arm has the same features with the third arm except for the difference that the loan is provided in kind. The designated investment in kind is a cow, as it was suggested by numerous members of NGOs and other community based organizations in the study site as the most popular and plausibly the only viable investment option for the borrowers of a microfinance program. In comparison with small livestock animals such as goats, cows are more versatile in flood prone areas than goats, while they require the maximum of just one year to start giving milk, which corresponds to the length of a grace period provided under the third and fourth treatment arms. As necessary services to supplement the cow investment, animal fodder, veterinary services, training program, and marketing consultancy services were

also provided. It is expected that the in-kind credit program thus designed would overcome the problem of the lack of entrepreneurial experiences and ability of the ultrapoor.

Our results show that the uptake rate is lowest in the regular contract, followed by the in-kind contract. It is also found that the microcredit demand of the ultrapoor is not necessarily small and in particular the ultrapoor are significantly more likely to join the program if a grace period with longer maturity is attached with large scale loans, irrespective of whether the credit is provided in cash or kind.

The rest of the paper is organized as follows. Section 2 explains the study site, sampling framework, and detailed designs of the randomized microcredit contract experiment. Section 3 discusses summary statistics of the sample households. Section 4 outlines the estimation strategy, followed by discussion on estimation results. Section 5 concludes the paper.

2. Study Settings

2.1. Study Area

The study has been conducted in the river island areas, known as "*Char*" in Bengali, of northern Bangladesh in Gaibandha and Kurigram districts. *Chars* are formed by sediments and silt depositions, and are prone to cyclical river erosion and floods. *Chars* are, by nature, not stable in its size and even in its existence, and the episodes of partial or complete erosion or sub-merging of *Chars* are quite common in Bangladesh. *Chars* absorb the habitants of ultrapoor households who are forced to relocate as a desperate attempt for survival across islands due to river erosion and floods. Seasonal floods periodically happen during the wet seasons as monsoon precipitation swells the river

together with glacier melting of the Himalayas, causing heavy down-stream in-flows of water that passes through the rivers of Bangladesh to reach the Bay of Bengal.

The major mode of transportation in *Char* areas is a boat. Boast services are un-organized, infrequent, and vulnerable with bad weather conditions. Due to the poor transportation infrastructure, few governmental services, like health and education, are available. Under-nutrition is widespread and mostly caused by inadequate diet, poor sanitation, and lack of knowledge on hygiene. Primary schools on *Chars* are rare, and where schools are run by NGOs or international humanitarian agencies, they are under poor management and suffer from severe problems of teachers' shortage and absenteeism (Marks and Vignon, 2008). Local government departments are in dearth with hardly any presence of law enforcement authority and protection against crime and robbery. Access to regular market is extremely limited for *Char* dwellers. Provision of national grid-based electricity is rare as hardly any *Char* has been properly electrified by the Rural Electrification Board of Bangladesh. Even microfinance services are rare on *Chars* despite the fact that Bangladesh has widespread network of MFIs in northern Bangladesh (Khandker, 2005).

2.2. Sampling Strategy

The sampling of our survey consists of a two-stage process; at the first stage we selected *Chars* and villages, and at the later stage we selected households. We discuss the detailed procedure of the sampling strategy below.

***Char* selection:** *Chars* could be categorized as island, peninsula, and bridged *Chars* based on its connection with river banks. The present study mainly concentrated on

island *Chars*, which are completely detached from river banks.[1] We initially used Landsat images to identify sample *Chars*. Given that *Chars* are not stable, we needed to use the most recent images (April, 2012) before the time of the baseline survey (September-October, 2012). By visual inspection, we counted the number of *Chars* over the image and inspected all *Chars* by field visits. Figure 1 shows the number of points on the Landsat image where GPS coordinates were measured to have rough location information of each *Char*. Upon a field visit, our counterpart NGO, Gono Unnayan Kendra (GUK)[2] sent their local area staffs who identified the name of each *Char* and the existence of villages on the *Char*. GUK provided us with a list of all the villages over the points shown in the image (Figure 1).

Once we identified *Chars*, we collected detailed information of existing program coverage or development assistants run by different NGOs or humanitarian agencies in different villages on those *Chars*. Our aim was to select only those villages where no microcredit activities by any other MFIs pre-existed. It turned out that, it is not difficult to find *Chars* without any microfinance services, as most of the MFIs of northern Bangladesh target their clients predominantly from the mainland areas. We found a small number of *Char* villages to have some NGO coverage that was mostly operating non-financial activities, such as education or health, or disaster-related relief and support activities. We put particular attention not to select any village that is under the existing coverage of the Chars Livelihoods Program (CLP) that makes similar attempts

[1] Peninsula *Chars* are divided by small, perennial streams or sometimes even merely connected to river banks when the water level is low. Bridged *Chars* are a type of island *Chars* lying next to river bank and are connected by an earthen passage.

[2] GUK is an NGO with 28 years of experience of doing development and microfinance activities in northern Bangladesh and one of the very few NGOs that works directly with *Char* dwellers.

to our interventions.[3] Through these procedures, we have collected information of 128 *Chars* that fulfilled our selection criterion, and out of this list, we randomly selected 80 *Chars*, stratified based on the distance to nearby boat stations.

Household selection: Household selection was done in two steps. In the first step, employing the participatory rural appraisal (PRA) method with the help of local elites, religious leaders and staff members of GUK, we listed all the households under each village and ranked them according to their wealth categorization (non-poor, moderately poor or ultrapoor) based on GUK's wealth gradation criterion.[4] Then, GUK officials randomly visited the listed ultrapoor households to verify whether the categorization was done accurately and truthfully. After verification and correction by GUK officials, the list was sent to the research team. Typically such process took three working days to complete all the required tasks for one village.

Once we received the list of all the households that reside in a village of a particular *Char*, we separately listed a group of ultrapoor households (UP) and a group of moderately poor households (MP) households. Then in each group, we re-arranged the

[3] The Chars Livelihoods Program (CLP) is an initiative by UK aid through the Department for International Development and the Australian Government (AusAID) to lift the extremely poor households out of poverty, that are living on *Chars* in north western Bangladesh. CLP has designed a packaged grant intervention that consists of asset purchasing fund, stipend and other social interventions, given to beneficiaries selected through eligibility criterion.

[4] The eligibility criterion used by GUK to identify a ultrapoor household is the one: a) without any source of regular income and/or totally dependent on other people; b) exposed to chronic food insecurity, i.e., members of the households often skip meals due to food insufficiency; c) with gross monthly per capita income below Tk. 800 (including own productions and income from other sources); d) without any land or shelter on embankment or other place; e). with at least one family member suffering from malnutrition; f) with at least one family member with disability and/or chronic illness; g) without any livestock or productive assets that generate income. The criterion to distinguish a moderately poor household from the non-poor is similar with higher thresholds than the above.

order of households randomly. These two sequences of household names,[5] which were randomly ordered in a mutually exclusive way, were sent back to GUK to select 14 UP and 6 MP from each village on the *Char*. The group size on each village was kept at 20 to follow the GUK's typical microcredit group size, where loans are distributed with individual liability, but a group is formulated for the purpose of peer monitoring.

Using these random sequences, GUK was instructed to give an eligibility offer of a microcredit group membership to households, and if the household accepts, the household is offered a formal microcredit group membership. If the household rejects, another household is drawn from the ordered-random sequence to be offered a membership. This process is repeated until the target group size of 20 households per village is secured, with 14 UP and 6 MP members. Following this process, we created 80 groups of 20 potential clients each, one group in one *Char* village.

It is important to note that we randomized the eligibility for membership at the household level, not at the village level. So in each village, all UP and MP households had a chance of getting an offer for the microcredit membership. This helps us in estimation to increase the statistical power at the given sample size. Also note that we included both UP and MP households to see the differential impacts of our planned interventions. However, a larger weight was given on UP than MP households, with the ratio of 7 to 3, since the majority of *Char* dwellers belong to the UP wealth category.

After the group formation, a detailed survey (baseline survey) was administered to understand the socio-economic conditions of *Char* dwellers. In the survey, we asked questions on household and personal characteristics, details of land holding and leasing,

[5] By name we mean the eligible female member of the household as GUK microcredit program is given only to women.

durable and non-durable asset information, debt, savings and credit information. The detailed timeline of our survey and sampling steps are given in Figure 2.

2.3. Experimental Design

During the time of the group formation procedure, households were only informed that there would be four different credit products that would be assigned randomly at the group level, but the exact type of credit design and contract were unknown to the group members. Also group members were informed that the credit would be given only to 10 (i.e., 7 UP and 3 MP) randomly selected members (hereafter, treated households) at the initial phase and other members (hereafter, control households) would need to wait at least for a year to receive the credit. It was also explained that the type of credit to be offered to the control households would be the same as the one offered to the treatment households within the same group.[6] Once our baseline survey was completed, we implemented the randomization in two levels: the *Char* and household levels. First, we randomly allocated 80 groups of *Char* villages into one of the following 4 treatment arms (clustered randomization).

1) **Regular microcredit (RC):** The design of this treatment arm is similar with the flagship Grameen-style microcredit lending design, which is widespread in Bangladesh. Under this treatment arm, members of the group will receive 5,600 taka credit with loan repayment to begin after two weeks of the distribution. The amount is approximately 8% of the average annual household income according to our

[6] The objective to have those control households is to create exogenous variations within the group to identify the impact of credit, which will be examined in details in the future research.

baseline survey. Members will repay under a weekly repayment scheme and will be required to meet regularly on weekly meetings as well as to save regularly an amount decided jointly by the group members. The contract maturity of this loan is one year, and if borrowers successfully repaid the due amount following the repayment discipline, they are eligible for another two loan contracts of equivalent amount for the next consecutive years. The required regular weekly repayment for this group is 125 taka, payable in 50 weekly installments.

2) **Large credit, without a grace period (LC):** Under this treatment arm, members of the group will receive 16,800 taka credit with a longer period of loan maturity contract, where the loan repayment begins after two weeks of the distribution. The loan repayment discipline is the same as the RC groups. The contract maturity period of this loan is three years. The required weekly repayment for this group is 125 taka payable in 150 weekly installments (for three years).

3) **Large credit, with one year grace period (LC+GP):** Under this treatment arm, members of the group will receive 16,800 taka credit with loan repayment to begin after one year of the distribution. The loan repayment discipline is the same as the RC groups. However, during the first year grace period, members are required to meet weekly and follow the group activities like compulsory savings. The contract maturity of this loan is three years. The required weekly repayment for this group is 190 taka payable in 100 weeks of installments, starting after one year.

4) **In-kind credit, with one year grace period (IK+GP):** Under this treatment arm, members of the group will be eligible to receive an in-kind credit of cow, within the

price range of 16,000 taka with loan repayment to begin after one year of the distribution. In addition, the members will receive fodder, training on cow rearing, regular VET and vaccination service, and marketing consultancy services from the GUK authority, worth 800 taka for the entire service given for three years. The loan repayment discipline and the contract maturity of this in-kind loan is the same as the LC+GP groups. The required weekly repayment for this group is 190 taka payable in 100 weeks of installments, starting after one year. The detailed design of our randomization protocol and treatment arms is given in Figure 3.

After the clustered randomization for different treatment arms at the village level, we randomly selected 7 UP and 3 MP households for the initial loan distribution (treatment households) from each group. We also kept the rest as waiting members who need to wait for at least a year to become eligible to borrow, but still need to attend weekly meetings (control households).

Once this two-level randomization was completed, we announced the randomization results to our group members and explained that they would need to decide whether to accept the offer or not before the actual loan distribution. On the whole, we have 800 treatment and 800 control households with village level clustered randomization among 4 treatment arms. At this stage, several member households or groups decided to quit from the program. We call this rejection, which we analyze in the rest of this paper.

3. Summary Statistics

3.1. Household Characteristics and Balance Test

Table 1 presents the selected demographic and wealth information of the sample

households, collected before the announcement of the treatment arms and credit eligibility. To examine whether the clustered randomization works, it also compares the means in differences between the RC group (the reference group) and each of the other three groups.

The annual total household income is, on average, 70 thousands taka (equivalent to USD903).[7] Approximately 55% of sample households are classified as poor if we set daily per capita income of 49.56 taka as a poverty line, following the Bangladesh Bureau of Statistics' computation of regional poverty lines used in Household Income and Expenditure Survey in 2010. The majority of *Char* dwellers are actively engaged in wage employment, including temporary migration (Shonchoy and Kurosaki, 2014). Indeed, the predominant source of income of our sample households is wage employment, followed by non-farm enterprises. The role of agriculture is minor partly because less than 1% of the sample households report to own agricultural land and the average landholding is only 0.3 acre and partly because the productivity and cropping intensity are substantially low due to the infertility of the sandy soil and periodic flooding. Livestock and poultry provide the supplementary income to sample households; 48% of the households had ever raised livestock, especially small animals like goats or through a cow leasing informal contract, locally known as "*Adhi*". At the same time, as the average number of current cattle holding, including cow, oxen, and calf, is small (less than one as shown in the table), the percentage contribution of livestock to the total household income is small.

The average household size is slightly more than four with the dependency ratio (the number of household members below 15 and above 65 years old relative to the number

[7] 1 USD is equivalent to 97 BDT as of September 2012.

of household members in between 15 to 64 years old) to be approximately 0.9. The average age of household head is 39 years old and about 91% of them are male. Many household heads have never received the formal education with the average years of completed education well below one year. The sample households live in 5 years in the current location, approximately 70% of which are in the Gaibandha district.

As far as balance tests are concerned, overall balance seems to be achieved, but there are some variables that are significantly different across treatment arms. For example, the average years of education of household heads are highest among the IK-GP group, followed by the LC group, both of which are statistically significantly larger than the RC group. It is also revealed that landholdings, cattle holdings, the value of assets, and several household incomes are also statistically different across the treatment arms. Given that our randomization was at the village level and we have only 80 sample villages, such imbalance may be unavoidable. Given that our main covariates are randomized, covariate imbalance will not result in inconsistent estimates. However, to control for any efficiency loss caused by the imbalance in baseline characteristics, we will include them as control variables in our regression analysis.

It is important to note that the initial participation offer was made before the specifics of the arms were revealed, and all the subjects in our sample accepted to participate at that time. Then we revealed the specific contents of each arm and measured the compliance (accept/reject). So there is no selection by the time of compliance according to the specific contents of each arm, except for the fact that they selected themselves into an unknown microfinance program. This gives us an opportunity to study the ultrapoor's response to various type of microcredit contracts.

3.2. Uptake of the Microcredit Program

Table 2 reports the number and percentage of households by uptake statuses and treatment arms. The top panel shows the total number, while the middle and bottom panels show the number within the treated households that are eligible to receive the credit immediately and control households that should wait for more than a year to become clients, respectively. We presume that the reasons for rejecting the offer will be different between the treated and control households. Namely, the treated households may reject the offer if the offered credit design does not suit their needs, while the control households may reject it if they do not want to wait for a long period, during which they have to attend weekly meetings, in addition to the mismatch of the offered credit design with their demand.

Although we do not know the exact reasons for rejection, in the field, we faced three types of rejection as follows. The first one is the “individual rejection” where a household rejected the offer individually, when the group as a whole continued the program. The second one is the “group rejection” where everyone in the same group collectively rejected the offer. The third one is “erosion and relocation,” where households were not able to join the program because they were affected by erosion and forced to relocate since the early November 2012. Because each erosion-affected household had to find a new location geographically scattered over *Chars*, transaction costs with them became prohibitively high. As a result, we were not able to continue the microcredit program with them. Hence, the first two reasons are a result from voluntary decisions while the last one is rather a result from forced decisions.

A glance at the table establishes that the uptake rate is lowest among the RC group. Among 400 households in this arm, only 226 (56.5%) households remained in the group

after the randomization was announced. Rejection was mostly due to voluntary decisions, in which a relatively high proportion of rejection came from group decisions. The rates for individual rejection are not so much different between the treated and control households within the RC arm. Note that, by construction, group and relocation-forced rejection happened at the group level, such that we have the same rates of rejection from the treatment and control households for these groups.

Interestingly, the second lowest uptake rate observed is among the clients of the IK-GP group (with the uptake rate of only 75%). The vast majority of rejection in this group was due to individual decisions. This is surprising, as our *a priori* conjecture was that given limited investment choices in the study area, in-kind livestock credit should be no less attractive than cash credit. In fact, we obtained an impression from our counterpart NGO that the IK-GP arm can be even more attractive because it can reduce transaction costs to buy livestock animals in the market and can give an opportunity to join training to enhance clients' skills of livestock rearing. However, as is apparent from Table 2, the uptake rate in the IK-GP group is much less than that of the LC and LC-GP groups, and the detailed analysis shows that the differences are statistically significant. By contrast, the difference in uptake between the LC and LC-GP groups seems to be minor and negligible.

In sum, in the bivariate analysis, we found that the uptake rate of the IK-GP arm was greater than the RC arm, but significantly smaller than the other LC and LC-GP arms. Whether we should observe the same tendency, *ceteris paribus*, and if so what factors drive such a result are important questions we address below.

4. Estimation

4.1. Estimation Strategy

Differential type of rejection by treatment arm and other covariates

In order to study more rigorously the attractiveness of each microcredit design and a more general set of determinants of program uptake, we will implement regression analysis. Ignoring for a moment the possibility of forced rejection due to erosion and relocation, household *i* belonging to a borrowers' group can potentially find itself into one of the three exclusive outcomes: (1) the group accepts the treatment arm randomly allocated to it and household *i* also accepts the offer of either the treatment or control status; (2) the group accepts the treatment arm but household *i* rejects the offer of either the treatment or control status; and (3) the group as a whole rejects the treatment arm. Assuming that factors determining the group-level decision making are wholly represented by characteristics of the household only, we can think of U_{ij} as a reduced-form utility of household *i* that chooses one of (1), (2), and (3). If the choice is motivated by utility maximization, this implies:

$$Y_{ij} = 1 \text{ if and only if } U_{ij} = \max\ (U_{i1}, \ldots, U_{i3}), \qquad j=1,2,3$$

$$= 0 \text{ otherwise.}$$

Suppose further that the utility for a given household is comprised of a non-stochastic component, which is a parametric function of explanatory variables, D_{1i}, D_{2i} D_{3i} and X_i, and a stochastic component, e_{ij}, where D_{1i}, D_{2i}, and D_{3i} are the dummy variables representing the LC, LC-GP, and IK-GP groups (the reference is the RC group), respectively; X_i are other control variables that contain the following factors: (1) the dummy equal to one if the household is specified as the ultrapoor; (2) the dummy equal to one if the household is in the treatment group (the reference is the

control group); (3) the years in the current location; (4) land size; (5) the dummy equal to one if the household has ever raised any livestock; (6) the number of owned cattle; (7) the value of assets; (8) the household size and the dependency ratio; (9) a set of household head characteristics, such as gender, age, and years of education; and (10) the district dummy for Gaibandha (the reference is Kurigram district).

If e_{ij} is independently and identically distributed with the extreme value distribution, the above choice equation can be estimated by the multinomial logit model (Maddala, 1983). The probability of $Y_{ij} = 1$ is given by:

$$\Pr(Y_{ij} = 1) = \frac{\exp(\alpha_k^1 D_{1i} + \alpha_k^2 D_{2i} + \alpha_k^3 D_{3i} + X_i \alpha_k^{Xi})}{\sum_{k=1}^{J} \exp(\alpha_k^1 D_{1i} + \alpha_k^2 D_{2i} + \alpha_k^3 D_{3i} + X_i \alpha_k^{Xi})}, \quad j=1,2,3 \qquad (2)$$

where α_k^1, α_k^2, α_k^3 and $\alpha_k^{X_i}$ are a vector of coefficients to be estimated, respectively.

Because drop-out due to relocation and erosion is not a choice variable, we will estimate this without that outcome group. We will, however, test whether the results are robust by the inclusion of that group with an additional choice of relocation.[8]

The empirical model of equation (2) is convenient for testing whether different credit products have different attractiveness for potential borrowers. Alternatively, we can follow the insights of Lancaster (1966) and Berry, Levinsohn, and Pakes (1995) and work on the characteristics space rather than the product space. Using RC as the reference category as before, the three dummy variables of D_{1i}, D_{2i}, and D_{3i} can be transformed linearly into a different set of three dummy variables D_i^{LC} (for large scale

[8] Alternatively, we can convert the "relocation and erosion" group into the "participation" group because group members have agreed to join the program had they not been forced to relocate. The estimation results with this classification are qualitatively similar to the estimation results without this group presented in Table 3 (Columns (1)-(3)) and available from the authors upon request.

loans), D_i^{GP}(loans with a grace period), and D_i^{IK} (in-kind loans): $D_i^{LC} = D_{1i} + D_{2i} + D_{3i}$, $D_i^{GP} = D_{2i} + D_{3i}$, and $D_i^{IK} = D_{3i}$. Then the coefficient on D_i^{LC} shows the difference in uptake attributed to the large credit size relative to RC, the one on D_i^{GP} shows the difference in uptake attributed to the grace period in comparison with no-grace period and the one on D_i^{LC} shows the difference in uptake attributed to the in-kind provision of investment capital and complementary services. The alternative specification has an advantage of clearly showing how potential borrowers evaluate the characteristics of products. Usually, it takes instrumental variables for each characteristic in estimation because characteristics are catered for the potential market demand. However, in our case, arms are randomized so their respective bundled characteristics are also randomly chosen and offered, thereby rendering the instruments unnecessary. As the alternative set of three dummy variables are simply a linear transformation of our default set of three dummy variables corresponding to credit products, we report the results from the alternative specification in appendix only.

Factors associated with rejection in each treatment arm

The multinomial logit model in equation (2) has apparent drawbacks. First, the infamous IIA (independence of irrelevant alternative) assumption could induce logical incoherence. If an individual is choosing between individual participation and individual rejection, adding group rejection can make the individual choice redundant, thereby nullifying the original choice. This is an extreme form of violation of IIA. Second, group rejection cannot be an individual choice unless everyone acts unanimously as if there is only one individual, despite heterogeneity we observe in data. If the group to which household *i* belongs decides to reject the treatment arm as a whole

group, household *i* has no choice but results in the outcome of "group rejection." We cannot observe whether household *i* was willing to accept the offer or not if the group had not accepted the treatment arm. The first point can be relaxed if one uses the mixed logit models, but the second point cannot be remedied by the mere change in parametric specifications. We plan to collect in the field in the near future the information regarding group-level decision making as well as individual-level initial willingness to accept the offer. At this moment, we must leave for further study the theoretical modeling and empirical analysis of interactions among members.

Given this limitation, we instead estimate simpler bivariate models focusing on uptake, ignoring whether it occurred as a result of individual or group decisions. By estimating separate regressions for each treatment arm, where the dependent variable is equal to one if the household accepts the offer and zero otherwise (due to any observed or unobserved reasons), we can deepen our understandings of the uptake rates as well as factors associated with acceptance/rejection. The same explanatory variables, X_i , as above, are used for these regressions, except for the land size, because we noticed that very few households own land and sometimes the land ownership perfectly predicts the outcome status. These separate regressions could encounter the classical selection problem if the households self-select themselves into each treatment arm. However, because of the experimental set-up, the treatment allocation was exogenously determined by the research team. Therefore, these sets of treatment specific separate regressions should yield consistent estimates without worrying for the selection correction. We will again estimate regressions with and without the relocated-forced

dropouts for robustness checks.[9] The whole part of this analysis is implemented with the probit model.

Clustered standard errors at the village level are employed for all regressions to derive statistical inference.

4.2. Estimation Results

Differential type of rejection by treatment arm and other covariates

Table 3 presents the estimation results of the multinomial logit model. The values reflect the marginal effect with respect to a unit change in the regressor for continuous variables and to a discrete change from zero to one for dummy variables. Columns (1) to (3) show the estimated results without the relocation group, while Columns (4) to (7) are those with the relocation group. As is apparent, these results are qualitatively quite similar, so we use Columns (1) to (3) for most statistical inference unless otherwise noted.

One of the most important results we have is that, holding other variables constant, the probability of program participation is statistically significantly higher for all non-regular designs than the RC design, by 19 percentage points for the LC group, 18 percentage points for the LC-GP group, and 12 percentage points for the IK-GP group, respectively. With the inclusion of the relocation dropouts, we do not find any statistically significant difference for the IK-GP group, but the other two groups stand

[9] Table 4 (Columns (5)-(8)) treats the erosion and relocation group as the drop-out. As in the multinomial logit estimates (footnote 8), we additionally run regressions by converting the "relocation and erosion" group into the "participation" group because group members have agreed to join the program had they not been forced to relocate. The estimation results with this classification are qualitatively similar to the results without this group presented in Table 4 (Columns (1)-(4)) and available from the authors upon request.

up to the robustness check. The results generally suggest that the credit demand of the poorer households is not necessarily small, contrary to the standard presumption in the existing literature (Hulme, 1999). Our present study does not tell anything about how a large scale credit induces higher default rates. Yet, the result at least suggests that if MFIs agree to provide the poor with larger loans from the beginning, they will attract more clients from the poorer segment of the society, which would potentially contribute to reduction of extreme poverty. Potentially, this particular finding could reflect the technological characteristics pervasive in our study area: Smaller livestock animals such as goats are riskier due to high morbidity/mortality, while larger livestock animals such as cows have more stable returns, a widely held view by farmers and NGO practitioners.

While the large amount of credit is commonly preferred over the traditional small amount by our sample households, we find that the type of rejection differs within the large amount treatment arms, i.e., LC, LC-GP and IK-GP. The table shows that individual rejection is smaller for the LC group, both individual and group rejections are smaller for the LC-GP group, and group rejection is smaller for the IK-GP group compared with the RC arm. This finding raises another question of why the in-kind credit design only reduces the joint rejection by groups. In all likelihood, the great advantage of cash loan against in-kind loan is the fungibility. On the other hand, the in-kind credit is attractive for those who have too little entrepreneurial capacity to select where to invest. In the end, as the number of the second type of households becomes greater than the number of the first type of households, the cow provision is highly attractive at the group level. In our settings, non-negligible households may prefer fungibility of credit because it may be more useful to cope with climate shocks, but they cannot compose the majority of the group, such that the group rejection is not pervasive

for the in-kind contract.

We previously discussed that being in a control group may create additional reason to reject the offer (dissatisfaction with being forced to wait for a long period). The regression results, however, suggest that the probability of individual rejection is significantly higher if the one is in a treatment group than otherwise. On the other hand, the individual rejection is significantly reduced among the ultrapoor, which may indicate that our overall program designs fit well their demand.

Judging from variables of head's age and its squared, middle-aged (i.e., not too young, and not too old) household heads are more likely to accept our offer and borrow credit. In addition, the head with higher education levels is more likely to join the program and less likely to reject the offer especially as a group. Similarly, the households with larger land size is more likely to accept and less likely to reject the offer as a group. These latter two results may indicate that, given that the majority of heads did not have any formal education and have no land holdings, those with them have stronger power to make a decision in the community.

The contrast shown across treatment arms could be transferred into the contrast across characteristics. Appendix Table 1, panel A, shows that the large credit size is associated with higher probability of staying in the program and lower probability of individual rejection; the grace period is not significantly corrected with rejection or acceptance; the in-kind credit provision is associated with higher probability of individual rejection but lower probability of group rejection. The pattern is consistent with our interpretation of coefficients on the three dummies corresponding to products shown in Table 3.

Factors associated with rejection in each treatment arm

To explore differential factors correlated with uptake by the treatment arms, we conduct the separate regressions using the probit model, results of which are presented in Table 4. Again, the values reflect the marginal effect with respect to a unit change in the regressor for continuous variables and to a discrete change from zero to one for dummy variables. Columns (1) to (4) show the estimated results without the relocation group, while Columns (5) to (8) are those with the relocation group.

It is important to observe that the ultrapoor tend to accept the offer if there is a grace period in the repayment schedules. Indeed, the acceptance rates among the ultrapoor are significantly higher under the LC-GP and IK-GP arms.[10] Although such statistical significance disappears for the LC-GP group with the relocated households, we find robust results for the IK-GP groups. Combined with the previous findings that the overall uptake is higher for the ultrapoor than the moderately poor, the results imply that the ultrapoor are attracted more if they do not have to repay loans immediately after they receive them. Provided that the ultrapoor tend to be more cautious in taking risks, our results are consistent with Field et al. (2013) who find that more risk-averse clients benefit more if there is a grace period in the repalyment schedule.

Consistent with the previous findings, the middle-age household heads are less

[10] Appendix Table 2 shows what factors are associated with the ultrapoor. It shows that those with smaller land size, fewer values of durable assets and female-headed households are more likely to be defined as the ultrapoor by community members. Though we can use more direct measures, such as the poverty dummy equal to one if a household's per capita income in the baseline survey is below a poverty line, to reflect sample's living standards, such a variable is likely to be endogenous. Moreover, many MFIs will not conduct the detailed household survey before opeartion. In order to fit the real conditions, we keep the ultrapoor dummy variable, which is derived from simpler field focus group discussion, in our analysis.

likely to reject the offer, especially in the RC and LC-GP groups. Years of head's education are generally positively correlated with uptake, especially among the RC and LC groups. The latter is an interesting finding as it can indicate the need for cash income earning capacity to join under RC and LC. In particular, we see that livestock holding is also statistically significant at the RC group where the magnitude of education coefficient is largest among all arms. Livestock can provide daily cash flows which can be used for repayment. The traditional microcredit programs utilize the immediate and frequent repayment installments that are generally interpreted as an effective device for monitoring and counteracting present bias (Jane and Mansuri, 2003; Fischer and Ghatak, 2010). It may, however, carry a cost of screening out the clients without regular cash flows. As it is revealed below, education impacts become zero among the treated household subsample, yet the livestock holding for RC remains statistically significant.

It is also found that households in the treated group and residing in the same location for a longer period are less likely to join the LC program.

Experience of livestock rearing induces participation especially in the LC and LC-GP groups. This may be because those who experience livestock production have more concrete projects to invest, such as cow, and/or have better know-hows how to manage. Against our expectation, the probability of acceptance of the IK-GP design is not significantly different between those who have experience of livestock production or not. This is not robust, however, as shown below. Also, the number of current cattle holding does not systematically affect the probability of accepting one of the large credit treatment arms, i.e., the LC, LC-GP and IK-GP groups.

4.3. Heterogeneity Analysis

Our analysis thus far includes both the treated and control households. As repeatedly argued, it is likely that that reasons for rejection differ between the two. As those members who were assigned to be in the control group had additional reasons to reject the program participation and the strength of the main reason (dissatisfaction of staying in the group without obtaining the credit for a year or so) may differ across treatment arms and household characteristics, regressions using only treatment households could offer us a cleaner picture of attractiveness regarding different credit types. In other words, it is possible that the response of treatment households with respect to rejection or acceptance could be highly different from that of control households, which may not be captured by a dummy variable for the treatment household adopted in Tables 3-4. To address this possibility, Table 5 and panel B of Appendix Table 1 show the estimation results of the multinomial logit and probit models for only treatment households without the relocation group.[11] Since the treatment status is randomly assigned to each household within the group, our estimation here does not suffer from a selection problem.

While most results are similar to the previous ones, there are several notable changes. First, the IK-GP arm turns out to be positively and significantly related to individual rejection. Second, among the treated households, female-headed households are more likely to reject the offer individually. Third, if the households have prior experience of livestock rearing, they are less likely to reject the offer. These three findings seem to reflect behavioral consequences when the in-kind credit is offered. As

[11] Estimation results with the relocation group is qualitatively very similar and available from the authors upon request.

can be seen in Column (7) in Table 5, the coefficients on male-headed dummy and experience dummy turn out to be positive and significant in the in-kind treatment arm. In other words, households headed by males and with previous livestock rearing experiences are more likely to accept the in-kind (cow) credit. Since raising livestock requires physical strength, it seems natural that female-headed households do not prefer this form of credit. Female-headed households may also have constraints on market and business linkages to gain from the in-kind treatment. Also, without prior experience of livestock production, livestock credit may be burdensome. These results together suggest that the in-kind livestock credit requires better targeting. Also, the differences between the overall sample and only the treated households reflect that the latter takes the decisions more seriously because they should actually borrow credit once they agree.

5. Conclusion

Given the limited access to credit access for the ultrapoor and the paucity of economic research on the contract form suitable for such households in developing countries, we know little about what kind of credit designs are effective to expand outreach of microcredit to the ultrapoor. To shed light on this issue, we initiated a field experiment in river islands of northern Bangladesh, where a substantial portion of dwellers belong to the ultrapoor due to periodic floods. We randomly offered four types of loans to such dwellers to establish a causal inference: regular small loans in cash, large cash loans with immediate repayment, large cash loans with a one year grace period, and in-kind livestock loans with a one year grace period. Using microdata obtained from this experiment, we compared the uptake rates of each loan and

investigated the correlates of the uptake.

The regression results showed that the uptake rate is significantly lower in the regular contract than the other three arms. Contrary to popular belief, we found that large scale loans are preferred even by the ultrapoor who are usually believed to be risk-averse and demand small scale loans. Although the overall uptake of the in-kind credit is significantly lower than equivalently-valued cash credit, the ultrapoor are more likely to accept the in-kind offer than the moderately poor. Indeed, one of the keys to attracting the ultrapoor is to provide a grace period in the repayment schedule, irrespective of whether credits are provided in cash or kind. It is also found that when offered, in-kind (cow) credit was more likely to be accepted if a potential borrower had previous experiences of livestock rearing, indicating the necessity of supplementary trainings for the ultrapoor. This paper provides evidence that a typical microcredit with one-year maturity without grace period is not attractive for the ultrapoor. Our results suggest a possibility that microfinance institutions can expand their outreach to the ultrapoor by offering them longer maturity loans with convenient grace periods, without compromising the loan repayment schedules.

As a thorough study of the suitability of long maturity loans with a grace period for the ultrapoor in developing countries, this paper lacks the analysis of the impact of contract designs on repayment behavior of borrowers and on their welfare indicators. While our field observations indicate that repayment rates have not been substantially different across the treatment arms and some clients with a grade period contract have even voluntarily started savings to smooth future repayment, we cannot judge at this moment whether the large loans with a grace period benefit both MFIs and their clients. As the data collection is still going on in the field, these issues will be analyzed in more

details after the appropriate data will be available. Another remaining issue is the understanding of the within-group dynamics of members that led to “group rejection.” The results shown in this paper are reduced-form, with little insight into this issue. Modeling interactions among members theoretically and empirically analyzing the case in northern Bangladesh are also left for further study.

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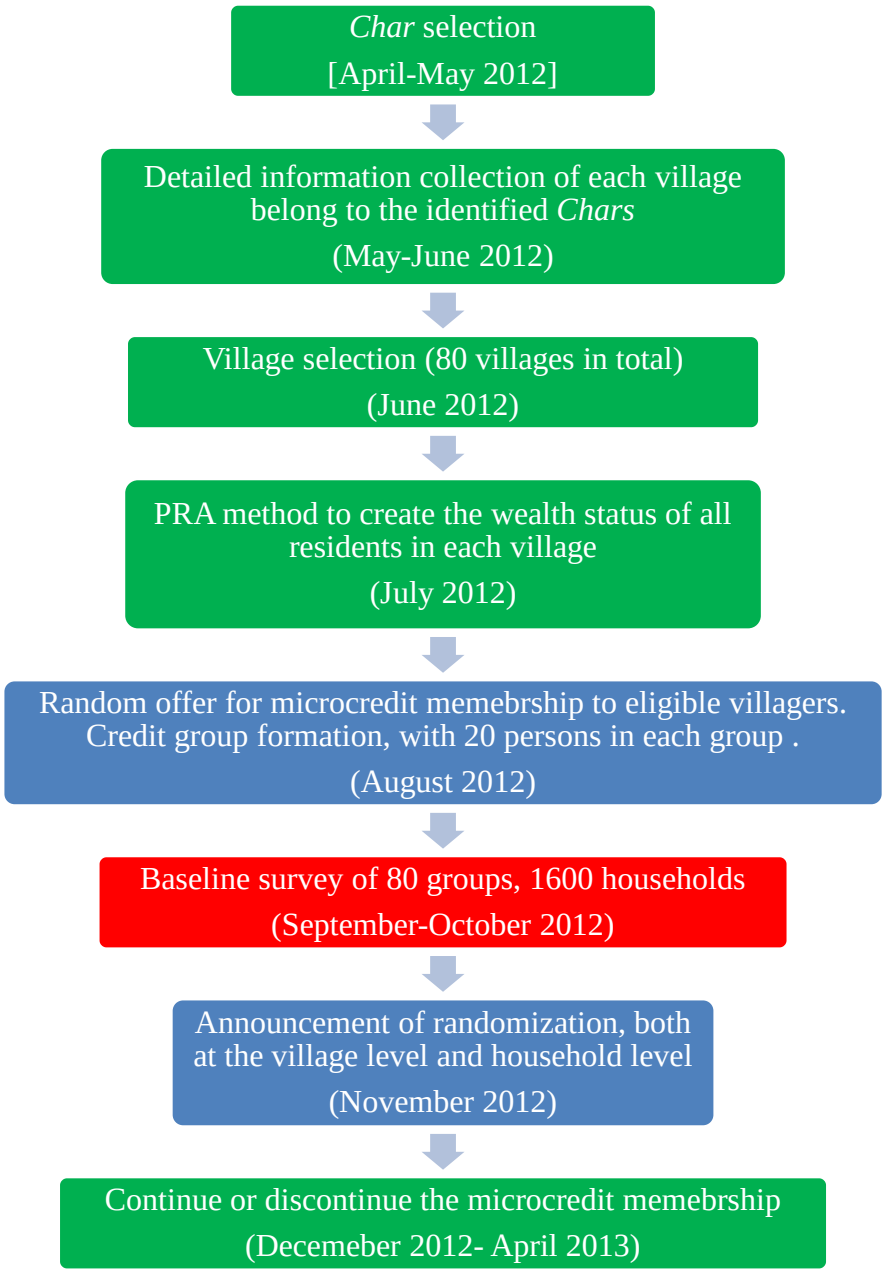
Figure 1: Satellite Image of *Chars* located in Northern Bangladesh

(Note: *Blue dots indicate the points where GPS coordinates were measured*)

Figure 2: Timeline of Interventions and Surveys



Source: *Prepared by the authors. The blue panels show events regarding interventions, red panels show events regarding surveys and the green panels show events regarding sample selection .*

Figure 3: Randomization design

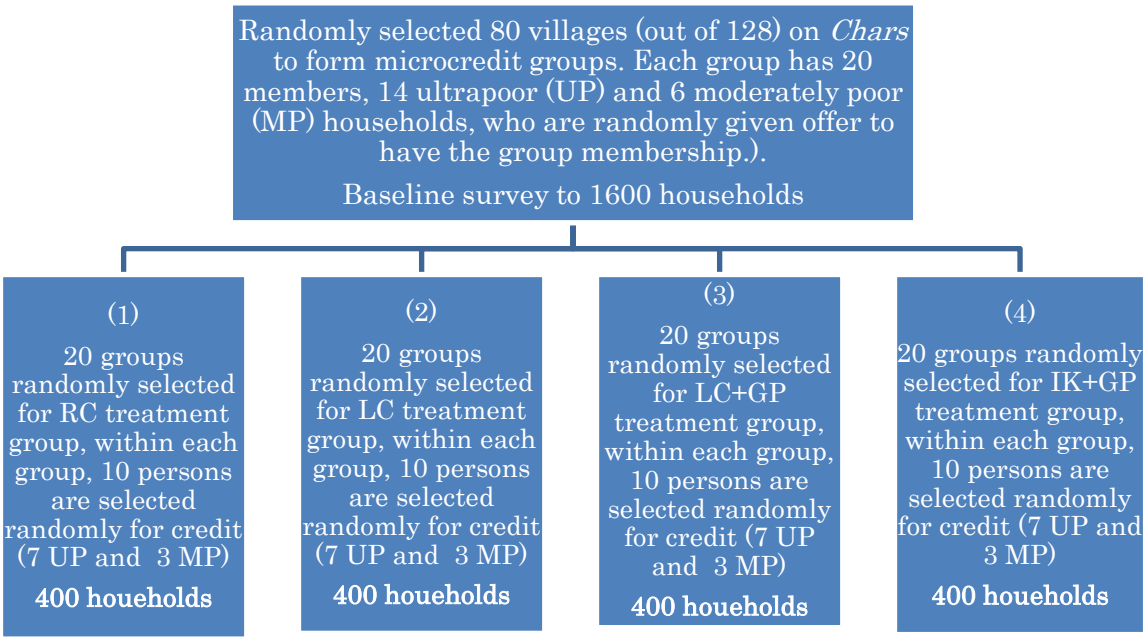


Table 1. Summary statistics of selected variables and balance test

	Mean					Difference in mean		
	Total	RC	LC	LC+GP	IK+GP	LC vs RC	LC+GP vs RC	IK+GP vs RC
Treatment (=1)	0.500	0.500	0.500	0.500	0.500	0.000	0.000	0.000
	(0.500)	(0.501)	(0.501)	(0.501)	(0.501)	(0.035)	(0.035)	(0.035)
Ultrapoor (=1)	0.701	0.700	0.700	0.700	0.705	0.000	0.000	-0.005
	(0.458)	(0.459)	(0.459)	(0.459)	(0.457)	(0.032)	(0.032)	(0.032)
Total HH income ('0000taka)	7.289	7.003	7.355	7.824	6.975	-0.353	-0.821**	0.028
	(3.760)	(3.307)	(3.173)	(4.754)	(3.544)	(0.229)	(0.290)	(0.242)
Agricultural income ('0000taka)	0.018	-0.008	0.047	0.001	0.033	-0.054*	-0.008	-0.041
	(0.376)	(0.239)	(0.481)	(0.033)	(0.523)	(0.027)	(0.012)	(0.029)
Livestock and poultry income ('0000taka)	0.169	0.132	0.192	0.166	0.184	-0.060	-0.035	-0.052
	(0.488)	(0.355)	(0.544)	(0.498)	(0.532)	(0.032)	(0.031)	(0.032)
Non-farm enterprise ('0000taka)	0.306	0.264	0.149	0.449	0.361	0.115	-0.185	-0.098
	(1.405)	(1.207)	(0.848)	(1.883)	(1.464)	(0.074)	(0.112)	(0.095)
Wage income ('0000taka)	6.759	6.577	6.932	7.173	6.356	-0.355	-0.596*	0.220
	(3.870)	(3.444)	(3.308)	(4.911)	(3.562)	(0.239)	(0.300)	(0.248)
Non-income ('0000taka)	0.037	0.038	0.036	0.035	0.040	0.002	0.003	-0.002
	(0.133)	(0.102)	(0.124)	(0.167)	(0.132)	(0.008)	(0.010)	(0.008)
Poverty (=1)	0.558	0.547	0.530	0.555	0.598	0.018	-0.008	-0.050
	(0.497)	(0.498)	(0.500)	(0.498)	(0.491)	(0.035)	(0.035)	(0.035)
Land size (acre)	0.332	0.018	0.650	0.000	0.660	-0.633	0.018	-0.643*
	(4.536)	(0.350)	(6.534)	(0.000)	(6.263)	(0.327)	(0.018)	(0.314)
Experience of livestock production (=1)	0.476	0.435	0.525	0.482	0.460	-0.090*	-0.048	-0.025
	(0.500)	(0.496)	(0.500)	(0.500)	(0.499)	(0.035)	(0.035)	(0.035)
# cattle owned	0.456	0.422	0.448	0.568	0.385	-0.025	-0.145*	0.037
	(0.950)	(0.906)	(0.967)	(1.072)	(0.833)	(0.066)	(0.070)	(0.062)
Value of assets ('0000taka)	0.221	0.196	0.209	0.273	0.204	-0.012	-0.077*	-0.008
	(0.441)	(0.274)	(0.262)	(0.722)	(0.331)	(0.019)	(0.039)	(0.022)
Household size	4.206	4.080	4.235	4.282	4.225	-0.155	-0.202	-0.145
	(1.483)	(1.490)	(1.523)	(1.479)	(1.435)	(0.107)	(0.105)	(0.103)
Dependency ratio	0.862	0.815	0.861	0.862	0.909	-0.045	-0.046	-0.094*
	(0.616)	(0.603)	(0.635)	(0.598)	(0.625)	(0.044)	(0.042)	(0.043)
Head's age	38.583	38.925	38.042	38.672	38.690	0.883	0.252	0.235
	(10.528)	(10.529)	(10.533)	(9.878)	(11.153)	(0.745)	(0.722)	(0.767)
Head is male (=1)	0.899	0.907	0.902	0.897	0.890	0.005	0.010	0.018
	(0.301)	(0.290)	(0.297)	(0.304)	(0.313)	(0.021)	(0.021)	(0.021)
Head's years of schooling	0.748	0.498	0.877	0.660	0.958	-0.380**	-0.163	-0.460**
	(2.150)	(1.816)	(2.248)	(2.015)	(2.445)	(0.145)	(0.136)	(0.152)
Years of current location	5.090	4.185	8.482	3.277	4.415	-4.298***	0.907	-0.230
	(8.654)	(8.214)	(10.244)	(7.369)	(7.568)	(0.657)	(0.552)	(0.558)
Gaibandha (=1)	0.750	0.700	0.850	0.700	0.750	-0.150***	0.000	-0.050
	(0.433)	(0.459)	(0.358)	(0.459)	(0.434)	(0.029)	(0.032)	(0.032)
N	1600	400	400	400	400			

Note: Numbers in parentheses are standard deviations for the mean, while standard errors for the difference in mean.

Table 2. Uptake status by treatment arms and type of rejection

	# respodnents				%			
	Uptake	Individual rejection	Group rejection	Erosion and relocation	Uptake	Individual rejection	Group rejection	Erosion and relocation
Total								
RC	226	54	80	40	56.5	13.5	20.0	10.0
LC	347	13	40		86.8	3.3	10.0	0.0
LC+GP	337	23	20	20	84.3	5.8	5.0	5.0
IK+GP	301	79		20	75.3	19.8	0.0	5.0
Treated								
RC	107	33	40	20	26.8	8.3	10.0	5.0
LC	170	10	20		42.5	2.5	5.0	0.0
LC+GP	166	14	10	10	41.5	3.5	2.5	2.5
IK+GP	149	41		10	37.3	10.3	0.0	2.5
Control								
RC	119	21	40	20	29.8	5.3	10.0	5.0
LC	177	3	20		44.3	0.8	5.0	0.0
LC+GP	171	9	10	10	42.8	2.3	2.5	2.5
IK+GP	152	38		10	38.0	9.5	0.0	2.5

Table 3. Estimation results on acceptance and rejection (multinomial logit)

	w/o Erosion			w Erosion			
	Uptake	Individual rejection	Group rejection	Uptake	Individual rejection	Group rejection	Erosion and relocation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LC (=1)	0.189***	-0.118***	-0.071	0.160***	-0.115***	0.000	-0.045**
	(3.300)	(-3.93)	(-1.22)	(4.610)	(-3.85)	(-1.40)	(-2.05)
LC+GP (=1)	0.179***	-0.079**	-0.100*	0.082**	-0.080**	-0.001**	0.000
	(2.870)	(-2.16)	(-1.68)	(2.560)	(-2.52)	(-1.99)	(-1.05)
IK+GP (=1)	0.116*	0.028	-0.144***	0.055	0.013	-0.068**	0.000
	(1.920)	(0.690)	(-2.87)	(1.220)	(0.340)	(-2.48)	(-0.80)
Treatment (=1)	-0.035**	0.035**	0.001	-0.033**	0.033**	0.000	0.000
	(-2.25)	(2.230)	(0.200)	(-2.21)	(2.210)	(0.660)	(1.060)
Ultrapoor (=1)	0.049**	-0.046**	-0.003	0.044**	-0.044**	0.000	0.000
	(2.450)	(-2.41)	(-0.64)	(2.330)	(-2.33)	(-0.90)	(-0.35)
HH size	0.012	-0.008	-0.004	0.007	-0.007	0.000	0.000
	(1.030)	(-0.84)	(-0.50)	(0.790)	(-0.79)	(-0.27)	(0.310)
Dependency ratio	-0.018	0.010	0.008	-0.009	0.009	0.000	0.000
	(-0.78)	(0.660)	(0.430)	(-0.63)	(0.630)	(0.290)	(-0.30)
Head's age	0.012**	-0.010*	-0.002	0.010*	-0.010*	0.000	0.000
	(2.140)	(-1.91)	(-0.54)	(1.940)	(-1.94)	(-0.53)	(-1.03)
Its squared	-0.000*	0.000**	0.000	-0.000**	0.000**	0.000	0.000
	(-1.89)	(2.030)	(0.240)	(-2.03)	(2.030)	(0.190)	(0.850)
Head is male (=1)	-0.010	-0.029	0.039	0.023	-0.023	0.000	0.000
	(-0.20)	(-0.92)	(0.880)	(0.790)	(-0.79)	(0.780)	(-0.64)
Head's years of schooling	0.019***	-0.005	-0.015**	0.006	-0.006	-0.000**	0.000
	(2.970)	(-1.07)	(-2.37)	(1.540)	(-1.51)	(-1.98)	(0.170)
Years of current location	-0.005*	0.002	0.003	-0.002	0.002	0.000	0.000
	(-1.85)	(1.360)	(1.340)	(-1.61)	(1.600)	(1.420)	(-0.44)
Land size (acre)	0.114***	0.017**	-0.131***	0.002	0.000	-0.001***	-0.001**
	(3.170)	(2.440)	(-3.23)	(1.150)	(0.020)	(-2.66)	(-2.40)
Experience of livestock production (=1)	0.030	-0.009	-0.021	0.009	-0.009	0.000	0.000
	(0.970)	(-0.50)	(-0.76)	(0.530)	(-0.51)	(-0.64)	(-0.51)
# cattle owned	0.021	-0.012	-0.009	0.014	-0.014	0.000	0.000
	(1.070)	(-1.03)	(-0.50)	(1.310)	(-1.32)	(-0.43)	(1.560)
Value of assets (10 thousands taka)	-0.017	0.002	0.016	-0.004	0.004	0.000	0.000**
	(-0.67)	(0.080)	(0.710)	(-0.27)	(0.250)	(0.860)	(2.280)
Gaibandha (=1)	0.014	0.027	-0.042	-0.023	0.023	0.000	0.000
	(0.190)	(0.810)	(-0.52)	(-0.78)	(0.790)	(-0.44)	(0.270)
N	1520			1600			

Note: Cluster standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Estimation results on uptake by treatment arms (probit)

	w/o Erosion				w Erosion			
	RC	LC	LC+GP	IK+GP	RC	LC	LC+GP	IK+GP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ultrapoor (=1)	0.027	0.000	0.052*	0.124**	0.039	0.000	0.046	0.101*
	(0.052)	(0.026)	(0.028)	(0.057)	(0.047)	(0.026)	(0.028)	(0.059)
HH size	0.019	0.020	-0.002	0.033*	0.029	0.020	-0.027	0.022
	(0.027)	(0.015)	(0.016)	(0.020)	(0.026)	(0.015)	(0.026)	(0.017)
Dependency ratio	0.005	-0.020	-0.042	-0.059	-0.027	-0.020	0.003	-0.045
	(0.057)	(0.023)	(0.045)	(0.048)	(0.065)	(0.023)	(0.061)	(0.043)
Head's age	0.047***	0.005	0.023**	0.002	0.046***	0.005	0.025**	0.002
	(0.017)	(0.010)	(0.011)	(0.011)	(0.017)	(0.010)	(0.012)	(0.012)
Its squared	-0.001***	-0.000	-0.000**	-0.000	-0.001***	-0.000	-0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Head is male (=1)	-0.122	-0.077*	0.058	0.078	-0.028	-0.077*	0.084	0.054
	(0.092)	(0.044)	(0.101)	(0.067)	(0.108)	(0.044)	(0.114)	(0.072)
Head's years of schooling	0.031*	0.013*	0.002	0.017	0.036**	0.013*	-0.005	0.009
	(0.018)	(0.007)	(0.009)	(0.012)	(0.018)	(0.007)	(0.010)	(0.011)
Treatment (=1)	-0.081	-0.043*	-0.024	-0.001	-0.071	-0.043*	-0.022	-0.008
	(0.049)	(0.024)	(0.027)	(0.033)	(0.045)	(0.024)	(0.028)	(0.033)
Years of current location	0.000	-0.008*	0.000	-0.007	0.001	-0.008*	0.000	-0.006
	(0.006)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)	(0.005)
Experience of livestock production (=1)	-0.064	0.088*	0.068*	-0.030	-0.011	0.088*	0.053	-0.029
	(0.077)	(0.048)	(0.040)	(0.037)	(0.092)	(0.048)	(0.046)	(0.042)
# cattle owned	0.196**	-0.027	-0.004	-0.009	0.145**	-0.027	-0.005	-0.077
	(0.078)	(0.022)	(0.007)	(0.028)	(0.066)	(0.022)	(0.009)	(0.054)
Value of assets (10 thousands taka)	-0.176	0.077	-0.023	-0.022	-0.154	0.077	-0.036***	-0.012
	(0.122)	(0.075)	(0.016)	(0.049)	(0.125)	(0.075)	(0.013)	(0.070)
Gaibandha (=1)	0.271	-0.034	-0.102	-0.049	0.283	-0.034	-0.170*	-0.130
	(0.204)	(0.056)	(0.075)	(0.073)	(0.198)	(0.056)	(0.097)	(0.094)
N	360	400	380	380	400	400	400	400

Note: Cluster standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Heterogeneity analysis (with only treated households)

	Multinomial logit			Probit for the probability of uptake			
	Uptake	Individual rejection	Group rejection	RC	LC	LC+GP	IK+GP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LC (=1)	0.243***	-0.169***	(0.074)				
	(3.390)	(-2.72)	(-1.22)				
LC+GP (=1)	0.236***	-0.114**	(0.122)				
	(2.790)	(-2.01)	(-1.40)				
IK+GP (=1)	1.058***	0.195***	-1.253***				
	(3.370)	(3.000)	(-3.48)				
Ultrapoor (=1)	0.057**	-0.057**	0.000	-0.036	0.049	0.119**	0.133*
	(2.230)	(-2.36)	(-0.00)	(0.070)	(0.048)	(0.056)	(0.073)
HH size	(0.006)	0.008	(0.002)	-0.004	0.011	-0.015	-0.013
	(-0.41)	(0.620)	(-0.20)	(0.044)	(0.019)	(0.018)	(0.031)
Dependency ratio	0.019	(0.012)	(0.008)	0.100	0.007	-0.004	-0.024
	(0.740)	(-0.54)	(-0.43)	(0.078)	(0.039)	(0.041)	(0.070)
Head's age	0.019**	-0.019**	(0.001)	0.043	0.023	0.030**	0.012
	(1.990)	(-2.27)	(-0.09)	(0.030)	(0.018)	(0.012)	(0.013)
Its squared	-0.000*	0.000**	0.000	-0.000	-0.000	-0.000**	-0.000
	(-1.72)	(2.310)	(-0.31)	(0.000)	(0.000)	(0.000)	(0.000)
Head is male (=1)	0.046	-0.087*	0.041	-0.210*	-0.033	0.153	0.269**
	(0.770)	(-1.91)	(0.880)	(0.115)	(0.056)	(0.138)	(0.131)
Head's years of schooling	0.025**	(0.006)	-0.020**	0.027	0.018	0.005	0.035*
	(2.520)	(-0.81)	(-2.04)	(0.021)	(0.015)	(0.012)	(0.019)
Years of current location	-0.005*	0.002	0.003	-0.000	-0.008	0.001	-0.009
	(-1.87)	(1.120)	(1.460)	(0.007)	(0.005)	(0.005)	(0.006)
Land size (acre)	0.023***	0.005**	-0.028***				
	(2.860)	(2.480)	(-3.15)				
Experience of livestock production (=1)	0.059*	-0.060***	0.001	-0.031	0.088*	0.092**	0.072**
	(1.810)	(-2.83)	(0.050)	(0.091)	(0.049)	(0.039)	(0.036)
# cattle owned	0.044	0.000	(0.044)	0.271***	-0.013	0.002	-0.046
	(1.590)	(-0.01)	(-1.56)	(0.099)	(0.021)	(0.024)	(0.037)
Value of assets (10 thousands taka)	(0.027)	0.008	0.019	-0.233	0.152	-0.037**	-0.076
	(-0.81)	(0.240)	(0.970)	(0.173)	(0.099)	(0.016)	(0.130)
Gaibandha (=1)	0.019	0.028	(0.047)	0.289	-0.048	-0.065	-0.082
	(0.290)	(0.630)	(-0.70)	(0.192)	(0.069)	(0.080)	(0.076)
N		760		180	200	190	190

Note: Cluster standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table 1. Estimation results on acceptance and rejection focusing on characteristics (multinomial logit)

	Panel A			Panel B		
	full sample (without erosion sample)			treated households only (without erosion sample)		
	Uptake	Individual rejection	Group rejection	Uptake	Individual rejection	Group rejection
Large (=1)	0.302***	-0.225***	-0.077	0.243***	-0.169***	-0.074
	(3.29)	(-2.99)	(-1.02)	(3.39)	(-2.72)	(-1.22)
Grace period (=1)	-0.033	0.078	-0.045	-0.007	0.055	-0.048
	(-0.41)	(1.20)	(-0.64)	(-0.07)	(0.82)	(-0.52)
In-kind (=1)	-0.054	0.159**	-0.105***	0.821**	0.310***	-1.131***
	(-0.64)	(2.13)	(-2.73)	(2.55)	(3.80)	(-3.17)

Note: Panel A corresponds to Table 3, columns (1)-(3), and panel B corresponds to Table 5, columns (1)-(3). The regression model also includes household characteristics included in Tables 3 and 5. As parameter estimates, standard errors, and statistical significance of these variables are the same with those reported in Tables 3 and 5, they are not reported for brevity. The full results are available on request.

Appendix Table 2. Factors correlated with the ultrapoor (probit)

	Ultrapoor
HH size	-0.001
	(0.010)
Dependency ratio	0.014
	(0.026)
Head's age	-0.009
	(0.007)
Its squared	0.000
	(0.000)
Head is male (=1)	-0.097**
	(0.042)
Head's years of schooling	-0.007
	(0.005)
Value of durables (10 thousands taka)	-12.592**
	(5.659)
Value of productive assets (10 thousands taka)	9.090
	(5.777)
# cattle owned	-0.015
	(0.013)
Years of current location	-0.001
	(0.001)
Land size (acre)	-0.004**
	(0.002)
Experience of livestock production (=1)	-0.031
	(0.027)
Experience of flood (=1)	0.016
	(0.027)
Gaibandha (=1)	-0.011
	(0.017)
N	1,600

Note: Cluster standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1