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The Microcredit Puzzle: Labour Supply Behaviour of Rural Households in Bangladesh

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Abstract

Using a unique panel dataset collected from rural households in Bangladesh, we examine the role of microcredit in the intra-household and inter-sectoral distribution of labour supply. The data also enables us to discuss seasonality in labour supply. We find robust evidence that the effects of microcredit on labour supply are not symmetrical across occupations and genders and access to microcredit could not smooth out the seasonality in the labour supply. The overall results suggest that opportunities for diversification into market oriented activities remain limited, even when an access to microcredit relaxes the financial constraints faced by households in rural Bangladesh.

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1 Introduction

The historical segregation of men and women in Bangladesh has had a long lasting effect on the participation of the latter in the formal labour market, which still remains divided along gender lines (Kabeer, 2001; Karim, 2011). Even when women are willing to participate in off-farm non-agricultural activities, their employment opportunities are limited, given the socio-cultural barriers that dictate their inheritance, their right to borrow capital from formal institutions, and their options for participation in the labour market (Amin, 1997). However, over the last two decades, Bangladesh has witnessed rapid growth in the participation of women in the labour market, which is attributable in part to the phenomenal expansion of microcredit programs in rural areas (Arun et al., 2009).

There exist now a large number of studies examining the impact of microcredit on households' socio-economic well-being. Generally, these studies find a positive impact of microcredit on self-employment activities (McKernan, 2002), the expansion of existing business enterprises (Banerjee et. al. 2013), and business profits (de Mel et. al., 2008; Skoufias et. al., 2013; Crepon et al., 2013). Studies also find that microcredit participation leads to higher incomes and better livelihoods (Pitt and Khandker, 1998; Imai, Thankom, and Annim, 2010; Islam, 2011), results in consumption smoothing and asset building (Kaboski and Townsend, 2005; Khandker, 2005; Islam 2011); and reduces household vulnerability (Amin et. al., 2003; Islam and Maitra, 2012). The findings also indicate that greater benefits accrue from long-term participation in such programs (Berhane and Gardebroek, 2010; Islam, 2011; Khandker and Samad, 2013).

Despite the plethora of empirical work in the field, empirical studies have not investigated the effects of microcredit on the labour supply of participating households. In this paper, we fill this gap using a large and unique panel dataset at the household level to examine the effects of microcredit program participation on the labour supply behaviour of household members. We examine the intra-household and inter-sectoral distributions of labour supply. We pay particular attention to the labour supply behaviour of the female and male members of the households in different activities/occupations. Our results shed some light on whether access to microcredit reinforces women's traditional roles[1], or promotes gender equality within the household. Finally, the availability of detailed seasonal data in each of the survey rounds, collected over eight years, allows us to study seasonality in the labour

[1] In Bangladesh, women hardly participate in agricultural activities outside their homes (Hossain and Bayes, 2009). Women's agricultural activities have been confined to homestead production and post-harvest operations (FAO, 2011) like the selection and storage of seeds, threshing, winnowing, drying, parboiling, husking, and milling; however, in recent years they have also been involved in livestock and poultry rearing activities, in addition to crop production activities.

supply. In particular, we examine whether participants smooth their labour supply across seasons by financing market-based activities[2]. To the best of our knowledge, there is also very little evidence[3] regarding the effects of households' participation in microcredit programs on the seasonality in labour supply behaviours.

An access to loans from microcredit programs is expected to smooth the income and consumption of poor rural households (Gertler, Levine & Moretti, 2009; Islam and Maitra, 2012), by allowing them to diversify into self-employment based activities, thus generating income streams that are not correlated with the income from agricultural production (Pitt and Khandker, 2002), particularly during lean seasons. Rural households are also known to use buffer stocks, productive assets like bullocks or access to the labour market to insure them against any seasonality in consumption (Jacoby and Skoufias, 1998; Kochar, 1995; Khandker et al., 2012). In the absence of an effective means of smoothing their labour supply, income or consumption, rural households may suffer from seasonal unemployment, poverty, and deprivation (Dercon and Krishnan, 2000; Khandker et al., 2012).

We find robust evidence that households in rural Bangladesh which have access to institutional credit are more likely to diversify into off-farm non-agricultural activities. Our results, however, indicate that the impact of microcredit program participation is more pronounced for men's labour supply behaviour, even though microcredit operations are targeted primarily at women. These results support the argument about socio-cultural norms that delineate the division of labour and responsibilities within the household, and limit women's participation in market-oriented self-employment based activities (Kabeer, 2001; Ngo and Wahhaj, 2012). In the absence of socially acceptable employment opportunities, women from participating households are better off handing over the borrowed amount to the male members, who play a much more important role than has been given credit for in the microcredit literature (Goetz and Gupta, 1996; Kabeer, 2001; Ngo, 2008). We also find that the labour supply behaviours of both males and females in farm and off-farm activities are procyclical in nature, and an access to credit fails to smooth out the labour supply. These findings are consistent with the evidence that suggest lack of appropriate opportunities in the rural non-agricultural sector, particularly during lean seasons, in Bangladesh (Khandker and Mahmud, 2012).

The paper is structured as follows: Section 2 provides background information on the microcredit programs and a discussion of the data. Section 3 then discusses the alternative estimation strategies

[2]Seasonal fluctuations in rural farm incomes and consumption are driven largely by the marked seasonal pattern of agricultural production in Bangladesh (Khandker, 2012).

[3]Only Pitt and Khandker (2002) discuss the effect of group-based credit on the seasonal pattern of the male and female labour supply.

that we use to evaluate the effects of program participation, and presents the salient features that are necessary for an analysis of labour market participation in terms of both incidence and intensity. Section 4 presents the results from the intra-household and inter-sectoral distribution of labour supply, the seasonal variation in labour supply, and the impact of the duration of participation on the same, thus disentangling the short- and medium-run effects of participation from the long-run effects. Finally, a brief conclusion is presented in the last section of the paper.

2 The Microcredit Programs and the Data

The microcredit sector in Bangladesh is one of the largest and oldest in the world. Since the late 1980s, the growth in the number of microcredit institutions (hereafter MCIs), as well as the total membership, has been phenomenal. We use a dataset which covers a range of MCIs, a few of them significantly large in terms of their loan disbursements and outreach, most notably ASA and Proshikha, which are the third and fourth largest MCIs in Bangladesh, and Society for Social Services (SSS) and Thengamar Mohila Sabuj Sangha (TMSS), who are among the top fifty MCIs in Bangladesh. The other MCIs are relatively small, but all of them follow Grameen Bank style lending procedures, assigning credit mainly to groups of women who are jointly liable for the repayment of the loan. There is also no collateral requirement, as the group-lending programs replace the need for physical collateral with a sort of 'social collateral' (Turnell, 2010). Households in the microcredit programs are primarily advanced loans in the range of US$40–$150 for any profitable and socially acceptable income-generating activities, and members are allowed to take larger loans once they have repaid their first loan.

This data covers about 3,000 households, selected from 91 program and control villages spread over 23 thanas (sub-districts) from 13 of Bangladesh's 64 districts. The first survey was administered after a census of all households in the 91 villages during October 1997. The participating households were drawn from 13 different MCIs, each of which is from a separate district, and all of which are members of the Palli Karma-Sahayak Foundation[4] (hereafter PKSF). The survey was initially designed to have two control villages and six program villages from each of the areas in which the MCI was operating. However, only a total of 11 control villages were included in the first round, as not enough control villages could be found in all areas. Subsequent rounds of the survey revealed that some of the control

[4]The Palli Karma-Sahayak Foundation (PKSF) works as a regulatory organisation for the MCIs in Bangladesh, monitoring the activities of the MCIs, and lending out donor and other funds to its partner organisations (PO) for microcredit.

villages had turned into program villages, so there were only 8 control villages in the final round of the survey.

The data were collected primarily for the PKSF by the Bangladesh Institute of Development Studies (BIDS), with financial assistance from the World Bank. Conducted over four rounds of surveys in 1997–98, 1998–99, 1999–2000 and 2004–05,[5] the BIDS-PKSF dataset contains detailed information regarding each of the respondent's personal and household characteristics, occupational background, income and expenditure, and housing and living conditions. The seasonal (past) labour supply information was collected (retrospectively) through the individual and household surveys for each season over the past year. Of the four rounds of the survey that were conducted, our analysis only uses data from the first, third and fourth rounds, as the second round did not collect comprehensive labour supply information. Each of the surveys was undertaken in the period between December and April.

The PKSF household survey has a separate module dedicated to the collection of detailed information on the labour force participation of all of the members in the households. More importantly, it contains information about the number of days and hours worked by each individual member of the household (both males and females) in different occupations, broadly categorized here as: (i) household-based farm and non-farm activities; (ii) agricultural and non-agricultural wage employment; and (iii) self-employment and non-agricultural work (see the appendix for a brief discussion). Each individual was asked to recall the total number of days and the number of hours per day that they had worked in the different sectors over each agricultural season in the last year.[6] The labour supply data were collected by trained enumerators, and care was taken to minimise the recall bias. Any recall bias that exists is assumed to be symmetrical across the participant and non-participant households.

The dataset consists of 2,691 households from the first round, 2,657 from the third, and 2,575 from the last round. The attrition rate from the survey is very low, and is not a major concern for our analysis (see Islam, 2011, for details).[7] We also conducted the analysis separately for attritors and stayers with respect to labour supply behaviour, but did not find any difference between the two groups. Hence, the results reported over here are not corrected for attrition bias. The final dataset consists of an unbalanced panel of a total of 94,295 individual seasonal observations, covering each of the five seasons from the three rounds of the survey.

[5] The first author was involved directly in data collection and report writing for the fourth round of the survey.

[6] For family labour in household-based farm and non-farm activities, we have data on total days worked in each season, hours worked per day, and minutes worked per day, while responses for the other categories were recorded as total days per season and hours per day.

[7] The attrition between the beginning of the survey in 1997 and the end of the survey in 2005 was less than 10%, or about 1.2% per year.

We define a household/member as a participant (the treatment group) if any individual in the household is a member of one or more of the MCIs, during a particular survey round. We consider only individuals aged 7–60 years at the time of the survey. We consider adult individuals (aged $15^{+}$to 60) and children (aged 15 years or below) separately. Furthermore, an individual is classified as being employed in household-based farm and non-farm activities if he/she reports having worked strictly positive hours in that particular sector/season. Labour supply is defined in terms of both incidence (activity) and the total number of hours worked in each occupation and season. We use households' participation statuses in microcredit programs during a round, to understand the differences in their labour supply behaviours.

Table 1 reports the summary statistics. Only 9–17% of females aged 15^{+}–60 are engaged in market-oriented activities (activities ii and iii), compared to 65–80% for males, which is about five times the rate for females. Men are more likely to work as wage labourers or be self-employed in the non-agricultural sector. Women, on the other hand, work predominantly in the household and agricultural sectors[8]. Moreover, while men tend to work in multiple occupations, women are more likely to specialise in household-based activities[9]. The male-female ratio of labour supply (total hours worked) per season is therefore lowest for household-based activities and highest for self-employment, and almost doubled between rounds one and four for self-employment based activities, while it fell for both household-based work and wage employment (see Figure 1).

[Table 1 here]

[Figure 1 here]

Overall, the activity of women from the participating households increased significantly from 80.08% in 1997/98 to 92.46% in 2004/05, due to a significant increase in household-based activities (from 76% to 85%), with a slight decline in self-employment and non-agricultural work (from 10.22% to 7.64%). These activity rates are significantly higher than those of their counterparts in non-participating households. However, there was no significant change in the overall employment rates for men (94.89% to

[8]Overall, the labour burden of rural women exceeds that of men, as it also includes a higher proportion of unpaid household responsibilities, related to preparing food, child rearing activities, and collecting fuel and water. For more information, see the definitions of C. Moser at the website: http://www.ilo.org/public/english/region/asro/mdtmanila/training/unit1/groles.htm.

[9]This is very clear from Table 1, where it can be seen that, while women's activity rates in all three sectors add up to more or less their total participation, the sum of the three male activity rates is significantly higher than their participation in terms of total labour supply. This is clear evidence that men participate in a number of different occupations at the same time.

95.87% for participants and 94.72% to 95.23% for non-participants), as an increase in their market-oriented activities was counteracted by a decline in their participation in household-based activities.

In terms of hours of labour supply per season, there was a slight decline in hours worked by women from participating households, from 96 hours in 1997/98 to 89 hours in 2004/05, but not much has changed in terms of men's labour supply, which was 395 hours in 1997/98 and 393 hours in 2004/05. The change in the intersectoral distribution of labour supply over time is somewhat similar to the change in participation rates for different occupations. Both the incidence and the extent of households' labour supply therefore vary based on the gender of the household members, the sector in which they are employed, and their participation status in a microcredit program.

3 Estimation Methodologies

There are potential concerns regarding a selection bias when program placement is endogenous and households self-select into the credit programs. There could be unobservable individual-, household- and village-level characteristics that influence both a household's decision to participate in the program and the MCI's decision to operate in a particular village. Estimating the causal impact of microcredit program participation on the labour supply therefore requires the issues of non-random program placement and the self-selection of households into the programs to be addressed. Luckily for us, the availability of the three-wave panel dataset spanning eight years, with labour supply data for five seasons in each wave, allows us to address these concerns about selection bias, which are common in such non-experimental program evaluations.

3.1 Regression Methods

The primary empirical methodology estimates the impact of an access to microcredit on the labour supply decision of a household at both the extensive and intensive margins. To this end, we run the following fixed effects regression:

$$L_{ijt} = \alpha_i + \beta_1 X_{ijt} + \beta_2 H_{ijt} + \gamma D_{it} + \theta S_j + \lambda \tau_t + \vartheta (S_j \times \tau_t) + \varepsilon_{ijt} \tag{1}$$

where L_{ijt} is the outcome of interest, and captures both participation (incidence) and hours worked in different activities by individual i during season j of year t; X_{ijt} is a vector of individual-specific characteristics (age, gender, marital status, and education level); and H_{ijt} is a vector of household-level characteristics (household size, total arable land owned, gender and age composition of the members of the household). α_i captures individual-level fixed effects, and the parameter θ picks up the seasonal fixed effects. The term τ_t represents the year fixed effects, while $(S_j \times \tau_t)$ can be interpreted as the seasonal-year fixed effects. As the participation decision is made at the household level, we are able to control for unobserved characteristics at both the household and individual levels using individual-level fixed effects. Moreover, the year and seasonal fixed effects, and their interactions, allow us to control for both time-variant unobservables, including macroeconomic conditions, and shocks such as rainfall variability across different seasons and years.

We are particularly interested in the sign and value of the parameter γ associated with the treatment variable D_{it}, which is the participation status of the household for individual i in year t. ε_{ijt} is the individual-specific error term, which is non-systematic and varies across individuals. To account for any correlation in errors across villages and years, we compute clustered–robust standard errors at the village-year level.[10] We also report our results by gender and occupation of the individual, and for adults and children separately.

3.2 Combining Propensity Score Matching and Regression Analysis

For the sake of comparability between participants and non-participants, we use an alternative estimation strategy that matches households based on their initial set of observable characteristics. In particular, we use the propensity score matching (PSM) method of Rosenbaum and Rubin (1983). We estimate propensity scores for each household using a standard logit model that regresses the participation status of the household in the first round of the survey on a set of household- and village-level observable characteristics that influence the households' decision to participate in microcredit programs (see the appendix for a brief discussion of the variables used for estimating the propensity score). We then match individuals from the participating and non-participating households based on these propensity scores. We use the nearest neighbour (NN) matching estimator, and choose to use

[10] We have also computed standard errors clustered at the village-year-seasonal level to allow for an arbitrary covariance structure within villages over time and seasons, but the results are very similar to those reported.

the five nearest neighbours for matching, limiting our comparison to only those households that lie within the common support or overlapping region. Both the t-test for the equality of means for the participating and non-participating groups and the standardised bias test suggest that the covariate distributions across the matched groups are well balanced after matching (Becker and Ichino, 2002). The results from the balancing test are provided in the appendix.[11] We have re-run Equation (1) for this subset[12] of matched individuals, and report results separately by gender and for different age groups (see the appendix).

3.3 Seasonality in Labour Supply

Next, we examine whether participation in microcredit programs affects the seasonal distribution of labour supply. Seasonality in the labour supply in rural Bangladesh is mostly driven by local rainfall variability and the labour demand for rice production. Even though the rice crop calendar varies slightly across the country depending on the physiographic and land type of the region, the cropping pattern is generally organised around three major rice-growing seasons: Aman, Aus and Boro, so named by the local farmers after the specific crops grown in each season. Aman is the most important rice in Bangladesh; it is planted in April–May and harvested in November–December (we call it 'season 1'), and is completely rain-fed. Aus is the second most important rice crop, and is sown in April–May and harvested in July–August, requiring supplementary irrigation in the initial stages even though it is primarily rain-fed. Finally, Boro rice is planted in December–February and reaped during April-May, and is completely dependent on irrigation.

[Figure 2 here]

The demand for agricultural labour during the Boro and Aus crop seasons is expected to be significantly higher than during the Aman period. The annual phenomenon of "seasonal unemployment", characterised by poverty and food deprivation, is therefore most severe during the lean seasons of March–April (season 4) and September–November (season 2), right after the Boro and Aman crops

[11] The t-test suggests that the difference between the two groups is not statistically significant. Moreover, the bias before and after matching (Rosenbaum and Rubin, 1985) is less than 5% for every variable of interest. These results are both indicative of a good balance.

[12] After balancing, we are left with 2619 households (1555 treated and 1064 untreated) from the first round of the survey.

are planted, when there is no more demand for agricultural labour. We identify the Aus and Boro harvesting periods as seasons 3 and 5, respectively.

[Figure 3 here]

Figure 2 shows the seasonality in the hours worked for household-based farm and non-farm work, wage employment and self-employment based activities during each of the three survey rounds. The differences between the two lean seasons and the three crop seasons are clear from Figure 2. The labour supply in both self and wage employment appears to co-move closely with the labour supply for household-based farm and non-farm activities. In Figure 3, we depict the labour supply for three different occupational categories by participation status. The seasonality in the labour supply in each of the three different occupations of the participating households appears to be very similar to that experienced by the non-participating households. We run the following regression to examine whether the seasonality in the labour supply differs by households' participation status in microcredit programs.

$$L_{ijt} = \alpha_i + \beta_1 X_{ijt} + \beta_2 H_{ijt} + \gamma D_{it} + \theta S_j + \phi(S_j \times D_{it}) + \lambda \tau_t + \vartheta(S_j \times \tau_t) + \varepsilon_{ijt} \tag{2}$$

This specification is an extension of Equation (1). Equation (2) captures the seasonal variation inherent in the rural agricultural and non-agricultural labour supply. If the labour supplies of rural households vary across seasons, the coefficient θ will be significantly different from zero. Similarly, ϕ is the interaction term between the treatment status of the household and the seasonal dummies that capture the impact of program participation on the seasonality in labour supply. Program participants are expected to utilise the credit provided by the MCIs for financing new productive activities, and hence may exhibit less seasonality in the labour supply (also referred to as labour supply smoothing). Therefore, in the case of self-employment, the sign of θ is expected to be countercyclical to household-based activities, due to individuals being more active in self-employment based activities during the lean seasons, when opportunities in the agricultural sector are limited. Similarly, as an access to microcredit provided by the MCIs relaxes the credit constraints faced by the rural households and lets them foray into the non-agricultural sector, we expect ϕ to be significantly higher for self-employment, particularly during the lean seasons.

4 Main Results

The results of our basic estimation equation are presented in Tables 2 and 3. Table 2 displays the effect of the program on participation in the different occupations (in percentage points[13]) using Equation (1). In Table 3, we report the coefficients using the hours of work in a season as the dependent variable. The regressions use the full set of controls (see the appendix), and include seasonal fixed effects, year fixed effects and seasonal-year fixed effects. As we are interested in the impact of program participation on the labour supply decision,[14] we focus on the sign and value of the parameter γ. If microcredit does have a positive effect on the incidence and hours worked, $\hat{\gamma}$ should be positive and statistically significant. Each row in the table is associated with a different set of individuals, and only the coefficient $\hat{\gamma}$ is reported.

[Table 2 here]

Table 2 shows that participation in microcredit programs significantly lowers the probability of being employed as a wage labourer, but increases the participation in self-employment based activities. However, the effect is not symmetrical for males and females. Adult men benefit disproportionately more from their household's participation in microcredit programs, as their participation in off-farm self-employment activities is increased by 9.34% — a significant increase — and their participation in the labour force as wage labourers is reduced by 4.95%. However, we find no such significant effect on their overall labour force participation rate (LFPR), which rises by just 0.43% and is statistically insignificant. On the other hand, microcredit significantly increases the participation of females from the program households in self-employment based non-agricultural work by 4.35%. Thus, the male members of the participating households experience a much greater increase in participation in self-employment activities than their female counterparts, who actually receive the loan from the MCIs. Finally, the results show that participation in microcredit does not have any effect on the incidence of child (7–15 years old) labour for either gender in any sector.

[13] The dichotomous variable, the incidence of participation (or activity) in different sectors, was multiplied by 100 so that the results can be expressed in terms of percentage points.

[14] The results presented in this section are robust to the definition of program participation used. We have also used the total loan amounts borrowed by the households as a robustness check, but the results are very similar to those obtained using treatment effects (see the appendix).

[Table 3 here]

The impact of microcredit program participation on the seasonal labour supply (in hours) is presented in Table 3. The results are similar to what we find in Table 2. Microcredit significantly increases both the labour supply for self-employment activities and the total labour supply, but decreases the hours worked as a wage labourer. This effect also varies widely by gender and across different age groups. Adult men from participating households work about 42 hours more in self-employment activities and 21 hours less in wage employment every season than their counterparts in the non-participating households. This is also significantly higher than the increase in hours dedicated to self-employment by women from the treatment households (an increase of about 11 hours). The total labour supply of women from participating households is about 13 hours higher, less than the increase for men, whose total seasonal labour-hours increase by more than 18 hours.

The results suggest that both the male and female labour supplies increase for the participating households. However, men experience a redistribution of the labour supply from wage employment to self-employment based activities, whereas women experience an "added effect", tending to increase their work in self-employment activities without a corresponding reduction in the number of hours worked in wage employment. See the appendix for the effect of microcredit on the shares of different occupations in the total labour supply.

Even though the overall results reported in Table 3 are very similar to those in Table 2, there are a few interesting differences. Children aged 7–15 years from participating households are found to be working significantly longer hours per season in self-employment based activities (17 hours), and less in wage employment (13 hours, though not significant), than children in non-participating households. However, there is no significant effect of program participation on either the incidence of child labour (in Table 2) or children's total labour supply (in Table 3).

Finally, the PSM results estimated by running Equation (1) on the sub-sample of matched households (households that lie in the common support) are presented in the appendix as a robustness check for our estimation methodology. The results are very similar to those reported in Table 3. Overall, we find that participation in microcredit programs is associated with a significant increase in market-oriented activities (by 41 hours), and a decline in the hours worked in wage employment (by 21 hours). Similar results were also found for adult women, who experienced an increase in the number of hours dedicated to self-employment (by 11 hours). Finally, we find evidence of a significant increase in the labour supply of children from the participating households in both household-based (6 hours) and

self-employment related (16 hours) activities.

4.1 Effect on Spousal Labour Supply

We now report the results on the effect of program participation on the member's own and spousal labour supply. In this subsection, we restrict the sample to household heads and their spouses, in order to assess the effect of women's participation in microcredit programs directly on their own and their husbands' labour supply. As most borrowers of microcredit (about 90% in our sample) are female, we also focus only on households with female MCI members. Panel A (in both the top and bottom sections) in Table 4 presents the results.

[Table 4 here]

The coefficients in panel A of Table 4 are similar to those obtained from the distribution of labour supply across gender and sectors, discussed in the last subsection (in Tables 2 and 3). The wife's participation in MCIs is associated with an increased engagement in household-based farm and non-farm activities and self-employment, thus increasing her overall labour-force participation. However, it also corresponds to a decrease in the spouse's participation in wage employment, while increasing his participation in self-employment based activities. Thus, while it is true that an increased access to microcredit contributes to self-employment generation for both members and their spouses (presented in the top panel A of Table 4), it is found to have a significantly larger positive effect on husbands' labour supply (bottom panel A of Table 4) than on that of the participating women (own labour supply).

4.2 Effect on Member's Labour Supply within Program Households

In this sub-section, we investigate the labour supply decision of individuals based on their membership status within the participating households. The top panel B in Table 4 demonstrates that households which are participating in microcredit programs experience a significant decrease in wage employment and household-based activities, but increase their involvement in self-employment activities. Within

the household itself, the actual members of the program are found to be comparatively more involved in household-based activities and self-employment than the non-members, and significantly less involved in wage employment.

The bottom panel B of Table 4 shows how the members' labour supply decisions are affected by their program participation. The results reveal that members devote significantly more hours to home-based activities and significantly fewer hours to wage employment than non-members from participating households. However, all individuals from the participating households contribute similar working hours towards self-employment based activities, irrespective of their membership status in the household. As such, while there is a significant increase in the overall labour supply for participating households, we find no evidence of differences in hours worked between the members and non-members from participating households. The effect of microcredit on the labour supply therefore appears to be more asymmetrical across gender than across the membership status of the individuals within the participating households. Thus, the positive impact of microcredit on self-employment based activities is not limited to just the recipients themselves or the recipients and their spouses, but also spills over to other non-member individuals within the household.

4.3 Seasonality in Labour Supply

The results for seasonality in labour supply by treatment status in the microcredit institutions are presented in Table 5. The labour supplies in the various different occupation categories tend to co-move, and there is no evidence of any time-use smoothing. Moreover, seasonality is significantly stronger for the program participants. Seasonality in non-farm self-employment is procyclical to seasonality in household-based farm and non-farm activities, suggesting that rural households are very much dependent on the agricultural sector. The number of labour hours contributed to household-based farm and non-farm activities is significantly higher during the Aus (5.1 hours) and Boro (17 hours) crop seasons, relative to the Aman season, and significantly lower during the major lean season, season 2. As is evident from Table 5, self-employment-based activities are also significantly more prevalent during the Aus (46 hours) and Boro (43 hours) seasons than in the Aman crop season.

[Table 5 here]

The imperfect ability of households to smooth the labour supply across seasons is clear from Table 5. It seems that, contrary to our initial hypothesis, loans from microcredit programs are not used to finance productive off-farm activities, which do not seasonally covary with agricultural production and could insure households against the significant declines in income and consumption that occur during the lean seasons (Pitt and Khandker, 2002). Instead, program participation actually increases the seasonality in labour supply. There is also a big difference in labour supply seasonality between males and females. Seasonality is more prominent among men who are employed in non-agricultural self-employment activities, while women from participating households show an increased level of seasonality in household-based activities, with some evidence of increased home-based activity during the lean season. They also experience only a limited increase in seasonality in self-employment based activities during the three agricultural seasons compared to their male counterparts. However, while program participation significantly increases the seasonality in self-employment based activities, it does not have much effect on the seasonality in wage employment for either men or women. The results suggest that microcredit repayment schemes could be aligned with the seasonal variation, thereby reducing the rural households' reliance on the local money lenders for repaying the loans during the lean season (see Islam, Nguyen and Smith, 2013)

4.4 Membership Duration and Labour Supply

We now examine the heterogeneous impact on labour supply based on the length of time that each household has participated in the microcredit program. Focusing on the duration of participation enables us to separate the short- and medium-term effects of microcredit program participation from the long-term effects (Islam, 2011; Khandker and Samad, 2013). We sort the participating households into six broad sub-categories based on their dates of joining and/or leaving the program, using the definitions of Islam (2011). The six different groups considered in our analysis are:

i) *Continuing participants:* Households who have been regular clients of the MCIs during all four rounds of the survey conducted between 1997 and 2005.

ii) *Newcomers1:* Households who were not clients of the MCIs in 1997 but joined between 1999 and 2001.

iii) *Newcomers2:* Households who were not members during the first round but joined later, between 2001 and 2004.

iv) *Leavers1:* Households who were clients in 1997 but dropped out after 1998 and never participated in any other MCI again.

v) *Leavers2:* Recent dropouts, who participated until 2001 and then decided to drop out of the program.

vi) *Drifters:* The remainder of the occasional clients who were not classified as either newcomers or leavers.

Out of the 1592 households that were clients of MCIs at one point or another, 47.2% were regular clients, while 9% (5%) were Newcomers1 (Newcomers2). Leavers1 represented 11.3% of the sample and Leavers2 11%, while the rest of the households were drifters. We estimate the effects of program participation for each of these groups by comparing them with the benchmark group of non-participants — households who never participated in any microcredit program — which includes all ineligible households, eligible but non-participating households in control villages, and eligible households in program villages who chose not to participate.

[Table 6 here]

Results from the sub-group analysis are presented in Table 6. We find significant differences in labour supply outcomes across the different groups of program participants — particularly in terms of self-employment activities — which is of particular interest to us. While the duration of participation seems to have no significant effect on the incidence and extent of labour supply for household-based activities, it increases the participation in non-agricultural self-employment activities for almost all of the groups that we consider in this study, particularly at the extensive margin. The results show that more involvement (in terms of both incidence and intensity) in market-oriented activities tends to follow from long-term participation in MCIs, with regular participants experiencing the greatest increase in self-employment activities, which also signals a move away from wage employment. Regular membership in MCIs increases the participation in self-employment based activities by 9.3%, and increases the number of hours of labour supply in the same by about 37 hours per season. The results for the occasional participants (in Table 6), particularly the leavers and drifters, confirm that the gains from program participation may continue even after leaving the program, although such benefits are likely to be short-lived, as the coefficients for self-employment are significant for 'Leavers2' but not 'Leavers1'.

5 Discussion and Conclusion

In this paper, we examine, for the first time, the impact of an access to microcredit on the intra-household and inter-sectoral distribution of labour supply. The particular focus on seasonal variation in the labour supply is also an important contribution of this study. We find evidence that an access to microcredit results in an increased participation in self-employment based activities at both the extensive and intensive margins. However, such effects are considerably lower among the females than the males (spouses of the MCI clients or otherwise). These results raise the question: why is the effect of program participation significantly higher for the men even though the MCIs are targeting the women? The second question related to our findings is: why program participation did not reduce the seasonality in self-employment labour?

An access to microcredit provides participating households with opportunities for occupational diversification by encouraging them to expand into non-farm activities, whose returns do not covary with agricultural production. However, due to the lack of suitable productive activities during the lean seasons, both men and women from participating households use the available credit to finance activities which only increase the seasonality in their labour supply. Women's labour supply is especially vulnerable, as they are mostly limited to household-based farm and non-farm activities. They mostly engage in crop processing during the post-harvest period (FAO, 2011), and, as such, increases in agricultural productivity[15] increase the household's demand for agricultural labour, thereby leading to seasonality in the household-based farm and non-farm activities of the women.

The results suggest that, although most of the micro loans provided by MCIs have been targeted towards women, microcredit actually has a significantly larger effect on the participation and labour supply of the males from the participating households. Microcredit has benefited participating households, but this is more likely to be due to the significant contribution of men, which for the most part has been profoundly overlooked. The effect of microcredit on the labour supply is therefore asymmetric across males and females from the participating households, as women have a limited degree of flexibility in terms of moving from household-based activities to market-oriented activities. Moreover, the co-movement of labour supply in all the three activities indicate the lack of appropriate alternative

[15] Constrained by the lack of availability of suitable productive opportunities during the lean seasons, households attempt to attain stability in their income and consumption by adopting High Yielding Variety crops, which they were unable to use earlier due to the lack of adequate credit (Wozniak, 1993; Government of Bangladesh 1999). They also use the available credit to invest in better quality land, improved seeds, fertilisers and better irrigation practices, which significantly increase their productivity and reduce their dependence on seasonal factors (Wahid, 1994). Ahmed (2004) shows that 12.23% of the total microcredit is used for agricultural activities.

opportunities in the rural sector, particularly during the lean season, even when an access to MCI credit relaxes the financial constraints faced by poor rural households.

Credit provided by MCIs may be unable to counteract the gender roles specified within the household (Kabeer, 1998, 2001; Mayoux, 1999; Johnson, 2004). In the current socio-cultural context, women lack the skills and opportunities which are necessary for the carrying out of productive activities beyond what is sanctioned by socially defined gender norms (Mayoux, 1999; Kabeer, 2001; Johnson, 2004; Ngo and Wahhaj, 2012). Without the active cooperation of spouses or male members of the household, who often play a complementary role by marketing and selling the goods produced by the small home-based businesses of the women, their ability to invest capital in autonomous activities is severely limited (Hashemi et al., 1996; Kabeer, 1998; Anderson and Eswaran, 2009). Thus, while the focus of the MCIs has always been on women, they might need to relinquish control over their loans, leaving the males to decide the ultimate fate of the funds (Goetz and Gupta, 1996; Kabeer, 2001; Ngo, 2008).

References

[1] Ahmed, S. (2004). Microcredit and Poverty: New Realities and Strategic Issues. In S. Ahmed and M. A. Hakim (eds), Attacking Poverty With Microcredit. Palli Karma-Sahayak Foundation and The University Press Limited.

[2] Amin, S. (1997). The Poverty–Purdah Trap in Rural Bangladesh: Implications for Women's Roles in the Family. Development and Change, 28(2), 213-233.

[3] Amin, S., Rai, A. S., & Topa, G. (2003). Does microcredit reach the poor and vulnerable? Evidence from northern Bangladesh. Journal of Development Economics, 70(1), 59-82.

[4] Anderson, S., & Eswaran, M. (2009). Determinants of female autonomy: evidence from Bangladesh. Journal of Development Economics, 90(2), 179-191.

[5] Arun, T., Hulme, D., Matin, I., & Rutherford, S. (2009). Finance for the poor: the way forward? In D. Hulme & T. Arun (eds), Microfinance: A Reader (pp. 7-16). Great Britain: Routledge.

[6] Banerjee, A., Duflo, E., Glennerster, R., & Kinnan, C. (2013). The Miracle of Microcredit? Evidence from a Randomized Evaluation. Working paper. MIT.

[7] Becker, S., & Ichino, A. (2002). Estimation of Average Treatment Effects Based on Propensity Scores. Stata Journal, 2(4), 358-377.

[8] Berhane, G., & Gardebroek, C. (2010). Does Microcredit Reduce Rural Poverty? Evidence Based on Household Panel Data from Northern Ethiopia. American Journal of Agricultural Economics, 93(1), 43-55.

[9] Crepon, B., Devoto, F., Duflo, E., & Pariente, W. (2013). Estimating the impact of microcredit on those who take it up: Evidence from a randomized experiment in Morocco. MIT Working paper, Department of Economics

[10] De Mel, S., McKenzie, D., & Woodruff, C. (2008). Returns to Capital in Microenterprises: Evidence from a Field Experiment. The Quarterly Journal of Economics, 123(4), 1329-1372.

[11] Dercon, S., & Krishnan, P. (2000). Vulnerability, seasonality and poverty in Ethiopia. Journal of Development Studies, 336(6), 25–53.

[12] FAO (2011). The Role of Women In Agriculture. ESA Working Paper No. 11-02 March 2011 Agricultural Development Economics Division.

[13] Gertler, P., Levine, D. I., & Moretti, E. (2009). Do Microcredit Programs Help Families Insure Consumption Against Illness? Health Economics, 18, 257-273.

[14] Goetz, A., & Gupta, R. S. (1996). Who Takes the Credit? Gender, Power, and Control Over Loan Use in Rural Credit Programs in Bangladesh. World Development, 24(1), 45–63.

[15] Government of Bangladesh (1999). National Agriculture Policy. Dhaka: Ministry of Agriculture, Government of the People's Republic of Bangladesh.

[16] Hashemi, S., Schuler, S. R., & Riley, A. P. (1996). Rural Credit Programs and Women's Empowerment in Bangladesh. World Development, 24(4), 635–653.

[17] Hossain, M., & Bayes, A. (2009). Rural Economy and Livelihoods: Insights from Bangladesh. A. H. Developing Publishing House, Dhaka, Bangladesh.

[18] Imai, K. S., Thankom, A., & Annim, S. K. (2010). Microcredit and Household Poverty Reduction: New Evidence from India. World Development, 38(12), 1760-1774.

[19] Islam, A. (2011). Medium- and Long-Term Participation in Microcredit: An Evaluation Using a New Panel Dataset from Bangladesh. American Journal of Agricultural Economics, 93(3), 843-862.

[20] Islam, A., & Maitra, P. (2012). Health Shocks and Consumption Smoothing in Rural Households: Does Microcredit have a Role to Play? Journal of Development Economics, 97(2), 232-243.

[21] Islam, A., Nguyen, C., & Smith, R (2013). Does Microcredit change the informal lending in village economies? Evidence from Bangladesh. Working paper.

[22] Jacoby, H. G., & Skoufias, E. (1998). Testing theories of consumption behaviour using information on aggregate shocks: income seasonality and rainfall in rural India. American Journal of Agricultural Economics, 80, 1–14.

[23] Johnson, S. (2004). Gender norms in financial markets: evidence from Kenya. World Development, 32(8), 1355–1374.

[24] Kabeer, N. (1998). Money can't buy me love? Re-evaluating the empowerment potential of loans to women in rural Bangladesh. IDS Working Paper.

[25] Kabeer, N. (2001). Conflicts over Credit: Re-Evaluating the Empowerment Potential of Loans to Women in Rural Bangladesh. World Development, 29(1), 63-84.

[26] Kaboski, J. P., & Townsend, R. M. (2005). Policies and Impact: An Analysis of Village-Level Microfinance Institutions. Journal of the European Economic Association, 3(1), 1-50.

[27] Karim, L. (2011). Microfinance and its Discontents: Women in Debt in Bangladesh. USA: The University of Minnesota.

[28] Khandker, S. R. (2005). Microfinance and Poverty: Evidence Using Panel Data from Bangladesh. The World Bank Economic Review, 19(2), 263–286.

[29] Khandker, S. R. (2012). Seasonality of income and poverty in Bangladesh. Journal of Development Economics, 97, 244–256.

[30] Khandker, S. R., Khalily, M. A. B., & Samad, H. (2012). Seasonal migration to mitigate income seasonality: evidence from Bangladesh. Journal of Development Studies, 48(8), 1063–1083.

[31] Khandker, S. R. & Mahmud, W. (2012). Seasonal Hunger and Public Policies: Evidence from Northwest Bangladesh. Washington, D.C.: The World Bank.

[32] Khandker, S. R., & Samad, H. (2013). Microfinance Growth and Poverty Reduction in Bangladesh: What Does the Longitudinal Data Say? Mimeo, World Bank, Washington, D.C.

[33] Kochar, A. (1995). Explaining household vulnerability to idiosyncratic income shocks. American Economic Review, 85(2), 159–164.

[34] Mayoux, L. (1999). Questioning virtuous spirals: micro-finance and women's empowerment in Africa. Journal of International Development, 11(7), 957-984.

[35] McKernan, S. M. (2002). The impact of microcredit programs on self-employment profits: Do noncredit program aspects matter? The Review of Economics and Statistics, 84(1), 93-115.

[36] Ngo, T. M. P. (2008). Microcredit and Gender Empowerment in Kyrgyzstan. Prepared for The World Bank – Agriculture and Rural Development Department (ARD).

[37] Ngo, T. M. P., & Wahhaj, Z. (2012). Microcredit and gender empowerment. Journal of Development Economics, 99(1), 1-12.

[38] Pitt, M. M., & Khandker, S. R. (1998). The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of the Participant Matter? Journal of Political Economy, 106, 958–996.

[39] Pitt, M. M., & Khandker, S. R. (2002). Credit Programmes for the Poor and Seasonality in Rural Bangladesh. Journal of Development Studies, 39(2), 1-24.

[40] Rosenbaum, P. R., & Rubin, D. B. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. Biometrika, 70, 41–55.

[41] Rosenbaum, P. R., & Rubin, D. B. (1985). Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score. American Statistician, 3, 33-38.

[42] Skoufias, E., Leite, P., & Narita, R. (2013). Expanding Microcredit in Brazil: Credit Utilisation and Performance of Small Firms. The Journal of Development Studies, 49(9), 1256-1269.

[43] Turnell, S. (2010). Microfinance in Burma. In A. Goenka & D. Henley (eds), Southeast Asia's Credit Revolution: From Moneylenders to Microfinance (pp. 190-205). USA & Canada: Routledge.

[44] Wahid, A. (1994). The Grameen Bank and Poverty Alleviation in Bangladesh. The American Journal of Economics and Sociology, 53, 1-15.

[45] Wozniak, G. D. (1993). Joint Information Acquisition and new Technology Adoption: Later versus early Adoption. Review of Economics and Statistics, 75(3), 438-445.

Table 1: Summary Statistics for the Activity Rates and Labour Supply of adult individuals in different occupations

	Round I: 1997–1998			Round III: 1999–2000			Round IV: 2004–2005		
	Treat	Control	Diff	Treat	Control	Diff	Treat	Control	Diff
Activity Rates (percentage points)									
Agricultural Labour	65.37	65.29	0.08	72.76	74.21	-1.45***	59.95	64.93	-4.98***
Male Sample	54.23	56.9	-2.67***	57.79	59.69	-1.9**	42.55	50.07	-7.52***
Female Sample	75.98	72.59	3.39***	89.36	89.28	0.08	84.55	85.08	-0.53
Wage Labour	18.71	19.31	-0.6	19.09	19.16	-0.07	21.38	22.19	-0.81*
Male Sample	32.24	35.86	-3.62***	31.27	32.7	-1.43*	31.56	34.09	-2.53***
Female Sample	5.82	4.89	0.93**	5.58	5.12	0.46**	6.98	6.04	0.94
Self Employed	25.86	16.16	9.7***	28.66	20.03	8.63***	29.92	23.38	6.54***
Male Sample	42.28	29.85	12.43***	44.47	33.91	10.56***	45.68	36.46	9.22***
Female Sample	10.22	4.24	5.98***	11.14	5.61	5.53***	7.64	5.65	1.99***
Total Labour	87.3	84.49	2.81***	93.97	92.91	1.06***	94.46	93.17	1.29***
Male Sample	94.89	94.72	0.17	94.41	93.42	0.99**	95.87	95.23	0.64**
Female Sample	80.08	75.59	4.49***	93.48	92.37	1.11**	92.46	90.38	2.08***
Labour Supply per Season (hours worked)									
Agricultural Labour	68.81	74.41	-5.6***	43.34	43.36	-0.02	57.89	63.73	-5.84***
Male Sample	89.81	105.19	-15.38***	53.62	56.63	-3.01**	63.18	71.47	-8.29***
Female Sample	48.81	47.61	1.2	31.95	29.59	2.36***	50.43	53.22	-2.79**
Wage Labour	71.71	76.74	-5.03**	62.42	66.19	-3.77**	76.04	76.19	-0.15
Male Sample	127.87	147.63	-19.76***	107.44	117.17	-9.73***	114.98	119.73	-4.75
Female Sample	18.23	15.02	3.21**	12.51	13.30	-0.79	20.99	17.14	3.85***
Self Employed	101.35	62.11	39.24***	104.86	75.32	29.54***	133.42	102.74	30.68***
Male Sample	177.01	121.08	55.93***	178.15	136.78	41.37***	215.20	168.16	47.04***
Female Sample	29.31	10.77	18.54***	23.64	11.56	12.08***	17.81	14.04	3.77***
Total Labour	241.87	213.25	28.62***	210.63	184.88	25.75***	267.35	242.66	24.69***
Male Sample	394.70	373.90	20.80***	339.22	310.59	28.63***	393.36	359.37	33.99***
Female Sample	96.35	73.40	22.95***	68.10	54.46	13.64***	89.24	84.40	4.84**

Footnote: The data are measured in terms of hours worked per season in a given round of the survey.
The reported p–values are from the two-tailed test with the null hypothesis that the group means are equal.

Table 2: Regression Estimates of Participation in different occupations at the individual level

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Activity at the Individual Level in percentage points			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Full Sample	-0.594	-2.231***	6.685***	1.363***
	(0.717)	(0.643)	(0.829)	(0.391)
Adult Men and Women	-0.665	-2.148***	6.829***	1.349***
	(0.712)	(0.658)	(0.808)	(0.385)
Adult Men	-1.812	-4.952***	9.337***	0.432
	(1.127)	(0.980)	(1.150)	(0.362)
Adult Women	1.022	0.304	4.345***	2.437***
	(0.772)	(0.622)	(0.868)	(0.694)
Child Labour	0.106	-3.254	3.832	1.631
	(3.431)	(2.901)	(3.092)	(1.864)
Boy Child	1.734	-5.469	5.527	3.372
	(4.726)	(4.045)	(4.175)	(2.519)
Girl Child	-3.636	2.974	-0.326	-1.901
	(4.094)	(3.258)	(3.967)	(2.564)

All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3: Regression Estimates of Program Participation on Labour Supply

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Hours of Labour Supply at the Individual Level			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Full Sample	-0.810	-9.584***	25.97***	15.58***
	(1.784)	(2.750)	(3.352)	(3.197)
Adult Men and Women	-1.117	-9.163***	26.50***	16.22***
	(1.813)	(2.808)	(3.410)	(3.247)
Adult Men	-2.849	-20.56***	41.71***	18.30***
	(2.699)	(4.528)	(5.640)	(4.880)
Adult Women	1.639	0.545	10.54***	12.73***
	(1.430)	(2.090)	(2.307)	(3.064)
Child Labour	4.790	-13.39	16.91*	8.314
	(3.945)	(9.779)	(8.794)	(10.82)
Boy Child	6.422	-26.02*	22.04	2.442
	(6.214)	(14.91)	(14.60)	(16.40)
Girl Child	2.618	16.20	3.065	21.88
	(2.263)	(12.68)	(6.909)	(13.89)

All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Regression Estimates of Program Participation on Own-Spousal and Member Labour Supply

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Activity at the Individual Level in percentage points			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Panel A: Effects on Spousal Labour Supply				
Own Labour Supply	1.529*	0.762	4.980***	2.577***
	(0.850)	(0.728)	(0.981)	(0.674)
Spousal Labour Supply	-0.218	-3.312**	7.685***	-0.0634
	(1.247)	(1.288)	(1.498)	(0.408)
Panel B: Effects on Member's Labour Supply				
Household's Participation Status	-2.317***	-1.520**	6.096***	0.338
	(0.882)	(0.751)	(0.934)	(0.447)
Member of the program in the household	5.048***	-2.083***	1.725*	3.001***
	(1.036)	(0.743)	(0.975)	(0.586)
	Dependent Variable: Hours of Labour Supply at the Individual Level			
	Household Based Farm and Non Farm Activities	Agriculture and Non Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Panel A: Effects on Spousal Labour Supply				
Own Labour Supply	1.201	1.302	11.59***	14.09***
	(1.708)	(2.514)	(2.788)	(3.789)
Spousal Labour Supply	-3.924	-17.03***	33.92***	12.96**
	(3.410)	(5.625)	(7.637)	(5.918)
Panel B: Effects on Member's Labour Supply				
Household's Participation Status	-4.415**	-6.063*	26.32***	15.84***
	(2.075)	(3.306)	(4.092)	(3.691)
Member of the program in the household	10.56***	-10.31***	-1.010	-0.763
	(2.204)	(2.993)	(4.294)	(4.174)

Same set of covariates as before. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Seasonality in the Labour Supply of adult individuals in different occupation choices

Seasonal Effects	Benchmark Case	Full Sample	Male Sample	Female Sample	Benchmark Case	Full Sample	Male Sample	Female Sample
	Household Based Farm and Non–Farm Activities				Agriculture and Non–Agriculture Wage Employment			
Season 2	-19.04***	-19.93***	-22.54***	-17.08***	-11.82***	-11.90***	-20.77***	-2.238***
	(0.958)	(1.153)	(1.441)	(1.361)	(0.835)	(1.002)	(1.814)	(0.497)
Season 3 (Aus)	5.133***	3.470***	8.847***	-2.382	16.21***	16.04***	26.61***	4.534***
	(0.968)	(1.131)	(2.131)	(1.504)	(1.555)	(1.944)	(3.395)	(0.989)
Season 4	1.057	0.405	-1.662	2.654*	-1.350**	-1.865**	-3.236*	-0.372
	(1.363)	(1.563)	(1.981)	(1.573)	(0.655)	(0.904)	(1.654)	(0.408)
Season 5 (Boro)	16.95***	16.27***	29.89***	1.436	31.63***	32.93***	57.66***	6.020***
	(1.360)	(1.720)	(2.552)	(1.714)	(1.336)	(1.758)	(3.035)	(0.926)
Participants*Season 2		1.546	0.883	2.368*		0.128	0.516	-0.0331
		(1.152)	(1.500)	(1.391)		(1.042)	(1.859)	(0.645)
Participants*Season 3		2.896**	1.230	4.595***		0.302	-0.348	0.703
		(1.266)	(2.169)	(1.605)		(1.907)	(3.276)	(1.205)
Participants*Season 4		1.137	0.810	1.566		0.897	1.504	0.260
		(1.540)	(1.884)	(1.790)		(1.067)	(1.958)	(0.620)
Participants*Season 5		1.196	-0.911	3.132*		-2.260	-5.863*	1.009
		(1.704)	(2.523)	(1.730)		(1.803)	(3.156)	(1.168)
	Self Employment and Non-Agricultural Work				Total Individual Level Labour Supply			
Season 2	4.023***	3.972***	7.587***	0.0375	-26.84***	-27.86***	-35.73***	-19.28***
	(0.673)	(0.786)	(1.500)	(0.258)	(1.402)	(1.660)	(2.537)	(1.514)
Season 3 (Aus)	45.98***	38.32***	68.71***	5.238***	67.32***	57.82***	104.2***	7.389***
	(1.786)	(2.027)	(3.699)	(0.895)	(1.999)	(2.302)	(4.135)	(2.023)
Season 4	2.146***	1.580**	2.931**	0.110	1.854	0.120	-1.967	2.391
	(0.656)	(0.695)	(1.293)	(0.401)	(1.567)	(1.898)	(2.676)	(1.698)
Season 5 (Boro)	42.79***	35.68***	63.79***	5.089***	91.37***	84.88***	151.3***	12.54***
	(1.508)	(1.848)	(3.274)	(0.791)	(1.887)	(2.574)	(3.698)	(2.246)
Participants*Season 2		0.0896	0.00731	0.0700		1.763	1.407	2.405
		(0.938)	(1.721)	(0.421)		(1.663)	(2.608)	(1.582)
Participants*Season 3		13.34***	20.56***	4.333***		16.54***	21.44***	9.631***
		(2.102)	(3.781)	(1.306)		(2.674)	(4.585)	(2.508)
Participants*Season 4		0.986	1.502	0.367		3.019	3.816	2.193
		(1.008)	(1.821)	(0.548)		(2.070)	(2.938)	(2.016)
Participants*Season 5		12.38***	16.88***	6.469***		11.31***	10.11***	10.61***
		(2.060)	(3.452)	(1.343)		(2.586)	(3.823)	(2.551)

'Aman' is the benchmark cropping season. Same set of covariates as before. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6: Regression Estimates for the Impact of the Duration of Program Participation on Labour Supply

	Regular Participants	Drifters	Newcomer1	Newcomer2	Leavers1	Leavers2
Activity at the Individual level (percentage points)						
Household Based Farm	-1.039	0.121	-0.894	-2.597	-2.024	1.663
and Non–Farm Activities	(0.949)	(1.115)	(3.117)	(4.667)	(2.858)	(1.457)
Agriculture and Non–Agriculture	-3.083***	-0.947	-2.859	0.130	0.963	-1.690
Wage Employment	(0.858)	(0.857)	(2.720)	(2.968)	(2.098)	(1.224)
Self Employment and	9.299***	4.291***	7.221**	1.480	5.210*	4.571***
Non-Agricultural Work	(0.979)	(1.095)	(3.628)	(2.885)	(2.930)	(1.564)
Total Individual Level	2.024***	0.767	-0.183	-0.555	0.950	2.146***
Labour Supply	(0.468)	(0.631)	(1.327)	(2.514)	(1.533)	(0.749)
Labour Supply (hours worked)						
Household Based Farm	-1.557	-1.907	6.764	3.812	-5.194	-2.900
and Non–Farm Activities	(2.381)	(2.373)	(5.161)	(11.74)	(6.921)	(3.163)
Agriculture and Non–Agriculture	-12.52***	-4.740	-12.16	2.178	8.123	-5.831
Wage Employment	(3.664)	(3.500)	(10.25)	(12.74)	(9.195)	(5.466)
Self Employment and	37.43***	13.83***	14.40	1.552	17.39	14.42**
Non-Agricultural Work	(4.045)	(4.814)	(12.96)	(13.70)	(12.94)	(6.373)
Total Individual Level	23.35***	7.182	9.009	7.541	20.32*	5.685
Labour Supply	(3.981)	(4.619)	(11.27)	(19.00)	(10.77)	(6.802)

Same set of covariates as before. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

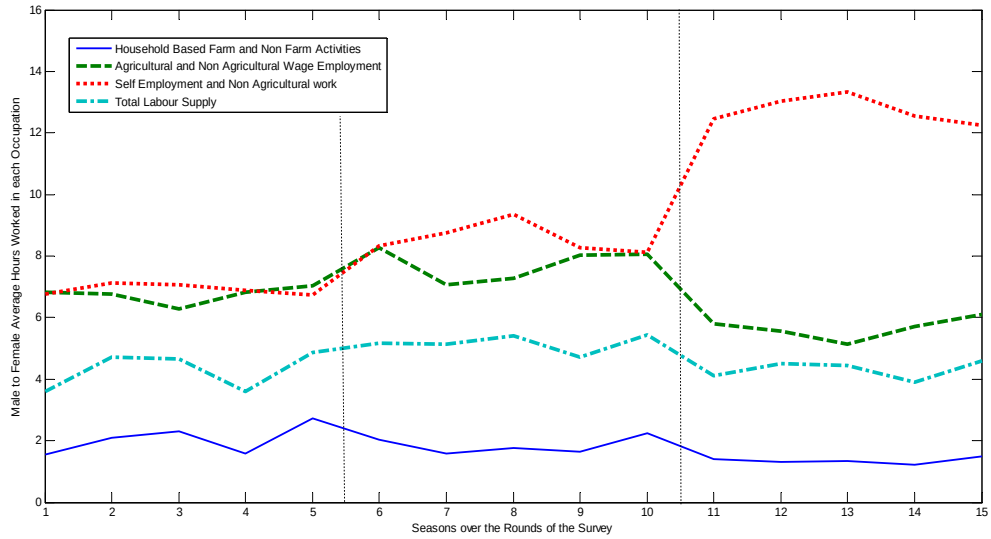

Figure 1: Seasonal variations in the male to female labour supply ratio across sectors

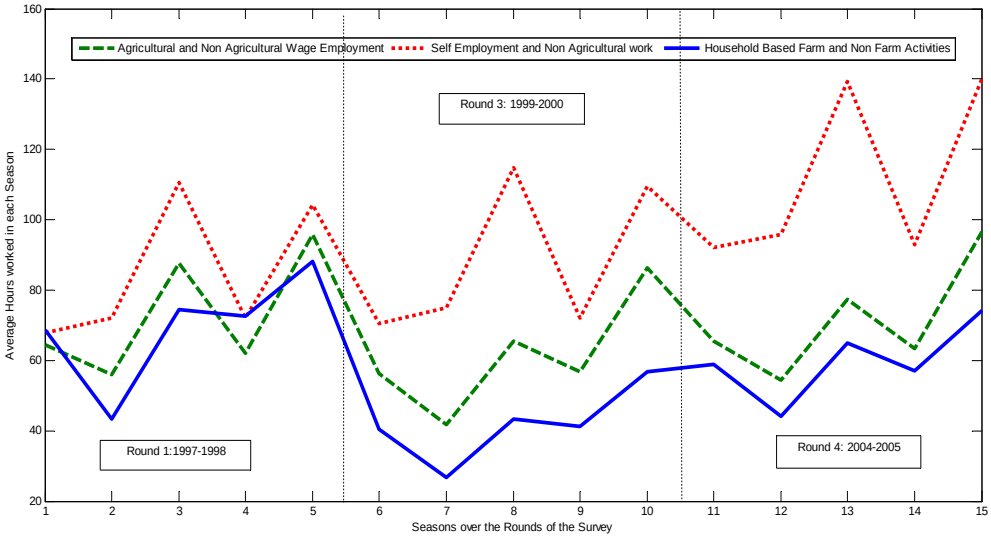

Figure 2: Seasonal Variations in Hours worked in each sector

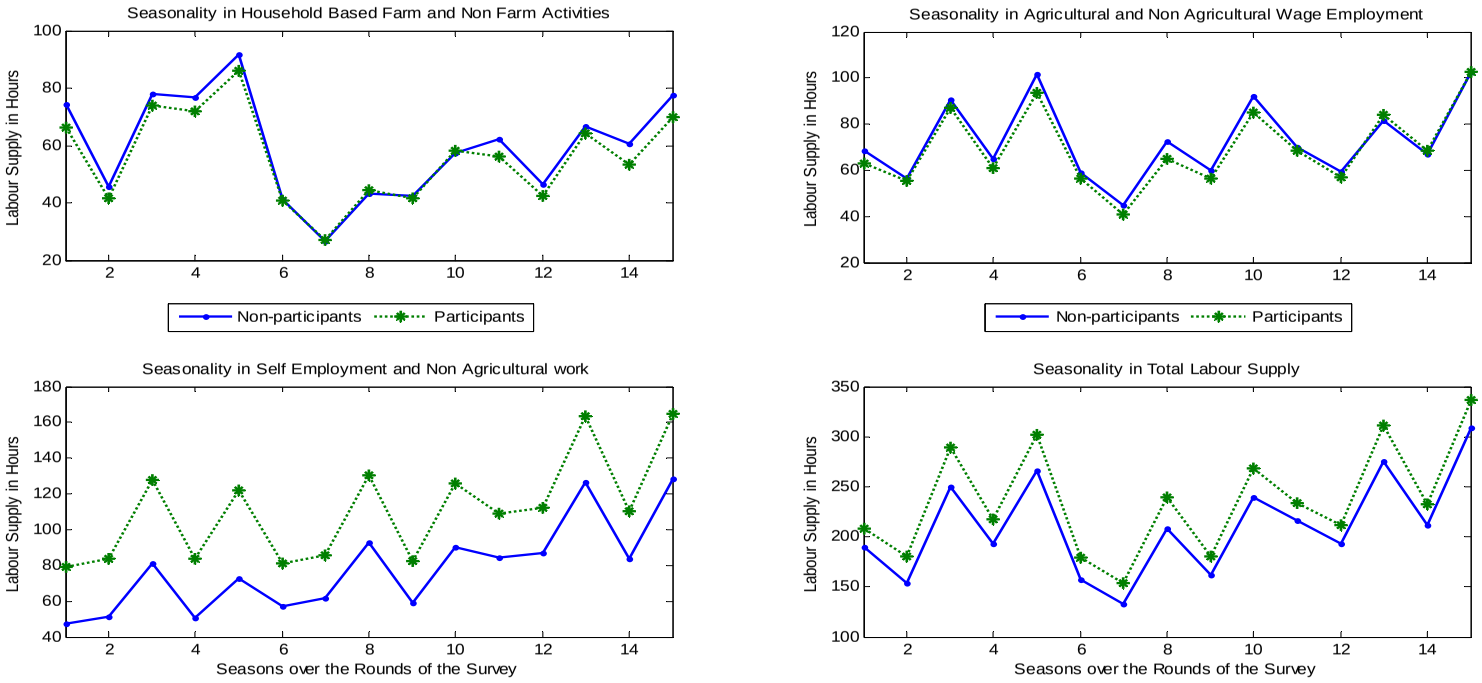

Figure 3: Seasonal Variation in Labour Supply by Participation Status

6 Appendix

We use the following variables in the primary empirical methodology.

6.1 Individual- and household-level variables:

Gender, age, marital status of the individual, their education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working-age people in the household, size of the household, highest education achieved by any household member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, number of married people in the household, gender of the household head.

We use the following variables in the alternative estimation methodology using the Propensity Score Matching technique.

6.2 Household-level variables:

Age of the household head, age of household head squared, number of working age people in the household, size of the household, highest education achieved by any household member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, number of married people in the household, gender of the household head.

6.3 Village-level variables:

Presence of primary school, secondary school or college, health facility, madrasah, adult male and female wage, presence of brick-built road, regular market, frequent haat, post office, bus stand, telephone office in village, local government office, youth organisation, distance to nearest Upazila (in kilometres), share of landowners in share cropping (in percentages), number of money lenders in the village, large farmers/traders, number of small credit/savings groups in the village, and numbers of low lift pumps, shallow tube wells, hand tube wells in irrigation, hand tube wells in drinking water, and deep tube wells in the village.

6.4 Classification of work under each of the three different occupation categories:

6.4.1 Household based farm and non-farm activities:

Cultivation in field, crop processing, cultivation of vegetables and nursery in homestead, rearing of hens and ducks, rearing of livestock, and cultivation of fish in pond.

6.4.2 Agriculture and Non-Agriculture Wage Employment:

Agriculture farm work (seasonal and contractual labour would be included), crops processing, porter/cooly, house repair, digging earth, road work, guards, cottage industry labour, brick breaking, transport worker run by machine, other transport labour, bidi labour, labour in small industry, and helper/non-agricultural day labour, etc. This category includes daily, contractual and seasonal wage labour.

6.4.3 Self-employment and Non-Agricultural work:

Potter, weaver, mason, fisherman, boatman, blacksmith, cobbler, rickshaw/van driver, car driver, other small business, business (mid-level/big), production-oriented small business, and production-oriented business (mid-level/big), etc.

Table 7: Descriptive Statistics of Individual and Household level characteristics by participation status

	Round I: 1997–1998			Round III: 1999–2000			Round IV: 2004–2005		
Demographic Variables	Treatment	Control	Difference	Treatment	Control	Difference	Treatment	Control	Difference
Individual level characteristics									
Individual is male	0.49	0.46	0.03**	0.53	0.51	0.02	0.59	0.58	0.01
Age of the individual	32.87	32.82	0.05	32.62	32.88	-0.26	34.60	34.23	0.37
Individual is married	0.758	0.751	0.007	0.734	0.735	-0.001	0.738	0.739	-0.001
Individual is single	0.209	0.211	-0.002	0.234	0.229	0.005	0.231	0.234	-0.003
Individual is illiterate	0.22	0.38	-0.16***	0.22	0.29	-0.07***	0.19	0.25	-0.06***
Individual can sign only	0.40	0.20	0.20***	0.36	0.23	0.13***	0.34	0.24	0.10***
Individual can read only	0.01	0.01	0.006**	0.02	0.01	0.003	0.01	0.01	0.001
Individual can read and write	0.37	0.41	-0.04***	0.40	0.47	-0.07***	0.46	0.50	-0.04**
Household level characteristics									
Age of the household head	44.02	44.98	-0.96*	46.22	47.07	-0.85	47.66	47.17	0.49
Number of working people	2.80	2.82	-0.02	2.99	3.09	-0.10*	3.68	3.66	0.02
Household size	5.72	5.52	0.20**	6.11	6.09	0.02	7.30	7.33	-0.03
Max education of any member	5.29	5.76	-0.47***	5.91	6.62	-0.71***	7.05	7.50	-0.45*
Number of children	2.93	2.70	0.23***	2.33	2.15	0.18***	3.02	3.03	-0.01
Number of women	2.73	2.57	0.16***	2.99	2.90	0.09	3.35	3.26	0.09
Number of old people	0.21	0.29	-0.08***	0.34	0.41	-0.07***	0.28	0.30	-0.02
If a woman is household head	0.04	0.06	-0.02**	0.05	0.06	-0.01	0.09	0.11	-0.02*
Number of married people	2.40	2.37	0.03	2.72	2.69	0.03	3.25	3.19	0.06
Area of arable land (in decimals)	57.80	83.08	-25.28***	65.38	102.35	-36.97***	55.42	92.90	-37.48***

Notes: The table gives the summary statistics of the individual and household level characteristics.
The reported p-values are from the two-tailed test with the null hypothesis that the group means are equal.

Table 8: Regression Estimates of the share of different occupations in total labour supply

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Share of each occupation in Total Labour Supply in percentage points		
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work
Full Sample	-2.371***	-2.090***	5.824***
	(0.806)	(0.600)	(0.747)
Adult Men and Women	-2.590***	-2.002***	5.941***
	(0.792)	(0.607)	(0.729)
Adult Men	-3.266***	-4.556***	8.253***
	(0.977)	(0.905)	(1.056)
Adult Women	-1.481	0.244	3.673***
	(1.009)	(0.571)	(0.771)
Child Labour	1.569	-3.444	3.505
	(3.637)	(2.776)	(3.011)

All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household , highest education achieved by any member, total arable land (in decimals), number of children aged 6–15 years, number of women in the household, number of old people in household, gender of household head, number of married people, All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9: Regression Estimates of the Impact of Program Participation on Labour Supply♯

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Hours of Labour Supply at the Individual Level			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Full Sample	-0.810	-9.584***	25.97***	15.58***
	(1.784)	(2.750)	(3.352)	(3.197)
Adult Men and Women	-1.614	-10.11***	28.24***	16.51***
	(1.810)	(2.890)	(3.500)	(3.357)
Adult Men	-3.201	-23.23***	45.45***	19.01***
	(2.719)	(4.734)	(6.040)	(5.045)
Adult Women	1.053	0.313	11.05***	12.41***
	(1.540)	(2.253)	(2.406)	(3.267)
Child Labour	-3.493	2.113	18.54***	17.16**
	(3.016)	(6.707)	(6.544)	(7.354)
Boy Child	-5.837	0.318	27.65***	22.13**
	(4.644)	(10.09)	(10.24)	(10.95)
Girl Child	1.419	8.772	2.101	12.29
	(1.695)	(7.078)	(5.101)	(7.794)

All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

♯ Robustness check using the alternative definition for adult and children: adult is anyone lying in the 18^{+}–55 age group .

Table 10: Regression Estimates of the Impact of the loan amount on the participation in different occupations

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Activity at the Individual Level in percentage points			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non-Agricultural Work	Total Individual Level Labour Supply
Full Sample	-0.623**	-0.839***	2.530***	0.286*
	(0.295)	(0.285)	(0.370)	(0.171)
Adult Men and Women	-0.620**	-0.817***	2.577***	0.295*
	(0.286)	(0.277)	(0.359)	(0.160)
Adult Men	-0.886**	-1.976***	3.677***	0.137
	(0.384)	(0.440)	(0.570)	(0.115)
Adult Women	-0.0987	0.648**	0.991***	0.480
	(0.407)	(0.305)	(0.314)	(0.341)
Child Labour	-0.725	-1.072	0.846	-0.336
	(1.745)	(1.053)	(1.280)	(1.189)
Boy Child	0.899	-4.047***	1.449	-0.0627
	(2.200)	(1.522)	(1.888)	(1.720)
Girl Child	-2.106	1.829	0.407	-0.286
	(2.091)	(1.213)	(1.612)	(1.525)

The loan amount is defined in terms of ten thousand taka (adjusted by the agricultural price index with 1997-98 as the base year). All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11: Regression Estimates of the Impact of the loan amount on Labour Supply

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Hours of Labour Supply at the Individual Level			
	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non–Agricultural Work	Total Individual Level Labour Supply
Full Sample	-1.292**	-3.757***	9.990***	4.941***
	(0.637)	(1.142)	(1.616)	(1.395)
Adult Men and Women	-1.343**	-3.548***	10.29***	5.399***
	(0.646)	(1.149)	(1.590)	(1.341)
Adult Men	-2.054**	-8.045***	15.68***	5.586***
	(0.867)	(1.822)	(2.567)	(1.715)
Adult Women	-0.0195	2.107*	2.394***	4.482***
	(0.655)	(1.098)	(0.853)	(1.584)
Child Labour	-0.658	-7.453*	1.503	-6.609
	(1.662)	(3.810)	(3.692)	(4.095)
Boy Child	1.561	-16.10***	0.0537	-14.49**
	(3.394)	(5.876)	(5.752)	(6.216)
Girl Child	-0.425	-0.614	3.540	2.501
	(0.968)	(4.694)	(4.221)	(5.033)

The loan amount is defined in terms of ten thousand taka (adjusted by the agricultural price index with 1997–98 as the base year). All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12: Matching Estimates of the Impact of Program Participation on Labour Supply

Regression Adjusted Estimates of	(Estimation based on full set of covariates) Dependent Variable: Hours of Labour Supply at the Individual Level			
Nearest 5-neighbour matching	Household Based Farm and Non–Farm Activities	Agriculture and Non–Agriculture Wage Employment	Self Employment and Non–Agricultural Work	Total Individual Level Labour Supply
Full Sample	-0.281	-9.745***	25.78***	15.75***
	(1.787)	(2.823)	(3.315)	(3.141)
Adult Men and Women	-0.632	-9.258***	26.31***	16.42***
	(1.825)	(2.883)	(3.369)	(3.193)
Adult Men	-2.204	-21.14***	41.16***	17.81***
	(2.703)	(4.654)	(5.560)	(4.793)
Adult Women	1.948	0.646	10.55***	13.15***
	(1.450)	(2.136)	(2.319)	(3.104)
Child Labour	6.416*	-15.13	15.64*	6.928
	(3.866)	(9.967)	(8.962)	(11.17)
Boy Child	8.027	-27.33*	19.14	-0.164
	(6.168)	(15.21)	(14.74)	(16.85)
Girl Child	3.372	14.90	3.048	21.31
	(2.287)	(13.18)	(7.074)	(14.30)

All specifications include the covariates: gender, age, marital status of the individual, education level (illiterate, can read only, can sign only, can read and write), age of household head, number of working age people in the household, size of the household, highest education achieved by any member, total arable land (in decimals), number of children aged 6–15, number of women in the household, number of old people in the household, gender of household head, number of married people in the household. All specifications control for year, seasonal, year-seasonal interaction fixed effects and individual fixed effects. We correct standard errors for village-year clusters. Clustered standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 13: Results of the Propensity score Matching Balance test

	Mean			t-test	
Variable	Treated	Control	%bias	t	$p>\|t\|$
Age of the household head	43.893	43.785	0.8	0.25	0.806
Age of household head squared	2075.5	2067.3	0.6	0.2	0.842
Working age people in the household	2.7859	2.7911	-0.4	-0.11	0.914
Household size	5.6559	5.7118	-2.4	-0.67	0.501
Maximum education by any household member	5.2675	5.2162	1.2	0.35	0.724
Total arable land owned (in decimals)	55.8	59.148	-2.3	-0.86	0.390
Number of children in the household	2.9042	2.8893	0.9	0.26	0.798
Number of women in the household	2.6855	2.7284	-3.1	-0.83	0.405
Number of old people in the household	0.20836	0.2117	-0.7	-0.21	0.837
A Woman is the household head	0.04502	0.04463	0.2	0.05	0.959
Number of married people in the household	2.3781	2.4132	-3.2	-0.86	0.387
Health facilities in the village	0.17621	0.15859	4.7	1.32	0.188
Madrasha in the village	0.89775	0.89672	0.3	0.09	0.925
Primary school in the village	0.85981	0.85093	2.6	0.7	0.482
Secondary school in the village	0.33698	0.33942	-0.5	-0.14	0.886
Adult male wage	56.932	57.041	-0.6	-0.17	0.866
Adult female wage	32.636	32.891	-2	-0.56	0.573
Presence of pucca road in the village	0.34791	0.34071	1.5	0.42	0.673
Presence of grocery market in the village	0.23087	0.23203	-0.3	-0.08	0.939
Presence of frequent haat (big market)	0.32283	0.34289	-4.3	-1.19	0.235
Presence of bus stand in the village	0.15048	0.14341	2	0.56	0.578
Presence of post office in the village	0.19678	0.20051	-0.9	-0.26	0.794
Presence of telephone office in the village	0.06238	0.05273	3.8	1.15	0.248
Presence of Union Parishad office	0.13826	0.14238	-1.2	-0.33	0.741
Youth organization in the village	0.15048	0.14341	2	0.56	0.578
Distance to nearest Upazila (in kms)	7.1887	7.1129	1.2	0.36	0.719
Share of landowner in share-cropping	47.561	47.554	0.1	0.03	0.977
Number of moneylenders in the village	8.0206	8.1174	-0.9	-0.25	0.803
Large farmers/traders in the village	3.7846	3.7977	-0.2	-0.05	0.96
Small credit/savings groups in the village	0.8045	0.76875	2.6	0.71	0.476
Number of Low Lift Pumps	0.42894	0.33363	3.9	1.22	0.221
Number of Shallow Tube Wells	12.744	13.254	-2.7	-0.75	0.452
Number of Hand Tube Wells in Irrigation	2.2945	2.4976	-2.1	-0.55	0.581
Number of Hand Tube Wells in drinking water	80.513	81.48	-1.2	-0.34	0.733
Number of Deep Tube Wells	0.28746	0.28592	0.3	0.10	0.924